



SUPPLEMENTARY ENVIRONMENTAL IMPACT STATEMENT

McARTHUR RIVER MINE PHASE 3 DEVELOPMENT PROJECT

MAIN REPORT & Appendices

May 2012



responsible business solutions

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1. SEIS Purpose and Directions for Use

This Supplementary Environmental Impact Statement (SEIS) supplements the Draft Environmental Impact Statement (Draft EIS) for the McArthur River Mine Phase 3 Development Project (the Project) submitted to the Department of Natural Resources, Environment, the Arts and Sport (NRETAS) on 31 January 2012. In combination with the Draft EIS, this SEIS comprises all environmental assessment documentation relating to the Project's Environmental Impact Assessment (EIA) process. This SEIS will undergo review by the Northern Territory Government. The review will establish the environmental acceptability of the Project and will determine the approval status.

The purpose of this SEIS is to fulfil McArthur River Mining Pty Ltd's (the Proponent) legislative requirements under the Northern Territory's *Environmental Assessment Act 1982* (EA Act) by addressing questions and comments made during the public exhibition period. The exhibition period for the Project's Draft EIS was between 4 February 2012 and 16 March 2012. Comments on the Draft EIS were received from the following Northern Territory Government departments and non-government organisations during the exhibition period:

Government departments

- Department of Resources
- Department of Lands and Planning – Transport Division
- Department of Business and Employment
- NT WorkSafe
- Department of Health
- Department of Natural Resources, Environment, the Arts and Sport (NRETAS).

Non-government organisations

- Environmental Recyclers NT
- Environment Centre NT
- Amateur Fishermen's Association of the NT Inc.

This SEIS provides information to support responses to comments made by these stakeholders during the public exhibition period and where applicable, is in addition to the information provided in the Draft EIS. The Proponent's response to the Draft EIS comments is provided in Section 3 of this document, following introductory components in Section 2. Comments have been addressed and categorised by respondent. In some instances comments have been split to facilitate a focussed response from the Proponent. Based on this approach, a total of 128 comments were received and have been addressed in this SEIS.

The Proponent has elected to address each individual comment rather than simply providing a collation of environmental information for Project stakeholders to consider. Section 3 provides each individual comment received in tabular format with the Proponent's response provided underneath. Appendices are referenced throughout and are provided at the end of the main document. This approach has been adopted to facilitate ease of information provision to each comment group.

In accordance with the Northern Territory's EA Act, the relevant Minister is required to state the result of the Project's environmental acceptability within 35 calendar days following the SEIS submission. The Northern Territory Government can choose to prolong this period or request further information from the Proponent.

The Project is not required to be assessed under Commonwealth legislation, as the Project did not trigger assessment requirements under the *Environment Protection and Biodiversity Conservation Act 1999*.

MRM Phase 3 Supplementary EIS

2. Introduction

2.1. Project Background

Mining and Energy Technical Services (MET Serve) was commissioned by the Proponent to develop a Draft EIS and this SEIS for the McArthur River Mine Phase 3 Development Project.

The proposed Project involves the expansion of the existing McArthur River Mine (MRM) open pit zinc-lead-silver mining and concentrate processing operation. The Project is located approximately 70 kilometres (km) south-west of the township of Borroloola, 120 km south of the Bing Bong concentrate storage and ship loading facility (Bing Bong) on the Gulf of Carpentaria, Northern Territory.

The Project would build on the successful conversion of MRM from an underground to an open-pit mining operation, approved as part of the 2005 Environment Impact Assessment (EIA) process, by further extending the life of the existing open-pit operation and increasing MRM's minable ore reserves and mine life.

MRM's current maximum run-of-mine (ROM) ore capacity is up to 2.5 million tonnes per annum (Mtpa), producing approximately 360,000 dry metric tonnes per annum (dmtpa) of zinc-lead concentrate for export markets. The Project involves increasing this ROM capacity up to 5.5 Mtpa to produce approximately 800,000 dmtpa of zinc-lead concentrate.

The Project is part of Xstrata Zinc's (MRM's owner) US\$900 million integrated expansion plan that involves increasing MRM's concentrate production to feed its upgraded offshore smelting and refining operations. This plan is dependent upon the future expansion of MRM's current operation.

The Project will continue to use and expand, where required, MRM's current mine and processing infrastructure and operational practices such as drilling, blasting, loading and transportation systems and concentrate storage.

Subject to the completion of further feasibility studies and Northern Territory Government approval, the Project will be developed in stages, with construction work expected to commence in 2012 for completion over a two year period. Peak mining rates will occur between the years of 2020 to 2025, and will then steadily decline until the end of mining currently planned for 2036.

The capital cost of approximately \$270 million for the Project is expected to boost industry output by approximately \$8.4 billion within the Northern Territory economy during the construction and operational periods. Nationally, the Project is expected to boost industrial output by \$9.3 billion.

Peak employment levels are expected to be 930 during construction and 735 during the operational phase, an increase from the current 440 permanent employees.

The Proponent is the current operator of MRM and is a subsidiary of Xstrata Zinc, a commodity business unit of Xstrata plc. Xstrata Zinc is one of the world's major producers of zinc, undertaking lead and zinc extraction and exploration activities in Australia, Canada, Germany, Peru, Spain and the United Kingdom.

The Proponent is seeking Northern Territory Government approval for the proposed Project under the EA Act.

MRM Phase 3 Supplementary EIS

2.2. Summary of Project Changes

In response to refinements of planning works, the Proponent has made a number of amendments to the proposed Project that was detailed in the Draft EIS. The Project changes proposed are described below, with the environmental implications of the changes provided in Section 2.4.

2.2.1. Irrigation Scheme

The Draft EIS included a proposal to re-use groundwater extracted from around the open pit to irrigate land on the adjoining McArthur River Station Pastoral Lease, outside the MRM Mineral Leases. Whilst this water management operation is still an important component of the Project, advanced studies have identified a number of location options, including within the MRM Mineral Leases. Following discussion with the Northern Territory Government, the approval of this Project component will be sought through an alternative assessment and approval process. Subsequent to selection of the preferred irrigation location and consideration of all environmental impacts, approval will be sought through either a Notice of Intent (NOI) for submission to NRETAS or under the annual Mining Management Plan (MMP) process pursuant to Section 40 of the *Mining Management Act 2001*. However the implications of the irrigation component for the Project's water management system and other environmental management aspects of the Project remain a consideration in this EIA process.

2.2.2. Temporary Sewage Treatment Plant for Construction Workforce

The Draft EIS proposed a temporary sewerage treatment plant for the treatment of sewerage from the Project's construction workforce. Since the submission of the Draft EIS, further design works have identified that it is preferable to upgrade the existing permanent facility (600 on-site persons) to cater for 1000 on-site persons. Due to the mine's rostering schedule, this will provide more than adequate capacity to cater for the on-site personnel throughout the construction and operational phase of the Project. In consultation with the Department of Health, the Proponent will seek approval for all on-site sewerage treatment facilities in accordance with the *Public and Environmental Health Act 2011*.

2.2.3. TSF Cell 4 Water Management Dam

In accordance with correspondence with, and advice from the Northern Territory Government's Department of Resources (DOR) regarding the approval for the construction and operation of Tailings Storage Facility (TSF) Cell 4 as a Water Management Dam (WMD), the proponent has submitted a Notice of Intent (NOI) to the Department of Natural Resources, Environment, the Arts and Sport (NRETAS). In the Project's Draft EIS it was proposed that approval for Cell 4 as a WMD would be sought through the annual Mine Management Plan process pursuant to Section 40 of the *Mining Management Act 2001*, However, through correspondence with DOR, the NOI process was determined to be more appropriate. Notwithstanding this, the construction and operation of the TSF Cell 4 as a WMD has been fully incorporated and assessed in the MRM Draft EIS, with additional information provided in this Supplementary EIS as per comments received during the public exhibition period.

As mentioned in the Draft EIS, the construction of TSF Cell 4 is required for use as a water management dam for existing operations and will be used as part of the current mine site water management system. The TSF Cell 4 WMD will be a turkey's nest dam approximately 65 ha in area with no external catchment area. TSF Cell 4 will not be used as a repository for tailings until the year 2032. The proposed use of TSF Cell 4 as a WMD has not changed from that proposed in the Draft EIS.

2.2.4. TSF Cell 3 and Cell 4 Lining

The Project's Draft EIS provided detail on the potential design of TSF Cell 4, which made reference to Cell 4 including an engineered liner (such as HDPE, bentonite or clay) to further limit potential seepage from the TSF (Appendix E1 – Tailings Storage Facility (TSF) Management Plan).

MRM Phase 3 Supplementary EIS

Since the lodgement of the Draft EIS, the Proponent has determined that a low permeability HDPE base layer with a network of underdrains to collect any seepage will be included in the final construction design for Cell 4 as well as Cell 3 to limit potential seepage from the TSF.

2.3. Potential Environmental Impact of Changes

2.3.1. Irrigation Scheme

The change proposed is an administrative one and confirms assessment and approval will be sought through an alternative approval mechanism. The environmental impacts associated with the irrigation proposal are heavily dependent on the location selected. However the environmental suitability of the location selected forms the primary selection criteria for the location assessment. The assessment criteria associated with the irrigation proposal are considerations in the Draft EIS and further detailed in Appendix D of this SEIS. These assessments will be refined and fully documented as part of the irrigation scheme approval process. It should be noted that the operational concept of the irrigation scheme is included and fully considered in the water management system provided in the Draft EIS and this SEIS.

2.3.2. Temporary Sewage Treatment Plant for Construction Workforce

The upgrade of the permanent sewage treatment plant is not expected to produce a significant increase in environmental impact. Incorporating the Project's construction personnel waste into the permanent sewerage system will not affect the total volume of wastes generated and will also marginally decrease the Project's footprint as the separate sewerage treatment plant for the construction phase is not required. These wastes will be incorporated into the upgraded waste management system for the site which will have sufficient capacity for these wastes to be managed effectively. Sewage at the accommodation village is currently treated through an intermittent extended aeration type treatment plant. Treated water from the plant is irrigated onto an area away from the village. The sewage sludge which accumulates at the sewage treatment plant is disposed on-site in a designated facility. The existing waste management system would be utilised and upgraded.

2.3.3. TSF Cell 4 Water Management Dam

There will be no difference in environmental impacts to those assessed and mitigated in the Draft EIS. The change proposed is an administrative one based on the existing needs of the site to manage water. The Draft EIS fully assesses the use of TSF Cell 4 as a WMD and a tailings storage facility. Comments were received regarding TSF Cell 4. These are addressed in Section 3 of this SEIS.

2.3.4. TSF Cell 3 and Cell 4 Lining

The environmental performance of the TSF will improve as a result of the Proponents decision to line both Cell 3 and Cell 4 of the TSF with a low permeability HDPE base layer with a network of underdrains. Based on key learning's from performance of Cell 1 and Cell 2 of the TSF, the Proponent has developed this robust solution to significantly reduce seepage both during operation and to meet post-mine sustainable development objectives. The seepage rates from the lined Cells 3 and 4 are modelled to be in the order of 1 to 2% of existing TSF seepage rates. Further discussion on the lining concept is provided in Section 3 of this SEIS.

The lining of TSF Cells 3 and 4 will result in a significant reduction in seepage from the cells and will provide greater protection of the downstream environment. Studies to better understand and manage existing and potential future seepage are ongoing and will consider the potential impacts of the TSF on the downstream environs. Strategies to manage TSF seepage are being developed and considered by the Proponent.

MRM Phase 3 Supplementary EIS

3. Comments and Responses

Comments have been addressed and categorised by respondent. In some instances comments have been split to facilitate a focussed response from the Proponent. Based on this approach, a total of 128 comments were received and have been addressed in this SEIS.

Each individual comment received has been presented in tabular format with the Proponents response provided underneath. Appendices are referenced throughout and are provided at the end of the main document. This approach has been adopted to facilitate ease of information provision to each comment group.

Comments were received from the following Northern Territory Government departments and non-government organisations:

Government departments

- Department of Resources (DOR)
- Department of Lands and Planning – Transport Division
- Department of Business and Employment
- NT WorkSafe
- Department of Health
- Department of Natural Resources, Environment, the Arts and Sport (NRETAS).

Non-government organisations

- Environmental Recyclers NT
- Environment Centre NT
- Amateur Fishermen’s Association of the NT Inc.

3.1. Respondent: Department of Resources

Comment No.	EIS Section	EIS Discipline	Comment
1	1.4.2	Environmental Studies (Table 1-2 Study Team)	<p>There is no MRM staff included in the study team. Were any onsite personnel involved in the development of the EIS? If so, who? How much involvement? Evidence of involvement.</p> <p>If there has been limited involvement by MRM personnel in the development of the Draft EIA then there is a risk that MRM operational personnel are not aware of the content of the EIS and there is a general lack of 'buy in' and ownership of the project at the operational level</p>

MRM Phase 3 Supplementary EIS

Response:

The Proponent concurs with DOR that site and management personnel involvement in the EIA process is integral to the development of workable environmental mitigation and management measures and the success of Project implementation. A number of MRM personnel were involved in the Draft EIS, particularly in the collation and discussion of baseline information and the development of mitigation and management measures. Site personnel were regularly involved in discussion/ correspondence with specialist technical teams to provide site specific and operational input into the development of environmental management measures. Site visits and meetings were also held between MRM personnel, specialist technical teams, the coordinating EIS consultancy and Xstrata corporate and project teams. A number of Xstrata corporate personnel were involved in key decision making processes. MRM site personnel have also been involved in the development of responses presented in this Supplementary EIS. The key MRM personnel involved in the development of the Draft EIS, their position, qualifications and experience is provided in Appendix A.

Regular fortnightly minuted meetings were held with the General Manager and Managers of MRM with the objective of facilitating constant awareness, information flow and decision making. The meeting agenda include the following headings:

- Mining
- Environmental
- Civil/Water
- Metallurgy
- Community
- Geotechnical
- Commercial

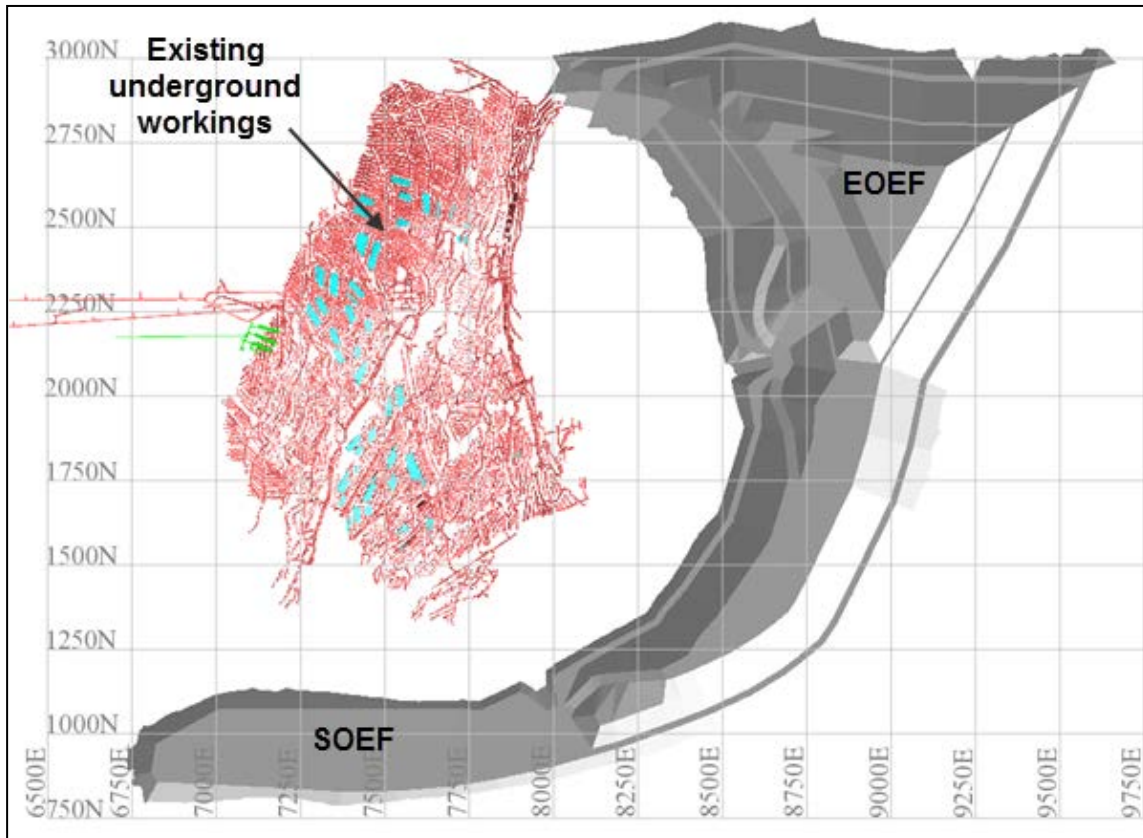
Additional meetings with site personnel were held on an as required basis, e.g. to sign-off on all commitments provided in the Draft EIS. The General Manager of MRM sits on the Steering Committee for the Project. All major Risk Assessments were conducted on-site and included all relevant operational and project personnel.

Comment No.	EIS Section	EIS Discipline	Comment
2	3.4.3	Mining Method	<p><i>"Underground mining techniques result in reduced impacts on surface environmental values due to the reduced requirement for external waste rock emplacements and hence, minimal surface disturbance. Mining induced subsidence can, however, result in impacts on surface environmental values such as flora and fauna, cultural heritage, groundwater and surface water resources. While underground mining has previously occurred, due to significant faulting and the requirement to backfill voids to maintain stability, MRM's underground mining operation eventually became impractical and uneconomical."</i></p> <p>The open cut mining operation is located directly over the top of the old underground workings. How will the expansion of the open pit mine and the proposed location of the new OEFs (i.e. the increased weight and pressure over the old underground workings) impact the geotechnical stability of the underground mine?</p>

MRM Phase 3 Supplementary EIS

Response:

The proposed new south OEF (SOEF) and east OEF (EOEF) are both located outside of the 'footprint' of the underground workings and will therefore not impose a surcharge on these workings. This relationship is provided in the figure below which presents the footprint of the underground workings and the location of the SOEF and EOEF.



Numerical modelling was undertaken as part of geotechnical study in 2004 (document reference, 'Geotechnical Study of the McArthur River Open Pit Mine', by BFP Consultants Pty Ltd, dated 20 December 2004). This analyses considered a pit of similar size to that proposed as part of the Project, and found that the stability of the underground workings would not affect the stability of the open pit or result in any surface expressions (subsidence) due to potential failures.

Comment No.	EIS Section	EIS Discipline	Comment
3	3.4.7	Accommodation Village	<p>"... The preferred option is to continue to house FIFO employees at the Project's expanded accommodation village."</p> <p>How many people was the accommodation village designed for prior to the expansion? How many people is it designed for now?</p>

MRM Phase 3 Supplementary EIS

Response:

The existing permanent accommodation village currently has a design capacity to provide accommodation for 627 people (408 rooms). This capacity will be increased to accommodate up to 738 people (480 rooms) to meet the Project's operational accommodation requirements. It should be noted that the Project's roster system allows rooms to be 'shared' between personnel at any one time as some are on-site while some are on rostered break. A separate temporary accommodation camp of up to approximately 350 rooms will be constructed to accommodate the Project's construction workforce.

Comment No.	EIS Section	EIS Discipline	Comment
4	3.4.8	General Waste	<p><i>"Use of current facilities is preferable to the creation of new facilities that would create a larger footprint and environmental impacts."</i></p> <p>Are the current facilities adequate for the increased waste associated with increased personnel on site as well as the increase in industrial waste being generated during the expansion?</p>

Response:

The current putrescible waste management facility holds adequate capacity to accommodate the increase in putrescible waste production associated with the Project's expansion and which is described in the Draft EIS, Chapter 9 – Waste Management, Table 9-2 and Table 9-2. The operation of the facility is governed by a Putrescible Waste Management Procedure which details the type of wastes to be disposed of in the facility and management measures to maintain capacity (primarily burning in order to reduce land fill).

The contaminated waste facility is operated in an alternative manner and does not have infinite capacity. The current facility has an estimated capacity to receive a further three years of waste production from the site. Prior to the exhaustion of this capacity, MRM will develop alternative contaminated waste management facility locations and select the most appropriate option on the basis of operational and environmental criteria. The Department of Resources will be consulted as part of the waste management facility location selection process. Opportunities for the both the further reuse and recycling of wastes will continue to be explored.

Comment No.	EIS Section	EIS Discipline	Comment
5	3.4.8	General Waste	<p><i>"Existing sewage facilities have recently been upgraded to accommodate the increased personnel on-site. A construction workforce sewage facility will be required to handle the peak workforce numbers during this time. This facility will be removed following the construction period."</i></p> <p>The sewage facilities were extremely inadequate and an upgrade was required. There are currently 440 permanent employees (as per Section 1.1). Was the upgrade of the sewage facilities specifically designed to cater for the increased personnel to 735 during the operational phase of the project or is a further expansion and upgrade required to cater for the additional 295 employees?</p>

MRM Phase 3 Supplementary EIS

Response:

The current upgraded facility has a design capacity to process 300 kl/day. The existing sewage treatment plant will be further upgraded to manage 1,000 Single Occupancy Units from its current capacity of 600 Single Occupancy Units. This will provide adequate capacity during the construction phase and excess capacity during the operational phase. This upgrade will incorporate capacity for the construction workforce, eliminating the requirement for the previously proposed separate construction sewage treatment plant.

Comment No.	EIS Section	EIS Discipline	Comment
6	3.4.9	OEF Locations	<p><i>"Must allow room for McArthur River and Barney and Surprise Creeks floodwaters and limit risks of physical erosion and instability. "</i></p> <p>Is there enough room? Evidence.</p>

Response:

A flood study of the McArthur River has been undertaken to assess the potential impacts of the proposed Project mining operations at MRM on flood levels, flood velocities and flood extents within and in the vicinity of the mine. In this study, the potential impacts of the proposed Project works were assessed using a two-dimensional hydraulic model of the McArthur River, Barney Creek and Surprise Creek and their floodplains in the vicinity of the mine. The hydraulic model, together with the hydrologic model used to provide input to the hydraulic model, was calibrated against recorded discharge and water level data for several significant historical flood events. Chapter 10 – Water Resources, section 10.4.4 and Appendix D3 (Sections 9 and 10) of the Draft EIS present the methodology and results of the flood study as well as potential flood impacts and flood mitigation measures that may be required during Project operations.

The flood study results revealed that the proposed Project mining operations will have a relatively minor impact on flood levels and flood velocities at the MRM site. The flood study results also show that these impacts are manageable with appropriate mitigation measures and that there is enough room for the passage of the McArthur River, Barney Creek and Surprise Creek floodwaters. Full details on the potential water level and velocity impacts of the proposed works are provided in Chapter 10 – Water Resources, section 10.4.4.2 and Appendix D3 (Section 9.6) of the Draft EIS.

Table 10-20, in Chapter 10 – Water Resources of the Draft EIS demonstrates there is minimal change in flood heights in the Barney Creek Channel for the 1-in-100 and 1-in-500 year events (ranging from 0.06 to 0.65 m depending on location). The modelling demonstrated that velocities along the Barney Creek channel could potentially be increased by up to 0.2 m/s at location G.

During large flood events, velocities between 4 m/s and 7 m/s would potentially occur along the Barney Creek Channel between reporting locations H and I in the vicinity of the Haul Road. Velocities between 3 m/s to 4 m/s would potentially occur along the McArthur River Channel between reporting locations B & D (see Figure 10-14 for locations). A regular erosion monitoring program will be undertaken along these high velocity reaches. Additional erosion protection works will be undertaken in areas where visible erosion is evident during this monitoring program.

The proposed flood impact mitigation measures are detailed in Chapter 10 – Water Resources, section 10.6.2 and Appendix D3 (Section 9.7) of the Draft EIS. To mitigate against potential erosion, the proposed erosion protection bund will be constructed to protect the overburden emplacement facilities (OEF) containing non-acid forming (NAF) materials (i.e. East and South OEFs) from erosion by McArthur River and Barney Creek floodwaters. The average height of the bund wall will vary from approximately 5 m to 13 m, to place the crest level above the 1% AEP (100 year ARI) level. The bund would be constructed with rocks from selected NAF material. The rocks will be sized to withstand erosive forces generated by floodwaters from the McArthur River and Barney Creek. The proposed bund will be set back at least 75 m as a buffer from the top of bank of the McArthur River and Barney Creek diversion channels.

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Note that the flood modelling results demonstrate that the protection of the open pit from a 0.2% AEP (500 year ARI) event is not compromised by the proposed Project works and no additional open pit flood protection works are required.

Also see response to Comment 32.

Comment No.	EIS Section	EIS Discipline	Comment
7	3.4.9	OEF Locations	<p><i>"After assessing all of the above considerations, it was determined that a combination of the North, East and South OEF alternatives would be utilised for the storage of project mine overburden."</i></p> <p>Will the location of the OEFs create bottle-necking of the river and creeks?</p>

Response:

A flood study of the McArthur River has been undertaken to assess the potential impacts of the Project mining operations at MRM including the impacts of the proposed North, East and South OEF footprints on flood levels, flood velocities and flood extents within and in the vicinity of the mine. The potential impacts and mitigation measures are discussed in the response to the Reference No 6 (from Department of Resources).

Flood modelling was undertaken for the Project Draft EIS to determine if bottlenecking would occur. During the feasibility process, a number of OEFs located to the south of the McArthur River were considered, but were ruled out because of the potential significant impacts on flooding and bottlenecking. Hence, the current OEF configuration placing overburden in the South, East and North OEFs was selected on the basis of these flood modelling results, economic considerations, the optimisation of haul distances, and environmental constraints and impacts.

Table 10-20 (Chapter 10 – Water Resources) of the Draft EIS demonstrates there is minimal change in flood heights in the McArthur River and Barney Creek Channels for the 1-in-100 and 1-in-500 year events. For example, flood heights change in the McArthur River Channel from 0.05 to 0.54 m depending on location (with Barney Creek ranging from 0.06 to 0.65 m depending on location). The modelling demonstrated that velocities along the Barney Creek Channel could potentially be increased by up to 0.2 m/s and in the McArthur River by up to 0.7 m/s in some locations. Hence, bottlenecking will not be a significant issue for the Project.

Also refer to response to Comment 6.

Comment No.	EIS Section	EIS Discipline	Comment
8	3.4.12	Power Supply	MRM does not own the power station. What considerations need to be made in relation to the "upgrade and expansion of the existing power plant"?

Response:

The upgrade of the power station is subject to a number of commercial and environmental considerations designed to maintain a continuous and efficient power supply to the operation throughout its life.

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The upgrade and operation of the power plant will be achieved through a Build, Own, Operate (BOO) style Contract, which will be tendered and awarded during the detail design phase. Similar to the current situation, the contractor will own and operate the upgraded power station and deliver power to MRM under a comprehensive Power Purchase Agreement.

The upgrade of the power station has provided an opportunity to explore new technologies and energy efficiency initiatives to improve the operation of the power station. The current proposed expansion will result in an expected energy efficiency increase of up to 60% which, through improved generator efficiencies, will result in a significant reduction of greenhouse gas emissions from the power station per tonne of ore processed. Air quality and noise emissions are not expected to increase significantly as a result of the upgrade and will be monitored following commissioning to compare actual results with this expectation.

The location of the upgraded power station is provided in Appendix S.

Comment No.	EIS Section	EIS Discipline	Comment
9	3.4.13	TSF	<p><i>"The new water management dam would also be lined to minimise potential seepage."</i></p> <p>What type of liner will be used and what construction methods will be employed to ensure the integrity of the lining?</p>

Response:

The new TSF Cell 4 water management dam will be converted to a Tailings Storage Facility (TSF) in 2032 and as such will be constructed to the specifications of a TSF. An NOI for Cell 4 to be utilised as a water management dam was submitted by the Proponent on 4 May 2012 in accordance with correspondence with, and advice from DOR (see section 2.4.3).

The new water management dam and subsequent TSF will be lined with a low permeability High Density Polyethylene (HDPE) geomembrane over the storage floor with associated under-drainage pipework. The use of a HDPE liner with a network under-drainages (which will assist in the collection of any seepage that may permeate the liner or embankment walls) was developed as a new robust solution to better control seepage both during operation and post-mining.

The Proponent also commits to lining TSF Cell 3. Cell 3 will be lined to a similar specification as Cell 4. The liner will consist of high quality polyethylene resin or polypropylene resin containing no more than 2% clean recycled polymer by weight and is expected to contain the following specified properties, measured using the test methods indicated:

Property	Test Method	Required Values	
		Polyethylene	Polypropylene
Thickness	ASTM D 1593	1.50mm min	1.50mm min
Density	ASTM D 1505	0.925 – 0.935	0.890 - 0.930
Melt Index	ASTM D 1238E	<0.6 gm/10min	N/A

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Property	Test Method	Required Values	
		Polyethylene	Polypropylene
Carbon Black Content Dispersion	ASTM D 1603	2 – 3%	2 – 3%
Tensile Properties	ASTM D 638		
1. Ultimate Tensile Strength	Type IV specimen at 2 inches/minute	40kN/m min	40kN/m min
2. Ultimate Elongation		500% min	500% min
3. Yield Tensile Strength		22kN/m min	22kN/m min
4. Yield Elongation		12% min	12% min
Tear Strength	ASTM D 1004 Die C	200N min	200N min
Dimensional Stability	ASTM D1204 212 ^o F, 15 min	± 1%	± 1%

With regard to the liner installation, the subgrade preparation requirements are expected to be as follows:

Surfaces to be lined shall be flat within +/- 50mm in any 10 square metre area. All intersections between straight or curved smooth surfaces shall be made along straight lines or smooth curves.

The subgrade shall be smooth and free of protruding rocks, sharp stones, sticks, roots, sharp objects, or debris of any kind, and shall provide a firm, unyielding foundation for the membrane with no sudden, sharp or abrupt changes or break in grade.

A panel is a single sheet of liner (prefabricated or otherwise) which is to be seamed to other panels in the field. Usually a panel is a roll or a portion of a roll cut in the field.

Panels are expected to be placed one at a time, and each panel is expected to be seamed immediately after its placement (in order to minimise the number of unseamed panels).

Construction and installation of the liner would be in accordance with ANCOLD and/or ICOLD guidelines (specifically ICOLD Bulletin 135, 2010) and current industry best practise, including a detailed quality assurance and quality control test program during installation.

Comment No.	EIS Section	EIS Discipline	Comment
10	3.4.13	TSF	<p><i>"This new water management dam, that is being designed and constructed to facilitate future use as a TSF, is currently being considered under the annual Mining Management Plan process pursuant to Section 40 of the Mining Management Act 2001."</i></p> <p>Has the new water management dam been designed to meet the ANCOLD guidelines (i.e. will last 1000 years)?</p>

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Response:

The key Cell 4 design aspects are expected to be as follows:

- Minimum Design and Operating Standards - relates to maintaining a minimum freeboard to minimise spill risk based on the hazard rating of the storage. The hazard rating assessment was undertaken in accordance with ANCOLD (1999, Guidelines on Tailings Dam Design, Construction and Operation). Based on the site climatic conditions, the Queensland guideline DME (1995, Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland) are proposed which states that the freeboard as at the 1 November of each year shall be a minimum of a 200 year ARI 2 month wet season (for a High Hazard storage).
- Embankment Stability - relates to seepage and stability analyses. Modelled cases included end of construction, long term steady state (assuming filled with water), rapid drawdown, seismic loading. Analyses based on ANCOLD (1999) and ANCOLD (1998, Guidelines for Design of Dams for Earthquakes), to withstand the most severe and unfavourable combination of static and dynamic loads.
- Construction Materials - Criteria adopted for materials to be used in construction of the Cell 4 embankment can be developed interactively with related criteria (particularly embankment stability) to ensure that appropriate performance standards are achieved.
- Stormwater Management - Spillway to be designed in accordance with ANCOLD (2000, Guidelines on Acceptable Flood Capacity for Dams) and ANCOLD (1999).

Comment No.	EIS Section	EIS Discipline	Comment
11	3.4.16	Water Supply and Management	This seems to relate to the water supply for the mine only. What about the increase in potable water supply requirements associated with the increased number of personnel?

Response:

Potable water demand will increase with the increased number of personnel. Sufficient supply exists for the provision of this potable water through the existing bore network. MRM currently utilises three major bore fields, Emu, Mimex and Donkey around the mine operation. In general, water usage from bores over the past three operational years has decreased with a greater emphasis on the use of decant water from Cell 2 at the TSF and the Water Management Dam to supply the plant. Bore water is still utilised however for reagent mixing, wash down water and potable requirements.

Raw groundwater is pumped from the bore fields to storage tanks and then the raw water is treated by ion exchange to produce softened water. Water being utilised for potable water undergoes further chemical treatment with hypochlorite to ensure it is fit for human consumption.

In future the Mimex borefield will be utilised as the primary source of potable water. Sufficient capacity existed within the Mimex borefield, within existing authority requirements, to supply the potable water demand.

Also refer to the response to comment 101.

Comment No.	EIS Section	EIS Discipline	Comment
12	3.4.17	Final Void	What about backfilling the void with waste rock?

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Response:

Open pit void backfilling has been considered by the Proponent. Backfilling is most feasible where multiple pits or underground voids have been or are being developed, permitting mine or other wastes to be deposited in the voids. There are a number of key issues requiring consideration in this decision making process:

- operational costs, schedules and engineering considerations;
- resource sterilisation;
- water management and environmental risks; and
- land disturbance.

Completely filling the Project's mine void with waste rock has not been adopted as a practical solution for the following reasons:

- It will sterilise any remaining resource – pumping water out of the open pit and re-working the resource is a feasible option but re-excavating the open pit is not.
- The cost of rehandling all of the waste rock back into open pit could reduce the size of the proposed open pit void due to significantly increased rehabilitation costs (increased costs typically result in higher cost material being excluded from the minable resource).
- Re-opening the capped PAF cells in the NOEF would create an environmental risk by re-exposing this material to atmospheric conditions.

Larger-scale in-pit dumping during the mine life has been analysed by MRM in previous mine planning, with preliminary estimates of environmental and economic advantages compiled. A 2004 study shows three in-pit dumps capable of holding up to 24Mt. However, there is insufficient geotechnical data to analyse in-pit dump stability with the confidence required to include these in the current mine plan. Further geotechnical investigations will be undertaken in the future to enable the in-pit dump concept to be developed further if possible.

Progressive in-pit dumping of waste rock with the current extraction sequence, which is from the shallowest ore to deepest ore, would require that mining operations work down-dip from dumped waste, similar to the way most waste strip coal mines work. However, the dip of the majority of the deposit (approximately 17 to 30 degrees, compared to the natural angle of rill of waste rock of around 35 degrees) and geotechnical properties of the tuff beds to the footwall of the orebodies make this a high risk proposition – any failures of the dumps (or of the beds below the dumps) could result in dumped material sliding onto operations below.

Therefore the direction of mining would need to shift to one aligned along the strike of the deposit – either north-south or south-north. So the pit stages would contain ore from the shallowest part in the west to the deepest part in the east.

Whilst this is possible, a number of issues exist:

- As the deepest parts of the economic orebodies are so deep (+400m), a very large excavation must be made before the bottom is reached – hence, much of the deposit needs to be mined before any waste rock can be progressively back filled into the open pit void.
- The stripping ratio incurred is very large from the start of operations, instead of a gradually increasing value. This results in a significant cost to remove waste at the start of the operations, which must be funded by small quantities of ore. This severely impacts on the net present value of the project, to the point that it would not meet investment hurdles required by most mining companies, including Xstrata Zinc.

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Detailed planning undertaken in 2001 indicated that only approximately 20% of the total waste mined over the life of mine could be tipped directly into in-pit dumps without rehandling, and it would be 15 years before any in-pit dumping commenced. Thus, the environmental impacts of the waste dumping operations are not significantly mitigated by a progressive in-pit dumping strategy.

Also refer to response to Comments 86 and 104.

Comment No.	EIS Section	EIS Discipline	Comment
13	4.7.5	Sewerage	"The treatment plant has recently been expanded to a current capacity of 400 equivalent persons. Section 1.1 of the EIS states <i>"Peak employment levels are expected to be 930 during construction and 735 during the operational phase up from the current 440 permanent employees."</i> The treatment plant is already inadequate for the <i>"current capacity of 400 equivalent persons."</i> Another upgrade and expansion is required to ensure the treatment plant can cater for the expected 735 employees during the operational phase.

Response:

The current upgraded facility has a design capacity for approximately 600 on-site personnel. The Draft EIS had proposed to cater for construction personnel in separate temporary modular treatment facility. As discussed in Section 2.3.2, optimisation assessments have determined it would be preferable to upgrade the existing permanent facility to cater for 1000 on-site persons. Due to the mine's rostering schedule, this will provide more than adequate capacity to cater for the on-site personnel throughout the construction and operational phase of the Project. In consultation with the Department of Health, the Proponent will seek approval for all on-site sewerage treatment facilities in accordance with the *Public and Environmental Health Act 2011*.

Comment No.	EIS Section	EIS Discipline	Comment
14	10.2.3	Water Resources	<p>With reference to the sentence "The MRM is situated adjacent to the McArthur River, in the middle reaches of its catchment, between the confluences of the Kilgour and Glyde Rivers."</p> <p>The MRM is situated on the site of the McArthur River and Barney Creek, both of which were diverted around the mine for phase 2 activities.</p> <p>It is important to continue to highlight the diversion of two water bodies as it demonstrates existing impacts and potential sources of water infiltration into mining operations and potential flow paths out of the mine.</p> <p>Update text to include the McArthur River and Barney Creek diversion channels. Figure 10-2 highlights the diversion channels but the text does not, particularly for the McArthur River. The document should also mention that the McArthur River Diversion Channel is situated over the lower section of Bull Creek.</p>

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Response:

As discussed in the Draft EIS, the McArthur River and sections of the lower reaches of Barney Creek were diverted as part of approvals for prior phases of the MRM to access ore required for the open pit. As no diversions are required for the Project, the focus of the surface water assessment was to model the potential flooding impacts of the Project on a whole-of-site scale. The McArthur River Channel is situated over the lower section of Bull Creek - this was approved as part of the Phase 2 Development.

Comment No.	EIS Section	EIS Discipline	Comment
15	10.2.4.1	Water Resources	With reference to "Sections of the lower reaches of Surprise and Barney Creeks were diverted in 2009 as part of approvals for prior phases of the MRM". Surprise Creek was not diverted. A lower portion was removed as the Barney Creek Diversion Channel intercepts Surprise Creek further upstream than the original channel.

Response:

The flow from Surprise Creek was diverted down the Barney Creek Diversion Channel. This resulted in the removal of the lower reaches of Surprise Creek.

Comment No.	EIS Section	EIS Discipline	Comment
16	Figure 10-1	Water Resources	A more useful representation of catchments is to show the catchment boundaries for each river/creek, with particular interest in Surprise Creek, Barney Creek and Little Barney Creek. All three are close to either the tailings storage facility (TSF), northern overburden emplacement facility (NOEF) or the processing plant. Include an additional figure highlighting these catchments and other surface water catchments close by.

Response:

Figure 2.2 of Draft EIS Appendix D3 – Surface Water shows the local drainage network in the vicinity of the existing McArthur River Mine. A new catchment figure, showing the local catchments covering the Project area has been provided in Appendix B.

Comment No.	EIS Section	EIS Discipline	Comment
17	Figure 10-2	Water Resources	Highlight the original path of the McArthur River and highlight and label Little Barney Creek, including the section the water management dam now (WMD) covers.

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Response:

The original path of the River and Creek systems is provided on the revised Figure 10-2 in Appendix B. These alignments are also identified as red lines on Figure 10-14 of the Draft EIS.

Comment No.	EIS Section	EIS Discipline	Comment
18	10.2.6	Water Resources	<p>"WDL 174-1 Trigger Levels" misrepresent what the community would expect to be trigger values to judge water quality.</p> <p>The values are based on hardness modified trigger values (HMTV) calculated using Table 3.4.3 in the ANZECC (2000) guidelines.</p> <p>These HMTVs have been calculated based on hardness values averaged from several years of sampling. Figure 3.4.2 in the guidelines shows a decision tree for metal speciation. It shows that total metal concentrations should be compared to the guideline trigger value first, should it be exceeded then the HMTV should be used. Should that be exceeded then the dissolved concentration should be compared to the HMTV. The HMTV should be calculated based on the hardness of the water for that sample only, not an average over many years of sampling. Hardness values in the McArthur River vary greatly from <10 mg/L to >600 mg/L. This variability places great importance on ensuring the HMTV is calculated based on the hardness for that sample.</p> <p>As such Section 10.2.6 and its tables should compare results to the trigger values for ANZECC 2000 95% level of protection for freshwater. It may also refer to trigger values for WDL-174-1 however it should include an explanation of the HMTV.</p>

Response:

The application of water quality guidelines, in conjunction with the assessment of background water quality, is an important aspect of water quality monitoring at MRM. However the MRM site is remote and monitoring programs must consider the feasibility of obtaining analysis results within the transport and analysis limitations of the site. Whilst the ANZECC guidelines provide a decision tree, this is not necessarily practical to implement the procedure at a remote site. As this is an ongoing operational issue, the Proponent will work with the Department of Resources to improve the procedure where practicable.

It is generally accepted that the toxicity of certain metals, including zinc, is dependent on water hardness (USEPA, 1976; USEPA, 1986; USEPA, 1987). As well as their published trigger values, which are calculated at a hardness of 30 mg/L as CaCO₃, ANZECC has published equations that enable the calculation of a hardness-modified trigger value (HMTV) from their published trigger value, which apply at any hardness concentration (Refer Table 3.4.3 in ANZECC 2000). The hardness conversion is based on the slope of the regression line that is used to fit the toxicity data versus hardness relationship.

Guidelines applied for monitoring environmental performance include:

Australian and New Zealand Guidelines for Fresh and Marine Waters (ANZECC; 2000);

- i. Natural surface water (95% level of protection);

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- ii. Marine water (95% level of protection); and
- iii. Groundwater (livestock drinking water guidelines; non-potable bores).

Interim Sediment Quality Guidelines (ISQG);

- i. Freshwater sediments (ISQG low trigger values);
- ii. Marine sediments (ISQG low trigger values).

Australian Drinking Water Guidelines (ADWG);

- i. Groundwater (Potable water bores only).

All monitoring programs, with the exception of surface water, utilise the default trigger values as found in the respective guideline. In addition to utilising default guidelines, HMTV and interim site specific trigger values (sulphate) are calculated for particular surface water sites. These additional trigger values are calculated using the relevant guidelines and are explained below.

Natural Surface Water Trigger Values

Natural surface water monitoring is the most intensive monitoring program undertaken at MRM. Results from laboratory analysis of samples are compared against the relevant guideline and, if necessary, background levels to determine if recorded concentrations pose a risk to the environment.

Due to the known natural mineralisation in the area, elevated background levels may be encountered with the potential to exceed the relevant trigger values. On collection and review of sufficient data MRM, in consultation with DoR, will develop and apply site specific guidelines for monitoring at the mine site and Bing Bong concentrate storage and ship loading facility. In the interim the above guidelines will be applied. Influence of hardness on receiving waters is taken into account through the development of HMTV's.

Calculation of the HMTV's occurred in the 2009/10 WMP incorporating all available data. These TV's were applied during the previous reporting period and were subsequently used as comparative TV's in the monitoring sections. Re-calculation of these HMTV's has been undertaken for application in the 2011/12 reporting period and subsequent WMP incorporating data from the current reporting period. HMTV's will be recalculated as necessary throughout the life of the Project.

These HMTV's were calculated as per Table 3.4.3 of the ANZECC Guidelines with hardness data collected at the most upstream site with appropriate data available. Hardness data is collected on a weekly basis at all surface water monitoring sites as per MRM's monitoring commitments, presented in the Environmental Monitoring Manual. McArthur River HMTV's incorporate data from July 2007-June 2011. Surprise Creek HMTV's were calculated based on data from July 2008-June 2011 when flowing. Upstream reference site SW10 was again used in the calculations of McArthur River HMTV's to maintain consistency and due to the greater level of access to the site over the wet season.

Statistical comparison of SW10 and SW21 showed no significant difference ($P > 0.05$) between the two sites indicating a comparable water quality. As MRM does not consider Surprise Creek site SW1 as a suitable reference site an additional site was created in 2009. As this site now has sufficient hardness data available this site will be used for the calculation of the Surprise Creek HMTV's for application in the 2011/12 reporting period.

As there is limited data for Barney Creek due to short periods of flow post rainfall events and as hardness remains comparably low compared to other systems the ANZECC default guidelines will continue to be applied to upstream Barney Creek. However as per previous reporting periods Surprise Creek HMTV's will be applied to sites on Barney Creek downstream of the Surprise Creek confluence due to the comparably larger flow and influence of hardness from this system.

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The HMTV's are detailed below:

Surprise Creek sub-catchment (applied to SW23, SW1, SW2, SW24, SW18, SW19, SW20, SW6 and SW25):

- i. Cd HMTV: 0.39 μ g/L
- ii. Cu HMTV: 2.68 μ g/L
- iii. Pb HMTV: 8.95 μ g/L
- iv. Zn HMTV: 15.29 μ g/L

Barney Creek sub-catchment (applied to SW4; SW22 and SW3):

- i. Default TV's to be applied

McArthur River sub-catchment (applied to SW21; SW10; SW7; SW13; SW14; SW15; SW16; SW17; SW12; SW11):

- i. Cd HMTV: 1.79 μ g/L
- ii. Cu HMTV: 11.33 μ g/L
- iii. Pb HMTV: 77.28 μ g/L
- iv. Zn HMTV: 64.72 μ g/L

MRM initiated the derivation of site-specific high reliability trigger values for sulphate, based on ecotoxicity testing of local aquatic biota, to maintain appropriate measures in place for protecting the receiving McArthur River ecosystem. Site-specific high reliability trigger values were derived through the performance of toxicity tests with regionally relevant species and the construction of species sensitivity distributions (SSD) as prescribed by ANZECC & ARM CANZ (2000). The ecotoxicology tests were undertaken on an averaged hardness for practicality.

The following species and tests were selected as relevant species for the construction of SSD:

- 72 h *Chlorella sp.* algal cell division rate test (chronic);
- 96 h *Lemna aequinoctialis* plant growth test (chronic);
- 48 h *Ceriodaphnia cf. dubia* (waterflea) immobilisation test (acute);
- 7 d *Ceriodaphnia cf. dubia* three brood test (chronic);
- 96 h *Hydra viridissima* (hydra) population growth test (chronic);
- 10 d *Melanotaenia splendida* (rainbowfish) embryonic development and post-hatch survival test (chronic); and
- 96 h *Macrobrachium bullatum* juvenile prawn survival test (acute).

Using the commercially available test species considered appropriate for the region, and performing toxicity tests in water obtained from the McArthur River, the concentrations of sulphate that would protect 95% of species was determined at 341 mg/L sulphate and the concentration predicted to be protective of 99% of species was determined at 123 mg/L.

For the purposes of internal investigation; if concentrations are recorded above the trigger value, levels will be compared to background concentrations. If levels are greater than 10% above background levels an internal investigation will be conducted with the completion of an incident notification form. Once the source has been identified mitigation strategies and associated actions will be identified and assigned.

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For the purposes of external reporting; trigger values will be applied to SW11, the most downstream site on the McArthur River (within the mine lease). This has been deemed the 'compliance point' as water quality measured at SW11 will best indicate any potential downstream contamination beyond the mine lease boundaries. In the event of an exceedance of one or more TV's/HMTV's at SW11, the concentrations will be compared to background levels (SW21, upstream McArthur River and SW9, Glyde River) to determine the influence of background concentrations. This will be considered an exceedance if 10% greater than background levels.

Revised Tables 10-1 and 10-2 from Section 10.2.6 are provided below incorporating comparison with the ANZECC 2000 freshwater guidelines for 95% protection.

Also see responses to Comments 110 and 111.

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Summary Surface Water Quality Data, McArthur River, Barney Creek, Surprise Creek and MR Channel

Parameter	Units	MRM WDL174-1 Trigger Value	ANZECC 2000 95%	SW11				SW10				SW21				Old McArthur River
				Med-ian	95 th %ile	Min	Max	Med-ian	95 th %ile	Min	Max	Med-ian	95 th %ile	Min	Max	
pH		<6 and >8.5	<6 and >8.0	8.3	8.6	6.6	8.7	8.3	8.56	7.5	8.6	8.4	8.6	7.3	8.6	7.4
EC	µS/cm	n/a	20-250	662	751.6	21	783	679	724.2	79	741	662	713	66	735	565
Arsenic (As)	µg/L	13	13	1.1	2	0.2	2.5	1	1.86	0.3	2.3	1	1.9	0.35	2.3	1.08
Cadmium (Cd)	µg/L	1.79	0.2	0	0	0	0.1	0.02	0.02	0.02	0.2	0.02	0.02	0.02	1	0.02
Copper (Cu)	µg/L	11.33	1.4	0.5	1	0.2	1.4	0.42	1.33	0.14	2.25	0.49	1.26	0.13	1.35	0.97
Lead (Pb)	µg/L	77.28	3.4	0	0.2	0	1	0.01	0.14	0.01	0.79	0.02	0.15	0.01	1	<0.1
Zinc (Zn)	µg/L	64.72	8	0.5	1.7	0.2	5	0.5	1.36	0.2	24.1	0.5	2.14	0.2	5	33.1
Sulphates (SO ₄)	mg/L	15.8	-	12.2	19.8	0.6	21	8.2	13.26	0.8	14.5	7.4	12.72	0.9	13.9	248

(WRM, 2012)

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Summary Water Quality Data, Lake Archer and Open Pit Sump

Parameter	Units	MRM WDL174-1 Trigger Value	ANZECC 2000 95%	Lake Archer				Pit Sump			
				Median	95 th ile	Min	Max	Median	95 th ile	Min	Max
pH		<6 and >8.5	<6 and >8.0	8.2	8.2	7.5	8.2	7.7	7.9	6.8	8.0
EC	µS/cm	n/a	20-250	1,210	1,594	1,200	1,650	3,320	3,730	2,830	3,760
Arsenic_As	µg/L	13	13	31.0	40.4	1.5	41.0	1.1	15.9	0.5	16.5
Cadmium_Cd	µg/L	1.79	0.2	2.1	18.0	0.2	20.4	8.5	14.7	2.8	15.6
Copper_Cu	µg/L	11.33	1.4	0.9	2.1	0.4	2.3	0.7	1.8	0.4	1.9
Lead_Pb	µg/L	77.28	3.4	6.0	31.2	0.3	36.6	58.2	77.5	49.9	77.9
Zinc_Zn	µg/L	64.72	8	488	3,974	48	4,560	13,500	16,610	1,770	16,700
Sulphates (SO ₄)	mg/L	15.8	-	250	895	167	928	2,000	2,140	1,600	2,170

(WRM, 2012)

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Comment No.	EIS Section	EIS Discipline	Comment
19	10.2.8.5	Water Resources	Dilution ratio is 1:162 not 1:160 as stated.

Response:

Noted. The ratio stated in Waste Discharge Licence 174-1 is 1:162. This is a typographical error in the Draft EIS. The dilution ratio specified in Section 10.2.8.5 and Appendix D3 (Section 6.3) of the Draft EIS should be 1:162. Further detailed ecotoxicology studies are being undertaken which may result in changes to the dilution ratio.

Comment No.	EIS Section	EIS Discipline	Comment
20	10.2.8.5	Water Resources	There is a need to include reference to minimum heights in both Little Barney and Barney Creeks in order to discharge from the WMD.

Response:

The Draft EIS states that Waste Discharge Licence Release Points are 1) WMD into Little Barney Creek and 2) Old McArthur River (OMR) into the McArthur River Channel. Minimum Heights required for releasing water into Barney and Little Barney Creeks are as follows: water discharged to Little Barney Creek only when flow is higher than 0.25m on the gauge board in Little Barney Creek and then consecutive siphons every 0.25m. Water will only be pumped into Barney Creek at a rate of 83 litres per second when the water is at a height of 0.7m.

The Draft EIS proposes that water is discharged to the McArthur River under an appropriate 'controlled' release strategy during high flows in the river or pumped off-site for the irrigation scheme. A Waste Discharge Licence would be required from NRETAS to allow controlled releases of 'intercepted' water stored in the TSF Cell 3 WMD to the McArthur River or the irrigation scheme.

Approval for all proposed discharges will be sought through the Waste Discharge Licence approval process under the Water Act 2004. Ecotoxicology studies are being undertaken to assist with evaluations of the receiving environment, appropriate dilution ratios and release criteria. This work will be presented as part of the Waste Discharge Licence application.

Comment No.	EIS Section	EIS Discipline	Comment
21	Figure 10-3	Water Resources	<p>The figure:</p> <ul style="list-style-type: none"> • Does not indicate seepage rate from Cell 1. • Suggests 100% capture of seepage from Cell 1 which is incorrect. • Storages should include capacity. • Sprinklers should include the amount that can be evaporated, not that can flow into the sprinkler. • Rainfall inputs are not included. • The VDD has the potential to receive contaminated

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			<p>water and therefore should not be used for water cart operations.</p> <ul style="list-style-type: none"> • Spillways for all PAF runoff dams flow to the McArthur River. This is high risk to the River. Spillways should be diverted to alternative storages for treatment before release to the environment. • Suggests that Cell 2 and Cell 3, seep, which is unacceptable for tailings storage. What modifications to Cell 3 can be undertaken to reduce seepage before the cell begins to receive tailings?
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Response:

Revised Figure 10-3 is provided in Appendix C and updates and replaces Figure 10-3 and Figure 6.2 of Appendix D3 of the Draft EIS.

Predicted Seepage Rates from Tailings Storage Facility

The seepage rates provided in revised Figure 10-3 are based on model predictions made in URS (2006). Revised Figure 10-3 provides a TSF Cell 1 seepage recovery rate of 200 kL/d, which is pumped to TSF Cell 2. Based on URS (2006), the predicted total TSF Cell 1 seepage rate is 1,520 kL/d. Of this, 890 kL/d would seep through the embankment. The remaining 630 kL/d would infiltrate to the water table. Meter readings from recovery bores between 2009 and 2012 indicate that seepage water along the northern embankment is collected and pumped to TSF Cell 2 at an average rate of about 200 kL/d (22% of the predicted seepage rate through the embankment). Therefore, the predicted seepage from TSF Cell 1 that is not recovered and infiltrating to the water table is 1,320 kL/d.

The revised Figure 10-3 provides a TSF Cell 2 seepage loss of 1,460 kL/d. Based on URS (2006), the total predicted TSF Cell 2 seepage rate is 1,710 kL/d. Of this, 1,130kL/d would seep through the embankment. The remaining 580 kL/d would infiltrate to the water table. Similar to TSF Cell 1, assuming 22% of embankment seepage (565 kL/d) would be collected in seepage trenches and pumped back to TSF Cell 2, the estimated seepage loss from TSF Cell 2 is predicted to be 1,460kL/d.

As described in Section 2.3.4 and in response to Comment 36. TSF Cell 3 and TSF Cell 4 would be lined incorporating an underdrain seepage collection system. Therefore, it was assumed that no seepage (0kL/d) would report into the environment from these cells. This is a conservative assumption for water balance modelling purposes (i.e. the water balance models maximum retention).

Also see response to Comment 82 in regards to seepage from the TSF. Seepage rates will be estimated throughout the life of the project based on modelling and monitoring data.

Storage Capacities and Catchment Areas

The table below identifies the current storage capacities and catchment areas draining directly to each of the existing mine water dams. This information was compiled from Table 10-3 of the main report and Table 6.1 and Table 8.1, Appendix D3 of the Draft EIS.

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Storage Capacities and Connected Catchment Areas of Existing Storages

Dam Name	Storage Capacity at FSL (ML)	Connected Catchment Area (ha)
Anti Pollution Pond (APP)	23	14.5
Concentrator Runoff Pond (CRP)	27	13.0
Van-Duncans Dam (VDD)	25	37.9
Pete's Pond (PP)	100	2.1
Cell 3 Water Management Dam (Cell 3 WMD)	1834	129
Lake Archer (LA)	20	39.1
Eastern Levee Storage (ELS)	850	54.0
Old McArthur River (OMR) Channel	600	180.0
North Overburden Emplacement Facility (North OEF) Southern PAF Sediment Dam (SPSD)	250	77.2
Northern Overburden Emplacement Facility (North OEF) Southern PAF Runoff Dam (SPROD) ^a	810	17

^a Overflows from SPSD spill into SPROD?

Monitoring to validate water balance modelling will occur throughout the life of the Project, as is the current case. As part of the existing operations, an annual water balance and water management plan are submitted to the Northern Territory Government, and this will continue for the Project. The water balance will take into account all of the water inputs and outputs occurring at the time of modelling, as this will vary throughout the life of the Project as catchment areas and potential water inputs and outputs change.

Sprinkler Loss Rates

The revised Figure 10-3 shows the adopted sprinkler pumping, loss and return rates. Revised Figure 10-3 shows an average sprinkler loss rate of 0.75 ML/d from Pete's Pond and the North OEF dams (NOEF SPSD & NOEF SPROD). The total pumping rate to sprinklers from the above storages is 3.0 ML/d (based 60 l/s on average for 14 hr/d).

Of this, approximately 0.75 ML/d (25% of the pump rate) is evaporated by the sprinkler system. The remaining 2.25 ML/d is assumed to return back to the water storage. The sprinkler system is operated taking into account the micro-climate conditions in the vicinity of the sprinklers to minimise any potential spray drift away from containment areas.

Rainfall Inputs

Not all inflows to and outflows from mine water storages are explicitly shown in Figure 10-3 to reduce clutter. Appendix D3 (Table E1, Appendix E) of the Draft EIS lists all the inflows to and outflows from each storage shown in Figure 10-3, including rainfall inputs.

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Water Cart Operations

The VDD has the potential to receive contaminated water and is used for water cart/dust suppression operations. This water, when sprayed on haul roads, is largely contained within the mine water management system, and controls are in place, such as windrows, drains and collection sumps to maximise contaminated water collection. This component is currently being addressed from an operational perspective through the SDWMP.

Overflows from PAF Runoff Dams

The water balance modelling undertaken to size mine site dams, including PAF runoff collection dams, is described in Section 10.4.3 (Chapter 10 – Water Resources) and Appendix D3 (Section 8) of the Draft EIS. The storage capacities of the PAF runoff dams have been sized to ensure that during the periods when these dams collect PAF runoff, the risk of uncontrolled overflows from these dam spillways is minimised.

The water balance model results indicate that the probability of the proposed PAF runoff dams overflowing during the periods when it is expected that PAF material is exposed within the connected catchment area is 5% over the life of the mine. This is considered an acceptable level of risk. To further reduce risk, PAF runoff dams would potentially be constructed with two components (i.e., with an initial sediment dam that overflows into the main containment storage), to meet good practice objectives. This design will be further refined during the detailed engineering stage.

Seepage from TSF Cell 2 and Cell 3

As mentioned previously and described in detail in Section 2.3.4 and in response to Comment 36, TSF Cell 3 will be lined with HDPE, including a network of drainage pipes under the liner to minimise seepage.

Comment No.	EIS Section	EIS Discipline	Comment
22	10.3.6.4	Water Resources	<p>Seepage is occurring in the Southeast section of the WMD. This is of major concern considering this is the future Cell 3 for tailings.</p> <p>What is being done to prevent seepage before this dam begins to receive tailings?</p> <p>While the South-eastern section will be sectioned off for WMD rather than tailings, it is likely that seepage will allow contaminants from tailings to enter this WMD.</p> <p>It is also noted that this section is currently used for the dumping of putrescible waste. This is likely to impact water quality now and into the future and warrants an increase in the analysis undertaken in the WMD and Little Barney Creek.</p>

Response:

Seepage management measures will be similar to those proposed in Appendix E1 – Tailings Storage Facility Management Plan of the Draft EIS. The existing WMD (Cell 3) will be lined prior to the commencement of tailings deposition minimising the amount of seepage that could potentially occur. The capacity of the existing TSF Cell 3 WMD will be reduced from approximately 1,830 ML to 532 ML to allow for the construction of the tailings storage component of Cell 3. TSF Cell 3 WMD is a turkeys nest dam with a surface area of approximately 129 ha prior to and 25 ha after it's reduction in size to allow tailings deposition. Seepage monitoring and modelling of the TSF will also be undertaken during the Project, which will include the effectiveness of the Cell 3 controls.

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In late 2011, MRM constructed a clay bund wall as a protective barrier for maintaining separation between the contaminated waste dump and waters within the Water Management Dam (WMD). Additional works to increase the height of the bund wall was carried out in 2011 and overtopping of the bund has not occurred.

The main putrescible waste dump was filled with clay in 2011 and rehabilitated to prevent water from the WMD coming into contact with disposed putrescibles. Currently a second pit is being utilised to dispose of putrescible waste. This pit does not have a direct impact on the WMD.

The routine environmental monitoring schedule includes TPH testing and analysis for samples collected from the WMD to ascertain if any hydrocarbon contamination is occurring as a result of the contaminated waste dump. During 2010/2011 reporting period TPH monitoring was scheduled biannually however during the wet season additional monitoring events were implemented as a proactive approach prior to and during the period of discharge. Laboratory results show all fractions were below the Limit of Reporting.

MRM commit to increasing the frequency of TPH monitoring at the WMD to a quarterly regime and monthly monitoring during potential discharge periods. MRM does not include bacteriological analysis of water collected from the WMD as conclusive results may be confounded by the influence of bird resting and foraging within the WMD.

MRM commits to the following monitoring schedule:

Parameters tested	Monitoring frequency			
	Monthly	Bi monthly	Quarterly	Biannually
pH, Temp, EC and ORP (field meter)	WMD, Little Barney Creek*	Bores GW6, 4, & 14,	WMD, Bores GW6, 4, & 14, Little Barney Creek *	
TDS/TSS				
Hardness				
Acidity/ Alkalinity				
Total metals (As, Cd, Cu, Pb, Zn)				
Filtered metals (As, Cd, Cu, Pb, Zn)				
Total major cations (Ca, K, Mg, Na)				
Filtered major cations (Ca, K, Mg, Na)				
Soluble Cl ⁻ and SO ₄ ²⁻				
TPH, PAH, BTEX			WMD, Bores GW6, 4, & 14, Little Barney Creek*	
Multi-element ICP-MS scan (Inc. Hg)				WMD, Bores GW6, 4, & 14, Little Barney Creek *

* discharge and/ or flow periods

Pesticides/ Herbicides are not used within the vicinity of the WMD, Little Barney Creek or adjacent groundwater bores. Containers used for annual spraying at other locations are recycled in the *drumMuster* program and not disposed at the contaminated waste area. MRM does not use cyanide in the zinc/lead process circuit therefore does not commit to monitoring this parameter.

Also see response to comment 4.

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Comment No.	EIS Section	EIS Discipline	Comment
23	10.3.6.7	Water Resources	Sections above have stated all but sulfate concentrations have been below guidelines. This section makes no mention if exceedances have or have not occurred. Please include a summary of exceedances in this section.

Response:

GW43A and GW43B are positioned close to the most eastern extent of the TSF and are in close proximity to each other. This may explain the similarities in their results of the tested parameters; the close relationship is most evident in both Cu and Pb results. These parameters fluctuate over time independently of each other. It appears that they peak and trough at different times however the pattern and scale to which they fluctuate, indicates that Pb is the same, but delayed, response as Cu.

EC, pH, SO₄ and Cl⁻ appear to show similar trends to the other locations. The pH results remain steady at approximately 7. Both EC and SO₄ reflect one another with GW43B returning higher results in both of these parameters. This is also the case with Zn which is at its highest concentrations at GW43B in comparison to all other sites around the TSF and is steady at approximately 1000 µg/L. This may be attributed to the depth of the bores with GW43A at 10.35 m and GW43B at 16.5 m as appeared to be evident in elevated concentrations at bores GW21, GW22 and GW23. Neither As nor Cd has demonstrated any significant temporal trends.

Metal concentrations in groundwater were all well below the respective guideline values. A summary of results for major metals and metalloids collected during 2010 -2011 is summarised below:

- Arsenic concentrations ranged between 1.3 and 3.45 µ g/L (μ =1.97 µ g/L; n=12). The median value for As concentrations measured was 1.68 µ g/L (NEPC1999=500 µ g/L);
- Copper concentrations ranged between 0.05 and 8.65 µ g/L (μ =1.78 µ g/L; n=12). The median value for Cu concentrations measured was 1.09 µ g/L (NEPC1999=500 µ g/L);
- Cadmium concentrations ranged between 0.1 and 6.96 µ g/L (μ =1.5 µ g/L; n=12). The median value for Cd concentrations measured was 1.04 µ g/L (NEPC1999=10 µ g/L);
- Zinc concentrations ranged between 18.2 and 1,240 µ g/L (μ =582.3 µ g/L; n=12). The median value for Zn concentrations measured was 527 µ g/L (NEPC1999=20,000 µ g/L); and
- Lead concentrations ranged between 0.48 and 11.2 µ g/L (μ =3.88 µ g/L; n=12). The median value for Pb concentrations measured was 3.24 µ g/L (NEPC1999=100 µ g/L).

Technical studies have identified the local groundwater to have a high SO₄ content. However the 2010-2011 data indicates a slight decrease in SO₄ concentrations since monitoring commenced in 2005. The range of SO₄ concentrations recorded during 2010-2011 was 4,170 to 5,930 mg/L (μ =4,935.8 mg/L; n=12).The median value for SO₄ concentrations measured 4,935.8 mg/l.

All groundwater monitoring is submitted to DoR on a quarterly basis and within the Sustainable Development Water Management Plan on an annual basis.

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Comment No.	EIS Section	EIS Discipline	Comment
24	10.3.6.8	Water Resources	As per Section 10.3.6.7. Please include a summary of exceedances.

Response:

GW21, GW22 and GW23 are located on the north eastern boundary of Cell 1 and consist of a group that transect from the TSF and straddles Surprise Creek. Situated in what is believed to be a transmissive pathway (in filled tributary of Surprise Creek), GW21 is situated between the TSF and Surprise Creek while both GW22 and GW23 are positioned on the northern side of Surprise Creek (opposite side to the TSF). Values for pH at each of these three sites has consistently hovered around 7 (neutral).

Predictably, each of these sites show reducing concentrations of most parameters as the distance from the TSF increases. The most obvious of these is for EC, sulphate and chloride.

Pb and Zn concentrations for these bores however depict a differing relationship. GW22 appears to have the highest concentrations of these parameters despite being further away from the perceived source. This may be due to the depth of the bores, which are:

- GW21: 9.17 m;
- GW22: 15.56 m; and
- GW23: 10.84 m.

GW22 is the deepest of the three bores which may result in an intersection of greater quantities of these parameters in a lower section of groundwater as represented in the results.

During the 2010-2011 reporting period this group of bores recorded pH values ranging from 7.1 to 8.2 units ($\mu = 7.61$ n=18). The median measured 7.55. Generally pH levels show a gradual increase over time with all bores recording pH >8 in April 2011, however several seasonal fluctuations have reached levels measuring pH >8 since 2007.

Sulphate concentrations at GW21 exceeded NEPC guidelines on investigation levels for soil and groundwater used for Agricultural Livestock Purposes (1999) applied to SO₄ on all (6) monitoring events in the reporting period. GW22 exceeded guideline concentrations on one occasion. Nil exceedances were reported for GW23 signifying a decreasing spatial trend away from TSF. The range of SO₄ concentrations recorded for this group was 80.8 to 2240 mg/L ($\mu = 975.1$ mg/L; n=12). The median value for SO₄ concentration measured 761 mg/l. Electrical Conductivity (EC) measured at the three sites ranged between 1,030 and 6,680 μ S/cm (TDS = 630-5270 mg/L; n=18). The median level for EC measured 2,926.7 μ S/cm (TDS median = 1,910 mg/l).

There were no exceedances of NEPC Guidelines recorded for major metals and metalloids during the 2010-2011 reporting period. A decreasing spatial trend away from the TSF is also evident for metal concentrations. Conversely As concentrations were highest at the most distant bore from the TSF i.e. GW23. Lead (Pb), Zn and Cd levels are generally higher in GW22 than the other two bores. GW22 is located in the middle of the transect formed by the bore group and the higher metal concentrations recorded in this bore may be due to it being the deepest bore of the group. Lead (Pb) and Zn concentrations in GW21 showed notable increased levels in March 2011. Copper (Cu) levels have generally been consistently low over the last year.

A summary of results for major metals and metalloids results for collected during 2010 -2011 is summarised below:

- Arsenic concentrations ranged between 1.15 and 22 μ g/L ($\mu = 5.8$ μ g/L; n=18). The median value for As concentrations measured was 4.85 μ g/L (NEPC1999=500 μ g/L);

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- Copper concentrations ranged between 0.05 and 2.65 $\mu\text{g/L}$ ($\mu = 0.45 \mu\text{g/L}$; $n=18$). The median value for Cu concentrations measured was 0.32 $\mu\text{g/L}$ (NEPC 1999=500 $\mu\text{g/L}$);
- Cadmium concentrations ranged between 0.1 and 1.5 $\mu\text{g/L}$ ($\mu = 0.22 \mu\text{g/L}$; $n=18$). The median value for Cd concentrations measured was 0.1 $\mu\text{g/L}$ (NEPC 1999=10 $\mu\text{g/L}$);
- Zinc concentrations ranged between 8.1 and 359.0 $\mu\text{g/L}$ ($\mu = 88.1 \mu\text{g/L}$; $n=18$). The median value for Zn concentrations measured was 58.2 $\mu\text{g/L}$ (NEPC 1999=20,000 $\mu\text{g/L}$); and
- Lead concentrations ranged between 0.11 and 28.0 $\mu\text{g/L}$ ($\mu = 5.436 \mu\text{g/L}$; $n=18$). The median value for Pb concentrations measured was 2.08 $\mu\text{g/L}$ (NEPC 1999=100 $\mu\text{g/L}$).

All groundwater monitoring is submitted to DoR on a quarterly basis and within the Sustainable Development Water Management Plan on an annual basis.

Comment No.	EIS Section	EIS Discipline	Comment
25	10.6.3.9	Water Resources	As per Section 10.3.6.7. Please include a summary of exceedances.

Response:

The Group C1-N (GW42B/GW8A; GW45B; GW48; GW47B) of bores monitors groundwater along the northern boundary of Cell 1. It should be noted that GW42B was installed in June 2007 to replace GW8A which was damaged during the raising of the TSF wall. Historically, the pH values at serviceable bores have remained steady, being concentrated around a neutral level of pH 7. During the 2010-2011 reporting period the C1-N group recorded pH values ranging from 7.1 to 8.2 ($\mu = 7.73$ $n=18$). The median value for pH is 7.55. pH has been somewhat variable and slightly higher since 2009 however emerging trends are not yet defined.

Electrical conductivity data has been gathered at these sites since June 2007 and has demonstrated a consistent trend. Historically GW42B has recorded lower EC values than GW45B and GW48, 3500 $\mu\text{S/cm}$ and 8000 $\mu\text{S/cm}$ respectively. During 2010-11, Electrical Conductivity (EC) measured at the four sites ranged between 978 and 9930 $\mu\text{S/cm}$ (TDS = 640-9810 mg/L ; $n=18$). The median level for EC measured 7425 $\mu\text{S/cm}$ (TDS median = 8060 mg/l).

SO_4 concentrations at this site show a similar recent trend with a close relationship evident with EC. The initial stages of this emerging trend were observed and reported on in the 2009 WMP. An upward trend has continued and results are now very similar to those obtained from GW45B and GW48. The increases noted in EC and SO_4 over the reporting period are likely to be attributed to the full utilisation of Cell 2 in 2009 as prior to this, the cell was segregated into two sections with the south-east section receiving tailings and the north-west section remaining dry. These concentrations remain comparable to other bores in the area, ongoing monitoring will continue to assess these concentrations for further developing trends.

Sulphate concentrations exceeded NEPC guidelines on investigation levels for soil and groundwater used for Agricultural Livestock Purposes (1999) at GW42B, GW45B and GW48 for all (6) monitoring events in the 2010-2011 reporting period. GW42A exceeded guideline concentrations on one occasion. GW42 is a shallow bore (5.0 m) installed at the most north westerly corner of the Cell 1. The range of SO_4 concentrations recorded for the C1-N group was 249 to 5,810 mg/L ($\mu = 3,799.89 \text{mg/L}$; $n=18$). The median value for SO_4 concentrations measured 4,995 mg/l .

There were no exceedances of NEPC Guidelines recorded for major metals and metalloids within C1-N during the 2010-11 reporting period. Metal concentrations in the groundwater of the group have been consistent with historical levels with the exception of a slight increase in lead and zinc concentrations in GW48 over this period.

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A summary of results for major metals and metalloids results for collected during 2010-2011 is summarised below:

- Arsenic concentrations ranged between 0.4 and 12.5 $\mu\text{g/L}$ ($\mu = 3.21 \mu\text{g/L}$; n=17). The median value for As concentrations measured was 2.6 $\mu\text{g/L}$ (NEPC1,999=500 $\mu\text{g/L}$);
- Copper concentrations ranged between 0.41 and 10.2 $\mu\text{g/L}$ ($\mu = 2.43 \mu\text{g/L}$; n=18). The median value for Cu concentrations measured was 1.46 $\mu\text{g/L}$ (NEPC1,999=500 $\mu\text{g/L}$);
- Cadmium concentrations ranged between 0.06 and 0.26 $\mu\text{g/L}$ ($\mu = 0.14 \mu\text{g/L}$; n=18). The median value for Cd concentrations measured was 0.1 $\mu\text{g/L}$ (NEPC1,999=10 $\mu\text{g/L}$);
- Zinc concentrations ranged between 15.7 and 106 $\mu\text{g/L}$ ($\mu = 48.36 \mu\text{g/L}$; n=17). The median value for Zn concentrations measured was 40.1 $\mu\text{g/L}$ (NEPC1,999=20,000 $\mu\text{g/L}$); and
- Lead concentrations ranged between 0.12 and 8.14 $\mu\text{g/L}$ ($\mu = 1.34 \mu\text{g/L}$; n=18). The median value for Pb concentrations measured was 0.59 $\mu\text{g/L}$ (NEPC1,999 =100 $\mu\text{g/L}$).

All groundwater monitoring is submitted to DoR on a quarterly basis and within the Sustainable Development Water Management Plan on an annual basis.

Comment No.	EIS Section	EIS Discipline	Comment
26	10.6.3.10	Water Resources	As per Section 10.3.6.7. Please include a summary of exceedances.

Response:

MRM made commitments as part of environmental management plans and in accordance with Waste Discharge Licence WDL174-1 to install groundwater monitoring bores and characterise the hydrogeology of the Bing Bong site. The hydrogeological investigation set out to delineate the extent of transmissive aquifers and possible connection with the marine environment.

Seven groundwater monitoring bores were installed at four sites between the 20th November and the 23rd of November 2010. The maximum depths of the bores ranged between 2.25 and 6.6 m below ground level. Initial modelling concluded that the overall direction of groundwater flows towards to coast. MRM technical staff routinely sample the groundwater bores on a two monthly cycle.

Groundwater is neutral to slightly alkaline showing little variation between ($\mu = 7.5$ units n=26). The highest pH was recorded on a single occasion (31/3/11) at BB03A and BB03B. The median value measured pH 7.6.

SO_4 ranged between 1,060 to 5,940 mg/l ($\mu = 3002.7$ mg/L; units n=26). Bores BB03A, BB03B and BB02 are saline with monitoring results consistently in the upper limit for SO_4 (>4,000 mg/l), EC (>25,000 mS/cm) and TDS (>25,000 mg/L) compared to other bores. Sites BB03 A&B and BBB02 are installed immediate to the dredge spoil stockpile on the seaward perimeter suggesting some seepage from the spoil is occurring. Groundwater seepage was observed through shell fragments and fine to medium sands during drilling works was recorded during the drilling works. The median value for SO_4 , EC and TDS measured 2,750 mg/L, 24,750 mS/cm and 16,700 mg/L respectively.

Groundwater samples collected during bore installations were reported all saline. Sodium (Na_F) levels ranged between 1,980 mg/l – 14,600 mg/l, SO_4 range = 1,510 mg/l – 5,820 mg/l suggesting the influence of marine water infiltration to the underlying aquifer. In addition it was reported that assuming the dredge spoil placement 15 years ago, the anticipated migration of seepage from the Dredge Spoil Stockpile Area are between 36-127 metres for the upper aquifer and between 7-56 metres in the lower aquifer.

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Groundwaters tested well below NEPC (Agricultural Livestock Purposes 1999) guidelines. MRM considers this an appropriate guideline as the Port Facility is within a pastoral lease. An exceedance of the guideline resulted for Pb on 15/1/11 at BB04A (129 μ g/L). The result is an outlier in regard to the previous and post monitoring results for the same site suggesting this to be an anomalous result.

A summary of results for major metals and metalloids results for collected subsequent to bore installation in late 2010 is summarised below:

- Arsenic concentrations ranged between 0.5 and 5.0 μ g/L (μ =3.07 μ g/L; n=26). The median value for As concentrations measured was 2.47 μ g/L (NEPC1,999=500 μ g/L);
- Copper concentrations ranged between 0.9 and 20.4 μ g/L (μ =5.67 μ g/L; n=26). The median value for Cu concentrations measured was 3.225 μ g/L (NEPC1,999=500 μ g/L);
- Cadmium concentrations ranged between 0.2 and 2.76 μ g/L (μ =1.22 μ g/L; n=26). The median value for Cd concentrations measured was 0.94 μ g/L (NEPC1,999=10 μ g/L);
- Zinc concentrations ranged between 2.7 and 268 μ g/L (μ =76.30 μ g/L; n=26). The median value for Zn concentrations measured was 48.65 μ g/L (NEPC1,999=20,000 μ g/L);and
- Lead concentrations ranged between 0.4 and 129 μ g/L (μ =16.50 μ g/L; n=26). The median value for Pb concentrations measured was 3.45 μ g/L (NEPC1,999=100 μ g/L).

Comment No.	EIS Section	EIS Discipline	Comment
27	10.4.1.1	Water Resources	A reminder that HMTV should be based on hardness of water for that sample and not on historical averages HMTVs should only be used in the circumstance that the ANZECC (2000) 95% protection level for freshwater is exceeded.

Response:

Noted. See response to Comment 18 for a discussion on HMTV's.

Comment No.	EIS Section	EIS Discipline	Comment
28	10.4.1.2	Water Resources	Numerical water balance is based on modelling. What do MRM intend to undertake to ensure water balance modelling is representative of real world conditions? What margin of error in water balance modelling can management plans accommodate?

Response:

Monitoring to validate water balance modelling will occur throughout the life of mine, as is the current case. As part of the existing operations, an annual water balance and water management plan are submitted to DoR and NRETAS, and this will continue for the Project.

One key assumption is the amount of groundwater that will enter the mine water management system over the Project life (e.g. groundwater inflows and groundwater interception rate) that could have major implications to water management on the site. Groundwater monitoring will be used to validate the

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groundwater modelling, and water balances will be updated and refined to reflect this progressive collation and confirmation of data.

General

Additional numerical water balance modelling using the Goldsim model developed for the Project's Draft EIS was undertaken to assess the robustness of the proposed water management plan by testing the sensitivity of its performance for four (4) key model inputs:

- Average annual rate of groundwater inflows was varied by $\pm 25\%$ (21.25 ML/d and 12.75 ML/d);
- Groundwater interception rate was varied by $\pm 10\%$ (80% and 60%);
- Dilution ratio for release of 'Intercepted' groundwater to the McArthur River water was varied by $\pm 50\%$ (1:500 and 1:166); and
- Evaporation fan effectiveness was varied by $\pm 10\%$ (50% and 30% loss of the pumped inflow).

The following model input parameters were also revised based on additional information obtained and presented in response to Department of Resources' Comment Numbers 21 and 30:

- TSF Cell 1 seepage bore recovery rate of 0.2 ML/d pumped to TSF Cell 2;
- TSF Cell 2 seepage loss rate of 1.46 ML/d;
- PP sprinkler loss rate of 5 l/s, 14 hrs/d (25% of the sprinkler pump rate); and
- NOEF SPSP & NOEF SPROD sprinkler loss rate of 11 l/s, 14 hrs/d (25% of the sprinkler pump rate).

Full details of the water balances across the mine site for existing mine conditions and different stages of the Project's mining operations are given in Section 10.4.3 (Chapter 10 – Water Resources) and Appendix D3 (Section 8) of the Draft EIS.

Results and Discussion

The tables below present the representative long-term mine water balance results for the dry (90th percentile), median (50th percentile) and wet (10th percentile) 26-year rainfall sequences, respectively. The first two columns in these tables compare the results of the original analysis undertaken for the Draft EIS and the revised analysis incorporating the above changes to the TSF seepage rates and sprinkler loss rates. The results of the revised analyses indicate the following:

- The change in the overall water balance for the site is insignificant.
- The predicted seepage loss from the TSF Cell 2 has increased significantly from about 50 ML/yr to about 460 ML/yr.
- The sprinkler and water fountain loss rates have decreased significantly from about 1360 ML/yr to about 530 ML/yr.
- The predicted off-site releases of 'intercepted' groundwater to the McArthur River and the irrigation scheme have increased by about 3 to 6% and 40 to 50% respectively when compared with the original analysis.
- The irrigation scheme could expect to receive 'intercepted' groundwater at a daily rate of 3 ML/d (monthly average) or more during January and from April to September. The irrigation water supply would peak at 7-8 ML/d (monthly average) in May and June. The proposed irrigation scheme would have sufficient flexibility to accommodate the predicted increase in mine water supply.
- The mine would have marginally more opportunities to release 'intercepted' groundwater to the McArthur River during the months of January and March.

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- There is little change in the expected duration for which the open pit floor would be inundated.

The tables below also show the results of the sensitivity analysis for the dry, median and wet 26-year rainfall sequences, respectively. The following is of note with respect to the results of the sensitivity analysis:

- Sensitivity of adopted groundwater inflow rates:
 - The overall water balance for the mine site is sensitive to the adopted groundwater inflow rates.
 - The predicted average annual irrigation scheme supply is quite sensitive to the adopted groundwater inflow rates. The results indicate that irrigation supply could almost double if there is a 25% increase in groundwater inflows, and the irrigation supply rate would be reduced to about a third if there is a 25% decrease in groundwater inflows, when compared with the base case. The proposed irrigation scheme would have sufficient flexibility to accommodate such variations in mine water supply.
 - In the case of a 25% increase in the groundwater inflow rates, the irrigation supply scheme could expect to receive 'intercepted' groundwater at a daily rate of about 5 ML/d (monthly average) or more for all months of the year, peaking at 13 ML/d (monthly average) in January and 12 ML/d (monthly average) in May and June. The TSF Cell 3 WMD would only send water to the irrigation scheme when its volume is above the maximum operating level (MOL) volume so there is no additional capacity in this storage. There may be capacity in the TSF Cell 4 WMD during dry periods although maintaining the maximum amount of storage capacity in this dam to limit interruption of open pit dewatering will be the primary goal for Cell 4 WMD. However, the objective of the irrigation scheme is to use uncontaminated intercepted groundwater and, to minimise the amount of potentially contaminated water by preventing its entry into the mine water management system.
 - The average annual releases to the McArthur River are not sensitive to the groundwater inflow rate. The results indicate that releases to the McArthur River would increase by 5% and decrease by 25% respectively due to an increase and decrease of groundwater inflows by 25%. The months during which 'intercepted' groundwater can be released to the McArthur River is not sensitive to groundwater inflows rates.
 - In the case of a 25% increase in the groundwater inflow rate, the TSF Cell 4 WMD was filled to its Maximum Operating Volume by 'contaminated' water during one year during the wet (10th percentile) 26-year simulation. As a consequence, the open pit floor was inundated for 2 months longer than in the base case for that year. In the case of a 25% decrease in the groundwater interception rate, the duration of open pit inundation would be reduced.
- Sensitivity of adopted groundwater interception rates:
 - The overall water balance for the mine site is not sensitive to the adopted groundwater interception rates.
 - The predicted off-site release rates of 'intercepted' groundwater are relatively insensitive to the range of groundwater interception rates analysed. The results indicate that releases to the McArthur River would vary by about 3% and releases to the irrigation scheme would vary by about 1%.
 - In the case of a 10% decrease in the groundwater interception rate, the TSF Cell 4 WMD was filled to its Maximum Operating Volume by 'contaminated' water during one year during the wet (10th percentile) 26-year simulation. As a consequence, the open pit floor was inundated for 2 months longer than in the base case for that year. In the case of a 10% increase in the groundwater interception rate, the duration of open pit inundation would be reduced.

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- Sensitivity of the adopted dilution ratios for releases of 'intercepted' groundwater to the McArthur River:
 - The overall water balance for the mine site is not sensitive to the adopted groundwater interception rates. However, the relative proportion of 'intercepted' water released off-site to the McArthur River and to the irrigation scheme would change depending on the adopted dilution ratio.
 - If the dilution ratio is increased by 50% (1 part mine water to 500 parts river water), the volume of 'intercepted' groundwater that could be released to the McArthur River would decrease by about 15%. As a consequence, the MRM water management system would have to compensate for this by releasing the shortfall for irrigation scheme supply. Conversely, if the dilution ratio is reduced by 50% (1 part mine water to 166 parts river water) there would be an increase of about 25% in the volume of 'intercepted' groundwater that could be released to the McArthur River.
 - The predicted off-site releases of 'intercepted' groundwater to the McArthur River would vary by about 3% and releases to the irrigation scheme would vary by about 1%.
 - The duration of open pit floor inundation is not sensitive to the range of 'intercepted' groundwater dilution ratios investigated.
- Sensitivity of the adopted evaporation fan effectiveness:
 - The overall water balance for the mine site is not sensitive to the adopted evaporation fan effectiveness.
 - The predicted average annual irrigation supply rate is moderately sensitive to the adopted evaporation fan effectiveness. The irrigation supply rates could vary by about 30% as a result of a 10% change in evaporation fan effectiveness when compared with the base case. This is due to variation in the volume of 'intercepted' groundwater being pumped to the evaporation fans to enhance evaporation losses.
 - The duration of open pit floor inundation is not sensitive to the range of evaporation fan evaporation effectiveness investigated.

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Summary Average Annual Water Balance, Dry Rainfall Sequence - Sensitivity Analysis

Component	Process	Average Volume (ML/y)									
		Base Case - Original Analysis ^{a,b}	Base Case - Revised Analysis ^{a,b}	Sensitivity Analysis - Groundwater Inflow Rate ^c		Sensitivity Analysis - Groundwater Interception Rate ^d		Sensitivity Analysis - McArthur River Water Release Dilution Ratio ^e		Sensitivity Analysis - Evaporation Fan Effectiveness ^f	
				+25%	-25%	+10%	-10%	+50%	-50%	+10%	-10%
Inflows	Direct Rainfall	635	621	631	572	618	626	623	614	592	637
	Surface Runoff	1732	1740	1736	1755	1742	1738	1739	1743	1751	1734
	Groundwater	5578	5578	6973	4184	5578	5578	5578	5578	5578	5578
	Borefields	731	731	731	731	731	731	731	731	731	731
	Raw Feed Moisture	191	191	191	191	191	191	191	191	191	191
	TOTAL	8866	8861	10261	7432	8859	8863	8862	8856	8843	8870
Outflows	Evaporation	1892	1823	1859	1647	1811	1841	1828	1797	1703	1898
	Spray Fans	2156	2159	2159	2123	2159	2159	2159	2158	2755	1660
	Sprinklers/Water Fountain ^b	1359	532	532	530	532	532	532	532	532	532
	Irrigation	881	1312	2598	348	1310	1306	1449	1065	880	1703
	Water Cart Usage	1096	1096	1096	1096	1096	1096	1096	1096	1096	1096
	Truck Wash	15	15	15	15	15	15	15	15	15	15
	Potable Use	194	194	194	194	194	194	194	194	194	194
	Industrial Use	15	15	15	15	15	15	15	15	15	15

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Component	Process	Average Volume (ML/y)									
		Base Case - Original Analysis ^{a,b}	Base Case - Revised Analysis ^{a,b}	Sensitivity Analysis - Groundwater Inflow Rate ^c		Sensitivity Analysis - Groundwater Interception Rate ^d		Sensitivity Analysis - McArthur River Water Release Dilution Ratio ^e		Sensitivity Analysis - Evaporation Fan Effectiveness ^f	
				+25%	-25%	+10%	-10%	+50%	-50%	+10%	-10%
	Product Moisture	120	120	120	120	120	120	120	120	120	120
	TSF Moisture Retention	493	493	493	493	493	493	493	493	493	493
	Seepage losses ^a	41	461	461	461	461	461	461	461	461	461
	Off-site Releases	885	913	980	672	934	889	771	1181	860	944
	TOTAL	9145	9129	10519	7712	9138	9117	9130	9125	9121	9130
	Change in Site Water Inventory	-284	-279	-268	-257	-279	-278	-254	-268	-268	-278

^a The original analysis adopted a seepage loss rate of 0.5mm/d from TSF Cell2/Cell3. The revised analysis adopted a seepage loss rate of 1.26ML/d from TSF Cell2 (1.71ML/d total seepage loss from TSF Cell 2 minus 0.45ML/d seepage recovery from TSF Cell1 and TSF Cell2). The adopted seepage loss from TSF Cell 3 and TSF Cell 4 in the revised analysis was zero.

^b The original analysis adopted a sprinkler pump rate of 60l/s for 14 hrs/d from Pete's Pond and the North OEF dams with an assumed 100% loss from the system. The revised analysis adopted a 25% evaporation loss from the sprinkler system (sprinkler loss rate of 15l/s for 14 hrs/d (0.75ML/d) and a return water rate of 45l/s for 14 hrs/d (2.27ML/d)).

^c The base case maximum groundwater inflow rate = 17ML/d (annual avg in years 2021 to 2036). Adopted variation of maximum ground water inflow for sensitivity analysis = ±4.25ML/d

^d The base case groundwater interception rate = 70%. Adopted variation of ground water interception rate for sensitivity analysis = 60% (-10%) and 80% (+10%) of the daily inflow rate

^e The base case 'intercepted' groundwater dilution ratio of 1:333 (mine water:McArthur River water). Adopted variation of dilution ratio for sensitivity anal = 1:166 (-50%) and 1:500 (+50%)

^f The base case evaporation fan effectiveness = 40%. Adopted variation of evaporation fan effectiveness for sensitivity analysis = 30% (-10%) and 50% (+10%) of the daily pump inflow rate

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Summary Average Annual Water Balance, Wet Rainfall Sequence - Sensitivity Analysis

Component	Process	Average Volume (ML/y)									
		Base Case - Original Analysis ^{a,b}	Base Case - Revised Analysis ^{a,b}	Sensitivity Analysis - Groundwater Inflow Rate ^c		Sensitivity Analysis - Groundwater Interception Rate ^d		Sensitivity Analysis - McArthur River Water Release Dilution Ratio ^e		Sensitivity Analysis - Evaporation Fan Effectiveness ^f	
				+25%	-25%	+10%	-10%	+50%	-50%	+10%	-10%
Inflows	Direct Rainfall	807	786	802	735	780	793	787	782	750	810
	Surface Runoff	2190	2199	2191	2221	2201	2196	2198	2201	2214	2190
	Groundwater	5578	5578	6973	4184	5578	5578	5578	5578	5578	5578
	Borefields	731	731	731	731	731	731	731	731	731	731
	Raw Feed Moisture	191	191	191	191	191	191	191	191	191	191
	TOTAL	9496	9484	10887	8061	9480	9488	9484	9483	9463	9499
Outflows	Evaporation	2081	1987	2041	1843	1964	2018	1993	1980	1845	2097
	Spray Fans	2155	2155	2155	2133	2155	2155	2155	2155	2761	1658
	Sprinklers/Water Fountain ^b	1360	532	532	532	532	532	532	532	532	532
	Irrigation	1086	1546	2824	544	1533	1544	1695	1296	1120	1916
	Water Cart Usage	1096	1096	1096	1096	1096	1096	1096	1096	1096	1096
	Truck Wash	15	15	15	15	15	15	15	15	15	15
	Potable Use	194	194	194	194	194	194	194	194	194	194
	Industrial Use	15	15	15	15	15	15	15	15	15	15

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Component	Process	Average Volume (ML/y)									
		Base Case - Original Analysis ^{a,b}	Base Case - Revised Analysis ^{a,b}	Sensitivity Analysis - Groundwater Inflow Rate ^c		Sensitivity Analysis - Groundwater Interception Rate ^d		Sensitivity Analysis - McArthur River Water Release Dilution Ratio ^e		Sensitivity Analysis - Evaporation Fan Effectiveness ^f	
				+25%	-25%	+10%	-10%	+50%	-50%	+10%	-10%
	Product Moisture	120	120	120	120	120	120	120	120	120	120
	TSF Moisture Retention	493	493	493	493	493	493	493	493	493	493
	Seepage losses ^a	52	461	461	461	461	461	461	461	461	461
	Off-site Releases	1116	1153	1223	905	1186	1125	999	1409	1096	1185
	TOTAL	9781	9764	11167	8349	9761	9766	9765	9763	9746	9779
	Change in Site Water Inventory	-284	-280	-280	-288	-280	-277	-280	-280	-283	-280

^a The original analysis adopted a seepage loss rate of 0.5mm/d from TSF Cell2/Cell3. The revised analysis adopted a seepage loss rate of 1.26ML/d from TSF Cell2 (1.71ML/d total seepage loss from TSF Cell 2 minus 0.45ML/d seepage recovery from TSF Cell1 and TSF Cell2). The adopted seepage loss from TSF Cell 3 and TSF Cell 4 in the revised analysis was zero.

^b The original analysis adopted a sprinkler pump rate of 60l/s for 14 hrs/d from Pete's Pond and the North OEF dams with an assumed 100% loss from the system. The revised analysis adopted a 25% evaporation loss from the sprinkler system (sprinkler loss rate of 15l/s for 14 hrs/d (0.75ML/d) and a return water rate of 45l/s for 14 hrs/d (2.27ML/d)).

^c The base case maximum groundwater inflow rate = 17ML/d (annual avg in years 2021 to 2036). Adopted variation of maximum ground water inflow for sensitivity analysis = ±4.25ML/d

^d The base case groundwater interception rate = 70%. Adopted variation of ground water interception rate for sensitivity analysis = 60% (-10%) and 80% (+10%) of the daily inflow rate

^e The base case 'intercepted' groundwater dilution ratio of 1:333 (mine water:McArthur River water). Adopted variation of dilution ratio for sensitivity anal = 1:166 (-50%) and 1:500 (+50%)

^f The base case evaporation fan effectiveness = 40%. Adopted variation of evaporation fan effectiveness for sensitivity analysis = 30% (-10%) and 50% (+10%) of the daily pump inflow rate

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Comment No.	EIS Section	EIS Discipline	Comment
29	Figure 10-6 to 10-10	Water Resources	<p>Little Barney Creek, Barney Creek and McArthur River diversion channels are highlighted in maps as "Existing Natural Drainage Path".</p> <p>These are constructed diversion channels and should be highlighted as such.</p> <p>The first year in the set of figures is 2015. It is difficult to relate how the new phase 3 in 2015 relates to the current layout in 2012. Include the current layout (2012) using the same formatting as figures 10-6 to 10-10.</p>

Response:

Figure 10-6 to Figure 10-10 have been revised to correctly annotate the constructed channels and are provided in Appendix C. Revised Figure 10-6 to Figure 10-10 update and replace Figure 10-6 to 10-10 and Figure 7.1 to 7.5 of Appendix D3 in the Draft EIS. The current layout of the existing operations is shown in Figure 6.1 of Appendix D3 of the Draft EIS. Figure 4-1 in Section 4 of the Draft EIS shows the existing operations in comparison to the proposed layout of the Project.

Comment No.	EIS Section	EIS Discipline	Comment
30	Figure 10-11	Water Resources	<p>With reference to the schematic of the water management system:</p> <ul style="list-style-type: none"> • Storages should include capacity. • Sprinklers should include the amount that can be evaporated not flow. • Are sprinklers controlled the same as fans to reduce spray drift impacts during unfavourable climatic conditions? • How was the figure of 70% groundwater interception calculated? • Why is there a return of water from the 6 fans to the Tailings storage facility Cell2/Cell3? • Why is there a spill overflow pathway from the Mill to the CRP? • Schematic suggests 100% recovery of seepage from Cell 1 and no seepage. Both are incorrect, Cell 1 is seeping; recovery bores are unlikely to retrieve 100% of the seepage. • Rainfall inputs are not included. • Loss should be included at the end of the truck wash-down • The VDD has the potential to receive contaminated

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			<p>water and therefore should not be used for water cart operations.</p> <ul style="list-style-type: none"> • Spillways for all PAF runoff dams flow to the McArthur River. This is high risk to the River Spillways should be diverted to alternative storages for treatment before release. • Seepage from TSF Cell 2 and Cell 3 is included. Cell 3 should have its construction improved to prevent seepage before being used to hold tailings. • Will TSF Cell 3 WMD contain clean water considering a waste dump for general waste exists in the area?
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Response:

General

Revised Figure 10-11 updates and replaces Figure 10-11 and Appendix D3 (Figure 7.6) of the Draft EIS. Refer to figures in Appendix C.

Storage Capacities and Catchment Areas

The table below shows the storage capacities and catchment areas draining directly to each of the existing and proposed mine water dams at five progressive stages of mining (years 2015, 2020, 2025, 2025, 2030 & 2035). This information was compiled from Table 10-8, Table 10-9, Table 10-10, Table 10-11 and Table 10-12 and Appendix D3 (Table 7.2, Table 7.3, Table 7.4, Table 7.5, Table 7.6, Table 8.1 and Table D1, Appendix D) of the Draft EIS.

Required Storage Capacities and Connected Catchment Areas of Existing and Proposed Storages for five progressive stages of mining

Dam Name	Required Storage Capacity (ML)	Connected Catchment Area (ha)				
		2015	2020	2025	2030	2035
Anti Pollution Pond (APP)	23	14.5	14.5	14.5	14.5	14.5
Concentrator Runoff Pond (CRP)	27	13.0	13.0	13.0	13.0	13.0
Van-Duncans Dam (VDD)	35	37.9	37.9	37.9	37.9	37.9
Pete's Pond (PP)	100	2.1	2.1	2.1	2.1	2.1
Lake Archer (LA)	40	36.0	36.0	36.0	36.0	36.0
Cell 3 Water Management Dam (Cell 3 WMD)	532	25	25	25	25	25
Cell 4 Water Management Dam (Cell 4 WMD)	4300	65	65	65	65	65
North Overburden Emplacement Facility (North OEF) Southern PAF Sediment Dam (SPSD) + Southern PAF Runoff Dam (SPROD) ^a	>1350 ^b /810 ^c	113.7	113.7	166.5	166.5	140.2
Northern Overburden Emplacement Facility (North	648 ^b /343 ^c	51.0	85.0	85.0	72.2	72.2

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Dam Name	Required Storage Capacity (ML)	Connected Catchment Area (ha)				
		2015	2020	2025	2030	2035
OEf) South-East PAF Runoff Dam (SEPROD)						
Northern Overburden Emplacement Facility (North OEf) East PAF Runoff Dam (EPROD)	875 ^b /500 ^c	75.6	66.3	66.3	59.7	59.7
Northern Overburden Emplacement Facility (North OEf) North-East PAF Runoff Dam (NEPROD)	1196 ^b /698 ^c	33.2	77.8	94.0	94.0	94.0
Northern Overburden Emplacement Facility (North OEf) North-West PAF Runoff Dam (NWPROD)	1981 ^b /805 ^c	105.3	108.5	85.8	74.4	74.4

Overflows from SPSP spill into SPROD

^b North OEf Dam storage requirements assuming no sprinklers installed at the North OEf dams

^c North OEf Dam storage requirements assuming sprinklers installed at a loss rate of 41l/s, 14hr/d

Bold values denote maximum catchment area containing exposed PAF Material during the 5 year period for each stage (eg, stage 2020 includes the five years from 2018 to 2022, inclusive of 2022)

Sprinkler Loss Rates

The revised Figure 10-11 shows the adopted sprinkler pumping, loss and return rates. Revised Figure 10-11 shows an average sprinkler loss rate of 0.75 ML/d from Pete's Pond and the North OEf dams (NOEF SPSP & NOEF SPROD). The total pumping rate to sprinklers from the above storages is 3.0 ML/d (based 60 l/s on average for 14 hrs/d). Of this, approximately 0.75 ML/d (25% of the pump rate) is evaporated by the sprinkler system. The remaining 2.25 ML/d is assumed to return back to the water storage. The sprinkler system is operated taking into account the micro-climate conditions in the vicinity of the sprinklers to minimise any potential spray drift away from containment areas.

Groundwater Interception Rate

The response to Comment 28 provides details on the groundwater interception rate.

Return Water from Evaporation Fans at the Tailings Storage Facility

Six (6) evaporation fans are installed on the embankment of the active Tailings Storage Facility (TSF) to increase the evaporation rate from the decant water pond within the active TSF. In addition, evaporation from the TSF Cell 4 WMD would be enhanced using the evaporation fans during times when the active TSF decant water pond is at the optimal volume for the Mill return water system. The evaporation fans will be positioned so that spray from the fans will be directed towards, and the residual return water pipe will discharge to, the active TSF decant water pond. Hence, the reason for the return water from the evaporation fans shown in revised Figure 10-11 being directed back to TSF Cell 2/Cell 3.

Based on evaporative dispersion modelling undertaken in a study by PAE Holmes (2011), the predicted average evaporation effectiveness of the fans at the TSF was 38%. The remaining 62% of the water pumped to the TSF evaporation fans was assumed to return back to cell two. Additional fall out monitoring will also take place to verify spray modelling undertaken by PAE Holmes. The evaporation fans will be operated taking into account the micro-climate conditions in the vicinity of the fans to minimise any potential spray drift away from containment areas, as is the case with the existing six (6) evaporation fans installed at the open pit.

Overflows from the Mill Thickeners to the Concentrator Runoff Pond

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Water overflow rate from the Mill Thickeners during daily operations is estimated to be about 10% of the total makeup water demand from the Decant Water Tank. Overflows from the Mill thickeners are directed to Concentrator Runoff Pond via overland flow paths.

Predicted Seepage Rates from Tailings Storage Facility

The seepage rates shown in revised Figure 10-11 are based on model predictions made in URS (2006). Revised Figure 10-11 shows a TSF Cell 1 seepage recovery rate of 200kL/d, which is pumped to TSF Cell 2. Based on URS (2006), the predicted total TSF Cell 1 seepage rate is 1,520k L/d. Of this, 890 kL/d would seep through the embankment. The remaining 630 kL/d would infiltrate to the water table. Meter readings from recovery bores between 2009 and 2012 indicate that seepage water along the northern embankment is collected and pumped to TSF Cell 2 at an average rate of about 200 kL/d (22% of the predicted seepage rate through the embankment). Therefore, the predicted seepage from TSF Cell 1 that is not recovered and infiltrating to the water table is 1,320 kL/d.

The revised Figure 10-11 shows a TSF Cell 2 seepage loss of 1,460 kL/d. Based on URS (2006), the total predicted TSF Cell 2 seepage rate is 1,710 kL/d. Of this, 1,130 kL/d would seep through the embankment. The remaining 580kL/d would infiltrate to the water table. Similar to TSF Cell 1, assuming 22% of embankment seepage (565 kL/d) would be collected in seepage trenches and pumped back to TSF Cell 2, the estimated seepage loss from TSF Cell 2 is predicted to be 1,460 kL/d.

TSF Cell 3 and TSF Cell 4 will be lined incorporating an underdrain seepage collection system. Therefore, it was assumed that no seepage (0 kL/d) would report from these cells to the environment. This is a conservative assumption for water balance modelling purposes.

Rainfall Inputs

Not all inflows to and outflows from mine water storages are explicitly shown in Figure 10-11 to reduce clutter. Appendix D3 (Table E2, Appendix E) of the Draft EIS lists all the inflows to and outflows from each storage shown in Figure 10-11, including rainfall inputs.

Truck Wash Down Loss

Revised Figure 10-11 shows a truck wash down demand of 0.2 ML/d, which is based on information provided by MRM mine staff. Of this, it is assumed that 20% (0.04 ML/d) is lost from the system and the remaining 0.16 ML/d returns (via overland flow) to the Anti-Pollution Pond. Given that the estimated truck wash down demand rate is small when compared with the total inputs to the Project's water balance (less than 1% of the total daily inflows to the system), the impact of the truck wash down demand on the overall water balance is insignificant and the assumed loss from the system is considered appropriate for water balance modelling purposes.

Water Cart Operations

The VDD has the potential to receive contaminated water and is used for water cart/dust suppression operations. This water, when sprayed on haul roads, is largely contained within the mine water management system and controls are in place, such as windrows, drains and collection sumps to maximise contaminated water collection. This component is currently being addressed from an operational perspective through the SDWMP.

Overflows from PAF Runoff Dams

The water balance modelling undertaken to size mine site dams, including PAF runoff collection dams, is described in Section 10.4.3 and Appendix D3 (Section 8) of the Draft EIS. The storage capacities of the PAF runoff dams have been sized to ensure that during the periods when these dams collect PAF runoff, the risk of uncontrolled overflows from these dam spillways is minimised. The water balance model results indicate that the probability of the proposed PAF runoff dams overflowing during the periods when it is expected that PAF material is exposed within the connected catchment area is 5% over the life of the mine. This is considered an acceptable level of risk. To further reduce risk, the PAF runoff dams would potentially be

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constructed with two components (i.e., with an initial sediment dam that overflows into the main containment storage). This design will be further refined during the detailed engineering stage.

It is also proposed to install sprinklers on the walls of the North OEF PAF dams to enhance evaporation of water stored within. The required storage volumes for the proposed North OEF PAF dams are given in the Table above. The modelling results show that the adoption of evaporation enhancing mechanisms can significantly reduce the required sizes of PAF dams. For example, a sprinkler loss rate of 41 l/s for 14 hrs/day, could reduce the sizes of North OEF dams by about 40% when compared with a scenario of not having sprinklers installed. The required PAF runoff dam storage volumes were estimated for two cases; with sprinkler and without sprinklers. If the adopted sprinkler loss rate could be achieved, modelling suggests that the size of the North OEF dams could be reduced by up to 40%. If the expected sprinkler loss rates are less, then the dam storage volume requirements would be greater.

See also response to Comment 21.

Seepage from TSF Cell 2 and Cell 3

The response to Comment 21 provides details on TSF seepage.

Management of Existing Waste Dump within the TSF Cell 3 Water Management Dam

Putrescible waste is disposed of in a small pit located in the south-eastern corner of the Water Management Dam at the TSF. This waste is periodically burnt to limit the potential impacts on water quality and fauna interference (scavenging). Currently putrescible wastes are stored away from the water in the Water Management Dam. A works Program was conducted in this area late in 2011 and early 2012 to improve the performance of this area.

As mentioned in the response to Comment 28, monitoring to validate water balance modelling will occur throughout the life of mine, as is the current case. As part of the existing operations, an annual water balance and water management plan are submitted to the Northern Territory Government, and this will continue for the Project.

Comment No.	EIS Section	EIS Discipline	Comment
31	10.4.2.2	Water Resources	With reference to "No further diversions of the McArthur River, Barney Creek or Surprise Creek channels are proposed as part of the Project." Include the diversion of Little Barney Creek around the WMD.

Response:

As mentioned in the Draft EIS, no further diversions of the McArthur River, Barney Creek or Surprise Creek channels are proposed as part of the Project. The expansion of the pit and the OEFs are located in areas that do not require creek diversions. An additional clean runoff drain will be constructed around the north western edge of the proposed TSF Cell 4 and will connect with the existing drain around the Water Management Dam which is connected to Little Barney Creek.

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Comment No.	EIS Section	EIS Discipline	Comment
32	10.4.4	Water Resources	<p>The OEF and the Mine Pit constrict Barney Creek floodplain. This increases depth and flow velocities during flood. The figures indicate water up against the Southern side of the North OEF, the Northern side of the Western OEF and the pit levee at elevated flow velocities.</p> <p>What engineering will take place to ensure there is no damage to these three structures during flood?</p> <p>Will the design of these structures be able to withstand predicted flood height and flow velocities? Simply monitoring for damage and applying more armour may not be possible during the event and may be too late if the erosion results in major failure of the structure.</p> <p>If the structures fail, will PAF cells be exposed or PAF run off dams fail?</p>

Response:

A flood study of the McArthur River has been undertaken to assess the potential impacts of the Project's mining operations at MRM, including the impacts of the constrictions of the floodplains caused by the mine open pit and the OEF's, on flood levels, flood velocities and flood extents within and in the vicinity of the mine.

The potential impacts and mitigation measures are discussed in the response to Comment 5 (from Department of Resources). Note that the flood modelling results demonstrate that the protection of the mine pit from a 0.2% AEP (500 year ARI) event is not compromised by the proposed Project works and no additional mine pit flood protection works are required. Also note that all proposed PAF cells and PAF runoff dam spillways would be elevated above the 1% AEP (100 year ARI) flood level.

The location and design of the OEFs was influenced by the results of flood modelling so that flood levels and velocities would be minimised, hence, decreasing the potential for erosion as much as practicable. The OEF locations are determined by a number of factors, including haul distances and proximity to local watercourses.

However, to mitigate against potential erosion, the proposed erosion protection bund will be constructed to protect the NAF OEFs (ie East and South OEFs) from erosion from McArthur River and Barney Creek floodwaters for floods. The average height of the bund wall will vary from approximately 5 m to 13 m, to place the crest level above the 1% AEP (100 year ARI) level. The bund would be constructed with rocks from selected NAF material. The rocks will be sized to withstand erosive forces generated by floodwaters from the McArthur River and Barney Creek. The proposed bund will be set back at least 75 m from the top of bank of the McArthur River and Barney Creek diversion channels.

At this stage, it is not predicted that flood protection works are required for the North OEF. However, erosion rates will be monitored to see if there are potential issues from flooding throughout the life of the Project. Investigation into erosion protection requirements of existing and proposed OEF batters and mitigation strategies was commenced in May 2012. These assessments are based on the level of risk that the proposed water body velocities will pose on existing and proposed structures. Where erosion protection works are required the studies identify suitable management options. Preliminary results have identified a combination of riprap and geotextile to be the most appropriate erosion protection methodology.

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If required, flood protection works will be implemented to prevent erosion causing damage to the North OEF. As is the current case, PAF cells will continue to be constructed above the 1% AEP (100 year ARI) flood level and are located at least 80 m horizontally in from the outer edge of the NOEF, therefore the risk of exposure of these PAF cells is negligible.

Comment No.	EIS Section	EIS Discipline	Comment
33	10.4.4	Water Resources	Increasing the area for Barney Creek to flood would reduce flow velocities and depth, reducing the risk of damage or failure to structures. What alternative layouts have MRM considered to increase the floodplain for Barney Creek?

Response:

Flood modelling was undertaken for the Project's Draft EIS to determine the flood levels and velocities of a number of OEF layouts. During the feasibility process, OEFs located to the south of the McArthur River were considered, but were ruled out because of the potential significant impacts on flooding, 'bottlenecking' and increased velocities. Also, the potential locations of the OEFs are limited by a number of factors, both economic and environmental. Hence, the current OEF configuration of placing overburden in the South, East and North OEFs was selected on the basis of flood modelling results, and taking into account economic and environmental aspects. Also see the response to Comments 6 and 7.

Comment No.	EIS Section	EIS Discipline	Comment
34	10.5.3.6	Water Resources	Have MRM considered the impact on subsurface PAF material that may be drained due to mine dewatering and then re-wet following mine closure? In this setting, can PAF material undisturbed but drained oxidise?

Response:

Based on current available geochemical data, which is in the process of being refined, the majority of material present in the pit is expected to be non-acid forming. Modelling of the overburden geochemistry for the open pit (2005 EIS process) indicated that 12-13% of waste would be potentially acid forming (PAF). During actual mining operations, the percentage of PAF material removed from the pit was closer to 25% (AMDAD, 2011). However, the vast majority of material excavated is still NAF material. This is also the case for the final pit.

The scenario where groundwater is drawn down and then recovers to a final level in *in-situ* rock after mining and pumping ceases occurs at every mine operation where groundwater needs to be removed to maintain safe mining conditions. A significant exposure of this material to oxygen is not expected, and as mentioned above, if the *in-situ* material became acid producing due to re-wetting, there are large amounts of NAF material for neutralisation.

As mentioned in Appendix E4 – Mine Closure Plan of the Draft EIS, the open pit walls will contain exposed PAF material which could influence the pit water quality. A scheduled drilling program will improve the geochemistry knowledge of PAF predictions in the open pit walls to determine the influence on pit water. These further geochemical investigations will verify the final pit wall geochemistry, which is expected to be largely acid neutralising because of abundance of a large dolomite rock unit. This high amount of NAF would

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offset any potential oxidation and leachate generation from the PAF material. Modelling of the pit water quality will be refined throughout the life of the Project based on the input of the most recent data.

Further assessment and design works to refine MRM's understanding of NAF/ PAF material distribution and groundwater quality have been scoped and will commence in June 2012. Information on further studies that will be undertaken is provided in Appendix D.

Comment No.	EIS Section	EIS Discipline	Comment
35	18.7	Hazardous Materials	The EIS states that the process of identifying and managing sustainable development related risks considers " <i>potential incident and accident records</i> ". Has this consider 'actual' incident and accident records (i.e. diesel discharge incidents etc.)

Response:

The procedures utilised for risk management at MRM do consider 'actual' incident and accident records. This is a typographical error in the Draft EIS and should read "potential incident (near miss), incident and accident records". Other dot points in Section 18.7.1 identify that the following are reviewed and considered in the identification and management of risks at MRM:

- Internal and external audit results;
- Occupation and environmental hazard records; and
- Complaint records.

Furthermore the procedures for the management of hazards and risks incorporate feedback and review mechanisms such that the management of new and 'actual' incidents and hazards is incorporated into procedures and planning for future operations.

Comment No.	EIS Section	EIS Discipline	Comment
36	Appendix E1	TSF	<p>The placement of Cell 3 and Cell 4 over the drainage line of Little Barney Creek is of concern to the Department. Currently TSF Cell 1 is seeping via back filled drainage lines into Surprise Creek. This fault in the design of Cell 1 appears to be replicated in Cells 2, 3 and 4. Cell 2 is seeping into the WMD while the WMD is seeping in the Southeast section. Additionally there has been no preparation of the Cell 3 base, relying on the natural clays present.</p> <p>Based on this the Department has no confidence in the integrity of Cell 3 to retain tailings and/or contaminated water. The lack of Cell 4 design information within the EIS leads the Department to the same conclusion. The Department suggests:</p> <ul style="list-style-type: none"> • Include detailed designs for Cell 4. • The relocation of Cell 3 and 4 to a location without significant drainage lines.

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			<ul style="list-style-type: none"> • If alternative locations cannot be found then Cell 3 and 4 should be built with impermeable linings to prevent seepage. • MRM should consider excavating Cell 1 and transferring the contents to the new cells and then re-construct Cell 1 to have an impermeable lining and finish a greater distance from surprise creek. • MRM should investigate the potential for chemical attack on clays from tailings and if this may compromise the structure of the clay.
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Response:

The location of Cell 4 has been chosen to minimise environmental disturbance by utilising the structure of the existing Tailings Storage Facility (TSF). Further discussion on the options considered for the location and design of Cell 4 are provided in Chapter 3 – Project Rationale and Alternatives, Section 3.4.13 - Tailings storage facilities of the Draft EIS. Detail designs for Cell 4 are not yet available and will be completed in the Detail Design Phase following Project Approval, however additional design information of Feasibility level standard is provided in Appendix E.

Cell 4 will be lined with High Density Polyethylene (HDPE) geomembrane over the storage floor with associated under-drainage pipework. The HDPE will be in conformance with the specifications provided in the response to Comment 9 above.

In relation to Cell 1, MRM will continue to develop and assess contingencies for the future management of TSF Cell 1, including and not limited to reprocessing or relocating TSF Cell 1 tailings.

Clay material has been sourced on site by MRM. See response to Comment 37.

Clay material will undergo detailed classification, geotechnical and geochemical analysis and assessment of suitability for purpose. See response to comment 37 for further information. A qualified geochemist will provide an evaluation of the clay material available and a justification for its use as a clay liner, or alternatives and remedial measures should the clay liner prove unfit for use.

Further assessment and design works to refine MRM's understanding of clay behaviour have been scoped and will commence in June 2012. Information regarding further assessment work is provided in Appendix D.

Comment No.	EIS Section	EIS Discipline	Comment
37	Appendix E2	OEF Management Plan and PAF Encapsulation	<p>The Department is concerned about PAF cell design, particularly the clay lining.</p> <p>There are potentially two directions of influence on the structure of the clay liner:</p> <ol style="list-style-type: none"> 1. Changes in moisture content surrounding the clay causing it to shrink or swell and hence crack. 2. A chemical attack from the acidic PAF material which could impact the structure of the clay. There is potential dissolution of Al-octahedral and Si-tetrahedral layers and a release of Ca, Al and Si into solution.

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			<ul style="list-style-type: none"> • What investigations have been undertaken to characterise the clay that will be used to line PAF cells? • What type of clay will be used for the PAF cells? • How will clay be managed while PAF cells are open to ensure clay stays moist?
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Response:

Clay material has been sourced on site from areas excavated for the open pit. Clay layers are constructed with moisture content between its optimal level and 2% above. Site procedures exist to maintain appropriate moisture content while exposed during construction and are provided in Appendix F.

Key material evaluation criteria include:

- Soil must be a Unified Soil Classification of (ML, CL, CI, or MH)
- Soil must contain a minimum of 50% by weight which passes 0.075mm AS1152 sieve
- Soil must have a clay content of 25% (less than or equal to 0.005mm AS1152 sieve) by weight or greater
- Soil must have a plasticity index of 10 or greater
- Soil must have a hydraulic conductivity of not more than 1×10^{-7} cm/sec
- Soil compaction is required to have a relative compaction of 98% (standard proctor) and moisture content between Optimum Moisture Content to 2% above.

Clay test pits are being constructed north east of the levee wall (section 4.1.7.9 of 2011/2012 Mining Management Plan) with collection of samples for geotechnical analysis. Critical moisture content levels will be investigated as part of this work and if necessary, additional drying mitigation techniques can be considered for the final OEF cover design (such as a saturated cover using sandy clay layers above the clay cover).

PAF material is not necessarily acidic as stated, it has the potential to oxidise and generate acid leachate under certain conditions. The upper clay layer is designed to exclude drainage into the PAF cell to prevent generation of low pH leachate. Some NAF material that will be present with PAF material is also expected to have an acid buffering effect. Some clays have been shown to have an acid neutralising capacity through their cation exchange capacity, though further work on the classification of clays at McArthur River is required to determine their expected behaviour under these circumstances.

Specialised geochemical characterisation of the PAF and the acid buffering capability of the NAF is currently being conducted by internationally recognised geochemists to confirm and build upon MRM's understanding of these geochemical interactions. This work will have applications across the Project including the OEFs, TSF and Final Void. Geochemical analysis and assessment of the clays used at MRM will be also conducted to expand upon current knowledge of clay behaviour and optimise classification and application on site.

Further assessment and design works to refine MRM's understanding of clay behaviour have been scoped and will commence in June 2012. Information regarding this further assessment work is provided in Appendix D.

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Comment No.	EIS Section	EIS Discipline	Comment
38	Appendix E2	OEF Management Plan and PAF Encapsulation	<ul style="list-style-type: none"> Have investigations been undertaken to assess which clay type is best for the lining? What its resistance to chemical attack internally and its resistance to shrinkage or swelling from moisture changes externally?

Response:

Clay material has been sourced on site by MRM. See response to 37.

Clay material will undergo detailed classification, geotechnical and geochemical analysis and assessment of suitability for purpose (Appendix D). Please see response to 37 for further information. A qualified geochemist will provide an evaluation of the clay material available and a justification for its use as a clay liner, or alternatives and remedial measures should the clay liner prove unfit for use (Appendix D).

Comment No.	EIS Section	EIS Discipline	Comment
39	Appendix E2	OEF Management Plan and PAF Encapsulation	<ul style="list-style-type: none"> What is the expected lifespan for PAF cell design?

Response:

The PAF (potential acid forming) cells within the Overburden Emplacement Facility (OEF) are considered permanent.

Key objectives of PAF cell design within the OEF include the following:

- Construct a stable landform.
- Provide surface water controls
- Construct a cover at the end of the OEF construction that will allow rehabilitation of the surface of the OEF.
- Limit the risk of generating acid leachate from the PAF materials.
- Limit the risk of infiltration to the PAF cell.
- Provide controls during construction of the OEF to collect possible acid leachate such that it is not released into the environment.

A "multiple lines of defence" strategy has been developed to minimise the risk of PAF materials generating potentially acid seepage including:

- Foundation preparation to limit seepage into the foundation.
- Identification, selective handling and placement of PAF waste rock into dedicated cells.
- Progressive encapsulation of PAF waste rock in a low permeability cell within the OEF to limit the potential for oxygen and water infiltration that could react with PAF waste rock and generate acid.

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- Covering PAF waste rock cell with a significant cover of NAF (non-acid forming waste rock).
- Providing a surface cover across the OEF to minimise rainfall infiltration, limit potential seepage, and stabilise the surface of the dump.
- Diversion of clean surface runoff towards the end of the OEF perimeter, linking with engineered drop structures to transport the runoff to sediment traps close to ground level. (URS, 2008).

Comment No.	EIS Section	EIS Discipline	Comment
40	Appendix E2	OEF Management Plan and PAF Encapsulation	<ul style="list-style-type: none"> • What timeframe will the final capping occur on the OEFs? While they are uncapped they allow significant changes in moisture within the stockpile.

Response:

Scheduling of overburden materials placement is one of the most critical issues in the design and operation of the OEF. The placement locations of overburden materials can affect the performance of the OEF. Moreover, overburden production scheduling has to be considered to avoid double handling of materials.

The placement of PAF and NAF materials will be staged to coincide with overburden production rates, to limit the amount of surface water management controls, and to allow for progressive cover rehabilitation.

The NOEF will contain PAF and NAF material, with the PAF material encapsulated in dedicated cells in the interior of the NOEF. In order to provide a rehabilitated landform that achieves the final land use criteria the OEF will require a cover to establish vegetation. However the nature and performance of this cover will be different for the NAF areas and above the PAF cell.

Where the OEF comprises only NAF materials, the cover is required to establish a vegetative cover.

However where the PAF cell is located the cover is required to limit infiltration of water in the OEF such that infiltration to the PAF cell is minimised.

Cover infiltration will be reduced by constructing a cover that will behave as a store-and-release cover, which is also referred to as an evapotranspiration (ET) cover. An ET cover is designed to temporarily store infiltrated rainfall, which is subsequently removed from the cover soils by evaporation directly from the soil surface and by plant transpiration where soil moisture is drawn into the plant roots and conveyed up into the leaves of the plants. Local vegetation species would be selected and established on the cover.

The NAF cover is intended to support vegetation as part of rehabilitating the OEF to a suitable final land use. Therefore the cover is only required over the gently sloped final "dome" of the OEF. The key assumption in this decision is that the outer batter slopes comprise sound, hard, durable NAF rockfill.

The cover in the NAF cell area will comprise a two layered system which is summarised as follows:

- The first layer to be placed will comprise a 'protection' which would comprise an uncompacted material suitable for root growth.
- The second layer will be topsoil to provide a growth layer for vegetation.

The PAF cover is a risk reduction measure to improve the controls to limit infiltration to the dedicated PAF cell. Therefore the PAF cover would extend a minimum of 50m beyond the outer limits of the PAF cell footprint to limit the risk of infiltration.

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The cover above the PAF cells has been modelled from the four-layered system developed for the Tailings Storage Facility to a three-layered system by eliminating the capillary break layer, which is considered unnecessary for a cover placed over free-draining NAF material. The PAF cover design is described below:

- The first layer (clay liner) to be placed would be the 'barrier layer' comprising a low permeability material that would be compacted in place to act as a barrier to infiltration into the waste rock materials.
- The second layer would be the 'protection layer' which would comprise an uncompacted material suitable for root growth and to provide protection to the underlying barrier layer.
- The final layer would be topsoil to provide a growth layer for vegetation.

Further description of these layers as well as the ET cover is provided in Appendix E2 – Overburden Emplacement Facility Management Plan of the Draft EIS.

A diagrammatic representation of an NOEF PAF Cell development over time is provided in Appendix G.

Comment No.	EIS Section	EIS Discipline	Comment
41	Appendix E2	OEF Management Plan and PAF Encapsulation	<ul style="list-style-type: none"> • How will the stockpiles be created? It is difficult to understand the order and timeframes in which stockpiles will develop. This is an important detail in terms of limiting oxidation of PAF, infiltration of water and management of clay liners.

Response:

As provided in the response to comment 40 above, scheduling of overburden materials placement is one of the most critical issues in the design and operation of the OEF. The placement locations of overburden materials can affect the performance of the OEF. Moreover, overburden production scheduling has to be considered to avoid double handling of materials.

The placement of PAF and NAF materials will be staged to coincide with overburden production rates, and to limit the amount of surface water management controls, and to allow for progressive cover rehabilitation.

A diagrammatic representation of an NOEF PAF Cell development over time is provided in Appendix G.

Comment No.	EIS Section	EIS Discipline	Comment
42	Appendix E2	OEF Management Plan and PAF Encapsulation	<ul style="list-style-type: none"> • Has an assessment of current PAF cell performance been undertaken?

Response:

Whilst the NOEF is only 5 years old and MRM are yet to complete a PAF cell in its entirety (to complete final design specification and rehabilitation), investigations into OEF performance with particular focus on PAF cell behaviour have been undertaken and are ongoing.

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Due to the design and specifications of the NOEF, testing is required to monitor and minimise long term seepage from the PAF cells. This seepage is controlled by a clay liner that has a low permeability, effectively controlling seepage. MRM's Clay Liner Quality Control and Construction at the NOEF technical services manual (Appendix F) provides a construction and quality control system that is used to directly monitor and control the quality of the dump construction.

This manual provides:

- construction specifications
- material evaluation
- preparation of foundation
- clay liner installation
- keying in liner segments
- quality control measures
- post installation activities

Further detailed studies including site monitoring, lysimeters, geochemical testwork and mathematical modelling will be continued as more accurate information about the actual permeability characteristics of the constructed NOEF layers, wearing surfaces, and the clay encapsulating the PAF cells.

Lysimeters will be installed in the OEF at various stages to monitor water infiltration. Such information, along with information from kinetic leach columns, on-going static testing and monitoring of OEF leachate quality, will be used to continually re-evaluate the classification, storage and management of mined materials. Periodic electromagnetic surveys or other forms of assessment will also be conducted to determine the status of seepage through the mine life. As mentioned in the 2011/12 Sustainable Development Mining Management Plan, the installation of lysimeters will be undertaken during this operational year.

Further assessment to refine MRM's understanding of clay behaviour and NAF/ PAF classification have been scoped and will commence in June 2012. Information regarding these additional studies is provided in Appendix D.

Comment No.	EIS Section	EIS Discipline	Comment
43	Appendix E2	OEF Management Plan and PAF Encapsulation	NOEF The Department is concerned that a 600 mm clay liner for each PAF cell leaves no margin for error. MRM should consider increasing the thickness and undertake investigations into clay types and optimal thicknesses.

Response:

Details of the PAF cell construction and the process to determine the thickness of the 600mm clay is provided in Appendix E2 – Overburden Emplacement Facility Management Plan, section 3.6.4. The thickness PAF cell clay liner was determined using numerical modelling to assess the leakage through various evapotranspiration (ET) cover options for the OEF. The ET cover leakage rates were evaluated using Visual HELP which employs a quasi-two-dimensional water-balance modelling package developed for the US EPA.

MRM is committed to undertaking further testing of the 600 mm clay liner and will commence this work in June 2012. An outline of the works planned to test the clay lining is provided in Appendix D.

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Comment No.	EIS Section	EIS Discipline	Comment
44	Appendix E2	OEF Management Plan and PAF Encapsulation	<p>WOEF</p> <p>The Department is concerned that only 3 metres of material above the clay liner for the PAF cell will allow greater changes in moisture, potentially driving shrinkage or swelling in the clay. While the clay liner is proposed to be at least 1 meter thick, The Department suggests MRM further investigate clay types that are available and their properties under changing moisture conditions and capacity to hold acidic material.</p>

Response:

The WOEf has been designed using different criteria to those of the other OEFs. As the WOEf is within the bund, it does not need to consider flood events in its design. Also, due to the underlying surface topography and proximity to the open pit, runoff from the OEF reports to the open pit and hence, potentially contaminated water does not need to be contained and treated. Consequently, less cover over the WOEf PAF cell is required.

The WOEf is located wholly within the mine levee wall. The WOEf was completed in 2011 to the original design; however the requirement to upgrade the ore crushing facilities has resulted in further works to be designed for construction in 2012 and 2013. This has made it desirable to move the existing stores building and yard, which makes an additional area of 2.5 ha available.

Approximately 4.5 Mt of overburden will be able to be stored in the WOEf, both in the area now occupied by the stores yard, and in building a portion of the OEF the height of the crusher.

Detailed designs for the WOEf, including the interaction with the proposed crusher system, will be undertaken in 2012.

As the WOEf is being used as a base for major infrastructure, it will not be rehabilitated until the end of the mine life. Despite having a NAF cap above the PAF cells, it is anticipated that the use of the top of the WOEf as an industrial area and ROM pad will result in the top 1 m of NAF becoming potentially contaminated.

Therefore, the closure plan for the WOEf has allowed for 1 m of NAF to be excavated and placed in the bottom of the final open pit void, with a fresh 1 m layer of NAF replaced. The final cover would then be constructed over this, along with contouring and drainage structures to ensure the WOEf remains stable in the long term.

However, based on the proposed final design of the WOEf, the rock fill cover over the clay lining will be thicker in most areas than the minimum design thickness of 3m.

Further to this, MRM will investigate the clay properties in conjunction with the clay study for the NOEF. This work will commence in June 2012. An outline of the works planned to test the clay lining is provided in Appendix D.

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Comment No.	EIS Section	EIS Discipline	Comment
45	General	General Water Management	It is unclear in the EIS as to the water balances across the site. Details are contained within the EIS however it would be helpful to provide a schematic or adjust existing schematics to show volumes and catchment surface areas for each storage facility.

Response:

A schematic identifying the volume and catchment area of each storage is provided in Appendix T.

Full details of the water balances across the mine site for existing mine conditions and different stages of Project mining operations are given in Section 10.4.3 and Appendix D3 (Section 8) of the Draft EIS. Revised Figure 10-3 shows the water balance flow chart for existing conditions (Appendix C). Revised Figure 10-11 shows the water balance flow chart for proposed Project mining conditions (Appendix C).

The table presented in response to Comment 21 shows the current storage capacities and catchment areas draining directly to each of the existing mine water dams. This information was compiled from Table 10-3 and Appendix D3 (Table 6.1 and Table 8.1) of the Draft EIS.

The table presented in response to Comment 30 shows the storage capacities and catchment areas draining to each of the existing and proposed mine site storages under Project mining conditions. This information was compiled from Table 10-8, Table 10-9, Table 10-10, Table 10-11 and Table 10-12 and Appendix D3 (Table 7.2, Table 7.3, Table 7.4, Table 7.5, Table 7.6, Table 8.1, and Table D1, Appendix D) of the Draft EIS.

All of the assumptions provided in the water balance modelling are provided in Appendix D3 – Surface Water of the Draft EIS. This includes a list of all the storages used in the water balance and their capacities via schematics and tables. Also refer to the response for Comments 21, 28 and 30.

Comment No.	EIS Section	EIS Discipline	Comment
46		General Water Management	Over the life of the mine, it appears that water storage is reduced as Cell 3 and Cell 4 are used for tailings and the pit voids are excavated. How are MRM going to manage surface runoff if catchment areas do not decrease but storage capacity does?

Response:

The water management in the TSF area over the life of the mine is detailed in Section 10.4.2.1.2 and Appendix D3 (Section 7.3.4) of the Draft EIS. As explained in the Draft EIS, the available storage capacity is not expected to decrease until 2032. It is possible that some of the proposed PAF runoff dams around North OEF may become available at this time (because their storage requirements will be reduced due to non-PAF runoff inflows) to compensate for the loss of TSF area storage. The additional post-2032 storage requirement will be continually assessed as part of the annual reviews of the water management system as more Project operational and monitoring data becomes available.

As mentioned in the Draft EIS, Cell 4 will not be used for tailings deposition until 2032, before which it will be used for water management throughout the majority of the Project. Monitoring to validate water balance modelling will occur throughout the life of mine, as is the current case. As part of the existing operations, an annual water balance and water management plan are submitted to the Northern Territory Government, and this will continue for the Project.

Also refer to the response for Comments 21, 28 and 30.

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3.2. Respondent: Department of Lands and Planning – Transport Division

Comment No.	EIS Section	EIS Discipline	Comment
47	Chapter 8	Impact on NTG Roads	<p>This is a significant project representing a major expansion in current operations. The proposal entails more than doubling the mine’s output including the use of heavy haulage vehicles (being up from 9 truck movements per day to 18) and the frequency of truck return trips increasing to approximately 6,570 per year.</p> <p>This region has a number of low volume roads that are essential as access for commercial, industrial and social activities (including by the township of Borroloola). Any increase in road usage by heavy vehicles is likely to have significant flow-on effects to other road users, especially in terms of the obvious implications on NTG road wear and tear (eg increased maintenance demands). While MRM states that ‘the impact from this increase in traffic volumes on the existing road system is considered relatively minor’ (Section 8.4 Traffic and Transport) this is unlikely to be the case.</p> <p>It is noted that the <i>McArthur River Project Agreement Ratification Act</i> (gazetted in 1992) contains an Agreement (in Schedule 1) between the mining company and the NT Government. This Agreement includes clause 8 which deals with public roads (specifically, the construction and maintenance of public roads from the Carpentaria Hwy intersection with the mine access road to the port of Bing Bong.</p> <p>Despite the existence of this 1992 Act the Department of Lands and Planning’s Transport Division asserts that some responsibility needs to be accepted by MRM in terms of maintenance costs to these affected roads.</p> <p>In effect MRM is saying that despite them being the chief road user (24 hours/day, 365 days/year) in this locality it is the NTG’s responsibility to fix the roads (ie ‘user pays’ need not apply). However, it is MRM’s use of these NTG roads is accelerating the rate of deterioration and issues of safety and pavement failure are highly attributable to MRM’s transport vehicles.</p> <p>The EIS states that there will be a “change in traffic patterns during the project’s construction and operations stage” involving an increase in traffic numbers during the construction phase due to the transportation of new milling equipment and components and an increase in truck movements between the mine site and Bing Bong in line with the growth in annual concentrate production (Section 8.4 Traffic and Transport).</p>

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			<p>The proponent states that the haulage routes are those already utilised by the current MRM mine with no new haul roads required. However, it should be noted that the Carpentaria Highway and a small length of the Old Bing Bong Road are NTG assets.</p> <p>Statements in Section 8.4.2 (Road Link Impact) of the EIS concerning the state of the Carpentaria Highway (pot holes, water damage and uneven surfaces) can in fact largely be attributed to the use of the road by MRM heavy vehicles.</p> <p>The issue of incorrect cambers and narrow sections of Highway (also in Section 8.4.2) are a concern to the NTG. It is understood that the Tennant Creek Office of the Department of Construction and Infrastructure has had recent talks with MRM with regards to not using this route for the transport of heavy machinery components, etc to the mine site. Instead, DCI is recommending the use of the port and the Bing Bong Road as the preferred route. Likewise, it is recommended that MRM not use this Darwin via Stuart Highway and Carpentaria Highway route to the mine site as their "mine input delivery haul route" for the mine's expansion works (Section 8.3.1 External Haul Routes).</p> <p>It is stated in the EIS that the Carpentaria Highway "requires reconstruction works to a suitable road pavement standard to provide adequate safety to all current and future road users. These works are required regardless of whether the Project proceeds. If these works are undertaken to rectify the safety concerns related to the current road pavement condition of the Carpentaria Highway, the resulting pavement is likely to be sufficient to avoid any further pavement maintenance works for the life of the Project" (Section 8.4.2 Road Link Impact).</p> <p>As mentioned earlier Transport Division asserts that some responsibility needs to be accepted by MRM in terms of the maintenance costs to these affected roads (which is partly outside the terms of the <i>McArthur River Project Agreement Ratification Act</i>).</p>
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Response:

The Draft EIS provides information relating to the continued use of the road from the intersection of MRM's mine access road with the Carpentaria Highway, to the Mineral Lease on Bing Bong Pastoral Lease No 686 (the "Road") including highlighting some deficiencies in the current state of the Road.

It is noted that the Transport Division's response asserts that *"some responsibility needs to be accepted by MRM in terms of maintenance costs to these affected roads."* Such assertion is contrary to the provisions contained within the *McArthur River Project Agreement* between Northern Territory of Australia (the Territory") and Mount Isa Mines Limited (the "Company" or "MIM") (Xstrata acquired MIM in 2003) dated 25 November 1992 (the "Project Agreement") which was ratified by the *Northern Territory McArthur River Project Agreement Ratification Act* (the "Act").

Note the express obligation imposed upon the Territory in clause 8.1 of the Project Agreement which clearly states that "...the Territory shall, at no expense to the Company, where necessary construct and maintain" the Road. The Project Agreement does not impose any obligation upon MIM to contribute to the costs of

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construction or maintenance of the Road. The only requirement imposed upon MIM in relation to the use of the Road is to ensure that any vehicles used shall be registered in the Northern Territory and operated in accordance with the *Motor Vehicles Act*, the *Control of Roads Act* and the *Traffic Act*.

MIM have assumed many other responsibilities under the Project Agreement in consideration of the Territory assuming, amongst its other obligations, the responsibility of construction and maintenance of the Road.

It is irrelevant as to whether MIM's usage of the Road contributes to the deterioration of the state of the Road. Clause 8.5 of the Project Agreement states that MIM and its contractors "shall at all times be entitled to use the road for all purposes associated with the McArthur River Project". The Project Agreement places no restriction upon MIM's usage of the Road.

We note section 4 of the Act which clearly ratifies the Project Agreement and authorises the implementation of the Agreement.

We reiterate our concerns relating to the maintenance of the Road and confirm that we will make members of the team available for consultation with the Territory in relation to ensuring that the Road will be maintained, by the Territory, to a reasonable standard for the purposes of the operation of the project.

Alternative construction haulage routes between Darwin and site, including the usage of the Bing Bong concentrate storage and ship loading facility, have been considered. The routes selected and assessed in the Draft EIS have been determined to be the most appropriate on the basis of a number of commercial, operational and environmental criteria. A summary evaluation supporting the current route selection between Darwin and site is provided in Appendix H.

Comment No.	EIS Section	EIS Discipline	Comment
48	Chapter 8	Impact on NTG Road Intersections	<p>The proponent states that "intersection volumes are anticipated to remain very light even with the presence of additional road traffic generated by the Project's construction and operation" with no mitigation works being proposed on any of the intersections on the identified external haul roads (Section 8.4.3 Intersection Impact). Also the proponent states that "due to the very low existing traffic volumes at the Carpentaria Highway/MRM mine access road intersection, it is considered that intersection turning movement analysis is not required. However, the layout of the intersection has been compared with the standard accepted layouts in DTMR's RPDM to confirm that the junction can adequately and safely accommodate turn movements for all vehicle types expected to use the intersection during the Project's life" (Section 8.3.6 Intersection Analysis).</p> <p>Despite these assertions RND still has concerns with regards to the adequacy (safety) of the existing road intersections in terms of spare capacity to safely accommodate the expected increase in traffic (also given the proportion of MRM vehicles utilising the intersections).</p> <p><i>Note: Further to the above comments, the Transport Division of DLP is increasingly concerned at the cumulative effect that this and other proposals (i.e. a combination of proposals) will have on the NTG road network in terms of the need for increased road maintenance and upgrading and safety issues. The impact of heavy vehicles on the road network is likely to be significant in terms of environmental, social and economic impacts.</i></p>

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Response:

The methodology utilised for the transport assessment was agreed with the Department prior to commencement of the assessment. The agreed methodology has been followed however the department has expressed 'concerns' with regard to the capacity of the intersections. The results of the assessment clearly identify that the volumes of traffic are well within the capacity of the road network, particularly in the context of the low existing traffic conditions.

Whilst the assessment has not directly considered traffic volumes from specific other proposals, the GARID methodology incorporates 'traffic growth trends' in the modelling allowing future traffic volumes to be generated both including the project and without, in consideration of 'natural growth'. The assessment considers these future volumes in the context of the project and identifies no future capacity issues.

The department does not provide any assessment or calculation findings to support its concerns. MRM's position with regard to the maintenance of the road network is presented in the response to Comment 47.

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3.3. Respondent: Department of Business and Employment

Comment No.	EIS Section	EIS Discipline	Comment
49	General	Economic Environment, Social Environment	<p>The Department of Business and Employment considers the draft EIS provided to be of an excellent standard and has no major issues or concerns.</p> <p>The proposed expansion of the McArthur River Mine site will increase the mine life by 9 years and is likely to make significant economic, business, employment and social contributions, direct and indirect, to the local community and the Northern Territory.</p> <p>The Department is pleased to note that the project will provide valuable opportunities for employment growth, with a major increase in employment once the expansion is completed in 2014 with a focus on local and indigenous employment opportunities. The commitment to source from local suppliers across the Northern Territory where possible is also welcomed by the Department.</p>

Response:

Noted.

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3.4. Respondent: NT Worksafe

Comment No.	EIS Section	EIS Discipline	Comment
50	17.9.6	Health and Safety	Since the original project proposal was developed our administrative legislation has changed (see below). Some of the important changes include the incident reporting as mentioned in Chapter 17.9.6. The proponent should be aware that any notifiable incidents are to be reported immediately (pursuant to Section 38 of the <i>Work Health and Safety (National Uniform Legislation) Act 2011</i>) and the scene preserved unless given a direction by an inspector (pursuant to Section 39 of the <i>Work Health and Safety (National Uniform Legislation) Act 2011</i>).

Response:

Noted. MRM is aware of the incident reporting requirements and the *Work Health and Safety (National Uniform Legislation) Act 2011* is included on MRM's Legal Compliance Register.

The MRM Compliance Register contains a list of the applicable legislation that MRM requires compliance with. This includes Northern Territory and Commonwealth legislation and other guidelines. This register is regularly reviewed to maintain an up to date register with the relevant compliance and regulatory requirements.

Comment No.	EIS Section	EIS Discipline	Comment
51	Chapter 2	Regulatory Environment	I wish to draw attention to the following legislation which now applies to all operations in the Northern Territory: <ul style="list-style-type: none"> • <i>Work Health and Safety (National Uniform Legislation) Act 2011</i> and its Regulations; • <i>Transport of Dangerous Goods by Road and Rail (National Uniform Legislation) Act</i> and its Regulations • <i>Electricity Reform Act</i> and its Regulations Details of these are available on our web site at www.worksafe.nt.gov.au .

Response:

Noted. MRM is aware of the aforementioned legislation. MRM's Legal Compliance Register includes the legislation identified, namely:

- *Work Health and Safety (National Uniform Legislation) Act 2011* and its Regulations;
- *Transport of Dangerous Goods by Road and Rail (National Uniform Legislation) Act* and its Regulations; and
- *Electricity Reform Act* and its Regulations.

The MRM Compliance Register contains a list of the applicable legislation that MRM requires compliance with. This includes Northern Territory and Commonwealth legislation and other guidelines. This register is regularly reviewed to maintain an up to date register with the relevant compliance and regulatory requirements.

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3.5. Respondent: Department of Health

Comment No.	EIS Section	EIS Discipline	Comment
52	General		<p>Routine mosquito monitoring is conducted at McArthur River Mine, with traps set by MRM environmental officers, and mosquitoes identified by Medical Entomology. An annual report is produced by Medical Entomology for MRM, based on the mosquito trapping results and any field investigations. The recommendations in the annual reports should be implemented by MRM to reduce the potential for mosquito borne disease transmission to mine workers and contractors.</p> <p>General guidelines on mine developments can be found in the Medical Entomology handout 'Guidelines for preventing mosquito breeding sites associated with mining sites in the Northern Territory'.</p>

Response:

Noted. Regular adult mosquito monitoring is undertaken consisting of monthly trapping during the dry season and fortnightly trapping during the wet season. Trapping occurs at four sites at the Mine and two sites at the Bing Bong concentrate storage and ship loading facility. A site inspection and survey is carried out by Medical Entomology personnel annually to assess water holding receptacles that could act as artificial mosquito breeding sites at MRM and to inspect dredge pond areas and associated disturbed areas at Bing Bong.

The table below provides the latest recommendations from the Mosquito Monitoring Program McArthur River Mine 2010/11 report and describes how these recommendations have been or will be implemented on site.

Recommendation	Rectified YES/NO	Action Taken/Required	Timeframe	Monitoring of effectiveness
<p>1 (Bing Bong) The access track along the north edge of the dredge ponds, as well as the raised elevation of the dredge ponds, appears to be exacerbating ponding in the low lying saline area between the dredge ponds and the port facility. There would need to be suitable culverts provided in the access track where they cross low lying saline areas. A drain should also be constructed from the dead paperbark area at the NW edge of the ponds near Trap Site 1, through the lowest sections in the low lying saline area north of the dredge ponds, to the outlet drain to the beach.</p>	No	In 2012 investigations will be undertaken into drainage works to rectify this issue.	2012 (investigation)	NA

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Recommendation	Rectified YES/NO	Action Taken/Required	Timeframe	Monitoring of effectiveness
<p>2 (Bing Bong) The catch drain around the dredge ponds at present, it appears that spoil from the drain construction has been placed immediately adjacent to the drain, at least in the upper reaches along the west edge of the dredge ponds. Appropriate drainage cuts should be provided in the spoil as a minimum, to allow adjacent low lying areas to drain into the diversion drain.</p>	Yes	Drain cleared to allow appropriate drainage	Late 2011	MRM adult mosquito Monitoring program and visual monitoring of effectiveness of drainage.
<p>3 (Bing Bong) The disused areas of the dredge ponds, vegetated with small shrubs and grasses, could be rectified by draining into the lower lying large open ponds. The two ponds at the eastern edge of the dredge area are likely to be productive mosquito breeding sites due to the presence of vegetation, therefore should be drained. The large dune depression near the barge landing could be filled and levelled with sand to above the wet season water table, to remove wet season ponding and salt marsh mosquito breeding.</p>	No	Due to the design of the dredge spoil ponds some ponding of water is required to assist in leaching excess salt from the dredge spoil. Ponding however is only for a short duration before absorption into the spoil.	NA	NA
<p>4 (Bing Bong) In general, the port area should be maintained clear of any artificial receptacles that could pond water including used tyres that should be provided with drainage holes or removed.</p>	Yes	Incorporated into HSEC Inspections and actions taken to remove receptacles where required.	Ongoing	HSEC Inspections and MRM adult mosquito Monitoring program.
<p>5 (Mine Site) Regular wet season inspections conducted around McArthur River Mine, to locate artificially created depressions caused by site disturbance and development. Water ponding areas should be fixed the following dry season by filling or draining, or a combination of both.</p>	Yes	Artificially created depressions around the Mine Site are filled or drained where practicable	Ongoing	MRM adult mosquito Monitoring program and visual inspection of artificially created depressions.

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Recommendation	Rectified YES/NO	Action Taken/Required	Timeframe	Monitoring of effectiveness
<p>6 (Mine Site) Ground pools around the airport and mine accommodation area should be rectified by filling or draining. The drain that runs along the road at the southern edge of the mine accommodation area is partly impounded by a small access track culvert that has been installed higher than the invert of the drain, therefore the culvert should be lowered to the level of the upstream drain. Depressions adjacent to the ROM and alongside the McArthur River diversion should be rectified by filling or draining.</p>	Yes	Drainage works completed around the airport and accommodation village to ensure adequate drainage of these areas (refer to MRM Camp Drainage Project Summary copy available)	Late 2011, early 2012.	MRM adult mosquito Monitoring program and visual inspection of new drainage works.
<p>7 (Mine Site) The sewage irrigation area should be rectified by appropriately grading the irrigation area to be free from depressions, and managing the irrigation area by alternating the use of sprinklers to different sections, on a week on/week off basis, to prevent soil waterlogging and subsequent ponding at the base of the sprinklers. Grass should also be kept short to help with evaporation. If wet season overland flows occur across the site, a diversion bund might be required to prevent the flows from entering the irrigation area.</p>	Yes	Issue rectified by instillation of new sewage system.	Late 2011	MRM adult mosquito Monitoring program and routine monitoring of sewage system.
<p>8 (Mine Site) Disused artificial receptacles such as used tyres, old drums, buckets and other items that can pond water should be removed from the site, buried, or provided with drainage holes, to prevent the potential for receptacle mosquito breeding.</p>	Yes	Incorporated into HSEC Inspections and actions taken to remove receptacles where required.	Ongoing	HSEC Inspections and MRM adult mosquito Monitoring program.

MRM are aware of the Guidelines for Preventing Mosquito Breeding Sites Associated with Mining Sites. The guidelines are included on the MRM Legal Compliance Register and a copy is kept on-site. MRM adhere to these guidelines, where practicable.

The MRM Compliance Register contains a list of the applicable legislation that MRM requires compliance with. This includes Northern Territory and Commonwealth legislation and other guidelines. This register is regularly reviewed to maintain an up to date register with the relevant compliance and regulatory requirements.

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Comment No.	EIS Section	EIS Discipline	Comment
53	2.4.7	Other Relevant Legislation	The Public Health Act should be applicable to the project.

Response:

Noted. MRM acknowledge that the *Public and Environmental Health Act 2011* is applicable to the project. It is included in the MRM Legal Compliance Register.

The MRM Compliance Register contains a list of the applicable legislation that MRM requires compliance with. This includes Northern Territory and Commonwealth legislation and other guidelines. This register is regularly reviewed to maintain an up to date register with the relevant compliance and regulatory requirements.

Comment No.	EIS Section	EIS Discipline	Comment
54	19.5.8	Mosquito Management Plan – Operations Environmental Management Plan	Actions – Mosquito breeding sites that have been created at McArthur River Mine during prior operations and haven't been rectified, should be rectified to prevent potential health impacts in the increased workforce. These include the numerous disturbed areas and certain dredge ponds at Bing Bong, the sewage irrigation area at the mine site and storm water drains near the accommodation village. Further details on areas that require rectification, and potential rectification methods, can be found in the 2010/11 Mosquito Monitoring Program report for McArthur River Mine.

Response:

Noted. See response to Comment 52.

Comment No.	EIS Section	EIS Discipline	Comment
55	19.5.8	Mosquito Management Plan – Operations Environmental Management Plan	Other actions that can be utilised to prevent/minimise mosquito breeding include regular de-silting of open drains, and removal or appropriate management of artificial receptacles.

Response:

The management of drains and artificial receptacles is incorporated into Health, Safety, Environment and Community Inspections. Through this inspection process drains are monitored and maintained as necessary to remove silt and artificial receptacles are noted and removed where practicable. In December 2011 action was taken to improve drainage at the accommodation village by installing a number of new drains as well as maintaining and modifying existing drainage infrastructure to improve drainage. Appendix I provides a summary report on the drainage works undertaken.

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Comment No.	EIS Section	EIS Discipline	Comment
56	Chapter 5	Rehabilitation	Guidance on rehabilitation to prevent mosquito breeding legacies can be found in 'Guidelines for preventing mosquito breeding sites associated with mining sites in the Northern Territory'. Medical Entomology should be consulted during the final decommissioning of the mine for advice on rehabilitation of certain areas, in particular the Bing Bong dredge storage area, as well as pits and water ponds at the mine site.

Response:

MRM are aware of the Guidelines for Preventing Mosquito Breeding Sites Associated with Mining Sites. The guidelines are included on the MRM Legal Compliance Register and a copy is kept on-site. MRM adhere to these guidelines where practicable. Department of Health Medical Entomology personnel conduct a site visit annually to assess water holding receptacles that could act as artificial mosquito breeding sites. The Medical Entomology section within the Department of Health will be consulted during the decommissioning phase of the Project for advice on rehabilitation to mitigate mosquito breeding after closure.

Comment No.	EIS Section	EIS Discipline	Comment
57	Table 9.2 and 9.3	Waste management	Tyres - the designated areas to store the waste tyres should ideally be under cover away from rain. Alternatively the tyres could be provided with drainage holes if left out in the open exposed to rain before burial.

Response:

Tyres are disposed of in accordance with MRM's Technical Services procedure - Waste Tyre & Conveyor Belt Management Procedure. This procedure provides that tyres will be disposed of in the Potentially Acid Forming (PAF) cells of the North Overburden Emplacement Facility (OEF) within the designated waste tyre cell. Each cell will consist of an area 20m x 20m and will contain a maximum number of tyres depending on the type of the tyres being disposed, either heavy vehicle and light vehicle/truck tyres. Light vehicle tyres will be placed inside the heavy vehicle tyres. Light vehicle tyres will not be stacked on top of heavy vehicle tyres.

Where temporary storage of tyres is required prior to disposal, exposure to rain will be minimised where practicable.

Comment No.	EIS Section	EIS Discipline	Comment
58	Table 9.2 and 9.3	Waste management	Sewage waste – there has been issues with effluent ponding at the base of the sprinklers in the existing irrigation area, as well as wet season overflow into a drain from the sewage plant. These issues, if not yet resolved, should be fixed. The proposed construction camp sewage facility should be designed and managed to prevent the above mentioned problems from occurring at the construction camp. The Department of Health (Environmental Health and Medical Entomology) should be required to approve the sewage treatment plant for the accommodation village.

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Response:

The issue of effluent ponding in the irrigation area and overflow during the wet season has been rectified by the instillation of a new sewage system in November 2011. The upgraded sewage treatment facility will be designed and operated in consideration of the Guidelines for Preventing Mosquito Breeding Sites Associated with Mining Sites. The Department of Health will be consulted during its design and operation.

Comment No.	EIS Section	EIS Discipline	Comment
59	10.4.2.7	Irrigation Concepts	Irrigation has the potential to lead to ground waterlogging and associated surface ponding and mosquito breeding. The Pivot Irrigation Systems appears to be a good concept to dispose of pit water, as long as the irrigation area is appropriately managed to prevent surface ponding and mosquito breeding.

Response:

Water from the Open Pit is classified as contaminated water. It is pumped to the Pete's Pond contaminated water storage facility. From Pete's Pond water can be pumped between other contaminated water storage dams when necessary and to increase evaporation potential by maximising water surface area. Contaminated water from these storage dams is utilised for dust suppression or evaporated. Contaminated water including water from the Open Pit would not be used for irrigation purposes.

Water from the TSF Cell 3 WMD (including groundwater intercepted by bores surrounding the pit) deemed to be of sufficient quality through the surface water monitoring and testing processes will be used for irrigation. Design and operation of the irrigation facilities will be undertaken in consideration of the Guidelines for Preventing Mosquito Breeding Sites Associated with Mining Sites, with particular focus on minimising the potential for long term ponding.

Comment No.	EIS Section	EIS Discipline	Comment
60	10.2.8	Existing Mine Water Management System	Clean water diversion drains, on-site collection, storages, and settlement traps all have the potential to breed mosquitoes if not designed and maintained appropriately. Guidelines on appropriate design to minimise the potential for mosquito breeding can be found in 'Guidelines for preventing mosquito breeding sites associated with mining sites in the Northern Territory'. Design plans should be sent to Medical Entomology for review and comment.

Response:

Surface water infrastructure is monitored and maintained through the implementation of the McArthur River Mine Sustainable Development Water Management Plan. MRM are aware of the Guidelines for Preventing Mosquito Breeding Sites Associated with Mining Sites. The guidelines are included on the MRM Legal Compliance Register and a copy is kept on-site. MRM adhere to these guidelines at all times where practicable. The Department of Health will be consulted in relation to the design and operation of surface water infrastructure associated with the Project.

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Comment No.	EIS Section	EIS Discipline	Comment
61	Chapter 4	Project Description	Very little information is provided within the report regarding the expansion of the Accommodation Village. Any expansion will need to comply with the requirements outlined in the fact sheet: http://www.health.nt.gov.au/Environmental_Health/Health_Risk_Assessment/index.aspx

Response:

Both the existing accommodation village and the temporary construction camp will abide by the Requirements for Mining, Construction & Bush Camps as outlined in the Northern Territory Government Department of Health Environmental Health Fact Sheet 700. All relevant legislation within this fact sheet is included on the MRM Legal Compliance Register and MRM acknowledges that these pieces of legislation are applicable to the Project.

The expansion of the permanent accommodation village will be to the North of the existing facilities. This expansion will house the Project's increased operational workforce and utilise the existing dining, wet canteen, recreation/entertainment, laundry and sewage facilities. These existing facilities will be upgraded where necessary to cater for the increased operational demand. The Sewage treatment plant has recently been upgraded in November 2011 doubling previous capacity to 600 on-site persons. Further design works have identified that it is preferable to upgrade the existing permanent facility (600 on-site persons) to cater for 1000 on-site persons. Due to the mine's rostering schedule, this will provide more than adequate capacity to cater for the on-site personnel throughout the construction and operational phase of the Project. In consultation with the Department of Health, the Proponent will seek approval for all on-site sewerage treatment facilities in accordance with the *Public and Environmental Health Act 2011*.

The construction workforce will be accommodated in a purpose built temporary construction camp with a capacity for up to 350 on-site personnel. This camp will be located adjacent to the existing accommodation village and be connected to all necessary utilities including water and electricity. The construction workforce will utilise the facilities of the existing accommodation village however some additional facilities are expected to be required such as dining facilities and laundry facilities. Once the construction phase of the Project is complete the construction camp will be decommissioned.

Comment No.	EIS Section	EIS Discipline	Comment
62	Chapter 4	Project Description	All prescribed accommodation must be registered with the Department of Health - Environmental Health Branch under the terms of the <i>Public and Environmental Health Act 2011</i> (Shops, Boarding Houses, Hostels and Hotels Regulations). In addition all sleeping accommodation rooms should be designed and built in accordance with the Building Code of Australia.

Response:

The *Public and Environmental Health Act 2011* and the Building Code of Australia are both included on the MRM Legal Compliance Register. MRM acknowledge that these pieces of legislation are applicable to the Project and confirm that operations associated with accommodation facilities will be undertaken in accordance with its requirements.

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Comment No.	EIS Section	EIS Discipline	Comment
63	Chapter 4	Project Description	<p>It is noted there will be no change to the potable water system currently in place. This supply is sourced from the Mimex borefield. There have recently been some minor amendments to the requirements of the Department of Health regarding private water supplies. In addition to ensuring the water supply does not contain <i>E. coli</i> prior to the renewal of the camp food business registration, the Department now also requires a chemical and metal analysis of the water supply by a NATA accredited laboratory to ensure it complies with the Australian Drinking Water Guidelines. Chemicals and metals commonly found in drinking water which should be analysed for can be found at:</p> <p>http://www.health.nt.gov.au/Environmental_Health/Water_Quality/index.aspx#FactSheetsWaterQuality.</p>

Response:

MRM are aware of the Australian Drinking Water Guidelines 2011 and the recent amendments to these guidelines. MRM acknowledge that the guidelines are applicable to the Project and they are included on the MRM Legal Compliance Register. The potable water supply at the accommodation village, mine site and the Bing Bong concentrate storage and ship loading facility is monitored in accordance with the Australian Drinking Water Guidelines 2011 through the implementation of the MRM Technical Manual for Environmental Monitoring. Additional monitoring points in new Project related infrastructure such as the construction camp will be incorporated into the potable water monitoring program.

Comment No.	EIS Section	EIS Discipline	Comment
64	Chapter 4 and 9	Project Description and Waste Management	<p>It is noted the packaged sewage treatment plant has recently been upgraded without Department of Health approval. The Department of Health requires an application for site specific design approval for all on site wastewater management systems in accordance with the <i>Public and Environmental Health Act 2011</i> (General Sanitation, Mosquito Prevention, Rat Exclusion and Prevention Regulations). It is requested that an application for approval be submitted and copies of verification monitoring results be supplied to the Department immediately. Application forms can be found at:</p> <p>http://www.health.nt.gov.au/Environmental_Health/Wastewater_Management/index.aspx</p>

Response:

Noted. The *Public and Environmental Health Act 2011* is included on the MRM Legal Compliance Register and MRM are aware that this legislation is applicable to the Project. A new sewage system was installed in November 2011. The approval process for the sewage treatment plant has commenced and will be progressed in consultation with the Department of Health.

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Comment No.	EIS Section	EIS Discipline	Comment
65	Chapter 4 and 9	Project Description and Waste Management	Disposal of effluent from the sewage treatment plant is not permitted within 100 m of a bore or surface water body.

Response:

Noted. The disposal of effluent from the sewage treatment plant occurs approximately 200m from Barney Creek and there are no bores in the vicinity of this disposal area.

Comment No.	EIS Section	EIS Discipline	Comment
66	General	General	The proposed waste management, dust control, noise and air quality monitoring and mitigation plans appear to be satisfactory.

Response:

Noted.

Comment No.	EIS Section	EIS Discipline	Comment
67	Chapter 10	Water Resources	Ground and surface water impact studies should also include an analysis of potential risks to public health, particularly following any release in excess of that prescribed by the NRETAS waste discharge licence.

Response:

The site has a comprehensive environmental monitoring program incorporating surface water and groundwater. Throughout the history of the mine, there have been no releases of excess water that would constitute a risk to public health, both in terms of ANZECC Guidelines and the NRETAS Waste Discharge Licence. This monitoring and validation will continue for the Project.

MRM Environmental monitoring activities are implemented either as a part of commitments agreed to with the Government or as extra-curricular proactive initiatives undertaken by the site to establish leadership positions in environmental management.

As an example, environmental performance through reports and audits during the 2010-2011 operational period included:

- Department of Environment, Water, Heritage and the Arts (DEWHA) Audit;
- Commonwealth Environmental Monitoring Report (CEMR) 2010,
- Independent Monitor (IM) - Independent Monitor Audit Report – Environmental Performance of the McArthur River Mine(2010 and 2011)

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- Department of Resources (DoR);
 - MRM Sustainable Development Water Management Plan (SDWMP)2009/2010;
 - MRM Sustainable Development Mining Management Plan (SDMMP)2009/2010;
 - MRM 2009/10 Mining Management Plan Compliance Audit December 2010;
 - MRM 2009/10 Water Management Plan Compliance Audit December 2010;
 - Site inspection for the Mine site and Bing Bong May 2010;
- Xstrata PLC - Xstrata Sustainable Development Standards Audit – Third Party Audit December 2010.

This will continue for the Project.

Comment No.	EIS Section	EIS Discipline	Comment
68	2.4.7	Other Relevant Legislation	Section 2.4.7 "Other Relevant Legislation" fails to recognise Public Health and Food legislation, i.e. Food Act 2004 and Public and Environmental Health Act 2011 and subordinate regulations. Please ensure that the proponent is made aware of this omission as Food and Public Health legislation are applicable to this project.

Response:

Noted.

The proponent is aware of the *Food Act 2004*, *Public and Environmental Health Act 2011* and subordinate regulations and confirms these are included in the Site Legal Compliance Register. The proponent acknowledges that these apply to the Project and will undertake Project activities in accordance with their requirements.

Comment No.	EIS Section	EIS Discipline	Comment
69	N/A	N/A	Your attention is also drawn to the previous comments made by the Department of Health on 5 April 2012 regarding the Notice of Intent for McArthur River Mine Phase 3.

Response:

Noted. Comments from the Department of Health on the Notice of Intent are not directly available to the Proponent, however were considered by NRETAS and where relevant incorporated into the Final Guidelines for the Draft EIS as part of the advisory consultation between government departments.

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3.6. Respondent: Environmental Recyclers NT

Comment No.	EIS Section	EIS Discipline	Comment
70	NA		<p>MRM/Xstrata has diverted a tropical wild river. This has irrevocably damaged the complex interrelationships between water, soil, air and living things. The fact that a mining company has permanently realigned a tropical wild river will not come into this EIS or interact with its current EIS remediation plans (or 'unplans' as its Rehabilitation and Decommissioning chapter in the Main Report terms it).</p> <p>This EIS proposal is full of sustainable (exponential growth) economics but very short on ecological sustainability.</p> <p>MRM is proposing to 'sustainably' enlarge its already environmentally unsustainable activities to allow nine more years of mineral extraction from an already over-exploited system. It sees this as a need to economically sustain the NT economy. The cost of its activities on the natural ecosystem is not given.</p> <p>There appears to be a vision of a 216 hectare vibrant lake system entrancing the 1860 hectare 'remediated' landscape of 2036 and beyond. This is a vision that wholeheartedly endorses technology's ability to fix broken things that complex natural systems no longer have the resilience to heal. In reality MRM's 216 hectare bottomless pit will remain another eutrofied void – indeed, a very dangerous but 'significant feature of the post-mining landform' for generations to come.</p> <p>MRM through Xstrata is committed to Ecologically Sustainable Principles. These may be constrained through the Mineral Council's translation of them in 'Enduring Value Principles for Sustainable Development' but a commitment is a commitment.</p> <p>The Mineral Council of Australia (MCA) in its 'Enduring Value Industry Framework for Sustainable Development: Guidance for Implementation' document has included the Brundtland definition of sustainable development as follows: "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Our Common Future, Brundtland 1987).</p> <p>However, the MCA also translates such development as industrial commitment 'to contributing to the sustained growth and prosperity of current and future generations'. There is no such thing as sustained or exponential growth in the natural environment so this statement alone shows a commitment to 'Business as Usual' (BAU) rather than ecological sustainability.</p>

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Comment No.	EIS Section	EIS Discipline	Comment
			<p>We propose to follow the Brundtland principles as well as MCA Guidelines for Implementation to show that the MRM/Xstrata proposal to expand its McArthur River mineral lease does not provide for the needs of the present nor will it allow for future generation needs.</p> <p>By setting our objections to this significantly unsustainable proposal into print we echo the sentiments of Thomas Berry, a poet ecologist, who wrote for the present and future generations of children in the world:</p> <p>To the children, to all the children, To the children who swim beneath the waves of the sea, to those who live in the soils of the Earth, to the children of the flowers in the meadows and the trees in the forest, to all those children who roam over the land and the winged ones who fly with the winds, to the human children too, that all the children may go together into the future in the full diversity of their regional communities.</p> <p>The Brundtland Report and its implications on mining In the Overview of the Report, the role of the international economy is seen as:</p> <ul style="list-style-type: none"> • looking first at the sustainability of the ecosystem that the world economy depends, • not over-exploiting non-renewable resources, • including environmental impacts of economic activities as an overriding cost, • financiers such as the World Bank supporting only environmentally sound production, • governments discouraging over-production of commodities that have no respect for long-term ecosystem health and • Not mining the global commons.

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Comment No.	EIS Section	EIS Discipline	Comment
			<p>In Chapter 2 of the Brundtland Report the concept of 'needs' includes satisfying essential needs of the poorest in our community while limiting technology and social organisation that prevents the environment from meeting healthy present and future biodiverse needs. This involves progressive transformation that places the environment first and respects environmental complexity and interaction.</p> <p>The Brundtland Report also sees economic growth as part of sustainable development where it supports environmental and socially sustainable development needs – equitably and non-exploitatively and does not endanger the environment. It particularly emphasises that diverting watercourses, extracting minerals and releasing noxious gases into the atmosphere are drastic and life-threatening to our natural support systems. Such activities cannot purport to be sustainable.</p> <p>Our small, fragile living planet that when viewed from space is dominated by clouds, oceans, greenery and soil cannot continue to recover from humanity's excesses while we carry out Business as Usual.</p> <p>Meeting the needs of the present generation.</p> <p>The first principle to be met is to provide for the needs of the present generation. While MRM purports to provide local employment and business support, it will employ 80% or more – or approximately 750 people - from outside the NT or the local area - at the peak of its activities. It will bring in the bulk of its food and equipment from interstate and overseas.</p> <p>By its own figures, a high percentage of its Indigenous workforce is not local and even if it were miraculously boosted to a quarter of the workforce at peak figures, 233 Indigenous people (mostly male and southern urban-based) would be employed.</p> <p>Principle 1 of the MCA Guidelines encompasses an ethical business code that engenders respect for the environment as well as cultural practices of local communities. Traditional land use management also embodies respect for Country. While approximately 200 people of Indigenous descent may economically benefit from destroying Country, at what cultural cost will this come to the local indigenous communities?</p> <p>Our experience of essentially highly-paid, bored FIFO mining personnel is that severe social/cultural disintegration occurs locally as well as regionally – creating a social schism between the haves and have-nots.</p>

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Comment No.	EIS Section	EIS Discipline	Comment
			<p>We doubt the truth, however, of MRM/Xstrata increasing employment opportunities for those most in need. If we are to go on current mining industry trends, the need for human truck, train and ore extraction machinery operators will soon be replaced by computers. Their operators can work from Spain or Switzerland – while their driverless machines break the 10 Principles of the MCA Guidelines accordingly in every accessible corner of every resource-rich region of the world. After all, why respect the long-term needs of the living Earth when wealthy shareholder short-term capital gain is at risk?</p> <p>Compromising the ability to meet needs</p> <p>MRM/Xstrata uses a linear accounting system or Net Present Value (NPV) that takes very little account of the holistic value of complex ecosystems and the effect their degradation has on the well-being of human and other animal and plant communities reliant on them. The traditional and non-market values of Country are not considered.</p> <p>By using NPV, the cost of rehabilitating for future needs is based on a current account discounted economic value system of risk assessment. If, for instance, the open pit and its thousands of hectares' effects on the wider environment spiral out as the climate changes and cause costs attributed to 'acts of god' and not to MRM, will the void remain beyond 2036 – at far greater public cost?</p> <p>While MRM points out that it looks at regional well-being, this is also focused on present economic models of what the NT human community wants now rather than on what is ecologically sustainable for tropical savannah forests and waterways and those who depend on their health into the future.</p> <p>Ecological Sustainability depends on uncertainty because complex living systems are not static. Mine sites will be rehabilitated into a 'stable landform' according to today's economic value. Current engineering plans and projects rely on today's legal and economic certainties. Vegetation is cleared according to current land clearing permits and will continue to be cleared according to these permits – well into the future. Land disturbances will be rectified to conditions prior to when mining disturbed the landscape – or as agreed and pre-determined – by today's methods and standards. Is the integrity of the environment assured over the long term?</p>

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Comment No.	EIS Section	EIS Discipline	Comment
			<p>Meeting the needs of future generations</p> <p>MRM/Xstrata relies on present global consumption figures for non-renewable mineral resources. This is said to justify a mine expansion and river diversion beyond its original highly-contentious mining plans and Life of Mine unplan.</p> <p>Instead of constantly using the word ‘sustainable’ as a means to appease the wants of the present human generations, we would suggest that MRM/Xstrata directors, shareholders and employees investigate what the needs of future generations to a healthy and resilient environment may mean.</p> <p>Future generations need current advocates with the leadership skills to share holistic knowledge and guide people through reflection, principled analysis, creative thinking and commitment to go beyond short-term electoral cycles and business interests – to protect the needs of our most vulnerable and poverty-stricken community members today without compromising the ability of future generations to meet their needs.</p> <p>We recommend that this proposal – to expand the mine and further significantly reduce the ability of the river system to provide for needs of future generations – be rejected.</p> <p>Furthermore, we suggest that MRM/Xstrata look beyond the commodity prices of today, beyond the concept of exponential growth and non-renewable resource extraction towards the practice of ecological sustainability as a holistic mind-set.</p> <p>Live today as if you care about the world’s future.</p>

Response:

Sustainable Development Governance

Xstrata’s commitment to sustainable development (SD) is one that is taken very seriously. It is governed by a complex, world-class framework stemming from our mission statement and corporate values and comprising business principles, Sustainable Development policy, Standards and Assurance program. This is overseen by a dedicated Board committee which takes a close and direct interest in matters arising from our operations across the world.

Figure 1-3 of the Draft EIS presents Xstrata’s Sustainable Development Policy.

The policy outlines company aims relating to health and safety, employees, the environment and communities. Such aims include:

- to operate a workplace that is injury and fatality free and to promote the wellbeing of employees and contractors;
- to maintain a workplace based on mutual respect, fairness and integrity;
- to preserve the long-term health, function and viability of the environment; and

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- to contribute to the social and economic development of the communities associated where Xstrata operates.

Xstrata's SD Framework has been mapped to international standards including the International Council on Mining and Metals framework, United Nations Global Compact Principles, Voluntary Principles on Security and Human Rights, ISO 14001 and OHSAS18001. In September 2011, Xstrata plc retained its position as Mining Sector Leader in the annual Dow Jones Sustainability Index review for the fifth consecutive year. The company was also again named as the Super Sector Leader for Basic Resources industries. The Dow Jones Sustainability Indices follow a best-in-class approach and include sustainability leaders from each industry on a global and regional level respectively. The annual review is based on a thorough analysis of corporate economic, environmental and social performance.

Past river diversion

Assessment and approval for the realignment of a 'tropical wild river' (McArthur River) has not been the focus of this EIS. The realignment was approved under the 2005/ 2006 EIS process. As stated in Section 1.1.1 of the Draft EIS, no major watercourses will be diverted as part of the expansion project pertaining to this Draft EIS. The Draft EIS is focused on the Proponent's management of the impacts associated with the Project.

With regards to concerns surrounding the rehabilitation of the final void, please refer responses to comments 12, 105, 123 and Appendix D in regards to the future works program.

Social benefits

MRM has placed heavy emphasis on understanding the needs and desires for current and future generations of residents of the Gulf region through its work with the MRM Community Benefits Trust. Since its establishment in 2007, the Trust and its officers have conducted extensive community consultation in order to identify a 20 year vision for the region and support the investments made by the Trust. This initial visioning program in 2007 revealed the desire for a 'thriving, healthy, vibrant region by 2027' which was then the estimated life of mine.

This vision has been reinforced annually since through ongoing liaison and consultation with community members. Within this planning, priorities were established in the areas of education, enterprise and job creation, health, social and community development, the environment and culture and art. Approximately \$7 million has been committed to grants since 2007.

In the earlier years, there was a heavy focus on job creation activities. It was partly due to the success of these programs that the Indigenous workforce participation rate at MRM grew from 9% to 24% over 4 years. To say that a high proportion of these employees are not local is incorrect. At least 75% of Indigenous employees live locally. Of the remaining who are FIFO, many originated from the Gulf region but due to social or housing issues outside of the mine's control, have opted to relocate to Darwin.

We continue to promote the development and recruitment of local personnel through the Trust's commitments to vocational education and training within the Borroloola School and our own trainee and apprenticeship programs.

There have also been a number of positive and high profile opportunities to promote the local culture of the four language groups present within the region. Support for artists engaged through the Waralungku Arts Centre to travel to London for an exhibition of their art and establish a website to support its commercial sale was provided through the Trust. A program operated by Barkly Regional Arts Inc through the 'Song People Sessions' has recorded the traditional songs of local women with a contemporary soundtrack which has been shared at Territory and national Indigenous arts events and is now the subject of a CD to be launched in June 2012. The group has performed to great acclaim and prominence at the Desert Harmony Festival in Tennant Creek, the National Indigenous Music Awards in Darwin, the National Indigenous Music, Sport, Entertainment and Community Awards in Sydney and the Melbourne Festival.

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Support has also been provided to Barni-Wardimantha Awara, a program to help action the Plan of Management developed in 2011 for the Yanyuwa country as an Indigenous Protected Area.

It also includes strategic land and sea management planning and the development of a business plan.

These initiatives follow other sponsored programs to support the documentation of local Indigenous language and stories.

These examples illustrate the extent to which MRM has facilitated opportunities to protect and maintain local culture to the benefit of all four local language groups while at the same time, promoted action to develop the community in line with needs and desires.

Economic benefits

Xstrata is dedicated to delivering a project that holistically considers social, environmental and economic factors. The Draft EIS demonstrates that the expansion of the MRM will assist in providing for the needs of the present and the future through significant benefits to the NT economy. Such benefits are predicted to increase the state and national industry outputs by \$8.4 billion and \$9.3 billion, respectively. The expansion will increase resource extraction by 50 percent, creating a secure market for MRM bulk concentrate and validating the continuation of current mine operations by 9 years.

The comment states that 'the cost of its [the Project's] activities on the natural ecosystem is not given.' The Draft EIS acknowledges that the economic evaluation of the Project's activities on the natural ecosystem is challenging. Despite this, the economic cost of the 706 hectares (ha) to be cleared by the Project has been assessed using two approaches. The first approach was a comparison between past studies. Bushbids is a market based instrument that offered \$59/ha to maintain highly valued remnant vegetation on private land in South Australia. The proximate environment to MRM is similar to that assessed by Bushbids and therefore \$59/ha was used to calculate the total economic value assigned to the 706ha to be cleared. This gave a total figure of \$41 654/annum.

The second approach places an economic value on the carbon sequestration benefits of the 706 ha; calculating an economic cost for carbon stored in current state and an annual sequestration value. \$4.9 million in total carbon currently stored in the soil is assumed to be lost upon clearing, whereas, \$48 714 is the value that encapsulates the cost of carbon sequestration of the 706 ha, over a 1 year period.

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3.7. Respondent: Environment Centre NT

Comment No.	EIS Section	EIS Discipline	Comment
71	General	General	<p>Our detailed comments are attached, however overall the Environment Centre NT finds that the Environmental Impact Statement (EIS):</p> <ul style="list-style-type: none"> • fails to consider prominent and significant project alternatives; • defers significant data provision and important design factors to future reviews of relevant management plans; • suffers from a paucity of contingency planning for key risks; and • fails to give due attention to significant issues raised in recent audit reports relating to extreme risks. <p>Accordingly the Environment Centre NT concludes that the EIS currently provides insufficient information for a fair analysis of the environmental risks posed by expansion.</p>

Response:

The proponent understands this to be an introductory and overarching comment and will defer much of the response to the specific comments provided below. However, in considering these responses, it is noted that many of the Environment Centre NT's comments relate to current operational issues which should and are dealt with under approval, audit and management frameworks other than the Project's Draft EIS. It is acknowledged that in some circumstances past and current operations and operational issues have implications for the Project, however many of the issues raised in audits and assessments are the subject of a current programme of assessment and consultation between the Proponent and its regulators. The Draft EIS has remained focussed on the proposed Project activities and has assessed these in the context of the existing approved operation.

A significant number of project alternatives have been considered over the life of the MRM and many iterations of concept designs were considered and assessed as the project proposals for the Project were developed. The EIS identifies relevant alternatives that were considered, however does not present a detailed assessment of all possible options and rather remains focussed on those that are viable at MRM. Further commentary on Project alternatives is provided in the response to Comment 73 below and throughout this SEIS. In addition, this SEIS seeks to provide further information on management contingencies associated with the Project.

The Proponent assures the Environment Centre NT that it, through consultation with its regulators, is paying due attention to any 'extreme risk' associated with the Project.

It is acknowledged that some project information is deferred to future detailed design of project components and therefore the future management requirements of those components. Due to the complex nature of the mining operation, significant engineering design is required. Such engineering designs are often time consuming and expensive and often require environmental approval prior to being commissioned. However, MRM has invested heavily in the planning, design and assessment of the Project to date and consider the level of detail provided to be sufficient. Where data and assessment of these proposals may be limited, MRM

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has identified this and committed to undertaking the required data collection and assessment work. In response to a number of comments throughout this SEIS, further work is committed to (Appendix D). It should be noted that some of these works require a significant amount of time to complete (potentially years) and therefore the data and management measures that will result, cannot be provided as part of this EIS.

Comment No.	EIS Section	EIS Discipline	Comment
72	General	Previous Impact Assessments	<p>The Environment Centre NT has had a close eye on McArthur River Mine since the initial assessment in 1992. So we recognise that Section 2.2.2 skips over some of the detail of the troubled process by which Xstrata eventually gained approval for the controversial proposal to convert from underground to open cut mining at McArthur River.</p> <p>We are told: <i>An EIS was lodged as part of the formal assessment process to the Northern Territory Government, based on the Guidelines issued in 2003. This was followed by the submission of an EIS Supplement (December 2005), Public Environmental Report (July 2006) and Mining Management Plan (MMP) (September 2006).</i></p> <p>This description leaps over the significant fact that the PER was prepared only because the initial EIA was unsuccessful. EIA specifically calls upon the proponent to provide this context.</p> <p>The Environment Centre NT considers it significant that the initial assessment rejection of the proposal is omitted from MRM's version of events.</p> <p>In February 2006, then Environment Minister Marion Scrymgour announced that the open cut plan would not be endorsed by her department: <i>"The proposal does not ... meet the test of sustainability - the EPA's assessment provides a compelling argument for caution. ... I have therefore advised Xstrata that their EIS did not convince me that the uncertainties associated with mine expansion could be managed."</i></p> <p>In leading to this recommendation, the Environmental Assessment Report (AR51, NRETAS) noted, alongside concerns regarding realignment of the river: <i>The potential environmental risk of mining operations and its components (including the tailings storage facility, the overburden emplacement facility and flood protection bund) posed by its location within the primary channel of a major tropical river. This includes the long term management of materials (sediments and contaminants), and their potential impact on ground and surface waters (and subsequent impact on local ecology) both during and post mining operations.</i></p>

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			<p>When, after reviewing a subsequent Public Environment Report, the Minister advised that the expansion could be approved, Environment Minister Marion Scrymgour nonetheless noted: <i>significant and long term risks of contaminants entering the river and ground water the proposed tailings facility would not be accepted in Queensland and Victoria</i>; and required: <i>the establishment of a mine-funded monitoring and regulatory agency</i>.</p> <p>A subsequent announcement by the new Mines Minister, Chris Natt, acknowledged that: <i>the appointment of an independent monitor was a condition of the project being approved</i>.</p> <p>The EIS also displays a lack of regard to the detailed recommendations and discussion of project risks aired in the annual reports of the audits conducted by the Independent Monitor. The Environment Centre NT recognises the instantiation of the Independent Monitor as a key component of the project gaining social license in the context of considerable controversy over the diversion of McArthur River. The EIS ignores key risks, recommendations and alternatives identified by the Independent Monitor. The Environment Centre NT is concerned that an approval that largely disregards this important source of guidance would undermine this important condition of the opencut approval.</p>
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Response:

The discussion of MRM's approval history provides information on the key approval milestones. The Proponent acknowledges that the EIS for the open pit operation was deemed to provide insufficient information on a number of aspects in 2006 and that a subsequent PER was required to provide sufficient information for approval.

The Proponent acknowledges that the Independent Monitor (IM) is an important source of guidance, and in consultation with its regulators and the IM is working to resolve issues associated with the current approved operations. As discussed in the response to comment 71 above, it is acknowledged that in some circumstances, past and current operations and operational issues have implications for the Project, and that many of the issues raised in audits and assessments are the subject of current program of assessment and consultation between the Proponent and its regulators. Furthermore key learnings from existing operations have been built into the assessment and design of the Project, for example the lining of TSF Cells 3 and 4.

Comment No.	EIS Section	EIS Discipline	Comment
73	Chapter 3	Alternatives Ignored	<p>The Draft fails to address these prominent project alternatives.</p> <ul style="list-style-type: none"> reprocessing cell 1 tailings (as recommended by EWL in 2006 (consultants commissioned by NRETAS to advise the EIA process of 2006), and more recently endorsed by the Independent Monitor in 2011)

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			<ul style="list-style-type: none"> • EWL's recommendation of considering other TSF sites (away from the high permeability alluvial soils of the floodplain) • EWL's recommendation of eventually returning the tailings to the old pit for closure; • re-building the TSF on an impermeable base • paddock dumping of PAF • storing excess water in underground workings • Golder's recommendation of using a limestone or calcium rich cover on the TSF to provide a source of alkalinity. (Golder Associates') <p><u>Hydrogeochemical</u></p> <ul style="list-style-type: none"> • dust stabilisation products and use of sprays to keep concentrate moist • returning tailings to the pit for closure <p>EWL's review of seepage (which was commissioned by NRETAS and included as an appendix to their Environmental Assessment Report 54, 2006) specifically noted that: <i>"While alternative tailings management strategies that would put tailings out of the flood zone, thus eliminating the main hazard to tailings containment were identified and discarded, these strategies should be kept in mind during the life of mining, and revisited in response to stakeholder consultation and environmental issues as they arise."</i></p> <p>The Environment Centre NT believes the recognition of biological impacts upon macroinvertebrate populations in Surprise Creek, and the extreme risk of acidification of tailings, are more than grounds enough for triggering the recommended revisitation of identified project alternatives. Xstrata should evaluate the options of reprocessing cell 1 tailings, re-siting tailings off the floodplain, and re-engineering an impervious base to the tailings facilities, with a focus on minimising seepage and maximising environmental protection. Further discussion on the TSF is provided in the section "Tailings Management".</p>
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Response:

The proponent has taken into consideration key recommendations of the Independent Monitor in planning for the future development of the TSF. MRM is intending to line the new water management dam (Cell 4) which is currently being developed as part of existing operations. This same dam will also support the proposed project. The design takes into consideration two key recommendations of the Independent Monitor: first to line the dam with a low permeability liner and second, to move the cells away from Surprise

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Creek. The low permeability liner - such as high-density polyethylene - is designed to minimise the potential for seepage. An underdrain system is also designed to capture any seepage through the low permeability layers. Both of these proposed components are new design features in response to issues identified in Cells 1 and 2.

The issues, recommendations and alternatives quoted largely relate to current operational issues which are being dealt with by the Proponent and its regulators. A program of ongoing and future investigations into key operational components such as seepage management, overburden management and tailings storage management is presented in Appendix D. Components of this program have been commenced with the remain components to be progressed in June 2012. MRM will continue to develop and assess contingencies for the future management of TSF Cell 1, including and not limited to reprocessing or relocating TSF Cell 1 tailings. TSF Cells 3 and 4 will be lined.

Also see responses to comments 9, 12, 36 and 75 to 86.

Comment No.	EIS Section	EIS Discipline	Comment
74	Management Plans	Parameters Deferred	<p>The EIS defers a number of important factors to reviews of management plans. The Environment Centre NT assumes the proponent plans to undertake these reviews after the EIS process is complete. Not only does this deny the assessment process the benefit of those reviews, which may well have bearing on environmental requirements, this attempt may also hide detail from public scrutiny. Despite policy announcements, and recent legislative amendments, that promise public access to relevant detail from Mining Management Plans, this reform has yet to become evident in practice.</p> <p>The TSF Management Plan tells us that <i>“a comprehensive review of the TSF will be conducted in 2012”</i>. This is indeed a welcome commitment, but in the light of the extreme risks identified by the Independent Monitor, and the biological impacts already noted due to seepage from cell 1, such a comprehensive review would have been welcome evidence for this assessment process. Fundamental detail such as further geochemical characterisation, reassessment of the cover design and investigation of seepage paths are each essential to an evaluation of the risks of this project, and should inform evaluation of all appropriate management alternatives. However by deferring this evidence and assessment to a private review, presumably after the EIA process, the assessment process is robbed of the opportunity to weigh the full risks and consider all available management options.</p> <p>Similarly, section 6.2 of the OEF management plan refers to ongoing geochemical assessment, to include species analysis of the elements in materials classed as Non Acid Forming. Once again, this is fundamental data that should be informing the assessment process, particularly given that less stringent management requirements are being set for NAF material. The Environment Centre NT recognises the potential for this ongoing investigation to</p>

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			<p>reveal grounds for reconsidering alternative designs and management practices for the overburden facilities.</p> <p>The Environment Centre considers these studies integral to the current assessment process and accordingly this information should be sought to be included in the Supplement.</p>
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Response:

The reviews and development of management plans will be subject to review and approval by MRM's regulators. These plans will also be appended to MRM's MMP which will be made public when submitted at the end of October 2012 in accordance with new legislative requirements. Information regarding the further works program is provided in Comment No. 73 and Appendix D. It should also be noted that detailed site investigations, associated laboratory analysis and modelling activities can take a significant amount of time to generate the information required (for example column leach tests which can take a number of years to generate meaningful long term results).

ECNT's interpretation of the basis for conducting further geochemical work on the NAF material is incorrect. Significant information and understanding on the geochemical properties and behaviour of the NAF material is held and has been a key component of operational studies. The works proposed aim to refine this understanding and data set, particularly in the context of the block model and field characterisation. The NAF storage designs and locations proposed as part of the Project are based on this understanding of NAF behaviour and the low risk of environmental impacts.

The Proponent has developed a comprehensive further works program for the site to be commenced in June 2012. Further information regarding these further works id provided in Appendix D.

Also see also responses to Comments 75 to 86.

Comment No.	EIS Section	EIS Discipline	Comment
75	9.9.3	Tailings Management	<p>A cursory glance of the latest (2011) report by Independent Monitor on the Environmental Performance of the mine illustrates considerable grounds for concern over tailings management.</p> <p>The audit notes (section 9.9.3) that: <i>the tailings deposited over the last five years will generate acid, [however] both TSF Cells have been designed on the basis that acidic leachate will not occur.</i></p> <p><i>Planning for the long term acidification of these tailings and mitigation of acidic seepage is likely to be the most significant issue for mine closure.</i></p> <p>The risk assessment from the 2011 Independent Monitor report was dominated by TSF matters.</p> <p>Both of the two extreme risks identified in the report relate directly to tailings management:</p> <ul style="list-style-type: none"> • <i>overtopping of TSF cells leading to an embankment failure; and</i>

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			<ul style="list-style-type: none"> • <i>for acid leachate migration from the TSF into Surprise Creek.</i> <p>Four of the high risks that were identified relate directly to tailings:</p> <ul style="list-style-type: none"> • TSF cell 1 embankment failure causing spillage into Surprise Creek; • failure of the TSF cell 2 embankment due to stability failure; • failure of TSF cell 2 embankment due to scouring at the toe of the embankment; • leachate containing salts and metals from TSF entering Surprise Creek and impacting flora and fauna; <p>The only assessed non-compliance was in relation to TSF:</p> <ul style="list-style-type: none"> • <i>“prior to capping the tailings, the post-mining tailings surface topography will be reformed to minimize erosion”.</i> • The cover was placed at 0.5 m thick, had not undergone reshaping, and was acting as a dust suppression measure only. Some erosion was observed. <p>and four of nine commitments noted as late or incomplete relate directly to TSF.</p>
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Response:

The Proponent is aware of the issues in relation to the tailings dam. As mentioned throughout the Draft EIS, and Appendix E1 – Tailings Storage Facility Management Plan, MRM has undertaken numerous mitigation strategies to minimise the potential impacts from the TSF, and will continue to monitor and manage the TSF throughout the life of the Project.

Current monitoring demonstrates that tailings water is not acidic. The artificial surface waters associated with the Tailings Storage Facility (TSF) (WMD, TDBP, TDSP, ID, ID2 and Cell 2) generally ranged between pH 6.5-8.5 for the last reporting period of 2010-2011. The WMD had a maximum of pH 9.0 recorded on 11/3/2011, with a couple of other results above 8.5.

The pH values of the artificial waters associated with the tailings storage area have generally been at the upper limit of the 6.5-8.5 range for the last 12 months – that is, alkaline, not acidic. The WMD has in particular reported several pH values above 8.5 with a maximum reading of pH 9 on 11/3/2011. The Interceptor Drain, Interceptor Drain 2, TDSP and TDBP also had a small number of readings above pH 8.5 including pH 9.16 in the TDBP on 22/09/10. Cell 2 had stable results well within the desired range. No clear trends have been identified from the data for this group. The pH values recorded in the TSF have shown that the tailings has a high degree of material that is non-acid forming.

There is no acid drainage occurring now. The Independent Monitor has raised this as a potential future risk. MRM has been working with the Independent Monitor to investigate this potential issue, as it is a complex question that needs detailed analysis of the chemical composition of the soils and ground conditions as well as the composition of the tailings deposited. MRM has commissioned a specialist report to analyse this risk.

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This work was done with the input of the Independent Monitor. The detailed analysis came to a different conclusion to that suggested by the Independent Monitor, and MRM will be engaging another specialist to conduct an additional review and gain further advice.

Safety audits are conducted by a specialist consultant annually and have verified the TSF embankment integrity. The height of the embankment was designed to store a 1 in 200 year, 2-month duration event, based on national guidelines for large dams. The crest of the dams are above the 1 in 500 year level with batter armouring for erosion protection also designed to the 1 in 500 year flood level. Emergency spillways have also been developed for additional protection. The last Independent Monitor's assessment was based on a site visit in May 2011 after MRM had experienced almost double the average amount of rainfall in a normal wet season. These water flows were well accommodated within the tailings storage facility design. Since then MRM have recycled between 80 and 95% of the water through the processing facilities and also used evaporation to reduce water levels.

Advances in technology and mine closure techniques will be monitored throughout the life of the Project so that the most relevant and appropriate closure strategy will be adopted. Cell 3 and Cell 4 will also be lined to minimise impacts from the TSF. MRM is committed to the consideration and development of contingencies to minimise impacts from the TSF, as provided throughout this SEIS.

Many of the Environment Centre NT's comments relate to current operational issues which should and are dealt with under approval, audit and management frameworks other than the Project's Draft EIS. It is acknowledged that in some circumstances past and current operations and operational issues have implications for the Project, however many of the issues raised in audits and assessments are the subject of a current program of assessment and consultation between the Proponent and its regulators.

Further assessment to refine MRM's understanding of TSF behaviour and management have been scoped and will commence in June 2012. Information regarding further assessment work is provided in Appendix D.

Comment No.	EIS Section	EIS Discipline	Comment
76	13.3.3.2	Tailings Management	Section 13.3.3.2 of the EIS reports that biological impacts are already occurring as a result of the seepage of neutral drainage from the TSF. Macroinvertebrate monitoring shows: <i>"negative impacts on aquatic biota associated with elevated levels of metals, sulphate and other water chemistry parameters within Surprise and Barney Creeks."</i>

Response:

During the 2010 sampling period, 57 taxa (family level or higher order) were recorded in edge habitat samples. Elevated levels of some surface water parameters, including sulphate and electrical conductivity, were recorded at exposed sites on Surprise Creek (below the TSF), Barney Creek diversion and the McArthur River below the Barney Creek diversion outlet. Elevated levels of some fluvial sediment metals, particularly zinc, were also recorded at these sites, however some off-stream reference sites (Glyde River and Carinbirini Creek) also recorded elevated fluvial sediment zinc levels.

Analysis suggests that the six most important surface water/fluvial sediment variables influencing the distribution of the edge habitat macroinvertebrate data are fluvial sediment cadmium (correlated with other fluvial sediment metals), pH, dissolved oxygen (field), and surface water copper, sulphate and zinc. These results are indicative of the range of variation in conditions in some of the sites and tributaries sampled, and also levels of metals at some sites from mine activities and natural mineralisation.

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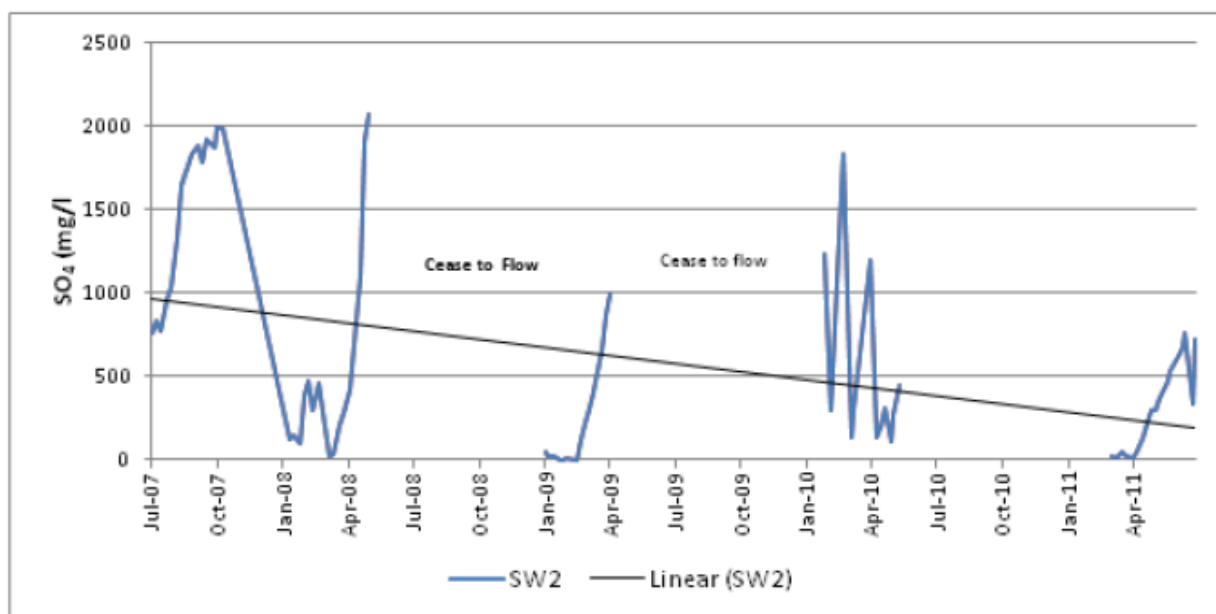
Analysis indicates that exposed sites on Barney Creek, Surprise Creek and on the McArthur River below the Barney Creek outlet are separated from reference sites based on macroinvertebrate communities, with the most influential variables being sulphate and electrical conductivity. This data indicates a level of impairment associated with water quality issues at these sites from mine related sources.

Riffle habitat samples are likely to show similar results for macroinvertebrates as for the previous sampling, with similar riffle invertebrates present in McArthur River Channel and reference sites, and some level of impairment of riffle macroinvertebrate communities at exposed sites on Surprise Creek/Barney Creek.

Edge habitats within diversion sites display similar conditions to those previously monitored, with edge habitat consisting of rocky banks with high levels of sediment and little organic material and no riparian vegetation. Important edge habitat variables include % root mats (edge) and 100 m reach % cover of trees >10 m.

However, recent monitoring results (2010-2011) have shown that the percentage of SO₄ exceedances at site SW2 (downstream of the TSF on Surprise creek) has reduced when compared to the previous reporting period, where 100% of recorded levels exceeded the interim site specific trigger value. This is supported by analysis of long term SO₄ trends in Surprise Creek downstream of the TSF (SW2) which showed reduced concentrations over the current reporting period when compared with data since 2007.

Sulphate Concentrations Recorded at SW2 from 2007-2011



During the 2010-2011 period, arsenic, cadmium, copper, lead and zinc concentrations all remained well below the applicable guidelines in Surprise Creek. A summary of results for major metals and metalloids results for Surprise Creek collected during 2010-2011 flow period is as follows:

- Arsenic concentrations (filtered) ranged between 0.2 and 2.0 $\mu\text{g/L}$ ($\mu=0.62 \mu\text{g/L}$; $n=69$). The median value for As concentration measured 0.62 $\mu\text{g/L}$ (ANZECC guideline 2000a, 95% level of protection=13 $\mu\text{g/L}$);
- Copper concentrations (filtered) ranged between 0.06 and 1.22 $\mu\text{g/L}$ ($\mu=0.30 \mu\text{g/L}$; $n=69$). The median value for Cu concentration measured 0.24 $\mu\text{g/L}$ (HMTV=4.07 $\mu\text{g/L}$ (filtered));
- Cadmium concentrations (filtered) ranged between 0.02 and 0.20 $\mu\text{g/L}$ ($\mu=0.08 \mu\text{g/L}$; $n=69$). The median value for Cd concentration measured 0.2 $\mu\text{g/L}$ (HMTV=0.61 $\mu\text{g/L}$ filtered);

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- Zinc concentrations (filtered) ranged between 0.1 and 13.8 $\mu\text{g/L}$ ($\mu = 2.38 \mu\text{g/L}$; $n=69$). The median value for Zn concentration measured 1.1 $\mu\text{g/L}$ (HMTV=23.28 $\mu\text{g/L}$ filtered); and
- Lead concentrations (filtered) ranged between 0.01 and 1.2 $\mu\text{g/L}$ ($\mu = 0.2 \mu\text{g/L}$; $n=69$). The median value for Pb concentration measured 0.1 $\mu\text{g/L}$ (HMTV=16.77 $\mu\text{g/L}$ filtered).

Comment No.	EIS Section	EIS Discipline	Comment
77	Appendix E1	Tailings Management	<p>This assessment was supported by EWL's 'Review of seepage issues related to the Tailings Storage Facility' (2006), which warned that: <i>"Seepage from the existing TSF has been much greater than expected, with seepage of contaminated waters to Surprise Creek observed in June 1997."</i></p> <p><i>Seepage will be an ongoing (major) issue for assessment ... during mine operations, and will rely heavily on appropriate data being made available.</i></p> <p>And as already discussed above, the Environment Minister's eventual recommendation to approve the open cut proposal was qualified with acknowledgement of the shortcomings of TSF design, and the risks posed to the environment by those tailings.</p>

Response:

As mentioned throughout the EIS (including Appendix E1 – Tailings Storage Facility Management Plan), the aspects relating to the performance and monitoring of the TSF will occur throughout the mine life to minimise the risks during operations and closure. MRM are aware of the potential risks of the TSF and has spent millions of dollars to mitigate the potential impacts. Monitoring and management measures will be continued throughout the mine life.

As mentioned throughout this SEIS, Cell 3 and Cell 4 will also be lined to minimise impacts from the TSF. MRM is committed to the consideration and development of contingencies to minimise impacts from the TSF, based on data that has been collated on site.

Also refer to response to Comment 75.

Further assessment to refine MRM's understanding of TSF behaviour and management have been scoped and will commence in June 2012. Information regarding further assessment work is provided in Appendix D.

Comment No.	EIS Section	EIS Discipline	Comment
78	General	Tailings Management	<p>Perhaps it should not surprise us that tailings management has become such a challenge. Certainly, the original EIS process of the proposed opencut proposal produced an Environmental Assessment Report by the EPA program (AR51 – which concluded that the proposal not proceed) that identified: <i>concern about the operation of the tailings storage facility and its potential to impact on the receiving environment due to seepage.</i></p>

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			And noted concerns that: <i>the proponent is unable to prevent seepage in the first instance and that the imperative is to recover groundwater that is potentially contaminated thus adding to the inventory of water in the water management system and potentially impacting on a wider area with respect to the drawdown cones of the bore network. This begs the question of the suitability of the site for location of a tailings facility.</i>
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Response:

See response to Comment 77. It is not feasible to relocate the entire TSF to another area as Mineral Lease, flooding, and soil conditions restrict the availability of an alternative site.

MRM considered relocating the TSF as part of the Phase 2 operations, and as part of the risk assessment for the Project. However, all alternative sites within the region have similar soils and therefore provide no benefit in terms of seepage control. The current site was found to offer the best environmental performance based on technical performance, seepage control and lowest long-term risks.

MRM is committed to the consideration and development of contingencies to minimise impacts from the TSF, based on data that has already been collated on site.

Further assessment to refine MRM's understanding of TSF behaviour and management have been scoped and will commence in June 2012. Information regarding further assessment work is provided in Appendix D.

Comment No.	EIS Section	EIS Discipline	Comment
79	Appendix E1	Tailings Management	But since then, our appreciation of the magnitude and nature of the risk has developed further. The latest Independent Monitor audit tells us that: <i>the sulfide minerals in the tailings dam are in excess of the buffering capacity of the tailings carbonate minerals. When the buffering capacity is exceeded, acidity will be generated and heavy metal concentrations in leachate will increase more than 100 times. The acidity together with high concentrations of heavy metals will have a significant adverse impact on Surprise Creek.</i>

Response:

This issue is currently being reviewed to determine the potential likelihood of this occurring. Management and mitigation measures to address potential acidity and leachate issues will be implemented if required. The Proponent is committed to the development and consideration of contingencies, including but not limited to the reprocessing and relocation of TSF Cell 1 tailings material.

See also response to Comment 75 regarding the existing monitoring of tailings behaviour.

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Comment No.	EIS Section	EIS Discipline	Comment
80	Appendix E1	Tailings Management	We are warned that it is likely the same issue would arise with cell 2, and that available data is: <i>insufficient to predict the timing and quantity of acidification in the tailings as well as the rate of discharge to Surprise Creek.</i>

Response:

See response to Comment 75 regarding the existing monitoring of tailings.

Based on the historic performance of TSF Cell 1, a revised TSF design concept was developed as part of the environmental impact assessment process for the conversion of MRM from an underground to an open-cut pit mine (Phase 2 Project) to improve the overall performance of the TSF, particularly with respect to seepage, and this was implemented for Cell 2.

The location and design objectives of future TSF cells were developed with the following objectives:

- improved tailings placement techniques – the previous TSF cell (Cell 1) deposited tailings using a central thickened discharge with water collected adjacent to the perimeter embankments and diverted to water storage dams within the non-active deposition area of the TSF. Given the historic seepage from Cell 1, the tailings placement strategy has been changed to a perimeter spigoted discharge with a central decant pond to keep water away from the perimeter embankments and hence reduce the potential for seepage.
- provide stable landform – the Cell 2 perimeter embankments were designed in accordance with the requirements of the Australian National Committee of Large Dam Guidelines to ensure that adequate factors of safety were provided across the landform both during the various stages of TSF development during mine operations and post mining after closure of the TSF. The design considered the geotechnical and seismic stability of the embankment materials as well as the surface stability and erosion resistance of the outer slopes to both rainfall and potential flood events.
- no excessive or uncontrolled emissions to the environment – based on the observed performance of Cell 1, additional design measures were developed for the future TSF cells to ensure that no excessive or uncontrolled emissions to the environment arise from the TSF. The emissions of particular concern relate to dust, erosion of embankment slopes, surface runoff, and seepage.
- minimise the area of the disturbance footprint – preliminary site layout studies considered the potential to relocate the TSF. The footprint of the existing TSF was already approved by the Northern Territory Government for tailings disposal and had sufficient capacity to accommodate the expansion required for the Phase 2 Project. Furthermore, given the consistent subsurface conditions across the site, there was no significant benefit in disturbing additional areas at the site as no significantly improved subsurface conditions are available.
- storage efficiency – the perimeter spigoted tailings discharge system requires higher perimeter embankments than the existing central thickened discharge system. Therefore a staged embankment arrangement was developed incorporating upstream lifting techniques to reduce the materials and resources required to construct the perimeter embankments of the expanded TSF.

These measures will minimise the issues that have occurred with Cell 1. Monitoring will provide feedback on the effectiveness of these control measures.

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As mentioned throughout this SEIS, Cell 3 and Cell 4 will be lined to minimise impacts from the TSF. MRM is committed to the consideration and development of contingencies to minimise impacts from the TSF, based on data that has already been collated on site. Alternatives may include, but are not limited to the relocation of Cell 1.

Also see response to Comment 9.

Comment No.	EIS Section	EIS Discipline	Comment
81	Appendix E1	Tailings Management	The Environment Centre NT is concerned that the issue of tailings seepage, and the imminent acidification of cell 1, is not being given the attention this extreme risk deserves. In personal communications with Xstrata representatives, we were alarmed to hear that the company 'has a different view' to the warnings of the Independent Monitor. Intimately aware of the Independent Monitor's integral relationship to the opencut approval, we are unimpressed to realise that the miner feels free to simply shrug off identified extreme risks as a difference of opinion.

Response:

See response to Comment 75 and 80.

MRM undergoes a regular risk assessment process for the operation and is aware of the potential TSF risks. This risk assessment drives a continuous improvement process, which requires the generation of solid scientific data so that informed decisions can be made in regards to the management of environmental issues on site.

MRM takes all risks associated with the Project seriously.

The data generated throughout the life of the Project is used to refine management measures, such as the change in tailings strategies for Cell 2 based on the lessons learnt for Cell 1 (see Comment response 80).

As mentioned in the EIS, the potential issue of Cell 1 acidification is currently being reviewed and investigated.

Comment No.	EIS Section	EIS Discipline	Comment
82	Appendix E1	Tailings Management	We firmly recommend that either a new site for tailings facilities be established, constructed with an impervious base, away from the alluvial soils of the floodplain

Response:

As mentioned in the response to Comment 77, the current site was found to offer the best environmental performance based on technical performance, seepage control and lowest long-term risks.

See also responses to Comments 75 and 80.

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Comment No.	EIS Section	EIS Discipline	Comment
83	Appendix E1	Tailings Management	or, alternatively, that the tailings in cell 1 be reprocessed, and all cells re-constructed with an impervious base.

Response:

The proponent will continue to develop and assess contingencies for the future management of TSF Cell 1, including and not limited to reprocessing or relocating TSF Cell 1 tailings.

See responses to Comments 75 and 80.

Comment No.	EIS Section	EIS Discipline	Comment
84	Appendix E1	Tailings Management	The Environment Centre NT is skeptical of the apparent plan to address seepage issues from the current infrastructure with cut-off trenches and interception bores. By pumping increasing volumes of contaminated seepage back into the TSF, the miner may not only risk deterioration of seepage quality, but may also hasten the likely acidification of the tailings, inducing a tipping point past which heavy metal loads in the seepage will increase 100 fold.

Response:

See response to Comments 75, 77 and 80. Monitoring data provides feedback on the performance of the recovery bore system which feeds into design reviews.

Comment No.	EIS Section	EIS Discipline	Comment
85	General	Tailings Management	The proponent should discuss alternatives and contingencies to manage this risk, including water treatment to allow greater flexibility in the system.

Response:

As part of the continuous improvement process, strategies, alternatives and contingencies are regularly reviewed facilitate greater flexibility and effectiveness of seepage management. As mentioned in the response to Comment 80, Cell 2 was designed and operates differently to that of Cell 1 to minimise potential seepage impacts.

Monitoring data provides information on the effectiveness of such controls and this feedback is regularly incorporated into reviews of TSF performance. This will be continued throughout the life of the Project.

The Proponent is committed to the consideration and development of contingencies to minimise impacts from the TSF, based on data that has already been collated on site.

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Comment No.	EIS Section	EIS Discipline	Comment
86	Appendix E1	Tailings Management	The Environment Centre NT recommends that the proponent should take this opportunity to reconsider the project alternative of depositing tailings back in the pit for closure. It is noted that the draft lists a number of alternatives for the void on closure, bar this one. We are concerned that the reliance on ongoing seepage recovery bores after rehabilitation is a measure of an unsustainable design. We expect that returning tailings to the open cut would lead to better environmental performance.

Response:

It is not practical to deposit tailings back into the pit for closure from the TSF as this is not economically feasible, and has not been a practice that has been commonly used in hard rock mining. The pit will be an active mining area up until the point of closure, after which additional ore will still be required to be processed. Also refer to the response to comment 104.

In-pit tailings disposal can also have inherent risks. The Western Australian HG-9 Guideline, titled 'Mine Void Water Resource Issues in Western Australia', states there are potential environmental problems involved with in-pit tailings storage which include:

- reduction of the material strength in the void wall
- integrity and strength of the tailings material
- possible contamination of groundwater
- rehabilitation difficulties as a result of the influx of hypersaline groundwater.

Also refer to the response to comment 12.

As mentioned in previous comments, Cell 3 and Cell 4 will have additional environmental management controls to accommodate the Project tailings. Contingencies and alternatives will also be investigated for the TSF.

Also refer to comment 104.

Comment No.	EIS Section	EIS Discipline	Comment
87	10.7	Groundwater	The EIS states that " <i>Groundwater monitoring and management plans currently in place will be amended</i> " however the public has no detail. The Independent Monitor identifies doubts about the utility of some existing monitoring bores (MW1, GW47B, GW47C) and recommends that bores used by the Golder Associates review should be incorporated into Xstrata's ongoing groundwater monitoring. No such detail is provided to describe how the groundwater monitoring program will be improved, or adapted to account for expansion of tailings storage.

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Response:

MW1 is a reference (background) bore that was drilled hydraulically up gradient to the TSF by Golder Associates for their 2011 Hydrogeochemical Investigation. This bore is included in the MRM Groundwater Monitoring Program using the identifier GWTSF01.

The Sustainable Development Water Management Plan is prepared and submitted annually which summarises the monitoring undertaken, including monitoring frequencies and results.

Comment No.	EIS Section	EIS Discipline	Comment
88	Chapter 10	Groundwater	While the URS Groundwater Technical Report (Appendix D4) presents a whole 6 years of observed head measurements as the basis for drawdown modeling, no water quality trend data is provided for discussion of the current regime and what it may already tells us about seepage and contaminant loads.

Response:

Groundwater Monitoring Program

A groundwater management program has been developed at MRM to assess potential impacts of the operation on local groundwater since the commencement of operations.

The objectives of the management program are to:

- Monitor the impacts of groundwater abstraction;
- Determine the extent of any contaminants in shallow aquifers;
- Assess the effectiveness of TSF seepage control systems; and
- Assess potential impact of the establishment of the Northern Overburden Emplacement Facility (NOEF).

Monitoring reports are submitted annually to the Northern Territory Government.

Water Quality Trend Data

Water quality trend data is presented for groundwater and surface water in the Xstrata report "Sustainable Development Water Management Plan 2011-2012", Section 6.3. In that report, data from 2007-2011 (and in some instances, from 2010-2011) is graphically presented. The plots include bores in the mine process area (GW15, GW16, GW3A, GW5A), the NOEF area (GW64D, GW64S, GW65D, GW65S), the TSF area , GW6, GW7, GW14, GW4, GW18, GW19, GW12A, GW20A, GW20B, GW43A, GW43B, GW21, GW22, GW23, GW42B, GW45B, GW48, GW42A) as well as the Bing Bong Port Facility bores. Samples were tested for pH, electrical conductivity, Total Dissolved Solids, Sulphate, and metals and metalloids including Arsenic, Copper, Cadmium, Zinc and Lead. Total Petroleum Hydrocarbons were monitored bi-annually at particular committed bores and this data is also presented.

A summary of this data is included in the responses to comments 23 to 26 of this SEIS. Groundwater monitoring locations are shown graphically in the response to Comment 105. Other groundwater monitoring data is shown in the response to Comment 109.

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Comment No.	EIS Section	EIS Discipline	Comment
89	Chapter 10	Groundwater	Apparently DOR have access to this data through a management plan – however the public are not given the benefit of being able to consider how groundwater monitoring could be improved, (through additional bores, continuous level monitoring and a more rigorous schedule) to best address the additional risk this expansion poses to groundwater values.

Response:

See response to Comment 88. The Mining Management Plan will be made public when submitted at the end of October 2012 in accordance with new legislative requirements.

Improvement of Monitoring Program

The proposed updated monitoring program is outlined in the amended Table 10-7 from the Draft EIS below, including the rationale for a range of proposed new monitoring bores identified as part of ongoing reviews. They are shown graphically in Appendix J. The monitoring program will be further updated as required following reviews by an independent consultant. There are 13 proposed new monitoring bore locations, nominally located where they would not interfere with mine operations. The locations of these bores will be subject to a ground-truthing exercise and may be subject to change if a more suitable location is identified.

The bores, once confirmed, would provide permanent monitoring points to fill identified gaps and also provide some baseline data prior to planned OEF expansion areas. Some minor on-site adjustment of the nominal locations identified may be required. These proposed bores will be reviewed and investigated on site, subject to further studies to warrant the effectiveness of these locations. This review process has commenced.

The naming convention utilised to identify the new bores in the table below is for the purposes of this SEIS. The names of each of the new bores will be refined in accordance with site specific conventions and will be determined by MRM site personnel.

Amended version of Table 10-7 (EIS, Chapter 10), incorporating additional monitoring locations

Site	Number of sites	Frequency	Parameters	Rationale for proposed updates (including new well installations)
Mine Process Area				
Process area	GW3A, GW5A, GW15, GW16. GW35, GW37 proposed to be monitored until mined out.	Every 2 months	Every two months <ul style="list-style-type: none"> • Standing water level • pH, EC • TDS • Filtered metals (As, Cd, Cu, Pb, Zn) • SO4 • Hardness Every 6 months, additionally: <ul style="list-style-type: none"> • Multi-element ICP-MS scan 	GW3A, GW5A, GW15, GW16 are already included in network

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Site	Number of sites	Frequency	Parameters	Rationale for proposed updates (including new well installations)
			(inc.Hg) <ul style="list-style-type: none"> TPH sites: GW3A, GW5, GW15. 	
West OEF	Proposed new wells: GW84		As above	Although groundwater flow is generally to the East, radial seepage from the West OEF is possible (due to the height of the OEF). Propose a monitoring well (GW84) be installed between the outside perimeter to the north of the West OEF and Barney Creek (to monitor the water quality impact from West OEF
North OEF	GW64S, GW64D, GW65S, GW65D Proposed new wells: GW85, GW86	As above	As above	<p>GW64S, GW64D, GW65S, GW65D are already included in network.</p> <p>To detect potential contaminated seepage from the North OEF in the direction of groundwater flow towards the surface water receptors (e.g. Barney Creek, Surprise Creek, Emu Creek), propose a new monitoring bore (GW85) be installed near the perimeter of proposed Dam East.</p> <p>To provide baseline data prior to planned OEF expansion and also to eventually monitor radial seepage from the expansion, propose a new monitoring bore (GW86) between the proposed Dam North and the proposed diversion channel.</p> <p>GW85 to be constructed and monitored as soon as practically possible while GW86 should be constructed and monitoring commenced at least two years prior to development of the North OEF expansion</p>
South OEF	Proposed new wells: GW87	As above	As above	Proposing a new bore (GW87) between the proposed South OEF and the McArthur River channel to monitor effects of dewatering on groundwater levels and gradients near the river, and eventually to provide evidence of the long term pit void character as a groundwater sink (as predicted), as well as to monitor the impact of OEF. The well to be installed prior to 2013 (considering South OEF emplacement will start prior to 2015)
East OEF	Proposed new wells: GW88, GW89, GW90, GW91	As above	As above	<p>Proposing four bores be installed near the East OEF:</p> <ul style="list-style-type: none"> GW88 is sited on the mine boundary (provided long term access will be available) and between the boundary and the OEF to provide data to confirm the final mine void character as a groundwater sink, and any influence of the OEF on gradients between the river

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Site	Number of sites	Frequency	Parameters	Rationale for proposed updates (including new well installations)
				<p>and the mine/void.</p> <ul style="list-style-type: none"> GW89 and GW90 are sited between the outside perimeter of the proposed expanded OEF and the diverted river channel. GW91 is sited on the northern side of the OEF and immediately south of the Barney Creek channel. <p>These bores will be used to monitor gradients and/or seepage towards or from the diversion channel, and to validate analysis and modelling of the final void character (predicted to be a long term sink). The well to be installed prior to 2013 (considering East OEF emplacement will start prior to 2015)</p>
TSF	<p>General note applying to subsequent Table entries: For all proposed new TSF sites, 2-monthly monitoring is sufficient. If a rise in the water table is detected during routine monitoring that could potentially drive flow towards the creek and provide a pathway for possible contamination, then monitoring will be increased in frequency and consideration given to undertaken airborne EM surveys to map any areal spread.</p> <p>Surprise Creek is a known natural discharge zone for shallow groundwater during the wet season, and for this reason a 2-monthly wet season monitoring frequency is proposed for TSF bores. If a seepage plume or rising contamination concentration trend is detected by any of the TSF bores, it may be necessary to install additional monitoring bores, particularly between the affected site and the potential contamination receptor (e.g. Barney Creek or Surprise creek, depending on the direction of plume migration). The need for other additional bores should be continually re-assessed.</p> <p>The following table entries provide details on the TSF monitoring network, grouped per Cell of the TSF.</p>			
Cell 1 Group C1-	GWTSF01 (Golder bore MW1) GWTSF02 (Golder bore MW2) GWTSF03 (Golder bore MW3) GWTSF04 (Golder bore MW4) GWTSF05 (Golder bore MW5)	See note (monthly to 2-monthly)	Every two months <ul style="list-style-type: none"> Standing water level pH, EC TDS Filtered metals (As, Cd, Cu, Pb, Zn) SO4 Hardness Every 6 months, additionally: <ul style="list-style-type: none"> Multi-element ICP-MS scan (inc.Hg) 	Comparison of the drilled depths for the 'GWTSF' series bores with the 'MW' series bores confirmed that these ID's correspond to the same bores.
Cell 1 Group C1-N	GW42A, GW45B, GW48B GW47B, GW47C	See note (monthly to 2-monthly)	As above	GW42A, GW45B, GW48B are already included in network. GW47B and GW47C were recommended by the Independent Monitor, and are proposed to be installed
Cell 1 Group C1-NE	GW21, GW22, GW23, BH8 (Golder bore)	See note (monthly to 2-monthly)	As above	Already included in network.

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Site	Number of sites	Frequency	Parameters	Rationale for proposed updates (including new well installations)
		monthly)		
Cell 1 Group C1-E	GW43A, GW43B, GW42B	See note (monthly to 2-monthly)	As above	Already included in network.
Cell 1 Group C1-SE	GW12, GW20A, GW20B	See note (monthly to 2-monthly)	As above	Already included in network.
Cell 2	GW18, GW19 Proposed new wells: GW92D	See note (monthly to 2-monthly)	As above	GW18 and GW19 are already included in network. Review of the EM mapping investigation (URS, 2011) highlighted an area of high vertical dipole to the east of Cell 2 which indicates that this area may be prone to increased levels of contamination. It is proposed that a deep bore (GW92D) be installed down gradient from bores GW18 and GW19, drilled to the weathered rock (e.g. 50 m) to allow for monitoring of potential deep seepage from the tailings to the deeper aquifer. Construction of this bore will occur promptly.
Proposed Cell 4	Proposed new wells: GW93	See note (monthly to 2-monthly)	As above	The proposed expansion of the TSF comprises the development of Cell 4 on the north-western side of the existing facility, to be operational from 2032. Proposing a monitoring bore (GW93) be installed on the North Eastern perimeter of the proposed expansion to provide baseline data prior to OEF expansion and to eventually monitor potential seepage to Surprise Creek. Construction of this additional bore is not necessary until prior to commencement of Cell 4 development.
Water Management Dam perimeter	GW4, GW6, GW7, GW14	See note (monthly to 2-monthly)	As above Bi-annually TPH sampling from GW4 and GW14.	Already included in network. GW4 and GW14 will be monitored for TPH as they are located close to the waste dump facility which receives TPH contaminated waste soil from the mine processing area
Bing Bong				
Bing Bong	GWBB01A, GWBB01B, GWBB002, GWBB03A, GWBB03B, GWBB04A, GWBB04B	Every 2 nd month	As above	Already included in network.
Mimex bore field				
Djirrinmini water hole	GW66, GW70, GW71, GW72, GW73, GW74, GW75, GW76, GW77, MAC 4 and MAC5. Proposed new wells: GW94S, GW94D	Water quality every 2 nd month. Water level every month.	As above	All these bores are included in the Sustainable Development Water Management Plan (Xstrata 2011). However was not included in the EIS. These are recommended as being included in MRM Groundwater Monitoring Program. MAC4 and MAC5 are bores that were drilled by URS for their 2005 study and will be useful for monitoring groundwater effects near the Djirrinmini waterhole. The documentation

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Site	Number of sites	Frequency	Parameters	Rationale for proposed updates (including new well installations)
				<p>was reviewed and no other water holes could be identified in the area of potential impact and thus our recommendations are based only on the knowledge of Djirrinmini water hole. A lowering of water table associated with groundwater abstraction from the Mimex production bores as well as mine dewatering may have implications for the nearby Djirrinmini waterhole. To effectively monitor the impact on groundwater due to abstraction from the Mimex potable production bores, we recommend two monitoring bores (shallow and deep) be installed close to the Djirrinmini waterhole (GW94S and GW94D) is proposed to be constructed and incorporated into the monitoring program .</p> <p>Construction and commencement of monitoring will be completed as soon as is practically possible.</p>
Mimex production bores	Proposed new wells : GW95	<p>Water quality every 2nd month.</p> <p>Water level every month.</p>	As above	<p>Proposing a monitoring bore (GW95) within the group of existing potable production bores to monitor water quality and determine magnitude of drawdown in the groundwater (i.e. aquifer response to pumping stress rather than pumping bore dynamics). Construction and commencement of monitoring to be completed as soon as is practically possible.</p>

Unless otherwise stated (notably bore GW92D , GW94D, GW95 and GW88 near the TSF), the additional bores outlined in the above will be drilled to a shallow depth, as contaminants are likely to be detected at shallow depths and drawdown is unlikely to occur to deeper aquifers. All additional drilled bores will be included in MMP. The frequency and parameters for testing proposed is considered appropriate, however future analysis including re-calibrated model predictions may indicate different monitoring imperatives and thus the monitoring regime may need to be re-assessed.

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Comment No.	EIS Section	EIS Discipline	Comment
90	Chapter 11	Dust and Contamination	<p>The Environment Centre NT welcomes Xstrata's commitment to a wet scrubber extraction system in the concentrate shed. However the EIS fails to adequately explore the issue of contamination at Bing Bong. We are concerned that there is insufficient monitoring data to judge the scale of risk posed by dust at Bing Bong. The EIS includes no trend data, and the Environment Centre NT is concerned that more than doubling the volume through the port will present a corresponding increase in risk. We find no basis for evaluating the adequacy of existing and proposed management actions, either at Bing Bong or the mine.</p> <p>Recommendations from the Simtars review (2010) – including the use of dust suppression products, and the use of sprays to continually keep the concentrate moist – are not explored in the EIS. The supplement should describe why these alternatives have not been adopted.</p> <p>The Environment Centre NT agrees with the Independent Monitor's recommendation that the proponent: <i>regularly undertake a similar dust audit to assess the effectiveness of mitigation measures.</i></p>

Response:

The depositional dust monitoring program has been ongoing for 7 years and provides a substantial dataset for understanding dust and contamination levels within the Bing Bong area. MRM installed an additional site on the western beach of the swing basin (BBD06, see figure below) in 2011 as recommended in the Independent Monitor Report (Appendix K). Dust monitoring sites at Bing Bong are strategically placed to ensure that fugitive dust transported mainly by prevailing south easterly winds in the dry season, are captured for analysis.

Historical data of Bing Bong dust and contaminant concentrations can be found displayed in graphs for each corresponding monitoring location in Appendix L. Data has been trended in the graphs to display a linear representation and outline concentrations over time so that an evaluation of environmental risk can be achieved.

Further works are also planned to repair roofing and side sheeting for the shed as necessary; and

Mini Vol® portable air samplers will be routinely placed around the site as a component of the dust monitoring program currently under revision.

The Simtars (2010) were commissioned to conduct a review of atmospheric and health issues at MRM. The report recommends numerous control considerations for Bing Bong in regards to controlling dust. However, it is important to note that this review is in relation to occupational health but still provides valuable information in regards to the cause of fugitive dust and mitigation measures.

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Dust Monitoring Sites at Bing Bong



MRM are have implemented numerous fugitive dust mitigation measures such as:

- Sprinkler systems around the concentrate shed;
- Restricting loading to appropriate conditions;
- Covered conveyors; and
- Maintaining appropriate moisture content.

The proponent will collate dust monitoring data in order to assess the effectiveness of dust management practices on an annual basis within the SDMMMP.

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Comment No.	EIS Section	EIS Discipline	Comment
91	Chapter 11	Dust and Contamination	No evidence of soil monitoring on site or at Bing Bong is provided, to illustrate current contaminant loads, adequacy of site specific criteria and any emerging trends, and no background data is presented for either soils or fluvial sediment to inform closure planning. There is therefore no basis for evaluating the risk, or subsequently testing the adequacy of dust management actions. The EIS doesn't even provide an adequate description of the basic parameters (such as the number and location of monitoring sites, and relevant focus and trigger levels) of the soil contamination monitoring regime. Back at the mine, there is no discussion about how dust management and soil contamination objectives may be impacted by moving the ROM pad and crusher.

Response:

The soil monitoring program at the mine site and Bing Bong aims to provide a health and environmental risk assessment of soil strata to which humans and other receptors could feasibly be exposed. The objectives of the program are to:

- assist in identifying any potential sources of impact from mining operations;
- undertake accurate assessment of the soil physico-chemical properties; and
- compliment the current dust monitoring program.

Soil samples undergo laboratory analysis by a NATA accredited laboratory. Parameters analysed are:

- Particle size distribution;
- Paste pH, EC;
- Major cations: Ca, Mg, Na, K ; and
- Metals: As, Cd, Cu, Fe, Pb and Zn (2mm fraction).

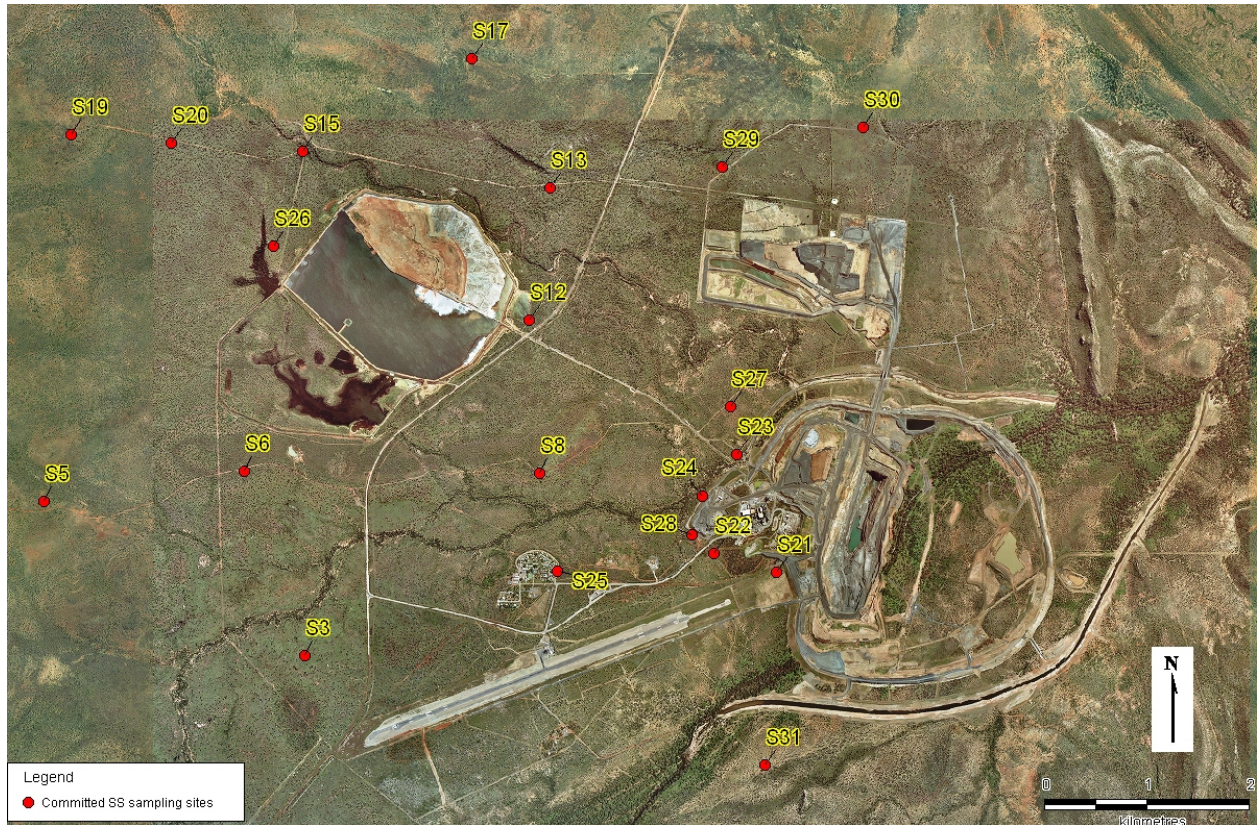
As per the independent monitors recommendations (2011) establishment of background trigger levels has been based on the National Environmental Protection Measure (NEPM) Ecological Investigation Levels (EILs). The NEPM-sourced EILs are based on phytotoxicity (copper and lead) and background soil survey data (barium, phosphorous and sulphur) from four Australian capital cities (not including Perth).

Mine Site Soil Monitoring

Soil samples are collected from locations adjacent to the dust samples sites which are illustrated in the figure below. The samples are collected on an annual basis, immediately prior to the wet season and sampled in conjunction with the dust sampling regime.

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Soil Monitoring Sites at MRM



Historical data of the quality of soils at the mine site can be found displayed in graphs for each corresponding monitoring location in Appendix L.

Bing Bong Soil Monitoring

Soils samples are collected on an annual basis from two sites within the dredge spoil, one site adjacent to the Bing Bong camp facility and two sites located at the eastern and western side of the swing basin (see figure below). Soil samples are collected from locations adjacent to the dust samples sites.

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Soil Monitoring Sites at Bing Bong



Historical data of the quality of soils at Bing Bong can be found displayed in graphs for each corresponding monitoring location in Appendix L.

The relocation of the crusher and ROM pad from the current location to the proposed site will see a reduction in dust contamination to Barney Creek and the aquatic environment. The proposed site is further away than the original with the following mitigation strategies to be implemented to control fugitive dust:

- Install windbreaks at the crushing and grinding points upwind of sensitive receptors if required;
- Various emission points will be hooded and use water sprays to prevent dust emissions; and
- Water stockpiles when necessary.

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Comment No.	EIS Section	EIS Discipline	Comment
92	Chapter 11	Dust and Contamination	The EIS should be informed by existing data, and an overview of the monitoring procedures for dust deposition, soil contamination and fluvial sediments. These monitoring regimes should be working towards an understanding of the transport of operational contaminants, with a view to analysing trends, sources and any biological impacts. This is particularly pertinent given the reported trends in fluvial sediment in Surprise Creek, Barney Creek and McArthur River. In light of these trends and elevated levels, the Environment Centre NT considers that the EIS deserves a full description of a rigorous monitoring regime which can contribute to a better understanding of the source and fate of project contaminants.

Response:

An overview of all monitoring procedures at MRM can be found within the 'Technical Manual for Environmental Monitoring' (Appendix M). The objectives of the environmental monitoring program for MRM at the mine site and Bing Bong region include:

- Confirm compliance with statutory regulations;
- Evaluate the environmental performance of the operation;
- Assist in improving environmental management strategies;
- Identify emerging environmental issues and potential impacts; and
- Contribute to the local knowledge on regional biodiversity.

The diversity of the area encompassed by the MRM leases requires a variety of monitoring programs to adequately assess the operations environmental performance.

MRM currently operates numerous monitoring programs including:

- Natural surface water;
- Artificial surface water;
- Groundwater;
- Potable water;
- Fluvial sediment;
- Depositional dust;
- Soil;
- Recovery bores;
- Marine water;
- Marine sediment;
- Product (ore, concentrate, tailings); and
- Production bore/water management.

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Other monitoring programs that generally utilise external consultants include:

- Fish surveys;
- Riparian Bird surveys;
- Marine biota;
- Vegetation surveys;
- Migratory Bird surveys; and
- Bing Bong Port Facility marine and dredge spoil monitoring.

Each monitoring program includes detailed descriptions regarding monitoring background, site locations, sampling frequency, parameters analysed, methodology and equipment, sample dispatch and data management.

MRM's monitoring program is a dynamic system, which is continually updated to reflect new government requirements, operational changes and/or other agreed stakeholder expectation.

Comment No.	EIS Section	EIS Discipline	Comment
93	Appendix E2	OEF/Waste Rock	<p>The Environment Centre NT welcomes the commitment in 6.2 of the OEF Management Plan for further geotechnical assessment of NAF waste. The Independent Monitor identified that some material, while generating a neutral leachate, gave high sulfate and metals, warning that: <i>the acidity from metal sulfide oxidation precedes the dissolution of the neutralizing carbonate. There is also the potential for bypassing of the neutralising mineralogy.</i></p> <p>MRM should describe contingency plans in the event that closer inspection of the NAF classification warrants reconsideration of other management techniques and designs. The Environment Centre NT notes that plans for NAF sediment ponds may prove problematic if NAF characterisation is found to be an inaccurate prediction of the material's suitability to this role.</p> <p>The latest Independent Monitor audit noted that end-dumping of PAF from high tip-head elevation risked segregation of the material and uneven distribution at the tip face. The Independent Monitor recommended building new facilities from the base up to allow for paddock dumping, and reducing the tip head height on existing facilities to minimise erosion and formation of oxygen pathways into the PAF zone.</p> <p>The EIS doesn't address these recommendations, or provide detail or commitments regarding construction methods and dumping practices.</p>

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Response:

The occurrence of this neutral leachate containing sulphate and metals will be investigated as part of an extensive analysis of the complex PAF and NAF geochemistry at the site as well as a multidisciplinary (geochemical, geophysical and geotechnical) review of the TSF and OEFs. Associated infrastructure, such as sediment dams, will be re-evaluated in response to the outcomes of these investigations and appropriate mitigation techniques will be developed as required.

In-field PAF/NAF identification techniques are presently under review by qualified geochemists. This work accompanies the work to improve overall characterisation of the overburden material and will produce a procedure that can utilise opportunities for PAF/NAF classification prior to excavation, such as during the placement of blasting charges. This will be in addition to the prediction of PAF material generated by the geological block model (which will also be improved by the additional data from current geochemical analysis), and post-blasting inspection by the Pit Technician trained in in-field PAF/NAF classification.

Geotechnical review of the NOEF will be conducted as part of a multidisciplinary study of the TSF, OEFs and predicted final void. In the case of the NOEF, this will include evaluation of the construction of PAF cells, NAF cover, clay liners and final cover. Input from the Independent Monitor will be taken into consideration during this work and practices will be adapted based on the recommendations from suitably qualified geotechnical engineers and geochemists. A summary of the works proposed is provided in Appendix D. These works are proposed to be commenced in June 2012. A schematic example of PAF cell development of the NOEF is provided in Appendix G.

Comment No.	EIS Section	EIS Discipline	Comment
94	Chapter 10, Appendix D3	Water Management	<p>The Independent Monitor reports concern about the volume of water in TSF Cell 2, warning: <i>There is considered to be an extreme risk of embankment failure or overtopping of the spillway.</i></p> <p>The Coffey Geotechnics review of the URS report recommends <i>assessing the capability of the underground workings to provide storage of excess water through reviewing current water quality within the workings and river gauging records to identify likely acceptable durations and rates of discharge of current stored water.</i> While there may be any manner of practical disqualifications to this alternative, there is no evidence that the proponent has even considered it.</p> <p>The Independent Monitor has identified a range of concerns regarding the level of water in operation tailings cells. The EIS should describe optimal water levels for active tailings storage, with focus on structural stability, tailings density and minimising seepage. Given concerns regarding the role of water storage in inactive cells and the adjacent WMD upon tailings seepage, the supplement should describe contingency measures in the event that seepage drives a need to reduce water levels in either facility.</p>

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Response:

The operation and management of the TSF is detailed in Appendix E1 – Tailings Storage Facility Management Plan of the Draft EIS.

The underground workings are connected to the open pit void and therefore receive pit water and groundwater inflow. This will continue throughout the life of the Project. With regard to the use of the underground workings as a water storage, during the latter stages of the Project as the pit expansion mines through a large portion of the underground void, the water storage capacity will be significantly reduced (see Table 10-9 of the Draft EIS). However, for the majority of the Project, the underground workings provide and are utilised for water storage.

The embankment design is in accordance with ANCOLD guidelines for high hazard dams. Only hard durable NAF rock that is resistant to erosion is to be used on the outer face. Engineering analysis of embankment stability has confirmed a factor of safety well in excess of minimum requirements. There is also regular inspection of embankment integrity undertaken. Monthly piezometric monitoring of phreatic surface levels within embankment and independent annual inspections are undertaken. If any issues with the embankment are identified, engineered remediation measures in accordance with ANCOLD guidelines will be undertaken.

The existing TSF was designed and developed based on national standards for large dams. It is operated under the national guidelines for tailings dams which set best practice standards under Australian conditions. The TSF operation is approved and regulated by the NT Government and regularly audited to check the integrity of the dam walls.

Appendix E1 of the Draft EIS also describes a number of strategies to minimise seepage, such as tailings deposition methods, embankment clay core with cut-off key trenches, recovery bores, geopolymer barriers and capping.

As mentioned throughout the Draft EIS and this SEIS, Cell 3 and Cell 4 will also be lined to minimise impacts from the TSF. MRM is committed to the consideration and development of contingencies to minimise impacts from the TSF, based on data that has already been collated on site. Alternatives may include, but are not limited to reprocessing and relocating Cell 1 tailings material. See also response to Comment 75 and 80.

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3.8. Respondent: Amateur Fishermen’s Association of the NT Inc.

Comment No.	EIS Section	EIS Discipline	Comment
95	Chapter 13	General Comments	<p>AFANT provided a detailed submission on the Draft Environmental Impact Statement for the McArthur River Mine Open Cut Project in October 2005. Much of what we said then underlies our consideration of the current McArthur River Mine Phase 3 Development Project proposal. Since the open cut project commenced we have been satisfied with the environmental performance of MRM. We also note the general satisfaction of MRM’s environmental performance through the independent environmental monitoring program.</p> <p>We have made a number of visits to the mine since the open cut project commenced and we have had reports from, and discussions with, MRM on issues that impact on recreational fishing in the McArthur River area. We have also been involved in specific monitoring projects relevant to recreational fishing and we note that there are no indications from these projects that the mining operations are having any adverse impacts on recreational fishing.</p> <p>At the time the open cut project was being developed we supported the approach to have the mine footprint in general and the bund wall in particular designed to allow for likely future mine expansion. This Phase 3 Project is largely accommodated within those design parameters and so there only a few particular issues that we would seek to see addressed at this stage. We will confine our comments on the Draft EIS to these specific issues.</p>

Response:

Noted. MRM understands this to be an introductory and overarching comment and will defer the response to the specific comments provided below.

Comment No.	EIS Section	EIS Discipline	Comment
96	Appendix E1	Tailings Storage Facility	<p>In our 2005 submission on the Draft EIS for the Open Cut Project we noted that “...the largest environmental risk associated with [the current mine’s] existing waste management practices is the disposal of tailings. While the TSF proposed for future operations has been designed to operate quite differently to the existing tailings dam it is still rated as a high hazard category given the potential impacts from an uncontrolled release or embankment failure.” We also noted concerns about a possible escape of materials from the TSF and the overall design of the facility. More recently, the mines Independent Monitor has</p>

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			<p>expressed concerns about these same issues.</p> <p>Another issue we had with the TSF was the prospect of continued seepage and the need for recovery bores to operate long after the mine is decommissioned. We are aware that there has been some continued low level seepage from the TSF into Surprise Creek over the past few years of mine operations.</p> <p>We note the redesigned TSF included in the Phase 3 Project and the proposal to establish a fourth cell to the north of the current facility. We also note and welcome the intention to rehabilitate Cell 1 of the existing facility as seepage from this area has been a concern for some time.</p> <p>It was our view back in 2005 and remains our view today that the TSF (other than from the freshwater storage cell) should not be able to discharge to the river or wider environment under any circumstances and that some method needs to be found to retain the tailings on site under all but the most drastic conditions. Put simply, we want to be sure that existing concerns with the TSF are addressed and that the redesigned facility will achieve this outcome.</p>
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Response:

Refer to responses to Comments 75 to 86 which address tailings management.

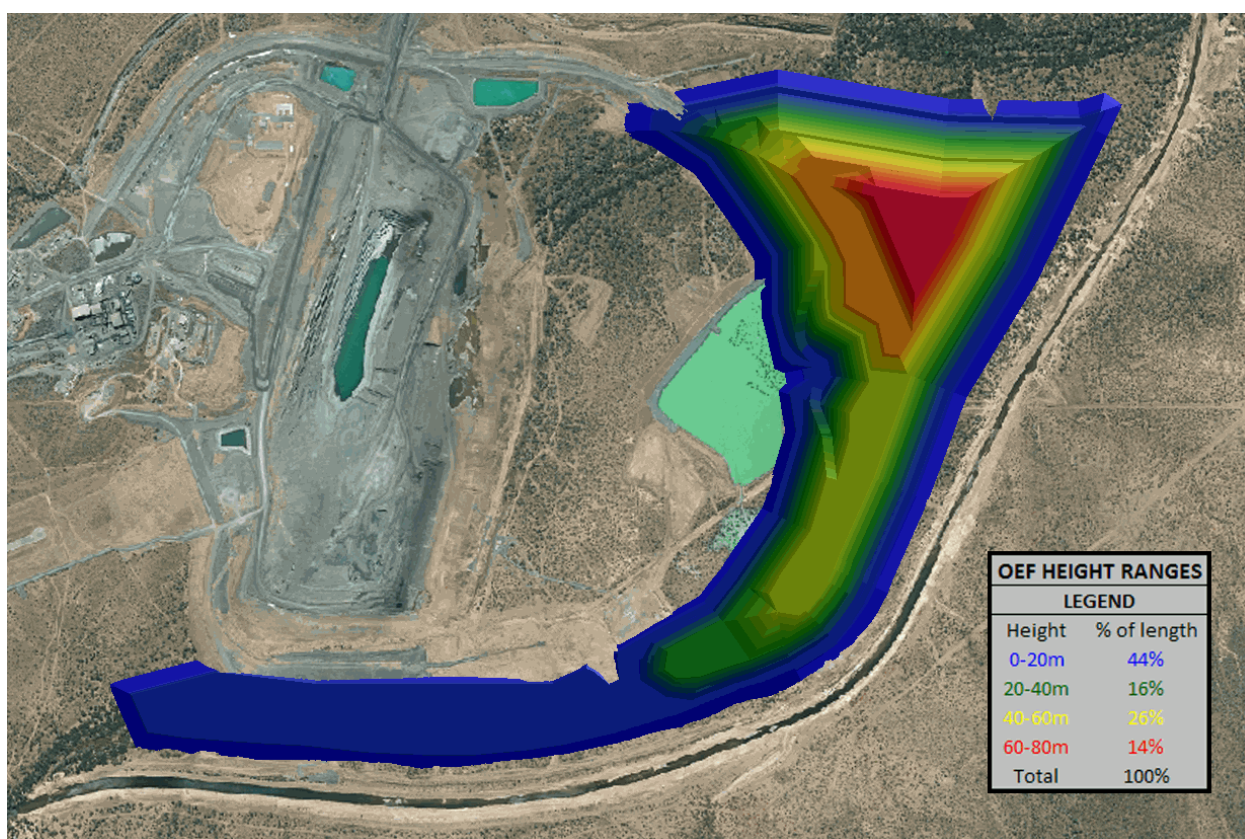
Comment No.	EIS Section	EIS Discipline	Comment
97	Appendix E2	Overburden Emplacement Facilities	<p>We do not have any particular issue with the expansion of the North OEF but there is concern with the proximity of the proposed East and South OEFs to the McArthur River realignment. Our view is that a setback of only 75 metres from the river channel is inadequate for the OEFs, particularly as they are proposed to be up to 80 metres high. We note that the East and South OEFs will not be used for potentially acid forming waste rock and welcome this. We also note the proposal to stage the development of these tow OEFs but their proximity to the river channel in the longer term remains a concern.</p> <p>We have seen details of the examination of alternatives to the proposed OEF configuration in the Draft EIS but, in our view, the placement of overburden along virtually the full length of the river diversion channel with an offset of just 75 metres for most of its length is very undesirable. While it may be necessary to place overburden this close to the channel at some points due to the placement of the flood bund we believe that a much greater offset should be used wherever possible. The formation of the diversion channel and its riparian zone to as natural a condition as possible has always been a key objective for AFANT and we believe that the proposed OEF placement may not be</p>

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			<p>consistent with that objective.</p> <p>Further examination of all possible alternatives to the current OEF configuration should be undertaken with a view to maintaining buffers as wide as possible between waste rock and the river channel.</p>
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Response:

The proposed 75 metre offset of the East and South OEFs from the McArthur River Channel is based on the consideration of many alternative configurations and that presented provides the best combination of riparian zone maintenance, OEF stability and flood protection and reduced footprint. Whilst areas of OEF's could be up to 80m high, the predominant height of the East and South OEFs will be between 0 and 20 metres with batters at a slope of 1:4 (see figure below).



A view of the East and South OEFs is shown in Figure 4-1 of the Draft EIS. These utilise the area between the open pit crest and the Barney Creek and McArthur River Channels, with offsets to allow for crest instability and rehabilitation requirements. The OEFs have a minimum setback of at least 75 m from the crest of the channels, and this buffer is over 125 m in many sections.

When the East OEF is established, banks will be stabilised by increased planting of the McArthur River Channel batters, direct seeding and planting of established trees to help prevent excessive erosion due to elevated flow rates and provide slow back-waters to aid upstream fish migration. Building additional baffling on the western channel wall to reduce erosion will be implemented if erosion appears.

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The strategy for the development of these OEFs is outlined below:

- The Erosion Protection Bund (EPB) will always be advanced in front of the bulk OEF tipping to ensure that water management and erosion controls are in place. Vegetation clearing and topsoil stripping will only occur in the dry season. Cleared and stripped areas not protected by the EPB must have rock tipped over them before the annual wet season
- The SOEF will be developed first, as this can be constructed to finished level very quickly, providing a large open area for storage of rehabilitation materials that will be stripped out from the EOEf footprint (topsoil and alluvials)
- The western end of the SOEF that fills in the old remnant McArthur River channel will be delayed until suitable habitat is established for fauna living in this area, subject to satisfactory control of ground and surface water in this area.
- The EOEf will then develop from the south out to the point of the triangle, but avoiding the old McArthur River channel in the north until the new channel has achieved agreed rehabilitation targets enabling this to occur
- Much of the base layer of the EOEf will have to be constructed to enable a large enough area for upper lifts to be placed

The external faces of the OEFs closest to the channels will be rehabilitated as soon as practicable after construction to minimise erosion.

Also see responses to comments 6 and 7.

Comment No.	EIS Section	EIS Discipline	Comment
98	Chapter 10	Reduction in the Dry Season Levels of Waterholes	<p>In our comments on the 2005 EIS we made the following comment in relation to a possible reduction in dry season water levels at Djirrinmini waterhole:</p> <p>“We note that the current plans will result in a drop of .5 m in the level of Djirrinmini waterhole by the end of the mine’s operation. Given the uncertainty of the importance of pools like this, AFANT believes that this is unacceptable and that a more precautionary approach should be taken. Although there is significant fluctuation in the level of these waterholes during the wet/dry season cycle, riparian and aquatic vegetation and aquatic fauna most likely rely on stable dry season water levels to survive. Groundwater management plans should be adjusted to ensure that the mine does not reduce the level of Djirrinmini or any other permanent waterholes.”</p> <p>We note that the Phase 3 Project could result in further lowering the level of this waterhole. We believe that all possible measures including those identified in the Draft EIS should be carefully considered and appropriate measures should be in place before the expected reduction occurs after 25 years of mining.</p>

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Response:

Djirrinmini waterhole is likely to be impacted by mine dewatering as well as groundwater abstraction from the Mimex bore field. The impact of mine dewatering on Djirrinmini waterhole (located 2 km upstream of the proposed open pit) was investigated by URS (2005 and 2012) and indicated a drawdown of groundwater level by 0.5 m to the alluvial and weathered bedrock aquifer. URS (2005) also noted that the Djirrinmini waterhole receives recharge from alluvium as it is located on low permeability bedrock which receives very limited upward recharge from the underlying formation.

As is currently the case, water levels in the Djirrinmini water hole are regularly monitored to assess the potential impacts of dewatering from the existing operation, and this will be continued for the Project. The current monitoring bore locations will be reviewed for adequacy. Additional monitoring of water levels between the mine and the Djirrinmini water hole will occur as part of the revision of the existing monitoring program. See response to comment 89.

The understanding of groundwater flow to Djirrinmini waterhole is limited to groundwater level measurement at MAC4 & MAC5, with the invert level of Djirrinmini waterhole and groundwater modelling. For better understanding of the groundwater contribution to Djirrinmini waterhole and its impact from Mimex bore field and from mine dewatering the following staged of investigation is proposed.

Stage 1 - Monitoring Program

- Monthly measurement of groundwater level (existing wells - GW66, GW34, GW70, GW71, GW72, GW73, GW74, GW75, GW76, GW77, MAC4 & MAC5 and proposed wells – GW94S, GW94D and GW95) around the Djirrinmini waterhole to monitor the impact of mine dewatering and groundwater abstraction from Mimex bore field.
- Monthly abstraction volumes and water levels at Mimex bore field (GW95 proposed well within the production area and GW94S and GW94D in between production bore and Djirrinmini waterhole).
- Daily monitoring of water level at Djirrinmini waterhole for one year and then monthly after establishing the relationship of water level with rainfall and evaporation.
- Daily rainfall measurement at the mine site.

Stage 2 - Annual investigation

An annual investigation of the monitoring data is required which will involve the following:

- Collate and analyse all monitoring data.
- Interpret the radius of influence of the groundwater abstraction.
- Assess whether groundwater abstraction from Mimex bore field and the open pit dewatering is affecting the natural condition of groundwater flow to the Djirrinmini waterhole
- Use statistical tools to establish relationships between rainfall/evaporation /groundwater level and the water level at Djirrinmini waterhole.
- Run the groundwater model with rate of abstraction, compare with the observed data and quantify changes to the volumetric groundwater contribution to the Djirrinmini waterhole and thus any impacts due to abstraction or mine dewatering.
- Run the existing groundwater model to predict future impact.
- Consider the need for mitigation or management

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Stage 3 - Implementation

- If the annual investigation including predictive model indicates that the mine dewatering/or abstraction from the Mimex bore field has no significant impact on Djirrinmini waterhole then continue with abstraction and dewatering.
- If the annual investigation including predictive model indicates that the mine dewatering and /or abstraction from the Mimex bore field will have significant impacts on Djirrinmini waterhole, then an alternative management strategy will be developed. The alternative management strategy may include the decommissioning of Mimex bore field if it causes significant impact and investigate alternative options of groundwater supplies that would not have impacts on waterhole and submit documentation for review to the Regulatory Authority.

In the event of a significant water level drop at the Djirrinmini water hole, the Proponent will investigate options to 'make good' the loss of water. This could include options such as replenishing the Djirrinmini water hole with water of a suitable quality from onsite (eg. Groundwater dewatering, subject to testing). However, modelling undertaken for the Draft EIS demonstrated there will not be a significant drop in water levels. The data obtained from the monitoring program will be used to validate the Draft EIS groundwater model.

Monitoring to date has not revealed a significant impact to water levels in the Djirrinmini water hole.

Comment No.	EIS Section	EIS Discipline	Comment
99	Chapter 13	Ongoing Monitoring of Fish and Recreational Fishing	Since 2005 McArthur River Mine and the MRM Trust have facilitated fish and recreational fishing monitoring programs in the mine area and downstream in the McArthur River and the Sir Edward Pellew's Group of Islands. With the planned expansion of mining operations, AFANT believes it is essential that these monitoring programs continue and that they be coordinated with other monitoring programs conducted by NT Fisheries and others in this area and around the Territory. We recommend that MRM gives a commitment to continuing these programs and those discussions take place with NT Fisheries to facilitate their integration into wider fish and recreational fishing monitoring programs.

Response:

In August 2011, the MRM Community Benefits Trust approved an additional application from the King Ash Bay Fishing Club extending the fish monitoring project commenced in 2009 by one year to December 2012. The study collects detailed information on fish stocks and the impact of recreational fishing in a broad region covering the McArthur River downstream of Borroloola, the McArthur River delta, coastal streams from Bing Bong to the Wearyan River and the Sir Edward Pellew Islands.

Total grants valued at \$319,880 have been committed to the four year study which has also been extended to include monitoring of the Golden Snapper, supporting the work of NT Fisheries and the Amateur Fishermen's Association of the NT in promoting better management of our fisheries.

Decisions regarding grant submissions are made democratically at meetings of the Trust's nine Directors, including 5 from the Gulf region. Within this forum, MRM is pleased to champion ongoing effective fish monitoring recognising the value of these studies to the community and recreational fishing industry, an important tourism driver to the Gulf region.

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Comment No.	EIS Section	EIS Discipline	Comment
100	Chapter 13	Ongoing Monitoring of Fish and Recreational Fishing	AFANT is happy to continue its involvement with these and other monitoring processes at McArthur River Mine.

Response:

Noted. See response to Comment 99.

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3.9. Respondent: Department of Natural Resources, Environment, the Arts and Sport

Comment No.	EIS Section	EIS Discipline	Comment
101	ES.8.2; App.D3/s.8. 5.1	Services	<p>For the potable water supply for the new accommodation village, demonstrate that consumptive extraction from the proposed source (Mimex borefield), is no more than 20% of the annual aquifer recharge.</p> <ul style="list-style-type: none"> Outline potential ecological impacts of the proposed groundwater extraction

Response:

Total extractions of Mimex and Emu bore field in the last four years are presented in the table below (Sustainable Development, Water Management Plan, Xstrata, 2011). Data was not available for Donkey Bore Field.

Rate of extraction (Mimex and Emu bore field)

Year	Rate of Extraction (Mimex bore field)		Rate of Extraction (Emu bore field)		Total extraction for Emu and Mimex bore fields
	Daily (kL)	yearly (ML)	Daily (kL)	yearly (ML)	yearly (ML)
2007	970	354	70	235	589
2008	945	344	470	171	515
2009/2010	915	334	1032	377	711
2010/2011	500	182	1000	365	547

Bore water demand for the Project is 2 ML/day (730 ML/year) as detailed in the Project's Draft EIS, Appendix D3. For a conservative estimation, it is assumed that all the bore water will be supplied from Mimex bore field, at a total extraction rate of 730 ML per year. The mean annual recharge for this region has recently been estimated as 10-15% of annual rainfall (CSIRO, 2009, Diffuse Groundwater Recharge Modelling across Northern Australia). Mean annual rainfall is 785 mm (EIS, Appendix D3). Considering a conservative 10% of annual rainfall value for recharge, the annual recharge rate is 0.078 m /year or 78 ML/ km².

To produce an annual recharge to match the annual extraction a catchment area of 9.35 km² is required. For the total extraction to amount to 20% of annual recharge, an area of about 47 km² is required which is five times of the area for annual extraction. The total disturbed area after Project development would be about 16.4 km². Total McArthur River catchment area is 20,000 km². Barney Creek located upstream of Mimex bore field has a catchment area of 570 km² (URS,2006, McArthur River Mine, Modified Open Cut Project, Public Environment Report) which is more than 10 times the required catchment area to support Mimex extraction.

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Recent investigations (URS, 2005 and 2012) simulated the impacts on groundwater resulting from the proposed mine expansion and associated dewatering. The groundwater model predicts a maximum drawdown of 0.5 m at Djirrinmini waterhole that will not occur until after 25 years of mining, prior to which drawdown is predicted to be significantly less. However, these simulations did not consider pumping from the Mimex production bores. Further work is proposed to investigate the potential ecological impact. Also see response to Comment 98.

Also see response to Comment 11 in regards to the potable water supply.

Comment No.	EIS Section	EIS Discipline	Comment
102	ES.12	Offsets	Detail all ecological and greenhouse offsets proposed by McArthur River Mining Pty Ltd (MRM), consistent with the Draft Northern Territory Offsets Policy http://www.greeningnt.nt.gov.au/climate/environmental/offsets.html

Response:

MRM have submitted a biodiversity offset programme proposal to the Northern Territory Government under the voluntary scheme as part of the 2005 EIS. MRM consider, though the environmental assessments completed as part of the Project's Draft EIS that no net material increase in impacts on key ecological areas would result. Therefore no biodiversity offsets, beyond those currently being considered by the Northern Territory Government as part of the 2005 EIS, are proposed.

Comment No.	EIS Section	EIS Discipline	Comment
103	s3.2	Silver	No discussion is apparent in the Draft Environmental Impact Statement (DEIS) of the market, extraction rates, processing or issues associated with silver, yet the mine is described as a lead, zinc and silver mine.

Response:

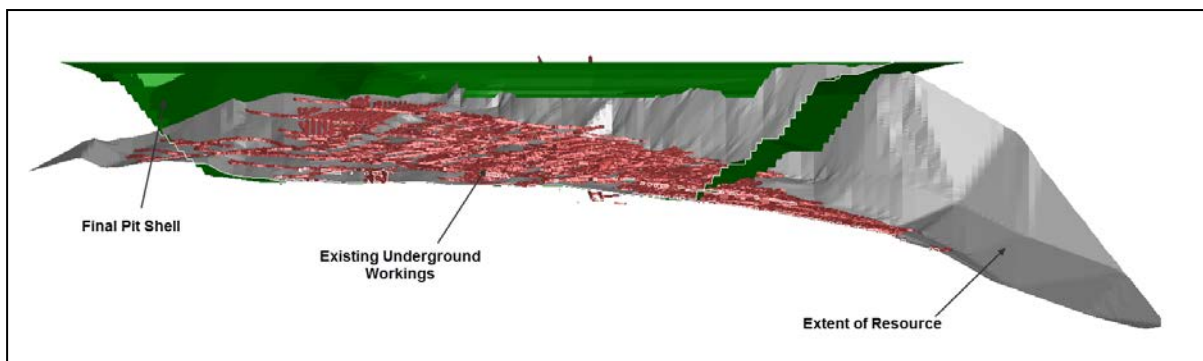
Silver is present in the ore in solid solution with the lead and zinc minerals, not as discrete silver minerals. Geological studies have shown some association of silver with antimony and with some minor copper bearing minerals. Silver is not specifically targeted in the flotation process, however it is recovered by association with the recovered zinc and lead minerals. The silver grades in the ore range from 30 - 48 g/t; 40 - 48% of this silver is recovered into the bulk concentrate with average grades of 112 - 140 g/t. Silver is extracted at the smelting and refining stage through the lead treatment process. The smelter treatment charge for silver consumes the majority of contained silver value in the MRM concentrate resulting in minimal revenue from this metal. Studies are ongoing to better understand the silver mineral associations, so that alternative process routes or reagents may be utilized to improve the silver recovery and revenue.

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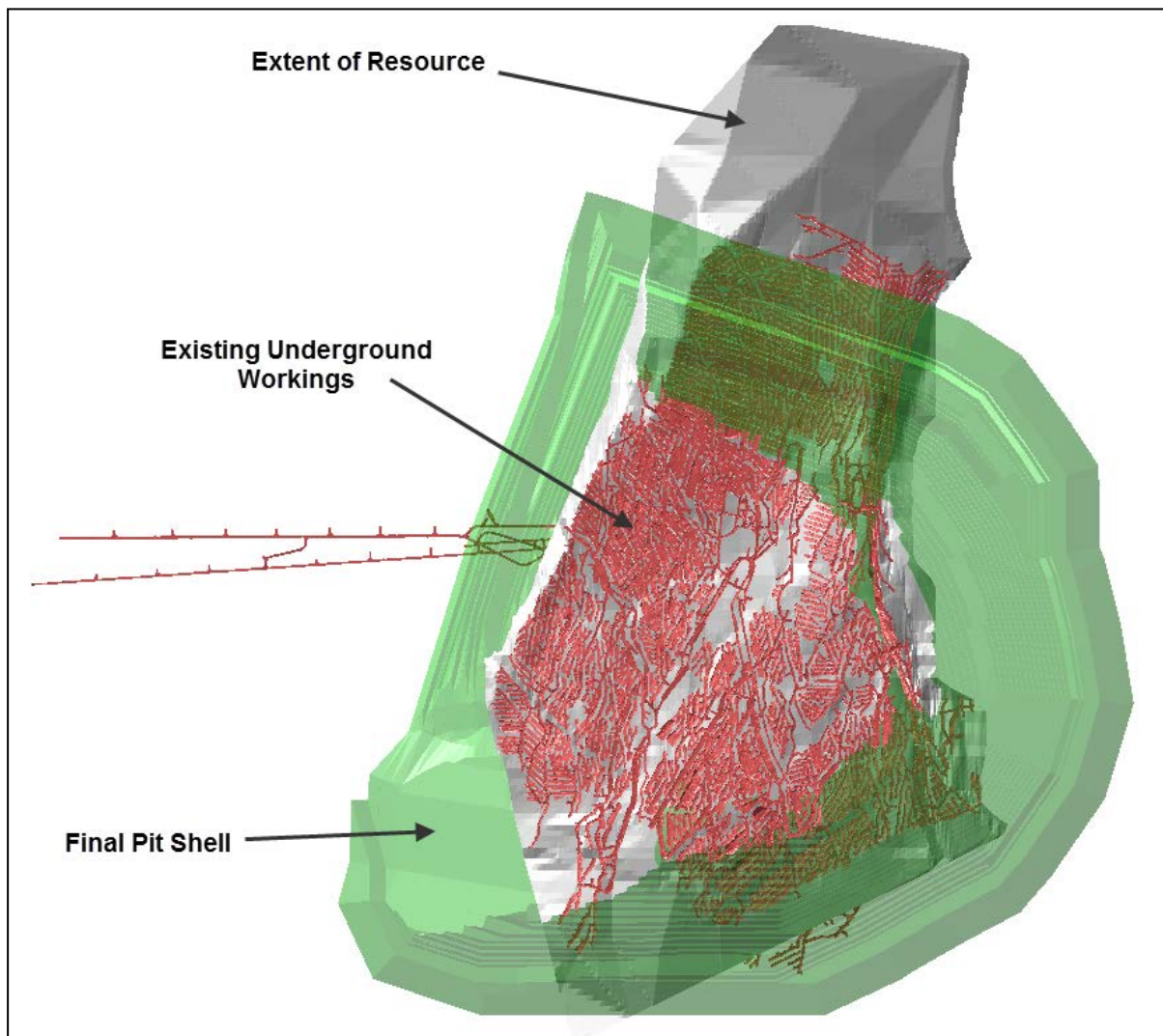
Comment No.	EIS Section	EIS Discipline	Comment
104	S1.1.1; s.3.2.2	Resource and Future Mining	<p>To what extent does the downward sloping ore-body extend further underground than the current proposal aims to remove?</p> <ul style="list-style-type: none"> • Provide a diagrammatic representation indicating the full extent of the known resource, beyond the targeted resource • Does reasonable potential exist for further expansion of the proposed project, such as extension of the pit, or return to underground mining once the pit depth limit has been reached? • If so, how is potential for further future expansion reflected in current proposed designs and environmental management? (Examples might include: avoidance of resource sterilisation; skewed progressive rehabilitation priorities; avoidance of progressive use of pit or underground workings for PAF storage; stalled preparation for closure; etc.)

Response:

The figures below provide section and plan views showing the extent of the identified resource, existing underground workings and the proposed final pit.



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Note that the resource surface shown is approximate basal surface of the resource. The upper surface of the resource is not shown.

It can be seen that the known resource extends beyond the boundaries of the proposed final pit and the existing underground workings. Optimisation results indicate that there is potential for future resource extraction to the north via open cut methods. Furthermore MRM is aware of another resource block called Woyzbun South which is approximately 150m below (as a result of faulting) the mineralised zone currently targeted by the open pit. Potential to target this via underground methods exists, however no feasibility work has been completed. Both of these potential future options are not sufficiently understood and are subject to future resource optimisation works and mine planning. Furthermore, current commodity prices and mining costs prevent the incorporation of these components into current mine plans.

The implications of these potential future resource recovery opportunities on current mine plans and environmental management strategies include:

- storage of tailings and overburden in locations other than the operational pit and final void;
- reconsideration and study of the existing approved proposal to allow the final void to flood with McArthur River surface waters at closure; and
- positioning of the proposed overburden emplacements in areas that are environmentally favourable, economically viable and do not inhibit potential future resource recovery.

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Comment No.	EIS Section	EIS Discipline	Comment
105	Chapter 10	Groundwater	<p>The most significant aquifer occurs within the weathered dolomite bedrock (URS, 2012) which extends approximately 4km east of MRM until it reaches the Emu Fault. Local and perched groundwater also exists in the alluvium which overlies the dolomite. Based on the groundwater contour map produced by URS in their technical report (URS, 2012) the inferred regional groundwater flow is in an easterly direction from the Tailings Storage Facility (TSF) towards the open pit and McArthur River.</p> <ul style="list-style-type: none"> • NRETAS considers the hydrogeological assessment to be adequate and consistent with published data and maps • Groundwater could become a pathway for contamination of the McArthur River, therefore appropriate monitoring and controls need to be in place. The current approach to dealing with this concern could not be assessed as insufficient information was provided in the DEIS • NRETAS has confirmed that the nearest offsite bore used for domestic purposes is located 25km north west of MRM, hence up hydraulic gradient, and therefore not at risk from MRM activities. NRETAS also conducted a 50km radius search which revealed that other than those owned by MRM there are no other groundwater extraction bores located down gradient of MRM, therefore there are currently no apparent impacts to other groundwater users • Activities at MRM have the potential to impact on groundwater quality. MRMs own potable bores at the MIMEX bore field are 2-3 km SE of the TSF. If groundwater is to be used for human consumption, NRETAS recommends routine testing to ensure the water is of suitable quality (according to the guidelines stated in the Australian Drinking Water Guidelines, 2011). A series of fact sheets and references can be accessed via the NTG Department of Health Environmental Health (water quality) web pages • Regular groundwater monitoring (every 2 months) is part of MRM's Water Management Plan (WMP), and is submitted annually to the Department of Resources. Although monitoring mainly appears to be concentrated around the TSF Cell 1, the process area, and the OEF, a full assessment of the adequacy of the monitoring plan and

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			<p>sampling procedures could not be made as the WMP and Environmental Monitoring Manual were not apparently supplied as part of their DEIS, nor was a location map apparent of the monitoring bores. Details of the groundwater monitoring plan during and after the expansion have not been provided as part of the DEIS, however MRM acknowledge the requirement to revisit and amend the WMP throughout the life of the project. NRETAS would expect, and recommends that the WMP and associated reporting to be submitted to a third party auditor, or similar, for the on-going assessment of impacts to groundwater.</p>
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Response:

A review of available information undertaken by RPS (2012, reference no, A254FC/001A) indicates that even after a peak rainfall event, the predicted post-mining groundwater rebound level remains above the predicted post-mining pit lake rebound level which ensures groundwater inflow to the pit lake, maintaining the sink status of the final pit void. The final void will be a groundwater sink and there are no pathways for water to flow towards the McArthur River/diversion channel. This means water will flow towards the final void, not away from it. The monitoring plan will be amended to provide sufficient data to confirm that the final void is going to remain as groundwater sink.

As mentioned in the EIS, the groundwater monitoring program on site will be adapted where necessary as part of the Project. This will include a review of monitoring sites, frequency and analytes. The monitoring program has the flexibility to be adapted throughout the Project, depending on operational conditions. The monitoring program will provide a warning mechanism to provide information on the potential impacts on groundwater (if any). The groundwater monitoring plan has been amended in Comments 87 to 89.

The Australian Drinking Water Guidelines, 2011 are included in the MRM Legal Compliance Register. Information on Potable water monitoring of the MIMEX bore field and the Federation bore (potable water supply to Bing Bong and Aburri) are in the MRM Technical Manual for Environmental Monitoring Section 9 (copy available).

As part of the Independent Monitor process, all environmental issues, including groundwater, are regularly subject to a third party review.

Refer to responses to Comments 87 to 89, 109 and 124 for detailed groundwater monitoring information.

More information regarding the monitoring program is shown below:

TSF Recovery Bore Monitoring

Recovery bores have been installed on the perimeter of the TSF in response to seepage from Cell 1. These bores are strategically located to capture water seeping from the TSF and return the contaminated water to the TSF through the pumps installed on these bores. This is aimed at preventing the contaminated seepage from reaching Surprise Creek, a tributary adjacent to the TSF. These bores are monitored to record the amount of water pumped back into the TSF to aid in determining the extent of seepage recovery.

Locations

The recovery bores are located on the north-eastern perimeter of the TSF with a total of 618 recovery bores commissioned. These bores are identified by the 'SC' codes labelled on the bore casing.

Frequency

Recovery bore monitoring is conducted on a weekly basis.

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Potable Water

The potable (drinking) water for the mine site and village is extracted from bores reserved specifically for potable use. Potable water at the MRM mine site is extracted from the MIMEX bore field, located to the south-west of MRM. Potable water for the MRM Port Facility and the MV Aburri (barge vessel) is extracted from 'Federation Bore' which is approximately 22km from Bing Bong. These water sources are monitored for general chemical and bacteriological water quality in accordance with the Australian Drinking Water Guidelines (2011). Potable water on site is monitored for regulatory compliance as well as for the assurance of the safety of MRM personnel in regards to drinking water consumption.

Potable water is analysed at the source (header tanks) as well as the end of each line to ensure compliance with the regulatory guidelines. This incorporates all sources of potable water used by MRM including the mine site, village and Bing Bong port facility (as well as the MV Aburri).

Frequency

Potable water samples for the start and end of potable water lines are collected every month for both chemical and bacteriological analysis. In-situ water quality data is also collected on a fortnightly basis.

Analyses

Potable water samples undergo both in-situ and laboratory analysis (chemical and bacteriological) to ensure this water is safe for human consumption based on the Australian Drinking Water Guidelines (2011).

In-situ analysis is conducted with the use of a Hydrolab Quanta Meter as well as a HACH Pocket Colorimeter II (free chlorine only), on location to ensure a true representation of the water quality at that point in time. Physical and chemical parameters are analysed through NTEL, a NATA accredited laboratory (as per NTEL quote 00021). The exceptions to this are Trihalomethane (THM) which is conducted by ALS Environmental in Brisbane, also a NATA accredited laboratory and the bacteriological analysis which is conducted by the Water Microbiology Laboratory at DoR.

From the McArthur River Mine Technical Manual for Environmental Monitoring Section 9 pp 64 and Section 24(GPS monitoring points).

Groundwater

Groundwater monitoring is conducted on site to assess the potential impact of the operation on local groundwater. This monitoring is mainly focused around the TSF due to the greater potential for groundwater contamination through seepage with the large volume of material and contaminated water creating additional pressures.

The objectives of this monitoring program are to:

- Monitor the impacts of groundwater abstraction;
- Determine the extent of any contaminants in shallow aquifers;
- Assess the effectiveness of TSF seepage control systems; and
- Assess the potential impact of the establishment of the Northern OEF.

Locations

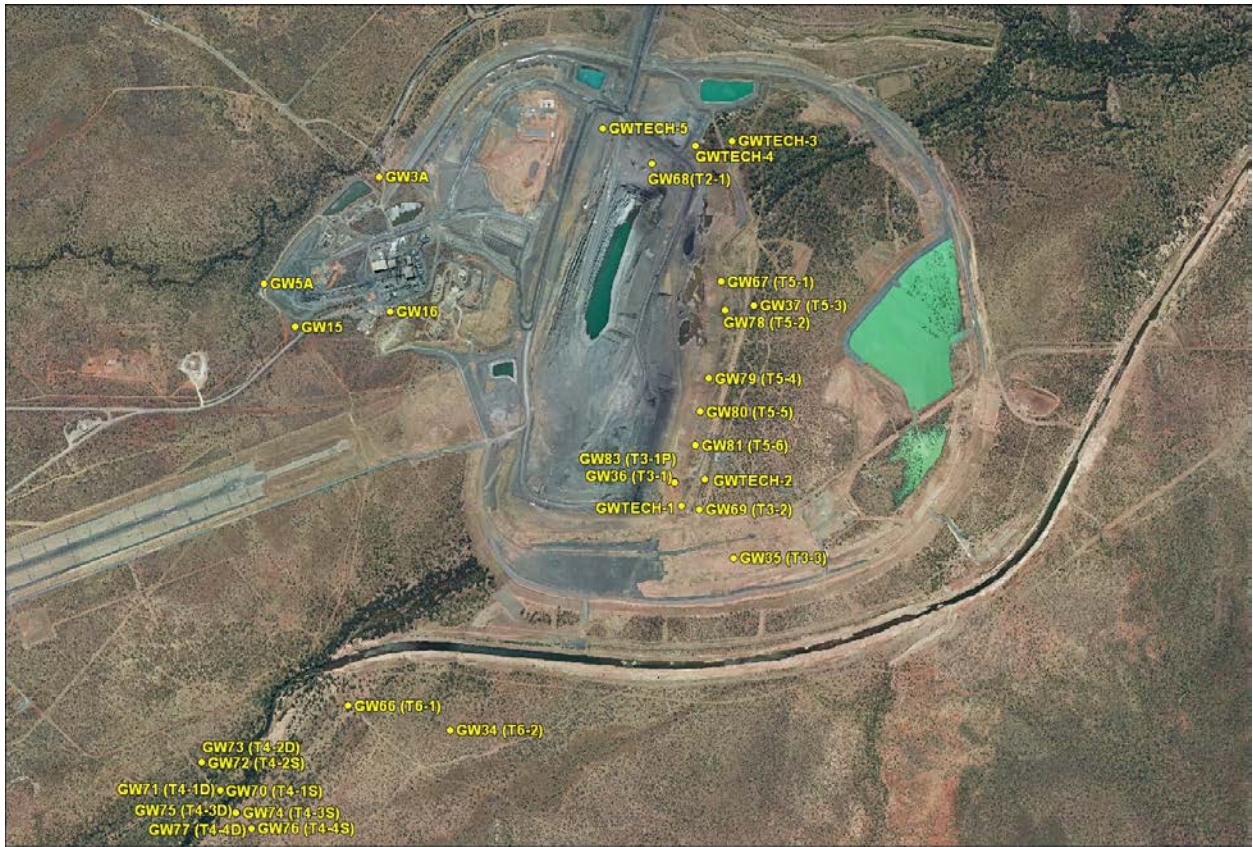
Currently 39 active monitoring bores are located on the perimeter of the TSF, with 24 located around the mine site and 4 located on the OEF perimeter.

Frequency

Groundwater monitoring bores located at the mine site, TSF and northern OEF are sampled every second month. If for any reason groundwater sites are inaccessible, information regarding the site and reasons must be recorded on the groundwater sample data sheet so that this can be noted when data is manipulated/assessed.

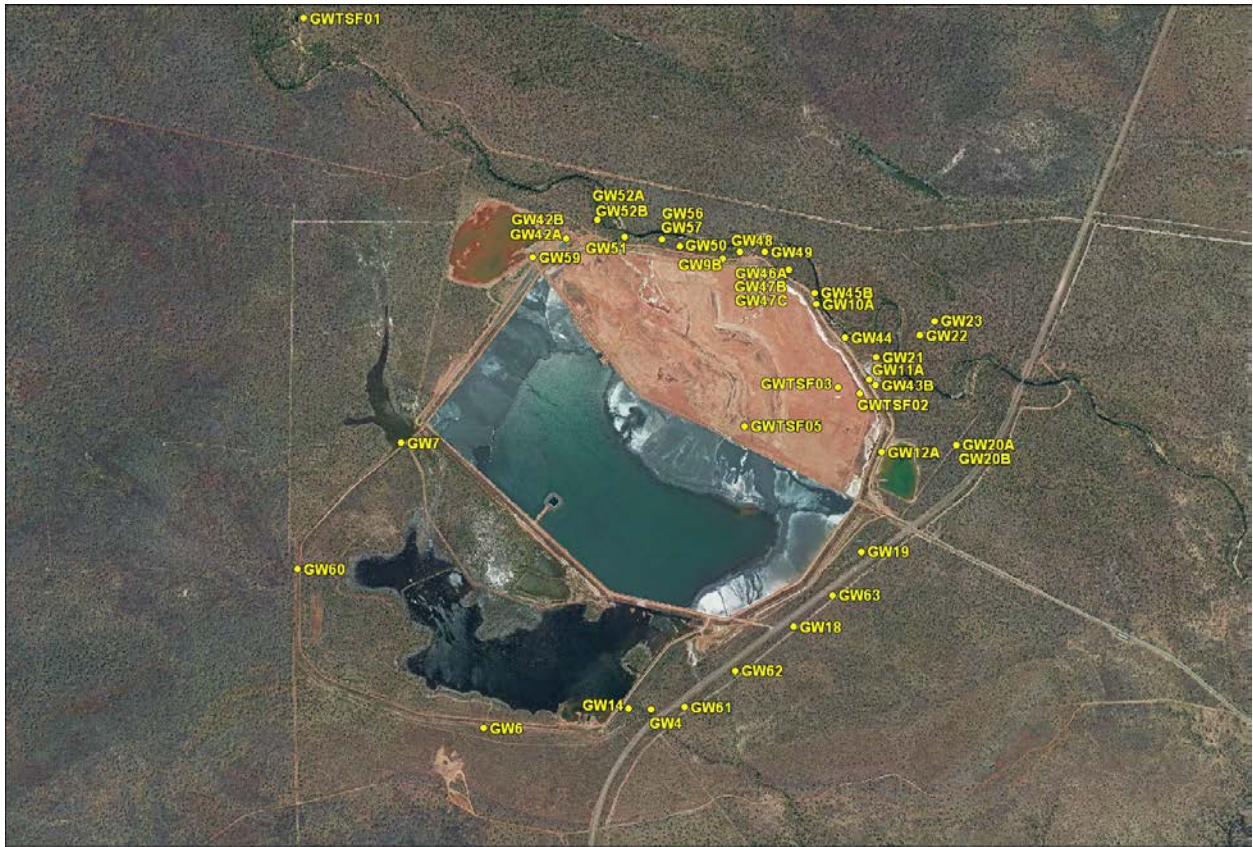
Sample site locations and site codes are provided below:

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Existing Groundwater Monitoring Bores Located Around the Mine Site

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Existing Groundwater monitoring bores located around the TSF

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Existing Groundwater Monitoring Bores Located Around the NOEF

As mentioned in the responses to Comments 87 to 89, 109 and 124, the groundwater monitoring program will be refined throughout the Project.

Comment No.	EIS Section	EIS Discipline	Comment
106	General	Beneficial Use Declarations	In relation to this proposal, the proponent needs to be aware that any actions during the development that cause a water body off the mining lease to be altered such that it no longer has water of quality suitable to its Beneficial Use, may result in prosecution unless permitted or authorised under the <i>Water Act</i> .

Response:

The Proponent is aware of the requirements of the Water Act and the 'Beneficial Use' of water. The Water Act is included in the MRM Legal Compliance Register. MRM is aware that a Waste Discharge Licence is required for all proposed discharge activities and is currently undertaking environmental and ecological assessments to better understand the receiving waters and develop appropriate discharge conditions.

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Comment No.	EIS Section	EIS Discipline	Comment
107	Chapter 10	Surface Water	<p>Flooding</p> <ul style="list-style-type: none"> Flood mitigation infrastructure appears to be suitably designed, and is based on flood modeling by a reputed engineering consultant who has excellent experience in the topic and the area. This infrastructure should significantly reduce risk of direct surface water pollution of the environment around the mine While Climate Change has not been directly assessed in the modeling, the methodology used for considering variation in annual climate is the best approach possible as it will be difficult to incorporate a factor for climate change without knowing change rate in the next twenty years.

Response:

Comment noted on flood mitigation structures. More information on flooding and mitigation is provided in the responses to Comment 6 and 7.

Impacts of Climate Change on Flooding

It is agreed that, until there is more certainty on the expected climate change in the Northern Territory and the expected rate at which change may occur, it is difficult to incorporate climate change impacts in flood modelling and assess the impacts of climate change on flooding with any degree of certainty. Further, there are no guidelines in the Northern Territory at present for the assessment of climate change impacts on flooding. It is noted that the flood modelling undertaken for the Draft EIS is based on the full historical record of climate data available for the McArthur River catchment. This data includes extended dry and wet periods affecting flows in the McArthur River.

The potential impacts of climate change (if any) on surface water the Project are difficult to assess as 'experts' in the field have presented evidence both for and against the theory. However, in addressing the potential risk of climate change for the purposes of this EIS, it can be noted that Engineers Australia have published a paper entitled, Implications of Climate Change on Flood Estimation: Discussion Paper for the Australian Rainfall and Runoff Climate Change Workshop No. 2 (February 2011). The paper summarises studies that have been completed or partially completed from Australia and other parts of the globe.

The conclusions reached for Australia were generally:

- NSW recommends a sensitivity analysis with a 10 % to 30 % increase in extreme rainfall
- Queensland is considering adopting a 5 % increase per degree temperature change for the 1:100 to 1:500 AEP events
- the Bureau Of Meteorology has concluded that it was "not possible to confirm that probable maximum precipitation will definitely increase under a changing climate."

As a simplified approach to estimate the potential impacts of climate change on the Project, a conservative scenario where all peak discharges increase has been assumed. The impacts of such an increase in peak discharges would include the following:

- the more frequent events would have higher discharges; however, the relative changes to existing creek system would remain the same

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- water management infrastructure within the mine areas would need to be upgraded to a larger capacity
- the previous flood events would become larger, however the proposed flood levees would provide protection, but with less freeboard.

Given that the proposed mine life is relatively short (2012-2037), it is unlikely that climate change would impact on the flood immunity at the mine site during the mine life. All major infrastructure at the mine site has at least 1% AEP (100 year ARI) flood protection and the major levee at the mine provides more than 0.2% AEP (500 year ARI) flood protection for the Open Pit and other key mining infrastructure.

It is possible that climate change post-mining may impact on the mining infrastructure that is proposed to remain after mine closure. Therefore, during mine closure planning, the impacts of climate change may have to be assessed if reliable climate change predictions and assessment guidelines are available at that time.

Comment No.	EIS Section	EIS Discipline	Comment
108	Chapter 10, Chapter 19	Erosion and Sediment Control	<p>Erosion and Sediment Control</p> <ul style="list-style-type: none"> • Land resource information, field verification and remote sensed imagery indicate that the proposed development contains areas of moderately to poorly drained soils in seasonally inundated low lying drainage regions and also includes creek lines and riparian zones. The Erosion and Sediment Control Plan (ESCP) will need to clearly outline how these areas, and surface water drainage of mine infrastructure, will be managed to avoid any risks to the environment, particularly off-site impacts. • The Environmental Management Plan Section 19.4.2 states that the Construction contractor is to <i>"prepare and implement a site-specific construction erosion and sediment control p/an in accordance with the Institution of Engineers Australia - Erosion and Sediment Control Guidelines (1996)"</i>. Additionally the IECA (2008) 'Best Practice Erosion & Sediment Control', International Erosion Control Association, November 2008 guidelines are a reference document to the EIS • Section 10.4.1.2 Management Objectives identifies the <i>"controlled release of 'dirty' water treated in proposed sediment dams, provided water quality is within the MRM Waste Discharge Licence water quality release limits"</i> but it is not clear what TSS values have been identified (and will monitored for) as triggers to determine water quality is adequate for "dirty" water release from basins and to be utilised to identify if erosion and sediment controls are effective.

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			<p>NRETAS recommends the ESCP is developed, implemented and monitored by a suitably qualified or experienced professional in erosion and sediment control planning. The above guidelines should be utilised to inform the development and implementation of the detailed ESCP including the adequate sizing of basins and erosion and sediment control structures.</p> <p>The Environmental Management Plan Section 19.4.5 states that the construction contractor will prepare a vegetation-clearing plan and the section describes some broad methods and strategies to minimise impact when clearing. It is recommended that mitigation and management methods identified in the NT Land Clearing Guidelines 2010 are implemented.</p> <p>Should the requirements of the above Guidelines, commitments given in the EIS and the management of "dirty" water from the development be implemented on the ground, erosion and sedimentation risk will be mitigated.</p>
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Response:

The principles, locations and sizing requirements of erosion and sediment controls (i.e., sediment dams, 'dirty' runoff drains, 'clean' runoff drains, and erosion protection structures) required for the segregation and management of 'clean' and 'dirty' runoff at the mine site have been identified in Section 10.4 and Appendix D3 (Section 7) as well as Appendix E2 (Section 3.7 and Section 4.5) of the Draft EIS.

In addition to end point controls such as sediment dams and runoff drains for treatment of sediment laden water, at source methods to minimise soil erosion from NAF and/or PAF areas of the OEFs would also be implemented. During the construction of the OEFs source controls such as surface mulching, contour banks, rock chutes and check dams would be adopted, with particular importance placed on protecting the dump during times that there is exposed, uncompacted material on the surface. Seasonal variation in weather would also be taken into account (i.e. dumping strategies for dry and wet seasons).

An erosion and sediment control plan will be implemented in accordance with IECA (2008) during the detailed design phases of the North, South and East OEFs.

The Total Suspended Solids (TSS) concentration limit for releasing water from sediment ponds to the downstream receiving environment would be based on data collected from background water quality monitoring of the receiving environment. For example, limits for sediment dams that discharge to Emu Creek would be set based on recorded background TSS concentrations at the monitoring location located upstream of the disturbed area (i.e., proposed natural surface water monitoring location Emu_Ck_1). Similarly, limits for sediment ponds that discharge into Barney Creek and the McArthur River would be based on recorded background TSS concentrations in Barney Creek and the McArthur River, respectively. The target TSS concentration limit in the sediment ponds prior to releasing to the receiving environment would be set as the 80th percentile recorded background TSS concentration of the receiving waterway. TSS is monitored in surface waters on a monthly basis (where practicable).

In regards to erosion and sediment control, before any vegetation clearing or digging can be undertaken, a Permit to Clear and or Permit to Dig must be obtained under the MRM Land Clearing And Digging Permit Procedure. This permit procedure ensures that activities at MRM comply with requirements regarding disturbance to ground or vegetation with respect to health and safety and environmental and cultural heritage issues.

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This procedure is reviewed annually so that relevant updates to land clearing policies and legislation are implemented. The NT Land Clearing Guidelines 2010 are included on the MRM Legal Compliance Register. The Erosion and Sediment Control Guidelines are also included on the MRM Legal Compliance Register.

Comment No.	EIS Section	EIS Discipline	Comment
109	App.E1-s.2.1, s.3.7, s3.3.2, s.4.7	Tailings Storage Facility	<p>Seepage volumes</p> <ul style="list-style-type: none"> • Present the following two calculations in terms of total seepage for the entire TSF (in L/day), and from the proposed TSF cell (4). • From App. E1/s. 2.1: <i>the predicted/long-term seepage volumes are generally low and are of the order of 30 to 40 L/day/m width of the TSF wall because of the relatively low permeability of the embankment core, the tailings and the underlying dolomitic siltstone material.</i> • From App. E1/s. 3.7.2: <i>The seepage estimates through the perimeter wall of Cell 2 were estimated in the range of 90 L/day to 170 L/day per metre of wall. With a conservative assumption of seepage from all four walls, daily seepage losses would be in the order of 400 kL to 900 kL.</i> • Appendix E1/33.2 states: <i>Investigation Identified the potential for lead and zinc seepage from the TSF. The report identified fractured geological structure as preferred seepage pathways that have limited the effectiveness of trialled seepage mitigation efforts.</i> <p>Electromagnetic surveys around the TSF have been conducted in 2009 and 2010 to assess seepage occurring from Cell 1.</p> <ul style="list-style-type: none"> • Results and findings of the survey such as aquifer and plume mapping beneath the TSF have not been provided; therefore, an assessment cannot be made on MRM's current environmental performance with respect to groundwater contamination. These should be provided in the Supplement, as a context for the Phase 3 Proposal. • Quantify long term expected transmission rates (from the TSF as a whole/per day) for seepage to escape through the base of the TSF cells to deeper aquifers, bypassing peripheral seepage capture devices (i. e. clay cut-off key, geopolymer barrier, perimeter drain, recovery bores at 10-30m depth).

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			<ul style="list-style-type: none"> Describe and map the extent of the existing (sulfate) plume emanating from the TSF, i.e. that has bypassed peripheral seepage capture devices: Include consideration of plume extent in aquifers extending deep -to and beyond the Surprise Creek channel. Quantify and evaluate groundwater quality changes in affected aquifer water quality as a result of TSF seepage. Include comparison to ANZECC aquatic ecosystem protection guideline levels. Project (map) potential/modelled long-term migration of contaminant plume with the proposed expansions of the TSF, considering proposed seepage management measures. <p>Where do the affected aquifers express?</p> <p>Define long term potential impacts from mine-related contaminants entering deep aquifers, such on Surprise Creek and McArthur River ecosystems</p> <p>Define proposed monitoring and management by MRM of identified potential Impacts.</p> <p>How will deep aquifer contamination be prevented from occurring in the proposed TSF4?</p> <ul style="list-style-type: none"> Describe propose monitoring and management.
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Response:

Total seepage from the entire TSF is estimated in the Table below:

Cell	Volume (kL/day)	Volume (ML/year)	Assumptions
1	1,320	481	some capture and return
2	1,460	533	some capture and return
3	16	6	HDPE lined*
4	14	5	HDPE lined*
Total	2,810	1,025	-

* Underdrains and over drains are proposed, however they are not considered in these calculations.

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Four electromagnetic (EM) surveys have been conducted at MRM (annually since 2007 at the end of the dry season) to determine the level of subsurface electrical conductivity surrounding the TSF as a means of detecting subsurface loss of conductive liquids stored in the TSF. This is undertaken by measuring change in measured ground conductivity compared to baseline conditions and complements data retrieved from the groundwater monitoring system.

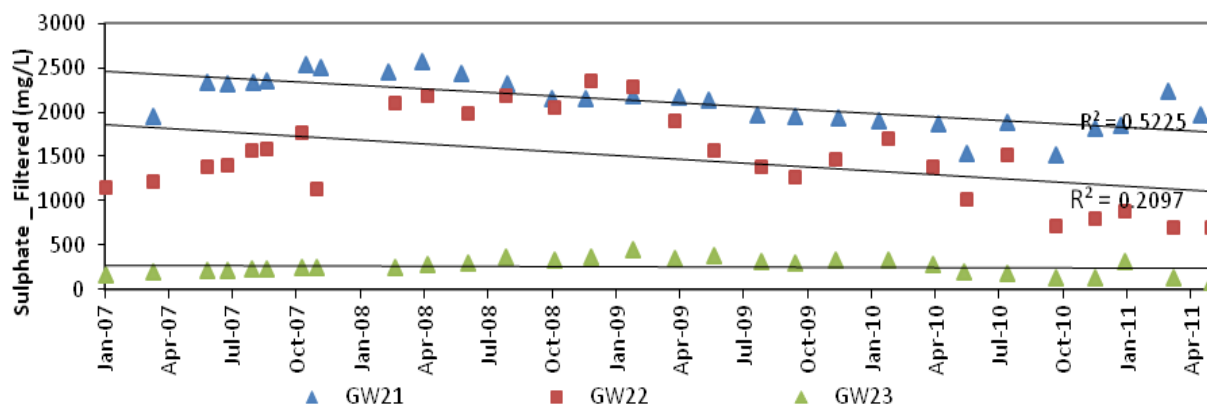
Results from the 2011 report (Conclusion, Section 5.1) found that changes in ground conductivity (both vertical and horizontal dipole configurations) between 2010 and 2009 have generally shown either no change or increases in ground conductivity, particularly to the north east and south west of the TSF (Lines SW1, SW2, NE1 and SE2). Compared to the 2007 data, ground conductivity has generally remained the same or slightly reduced apart from increases observed on Lines SW1, SW2, NE1 and SE2." EM Surveys will be continued for the Project to determine the potential seepage rates from the TSF. The 2011 report is available in Appendix N.

To accurately calculate the long term transmission rates for seepage to escape through the base of the cell to deeper aquifer will require a numerical model. However, an estimate can be provided by using the water balance information from the post closure analysis of the TSF (EIS, Appendix E1, Section 3.5.2).

In post closure scenario, a total infiltration to the TSF is about 756 kL/day (rate of infiltrations 65 mm/year through the TSF cap and total area of TSF of 460 ha). As a conservative approach (i.e. without benefit of modelling) if we assume that 10% of this volume infiltrate vertically to the deeper aquifer, then the expected transmission rate is 76 kL/day.

Mapping of the plume is not possible as the wells are mainly located within the periphery of the TSF. The extent of the sulphate plume can be described using two transects of monitoring bores (one to the northeast of Cell 1 and one to the southeast). The EM mapping has provided an understanding on the area of concern for the shallow TSF seepage. These two transects are located on the areas of concern. Furthermore, SO₄ is a conservative ion (if it does not react with calcium bearing rock (e.g., CaCO₃) and precipitate as gypsum) and can act as a TSF tracer.

The extent of the sulphate plume to the north east extent can be described using monitoring bores GW21, GW22 and GW23 is situated near the north eastern boundary of the Cell1 of the TSF and forming a transect that spans Surprise Creek. GW21 is situated between the TSF boundary and Surprise Creek, whilst GW22 and GW23 are located on the other side of the Creek. GW21 is located in an in-filled tributary of Surprise Creek, which is believed to be a transmissive pathway. Sulphate concentrations at GW21 exceeded ANZECC guidelines on groundwater used for Agricultural Livestock Purposes (2000) applied to SO₄ on all monitoring events in the reporting period. GW22 exceeded guideline concentrations in the past, but since 2010 October did not exceed the guideline values. Nil exceedance is reported for GW23 signifying a decreasing spatial trend away from TSF (see figure below). Thus the indicative northeast extent of Sulphate plume is about 160 m from the TSF boundary.



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Time series data for sulphate in monitoring wells (NE Cross section) (Sustainable Development, Water Management Plan, Xstrata, 2011).

The South Eastern Group of bores (GW12A, GW20A and GW20B), is situated directly east of the TSF near the south eastern corner of Cell 1 and form a transect. This transect does not extend up to the Surprise Creek and the nearest distance from Surprise Creek is about 240 m. Sulphate values for GW20A and GW20B are somewhat lower than GW12A. This reflects the close proximity of GW12A to the TSF which has a continuing influence on groundwater quality. All bores exceeded ANZECC guidelines on groundwater used for Agricultural Livestock Purposes (2000) applied to SO₄ on all monitoring events (see figure below) in the reporting period.



Time series data for sulphate in monitoring wells (SE Cross section) (Sustainable Development, Water Management Plan, Xstrata, 2011).

Water quality data for groundwater is provided in the table below in regards to the concentration of different analytes within and around the TSF area. The table provides concentration of analytes on monitoring wells within and around the TSF. Concentrations of analytes in GWTSF01 represent background groundwater quality.

Criteria	S04 (mg/L)	Hardness (mg/L)	As_F (µg/L)	Pb_F (µg/L)	Cd_F (µg/L)	Cu_F (µg/L)	Zn_F (µg/L)	
ANZECC (2000) for freshwater (95%)	n/a	n/a	13	3.4	0.2	1.4	8	
ANZECC (2000) for livestock	1000	n/a	500	100	10	400 - 5000	20,000	
ANZECC (2000) for irrigation	n/a	60,000 CaCO ₃ for corrosion, 350,000 CaCO ₃ for fouling	100 - 2000	2000-5000	10 - 50	200 - 5000	2000 - 5000	
Bore ID	Date							
GW6	22/12/2011	403	939	1.8	0.37	<0.2	0.15	24.2
GW12A	22/12/2011	5400	4380	<2	1.42	<0.8	1.97	8.9
GWTSF01	28/09/2011	27.3	203	8.1	1.04	<0.2	1.19	3.5
GWTSF03	28/09/2011	6960	6650	6.7	188	1.1	<0.1	9780
GWTSF04	28/09/2011	29100	30100	15.5	665	26	<10	22400
GWTSF05	28/09/2011	2860	2650	4.15	0.73	<0.2	0.49	23.5
GW18	14/12/2011	4710	2490	8.05	0.93	<0.8	2.79	52
GW19	14/12/2011	2940	2300	4.4	0.48	<0.2	0.44	27.1

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Criteria		S04 (mg/L)	Hardness (mg/L)	As_F (µg/L)	Pb_F (µg/L)	Cd_F (µg/L)	Cu_F (µg/L)	Zn_F (µg/L)
GW20A	14/12/2011	2820	3160	1	2.97	<0.2	0.93	687
GW20B	14/12/2011	3170	3230	1.5	0.62	<0.2	0.49	49
GW4	14/12/2011	2000	2520	2.45	0.3	<0.2	0.73	29.3
GW21	15/12/2011	2200	2400	4.55	0.54	<0.2	0.47	28.1
GW42A	15/12/2011	273	852	1.1	0.29	<0.2	0.51	14.1
GW42B	15/12/2011	3020	3270	2.3	0.19	<0.2	0.49	15.8
GW43A - MW01a	15/12/2011	4580	4310	3.55	0.96	<0.2	0.46	20.3
GW43B - MW01B	15/12/2011	5670	5550	<2	21.2	<0.8	3.84	1120
GW45B - MW03B	15/12/2011	5260	5510	4.75	<0.4	<0.8	1.86	37.6
GW48 - MW05	15/12/2011	6060	6140	<2	<0.4	<0.8	<0.4	18.3
GW14	22/12/2011	3720	3470	<2	23.2	<0.8	1.78	99.5
GWTSF02	13/07/2011	15900	16100	<2	209	30.6	1.38	>LWR
GW22	12/09/2011	316	649	1.75	18	3.62	<0.1	165
GW23	12/09/2011	70	533	10.5	0.19	<0.2	<0.1	29.5

The SO₄ concentration exceeded ANZECC (2000) livestock criteria for all the wells with the exception of GW06, GW42A, GW22 and GW23.

Arsenic exceeded ANZECC Freshwater criteria in one groundwater monitoring well (GWTSF04) located within the Cell 1 of the TSF.

Lead (Pb) exceeded the guideline values in four wells (GWTSF04, GW43B, GW14 and GWTSF02). Amongst these wells, GWTSF02 and GWTSF04 are located within the Cell 1 of TSF and GW43B is located NE corner of Cell 1 but within the periphery of the TSF indicating lead is still contained within the TSF and its periphery and has not migrated at an unacceptable level to the nearest Surprise Creek. Copper show minor exceedances of ANZECC (2000) Freshwater criteria in five wells (GW12A, GW18, GW43B, GW45B and GW14).

Zinc exceeded the guideline values of ANZECC Fresh water criteria in all the monitoring bores with the exception of the background bore. The Zinc concentration is very high in wells installed within the tailings (GWTSF03, GWTSF04 and GW TSF02 located within Cell 1 TSF). The zinc concentration in groundwater is relatively high (exceeding the ANZECC criteria) throughout the mine site and in the similar range as the wells located within the TSF periphery with the exception of GW20A, GW22 and GW43B. GW20A GW 22 and GW43B may have impacted by seepage concentrations observed in the remaining well within TSF periphery may be related to naturally occurring zinc mineralisation.

Results of groundwater monitoring, including sulphate levels have been summarised in the responses to Comments 23 to 27.

Monitoring and analysis has identified the likely fate of shallow seepage from the TSF is Surprise Creek. The impact of seepage that has found its way from TSF to Surprise Creek was minor and was characterised by sulphate, similar to common salt deposits. Close monitoring of this seepage in groundwater and surface water in the TSF area has found that no heavy metals have entered Surprise Creek from the tailings.

Golder Associates (June 2011) conducted a hydrogeochemical investigation of tailing storage facility. A numerical model was developed to predict the transport behaviour (migration) of the contaminants (lead and zinc) from Cell 1. Without considering any mitigation or management measures in the model, the arrival years of lead and zinc at Surprise Creek was predicted as 2092 and 2189 (considering an average value of retardation coefficient).

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However, proposed mitigation measures (as stated in EIS) would further constrain the migration of contaminants towards Surprise Creek.

A detailed hydrogeochemical contaminant transport model will be developed to consider different mitigation options (cut-off trench/seepage recovery bore/impermeable barrier etc) to predict the long term migration of contaminant, design appropriate management measures and identify the timeframes.

Surprise Creek and Barney Creek flow only during wet periods, and hence there are no long term groundwater contributions from deeper aquifer to these creeks. There could be some contribution during wet period from the shallow aquifer (alluvial).

There could be groundwater mounding in the TSF area due to excess seepage during the mine operations. Without any mitigation measures, this mounding may impact on Barney and Surprise Creeks. However mitigation measures will be undertaken to minimise the groundwater mounding (recovery bores/cut off trench/impermeable barrier wall) and to control any seepage and contaminant migration.

Long term mine related seepage entering into the deeper aquifer may not have any impact on the Surprise Creek or McArthur River. The regional groundwater contour map URS (2005) indicated that the principal groundwater flow direction from the TSF is east (towards the mine pit). Hence any groundwater seepage generated from the TSF to the deeper aquifer will migrate towards the mine pit and eventually will be discharged in the pit lake. The pit lake is predicted to be a long term groundwater sink (See Appendix O).

Furthermore, the presence of dolomite and shale in the deeper aquifer and in the portion of the pit wall has substantial capacity to neutralise /adsorb/precipitate and further attenuate contaminants. Groundwater in the deeper aquifer will be monitored to detect any potential impact. Monitoring locations are shown in amended groundwater monitoring plan (See response to comments 87, 88 and 89).

Contaminant transport modelling work will be undertaken to predict the fate of the contaminants transmitted to the deeper aquifer.

Deep aquifer contamination will be managed in the proposed TSF Cell 4 through the following initiatives:

- A liner (geo-polymer barrier) and underdrain system will be installed at Cell 4 to minimise the seepage potential for the environment.
- Seepage to the deep aquifer will be monitored by installing groundwater monitoring wells within the deep aquifer and continued to be monitored by periodic geophysical surveys and water balance.
- The available information suggests that the deep aquifer does not interact with the nearby Barney creek or Surprise Creek and will flow towards the mine pit. The deep aquifer consisting of dolomite and shale has substantial neutralising and adsorption capacity to attenuate contaminant migration. Monitoring and management options will be developed further following detailed contaminant transport modelling work.

Controls to be applied to Cell 4 (such as a liner) are discussed in the Draft EIS. Cell 3 will also be lined with HDPE. A prediction of seepage rates from the TSF has been completed recently – see response to Comment 115.

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Comment No.	EIS Section	EIS Discipline	Comment
110	s.I3.3.6	Sulfate Effects on Aquatic Fauna	<p>States:</p> <p><i>Elevated sulphate levels in the surface waters of Surprise and Barney Creeks in the vicinity of the MRM may affect biodiversity in these systems. Recent monitoring of fish diversity and abundance show there are still high numbers of resilient species within these systems.</i></p> <p><i>The biodiversity in the McArthur River may potentially be affected if the riparian vegetation between the channel and the OEF is not established effectively.</i></p> <p>MRM stated in an Environmental Assessment Forum for NRETAS, that a study was underway investigating the effects of elevated sulfates on ecosystems in Surprise Creek.</p> <ul style="list-style-type: none"> • Include results and discussion of this study in the Supplement, and/or summarise and discuss its findings to date. • Discuss future management of apparent slow instatement of riparian corridors along the new McArthur River channel

Response:

As part of an ongoing water quality monitoring program, 24 locations are sampled regularly at sites located upstream and downstream of the mining activities. Following preliminary studies, an Interim Site Specific Trigger Value for sulphate concentrations was calculated and set at 15.8mg/L. However, it has been reported that the mean sulphate concentrations varied in a downstream direction from 3.32mg/L to 15.84mg/L for the upstream sites, and from 209.09mg/L to 541.08mg/L for the downstream sites.

Fish surveys conducted in September 2011 reported that the fish populations in Surprise and Little Barney Creeks appeared abundant and healthy despite the elevated sulphate concentrations.

Thus McArthur River Mining (MRM) initiated the derivation of a site-specific high reliability trigger values for sulphate, based on ecotoxicity testing of local aquatic biota, to inform maintenance of appropriate measures for protecting the receiving McArthur River ecosystem.

Site-specific high reliability trigger values were derived through the performance of toxicity tests with regionally relevant species and the construction of species sensitivity distributions (SSD) as prescribed by ANZECC & ARM CANZ (2000).

The following species were selected as relevant species for the construction of an SSD:

- 72 h *Chlorella* sp. algal cell division rate test (chronic);
- 96 h *Lemna aequinoctialis* plant growth test (chronic);
- 48 h *Ceriodaphnia cf. dubia* (waterflea) immobilisation test (acute);
- 7 d *Ceriodaphnia cf. dubia* three brood test (chronic);
- 96 h *Hydra viridissima* (hydra) population growth test (chronic);

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- 10 d *Melanotaenia splendida* (rainbowfish) embryonic development and post-hatch survival test (chronic);
- 96 h *Macrobrachium bullatum* juvenile prawn survival test (acute).

Using the commercially available test species considered appropriate for the region, and performing toxicity tests in water obtained from the McArthur River, the concentrations of sulphate that would protect 95% of species was determined at 341 mg/L sulphate and the concentration predicted to be protective of 99% of species was determined at 123 mg/L.

The report is provided in Appendix P

Comment No.	EIS Section	EIS Discipline	Comment
111	s.I3.4.11	Pest Species Management	<p>States:</p> <p><i>More intensive, species-diverse revegetation of the main channel is necessary to create a functioning riparian system along the channel. A pest animal management plan should be implemented to control vertebrate pest animals on and adjacent to the Project site. Included in this plan should be species-specific management and, where practicable, eradication methods for terrestrial vertebrate pest animals on site in accordance with best practice. The plan is envisaged to include horses, pigs, donkeys, and unmanaged cattle.</i></p> <p>The language used in the Draft Environmental Impact Statement (DEIS) suggests the pest animal management plan is not in place or committed to yet. NRETAS supports commitment to the plan, along with increased measures to maintain cattle-exclusion fencing, control weeds and accelerate the establishment of functional riparian corridors on both sides of the river.</p>

Response:

A Pest Species Management Plan will be developed with a focus on managing the following species of concern, particularly in the context of rehabilitation management:

- Unmanaged cattle;
- Donkeys; and
- Feral pigs.

The Proponent is committed to environmental management and minimisation of environmental impacts arising from its operations. As such, MRM recognises that management of the rehabilitation process requires assessment of progress against quantifiable completion criteria and monitoring of ecosystem function.

The perimeter fencing was re-constructed in 2011 following floodwater damage in 2009-2010.

The fence aims to prevent access to the area by pest animals that have a negative impact on the success of the rehabilitation. Prior to the completion of the fencing, mustering was carried to remove all stock from inside the fence.

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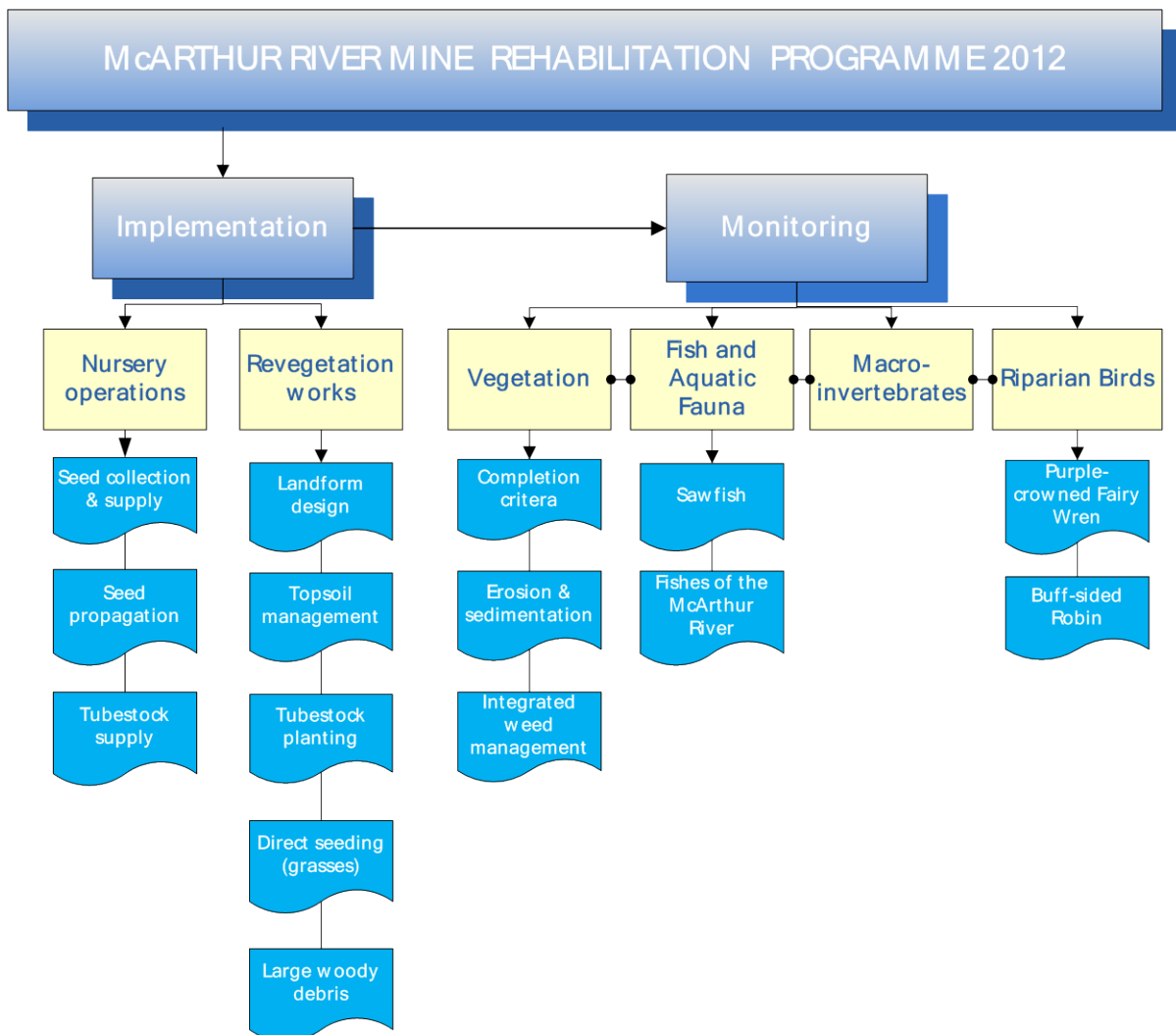
During the wet season, fences across the river and tributaries will be damaged by flood water and hence are replaced when flow has reduced. Additional mustering will be conducted following the wet season to ensure the rehabilitation areas are protected during the dry season.

Regular inspections of the fence will be conducted during the dry season (and as access permits) to ensure its integrity.

MRM has developed a Rehabilitation Management Plan that:

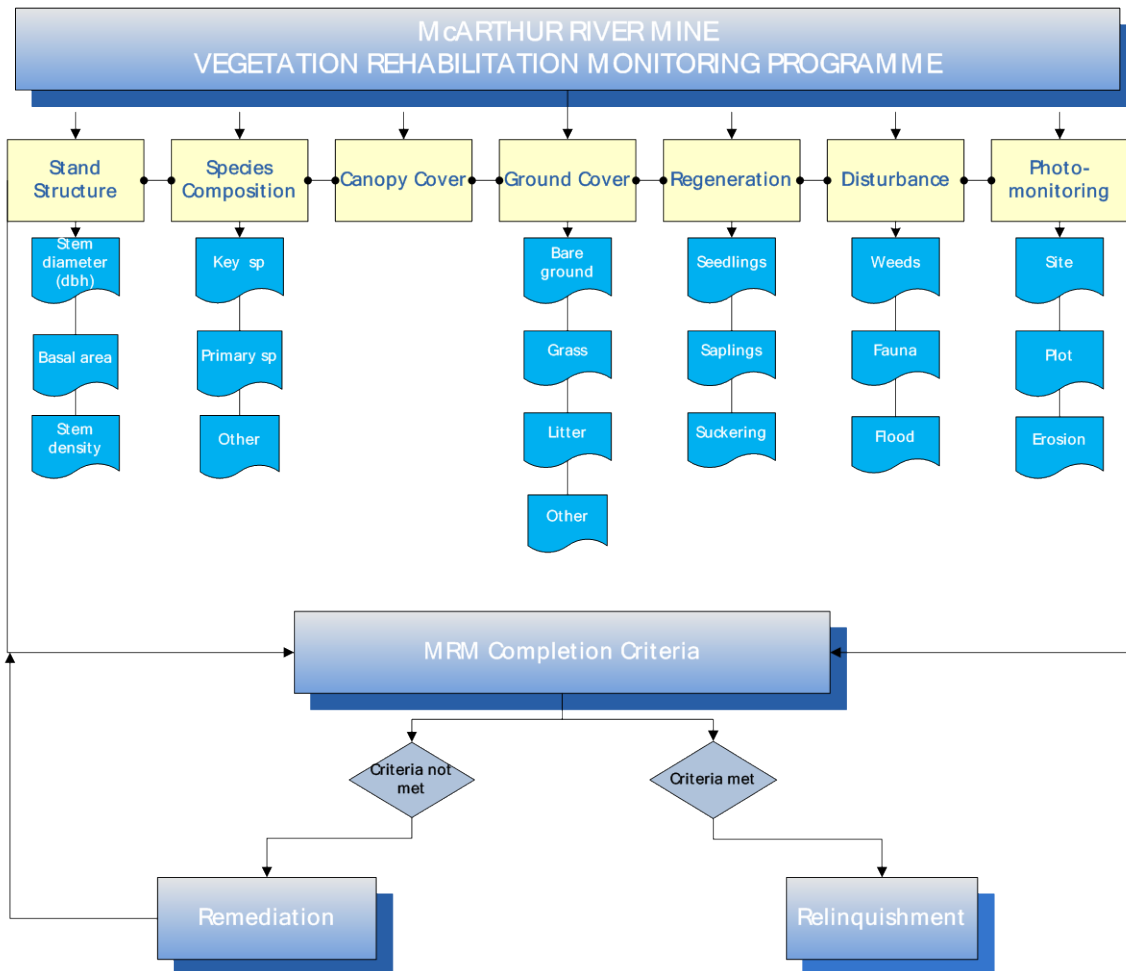
- Plans the placement of materials in a strategic manner to facilitate progressive rehabilitation and to minimise material handling costs;
- Plans studies that will enable effective techniques to be implemented when carrying out rehabilitation;
- Plans rehabilitation works that at the completion of the mining project will result in a stable, vegetated landscape having minimal impact on the surrounding environment; and
- Plans construction and rehabilitation works that at the completion of the mining project will result in stable stream channels having minimal impact on the surrounding environment.

The MRM Rehabilitation Programme for 2012 is illustrated in the figure below:



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The information gathered from the MRM Vegetation Rehabilitation Monitoring Programme is condensed into a set of indicators that form the completion criteria, and ultimately determine rehabilitation success (See figure below).



Selected indicators for monitoring vegetation at MRM.

The 2012 vegetation rehabilitation monitoring will highlight any issues with species composition and distribution and habitat development. This will assist in providing information on the ongoing management of the riparian revegetation process. It may identify issues such as:

- Vegetation cover;
- Survival rates of plants;
- Species composition; and
- Weed management.

Further information is provided in the Rechannel Rehabilitation Plan (Appendix Q)

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Comment No.	EIS Section	EIS Discipline	Comment
112	s.10.4.2.2	Evaporative Fans	<ul style="list-style-type: none"> • Discuss any potential for local environmental risks associated with spread and deposition of contaminants transported by wind-driven mists from evaporative fans. • How are mist-borne contaminants contained within water storage areas?

Response:

Six evaporation fans are currently operational located in the main pit area. An additional six fans have also been installed at the TSF. This amount may increase during 2012 depending on demands for evaporation and monitoring of the current fans. The designated water sources for the fans in the pit are from Pete's Pond whilst the designated water source for the fans at the TSF is from the decant water pond within the active TSF cell (including Cell 4 as utilised as a Water Management Dam.

The evaporative fans at the TSF will collect water in the following order of priority:

- i. The active decant water pond within the active TSF cell;
- ii. The TSF Cell 4 Water Management Dam; and
- iii. The TSF Cell 3 Water Management Dam.

MRM appointed PAE Holmes to determine the expected near and far field concentration of spray mist droplets and residual particle resulting from the proposed evaporator fans at the TSF.

The scope of the study was to:

- Determine the evaporation rate and evaporation efficiency for the fans;
- Model the expected range and concentration of spray mist from the evaporative fans for droplets and residual particles;
- Determine the weather conditions under which the evaporative fans could be operated so that spray mist or residual particles do not extend beyond the TSF footprint; and
- Determine the available opportunity that evaporative fans can be used at the TSF.

Emissions of compounds, metals and metalloids were estimated, based on physiochemical measurements and amount of water to be output from each evaporator unit. TDS and SO₄ combined to constitute approximately 81% of the contaminants contained in the TSF water. Of the metals and compounds of concern, manganese, arsenic and lead constitute 99% of the emissions.

Droplet evaporation rate and drying time were estimated using the theoretical mass transfer/diffusion equation approach. A strong negative correlation was found between evaporation rate and ambient temperature; and that there is a greater evaporation rate with wind direction from the northern and eastern directions than from the southern and eastern directions.

Spray drift modelling, including deposition of fan emissions was performed using AGDISP, a lagrangian model that predicts the motion of spray material released from ground sprays. Longer range transport of residual particles in the evaporated droplet was modelled using the US EPA regulatory model, CALPUFF. Maximum spray drift are predicted to occur under high humidity, high wind speed conditions whereas optimal conditions for minimising spray drift are low humidity, light wind conditions.

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MRM considers the fans have been effective in reducing the water inventory up to date in the pit area and studies suggest up to 38% can be lost through evaporation from fans at the TSF. MRM will continue to monitor and evaluate the data which will support the adaptive management planning of evaporative fans.

The use of evaporative fans at the site aims to reduce the amount of pit water entering the mine site management system. These fans are placed at the edge of the pit and the WMD, so that any potential contaminants present in the pit water would fall back into the pit or WMD, and be contained. The wind effect is minimal as the mine pit site is surrounded by the open cut walls and is located within a contaminated area defined by the Mine Levee Wall. The evaporation fans are however automatically operated taking into account the micro-climate conditions in the vicinity of the fans to minimise any potential spray drift away from sensitive areas. The fans are directed inland over the pit itself, and away from the McArthur River. The pit is wide enough to capture any potential mist that is not evaporated by the fans.

Comment No.	EIS Section	EIS Discipline	Comment
113	App.E2	PAF Cells	<p>Potentially Acid Forming (PAF) cells are proposed to be placed above 1-in-100 year flood lines, buried within the northern Overburden Emplacement Facility (OEF) under 20m of Non-Acid forming (NAF) waste rock. West OEF will also contain PAF material.</p> <p>[(App. E1/s. 3. 3.1) Tailings dam contents also contain 8% pyrites, high metal concentrations and have potential to produce AMD].</p>

Response:

As mentioned in Appendix E2 of the Draft EIS – Overburden Emplacement Facility Management Plan, each OEF has specific management strategies to minimise the potential for acid production. As mentioned in the Draft EIS, PAF cells in the North OEF are located above the 1 in 100 year flood event, encapsulated by clay, and covered with large amounts of NAF material. In regards to geochemistry/waste characterisation studies, the waste extracted from the pit is mainly non-acid forming (NAF). This material has either no PAF material, or a high acid neutralising capacity to counteract small proportions of PAF material that may be present.

The existing West OEF (WOEF) is located within the flood protection bund (outside of the flood zone) to the west of the open pit. As mentioned in Appendix E, as the West OEF drains back to the open pit, it can be used to store PAF overburden. The base of the PAF is above the 38 RL level, which was the 1:100 ARI flood level before the levee was installed. The PAF cells are encapsulated completely by at least 1 m of clay and is located at least 25 m horizontally and 3 m vertically from the final West OEF surface. This is to lower the risk of PAF exposure in the event of local instability. As with all OEF's the majority of the material is NAF which has a high capacity for neutralisation.

As mentioned in the response to Comment 75, tailings have been monitored regularly and have shown no signs of being acid forming. Tailings analysis has shown that it is alkaline, most likely due to the large amount of NAF material in the ore, and the subsequent tailings after processing.

A combination of all of these management techniques, in conjunction with a comprehensive modelling and monitoring program, demonstrates that MRM is actively managing the potential for acid generation in regards to all of its disturbance and landform types.

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Comment No.	EIS Section	EIS Discipline	Comment
114	App.E.2/2.4	OEF	<p>OEF Objectives states:</p> <p><i>Encapsulated PAF storage necessitates additional OEF construction objectives including:</i></p> <ul style="list-style-type: none"> • <i>limiting the potential for acid Leachate generation from the PAF cells</i> • <i>limiting water infiltration into the PAF cells</i> • <i>controlling any leachate that is generated, particularly during the construction phase of the PAF cells</i> • NRETAS recommends commitment to OEF expanded objectives to include intention to control any Leachate from PAF cells in the design, construction, operational and post closure phases, to prevent contamination of groundwater resources. This objective should equally apply to TSF designs (App.E1/s.3.1.2). The objective is partially inferred in s.I0.6.3.2, and should be committed to.

Response:

In the event of leachate from PAF cells occurring in the design, construction, operational and post closure phases, it will be assessed for impact potential and treated appropriately to prevent contamination of groundwater resources. However, the multiple lines of defence for the OEF (see Appendix E2 – Overburden Emplacement Facility Management Plan) are designed to prevent this from occurring.

The Proponent is committed to minimising the potential environment impacts from all aspects of the Project including and not limited to the OEF's and the TSF.

Further assessment to refine MRM's understanding of the OEF's and TSF behaviour and management have been scoped and will commence in June 2012. Information regarding further assessment work is provided in Appendix D.

Comment No.	EIS Section	EIS Discipline	Comment
115	ES.10; Appendix E1/s.4.3	Under-drains	<ul style="list-style-type: none"> • The future TSF cell 4 dam is proposed for construction, initially as a water storage dam in 2012. Designs as a TSF appear not to be finalised, not unreasonably since it will not be required for tailings until 2032. Under-drains are proposed to collect seepage. Provide clearer descriptions of the proposed conceptual under liner drainage designs.

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			<ul style="list-style-type: none"> • Would drainage be placed above or below a clay/HDPE layer, and above or below the initial clay base of the water dam? Discuss whether this capture method would also be used in TSF 2 and 3? • What transmission rates (whole TSF Cell, L/day) would still be expected to underlying aquifers with installation of this type of dam base? • Outline comparative risks and benefits of current design options for under-drains
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Response:

Incorporated with the TSF Cells 3 and 4 lining, underdrainage (beneath the HDPE liner) would be required to minimise uplift pressures on the lining system whilst operated as a water management dam. The configuration of the underdrainage system would be subject to detailed design, notwithstanding, it is considered that the system would comprise a herring bone configuration with drains located at maximum 100m centres and discharging at the low point. Monitoring the underdrainage system would also provide leak detection of the liner and in the event of a leak, reduce the hydraulic head and seepage through the underlying sequences.

In addition to the underdrainage, the lined cells would also incorporate above liner drainage to be installed at the commencement of tailings deposition to provide drainage of the tailings to improve consolidation and maximise tailings densities and strength. The tailings cell drainage would be subject to detailed design, notwithstanding, based on tailings physical characteristics it is envisaged that the drainage system would comprise a drainage net type product with filter.

The existing and approved TSF design includes Cells 1, 2 and 3. It is not possible to install an underdrain system for Cell 2 as this is now an active tailings deposition site. Cell 3 will be lined with HDPE to minimise seepage with the same under and over drains as Cell 4.

Seepage rates of alternative liner types were modelled by URS in April 2012. The following seepage rates were determined:

- Earthen liner (600 mm) - 8.64×10^{-4} m/day
- Clay liner (600 mm) - 8.64×10^{-5} m/day
- HDPE liner (1.5 mm) - 8.51×10^{-7} m/day

Seepage rates for the lined TSF Cell 3 and Cell 4 are modelled to be in the order of 1 to 2% of the existing TSF seepage rates.

The groundwater model was used to evaluate seepage rates using different liner designs for Cell 4, comprising earthen fill, clay or amalgamated HDPE/clay. Predicted seepage rates (vertical flux) ranged between 420 m³/day (earthen liner) and 13 m³/day for the HDPE/Clay liner. The amalgamated liner was simplified in the groundwater model to a 0.3 m thick unit to allow for convergence of the model. The vertical flux through the amalgamated liner is limited primarily by the vertical permeability of the HDPE liner and for the predictive simulation, may be considered conservative. It is likely, however, to be lower than clay liner option (205 m³/day) at the end of operation.

Fluxes from Cell 4 are influenced by active TSF Cells 2 and 3, reducing as both cells are being raised, limiting the seepage rates from Cell 4. Flux from Cell 4 increases on decommissioning of Cells 2 and 3, and the commencement of active tailings emplacement.

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The modelling simulations indicate that the magnitude of groundwater level mounding (associated with vertical seepage) in the TSF area changes - depending on the liner design for Cell 4. There are subtle differences in the mounds, where the amalgamated liner gives a smaller lateral mound than the clay or earthen liners.

The earthen fill and clay liner options for Cells 3 and 4 takes between 10 and 20 years post closure for the groundwater levels to effectively stabilise. For the HDPE/Clay liner option for Cell 4, it takes significantly longer (> 28 years) post closure for groundwater levels to effectively stabilise.

As mentioned throughout the Draft EIS and this SEIS, Cell 3 and Cell 4 will be lined to minimise impacts from the TSF. The primary risks to a underdrainage/above liner drainage systems and the design contingencies to minimise these risks are as follows:

Risk	Risk Management Approach
1. Clogging of the pipe/drainage system	To minimise the risk of clogging of the pipe and/or geotextile wraps (if employed), a graded filter/s would be designed to surround the pipe. This is particularly the case for the above liner drainage system that will be employed to assist in the drainage of the tailings.
2. Reduced drainage capacity from crushing the pipe by loading and creep effects of the drainage pipe materials	Design/installation considerations to reduce the impact of the crushing of the piping systems include: <ol style="list-style-type: none"> a. Trenching of underdrainage to create arching effect on underdrainage pipe b. Design and sizing of drainage system with consideration of crushed profile

Notwithstanding the above, failure of the underdrainage system would likely impact on the deposited tailings densities and thereby require a greater final storage volume, and rehabilitation works for the TSF cell, to the extent of creating longer time frame for tailings consolidation/settlement and reduced accessibility. These aspects can typically be managed at the operation and closure phases.

MRM is committed to the consideration and development of contingencies to minimise impacts from the TSF, including, but not limited to the reprocessing and/or relocation of residual Cell 1 tailings material. See also response to Comment 75 and 80.

Also refer to the response to Comment 9 which describes the HDPE liner properties and installation techniques.

Comment No.	EIS Section	EIS Discipline	Comment
116	Appendix E.2/3.4	PAF Management	PAF Management Concept states: <i>a NAF base is built up so that the lowest point of the PAF cell is above the 1:100 ARI level, to prevent the PAF cell being inundated. The NAF base is constructed as a series of planes with a slope of 1:100 toward dams on the perimeter of the OEF that can collect any water running off this surface.</i>

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			<ul style="list-style-type: none"> • Compare the concept of App. E2 /3.4 with what is being referred to when TSF 4 is described (in App. E1/s.4.3&4.7) as being designed with underdrains and a low permeability base. • Will the OEF PAF cell bases described above include similar standard of underdrains as per TSF cell 4, and the ability to capture (AMD) seepage that could otherwise travel vertically to deep aquifers? • If not, why not?
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Response:

There is no intention to construct underdrains as described for the TSF. The risk profile for PAF cell management within the OEF's at MRM is significantly different and much less than that of the TSF. PAF cells are encapsulated with clay and are designed to provide permanent encapsulation of PAF Material. The OEF itself (above and surrounding areas of PAF) will be capped with clay during final landform design.

During PAF cell construction clay will be utilised to encapsulate each PAF cell. Prior to each wet season the active PAF cell will be closed off and capped with Clay to minimise water infiltration during construction. PAF cells will also be protected from surface runoff from benches above the PAF layer within the OEF. Each individual PAF cell is sloped towards its purposed built PAF runoff Containment Dams PAF dam, allowing any runoff generated during PAF cell construction to be captured. . Considering these multiple lines of defence, underdrains as per the TSF beneath the NAF OEF base are deemed unnecessary. However ongoing investigations are progressing to refine the OEF development designs and as part of this work, mechanisms to provide further protection and additional lines of defence are being assessed. These measures include contouring of the OEF base to direct any potential seepage towards the PAF dams and sumps and pump back systems. An example of PAF Cell development in the NOEF is provided in Appendix G. This also provides examples of water management and seepage control during construction.

Also see responses to comments 40, 41 and 93.

Comment No.	EIS Section	EIS Discipline	Comment
117	App E2/s. 3.6.2	Clays	<p>App E2/s.3.6.2</p> <p><i>'Cracking of compacted layer Is Possible under extreme dry periods, however, the depth of the growth layer has been selected to protect the clay from drying out in these extreme periods.'</i></p> <ul style="list-style-type: none"> • Define the moisture-content range of clays at which clay cell layers will maintain their full functional ability to limit transmission of water and oxygen to contained PAF material? • Demonstrate how capping design (or other mechanisms) will maintain this moisture content around PAF-cell clay layers, particularly in light of the PAF cell's placement above the 1-in-100 year flood line. • Rate the risk and discuss consequence of clay layers cracking in the long term due to dehydration?

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			<p>Describe to what extent degradation of functionality of clay barrier layers around PAF cells could occur, due to factors such as:</p> <ul style="list-style-type: none"> • exposure in the long term to high sulfate or metal concentrations, and/or high acidity (within the cell); and • Do elevated Ca/Mg levels provide any safety margin? • high sulfates and dehydration (outside the PAF cell) • If degrading reactions are identified, what is the expected life of the proposed clay liners? • What minimum permeability coefficient will be applied to designs of PAF cell clay lining material? How will this permeability be consistently achieved in practice? • NRETAS supports recommendation by the Independent Monitor that MRM produce a technical specification for clay placement, to ensure a high level of supervision for clay placement; and to optimise compaction and moisture control for basal clay liner and lateral clay covers. MRM should discuss to what extent these recommendations will be incorporated.
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Response:

In addition to the work planned to comprehensively analyse the MRM clays long-term stability as clay liner material (see response to comment 37 and Appendix D), a geotechnical review of the NOEF cover is planned to evaluate the construction of PAF cells, NAF cover, clay liner and final cover. This work will be based on the improved understanding of the geochemistry of the MRM PAF and NAF material generated by the current geochemical investigation, and will result in the recommendation of any required mitigation measure to maintain the integrity of the clay liner - for example the use of a saturated layer of sandy clays above the final clay surface, below the growth zone.

A technical specification for the placement of clay material within the NOEF has been developed by MRM and is in use on site (MIN-TEC-PRO-1000-0026). This document is provided in Appendix F.

Comment No.	EIS Section	EIS Discipline	Comment
118	s. 5.9.11	Underground Working and PAF Storage	<p>s. 5.9.11 states: <i>The former underground workings that will be mined through as part of the Project will be transformed into the open pit. Further underground workings will remain beyond the final pit Limits. No remedial actions will be required for these as they will be flooded as the pit is inundated.</i></p> <ul style="list-style-type: none"> • Discuss feasibility of using existing underground tunnels which would remain after mining is complete, as final repositories of PAF material. Discussion should address environmental and economic long term costs and benefits.

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Response:

The volume of voids (mine workings) outside of the final pit shell is approximately 1.6Mm³ which equates to about 3.3Mt of capacity, if the total volume could be used as a repository, which is unlikely. Backfilling of low height tunnels would need to be by front-end loader or ejector tray trucks, which cannot fully fill the tunnel profile. Therefore, less than 1.5% of the 226.9Mt of PAF waste scheduled to be mined from the pit could be stored in these old underground workings. Due to the insignificant volume of material that could be stored underground it will not reduce any existing risks associated with storing PAF material above the surface, as it will not affect the size or design of the North OEF.

Further to this, the use of the underground workings outside of the final pit would require significant rehabilitation of these workings, and potentially construction of new workings where existing developments have collapsed or are unserviceable. This would include a detailed geotechnical study of the workings and installation of new ground support, which could be up to, or in excess of 30 years old, as the existing support could not be relied upon due to inundation (and subsequently dewatering) and lack of maintenance. This work would require a specialist underground crew and associated equipment, and the work would be very high risk, very expensive and time consuming.

Access to the workings would require a dedicated haul road which would in turn affect the design of the currently proposed pit. This would either increase the strip ratio or reduce the volume of economic ore.

Added to this is the logistics of getting the material from the surface to underground. This would either require the underground equipment taking the material from the surface to underground or the surface equipment hauling it to the portal and then re-handling the material into underground equipment. Neither of these options is practical. Operating underground equipment significantly increases the risk of accidents through the interaction of smaller underground equipment with the significantly larger surface mining equipment. This would also require smaller excavators as the payload of the underground trucks is not compatible with the currently proposed excavators. Alternatively, double handling of the material will result in significant cost increases due to rehandle and will also further affect the design of the pit to accommodate the additional area required for stockpiling the material (which will have similar affects as discussed above).

Comment No.	EIS Section	EIS Discipline	Comment
119	s.7.2.7.1; s.7.2.7.2	Waste Characterisation	<p>s. 7.2.7.1 defines overburden categorisation and management streams based on division into two types of potential environment impact, being:</p> <ul style="list-style-type: none"> • Potentially Acid Forming (PAF),' or • Non-Acid Forming (NAF) - which also includes Acid Consuming (AC) or neutralising material <p>s. 7.2.7.2 states: An investigation into the geochemical characteristics of the overburden ... indicated that overburden contained reactive pyrite. Also contained in the overburden was a significant amount of AC material. .. Results indicated that PAF material was restricted to zones within the upper and lower pyritic shale rock types, which had the capacity to generate a significant quantity of acid drainage.</p> <p>The W-Fold Shale and Teena Dolomite rock types have a very low sulphur content and high Acid Neutralising Capacity (ANC). These rock types are NAF and are also a potential source of highly AC material. Lower dolomitic</p>

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Comment No.	EIS Section	EIS Discipline	Comment
			<p>shares occasionally have relatively high sulphur content.</p> <p>Multi-element tests indicated that arsenic (As), cadmium (Cd), copper (Cu), manganese (Mn), lead (Pb), and zinc (Zn) are commonly present in most overburden rock types at elevated concentrations. Enrichment of these elements with respect to normal background concentrations is to be expected.</p> <ul style="list-style-type: none"> Overburden waste stream categorisation is dominated in the DEIS by characterisation in terms of potential or not of waste rocks to produce acidic drainage (as per s.7.2.7.2). Although this is of obvious importance in capturing and limiting high impact Acidic Rock Drainage, negligible consideration is provided in the DEIS of potential for, and impacts of, circum-neutral pH drainage of environmental contaminants. <p>App. E2/s.2.3 discusses seepage test results but discounts NAF drainage as being 'relatively lower' than for PAF material and apparently unworthy of discussion.</p> <p>Comparison is inappropriately made to ANZECC Livestock drinking water guidelines</p> <p>The seepage is not apparently destined for livestock drinking water. ANZECC aquatic ecosystem protection level guidelines should be applied to any discussions of seepage that could reach a creek or river, and hence should be applied to the majority of mine infrastructure, including the TSF and most OEFs.</p> <ul style="list-style-type: none"> Describe and discuss projected seepage qualities from NAF waste rock types, in terms of aquatic ecosystem protection guidelines. Describe appropriate management of circum-neutral drainage of environmental contaminants in seepage/runoff, and how MRM has applied such principles in the design of the proposed mine infrastructure. <p>Allowance is not indicated in management of waste rock streams for any potential of NAF characterised waste rock to still produce Acidic and/or Metalliferous Drainage (AMD) due to mixed-rock types, inherent heterogeneous structure of individual rocks, and/or potential for development of preferential pathways of drainage that bypass pockets of acid neutralizing capacity.</p>

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Comment No.	EIS Section	EIS Discipline	Comment
			<p>Lower dolomitic shale is described (App. E2/s.2.2) as containing pyrites, but also sufficient ANC to provide 'net' neutralisation of any acid able to be produced by the rock-type. If rocks are not homogenous in structure, potential seems to exist that at least occasional waste rock defined in overall terms as NAF, could produce quantities of AMD.</p> <p>The final categorisation decision on whether waste rock is directed to a 'PAF' or 'NAF' waste stream is based on human visual judgment (informed by a low resolution block model) rather than being based on laboratory testing. Significant potential therefore exists for inaccuracy, mixed rock types and human error. Uncertainty in characterisation accuracy suggests significant risk of at least occasional rocks generating AMD in sensitive locations, such as in OEFs beside the McArthur River.</p> <p>The DEIS states that only NAF waste rock types will be placed in the East and South OEFs (i.e. alongside the McArthur River). Based upon this assumption no management is proposed of PAF material or AMD at that location.</p> <ul style="list-style-type: none"> • On the basis of uncertainties in characterisation accuracy, and the sensitivity of the location adjacent to the river, limitation is recommended of only storing rock types with the absolute minimum chance of AMD production. Thus avoidance of storage of NAF class rock types commonly containing pyrites, such as Lower Dolomitic Shale, is recommended, to minimise risks arising from inaccurate waste rock characterisation. • Consideration and management of impacts at sensitive locations from circum-neutral pH drainage of contaminants appears also to be lacking, as discussed above.

Response:

Geochemical assessment of the NAF material conducted to date has not indicated any potential for circum-neutral drainage impacts on the environment; however both standard and specialised geochemical analysis of the NAF is currently underway. These works will also analyse seepage chemistry and assess this against appropriate guideline levels (ANZECC 2000 Aquatic Ecosystems). The results of this work will have applications for all OEFs and will be reviewed to determine the most appropriate management strategy for long-term NAF storage, particularly in areas deemed to be environmentally sensitive.

Visual assessment of the NAF/PAF does occur to confirm or deny the predictions from the block model after blasting. MRM also conducts laboratory testing of NAF materials at the OEFs to confirm that the classification process has been successful. This laboratory testing has determined that the current methodology with

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regard to visual assessments based on the block model has been highly accurate with only 1 sample classified as NAF in the field being identified as PAF in testing in the last 5 years of operation. Furthermore testing has shown that the current infield NAF/PAF characterisation is highly conservative. As such the OEF's have been designed with a 100% contingency for the volume of PAF identified in the block model.

Nonetheless, a works program to refine the current in-field NAF/ PAF characterisation methodology is underway. A site visit from an experienced and suitability qualified geochemist is planned to review the current in-field PAF/NAF classification processes and to provide an updated procedure. The review will seek opportunities to apply classification techniques independent of the block model predications, such as the use of samples from the drilling conducted to place blasting charges, while maintaining the use of geological block model predictions and visual assessment by Pit Technicians.

Furthermore, in late 2011, 915 overburden samples were collected from 18 drill holes for geochemical analysis. All of these samples are undergoing standard geochemical analysis including:

- Total Sulphur
- Net Acid Production Potential (NAPP) including:
 - Total Sulphur (S)
 - Acid Production Potential (APP)
 - Acid Neutralising Capacity (ANC)
- Net Acid Generation (NAG)
- Total Carbon (C)

These tests form the basis for Acid-Base Accounting techniques used to determine the classification of overburden material as either PAF or NAF.

Results from the standard geochemical characterisation will be reviewed and interpreted by suitably qualified and experienced geochemists to determine any necessary specialised geochemical analysis that may be required (e.g. sulphur speciation, carbon speciation, kinetic NAG testing, sodicity, dispersion, multi-element analysis, etc.) for a detailed characterisation of the overburden material at MRM. Furthermore, NAF seepage analysis (including consideration of circum-neutral drainage) will be completed to determine the nature of any potential seepage from the SOEF and EOEF.

In addition to the standard suite of geochemical characterisation analyses, the 915 overburden samples are also being tested for parameters which are used in the current MRM geological block model (maintained by Quantitative Group (QG)). This analysis includes:

- Zinc (Zn)
- Lead (Pb)
- Silver (Ag)
- Iron (Fe)
- Copper (Cu)
- pH

The results from this analysis will be used to increase the resolution and reliability of the block model and will improve the accuracy of NAF/ PAF characterisation. The Proponent is in the process of considering the development and utilisation on an onsite laboratory to assist with field based NAF/ PAF characterisation should reviews of the procedures deem it necessary.

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The principles, locations and sizing requirements of erosion and sediment controls (i.e., sediment dams, 'dirty' runoff drains, 'clean' runoff drains, and erosion protection structures) required for the segregation and management of 'clean' and 'dirty' runoff at the mine site have been identified in Section 10.4 and Appendix D3 (Section 7) as well as Appendix E2 (Section 3.7 and Section 4.5) of the Draft EIS.

In the unlikely event that PAF material is misplaced in the EOEf or SOEF, current operational procedures to identify and remove misplaced PAF material will be implemented.

The Proponent is investigating the future implementation of GPS based truck monitoring systems whereby trucks hauling PAF can be tracked from the PAF material in pit to the PAF dump. These systems can then be audited to determine if PAF material is misplaced in a NAF dump.

If, as a result of the abovementioned geochemical analysis and assessment, the emplacement of NAF material is determined to be inappropriate for the EOEf and SOEF locations identified and appropriate management strategies cannot be developed (for example the incorporation of cut off trenches, containment dams and underdrainage systems), emplacement in alternative locations away from the McArthur River will be considered and utilised (for example in an expansion of the NOEF).

Information regarding further assessment work is provided in Appendix D.

Comment No.	EIS Section	EIS Discipline	Comment
120	s.11.4.3; s.11.4.5; s.11.6.3.3	Dust/Marine Spills	<p>Recent Independent Monitor reports (2010 period) flagged dust management as an ongoing environmental issue at the Mine site and the Bing Bong Port. Fine dust, contaminated primarily with lead and zinc may be transported via wind and water where it can accumulate in soil and river/marine sediments. Elevated levels of lead and zinc were recorded in two gastropod species, as well as in surface sediments from the beach immediately west of the Bing Bong Port Facility.</p> <p>Improved dust management measures have been approved for the Bing Bong port, independent of the current proposal. However, both mine-site processing and the Bing Bong Port loading volumes are now proposed to more than double in throughput, raising the risk setting and potential for fugitive dust and marine spills. Less leeway will now exist for operations to avoid periods of high wind conditions at Bing Bong, and at the offshore barge decanting area.</p> <ul style="list-style-type: none"> • Demonstration is recommended that proposed management of fugitive dust from the expanded processing circuit will effectively control and reduce the existing levels of concentrate dust losses to the environment. • Recommendation is made that MRM maintain a vigilant dust and spill monitoring program at these sites, and ensure rigorous reactive management mechanisms are in place to investigate and mitigate any detected increases, particularly as production levels increase.

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Response:

Marine sediment sampling takes place in conjunction with the marine water sampling on a bi-annual basis. Monitoring marine sediment aims to identify any heavy metal contaminated areas and establishes spatial and temporal trends in the data. As sediment is a vital aspect of the marine environment it is important that this be monitored to ensure any contamination is minimised, it also provides temporal information regarding management and loading practices at the Bing Bong Port facility.

Additionally, an 'Annual Marine Monitoring Program' is completed by the Australian Institute of Marine Science to quantify metals and arsenic concentrations and lead isotope ratios in seawater, surface sediments and molluscs along the Bing Bong coastline. In 2010, another study by the Australian Institute of Marine Science on 'Metal Concentrations and Lead Isotope Ratios in Seafloor Sediments from the Xstrata Zinc MRM Trans-shipment Area' was conducted to determine the potential for metals dispersion via dust emission during the load out operation.

Observations made by the Independent Monitor during a site audit in May 2011 reported "We inspected the facility during the loading process and found it to be entirely closed, with no observable dust on the pavement or coming from the loading plant. Only a small amount of concentrate falls on the lowest end of the loading conveyor during loading..... we cannot rule out the possibility that small amounts of concentrate have been accidentally spilled through previous loadings, however our observation is that the loading plant and procedures appear to be satisfactory and that there is minimal opportunity for concentrate to escape during the loading process, so long as procedures are correctly followed" (Appendix R).

Along with the minimisation measures outlined in the table below, MRM will install the following instruments and equipment to monitor fugitive dust:

Tapered Element Oscillating Microbalance (TEOM) analyser.

- i. The TEOM provides near continuous monitoring of particle mass. The TEOM consists of an oscillating tapered tube with a filter on its free end. As particles land on the filter, the filter mass change is detected as a frequency change in the oscillation of the tube. The mass change and the flow rate through the system provide a measure of the particle concentration. Is typically operated at 10-minute intervals.
- ii. Relates to Australian Standards AS 3580.9.8-2001: Method for sampling and analysis of ambient air- Determination of suspended particulate matter – PM10 continuous direct mass method using a tapered element oscillating microbalance analyser
- iii. Operation at 10-minute intervals, allows detailed comparison with meteorological conditions
- iv. Data is stored at regular intervals
- v. The TEOM can be configured with an alarm system that is set off when Trigger Levels are exceeded, which is useful for management purposes

Mini Vol® Tactical Air Sampler

- i. Low volume sampler that collects particles by drawing a constant flow rate of ambient air through filter paper using a small pump
- ii. Provides a quantitative sampling and measuring technique for particle pollutants (active)
- iii. Operated over a 24 hour period
- iv. Relates to the following Australian Standards:
 1. AS/NZS 3580.9.92006; Methods for sampling and analysis of ambient air- Determination of suspended particulate matter – PM₁₀ low volume sampler – Gravimetric method;
 2. AS/NZS 3580.9.10.2006: Methods for sampling and analysis of ambient air- Determination of suspended particulate matter-PM_{2.5} low volume sampler – Gravimetric method;

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Project dust minimisation measures

Source	Minimisation Measures
Mining Areas	<p>Disturb the minimum area necessary for mining</p> <p>Rehabilitate disturbed areas promptly</p> <p>Remove overburden and emplace as soon as practicable after blasting</p> <p>Avoid topsoil stripping and replacement on high wind days, where practicable</p> <p>Vegetation barrier between the ROM Pad and main road</p>
Bing Bong	<p>Install a dust extraction system at the concentrate storage shed</p> <p>Install fast opening/closing doors at the unload ramp to prevent dust escaping from shed as haulage vehicles unload</p>
Stockpiles	<p>Water ore stockpiles when necessary</p>
Processing Plant	<p>Install windbreaks at the crushing and grinding points upwind of sensitive receptors if required</p> <p>Various emission points will be hooded and use water sprays to prevent dust emissions</p>
Haul Roads	<p>Maintain haul roads in good condition and regularly use water trucks</p>
Other Roads	<p>Keep number of other active roads to a minimum, maintain those required in good condition and regularly use water trucks</p> <p>Barricade and revegetate once a road is no longer in use</p>
OEFs	<p>Keep areas moist, particularly areas used by dump trucks</p>
General	<p>Strictly limit vehicular access within the site to authorised vehicles and designated routes - i.e. bitumen and major haul/access roads</p> <p>Limit the internal speed on unsealed roads, as required</p> <p>Keep dump truck routes as short as practicable</p> <p>Statistical software to improve current interpretation and reporting</p> <p>Review design of dust monitoring locations</p>

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Comment No.	EIS Section	EIS Discipline	Comment
121	Appendix D7, Appendix D8, Chapter 13 and Chapter 19	Biodiversity	<p>A total of 1,200 ha of native vegetation will be cleared within the existing mining lease, with 706 Ha of this due to the Phase 3 proposal.</p> <ul style="list-style-type: none"> • Appendix D "Terrestrial and Aquatic Fauna" in DEIS contains results of a fauna survey in the project area. The survey sampled only four sites. Given the relatively large area of native vegetation to be cleared for the project, this represents inadequate survey effort It's noted that there has been considerable number of historical surveys within and adjacent to the mining lease, but this does not account for movement of new species into the project area. • Four community types of native vegetation are identified as being affected by the proposal, including two lowland eucalyptus communities and two riverine/riparian communities. All of these communities are of reasonably wide extent in the region and in the Top End of the Northern Territory • The DEIS states that no EPBC listed flora species nor any flora species that are critically endangered or threatened will be impacted by the proposed development, based on a number of surveys undertaken for this and previous environmental assessments However it should be noted that riparian vegetation and closed forests typically associated with waterways are considered "significant and sensitive vegetation" . • The NT Planning Scheme section 10.2.3(a) states that "the clearing of native vegetation is to avoid impacts on environmentally significant or sensitive vegetation" and Section 10.3.2(c) states that "an application for the clearing of native vegetation is to demonstrate consideration of the presence of sensitive or significant vegetation communities such as rainforest, vine thicket, closed forest or riparian vegetation" . Any future development and removal of native vegetation should also consider the current presence of a number of exotic weed species including weed species of national significance.

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Comment No.	EIS Section	EIS Discipline	Comment
			<ul style="list-style-type: none"> The draft EIS contains no specific statement with regard to the use of native species in the rehabilitation of disturbed or mined areas. The EAF presentation on the 24th February 2012 indicated that native species are used but this not reflected in the document. It is an important aspect if rehabilitation is to be used as a key mitigation action for biodiversity on the mining lease. The EMP associated with the Draft EIS does not contain sufficient monitoring of the riparian vegetation and aquatic ecosystem. It's stated that native vegetation buffers will be used to mitigate impacts. The EAF presentation on the 24th February 2012 indicated the rehabilitation of stream banks had not been as successful as expected. The results of this and other management actions that have been recently implemented to improve the efficacy of rehabilitation efforts. in riparian areas should be provided in the Supplement. This activity has implications for management of purple-crowned fairy wrens, and clarification is required on what criteria will be used to assess the condition of suitable habitat for the species with regards to relocation into suitable habitat.

Response:

In reference to the flora and fauna assessments conducted for the Project, the surveys undertaken focused on the potential areas of impact (Project footprint areas). The surveys were a verification exercise of areas that had already been surveyed for past assessments, and operations flora and fauna monitoring. This targeted survey approach was adopted because of the large number of previous surveys that have been undertaken onsite and a large database of existing information.

Existing data on flora and terrestrial and aquatic fauna for the McArthur River Mine area are particularly robust in terms of species inventory and catalogue of threatened species, resulting from numerous environmental studies, as well as current and ongoing monitoring surveys. Research undertaken to date includes:

- database searches to determine lists of species known to occur, or potentially occurring in the area, particularly with reference to species of conservation significance
- literature reviews to obtain background or historical information on the biodiversity of the area
- summary review of several ongoing terrestrial and aquatic fauna monitoring programs currently in place at MRM
- field verification surveys incorporating quantitative and opportunistic sampling in the proposed Project expansion areas and an assessment of fauna habitats and current conditions.

An assessment of potential impacts on flora and terrestrial and aquatic fauna was undertaken based on the findings of the above studies. The flora study plots were selected at key locations to identify plant

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communities in areas proposed for the Project's mining operations. Prior to fieldwork, a desktop review of existing information identified priority flora species and communities for assessment during field surveys. Habitats potentially supporting species of conservation significance were targeted to assess species occurrence and important ecological systems were assessed in relation to potential environmental impacts. Plant species in study plots were recorded, as well as opportunistic records outside of study plots, to comprehensively record the species within the Project area.

Given the significant understanding of the ecology of the area and the minimal small likelihood of previously unrecorded species moving into the mine area (particularly considering it's increasingly disturbed condition, MRM considers the survey effort to be sufficient. Under the 'exceptions' of the Northern Territory Planning Scheme, the Scheme does not prevent the conduct of any mining activity under any mining interest. The requirements quoted therefore do not directly apply to MRM or the Project. However MRM recognise that riparian vegetation holds environmental value and efforts to minimise disturbance of these areas have been employed. With regard to the reference to "significant and sensitive vegetation" the paragraph quoted in the draft EIS is simply discussing vegetation in the context of applicable legislation, namely the EPBC Act.

Before any vegetation clearing or digging can be undertaken on site a Permit to Clear and or Permit to Dig must be obtained under the MRM Land Clearing And Digging Permit Procedure. This permit procedure ensures that activities at MRM comply with requirements regarding disturbance to ground or vegetation with respect to health and safety and environmental and cultural heritage issues. This procedure is reviewed annually and would apply to the Project.

As discussed in the draft EIS, MRM operates in accordance with a Weed Management Plan. This document provides procedures for weed identification and management and considers weed species of national significance.

Native provenance species are preferred but due to the remoteness of the mine this cannot always be achieved. Local seed collection will be carried out by the rehabilitation technician in 2012 and entered into the MRM seed register developed to identify species location and phenology for future collection.

External seed supply is currently sourced through Top End Seeds and Greening Australia. The quantity of seed collected each season will ultimately determine the final species mix and will be dependent on the season.

Seedling tenders are sent to wholesale nurseries in Darwin to determine the appropriate supplier. Several seedling species will also be grown within the MRM onsite greenhouse by MRM staff using sexual and asexual propagation techniques.

Species selected for revegetation works aims to develop a plant community that will:

- Return disturbed areas to an agreed post mine land use;
- Maintain the biodiversity of the area;
- Provide long-term and sustainable revegetation, consistent with existing vegetation communities in the area;
- Stabilise stream bank erosion;
- Provide micro-habitat for aquatic fauna; and
- Re-establish fragmented habitat utilised by riparian habitat specialist birds as identified in the EIS. For example Cane Grass (*Chionachne cyathopoda*) which is a favoured habitat for the Purple-crowned Fairy-wren and Freshwater Mangrove (*Barringtonia acutangula*) for the White Browed Robin.

In 2007 MRM direct seeded the McArthur River and Barney Creek rechannelling corridors prior to the first rains of the wet season. The programme's success was limited by:

- Heavy rainfall events and subsequent wet season flooding dislodged the seed bank; and

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- Newly germinated seedlings had insufficient root development for anchorage to withstand the flow rate of flooding.

Since 2008 seedlings propagated in 50ml tubes (tubestock) has provided the most successful method of plant establishment and survival, however native grasses are established by direct seeding and separation from motherstock.

During 2009 it was evident that major plantings should be conducted during the dry season. This accommodated access to potential planting sites and allowed adequate time for the seedlings to potentially develop sufficient root structure to withstand the subsequent wet-season water velocities. Revegetation works in the base section of the channel are carried out after wet season sedimentation. Deposited sediment provides a more favourable planting medium. Plantings must be irrigated during the dry season to maximise survival and plant growth.

Since 2007 approximately 30,000 tubestock have been planted at Barney Creek and a further 50,000 tubestock have been planted along the McArthur River channel.

Further information on the rehabilitation of riparian vegetation, including species selection, success criteria and monitoring is provided in the Rechannel Rehabilitation Plan (Appendix Q).

Comment No.	EIS Section	EIS Discipline	Comment
122	App. D12; s.4.3.12; s.10.4.2.4; s.10.4.2.7.5	Irrigation	<p>Use disposal of intercepted groundwater offsite for/via irrigation is presented in conceptual terms only, as an investigation of options, rather than as a firm proposal. No location details are provided, except to state (s.4.3.12; s.10.4.2.4) that the irrigation would planned to be on the adjoining McArthur River Pastoral Lease, rather than on the mining lease. Appendix D12 states: <i>All options will require some degree of clearing of existing native vegetation. Capacity to secure environmental approvals to allow clearing will need to be established.</i></p> <p>As the proposal would involve land clearing off the mine site, NRETAS confirms that a land clearing permit would need to be applied for under the <i>NT Pastoral Land Act</i>. Examination of issues relevant to the selected site would be undertaken during that permit application process.</p> <p>Irrigation on Pastoral Land should be informed by ANZECC water quality guidelines (2000) Chapter 4 - Primary Industries, and advice from the Primary Industries Division of the NT Department of Resources.</p>

Response:

The irrigation study is currently at a concept level and more investigation is required. Alternative locations both on and off pastoral land are being considered. As the proposal could involve operation on pastoral land, the Proponent would obtain the necessary approvals and permits (if required), such as that under the NT Pastoral Land Act. Examination of issues relevant to the selected site would be undertaken during that permit application process, such as irrigation water quality and the potential impacts of irrigation on the soil types irrigated. Irrigation on Pastoral Land would be informed by ANZECC water quality guidelines (2000) Chapter 4 - Primary Industries, and advice from the Primary Industries Division of the NT Department of Resources. Information obtained from the existing monitoring program will be used, including trigger values.

The ANZECC water quality guidelines are already included in the MRM Legal Compliance Register.

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Comment No.	EIS Section	EIS Discipline	Comment
123	s.3.4.17; s.5.9.5; s.10.5.3.6	Closure Plans	<ul style="list-style-type: none"> • Considerable uncertainty remains in relation to acid generation and seepage Leachate (much of which is based on 2005 data and modelling) and strongly indicates that there will be significant legacy costing in remediation. <p>Legacy Pit (Lake)</p> <ul style="list-style-type: none"> • Post closure, the quality of the pit water is expected to decline overtime due to evaporation (s.5.9.5). NRETAS has identified that due to the positive head induced by the pit water, the alluvium and weathered bedrock aquifer may act as a pathway for the movement of this low quality water down gradient towards McArthur River. MRM have addressed the necessity of a post mine closure groundwater monitoring program, however specific locations and frequency have not yet been determined as part of this EIS. • NRETAS considers that the creation by design of a scenario of ever-degrading water quality in the legacy pit is against principles of Ecologically Sustainable Development, and not in the interests of future generations or ecosystems. <p>NRETAS recommends commitment to an objective of maintaining sustainable water quality in the pit lake post-mining, sufficient to maintain healthy aquatic ecosystems, without causing detriment with those in the surrounding region.</p> <ul style="list-style-type: none"> • NRETAS recommends thorough identification and mitigation in this design phase of mine-site elements (for example, design of PAF containment in the West OEF), which could negatively impact on post mining options to develop self-sustaining, bio diverse aquatic and riparian ecosystems in and around a future pit lake • Discuss reasoning behind the decision to isolate the final pit lake from the McArthur River, and allow pit lake water quality to degrade • How will the pit water level compare with seasonal water levels in the McArthur River, in the long term? • How will pit walls containing exposed PAF material and generating AMD be managed? • TSF seepage is proposed to be pumped to the open pit for a number of decades post mining.

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Comment No.	EIS Section	EIS Discipline	Comment
			<ul style="list-style-type: none"> • Will 'contaminated' seepage be treated/remediated prior to discharge into the pit? • Is a commitment made to remediation of AMD seepage before its discharge to the pit? • Is commitment made for remediation of any long term AMD seepage issuing from the OEFs, or other mine site infrastructure, prior to discharge to the open pit? (s.10.3.6.2)

Response:

Pit lake water level rebound is estimated as -15 m AHD. Groundwater level rebound is estimated as 18 m AHD. The seasonal water level in McArthur River varies between 21 m AHD to 40 m AHD. This available information to date (hydrogeological investigation and modelling on post-closure groundwater rebound of groundwater and the pit lake level including assessment of major rainfall event (ARI 100 years and water level responses) suggest that the pit lake will form a long term groundwater sink. Hence, the pit lake would be too low to result in outflow and thus it will not have a significant impact on surrounding groundwater resources.

Analysis undertaken by RPS indicates that even in the peak rainfall event (8 January 1940, 300 ML rainfall), the pit lake level will remain as a groundwater sink (i.e, 31 m below the predicted post mining groundwater level) and no overtopping of water from the pit lake will occur.

In terms of the legacy pit, MRM propose to achieve the principles of ESD by containing pit water within the pit, minimising potential impact on the surrounding environment.

The option provided in the Draft EIS to isolate the final pit lake from the McArthur River is not final, and will be reviewed throughout the life of the project. Lessons learnt from other projects and many years of research and practical application will be considered before the final closure option for the pit is finalised. This process will be ongoing throughout the life of the Project, where new advances in technologies and methodologies will be adapted to produce the best practicable outcome for the management of all disturbance areas on site.

An advantage of isolating the final pit lake from McArthur River is that the final pit lake is a groundwater sink and water will remain confined from the surrounding environment. Considering this, there would be no outflows into the surrounding aquifers or surface water features. It is estimated that the water level in the pit lake would not over-top during peak rainfall events (100 ARI) and hence the surrounding surface water will not be contaminated from the pit lake water.

Further work will be undertaken to predict the water quality of the final pit lake. The scope of work will include the following:

- Review of the available geochemical data on waste rock, tailings material and final open pit wall (including kinetic leach test data)
- Review the water quality data (groundwater from different subsurface units (alluvium, shale and dolomite), surface water runoff, water quality of the tailing dam and water quality from the overburden emplacement facility (OEF)
- Identify if there is any data gap on the geochemical data (adequacy and representative of each lithological units) for detailed geochemical modelling to predict pit lake water quality

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- If data gap is identified then conduct further testing and analysis
- Review the existing geochemical model (URS, 2005)
- Develop a detailed conceptual model for pit lake water quality prediction that includes the following process:
 - Groundwater inflow to the pit (quantity and quality) including contaminant load or acid neutralisation capacity
 - Surface water inflow to the pit (quantity and quality) which may involve the following
 - Contributions from the tailing storage facility (TSF)
 - Contributions from the overburden emplacement facility (OEF)
 - Contributions from the pit wall surface
 - Sum of flows of all the water sources and concentrations
 - Evaporation
 - Precipitation
 - Geochemical equilibration
- Development of a numerical dynamic model to predict pit lake water hydrochemistry which will involve the following processes:
 - Pit lake hydrological processes involving groundwater inflow/outflow (considering , pit lake area, geometry and elevation)
 - pit wall runoff including contribution from OEF, tailings and pit wall containing PAF material (considering, pit lake area, geometry and elevation)
 - Chemical interactions of water from different origins
 - Neutralising capacity of groundwater from dolomitic rocks and dolomitic pit wall.
 - Limnological processes
 - direct precipitation and evaporation
 - The numerical modelling will be completed using commercially available industry standard software (e.g, Phreeqc, Goldsim etc).
 - The modelling will predict the water quality of the pit lake with time and will be updated and recalibrated with additional information as required. A conservative modelling approach will consider contaminant load from TSF, OEF and pit wall PAF material. Several scenarios of contaminant load will be considered in the model.
 - Depending on the prediction of water quality from the model, alternative management (remediation if required) and monitoring options will be investigated

This process of continuous improvement may change the preferred closure outcomes for the various disturbance categories on site, such as the pit, OEFs and TSF.

As detailed in the Draft EIS, MRM will implement a post-mine closure groundwater monitoring program, with specific locations and monitoring frequency to be determined prior to closure. At this stage, it is proposed to monitor post-mine groundwater level in five monitoring bores surrounding the open pit. The detail of frequency of monitoring will be provided in a post closure groundwater monitoring program.

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Design of PAF containment in the OEF including west OEF is provided in Appendix E2, Section 5.

Alternative monitoring and management options will be developed following the detailed hydrochemical modelling of the pit lake and considering environmental objectives. With regards to the management of PAF material in the pit wall, see response to Comment 34.

Depending on the prediction of final void water quality from the model, alternative seepage management (including remediation if required) and monitoring options will be developed and implemented. It is likely that TSF seepage water quality would be better than that occurring in the pit, so at present there are no plans to treat this water before it is pumped into the pit.

Comment No.	EIS Section	EIS Discipline	Comment
124	s.5.9.5	Alternative Pit Lake Options	<p>Compare the proposed closure plan for a contaminated pit lake with alternatives, in the context of:</p> <ul style="list-style-type: none"> • Principles of ecologically sustainable development, and MRMs responsibility to future generations; • Feasibility; • Economic costs and benefits (including legacy costing of mine-site remediation); and • Ecological costs and benefits, including potential long term impacts on local groundwater quality and McArthur River ecosystems. <p>Consider alternative options listed in s.5.9.5, as well as options of:</p> <ul style="list-style-type: none"> • Final storage and encapsulation of high risk PAF material in the final pit void; and • Alternatives currently available to treat collected 'contaminated' seepage prior to discharging it to the open pit.

Response:

The available information indicates that the pit lake will remain as a groundwater sink and thus there would be no pathways for any outflow from the lake to the surrounding aquifer or to the nearby McArthur River. Hence, the pit lake would not pose a risk to the ecological sustainability of the surrounding ecosystem. Detailed pit lake water hydrogeochemical modelling will be undertaken to predict the long term pit lake water quality and investigate alternative management options with regard to sustainable management and will commence in June 2012. Information regarding further assessment work is provided in Appendix D.

Owing to the vastness of the proposed mine void and based on the fact that the nature of mining will not permit backfilling during mining (Water and River Commission, Western Australia 2003) and the pit lake will remain as a groundwater sink; the contained pit lake option is considered a favourable option.

It is not feasible to backfill the entire pit with overburden extracted during the mining process, as this involves double handling of material and makes the Project unviable.

At this stage, isolating the pit from the McArthur River minimises the potential interaction between the pit and the surrounding environment. Potential water quality impacts will be confined to the pit itself. Monitoring to date has not indicated significant impacts are occurring from the pit on groundwater.

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The geochemical modelling of the pit lake will be an ongoing task during mine development, leading to model validation with monitoring data and subsequent refinements to models, and investigation and optimisation of final pit management plans.

The Closure Plan submitted as part of the EIS will be refined throughout the life of mine, and be produced in detail prior to mine closure, which will include the final land use and configuration for the pit.

Also see response to Comment 89.

Alternative options

The feasibility of alternative options will be assessed in terms of balancing potential reduction in beneficial use of water resources against the overall economic and social benefits. This will include the final storage and encapsulation of high risk PAF material in the final pit void.

The following alternative option will be investigated further:

- Feasibility study - Cost benefit analysis of encapsulation of high risk PAF material (including environmental, geotechnical and economic implication)
- Hydrological analysis on the availability of water to keep PAF material saturated
- Further groundwater, pit lake level and hydrogeochemical modelling considering encapsulation of PAF material. This will predict the status of the pit lake (groundwater sink/through flow/groundwater recharge) or its evolution from groundwater sink to through flow or groundwater discharge and the long term pit lake water and pore water quality of the encapsulated PAF within the mine void and potential outflows (quantity and quality).
- Provision of hydrogeological information as input to inform the assessment of impact to the downstream environmental receptors following the modelling exercise.

Alternatives currently available to treat collected 'contaminated' seepage prior to discharging it to the open pit will be investigated.

Also see response to Comment 123.

Comment No.	EIS Section	EIS Discipline	Comment
125	s.5.9.11	Underground Workings and PAF Storage	<p>s.5.9.11 states: <i>The former underground workings that will be mined through as part of the Project will be transformed into the open pit. Further underground workings will remain beyond the final pit limits. No remedial actions will be required for these as they will be flooded as the pit is Inundated.</i></p> <p>Discuss feasibility and outline risks of using existing underground tunnels which would remain after mining is complete, as final repositories of PAF material.</p>

Response:

Please see response to Comment 118 above.

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Comment No.	EIS Section	EIS Discipline	Comment
126		West OEF Closure	Discuss why the West OEF closure plan doesn't include a 20m covering of NAF rock, as proposed for the Northern OEF?

Response:

Please see response to Comment 44 above.

Comment No.	EIS Section	EIS Discipline	Comment
127	Chapter 14	Heritage	<p>Archaeological surveys in 2005 located a number of sites. Of these a number were destroyed/disturbed with permission in the expansion of the mine. One site, MRM4 was considered highly significant and was preserved and avoided by any works. However, <i>Table 14-5 Summary of potential impacts on identified sites within the EIS</i> (page 14-8) indicates that the edge of the MRM4 site may be impacted by the Phase 3 Development Project. In <i>Table 14-7 Mitigation measures for archaeological and historical sites</i> of the EIS, the archaeological consultant recommended however, that this site continue to be preserved and avoided during any future works, along with site MRM3.</p> <ul style="list-style-type: none"> • NRETAS supports this recommendation and would like to see that the site MRM4 in particular be monitored during the expansion of the North OEF. <p>More recent (2011) surveys have again discovered some archaeological sites and these may be impacted on by the expansion of the Phase 3 Development Project. The recommended mitigation measures made by the archaeological consultant include applying for permission to destroy/disturb the sites considered to be of low significance after detailed recordings of those sites• NRETAS supports this recommendation</p> <p>The Cultural Heritage Management Plan also states that an archaeologist will be made available when clearing and earthworks activities are conducted to ensure that any new archaeological sites discovered are documented and a rapid response plan will be implemented to ensure that NRETAS is contacted in the event of the discovery of any archaeological/heritage objects. MRM also commits to all employees and contractors undergoing Cultural Heritage Awareness Training.</p>

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Comment No.	EIS Section	EIS Discipline	Comment
			<ul style="list-style-type: none"> • NRETAS also supports these recommendations • If the above recommendations are followed and feedback provided on the status of archaeological site MRM4 during the Phase 3 Development Project, then there should be no further heritage or archaeological issues associated with this project until the next phase of expansion.

Response:

MRM acknowledges NRETAS' support for the recommendations described above and commits to their implementation as part of the Project. Site MRM 4 is not proposed to be disturbed and the mitigation measures proposed will be implemented to protect it, in its entirety from disturbance.

Comment No.	EIS Section	EIS Discipline	Comment
128	Chapter 11	Greenhouse Emissions	<p>The NT Government recognises that climate change is a serious environmental threat with significant social and economic impacts. Government has committed to the development of new land clearing regulation that provides a basis for climate change impacts to be included in land clearing decisions. This commitment recognises that vegetation clearing contributes significantly to greenhouse gas emissions from the Territory through the loss of stored carbon from existing vegetation and emissions of carbon dioxide (CO₂), methane and nitrous oxide from the burning and decaying of cleared vegetation.</p> <p>In meeting this commitment, NRETAS expectation is that any approval given for land clearing recognises the greenhouse implications of the activity and aims to minimise the Impact.</p> <p>The proposed land clearing for McArthur River Mine Phase 3 (exclusive of any offsite irrigation plans) will result in significant greenhouse gas emissions.</p> <p>It is estimated that the proposed clearing of 706 ha of native vegetation on this site will result in net greenhouse gas emissions of approximately 104 521.74 tonnes of CO₂-equivalent after five years from clearing. These calculations are based upon computer modelling of emissions using Full CAM, the Australian Government model for tracking the greenhouse gas emissions and carbon stock changes associated with land use and management. This method derives estimates from knowledge of environmental determinants of vegetation structure and density and soil carbon in the proposed area, but does not take account of the history of the site, which may affect vegetation pattern and storage of carbon.</p>

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Comment No.	EIS Section	EIS Discipline	Comment
			<p>These estimates nonetheless provide a useful indication of the scale of emissions expected from proposed clearing in the area indicated. A more precise estimate would require additional information to that provided by the proponent in the clearing application. The Department can advise on methods for site-specific estimates of the above ground carbon that is most immediately affected by land clearing, and groups who are competent to generate such estimates.</p> <p>These estimated emissions represent approximately 0.601%, of the total annual greenhouse emissions from the Northern Territory.</p> <p>Furthermore, the estimated emissions from this proposal are valued at approximately \$2 404 000, based on the price of greenhouse gas emissions under the Australian Government's Clean Energy Future legislation. This represents an indication only of the economic cost of the proposed clearing from a greenhouse emissions perspective.</p> <ul style="list-style-type: none"> The proposal has significant implications for the emission of greenhouse gases. It is recommended that in order to minimise greenhouse gas emissions the total area of clearing be reduced as much as possible. Areas of existing native vegetation should be retained wherever possible.

Response:

MRM commit to the minimisation of native vegetation clearance where practicable to minimise the greenhouse footprint of the MRM operation. Operational and approval limitations (for example OEF height limitations) must be considered and often influence the 'footprint' of the Project.

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