2.0 Modified Project

2.1 Open Cut Project

MRM proposes to change the McArthur River Mine from an underground mine to an open cut operation. The underground mine was closed in April 2006 and it is planned to be replaced with an open cut mine. The objective of this change is to enable mining operations to continue for an additional 25 years, and to increase mine production from 1.6 mtpa to 1.8 mtpa.

Open cut mining will involve the following key activities:

- Development of an open cut to access the ore body
- Realignment of the McArthur River and Barney Creek around the proposed open cut
- Construction of a flood protection bund around the open cut, and associated infrastructure facilities, to prevent floodwaters inundating the operational areas.

As part of these key activities, the following operations will be undertaken:

- Excavation of the alluvial cover materials that overlie the ore. This material will be used for construction purposes, encapsulation of other waste rock, and rehabilitation
- Excavation of overburden above and in between the various orebody levels. This waste rock will be placed in overburden emplacement facilities
- Excavation of ore from the open cut. The ore will be hauled to the run-of-mine pad where it will be fed into the existing ore processing plant
- Transport of the lead-zinc-silver concentrate to the port at Bing Bong for export in the same manner used for the underground operation
- Rehabilitation of the disturbed areas in accordance with statutory requirements and agreed post-mine land uses.

Further details of the proposed Open Cut Project are provided in Section 4 of the Draft EIS (URS, 2005a).

2.2 Project Modifications

During the preparation of the Draft EIS and EIS Supplement, numerous strategies were developed to reduce the project's environmental impact. These strategies related to components of the project's design and operations as well as the ongoing environmental monitoring program.

As noted in Section 1.4, since the release of the EPA's Environmental Assessment Report (EPA, 2006), further improvements have been made to the project's design. These include a number of the recommendations in a review of the river diversion by Professor Wayne Erskine (Erskine, 2006), commissioned by the EPA. The strategies suggested by Professor Erskine and adopted by MRM have

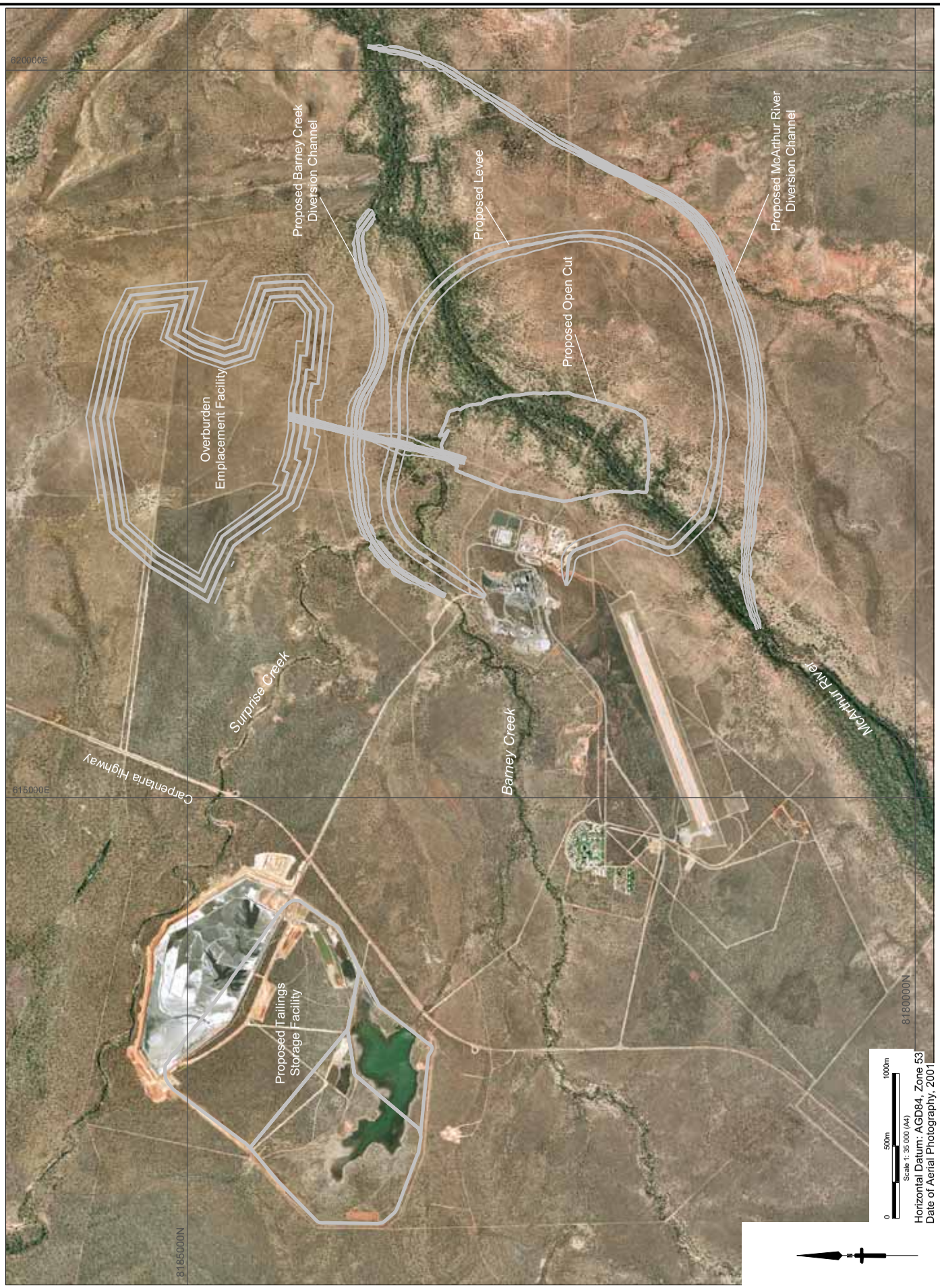
resulted in a modified project with reduced environmental impacts, compared with those assessed in the Draft EIS and EIS Supplement.

Since the release of the PER guidelines, and following discussions with the relevant government agencies and Professor Erskine, additional hydrological modelling has been undertaken and additional biological surveys have been conducted. Input has also been sought from a rehabilitation specialist and a tropical ecology specialist, to ensure that the final geomorphological form of the river diversion will be stable and ecologically sustainable.

The major modifications to the project compared with that described in the Draft EIS are:

- Incorporation of large woody debris in the river and creek diversion channel with defined spacing and orientation
- Provision of rock placement on the banks of the alluvial sections of the new river/creek channels
- Grading of rock placement on the alluvial banks with soil media placed within voids between rocks, for improved plant establishment
- Incorporation of riffle features along the bed of the diverted river channel in the alluvial section to reduce stream power and flow velocities
- Revised planting specification with respect to species, seed sources, planting densities, vertical zonation of species etc.
- Provision of crevices in banks along rock section of diversion channel
- Incorporation of stream bed stabilisation strategies in critical areas such as timber piling (groynes)
- Modification to the alignment, section and grade of the Barney Creek diversion to improve stability and to better replicate the hydraulic performance of the existing creek
- Replacement of the previously proposed low level culvert crossing of the haul road across Barney Creek diversion with a bridge
- Provision of contoured drainage to sediment ponds around the base of the flood protection bund and the tailings storage facility
- Significant expansion of the environmental monitoring program
- Relocation of the overburden emplacement facility so that it does not disturb the identified significant archaeological site MRM4
- Implementation of a 25 year community engagement strategy
- Support for the socio-economic sustainability of the Borroloola region.

Table 2.1 lists these modifications to the project as described in the Draft EIS and summarises the objectives/specifications and benefits/costs of each modification. The layout of the modified project is shown on Figure 2.1.



xstrata

URS

McARTHUR RIVER MINE
OPEN CUT PROJECT
PUBLIC ENVIRONMENTAL REPORT

LAYOUT OF MODIFIED OPEN CUT PROJECT

Drawn: VH	Approved: CMP	Date: 29-06-2006
Job No: **42625552**	File No: 42625552-g-215.wor	

Figure: **2.1**

Rev: A

A4

Table 2.1

Summary of Project Modifications

Project Modification	Objective/Specification	Benefit/Cost
Incorporation of large woody debris in the river and creek diversion channels with defined spacing, and orientation.	- Mimic existing river channel - Create microhabitats for aquatic fauna - Reduce stream power and flow velocity.	- Increases the natural character of the diversion channel - Provides shelter and protection from predation for migrating fish - Reduces erosion potential from river flow.
Provision of rock placement on the banks of the alluvial sections of the new river/creek channel.	- Place hard, dense, durable non-acid forming (NAF) rock on diversion banks - Finished surface to be rough and consisting of rocks with diameter up to 700 mm to resist flood flows - Increase hydraulic roughness of channel - In areas of dispersive soils, use geofabric under rock cover and increase thickness of rock cover.	- Reduces stream power and flow velocity - Provides protection against erosion from river/creek flows - Improves river/creek bank stability - Provides protection for topsoil supporting bankside revegetation - Provides protection for emergent revegetation on channel banks.
Grading of rock placement on the alluvial banks with soil media placed within voids between rocks, for improved plant establishment.	- No more than 20% of rocks to be less than 200 mm diameter, to provide space for topsoil - Topsoil to be spread over rock and sluiced into rock voids.	- Provides erosion protection for topsoil supporting bankside revegetation - Provides protection for emergent revegetation on channel banks.
Incorporation of riffle features along the beds of the diverted river and creek channels in the alluvial sections to reduce stream power and flow velocities.	- Mimic existing rock bars upstream and downstream of mine reach of river and in Barney Creek - Design in accordance with the requirements of Newbury and Gaboury - Construct from a combination of anchored rocks and large woody debris.	- Reduces stream power and flow velocity - Reduces erosion potential - Improves river/creek bank stability - Provides protection for emergent revegetation on channel banks.

Project Modification	Objective/Specification	Benefit/Cost
Revised planting specification with respect to species, seed sources, planting densities, vertical zonation of species etc.	- Determine the appropriate seed mix and seedling selection - Revegetate with same riverine and riparian species that occur along existing river reach - Reflect existing species diversity and abundance - Use variety of planting methods including seeding and seedlings - Provide a stable vegetation cover typical of the area to be disturbed	- Increases the natural character of the diversion channel - Increases river bank stability - Reduces fragmentation of riverine corridor for the movement of bird species - Provides shading and cooling of river water to enhance fish passage.
Provision of crevices in banks along rock section of diversion channel.	- Overblast the rock using controlled blasting techniques, and leave the blasted rock in-situ beyond the design channel cross section - Topsoil to be spread over rock and sluiced into rock voids.	- Provides voids in the rock to enable vegetation to be established - Provides erosion protection for topsoil supporting bankside revegetation - Provides protection for emergent revegetation along channel banks.
Incorporation of stream bed stabilisation strategies in critical areas such as timber piling (groynes).	- Provide lines of timber groynes across the outside bank and bed at junctions of the diversion and existing river - Groynes to be rows of 300 - 400 mm diameter timber piles at 1.2 m spacing.	- Provides increased bank and bed stability at critical areas - Provides snag opportunities for woody debris and hence additional aquatic habitats - Increases channel roughness and hence reduces stream power and flow velocity.
Modification to the alignment, section and grade of the Barney Creek diversion to improve stability and to better replicate the hydraulic performance of the existing creek.	- Increase the sinuosity, length, width and slope of the diversion channel - Provide rock lining of diversion channel.	- Reduces stream power and flow velocity - Increases creek bank stability

Project Modification	Objective/Specification	Benefit/Cost
Replacement of the previously proposed low level culvert crossing of haul road across Barney Creek diversion with a bridge.	- Provide single lane bridge with appropriate traffic control devices to ensure safe operation. - Place bridge deck approximately 1.5 m above the natural ground surface, with high flood immunity.	- Avoids road closures during flood flows - Improves fish passage - Improves hydraulic efficiency of diversion channel.
Provision of contoured drainage to sediment ponds around the base of the flood protection bund and the tailings storage facility.	- Runoff water from NAF material used for construction of mine facilities to be diverted to sediment ponds - Water and sediment in ponds to be monitored.	- Protection of downstream water quality if contaminated runoff occurs from NAF rocks - Reduced sediment discharge to McArthur River.
Significant expansion of the environmental monitoring program.	- Controls for OEF construction and management including on-going PAF and NAF material identification and leachate testing - Expanded water quality and sediment monitoring upstream and downstream of the mine - Expanded aquatic biology monitoring upstream and downstream of the mine - Targeted freshwater sawfish survey and management plan - Detailed erosion and deposition monitoring within and downstream of the diversion channel integrated with aquatic habitat monitoring - Increased sampling of water quality, sediment and biota at the mouth of the McArthur River and at Bing Bong - Establishment of a system for community involvement in the Gulf monitoring program including independent review of results.	- Additional protection for downstream water quality and aquatic/marine ecology - Greater potential to identify abnormal conditions and to implement remedial actions - Improved ability to report to government and community on the mine's environmental performance - Increased ability to address community concerns and perceptions.

Project Modification	Objective/Specification	Benefit/Cost
Relocation of the overburden emplacement facility (OEF) so that it does not disturb the identified significant archaeological site MRM4.	- Remove OEF away from MRM4 - Provide a setback of 50 m from the toe of the OEF embankment - Divert OEF runoff away from MRM4.	- Provides for the long-term protection of MRM4.
Implementation of a 25 year community engagement strategy.	- Form an effective working relationship with the community and MRM - Ensure satisfaction with transparent processes for sharing information - Tap all local knowledge and perspectives to help inform MRM decision-making - Fulfil obligations for shared responsibility for community well-being.	- Develops and maintains direct relationships between MRM and the local communities - Delivers the frequency of contact necessary to maintain relationships and the depth of information necessary for transparency - Builds on the current community activities to ensure MRM receives timely feedback on community perceptions.
Support for the socio-economic sustainability of the Borroloola region.	- Following mine closure, the local communities have been strengthened and their capacity built to the extent that they will flourish independently of the mining operation.	- Increased Aboriginal employment and training - Higher education attendance and completion rates - Increased percentage of local purchasing by the mine - Expansion of the economic base within the community - Improved quality of life through a safer, healthier community environment - Increased local population through a company housing project - Maintenance of traditional culture

2.3 Design Criteria

The design criteria to be adopted for the Open Cut Project are outlined in the Design Basis Report prepared by Kellogg Brown and Root (KBR), a copy of which is provided in Appendix B. This report provides the basic design criteria for the key project components including:

- The flood protection bund
- The overburden emplacement facility
- McArthur River and Barney Creek diversions
- Haul roads
- Project infrastructure.

Engineering drawings showing design details of the key project components are given in Appendix B.

Design criteria for the residue storage facility are given in a concept design report prepared by specialist consultant Allan Watson Associates. A copy of this report is given in Appendix G.

2.4 Construction Schedule

Subject to obtaining project approval, it is proposed to undertake the construction phase over the 2006 and 2007 dry seasons. The extent of work to be undertaken in each dry season is indicated on drawing BEE508-C-DWG-005 in Appendix B.

Work to be undertaken during 2006 (Stage 1 of construction phase) includes construction of:

- The downstream two-thirds of the McArthur River diversion
- The Barney Creek diversion
- The bridge over Barney Creek diversion
- Sections of the flood protection bund outside of the McArthur River riparian corridor.

During the 2006/07 wet season, McArthur River flows will remain within the existing river channel. The newly constructed two thirds of the McArthur River diversion will be connected to the existing McArthur River channel at its downstream end as it will carry flows from the tributaries it intercepts.

As construction of the Barney Creek diversion will be completed prior to the 2006/07 wet season, it will carry the wets season flows from Barney and Surprise Creeks. As discussed in Section 5.6, the diversion channel for Barney Creek has been designed to allow for newly-planted vegetation in the extremely weathered rock/alluvial downstream reach to be able to resist flow velocities and stream powers for flood events less than or equal to the a 50-year Average Recurrence Interval (ARI). This will be achieved by limiting stream powers through the alluvial section to less than or equal to 65 W/m^2. MRM would accept the risks associated with floods larger than a 50-year ARI. Potential risks would include the loss of non-

established vegetation and rock and topsoil mixtures. In such an event, MRM would reinstate the vegetation and the rock and topsoil mixture as per the vegetation management plan.

Modelling has shown that flood velocities around the partially completed flood protection bund during the 2006/07 wet season will be low enough to ensure bund stability. The open ends of the bunds will be faced with a temporary rock cover to prevent erosion and scour. In this way the risks from the exposure of the partially completed bunds to flooding will be minimal.

The balance of the construction work (Stage 2), to be undertaken during the 2007 dry season, includes construction of the remainder of the McArthur River diversion and project infrastructure, and final rehabilitation works. McArthur River flows (other than flows from intercepted tributaries) will first pass through the McArthur River diversion during the 2007/08 wet season.

2.5 NAF Rock Availability

Non-acid forming (NAF) rock will be utilised in the construction of the flood protection bund, tailings storage facility (TSF), OEF and lining of the diversion channel.

The NAF rock that will be produced by the excavation of the open cut and the diversion channels will consist of a range of materials that vary from upper alluvial and residual soils to extremely weathered, low strength rock, to slightly weathered, high strength rock. It will include a variety of shales, dolomite, breccia, siltstone and sandstone.

During the initial stages of project development, NAF material sourced from the open pit will primarily be used to construct the base of the OEF with a key objective to reach the underside of the potentially-acid-forming (PAF) cell to provide the design flood immunity. In general, any NAF material (low durability) could be used to construct the base of the OEF, with hard durable NAF rock only required for the outer lining of the final OEF profile for erosion resistance.

NAF rock utilised in civil works such as lining the diversion channels, the flood protection bund and the TSF embankment will typically be sourced from the diversion excavations or localised borrow pits. However surplus NAF material from the mining operation could also be used in selected civil applications if required. Hard, durable NAF rock will be used on the external faces of the flood protection bund, the TSF embankment, and where scour protection is required in the diversions. In other locations, long-term durability is not necessary and low durability NAF rock would be suitable.

A summary of the NAF material required at each for the key infrastructure facilities, the proposed source, and required general specification is presented in Table 2.1.

Table 2.1

Summary of NAF Rock Requirements for Initial Construction

Description of Facility	Approximate Quantity of NAF Rock Required	Source of NAF Rock	NAF Material Specification
OEF base – construction to underside of PAF cell	2,500,000 m^3 in 2006/2007	Open Cut	Generally any NAF material provided the outer lining of the final batter comprises sound, hard durable NAF rock
Flood Protection Bund (initial construction –upstream/river side)[1]	930,000 m^3 in 2006/2007	Diversion	Any NAF rock – no long term durability requirement
Flood Protection Bund (final arrangement -upstream/river side)[1]	1,300,000 m^3 to be placed from 2008 onwards, or earlier if surplus NAF material is available	Open Cut	Generally any NAF material provided the outer lining of the final batter comprises sound, hard durable NAF rock
Flood Protection Bund (final arrangement downstream/mine side)[1]	1,300,000 m^3 to be placed from 2008 onwards, or earlier if surplus NAF material is available	Open Cut	Generally any NAF material provided the outer lining of the final batter comprises sound, hard durable NAF rock
Barney Creek diversion – bank lining for initial protection of topsoil	80,000 m^3	Diversion excavation	Any NAF rock – no long term durability requirement
McArthur River diversion – bank lining for initial protection of topsoil	30,000 m^3	Diversion excavation	Any NAF rock – no long term durability requirement
Barney Creek diversion – scour protection	60,000 m^3	Diversion excavation	Hard durable NAF rock
Rock chutes and scour protection for tributary streams	60,000 m^3	Diversion excavation	Hard durable NAF rock
McArthur River diversion – scour protection	10,000 m^3	Diversion excavation	Hard durable NAF rock
TSF embankment	40,000 m^3	Water Management Dam storage area or external borrow to the south of the dam (borrow area accessed for armouring works on Cell 1).	Hard durable NAF rock

[1] See Figure 9.1

From Table 2.1 it can be seen that there is a demand for 6,140,000 m^3 of non-durable NAF rock and 170,000 m^3 of durable NAF rock for construction purposes.

A total volume of approximately 7,800,000 m^3 of NAF material will be generated from the open cut in 2006/2007 and there will be a further 5,700,000 m^3 of NAF material from excavation of the creek and river diversions during the same period. Therefore the available quantity of non-durable NAF material in 2006/2007 is well in excess of the construction demand.

Approximately 330,000 m^3 of durable NAF rock will be produced from the McArthur River diversion excavation in 2006/2007. This will adequately cater for the construction demand of 170,000 m^3.

A rock management plan will be developed to ensure that the sound, hard, durable rock from both the open cut operations and the diversion excavations is identified and selectively handled so that it is available for the outer lining of the key infrastructure facilities to provide control erosion.