6

# 6. Simplified Project Description

# 6 Simplified Project Description

## 6.1 Introduction

This section provides a summary of the project description of the Overburden Management Project (OMP) in response to stakeholder comments on the complexity and volume of project material presented in the Environmental Impact Statement (EIS) to date, namely **Draft EIS Chapter 3 – Project Description**. Where relevant, this section incorporates further information on project changes identified in **Supplementary EIS Section 4 – Summary of Project Changes**.

It should be interpreted as a summary document. The information presented in **Draft EIS Chapter 3 – Project Description and Justification** should be referred to where more detailed information is required. This summary focuses on the physical attributes of the proposed project and how they change over time. For context, activities that are currently approved are also discussed to provide a more complete picture of proposed operations. Information on the project exclusions, definition processes and conceptual models is contained within **Draft EIS Chapter 3 – Project Description and Justification**.

## 6.2 Overview of Current Site Features

This section provides a brief overview of the current site layout, including the key project features that will be discussed in this chapter. The current principal mining and processing infrastructure (including water management infrastructure) is summarised below, with locations presented in **Supplementary EIS Figure 6-1**.

The principal mining-related facilities include:

- Open cut.
- Mine Levee Wall, designed for flood protection of the operations.
- Three Overburden Emplacement Facilities (OEFs), comprising the:
    - North Overburden Emplacement Facility (NOEF), which is the principal OEF of McArthur River Mine (MRM), and includes the currently active Central West (CW) stage;
    - West Overburden Emplacement Facility (WOEF), which is no longer active as an OEF. The Run of Mine (ROM) pad, mining offices and workshops are located on the WOEF; and
    - South Overburden Emplacement Facility (SOEF), which is a temporary stockpile located south of the open cut, within the Mine Levee Wall;
- Three perimeter runoff dams (PRODs), designed to collect and capture poor quality runoff waters from the NOEF. These include the:
    - south perimeter runoff dam (SPROD);
    - southeast perimeter runoff dam (SEPROD); and
    - west perimeter runoff dam (WPROD).

The principal processing-related areas include the:

- processing plant, including the concentrator and administrative buildings;
- Tailings Storage Facility (TSF), where tailings are being deposited. This facility is subdivided into three distinct cells including:

  - Cell 1: currently dormant, awaiting recommissioning;
  - Cell 2: the active tailings deposition cell; and
  - Cell 3: used as a water management dam (WMD).

The two principal surface water channels include the:

- McArthur River Diversion Channel, enabling the McArthur river to bypass the open cut to the southeast; and
- Barney Creek Diversion Channel, enabling Barney Creek to bypass the open cut to the north.

**Supplementary EIS Figure 6-1** also identifies the project domains. The description of proposed project features is summarised in the context of these domains in **Supplementary EIS Section 6.3,** with further information on the key characteristics of each domain at each major phase of the project provided in **Supplementary EIS Section 6.5**.

**Supplementary EIS Table 6-1** provides a summary of the key components of the current operations, which are comprised of the Phase 3 Development Project (Phase 3) and subsequent Mining Management Plan (MMP) amendments, and how they will change as a result of the proposed project.

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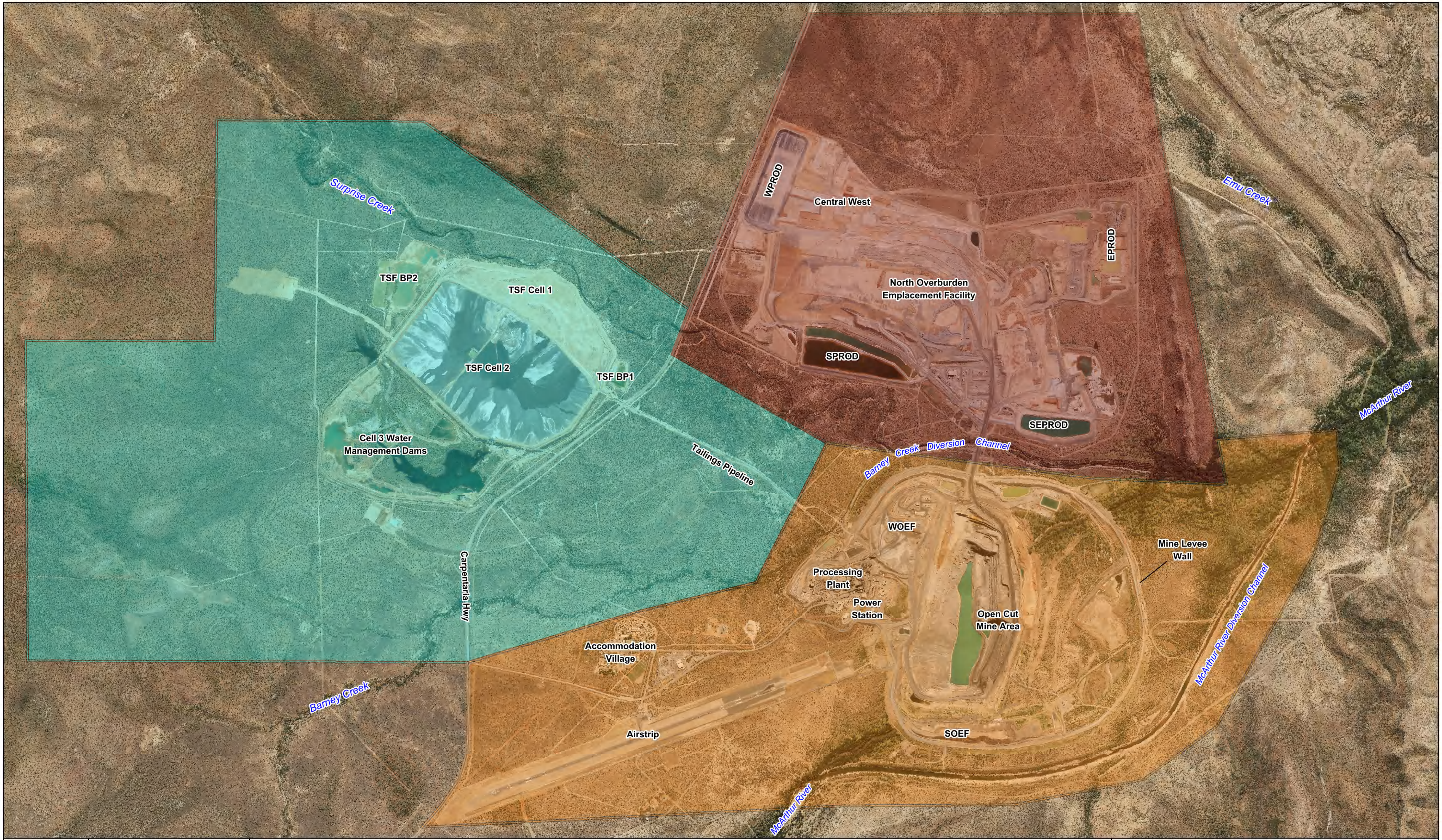


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LEGEND

**Project Domains**

- Tailings Storage Facility
- North Overburden Emplacement Facility
- Open Cut

Data Source: Aerial - McArthur River Mining Pty Ltd (Jul 2017); Project Domains - MetServe (Feb 2017)

McArthur River Mine
OMP Supplementary EIS

# Current Site Layout

0 0.5 1
Kilometres
Scale: 1:30,000 (A3)

07/12/2017

Datum: GDA94
Projection: MGA53

FIGURE 6-1

### Table 6-1 Comparison of Current Operations to Project Operations

| Component | Current Operations (i.e. Phase 3 Operations + MMP amendments) | Project Operations |
|---|---|---|
| Ore remaining from 2018 | 90 million tonnes (Mt) | 92 Mt |
| Mining Rate | Up to 5.5 million tonnes per annum (Mtpa) of ROM ore. | No change. |
| Mining life | Until 2036 (at 5.0 Mtpa). | Until 2037 (at 5.0 Mtpa) plus 10 years of tailings reprocessing (to 2047). |
| Mining method | Open cut mine using conventional drilling, blasting, loading and haulage methods. | No change. |
| Open cut dimensions | Length: 1,750 metres (m)<br>Width: 1,500 m<br>Depth: 420 m<br>Overall footprint: 210 hectares (ha) (within the existing approved bunded area). | Length: 1,950 m<br>Width: 1,550 m<br>Depth: 420 m<br>Overall footprint – 265 ha (within the existing approved bunded area) |
| Overburden | 530 Mt<br><br>Stored on surface in two existing OEFs (NOEF, WOEF) and two new permanent facilities (SOEF, East Overburden Emplacement Facility (EOEF)). | 595 Mt (this volume includes additional benign material specifically mined to supply closure materials).<br><br>Stored on surface in two permanent OEFs (WOEF and redesigned NOEF), two temporary OEFs within the Mine Levee Wall (SOEF, EOEF) and in-pit placement. |
| Processing | Heavy Media Plant (HMP) treats some ore in a pre-concentration phase.<br><br>Flotation process producing bulk concentrate and separate zinc and lead concentrates. | No change to HMP.<br>No material change to processes or concentrates produced. |
| Power | Gas power station with a capacity total of 54 megawatts. | No change. |
| Product | Up to 800 kilotonnes per annum of total concentrates, comprised of bulk, lead and zinc concentrates. | No change. |

| Component | Current Operations (i.e. Phase 3 Operations + MMP amendments) | Project Operations |
|---|---|---|
| Tailings | Tailings discharged to TSF.<br><br>Phase 3 used Cells 2, 3 and 4.<br><br>2017 amendment uses Cells 1 and 2 only (not approved as of December 2017). | Tailings deposition in Cells 1 and 2 only.<br><br>Tailings reprocessed and placed back into the open cut when mining complete. The TSF footprint will be rehabilitated. |
| Transport | Concentrate trucked 115 km to Bing Bong, transferred to barge, barged to offshore loading area onto bulk carriers (18 truck movements per day and 250 barge movements per year).<br><br>Lead concentrate transport to Mount Isa or Darwin. | No change to methods.<br><br>Reduced frequency of movements during the tailings reprocessing phase. |
| Water management system | Borefields for water supply.<br><br>Mine water collected and utilised in the process.<br><br>Evaporation from on-site dams.<br><br>Water discharge licence granted.<br><br>TSF Cell 3 dams and NOEF PRODs for water management.<br><br>Water treatment plant (WTP) with 6 megalitres per day (ML/d) capacity. | No material change to TSF Cell 3 dam and PROD concepts.<br><br>Increased WTP capacity to 15 ML/d total. |
| Workforce | Approximately 440 permanent staff and contractors (head count).<br><br>Construction phase workforce peak at approximately 930.<br><br>Operational phase workforce peak at approximately 735 permanent staff and contractors. | Operational phase workforce head count average at approximately 840 permanent staff and contractors with fluctuations between 550 and 1,020 depending on project stage and activities. Tailings reprocessing phase average of approximately 180 staff and contractors. |

## 6.3 Project Domains and Proposed Features

The project has been divided into three main areas, or domains, to simplify the description of key facilities. The three domains are:

- Domain 1 – open cut;
- Domain 2 – NOEF; and
- Domain 3 – TSF.

These three domains are linked by a number of operational activities and environmental processes, and are presented in **Supplementary EIS Figure 6-1** with the key existing facilities labelled. A summary description of each of the three domains and the key project components within each domain is provided in the sections below.

### 6.3.1 Domain 1 – Open Cut

The open cut domain encompasses the open cut mining operation and the processing plant. A Mine Levee Wall extends around the open cut area to protect the mine and associated facilities from McArthur River flooding. This levee is designed to protect the open cut up to a 1000 year annual recurrence interval (ARI) flood event. The McArthur River Diversion Channel connects the original McArthur River to the southwest and northeast of the Mine Levee Wall, bypassing the open cut operations area. Remnants of the old McArthur River remain along the former alignment, within the Mine Levee Wall. The Barney Creek Diversion Channel is located around the northern edge of the Mine Levee Wall and directs flow from the northwest around to the northeast, where it joins the original McArthur River.

The open cut is where the ore is mined, using surface mining equipment including excavators and trucks. To access the ore, overburden is removed and hauled to OEFs. Beneath the open cut are redundant MRM underground mine workings, which largely exist as unfilled open tunnels and stopes. Any groundwater and surface runoff which flows into the open cut and underground workings is removed (dewatered) to enable operations to continue in dry conditions. The Woyzbun Quarry will be incorporated into the southern end of the open cut to supply benign LS-NAF(HC) material for rehabilitation projects, and may be mined up to a depth of approximately 140 m.

The WOEF is the original mine OEF located wholly inside the Mine Levee Wall, developed when the open cut was first constructed. It is now used as a foundation for offices and workshops, and a ROM pad for temporarily storing mined ore. The EOEF and SOEF are temporary stockpiles located wholly inside the Mine Levee Wall. These will contain a number of different material types throughout the life of the project, but will be removed upon the completion of mining.

The processing plant and power station are located to the west of the open cut, inside the Mine Levee Wall. The processing plant is where the ore is crushed, ground and separated into the useful product (concentrates) and waste product (tailings). The area also contains offices and other support infrastructure. The power station has two gas power electricity generating plants; note that this infrastructure is not owned or operated by MRM.

There are numerous dams, ponds, sumps, pump stations and pipelines installed to manage water in the domain. The open cut is a net generator of water (of varying quality) that requires management. The processing operations consume large quantities of water of various classes (refer to **Draft EIS Chapter 8 – Water Resources** for a description of the various water classes), and also discharges large volumes of water with the tailings slurry into the TSF. Runoff from all of these facilities is contained in the site's water management system.

The open cut domain also includes infrastructure to support the operations including the airport, accommodation village, stores, workshops and connecting roads. **Supplementary EIS Figure 6-2** below provides an overview of the key project facilities within the open cut domain throughout the life of the project. Note that not all of these features are present at any one time.

### 6.3.2 Domain 2 – NOEF

The NOEF is the primary overburden storage facility for the project, and is located between the Carpentaria Highway and a prominent rocky ridge in the east called Barramundi Dreaming. The existing layout of the domain is presented in **Supplementary EIS Figure 6-1**.

**Supplementary EIS Figure 6-3** below presents the key project facilities. The NOEF is the key feature of the NOEF Domain. Overburden is hauled from the open cut, over the Mine Levee Wall, to the NOEF. The NOEF is designed to facilitate safe storage of a range of overburden types in a physically and chemically stable structure. To achieve this, the NOEF includes various zones within its structure in which different material types with different properties are stored. Each zone stores an assigned set of material types using particular placement methodologies for those materials. There are four main PRODs which collect runoff from the NOEF during construction. Support infrastructure, including the Mine Infrastructure Area (MIA), drains, sediment management structures, stockpiles and borrow pits are also located within the domain.

### 6.3.3 Domain 3 – TSF

The TSF domain is located to the west of the NOEF and open cut domains, on the western side of the Carpentaria Highway. The existing layout of the domain is presented in **Supplementary EIS Figure 6-1**.

**Supplementary EIS Figure 6-4** below presents the key project facilities within the domain. It is comprised of two areas (Cells 1 and 2) which will receive tailings in a slurry form from the processing facilities. Cells 1 and 2 will be integrated into a single cell as the facility develops throughout 2018-2020, and remain combined for the duration of the operational phase. Tailings are deposited around the perimeter of the cells, with excess water recovered from a central decant pond, where it is recycled back to the processing facilities. Tailings and return water are transported through pipes in a bunded corridor between the processing area and the TSF.

A third cell to the southwest of Cell 1 and Cell 2, named Cell 3, is currently used to store water from the TSF and mining area. In the near term, Cell 3 will be divided into two lined water management structures; the approximately 2.3 gigalitre (GL) WMD and the approximately 4.1 GL Process Water Dam (PWD). The WMD will be used to store better quality water, whilst the PWD will be used to store poorer quality water. This will enable the different classes of waters to be managed in accordance with the Waste Discharge License. A temporary construction dam will also be utilised for management of water during the construction of the PWD and WMD. This will be located in the south eastern corner of the Cell 3 footprint.

A series of benign material borrow areas and stockpiles are located in the areas around the TSF.

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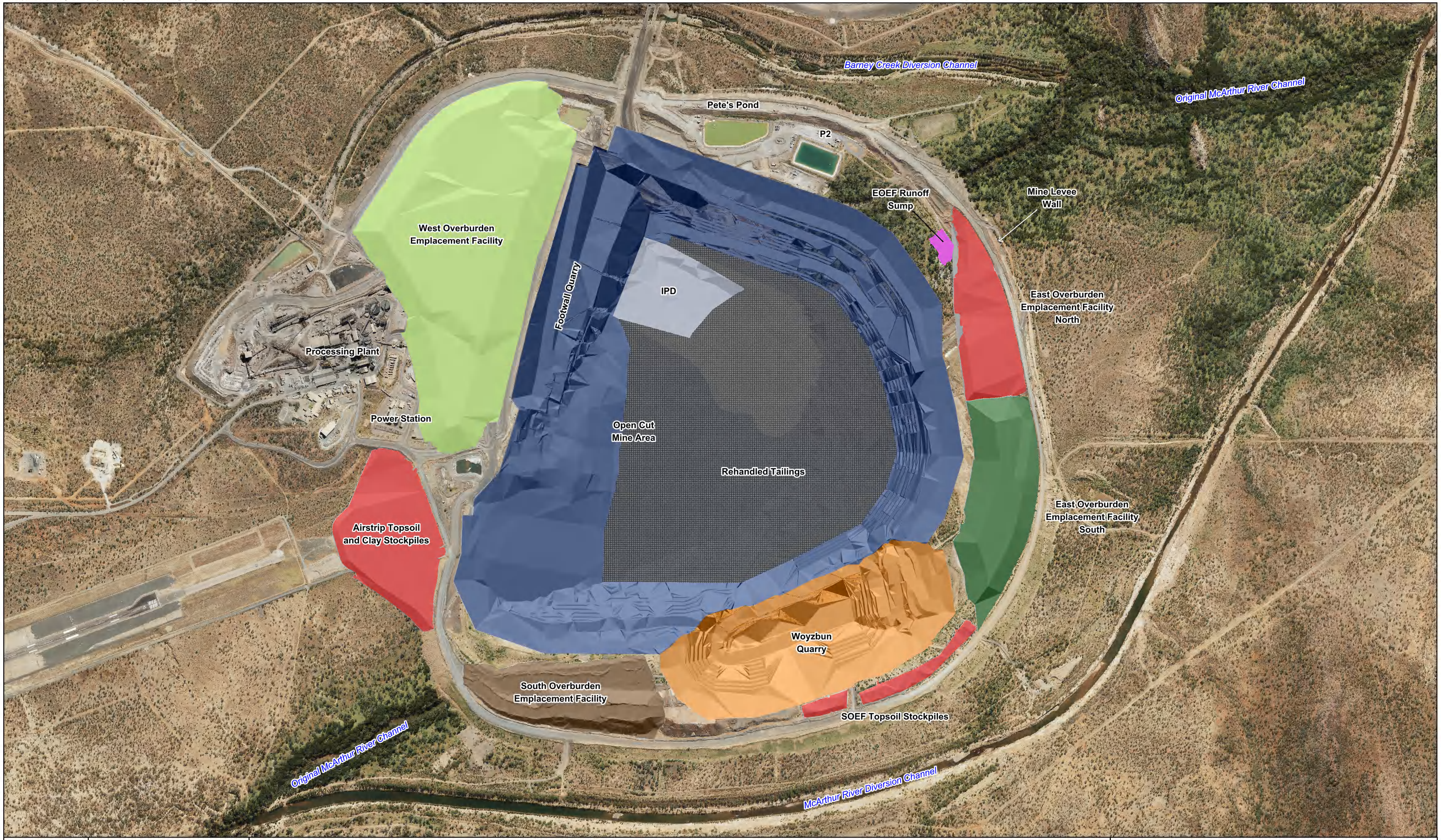


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LEGEND

- Open Cut Mine Area
- Rehandled Tailings
- In Pit Dump Material
- West Overburden Emplacement Facility
- South Overburden Emplacement Facility
- East Overburden Emplacement Facility South
- Woyzbun Quarry
- Benign Material Stockpile
- East Overburden Emplacement Facility North Runoff Sump

Data Source: Hillshade Rasters - Glencore (Jun 2016); Aerial - McArthur River Mining Pty Ltd (Jul 2017)

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## Key Project Facilities within the Open Cut Domain

250 0 250
Metres
Scale: 1:12,500 (A3)

07/12/2017

Datum: GDA94
Projection: MGA53

FIGURE 6-2

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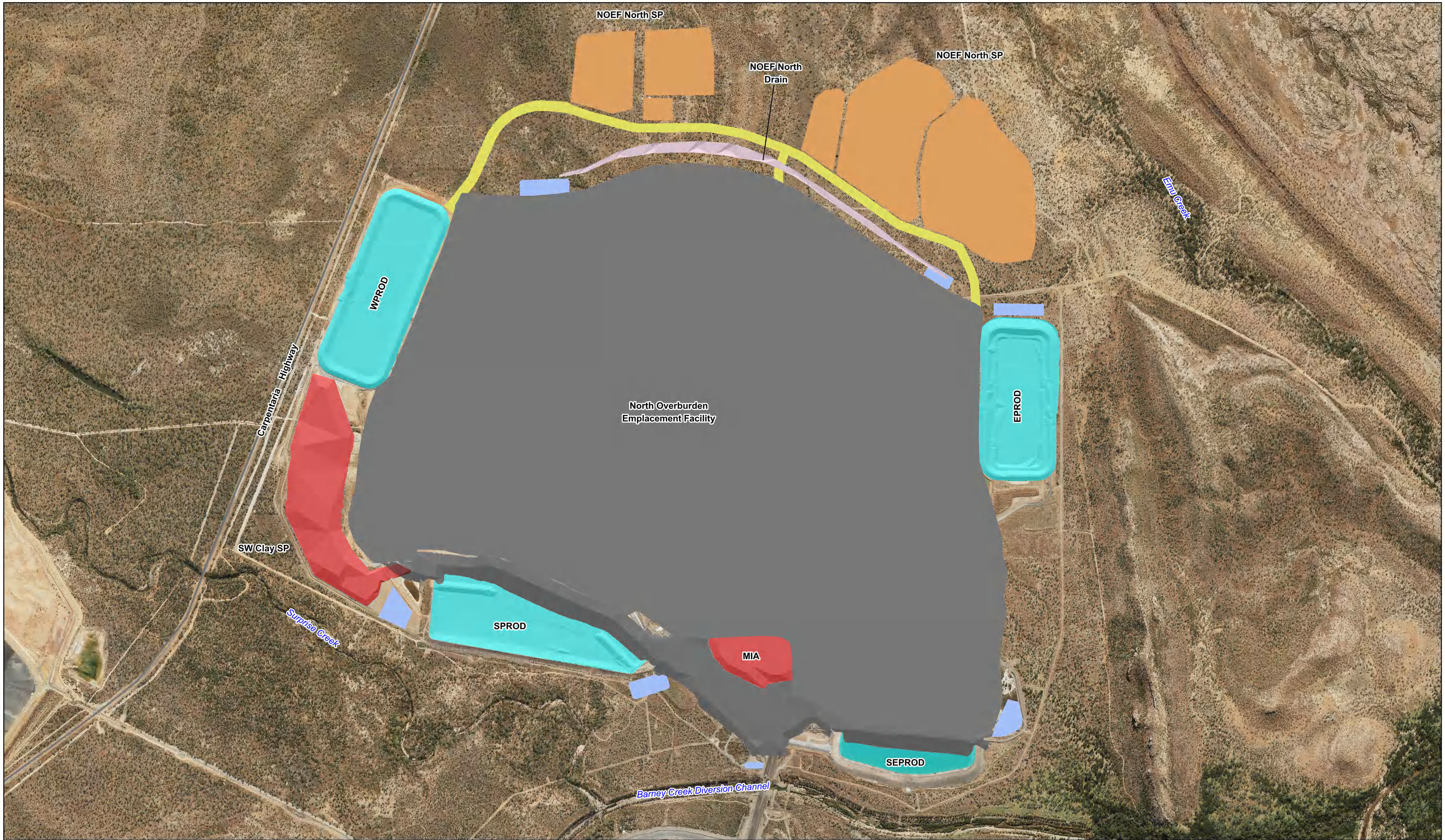


**LEGEND**

- North Overburden Emplacement Facility
- Borrow Area (Benign Material)
- Benign Material Stockpile
- Perimeter Runoff Dam
- Sediment Dam
- NOEF North Drain
- New Haul Roads

Data Source: Hillshade Rasters - Glencore (Jun 2016); Aerial - McArthur River Mining Pty Ltd (Jul 2017)

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## Key Project Facilities Within NOEF Domain

300 0 300
Metres
Scale: 1:16,000 (A3)

11/12/2017

Datum: GDA94
Projection: MGA53

FIGURE 6-3

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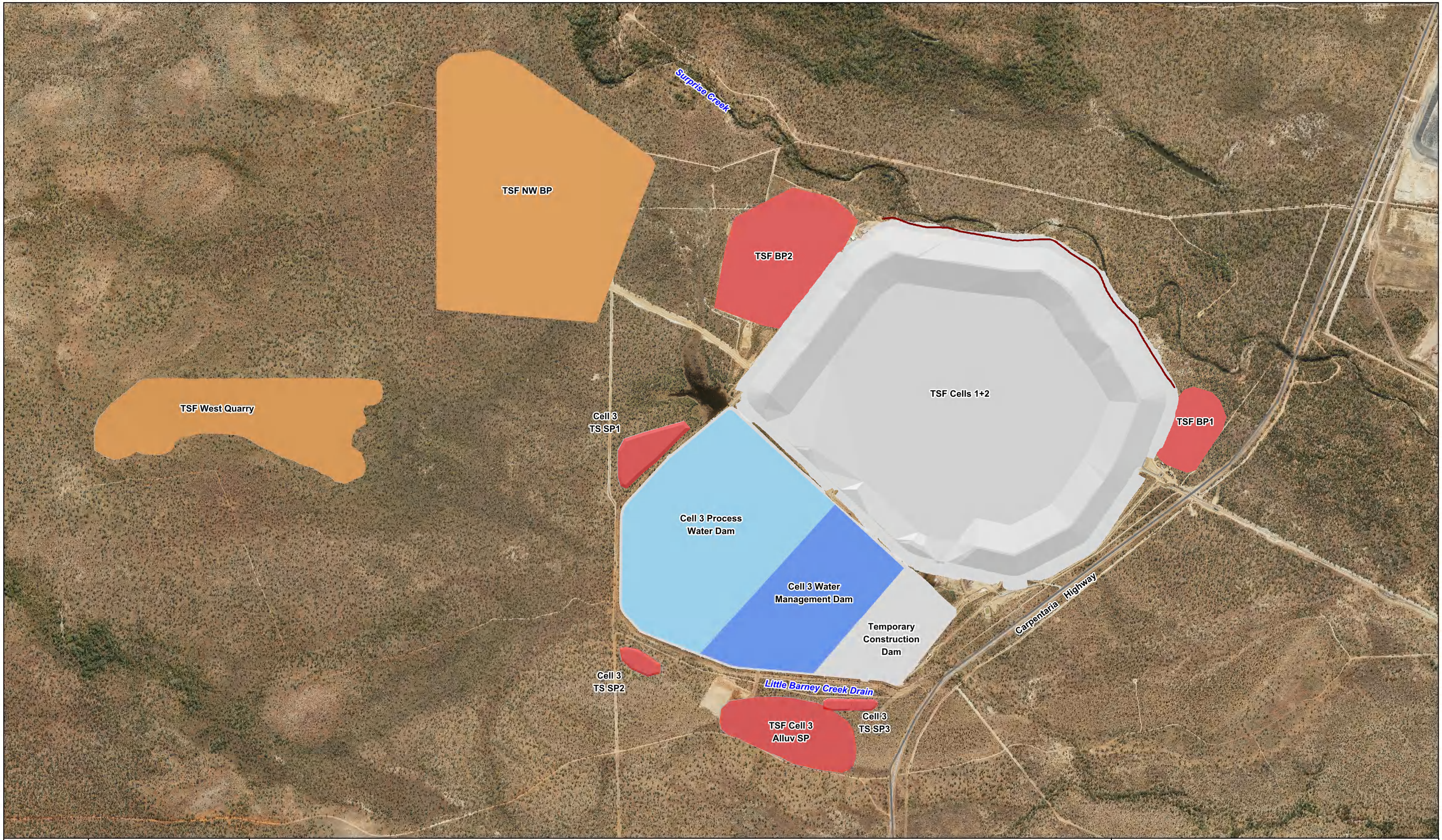


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LEGEND

- TSF Interception Trench
- Tailings Storage Facility (Cell 1 & 2)
- Borrow Area (Benign Material)
- Benign Material Stockpile
- Cell 3 Process Water Dam
- Cell 3 Water Management Dam

Data Source: Highway - NT Gov. (2012); Hillshade Rasters - Glencore (Jun 2016); Aerial - McArthur River Mining Pty Ltd (Jul 2017)

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**Key Project Facilities Within TSF Domain**

300 0 300
Metres
Scale: 1:16,000 (A3)

11/12/2017

Datum: GDA94
Projection: MGA53

FIGURE 6-4

## 6.4 Project Phases

The project includes many different components which change over time and will broadly be carried out in the following key phases:

- 2018 – Project commencement following EIS approval and authorisation of an associated MMP;
- 2018-2037 – Open Cut Mining Operations Phase;
  - 2032 Completion of NOEF construction and commencement of in-pit dumping;
- 2038-2047 – Tailings Reprocessing Operations Phase. The completion of this phase represents the end of the Life of Mine (LOM);
- 2048-3017 – Closure Phase;
  - 2048-2100 (nominally) – Active Closure. The majority of the large scale rehabilitation activities are undertaken in this stage (apart from the NOEF which will be complete), such as the demolition and removal of most infrastructure and rehabilitation of disturbed areas. Newly rehabilitated areas are anticipated to require active maintenance to assist with establishment and to maintain intended functionality. As the landforms and revegetation mature, the amount and frequency of maintenance and monitoring is anticipated to reduce significantly. It is expected that rehabilitated areas will achieve a low-maintenance, stable and largely self-sustaining state by the conclusion of this phase and that the majority of areas will achieve such a status within 25 years of initial rehabilitation activity.
  - 2101 onwards – Proactive Monitoring and Reactive Monitoring. Proactive Monitoring will be routine based monitoring and maintenance, albeit at a reduced intensity to the Active Closure phase. Reactive Monitoring is when routine monitoring and maintenance transition to being undertaken in response to a particular event (e.g. a large storm beyond what the design was intended to cope with) rather than on the basis of a set schedule.

Note that timeframes for the Closure Phase are nominal and will be dictated by the Adaptive Management process (refer to **Supplementary EIS Appendix R – Adaptive Management Report**). An indicative project timeline is provided in **Supplementary EIS Figure 6-5**.

**Supplementary EIS Table 6-2** provides a summary of anticipated operational and closure activities over the duration of the project from 2018-2100. The timing of ancillary infrastructure decommissioning will be subject to future operational requirements and detailed decommissioning planning.

Further discussion of project activities and features is provided in **Supplementary EIS Section 6.5**. The key activities within each project phase are described and are presented on a domain by domain basis.

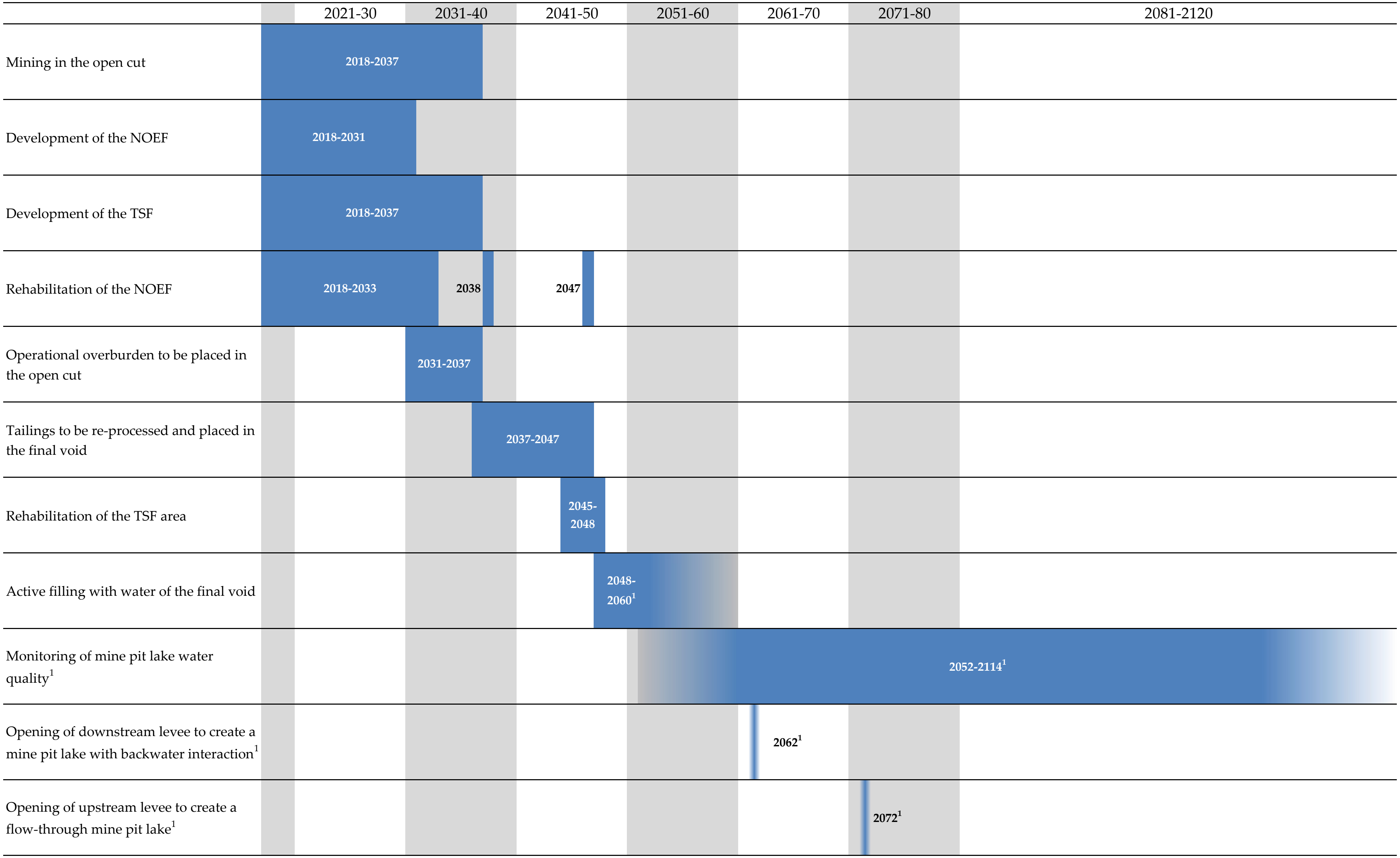


Figure 6-5 Mining, Decommissioning and Rehabilitation Timeframe

1. Timing is indicative and will be determined by the outcomes of adaptive management and monitoring programs

Table 6-2  Operation and Closure Details Over the Duration of the Project

| Domain/ Facility | Period/Stage (Finishing year) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **2018** | **2019** | **2022** | **2027** | **2032** | **2037** | **2042** | **2047** | **2052** | **2100** |
| Open cut | Mining of ore and overburden occurring in Stage I.<br><br>Removal of topsoil/clay/weathered rock in Stage J.<br><br>Footwall cutback complete.<br><br>Commence mining Woyzbun Quarry stage 1, a small cutback in the southeast corner of the open cut. | Ore mining from Stage I continues (no increase in pit depth).<br><br>Overburden pre-strip occurring in Stage J; pre-strip of clay and some alluvial material potentially occurring in Stage K.<br><br>Continue mining Woyzbun Quarry stage 1. | Ore mined from Stage J (with increase in pit depth).<br><br>Stage K pre-stripping progressing, with underlying ore exposed.<br><br>Stage L alluvium mining starting<br><br>Continue mining Woyzbun Quarry stage 1. | Open cut void reaches full footprint extent.<br><br>Mining of ore extending from Stage K to Stage L.<br><br>Commence Woyzbun Quarry stage 2 mining, including relocation of selected power and water infrastructure plus approximately 2 Mt of MS-NAF material from the SOEF to the NOEF. | Mining rate reduces substantially, although mining reaches to a depth of 328 m.<br><br>Northern end advanced to its final depth ahead of the southern end, enabling in-pit dumping of overburden to commence. | End of mining activities, with all economic ore recovered.<br><br>Northern in-pit dump (IPD) will contain all overburden from the previous 6 years of mining.<br><br>Open cut base being prepared for backfilling. | Final void being filled with tailings and overburden, and edge areas being re-profiled, topsoiled and revegetated.<br><br>SOEF and EOEF removed.<br><br>Southern and central portion of WOEF re-shaped and cover system applied.<br><br>Process plant – removal of redundant crushing infrastructure. | In-pit placement of tailings completed (filling the open cut void to within 175 m of the surface).<br><br>Process plant – removal of redundant infrastructure. | Mine pit lake in-filling with water completed.<br><br>Ongoing monitoring of water quality as part of adaptive management program.<br><br>Process plant – remaining infrastructure removed, with rehabilitation commencing.<br><br>Accommodation facility largely decommissioned and rehabilitation commencing. | Subject to demonstration of accepted water quality conditions within the isolated mine pit lake, a section of the downstream Mine Levee Wall will be removed to allow floodwaters to intermittently flow into the mine pit lake. Upon demonstration of accepted water quality conditions, a decision will be made to determine if the upstream Mine Levee Wall will be removed to create a second inlet, and hence a secondary path flowthrough mine pit lake. |
| NOEF | CW stage in progress. Installation of advection barriers on exposed batter faces.<br><br>Build EPROD<br><br>Establish northern stockpiles, sediment controls and roads. | Expansion of NOEF footprint to the end of CW stage, and on top of existing West stage PAF cell. Complete base and wedge in Southeast stage.<br><br>Commence trilinear batters and halo cover on south and west batters of existing NOEF.<br><br>Start PAF(RE) cell in central area. | Expansion of NOEF footprint to the northwest stage (intersecting un-named tributary of Emu Creek), with West and CW stages reaching full height.<br><br>Construction of a drain immediately to the north of the NOEF. | Development of NOEF footprint complete.<br><br>Western side of NOEF fully capped, and northeast stage is nearing completion. | Placement of overburden in the NOEF will have ceased, with rehabilitation across the remaining NOEF footprint having commenced; although the MIA remains operational.<br><br>Establish Emu Plains clay borrow as required. | Active Closure Phase, with monitoring and maintenance at planned intervals.<br><br>Decommission and rehabilitate one PROD (nominally WPROD) subject to water balance.<br><br>Rehabilitate completed northern stockpile and borrow areas. | Rehabilitation advanced with Active Closure and monitoring in progress.<br><br>Decommission and rehabilitate another PROD (nominally EPROD) subject to water balance. | MIA decommissioned and rehabilitation commenced, although adjacent LS-NAF(HC) stockpile remains active for long-term erosion maintenance.<br><br>Two PRODs remain for mine pit lake water management as required. | Active Closure Phase in progress, including rehabilitation monitoring.<br><br>SEPROD and SPROD rehabilitation commenced, assuming open cut water quality does not require ongoing treatment. | Remaining surface infrastructure will be removed including any remaining PRODs and sediment dams.<br><br>LS-NAF(HC) stockpile will remain in a stabilised condition for ongoing maintenance works. |

| Domain/ Facility | Period/Stage (Finishing year) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2018 | 2019 | 2022 | 2027 | 2032 | 2037 | 2042 | 2047 | 2052 | 2100 |
| TSF | TSF Cell 1 recommissioned with a raise (subject to approvals).<br><br>Interception trench constructed and commissioned between TSF and Surprise Creek.<br><br>Cell 3 dams construction commences. | Operate Cell 1 with raise to match Cell 2 elevation.<br><br>Interception trench is operational between TSF and Surprise Creek.<br><br>TSF PWD and WMD completed. | TSF Cell 1 and 2 footprints combined to form a single operating cell from 2020.<br><br>No change to TSF footprint, although annual lifting of Cell 1 and 2 walls ongoing.<br><br>Placement of an LS-NAF(HC) rock buttress at the toe of Cell 1. | No change to TSF footprint, although annual lifting of Cell 1 and 2 walls ongoing.<br><br>Cell 1 buttress raising completed. | No change to TSF footprint, although annual lifting of Cell 1 and 2 walls ongoing. | TSF fully developed. | Hydraulic mining and reprocessing of tailings within Cells 1 and 2 commenced.<br><br>Deconstruct upper perimeter walls and stockpile benign materials.<br><br>Cell 3 dams used or water management. | Hydraulic mining and reprocessing of tailings within Cells 1 and 2 complete.<br><br>Deconstruct mid – elevation perimeter walls and stockpile benign materials.<br><br>Cell 3 dams used for water management. | All of Cell 1 and 2 walls removed and material used to reshape landform and re-establish drainage pathways.<br><br>Interception trench between TSF and Surprise Creek continues to be operational (duration of operations subject to long-term monitoring results).<br><br>Cell 3 dams used for water management. | All aboveground infrastructure removed, landform/s stabilised with drainage pathways successfully re-established and revegetation completed. |
| Borrow areas | TSF - continue to operate South and NW. Borrows. Construct connecting haul roads.<br><br>NOEF – EPROD and East stage borrows. Start southeast borrow. | TSF – Continue to operate South and NW.<br><br>TSF – Rehabilitation commenced on original Cell 4 footprint.<br><br>TSF – Borrow area south of Cell 3 converted to alluvium stockpile.<br><br>NOEF – MRM4 borrow. | Clay borrow areas established within the NOEF footprint in the northeast and eastern sections.<br><br>Borrow area northwest of TSF expanded further to the west. | As per previous period. | Topsoil and clay stockpiles northeast of the NOEF have been exhausted, with footprints converted to a borrow area (retained for contingency purposes).<br><br>Development of borrow area (and associated haul road) west of TSF.<br><br>Continuing operation of clay borrow area northwest of the TSF. | Rehabilitation of all former NOEF borrow areas commenced or well advanced.<br><br>Rehabilitation of all former TSF borrow areas commenced or well advanced. | | | | All former borrow areas in advanced stages of rehabilitation. |

| Domain/ Facility | Period/Stage (Finishing year) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2018 | 2019 | 2022 | 2027 | 2032 | 2037 | 2042 | 2047 | 2052 | 2100 |
| Stockpile Areas | SOEF developed to full extent.<br><br>Clay and topsoil stockpile area established at southwest corner of NOEF, and to the north.<br><br>Topsoil stockpile area established southeast of the open cut and inside the flood protection levee.<br><br>Additional clay and topsoil area established west of the open cut and south of the processing plant. | Additional benign stockpiles established north of NOEF.<br><br>Additional alluvial material stockpile area established east of open cut.<br><br>Borrow area south of Cell 3 converted to alluvium stockpile, and additional stockpile areas established at southwest corner and on western side of Cell 3. | Clay and topsoil area west of open cut expanded to the south.<br><br>Construction of temporary clay-capped stockpile in the EOEF to store PAF rock (low grade ore (LGO)).<br><br>Clay stockpile areas (and associated haul roads) established at northeast corner of NOEF.<br><br>Alluvium stockpile established north of NOEF. | Alluvial material stockpile area east of open cut will be exhausted, and subsequently converted into EOEF PAF(HW) stockpile.<br><br>Topsoil and clay stockpile west of open cut void reaches maximum size.<br><br>Stockpile areas around the extremities of the NOEF are starting to reduce in size as progressive rehabilitation activities use the stockpiled clay and topsoil.<br><br>Rehabilitation commencing on stockpile area northwest of NOEF. | Reclamation commenced of topsoil and clay stockpile west of the open cut. | Rehabilitation of all former stockpile areas north of NOEF commenced or well advanced. | LS-NAF(HC) stockpile placed adjacent to the MIA for future NOEF maintenance works.<br><br>EOEF PAF(HW) stockpile (east of open cut) removed and placed in the IPD or co-disposed with reprocessed tailings.<br><br>EOEF LGO stockpile exhausted (re-purposed into LS-NAF(HC) stockpile area).<br><br>Rehabilitation commenced on SOEF stockpile, including some material placed in open cut void and some used for rehabilitation.<br><br>Topsoil stockpile on WOEF being reclaimed.<br><br>Rehabilitation commenced on the clay and topsoil stockpile at southwest corner of NOEF.<br><br>Former Cell 4 footprint (adjacent to TSF) converted to a benign material stockpile. | | All TSF stockpile material used, with rehabilitation either commenced or in an advanced state.<br><br>LS-NAF(HC) stockpile east of the open cut remains operational. | All former stockpile areas (except the NOEF LS-NAF(HC) stockpile) are in advanced stages of rehabilitation. |

| Domain/ Facility | Period/Stage (Finishing year) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2018 | 2019 | 2022 | 2027 | 2032 | 2037 | 2042 | 2047 | 2052 | 2100 |
| Water Management Dams (including sediment dams, runoff dams and Cell 3 WMD) | WPROD, SPROD and SEPROD continue operation.<br><br>Construct EPROD.<br><br>TSF WMD , PWD and construction dam construction commences. | TSF PWD and WMD completed. | Construction of sediment dams around the base of the NOEF along the northwest and southwest sides. | Additional sediment dams constructed around the base of the expanded NOEF footprint. | | WPROD decommissioned and rehabilitation commenced (subject to water balance). | NOEF EPROD decommissioned and rehabilitation commenced (subject to water balance).<br><br>The majority of the NOEF sediment dams have been decommissioned and rehabilitation commenced. | | NOEF SEPROD and SPROD have been decommissioned, and rehabilitation commenced, assuming open cut final void water quality is of acceptable quality and doesn't require ongoing water treatment.<br><br>TSF Cell 3 dams remain operational. | All former water management dams in advanced stages of rehabilitation. |
| Flood Protection | NOEF final South protection constructed.<br><br>Commence NOEF southeast protection. | NOEF final Southeast protection constructed (SEPROD to EPROD).<br><br>NOEF temporary CW and East protection constructed. | NOEF final NW and NE protection constructed. | | | | | | Construction of 1:1000 year Mine Levee Wall on western side of open cut void to protect WOEF and power station.<br><br>Sections of main levee wall cut down for inlet/outlets for backflow and flowthrough cases as required. | 1:1000 year Mine Levee Wall west of open cut remains in place. |

# 6.5 Project Description

## 6.5.1 Open Cut Mining Operations Phase (2018-2037)

This phase is defined by the period of open cut mining and supply of ore to the processing plant. The staged development plans presented in **Draft EIS Chapter 3 – Project Description and Justification** show the physical progression of the site over this period to the end of 2037. **Supplementary EIS Figure 6-6** provides an updated project layout plan that presents the key features of the stage (in 2032), incorporating relevant project changes discussed in **Supplementary EIS Section 4 – Summary of Project Changes**. An overview is presented below, then each domain and key facilities are discussed in more detail.

### 6.5.1.1 Overview

The removal of overburden from the open cut is required in order to expose the economically viable ore underneath. The revised overburden characterisation practices implemented in 2014 will continue to be used to define the various material types. There are five classes of overburden at MRM, in order of increasing potential for environmental impact they are:

- low salinity non-acid forming (high capacity) (LS-NAF(HC));
- metalliferous saline non-acid forming (high capacity) (MS-NAF(HC));
- metalliferous saline non-acid forming (low capacity) (MS-NAF(LC));
- potentially acid forming (high capacity) (PAF(HC)); and
- potentially acid forming (reactive) (PAF(RE)).

PAF(HW) is a subset of PAF(HC) located in the open cut hanging wall. It has been classified differently for operational purposes rather than significant geochemical differences.

Only LS-NAF(HC) material is considered environmentally benign. All other classes of overburden require some degree of encapsulation to limit oxidation and a water management strategy. **Draft EIS Chapter 6 – Materials Classification** contains an overview of the classification and management of the overburden material at MRM.

The physical process of excavating the overburden remains unchanged, although revised scheduling guidelines aim to reduce the amount of PAF(RE) material mined in the wet season, when the additional moisture can result in faster oxidation rates. However, the OEFs, and their design and operation, have been modified as part of the project.

The NOEF remains the principal destination for mined overburden between 2018 and 2032. Oxidation and infiltration controls are key to safely storing the overburden materials. A revised geometry has been adopted to limit the footprint of the NOEF, thereby assisting to limit infiltration. Revised construction and placement methods, internal layers, a revised cover system, and flood protection also limit oxidation and/or limit possible pathways to receptors. Further optimisation of the geometry, cover system (which now includes the replacing of the previously proposed compacted clay layer (CCL) with a geosynthetic liner (GSL)) and foundation has occurred since the submission of the Draft EIS (refer to **Supplementary EIS Section 4 – Summary of Project Changes**).

The compact footprint reduces the quantities of benign materials required for construction of the NOEF cover system. The majority of benign materials are sourced from the open cut area: alluvium from the upper benches; and a new southern extension to the mine called the Woyzbun Quarry, which targets a specific LS-NAF(HC) rock source adjacent to the open cut. Additional clay and alluvial resources have been identified surrounding and beneath the proposed NOEF to supplement requirements for specialised construction materials. Revised water management practices on, around and beneath the NOEF are planned to manage the risk of transport of constituents of concern to receptors.

The EOEF inside the Mine Levee Wall has been identified as a suitable temporary stockpile area for two materials: LGO awaiting future processing; and PAF(HW) material.

The ore mining and processing stream is not materially different to current practices. Mining of the open cut removes approximately 92 Mt of ore over the 20 year phase to the ROM pad located on the WOEF. The ore is then crushed and sent through the processing plant for separation into the marketable concentrates and waste tailings stream. The concentrates continue to be hauled to Bing Bong and Mount Isa for transport to the international markets.

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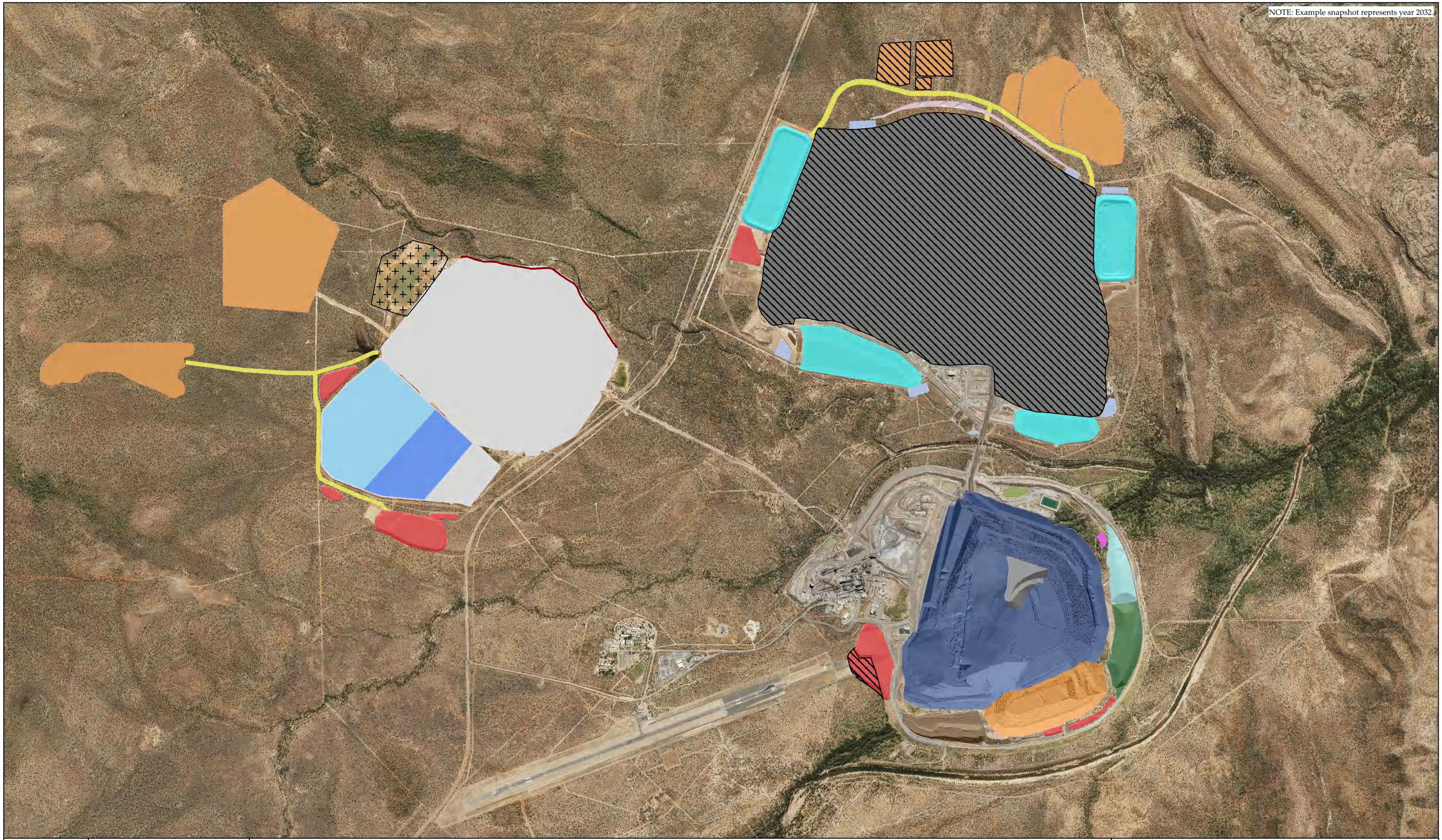


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**LEGEND**

- TSF Interception Trench
- Tailings Storage Facility (Cell 1 & 2)
- Borrow Area (Benign Material)
- New Haul Roads
- Benign Material Stockpile
- Perimeter Runoff Dam
- In Pit Dump Material
- Sediment Dam
- Open Cut
- South Overburden Emplacement Facility
- Cell 3 Water Management Dam
- Cell 3 Process Water Dam
- East Overburden Emplacement Facility PAF(HW) Stockpile
- NOEF North Drain
- East Overburden Emplacement Facility Low Grade Ore Stockpile
- EOEF Runoff Sump
- Rehabilitation Commenced
- Rehabilitation Advanced

Data Source: Hillshade Rasters - Glencore (Jun 2016); Aerial - McArthur River Mining Pty Ltd (Jul 2017)

McArthur River Mine
OMP Supplementary EIS

**Open Cut Mining Operations Phase (2018 - 2037)**

0 0.5 1
Kilometres
Scale: 1:30,000 (A3)

11/12/2017

Datum: GDA94
Projection: MGA53

FIGURE 6-6

The tailings continue to be pumped in slurry form to the TSF, for deposition into the combined Cell 1/Cell 2 area. The current water management practices incorporating maintenance of a small decant pond, low rate of rise, and groundwater recovery in the Surprise Creek Groundwater Interception Trench will be continued. Affected groundwater reporting to Barney Creek will be recovered in sumps as required to meet the surface water quality objectives. Benign construction materials will be sourced from local borrow sources identified in the vicinity of the TSF, and from the Woyzbun Quarry.

The site water management system will have increased capacity in the form of a 6 ML/d reverse osmosis system to be added in 2018, EPROD in 2018, and in 2018-2019 by the TSF Cell 3 WMD and PWD. Following approval, the project will incorporate approximately 9 ML/d of extra water treatment capacity (i.e. bringing it to a total of 15 ML/d water treatment capacity). Water management strategies and systems are described in more detail in **Draft EIS Chapter 8 – Water Resources** and **Supplementary EIS Appendix N – Updated Water Balance and Waterways Modelling Report**. The strategy will continue to focus on: segregating water classes; disposing of class 3 and 4 waters through managed release under the waste discharge licence (WDL); disposing of class 5 and 6 waters through recycling through the processing plant, evaporation, water treatment or potential managed release; and treating Class 2 waters through sediment management systems.

The sections below provide further details on the project operations during the 2018-2037 Operations Phase, including a discussion of key features and activities in the context of each project domain.

#### 6.5.1.2 Domain 1 – Open Cut

A high-level overview of the open cut domain is presented above in **Supplementary EIS Section 6.3.1**. Each key facility is discussed in more detail below for the Mining Operations Phase.

The key objectives for the open cut include to:

- enable safe and productive mining operations at rates required for economic processing;
- provide an open cut landform that is consistent with MRM closure objectives;
- provide benign materials for construction of final landforms; and
- safely and securely store non-benign materials in the remnant open cut walls, temporary OEFs and in the IPD.

##### 6.5.1.2.1 Open Cut Development Stages and Schedule

The Phase 3 open cut design met the first objective of providing safe open cut walls. A review of the open cut geotechnical stability was undertaken and found that additional information available since Phase 3 has shown the current slope designs remain acceptable and appropriate (refer to **Draft EIS Appendix N – Geotechnical Report**). The review confirmed that further data gathering via mapping and geotechnical drilling is still required for the later open cut stages.

The productivity of the open cut has been confirmed and optimised through rescheduling with the revised project data. **Supplementary EIS Figure 6-7** provides indicative tonnes of material mined from the open cut (by material class) over the LOM. The mining schedule presents similar total annual material movements to the Phase 3 Project. The open cut will be developed from west to east as was proposed previously and will occupy the majority of the footprint within the Mine Levee Wall. The open cut dimensions are provided in **Supplementary EIS Table 6-1** above.

One key change since the Phase 3 design is the addition of the Woyzbun Quarry, which has been designed to be incorporated into the southern end of the open cut. Up to 54 Mt of alluvium and LS-NAF(HC) material is available in the full quarry to a depth of around 140 m, although current estimates show mining need only progress to a depth of approximately 70 m to extract the required quantities for rehabilitation. Including the quarry, approximately 30% of the final mine walls are in benign material. The quarry will intersect much of the palaeochannel, therefore up to 4 ML/d of relatively clean water may be expected in the southern face. Sump locations will be determined in the detailed design phase to manage groundwater inflows when the base of the quarry is not connected to the main open cut.

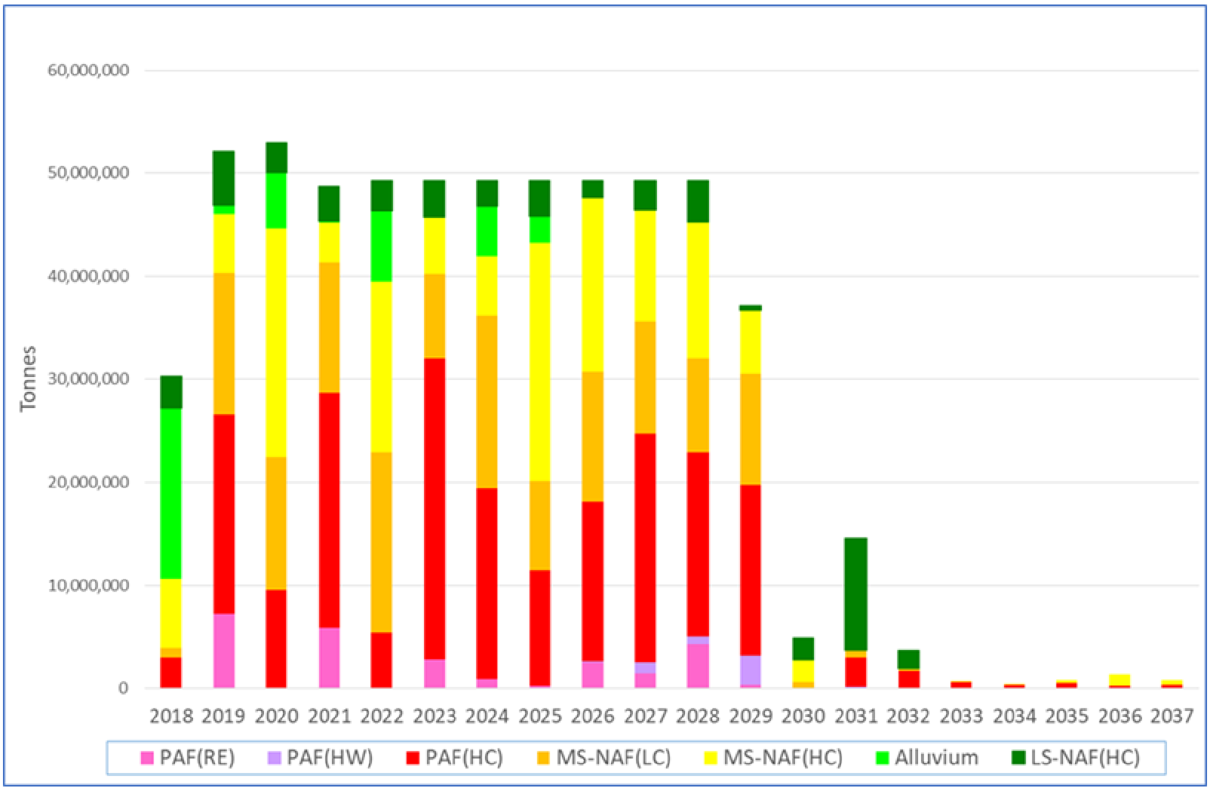



Figure 6-7 Ex-pit Material Movements by Waste Class

### 6.5.1.2.2 In-pit Dump

Mining staging alterations were tested to determine if large scale in-pit dumping could be achieved. Placement of portions of the overburden back into the open cut final void has the benefit of reducing the potential environmental impacts of overburden handling and storage operations by:

- reducing the volume and area/footprint disturbed by the external NOEF by reducing the amount of PAF material stored in the NOEF;
- permanently storing non-benign materials in a subaqueous geochemically stable environment;
- enabling closure and rehabilitation of the NOEF to occur during the mine's operational period; and
- reducing quarrying/rehandling requirements for benign NOEF cover material.

Due to unsuitable geometry and footwall rock geotechnical properties, large scale in-pit dumping, as commonly used in strip mining coal mines, is not practical for the MRM open cut. However, the low mining rates (refer to **Supplementary EIS Figure 6-7** above) proposed for the 2030 to 2037 period present an opportunity for smaller scale in-pit dumping with some adjustments to the late mine stages. The IPD is therefore proposed to store the overburden mined in these latter years, as well as non-benign materials removed from the surface as part of site closure.

The IPD will be located in the bottom 240 m of the open cut, with a capacity of approximately 7.9 million cubic metres (MCM) (16 Mt) of overburden. The upper surface will be approximately 165 m below the crest of the open cut. The toe of the IPD will abut the western, northern and eastern walls of the open cut (refer to **Supplementary EIS Figure 6-8**). An initial two-dimensional assessment of the IPD stability has been completed and the results are provided in **Draft EIS Appendix N – Geotechnical Report**. The IPD will be stable with an acceptable Factor of Safety (FoS) with normal operational controls.

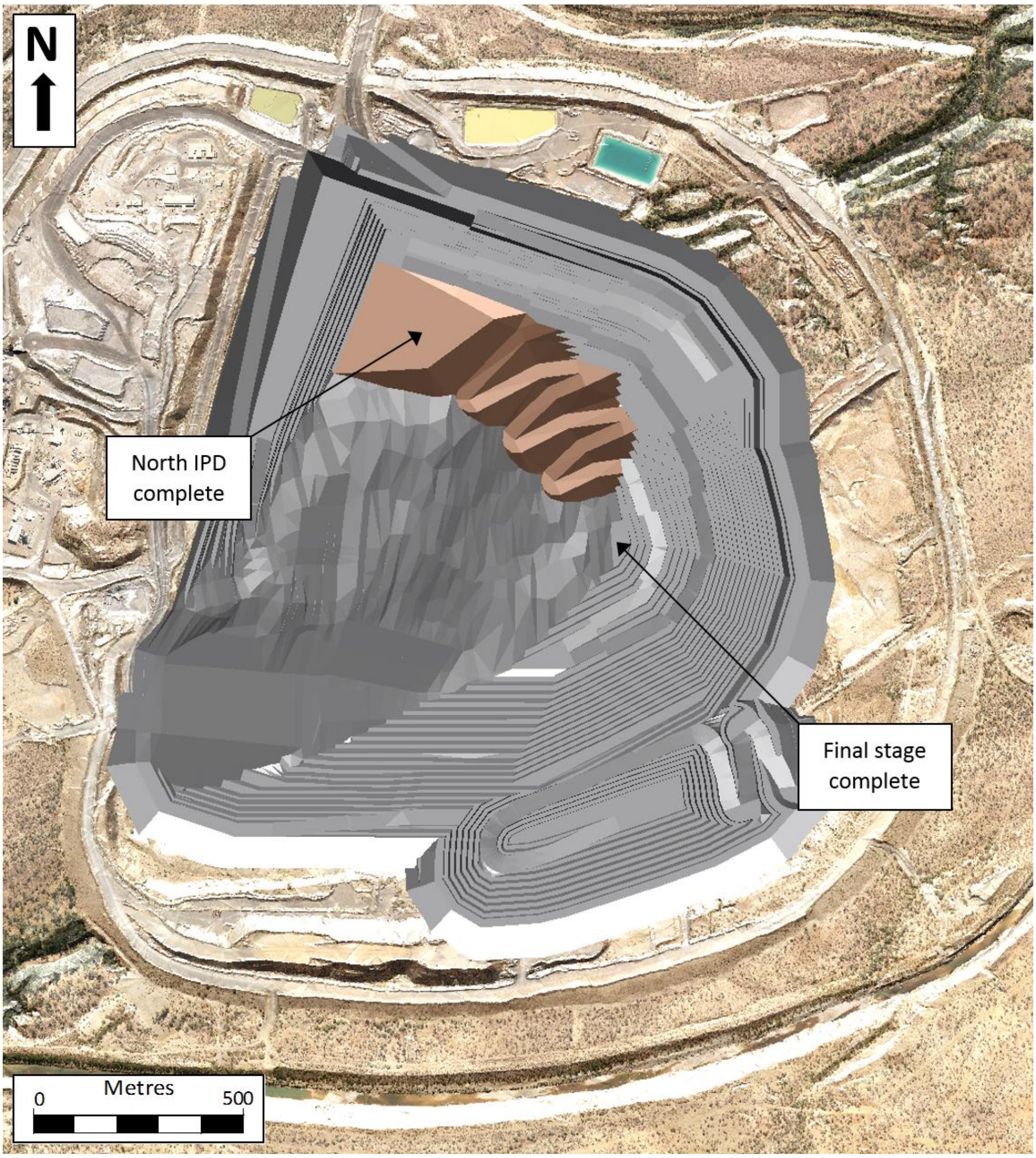



Figure 6-8 IPD at Completion of Final Stage

The IPD is planned to be constructed in 16 m lifts, corresponding with the bench height in the open cut. However, if risk assessments indicate that enhanced management of oxidation is required, then lift heights may be lowered and/or advection barriers constructed around problematic material to mitigate the risk.

To manage the risk of gas generation in the confines of the open cut, highly reactive materials such as those classified PAF(RE) and PAF(HW) would only be placed in the IPD after completion of mining operations, to facilitate prompt management of oxidation through proposed inundation.

#### 6.5.1.2.3 EOEF

The proposed EOEF is a new facility that is entirely different to the EOEF that was presented in the Phase 3 Project. During the Operations Phase, it will be operated as a temporary facility located wholly inside the Mine Levee Wall (refer **Supplementary EIS Figure 6-2** and **Supplementary EIS Figure 6-6**) and will be used to stockpile various material types during different periods of the project. The EOEF stockpiles include excess alluvial material, LGO, and high-pyrite PAF(HW) material. Before non-benign materials are stored, a low permeability foundation will be constructed to direct seepage to a collection drain and sump.

It is expected that PAF(HW) material will be managed similarly to PAF(RE) material at the NOEF, with low lifts, advection barriers and intermediate MS-NAF layers. Due to the PAF(HW) materials coming out later in the mine life, the exact geometries will be fine-tuned based on the experience of the PAF(RE) cells.

After the open cut mining phase, the non-benign materials will be removed and processed or placed in the IPD for permanent subaqueous storage.

#### 6.5.1.2.4 SOEF

The SOEF is an existing temporary OEF located wholly inside the Mine Levee Wall on the south side of the open cut (refer **Supplementary EIS Figure 6-2** and **Supplementary EIS Figure 6-6**) and contains primarily MS-NAF overburden. Its footprint lies to the southeast of the original McArthur River, on the alluvial floodplains that previously drained into the river. The subsurface structure and composition of the area has been investigated with exploration holes, open cut mapping, and a shallow groundwater investigation conducted in 2012, which confirmed that the SOEF seepage drains into the open cut. Surface water during operations will be managed using drains and sumps to collect the runoff for management in the contaminated water system.

Some of the SOEF will need to be relocated to facilitate development of the Woyzbun Quarry. This waste will be transferred to the appropriate area in the NOEF. After cessation of mining, the remaining non-benign waste and any contaminated foundation materials will be relocated into the WOEF for rehabilitation or the open cut for permanent subaqueous storage.

#### 6.5.1.2.5 WOEF

The WOEF is a permanent OEF located to the west of the open cut, wholly inside the Mine Levee Wall (refer **Supplementary EIS Figure 6-2** and **Supplementary EIS Figure 6-6)**, built to a height of approximately 40 m. It has a core of NAF and PAF material, encapsulated in a 1 m thick clay layer, then further NAF material. This was the first OEF built with materials from the western side of the open cut, therefore it does not contain PAF(RE) material in the core.

No material changes are planned for this facility during the Mining Operations Phase – it will continue to be used for offices and workshops on the northern end, and the ore ROM pad in the central portion. Ore stockpiles (typically up to 1.5 Mt) can be accommodated on the pad in preparation for delivery to the processing plant.

Upon Closure, infrastructure will be removed, the shape will be re-profiled to be compatible with a cover system, and a cover system constructed over the entire OEF. Drains and sediment traps will also be constructed to manage the surface water off the completed landform.

#### 6.5.1.3 Domain 2 – NOEF

Approximately 575 Mt of overburden will be placed within the NOEF between 2018 and 2032. This is in addition to approximately 195 Mt of material which will be in place by 2018. The NOEF is required to permanently store this material with an acceptable level of risk to the environment, under various physical constraints. More specifically, the key objectives of the NOEF are to:

- enable placement at a rate consistent with the mine plan;
- enable the use of local resources as much as possible, including construction materials and skills;
- be a physically and chemically stable storage of mined overburden for 1000+ years:
  - which meets the closure objectives, including water quality;
- leave a landform that is consistent with the nominated post-mine land use:
  - for the NOEF, this is native fauna habitat.

McArthur River Mining has planned an extensive system of instrumentation and modelling to monitor NOEF performance for comparison to the various models used. This will enable deviations in performance to be investigated early and corrective actions implemented where required. An array of management actions and mitigation strategies have been developed and documented to further manage any potential impacts if required (refer to **Supplementary EIS Appendix R – Adaptive Management Report**.

##### 6.5.1.3.1 Current NOEF

The NOEF has been in continuous operation since May 2008, presently it covers a surface area of approximately 228 ha. As of July 2016 the NOEF holds 195 Mt of overburden material dominated by dolomitic shales, dolomitic breccias and pyritic shales. The construction and composition of the existing NOEF is well-understood, enabling the overall NOEF facility to be engineered to deliver acceptable performance and meet the closure objectives. Investigation into the composition of the existing NOEF found that only approximately 18% of the total mass of the NOEF is considered PAF. PAF(RE) only comprises 5% of the total mass.

The remediation of the existing NOEF is well underway (refer to **Supplementary EIS Section 2 – EIS Clarifications** and **Supplementary EIS Appendix F – NOEF Temperature Update**). These works have included re-excavation and compaction of hot material, flattening off the batters, construction of an MS-NAF halo around the PAF cell, and application of advection barriers to close off air paths. The staging of post-EIS NOEF construction is based on burying the existing NOEF as quickly as possible to further restrict airflow into the core. Additionally, once the EIS is approved, construction of the final cover with the impervious GSL barrier layer will commence on the south and west sides to complete the exclusion of oxygen from the old NOEF. The entire existing NOEF will be completely encapsulated with low permeability materials by the end of 2021.

A plan of the current NOEF showing the location of current disturbance and infrastructure is presented in **Supplementary EIS Figure 6-1**.

##### 6.5.1.3.2 Design Concept

The position and layout of the NOEF satisfies all the relevant spatial constraints. This includes cultural sites, highway offsets, key habitats and avoiding diversions of major watercourses. The NOEF has been designed with a maximum height of 140 m, resulting in a reduced footprint compared to an option with the current 80 m height limit. For a given net percolation, a smaller footprint will result in lower quantities of infiltration. Lower infiltration translates to reduced loads that may be released.

To limit erosion and better mimic natural landforms, the geometry of the NOEF batters will be trilinear concave as follows:

- lower-slope section: 0-55 m elevation; batter angle 1V:4.5H;
- mid-slope section: 55-100 m elevation; batter angle 1V:3.5H; and
- upper-slope section: 100-140 m elevation; batter angle 1V:3H.

This incorporates a revision of the upper slope angle from 1V:2.5H to 1V:3H (refer to **Supplementary EIS Section 5 – Potential Environmental Impact of Project Changes**) for further information). The breakdown of the total 525 ha surface area of the NOEF facility will be approximately 120 ha of plateau (approximately 25% of total NOEF footprint area) and 405 ha of sloping batters (approximately 75% of total NOEF footprint area). Drainage is provided off the top plateau of the facility, and conveyed down purpose built drains built into the haul ramps to either the PRODs or sediment management facilities at the toe. **Draft EIS Chapter 8 – Water Resources** describes the water management system in detail. Updated water management information is provided in **Supplementary EIS Appendix N – Updated Water Balance and Waterways Modelling Report**.

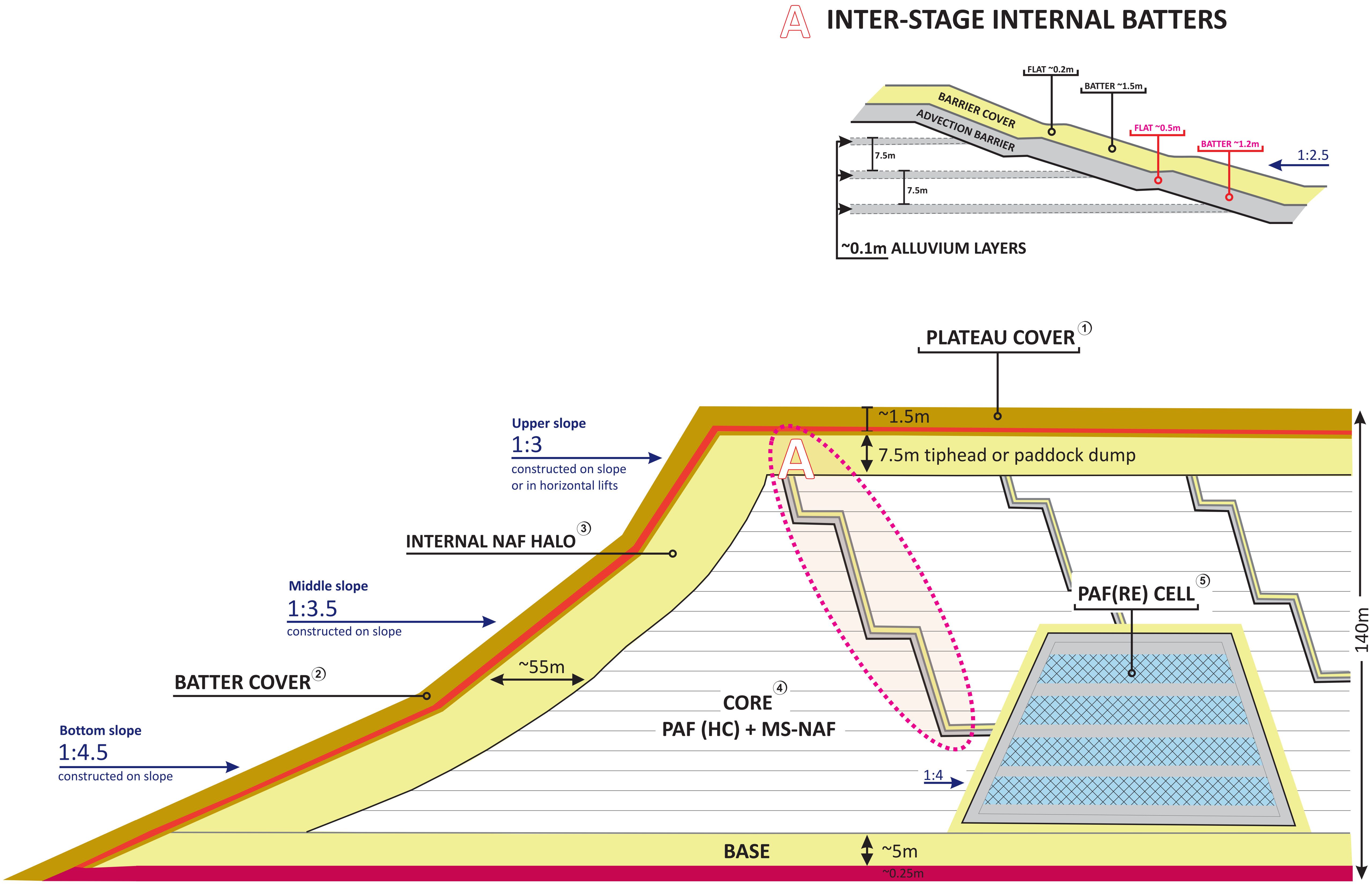
Stability analyses on the landform with a range of plausible input parameters indicated the NOEF landform to be stable with a FoS of over 1.5 under normal conditions, with the proposed key features included: foundation preparation; foundation drainage; cover materials selection and construction; and monitoring.

The placement methods to be used will be tailored to the materials being mined, to give a degree of geochemical source control. The lift height and/or use of fine-grained materials to construct barriers to advection currents will be varied to control oxidation rates of the placed materials. Lift heights (of maximum 7.5 m, nominally placed at 2 m on the bottom and then a 5.5 m tiphead) have been reduced compared to Phase 3, with even lower lifts specified for more reactive materials. Advection barriers comprised of alluvial materials (clay-silts-sands) with appropriate compaction will act to seal off airflow through the coarser overburden materials.

PAF(RE) materials with a higher risk of spontaneous combustion will be exclusively placed in 2 m lifts within dedicated cells with advection barriers and temporary wet season covers. The mining schedule limits mining PAF(RE) material in the wet season to further restrict water ingress into these materials. The PAF(RE) cells will initially be isolated from other active material placement areas to reduce the risk of heat build-up, before being incorporated into the core of the NOEF as construction progresses.

The location of non-benign materials within the overall facility has been planned so the most potentially deleterious materials are stored in the core of the facility, and progressively lower risk materials placed towards the outer surface. This will limit oxygen ingress into the more reactive materials. Additionally, if a temporary breach of the outer benign cover system occurred, only lower risk materials would likely be exposed until repairs could be undertaken.

A cross-section schematic of the NOEF design concept is presented in **Supplementary EIS Figure 6-9**.

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LEGEND

- Cover
- MS-NAF
- Cover GSL
- Basal CCL
- Alluvium
- PAF(RE)

| | | |
|---|---|---|
| 1 | PLATEAU COVER | • ~0.1m Topsoil (TS)<br>• ~0.6 - 0.9m Growth Media (GM) - alluvium<br>• ~0.2 - 0.5m drainage layer<br>• ~0.2 - 0.3m GSL Overliner (alluvium)<br>• Geosynthetic liner<br>• ~0.2m HMR or alluvium GSL Underliner |
| 2 | BATTER COVER | • ~0.1m Topsoil (TS)<br>• ~1.1 - 1.4m Breccia GM/Erosion protection<br>• ~0.2 - 0.3m GSL Overliner (alluvium)<br>• Geosynthetic liner<br>• ~0.2m HMR or alluvium GSL Underliner |
| 3 | INTERNAL NAF HALO | • MS-NAF's or better<br>• up to 7.5m tiphead |
| 4 | CORE | • PAF(HC)/MS-NAF<br>• 2m paddock dump and/or up to 7.5m tiphead with advective barriers (~0.1m alluvium) |
| 5 | PAF(RE) CELL | • 2m paddock dump<br>• ~0.1m alluvium every 2m<br>• ~ 1.2m alluvium every wet season plus ~1.5m MS-NAF for erosion protection |

McArthur River Mine
Overburden Management Project
Supplementary EIS

NOEF Concept Design

13/12/2017

FIGURE 6-9

The NOEF comprises several zones with varying construction materials and methods to achieve the design objectives and to manage the inherent risks of the overburden:

- A cover zone of at least 1.5 m thick of benign materials encapsulates the outer surfaces of the entire NOEF. This acts as a source control by isolating the reactive overburden from water and air pathways:
    - This layer has materials (topsoil and a growth medium) to enable vegetation growth, which assists erosion resistance and enhances the removal of incident rainfall through evapotranspiration.
    - The top of the NOEF (termed the plateau) also has a minimum 0.2 m thick drainage layer in the cover system, to aid in the removal of excess water from large rain events to a network of drains. The sides of the NOEF only use rock in the growth layer to better resist erosion.
    - The bottom of the cover is a barrier layer to limit water infiltration and limit oxygen entry into the NOEF. This has been changed from a 0.5 m thick CCL to a GSL (refer to **Supplementary EIS Section 4 – Summary of Project Changes** and **Supplementary EIS Appendix H – Geosynthetic Liner Design Details** for further information), with a 0.2 m thick alluvial or Heavy Media Rejects (HMR) crushed aggregate bedding layer beneath it and a 0.2 m to 0.3 m overlying alluvial layer. Field trials will be conducted through 2018, which will refine these layers before installation is scheduled to begin in 2019.
- The trilinear concave batter profile limits erosion and better matches the shape of local natural landform features. The slopes are flat enough to facilitate access to all areas in the event that repairs or maintenance are required in the future.
- The halo zone, constructed from MS-NAF materials, provides a buffer between the core zone and the cover. The lower reactivity of the MS-NAF materials will provide a durable platform for the cover construction, insulate the cover GSL from any heat generated in the core, and consume any diffusive oxygen entering through the cover system. Additionally, if any failure of the cover were to occur, the core would still have some protection from oxidation and infiltration.
- The core zone contains the cells for PAF materials:
    - PAF(HC) material, along with excess MS-NAF materials, would be placed in the core with construction methods to restrict the formation of advection currents. This could range from paddock dumping with no barriers to up to 7.5 m tip heads (nominally placed as a 2 m thick base and then 5.5 m tip head) in conjunction with regular application of fine-grained advection barrier layers.
    - PAF(RE) material would be restricted to only be placed in specific PAF(RE) cells. These would have the maximum controls against oxidation and water ingress applied: paddock dumping of all materials, application of fine-grained advective barriers, and application of periodic paddock dumped MS-NAF to limit oxygen diffusion.
- The core would sit on an MS-NAF base, approximately 5 m thick, which is designed to reduce the risk of interaction with any possible mounding or toe seepage flows.
- A low permeability foundation would underlie the new portions of the NOEF. Its role is to promote seepage flow to toe seepage rather than basal seepage, and to confine any possible rising groundwater to remain under the NOEF. Where possible, the existing NOEF in-situ materials will be retained, as much of the new footprint has low permeability materials naturally. Where geotechnical strength concerns or possible preferential pathways to groundwater exist, unsuitable foundations will be removed and replaced with a 0.25 m thick basal CCL.

- A network of water management structures including a new PROD, surface drains, stilling basins, sediment control measures, and seepage recovery systems will complement the main facility.

The cover system will incorporate a barrier layer in its composite profile, which will be the inhibitor of water and oxygen ingress. The CCL barrier proposed in the Draft EIS has been replaced with a GSL (refer to **Supplementary EIS Section 4 – Summary of Project Changes** and **Supplementary EIS Appendix H – Geosynthetic Liner Design Details).** The barrier layer extends from the top of the facility to below ground level, keying in with another low permeability barrier layer in the foundation. This provides flood protection for the interior of the NOEF, resisting the movement of floodwater into the facility and of infiltrated water out of the facility. The flood levels around the NOEF for various sized events can be found in **Draft EIS Appendix U – Surface Water Impact Assessment Report**.

Infiltration into the NOEF which does not report to the toe seepage collection system is expected to pass through the foundation layer into the shallow groundwater zones. McArthur River Mining has undertaken significant fieldwork and groundwater model calibration to gain a robust understanding of the levels and movement of groundwater, and its interaction with surface water. Updated modelling of NOEF seepage and its influence on the site wide groundwater system has been completed as part of the Supplementary EIS and is provided in **Supplementary EIS Section 5 – Potential Environmental Impact of Project Changes**) and **Supplementary EIS Appendix K – Revised NOEF Unsaturated Flow Modelling (TOUGH 2) Report**.

Details on the conceptual models, previous computer modelling and fieldwork can be found in **Draft EIS Chapter 8 – Water Resources** and **Draft EIS Appendix T – Groundwater Impact Assessment Report**. The work has demonstrated that beyond the influence of the open cut dewatering drawdown zone, groundwater flows regionally towards the McArthur River, and locally south-southeast towards creeks, where discharge occurs. Thus, groundwater expresses as surface water on the lease, or into the dewatered open cut/underground water management system.

As detailed in **Draft EIS Chapter 8 – Water Resources**, expression of NOEF derived groundwater is not expected to report to Emu Creek, but is expected in lower Barney Creek. Two collection sumps have been planned in reaches of the Barney Creek Diversion Channel on the lease to intercept poor quality surface water as required to meet surface water quality commitments at SW11, a downstream water monitoring point relevant to the WDL.

#### 6.5.1.3.3 NOEF Development Stages and Schedule

Staged construction of the NOEF is desirable so as to allow early progressive rehabilitation. This reduces stockpile sizes, stockpiled time (i.e. degradation of topsoil), and the quantity of mine-affected water to manage. The future NOEF has been designed with six additional stages (Stages 2 to 7), with Stage 2 built on top of the existing West and CW development up to the full height of the new NOEF (**Supplementary EIS Figure 6-10**). Stages 3 to 7 develop progressively in a clockwise direction from Stage 2. Two PAF(RE) cells have been designed within the centralised portion of Stages 2 and 6, with future cells permitted inside the designated zone in the figure, as far away from the NOEF toe as is practicable.

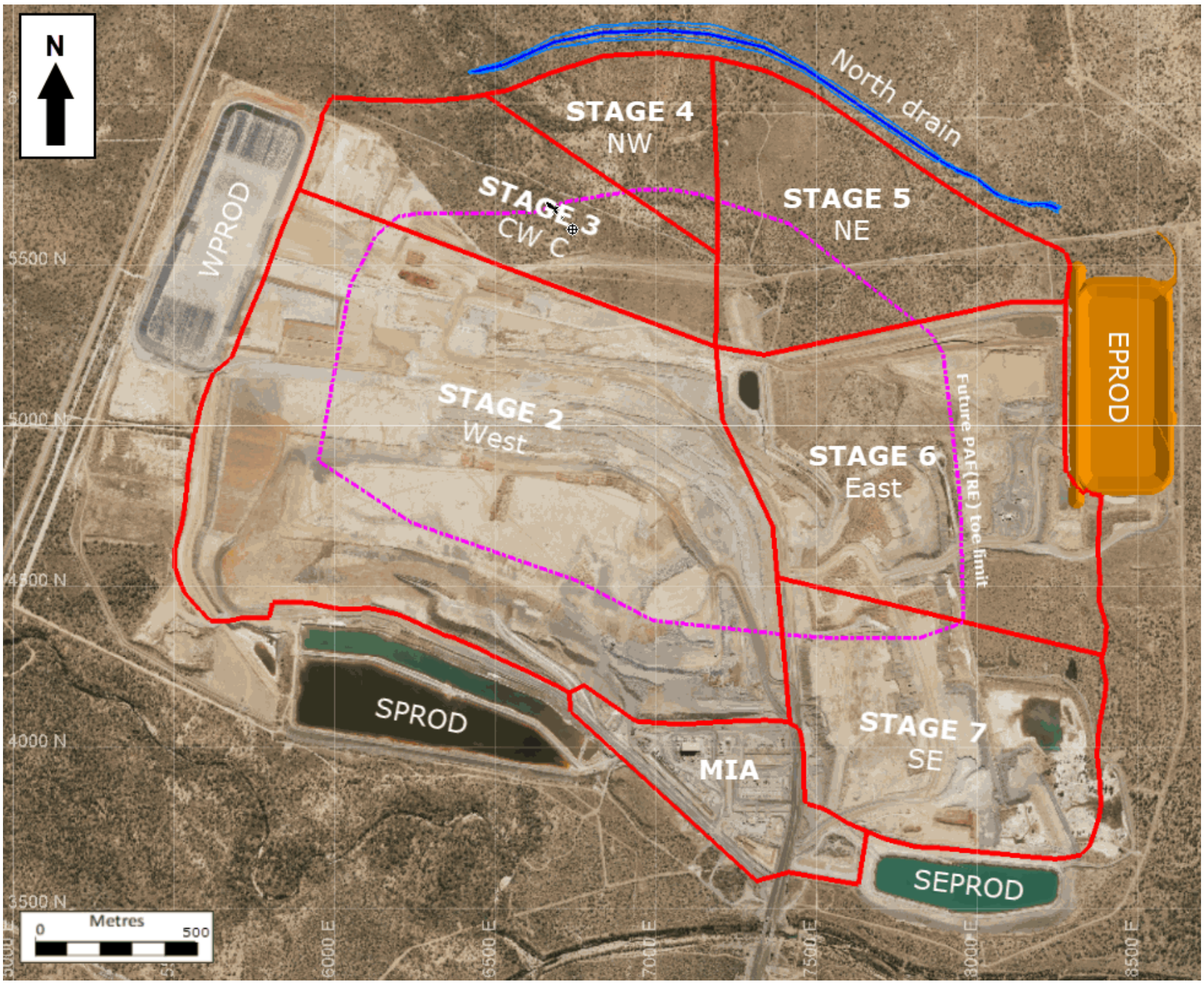



Figure 6-10 NOEF Stage Plan

The indicative NOEF overburden placement schedule by stage by year is provided in **Supplementary EIS Table 6-3**.

### Table 6-3 NOEF Overburden Placement Schedule by Stage

| Year | STAGE 2 000 m³ | STAGE 3 000 m³ | STAGE 4 000 m³ | STAGE 5 000 m³ | STAGE 6 000 m³ | STAGE 7 000 m³ | PAF(RE) Cell 1 000 m³ | PAF(RE) Cell 2 000 m³ | Grand Total 000 m³ |
|---|---|---|---|---|---|---|---|---|---|
| 2018 | 5,366 | 5,579 | | | | | 878 | | 11,823 |
| 2019 | 20,345 | 5,399 | | | | | 4,247 | | 29,991 |
| 2020 | 5,699 | 17,307 | 3,727 | | | | 34 | | 26,766 |
| 2021 | | 1,482 | 18,716 | | | | 3,450 | | 23,649 |
| 2022 | | | 13,345 | 9,806 | | | 1 | | 23,152 |
| 2023 | | | 555 | 23,259 | | | 1,646 | | 25,460 |
| 2024 | | | | 6,593 | 17,898 | | 507 | | 24,998 |
| 2025 | | | | | 23,293 | | 171 | | 23,465 |
| 2026 | | | | | 12,160 | 10,101 | 204 | 1,266 | 23,732 |
| 2027 | | | | | 3,150 | 19,339 | | 861 | 23,350 |
| 2028 | | | | | 305 | 19,864 | | 3,674 | 23,844 |
| 2029 | | | | | | 9,981 | | 6,531 | 16,512 |
| 2030 | | | | | | 761 | | 1,865 | 2,625 |
| 2031 | | | | | | 5,615 | | 75 | 5,691 |
| 2032 | | | | | | 919 | | | 919 |
| **Total** | **31,410** | **29,767** | **36,343** | **39,659** | **56,806** | **66,581** | **11,138** | **14,272** | **285,976** |

As can be seen from the indicative schedule, the stages are built in sequence, with a focus to complete a stage promptly to enable progressive rehabilitation. However, there is some overlap between the stages to allow enough time for foundation preparation and base zone construction of the next stage, to provide capacity for non-benign material while the upper halo zone and cover system is applied to the previous stage. It is also driven by the flow of certain material types from open cut mining, and attempting to optimise their placement within the various NOEF zones. The cover system will be developed progressively to enable each stage to be 'sealed' up; thereby reducing the overall site disturbed catchment.

#### 6.5.1.4 Domain 3 – TSF

The TSF domain during the open cut mining Operations Phase is required to safely and securely store the tailings and site waters to meet environmental, health and safety, visual impact and cultural heritage commitments. Additionally, benign materials required to construct the facility must be sourced from the area

#### 6.5.1.4.1 TSF Development Stages and Schedule

The current LOM schedule indicates a total tailings production of approximately 65 Mt at an average production rate of 3.3 Mtpa, with annual ranges of 3.2-3.7 Mtpa.

The following practices and features are extracted from the current TSF LOM plan. **Supplementary EIS Figure 6-11** shows the TSF domain as at mid-2018 on the 2016 aerial photograph. The minimum standards for the design and operation of the TSF are set out in the relevant sections of Australian National Committee on Large Dams (ANCOLD) Guidelines on Tailings Dam Planning, Design, Construction, Operation and Closure (ANCOLD, 2012).

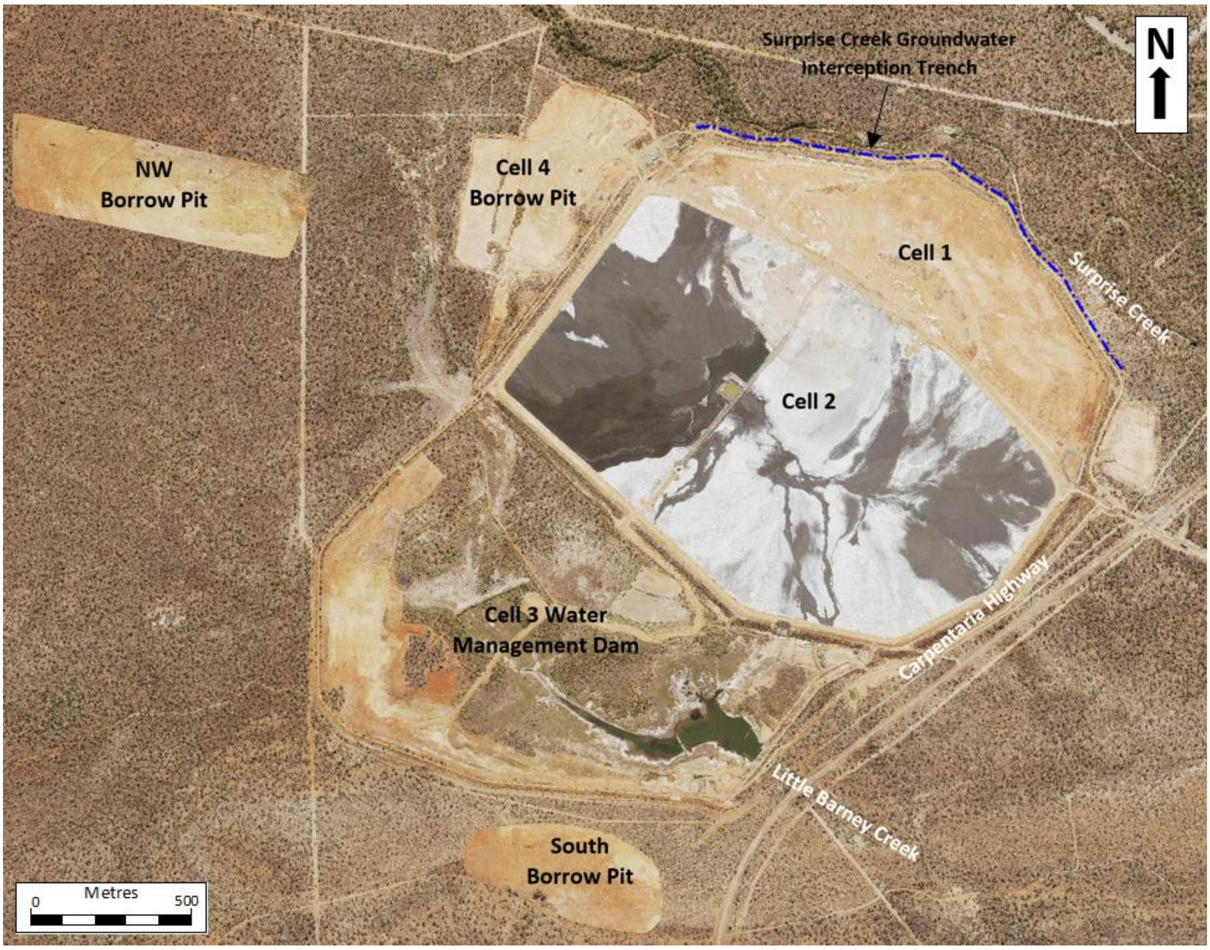



Figure 6-11 TSF Layout at the Start of the Project Period (Mid-2018)

After a review of a variety of alternatives in 2015 and 2016, McArthur River Mining selected the optimal alternative of conventional upstream raising on a combined Cell 1 and 2 with hydraulically placed tailings (**Supplementary EIS Figure 6-12).** This selection was endorsed by the Independent Tailings Review Board, a panel of experts instituted by the Department of Primary Industry and Resources (DPIR) to advise them on MRM's TSF. Development of the TSF in the selected plan will limit the area of disturbance, by allowing development of the total LOM operations within the current footprint. Deposition of tailings will be sub-aerially around the operational cell perimeter with a central decant pond. Additionally, during the operating phase of the current TSF, the large beach area and small central decant pond offer a number of advantages that will also provide benefits for the subsequent reprocessing phase including:

- a reduced average rise rate of the tailings (approximately 1.1 m per year) (lower risk of tailings failure – pathway control);
- increased ability to achieve drying and consolidation to a higher density (lower risk of tailings failure – pathway control);
- consequently reduced tailings permeability (pathway control);
- lower saturation levels in the tailings (lower risk of tailings failure – pathway control);
- minimal oxidation or acid generation risk (source control); and
- overall reduced seepage to groundwater (pathway control).

The TSF will have a 1V:4H downstream slope and 1V:2H upstream slope. Tailings and compacted clay will form the embankment. As part of the TSF LOM Plan (**Supplementary EIS Appendix I – Updated Tailings Storage Facility Life of Mine Plan**), stability analysis has been conducted to support the design of the embankment sections. Benign rock of varying weathering states would be used to buttress the wall where required to meet the stability criteria (**Supplementary EIS Figure 6-13**). The analysis demonstrated that the target FoS is achieved in all scenarios analysed.

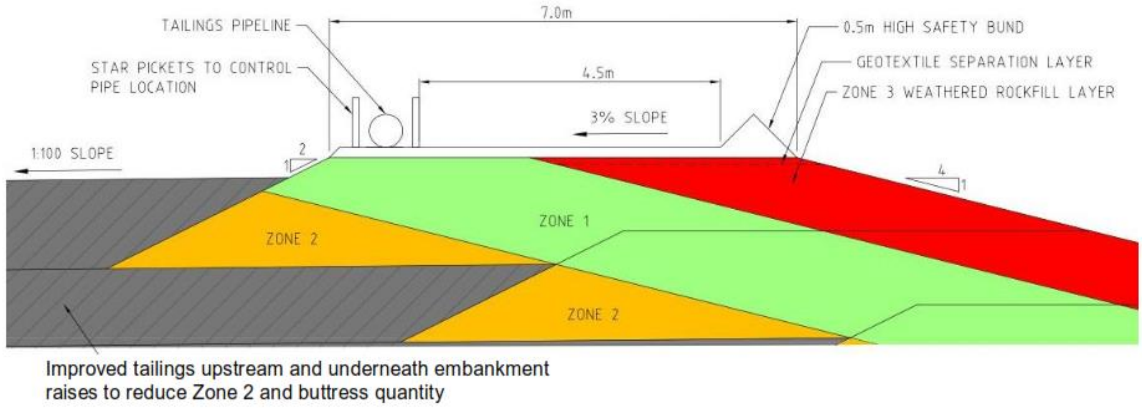



Figure 6-12 Typical Section Upstream Raise

Source GHD LOM Plan 2017

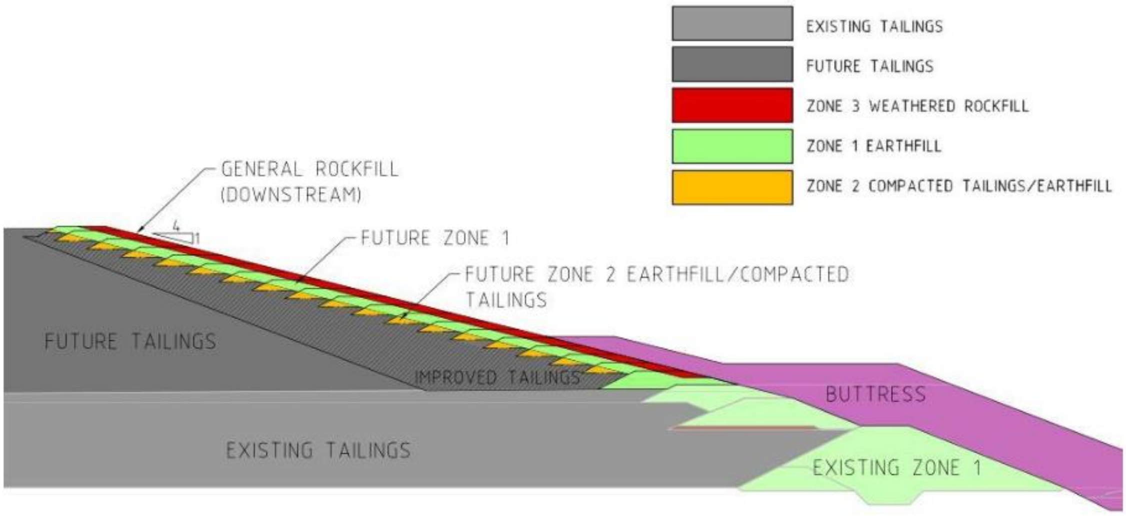



Figure 6-13 Typical TSF Section

Source GHD LOM Plan 2017.

As per the Phase 3 plan, Cell 3 will be split into two separate facilities for water management. Lined dams will be constructed to manage Class 3/4 waters and Class 5/6 waters. The eastern end will feature a small construction dam to assist in managing water during the development of Cell 3.

###### 6.5.1.4.2 Benign Borrow Material

Construction materials (both clays and benign rock) will be required in order to construct the facilities, including liners, embankments, buttresses, drains and the spillway. A number of suitable earthen and rock borrow areas have been identified, as detailed in **Supplementary EIS Figure 6-4**. The operation (and ultimate rehabilitation) of these areas will be managed in accordance with **Draft EIS Appendix AG – Borrow Pit Design Process Guidelines** to maintain site stability including controlling surface water drainage (both surface water run-on and runoff). Excavation will be maintained above the groundwater level where possible to avoid the capture and subsequent management of groundwater.

###### 6.5.1.4.3 Benign Borrow Material Stockpile Areas

All benign material excavated, including alluvium, clay, LS-NAF(HC) rock and topsoil will be stockpiled in dedicated areas as required. These stockpiles will be temporary in nature, with suitable clay and rock material being used for site construction purposes, and topsoils and suitable alluvium being used for encapsulation, stabilisation and rehabilitation purposes. The operation and rehabilitation of these stockpiles will be in accordance with standard industry practice, including installation of topsoil bunding around the upslope sides of these stockpiles to divert clean water around the sites, and the installation of appropriately designed sediment controls on the downslope sides to manage the risk of off-site movement of stockpiled materials. The proposed LOM borrow pits and stockpile areas are shown in **Supplementary EIS Figure 6-4**.

More detail on all aspects of the TSF operational phase is provided in **Supplementary EIS Appendix I – Updated Tailings Storage Facility Life of Mine Plan**.

## 6.5.2 Tailings Reprocessing Phase (2038-2047)

### 6.5.2.1 Overview

The tailings stored in the TSF over the LOM must be managed to meet site closure objectives. However, the residual metal content in the facility also represents a potential asset as the inherent value of the metal can be recovered economically. As part of a revised closure plan for the TSF, tailings are to be hydraulically mined and reprocessed before permanent disposal in the open cut final void, deep beneath the water of the final mine pit lake. This would recover value from the asset and remove the liability from the TSF footprint, with the tailings stored in a best-practice facility: subaqueously in the open cut void – a landform with no geomorphic risks and with no oxidation potential.

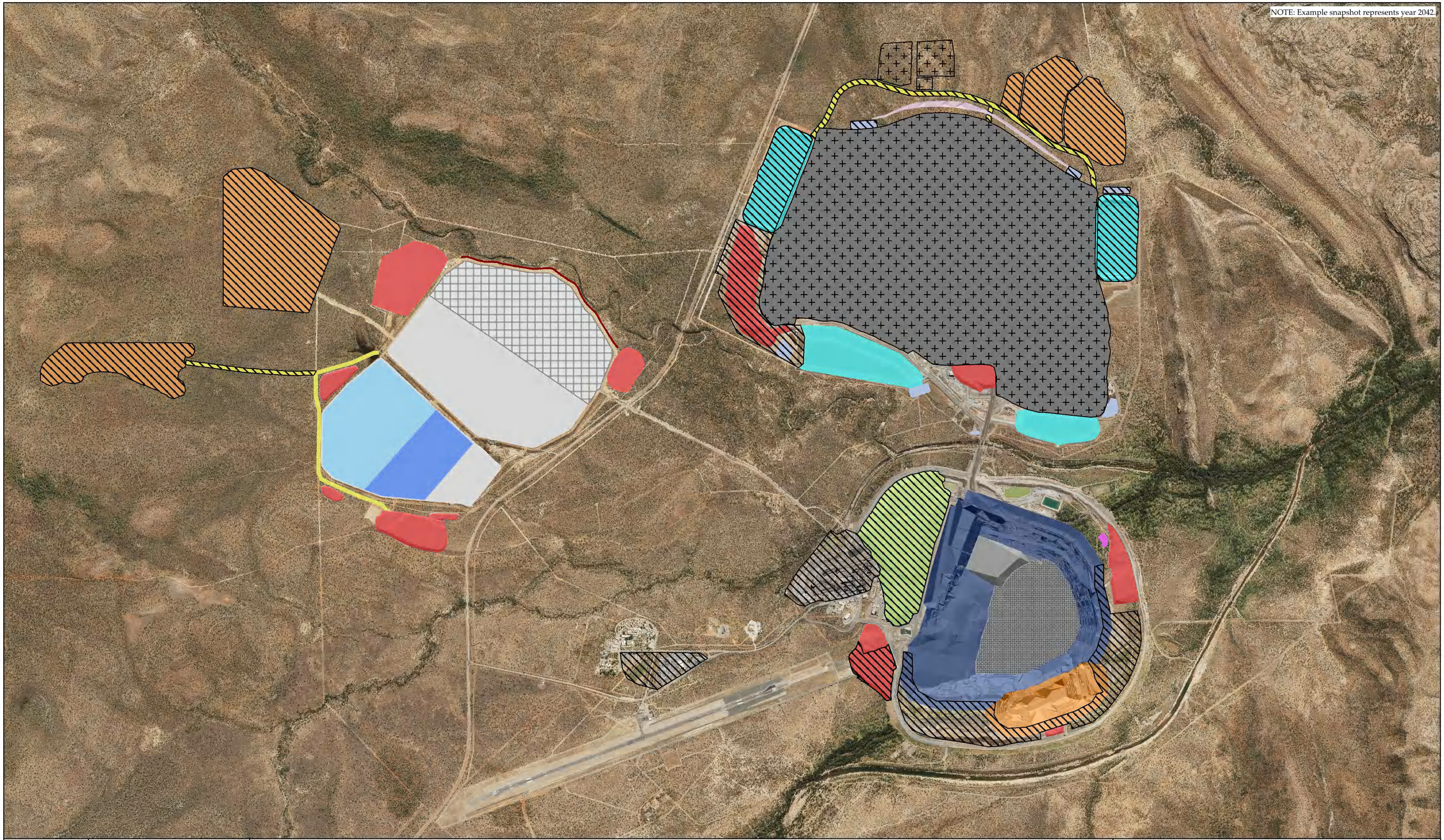
The Tailings Reprocessing Phase is defined by this period of reprocessing of the tailings and deposition of the reprocessed tailings into the open cut final void. Reprocessing is set to commence shortly after mining is complete, and is planned to occur over a 10 year period from 2038 to 2047 (refer to **Supplementary EIS Figure 6-14**).

The goal during this phase is also to remove as much non-benign material from above the surface as is practicable. The stockpiles of various materials between the open cut crest and Mine Levee Wall will also be removed, as well as any contaminated materials in facilities to be closed. The remainder of the EOEF LGO stockpile will be processed in 2038 immediately following the completion of the ex-pit ROM ore. The EOEF PAF(HW) stockpile and SOEF will also be removed during the initial five years of the phase, with the majority of these stockpiles being rehandled into the open cut final void, destined for permanent subaqueous storage. Some of the SOEF will be utilised in the reshaping and closure of the WOEF.

The WOEF is no longer required once ore mining from the open cut has ceased. The infrastructure on the WOEF, including the offices and workshops, will be removed. The facility is a permanent OEF, so the landform must be stabilised for adequate long-term performance and the non-benign internal composition isolated from the environment as far as practicable. To achieve this, the WOEF will be reshaped from angle of repose batters back to 1V:4H slopes. This enables a suitable cover to be installed over the entire WOEF. The planned cover system will be a low net percolation, low oxygen transmission, store and release type cover comprised of a 0.5 m thick CCL barrier layer with a permeability of less than $1 \times 10^{-9}$ m/s overlain by a 0.5 m thick coarse LS-NAF(HC) rock drainage layer overlain by 1.5 m of alluvium (on the plateau) or LS-NAF(HC) rock (on the batters) to act as a growth media zone, topped by 0.1 m of topsoil and vegetation.

At the commencement of this phase, the NOEF will have been completed for a period ranging from a minimum of five years to over 15 years and therefore will have established some vegetative cover with varying levels of maturity. The NOEF will be undergoing regular monitoring, with the key focus on such aspects as net percolation, oxygen permeability, erosion, temperature, seepage and stability. During this Active Closure period, cover and drainage system maintenance may still be required periodically to ensure they maintain their intended functionality. However, it is expected that requirement for maintenance works during this period will reduce as vegetation establishes

Water management will remain a strong focus during this period, as detailed in **Draft EIS Chapter 8 – Water Resources**. During this phase, the groundwater drawdown into the open cut remains high, with recharge from the NOEF and the eastern end of the Barney Creek Diversion Channel still active. Active dewatering of the open cut is maintained until 2047, to limit the depth of water into which tailings and overburden are placed, and to limit the quantity of oxidation products at the start of the mine pit lake Closure Phase. The excess water will be managed within the site-wide water management system, using evaporation, the 15 ML/d WTP and the associated managed release capabilities as the main disposal methods. This enables the water balance to be managed whilst continuing to meet the SW11 surface water quality targets.

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**LEGEND**

- TSF Interception Trench
- Tailings Storage Facility (Cell 1 & 2)
- Borrow Area (Benign Material)
- New Haul Roads
- North Overburden Emplacement Facility
- Benign Material Stockpile
- Perimeter Runoff Dam
- In Pit Dump Material
- Sediment Dams
- Open Cut
- West Overburden Emplacement Facility
- Cell 3 Water Management Dam
- Cell 3 Process Water Dam
- Rehandled Tailings
- NOEF North Drain
- EOEF Runoff Sump
- Rehabilitation Commenced
- Rehabilitation Advanced
- Partially Decommissioned TSF

Data Source: Hillshade Rasters - Glencore (Jun 2016); Aerial - McArthur River Mining Pty Ltd (Jul 2017)

McArthur River Mine
OMP Supplementary EIS

## Tailings Reprocessing Phase (2038 - 2047)

0 0.5 1
Kilometres
Scale: 1:30,000 (A3)

11/12/2017

Datum: GDA94
Projection: MGA53

FIGURE 6-14

### 6.5.2.2 Domain 1 – Open Cut

The existing MRM process plant will be utilised to reprocess the tailings at approximately 10 Mtpa over a 10 year period, with the reprocessed tailings destined for the open cut final void. **Supplementary EIS Figure 6-15** provides a conceptual plan of the tailings deposition layout. Additionally, non-benign overburden from the SOEF, EOEF and other remediation areas will be relocated into the IPD during the Tailings Reprocessing Phase.

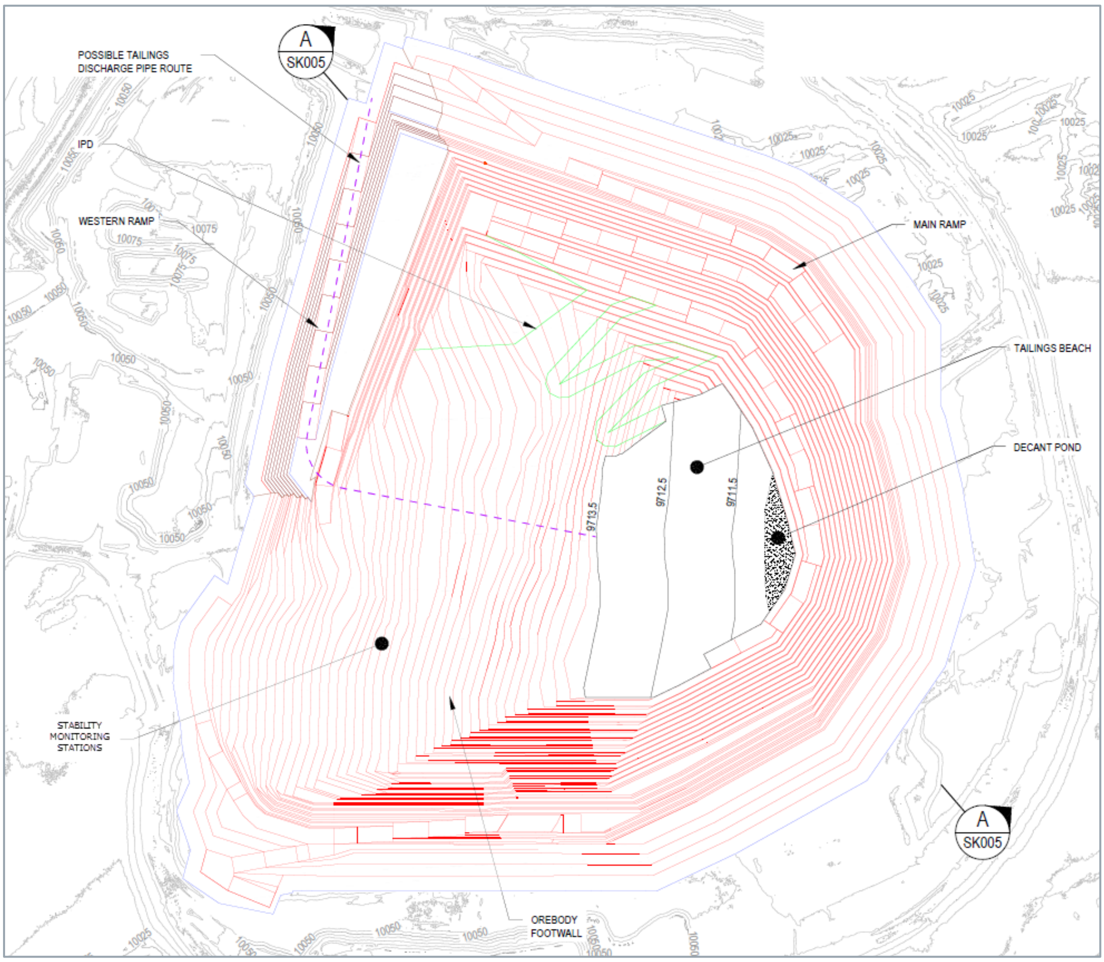


Figure 6-15 Conceptual Deposition Plan for the Final Void after Year 1 of Reprocessing

Any LGO remaining on the EOEF pad at the end of open cut mining will be processed, removing this possible contamination source from the surface.

The PAF(HW) material stockpiled in the EOEF will be rehandled from the surface location down into the final void during the Tailings Reprocessing Phase. Placement of the materials into the in-pit dump and active tailings deposition areas will require safe work procedures to be developed and implemented to manage the risk of slumping of the tip head into soft tailings or water.

After the stockpiles have been removed, the base will be decontaminated. The southern end is no longer required, and will have drainage into the open cut established, and the area topsoiled and revegetated. The northern end will become a stockpile area for LS-NAF(HC) rock mined from the Woyzbun Quarry. This stockpile will be used to service the long-term landform maintenance requirements, such as repairing erosion gullies and armouring areas prone to erosion. The sump will be re-purposed into a sediment basin to service this stockpile.

#### 6.5.2.3 Domain 2 – NOEF

With production related construction activities ceasing in 2032, there is limited change to this domain through the 2038 to 2047 Tailings Reprocessing Phase. The primary active role that the domain plays through this period is to support ongoing operations. The heavy vehicle workshop has been assumed to be kept operational through until approximately 2040 to support machinery associated with rehabilitation activities, before being decommissioned and removed. A small LS-NAF(HC) rock stockpile will be located on the former MIA area to service the long-term landform maintenance requirements of the facility.

The remaining three PRODs will be used as required to support the site water management system. It has been assumed EPROD will be decommissioned and rehabilitated during the 2038-2042 period.

During this phase, monitoring and maintenance activities of the Active Closure process will continue, to monitor and manage the cover and drainage systems. Given the expected advanced level of vegetation on some of the older sections of the NOEF in this phase, it may be possible to decommission some sediment management facilities, or convert them from active to passive operation. If monitoring indicates data materially different from that expected, such that additional mitigation might be required, options such as those presented in **Supplementary EIS Appendix R – Adaptive Management Report** and **Draft EIS Appendix Q – NOEF Mitigation Options Report** would be assessed and implemented if required.

#### 6.5.2.4 Domain 3 – TSF

At the cessation of mining in the open cut, tailings will be hydraulically mined, reprocessed and disposed of within the open cut, below the water level of the final mine pit lake. Approximately 95 Mt of tailings will be removed from the TSF and reprocessed, with the spent tailings deposited into the open cut final void over an approximate ten year period, at a production rate of approximately 10 Mtpa.

##### 6.5.2.4.1 Facility Design and Controls

Tailings will be extracted at a nominal rate of 35,000 t per day via a hydraulic mining system using high pressure water guns (**Supplementary EIS Figure 6-16**). The flow of water at high pressure will be directed onto the surface of the tailings in a sweeping motion to create a ditch on the surface. The monitors will work horizontally and vertically, operated by remote control using a system that allows them to rotate and advance.

The excavated tailings slurry will drain to the centre of a dedicated sump by gravity in ditches carved into the material by the monitor. The slurry will have a density of approximately 55% solids and will be pumped to shore tanks via high–density polyethylene (HDPE) pipelines. An operation of four hydraulic monitors and two sumps will be required in order to sustain the proposed production rate.

Figure 6-16 Example of Hydraulic Monitor Operation

Sourced: Garling and Prentice (2010)

Hydraulic mining bench heights will be typically set at approximately 10 m high and access ramps will be created to relocate the hydraulic monitors. The total depth of the tailings deposit will be approximately 35 m, requiring three mining benches with the possibility of a fourth to fully remove the base and any affected foundation alluvium/soils. Safety zones will be maintained near the TSF walls to manage their integrity, with the walls being deconstructed by conventional earthmoving equipment as the reclamation progresses. The TSF walls will be maintained at a suitable height to contain the design storm event, and all tailings material in the event of an earthquake triggering liquefaction.

Tailings material exposed away from the direct operations will have surface moisture maintained by irrigation, either via water carts and/or sprinklers. This will manage both the risks of dust generation and spontaneous combustion.

Subsequent pumping of the material to the processing plant and open cut final void will be via pipelines over a distance of approximately 2,700 m. One additional pipe to the existing pipelines is required to support the tailings pumping and reclaim water system, with reclaim water to run the monitors being sourced from the open cut. The pipelines will run in the existing pipeline corridor between the TSF and plant. This corridor has established bunds and spillage collection sumps to manage the risk of spill from a burst pipe.

Suitable salvaged wall construction materials will be stockpiled and/or used directly to re-shape and rehabilitate the TSF footprint.

#### 6.5.2.4.2 Reprocessing

Tailings will be supplied to the existing processing plant in slurry form. The remainder of the 10.5 Mtpa mined would report to the reprocessed tailings stream for deposition into the open cut final void. At this point in time it is not planned to create separate zinc and lead concentrates. If this was required, the process would not be materially different from the current processing. However, making separate concentrates would require a reduced overall processing rate.

The bulk concentrates produced from reprocessing will be sold to international markets as bulk concentrates are currently. However, the reduced quantity produced would result in a commensurate reduction in annual truck movements to Bing Bong, and barge trips from Bing Bong.

The physical plant, chemicals, processes and waste streams would be not materially different between the regular ore processing and tailings reprocessing phases. Operating times would be as per regular operations. Some crushing and grinding plant would be redundant and could be decommissioned early if desired. New classification cyclones to split the coarse and fine tailings would be installed, and situated within the current processing plant area. Plant water requirements have been incorporated into the updated site water balance (refer to **Supplementary EIS Appendix N – Updated Water Balance and Waterways Modelling Report**).

#### 6.5.2.4.3 Tailings Deposition

Permanent storage of the tailings below over 150 m of water is considered environmental best-practice for tailings management tailings as further oxidation is prevented, and risks associated with landform stability and seepage are removed.

## 6.5.3 Closure Phase (2048-3017)

### 6.5.3.1 Overview

The Closure Phase covers the period from the end of Tailings Reprocessing Phase (scheduled for completion in 2047) until the end of the assessment timeframe, i.e. 3017. This phase has been divided further into two periods, based on the type and frequency of management expected during each:

- 2048-2100 (nominally) - Active Closure. The majority of the large scale rehabilitation activities are undertaken in this stage (apart from the NOEF which will be complete), such as the demolition and removal of most infrastructure and rehabilitation of disturbed areas. Newly rehabilitated areas are anticipated to require active maintenance to assist with establishment and to maintain intended functionality. As the landforms and revegetation mature, the amount and frequency of maintenance and monitoring is anticipated to reduce significantly. It is expected that rehabilitated areas will achieve a low-maintenance, stable and largely self-sustaining state by the conclusion of this phase.
- 2101 onwards - Proactive Monitoring and Reactive Monitoring. Proactive Monitoring will be routine based monitoring, albeit at a reduced intensity to the Active Closure Phase. Reactive Monitoring is when routine monitoring and maintenance transition to being undertaken in response to a particular event, such as a large storm in excess of the design storm event, rather than on the basis of a set schedule.

The focus of this phase is transforming the remaining disturbed areas that are not to be retained in the long term to their final state. All rehabilitated areas must be configured to achieve the site closure objectives, and their individual objectives (such as post-mine land use).

The sections below focus predominantly on the shorter term Active Closure Phase, however the same source-pathway-receptors exist in the long term and therefore the controls applied in the short term will also mitigate any long-term potential effects.

**Supplementary EIS Figure 6-17** shows the proposed layout following the completion of the five year ‘decommissioning’ period at the beginning of the Active Closure Phase.

During this period the key activities include:

- decommissioning and rehabilitation of the TSF operational areas;
- removal of any remnant infrastructure not required for ongoing activities during the Active Closure Phase, such as processing plant, accommodation village, workshops, roads, powerlines, and pipelines;
- construction of flood protection for the power station;
- filling of the open cut final void with water;
- decommissioning, removal and rehabilitation of the Cell3 WMD and PWD; and
- the staged transition of the mine pit lake from an isolated facility to a secondary path flowthrough facility.

Further detail on the closure plan for the various facilities is provided in **Draft EIS Chapter 4 – Decommissioning, Rehabilitation and Closure**.

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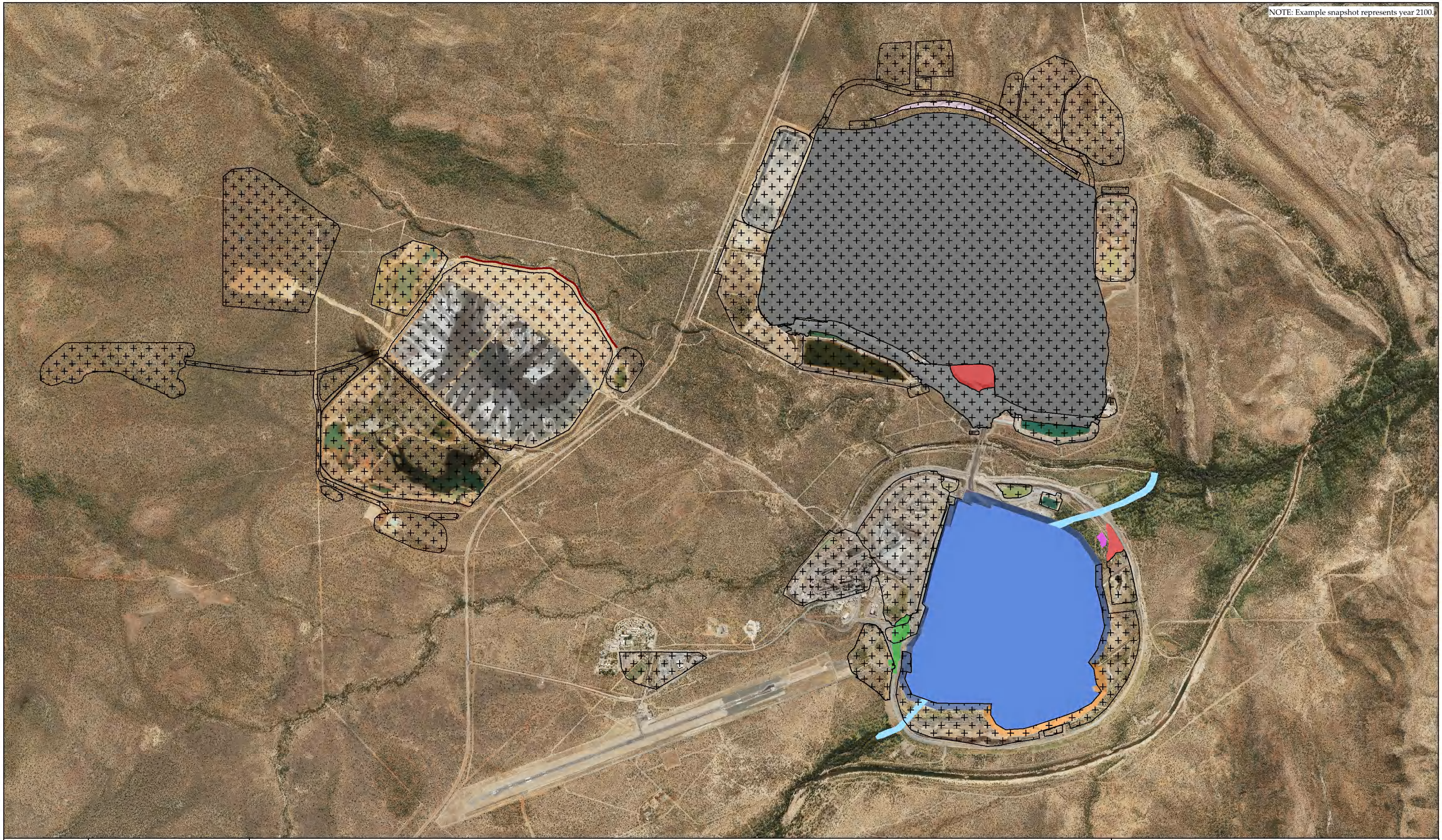


LEGEND

- TSF Interception Trench
- Borrow Area (Benign Material)
- North Overburden Emplacement Facility
- Stabilised Benign Material Stockpile
- Water Level
- Open Cut
- Flood Protection Levee
- NOEF North Drain
- EOEF Runoff Sump
- Restored McArthur River Channel
- Rehabilitation Advanced

Data Source: Hillshade Rasters - Glencore (Jun 2016); Aerial - McArthur River Mining Pty Ltd (Jul 2017)

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## Closure Phase (2047 - 3017)

0 0.5 1
Kilometres
Scale: 1:30,000 (A3)

13/12/2017

Datum: GDA94
Projection: MGA53

FIGURE 6-17

#### 6.5.3.2 Domain 1 – Open Cut

##### 6.5.3.2.1 Facility Design and Controls

The most effective method to mitigate the potential for poor quality water in the disused open cut is to rapidly fill it with water. This will submerge both the material stored in the base of the open cut final void and the open cut walls, eliminating further oxidation. As the generation of oxidation products and evapoconcentration are time dependent processes, rapid filling with fresh water (as opposed to slow filling) will result in the best quality water in the initial mine pit lake formation.

After the tailings relocation to the open cut final void is complete in 2047, water from McArthur River during high flow periods will be harvested using siphons and/or pumps at the rate of approximately 60 GL per year over approximately five wet seasons, and discharged into the open cut final void. This will fill the void rapidly to the steady state mine pit lake water level, which is estimated to be approximately 15 m below ground level, near the base of the alluvial zone. Water treatment may be required during this filling, so these facilities would not be decommissioned immediately after tailings reprocessing. Before flooding of the mine pit lake is completed, works will be required in the open cut area which will assist in achieving the closure objectives. These are described below.

The open cut design already features 18 degree (1V:3H) slopes in the upper alluvial zone to provide enhanced long-term stability in the mine pit lake setting. The batters will be topsoiled, revegetated and equipped with debris to form habitat structures suitable for a lacustrine environment. The Old McArthur River channels between the Mine Levee Wall and the open cut will also be armoured to provide scour resistance during inflows. These works are likely to commence in the Tailings Reprocessing Phase, however establishment will continue into the Closure Phase.

To protect the power station (in the event that it is still required beyond 2048), a clay core levee wall to the 1:1000 year flood level will be constructed between the southern end of the WOEF and the Mine Levee Wall.

Once the mine pit lake is formed, it will remain as an isolated facility (i.e. no inflow or outflow between the mine pit lake and the McArthur River) pending confirmation of the lake behaviour and evolution of its water quality (refer to **Supplementary EIS Appendix R – Adaptive Management Report** and **Appendix D – Pit Lake Closure with Strategic Riverine Connectivity**). Operation of the WTP and/or lake water treatment may be required to stabilise water quality at the desired values. Based on detailed, site-specific models of water quality within the mine pit lake over time (**Supplementary EIS Appendix M – Updated Mine Pit Lake Modelling Report)**), water quality in the isolated system is expected to remain reasonably stable in the short term.

Once water quality within the mine pit lake can be demonstrated to be within acceptable levels, and the models provide a confident representation of observed conditions, a section of the downstream levee will be removed to allow for water exchange between the mine pit lake and the McArthur River during periods of seasonal high flow. To control inflows to the mine pit lake the inlet through the Mine Levee Wall will be constructed with an abrupt steep face on the external side to deter entry of large fauna, and a sloped ramp on the inside (mine lake side) to reduce the risk of fall related injuries to fauna entering the mine pit lake in a flood. The introduction of external waters to the lake will also bring sediments into the mine pit lake, which will further bury the tailings and in-pit dump. Once the performance of this backflow mine pit lake is demonstrated and it is confirmed that external water management is no longer required, the WTP and Cell 3 dams will be decommissioned and their disturbance footprints rehabilitated.

A further period of assessment will then take place, monitoring both the water within the mine pit lake and within the McArthur River downstream of the mine pit lake. Upon demonstration of acceptable water quality conditions, a portion of the upstream Mine Levee Wall may be removed to create a second inlet, and hence a flow through system. The flowthrough mine pit lake will then form a secondary channel of the McArthur River during seasonal flood events, with the McArthur River Diversion Channel maintained as the primary flow path. Modelling has demonstrated that both backflow and flowthrough mine pit lakes are effective closure scenarios. The decision making process that will be adopted is presented in **Supplementary EIS Appendix R – Adaptive Management Report**.

##### 6.5.3.2.2 WOEF

As the WOEF will have been rehabilitated during the Tailings Reprocessing Phase, the WOEF will be in its Active Closure Phase. Corrective actions to manage drainage, cover systems and vegetation cover will be occurring on a scheduled basis.

##### 6.5.3.2.3 Other Infrastructure

Civil infrastructure in the open cut domain, such as processing facilities, accommodation village, administration buildings and workshop buildings (except those which will remain for beneficial use) are to be decommissioned and the disturbed areas rehabilitated. Where possible, materials will be recycled. Waste materials will be transported and deposited at depth in the open cut final void early in the mine pit lake development period. The dams that serviced the process area will be decontaminated and repurposed to become sediment basins. The top of the Barney Hill area will be re-profiled to shed water through these basins.

#### 6.5.3.3 Domain 2 – NOEF

In the Closure Phase, the main NOEF landform will be unchanged, with Active Closure activities continuing in the short term. By this stage, the last stage of the NOEF would have been covered and rehabilitated for approximately 15 years, with some areas completed for over 25 years. Vegetation, drainage, seepage, monitoring and maintenance should all be well established and understood.

It is envisaged that by around 2100, most of the NOEF would have been rehabilitated for well over 70 years, and the Active Closure Phase should have completed all the adjustments to aspects such as drains, erosion protection, water management systems and vegetation mix so that the facility is self-sustaining and robust to climatic events within the design criteria. Therefore, a transition to a Proactive Monitoring period is initially planned, whereby all environmental modelling work has been completed. However, environmental monitoring will still be conducted but at a reduced complexity and frequency, the details of which will be developed in consultation with the regulator.

Upon demonstration of acceptable environmental performance, a period of Reactive Monitoring is expected. This is where major inspections and remedial works are completed on an event basis rather than a time basis. When large storms, winds, droughts or fires beyond the expected 'normal' range occur, a program of checks with remedial works will be triggered.

#### 6.5.3.4 Domain 3 – TSF

By the start of the Closure Phase, the tailings have all been removed from the TSF domain, with only the remnant embankments remaining, plus associated infrastructure and disturbed stockpile areas. The area is now ready for final closure.

The disturbed areas will be reshaped using the benign materials remaining from the removal of the TSF embankments. The surface will be free draining to Surprise and Little Barney Creeks where possible. Alluvial material and topsoil will be spread over the higher ground before revegetation with suitable species, which will function as a control for dust and erosion. The drain areas will have suitable rocky LS-NAF(HC) lining the main flow paths to reduce erosion. Sediment management systems will be installed and maintained downstream of the rehabilitated areas until erosion rates meet the closure objectives. Borrow pits that remain as depressions would require suitable vegetation adapted to the revised moisture content of that setting. Any remnant infrastructure not required for ongoing activities during Active Closure, such as roads, powerlines, and pipelines, would be removed.

After the tailings have been removed, some contaminants are still anticipated to be in the groundwater zones, moving slowly towards the creeks, the mine pit lake and McArthur River.

The network of groundwater monitoring bores in use throughout the LOM would continue to be monitored. Based on current modelling, there are no plans for groundwater recovery from around the TSF domain after the removal of the tailings. Surface waters with unsuitable concentrations of elements will be recovered from Barney Creek and managed as required to meet the closure objectives, most commonly late in the dry season.

Refer to **Supplementary EIS Appendix I – Updated Tailings Storage Facility Life of Mine Plan** for further details on TSF closure considerations.

**Draft EIS Chapter 4 – Decommissioning, Rehabilitation and Closure** also provides further information on rehabilitation activities**.**

## 6.6 Footprints and Final Landform

**Supplementary EIS Figure 6-18** below provides a comparison of the maximum footprint of previous EISs (Phase 3 and prior) compared to the proposed project footprint (incorporating minor changes since the Draft EIS submission). **Supplementary EIS Figure 6-19** provides a comparison of the final project footprint post-rehabilitation with previous EIS footprints. **Table 3-5** in **Draft EIS Chapter 3 – Project Description and Justification**, compares the areas for the various domains over different phases of the project life.

The maximum disturbance footprint of the project is approximately 1,812 ha. The footprint varies over the LOM and includes some areas that have previously been approved in addition to the proposed project. At closure the footprint will be comprised of approximately 116 ha of remnant site infrastructure and 1,696 ha of rehabilitated areas, which have been rehabilitated to the principles outlined in **Draft EIS Chapter 4 – Decommissioning, Rehabilitation and Closure**.

The main differences between the footprints of the project and that of Phase 3 are:

- the addition of the Woyzbun Quarry to the open cut;
- the reshaping of the NOEF to accommodate the new, smaller footprint, with increased height;
- the omission of TSF Cell 4;
- the complete removal of the tailings for reprocessing and subsequent relocation of waste tailings material to the open cut final void for in-pit underwater storage;
- the rehabilitation of the remaining TSF footprint, including removal of all TSF batters and other associated infrastructure;
- the reduction of the Phase 3 EOEF and SOEF to smaller, temporary structures inside the Mine Levee Wall only, with rehandling into the open cut void at the end of mining; and

- the nominal locations of benign material borrow pits and stockpiles for the TSF have been defined in the project, whereas Phase 3 did not provide any specific locations.

The open cut domain is expected to reach its maximum footprint of 421 ha in 2027 when the excavation has reached its full horizontal extent at surface level and the temporary OEFs within the domain have been constructed. At closure, most infrastructure within the open cut domain will have been removed. Third party assets (power station) and infrastructure with potential for future use (aerodrome, accommodation village) may not be removed. The majority of the 421 ha footprint will be rehabilitated.

The NOEF domain will reach its maximum footprint of approximately 742 ha in 2022. At this point the NOEF will have reached its full extent and the associated domain infrastructure will be in place including the PRODs, sediment dams, clean water drain and benign material stockpiles.

By closure, the NOEF will have approximately 7 ha of remaining infrastructure for the purpose of monitoring and maintenance including the MIA stockpile. The other 735 ha will be rehabilitated, including the NOEF cover system.

The shape of the remnant NOEF footprint has changed since the approved Phase 3. Upon closure, Phase 3 did not include the rehabilitation of PRODs around the NOEF, whereas the project will decommission and remove these facilities.

The TSF domain will cover its maximum footprint of 522 ha in 2032. This will include the Cell 3 WMD and PWD, benign material quarries and stockpiles, and associated new haul roads.

The remnant footprint of ancillary infrastructure is 107 ha. Infrastructure that contributes to this footprint includes:

- the main fuel tanks;
- the power station (this facility is not owned by McArthur River Mining);
- selected roads and tracks;
- the airport and airstrip;
- parts of the accommodation camp area; and
- the site landfill facility.

Upon closure, this infrastructure will remain on site to support rehabilitation monitoring and maintenance as well as to potentially service future activities that may occur at, or close to MRM. Approximately 16 ha of the 124 ha maximum area is expected to be rehabilitated.

The project footprint figures presented may omit some minor disturbances, such as light vehicle tracks or temporary topsoil stockpiles that may be necessitated by day-to-day operations.

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LEGEND

**OMP (Project) EIS**

Maximum Proposed Footprint

**Previously Approved Disturbance**

Existing and/or Approved Footprint

Highway

Mine Access Road

Data Source: Mine Access Road, Project Footprints, Aerial - McArthur River Mining Pty Ltd (2012-2017); Highway - NT Gov. (2012)

METSERVE Mining & Energy Technical Services Pty Ltd

McArthur River Mining

A GLENCORE COMPANY

McArthur River Mine
OMP Supplementary EIS

# Maximum Project Footprint

07/12/2017

0 0.5 1
Kilometres
Scale: 1:30,000 (A3)

Datum: GDA94
Projection: MGA53

FIGURE 6-18


METSERVE
Mining & Energy Technical Services Pty Ltd

McArthur River Mining
A GLENCORE COMPANY

LEGEND

**OMP (Project) EIS**

Final Proposed Footprint

**Previously Approved Disturbance**

Previous Proposed Final Footprint

Highway

Mine Access Road

Data Source: Mine Access Road, Project Footprints, Aerial - McArthur River Mining Pty Ltd (2012-2017); Highway - NT Gov. (2012)

McArthur River Mine
OMP Supplementary EIS

# Final Project Footprint

08/12/2017

0 0.5 1
Kilometres
Scale: 1:30,000 (A3)

Datum: GDA94
Projection: MGA53

FIGURE 6-19