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MAXWELL UNDERGROUND MINE PROJECT

APPENDIX C

Surface Water Impact Assessment

Maxwell Underground Mine Project - Mine Entry Area Modification

Surface Water Impact Assessment

Malabar Resources Limited
1383-09-B2, 5 August 2021

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Client	Malabar Resources Limited
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1 Introduction

The Maxwell Underground Mine Project (the Project) is an approved underground coal mining operation owned by Maxwell Ventures (Management) Pty Ltd, a wholly owned subsidiary of Malabar Resources Limited (Malabar). The Project is in the Upper Hunter Valley of New South Wales (NSW), east-southeast of Denman and south-southwest of Muswellbrook.

The Project area comprises of substantial existing Maxwell Infrastructure (a former mining operation) and the approved Maxwell Underground.

A proposed Modification is being sought under section 4.55(1A) of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The Modification is located wholly within the approved Development Application Area and would comprise minor changes to the following approved components (refer to Figure 1.1):

- repositioning of the underground portal;
- realignment of a small section of the proposed access road at the Maxwell Infrastructure site to utilise an existing haul road and minimise impacts to established mine rehabilitation;
- repositioning of an approved clean water diversion for the mine entry area (MEA);
- repositioning of the water treatment facility from the MEA to Maxwell Infrastructure; and
- other minor works and ancillary infrastructure components within existing/approved surface development areas (e.g. works associated with the reconfiguration of the MEA, pumps/pipelines associated with the water treatment facility).

WRM Water & Environment (WRM) was engaged by Malabar to undertake a surface water assessment review to assess the proposed Modification.

1.1 APPROVED WATER MANAGEMENT STRATEGY

The objectives and design criteria of the Project site water management system are to:

- protect the integrity of local and regional water resources;
- separate runoff from undisturbed, rehabilitated and mining-affected areas;
- design and manage the system to operate reliably throughout the life of the Project in all seasonal conditions, including both extended wet and dry periods;
- provide water for use in mining operations that is of sufficient volume and quality;
- maximise the re-use of water on-site; and
- manage groundwater inflows and coal handling and preparation plant (CHPP) process water on-site.

The Project will involve the use of a combination of mine water, recycled treated mine water and potable water in underground and surface operations. Water will be required for CHPP operation, underground mining operations (e.g. for cooling and underground dust suppression), dust suppression on roads, stockpile dust suppression, washdown usage, and other minor non-potable uses.

The main water sources for the operation are:

- groundwater inflows to underground workings and existing mine voids;
- recovery from CHPP rejects (through dewatering and/or decant return water);
- catchment runoff and infiltration; and
- small volumes of potable water imported to site.

1.1.1 Up-catchment Runoff Control

Temporary and permanent up-catchment diversion structures will be constructed over the life of the Project to divert runoff from undisturbed areas around the MEA and the transport and services corridor.

Stabilisation of up-catchment diversions will be achieved by the design of appropriate channel cross-sections and gradients and the use of channel lining materials, such as grass or rock fill.

1.1.2 Rehabilitated Areas

Malabar is progressing the rehabilitation of previous mining areas at the Maxwell Infrastructure, including overburden emplacement areas.

As vegetation establishes on these areas, Malabar will progressively develop drainage works, with the aim of minimising the long-term catchment areas of the mine voids at the Maxwell Infrastructure as far as practicable.

1.1.3 Water Treatment

The Project will include the development of water treatment facilities, including a reverse osmosis plant (and/or other suitable water treatment technologies), to treat water for supply to underground mining operations (e.g. for cooling and underground dust suppression).

Treated water will be stored in the Treated Water Dam. Brine and/or precipitate from water treatment activities would be temporarily stored in a holding dam (Brine Dam), prior to being co-disposed with the CHPP reject material in the East Void.

1.1.4 Management of Excess Water

The water consumption requirements for an underground mining operation are typically lower than for open cut mines given there is significantly less surface disturbance area that requires watering for dust suppression. Accordingly, under some climate conditions, the Project has the potential to receive groundwater and surface water inflows in excess of its consumption requirements.

In the event that excess water accumulates at the Project, Malabar would manage this excess water according to the following hierarchy:

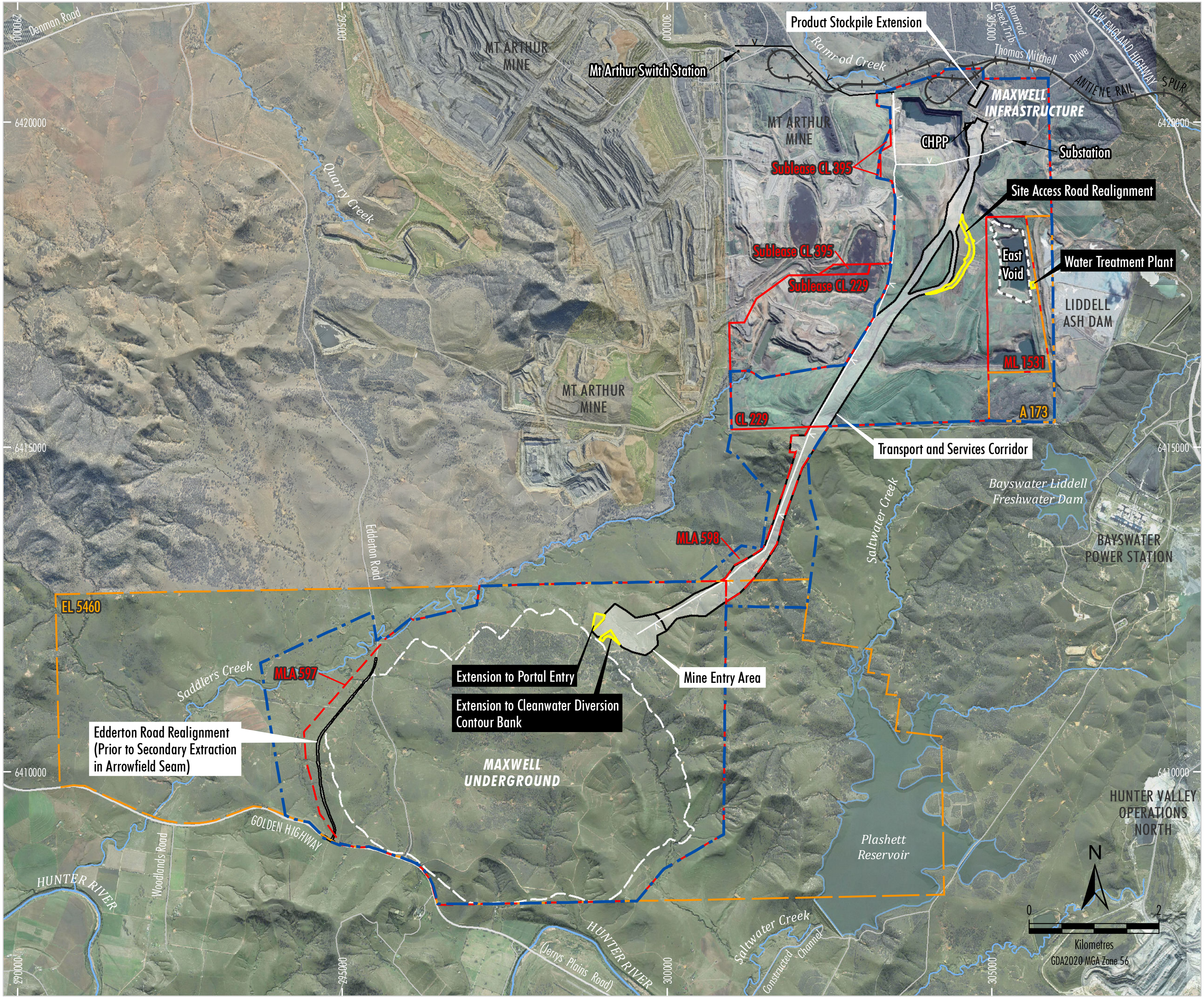
1. Sharing mine water with BHP's neighbouring Mt Arthur Mine (e.g. for use in dust suppression), so reducing that operations' reliance on other water sources.
2. Sharing mine water or treated water with other industrial users (e.g. AGL), so reducing their reliance on water sourced from the environment (e.g. the Hunter River).
3. Sharing treated water with agribusiness (e.g. viticulture or equine industries).
4. Irrigation or evaporation of water within the Project site (i.e. on land catchments that report to the site water management system, such as rehabilitation areas). Evaporation cannons may also be used in these areas to remove excess water from the site water management system.
5. Beneficial use on Malabar-owned pastoral property (e.g. irrigation with treated water).

1.2 PROPOSED CHANGES TO SURFACE WATER MANAGEMENT

The key changes to the surface water management system that have been assessed as part of this review are as follows:

- changes to the surface development area of the MEA associated with the repositioning of the underground portal and clean water diversion; and
- relocation of the water treatment facility to from the MEA to Maxwell Infrastructure.

The modified MEA layout is shown in Figure 1.2.



LEGEND
- Railway
- Exploration Licence Boundary
- Mining and Coal Lease Boundary
- Mining Lease Application Boundary
- Proposed Ausgrid 66 kV Power Supply Extension #

Approved Maxwell Mine
- Development Application Area
- Indicative Surface Development Area
- CHPP Reject Emplacement Area
- Extent of Conventional Subsidence from Underground Mining
- 66 kV Power Supply

Proposed Modification
- Indicative Additional Surface Development Area

Subject to separate assessment and approval.

Source: NSW Spatial Services (2021); MSEC (2019); AECOM (2019)
Orthophoto Mosaic: 2020, 2019

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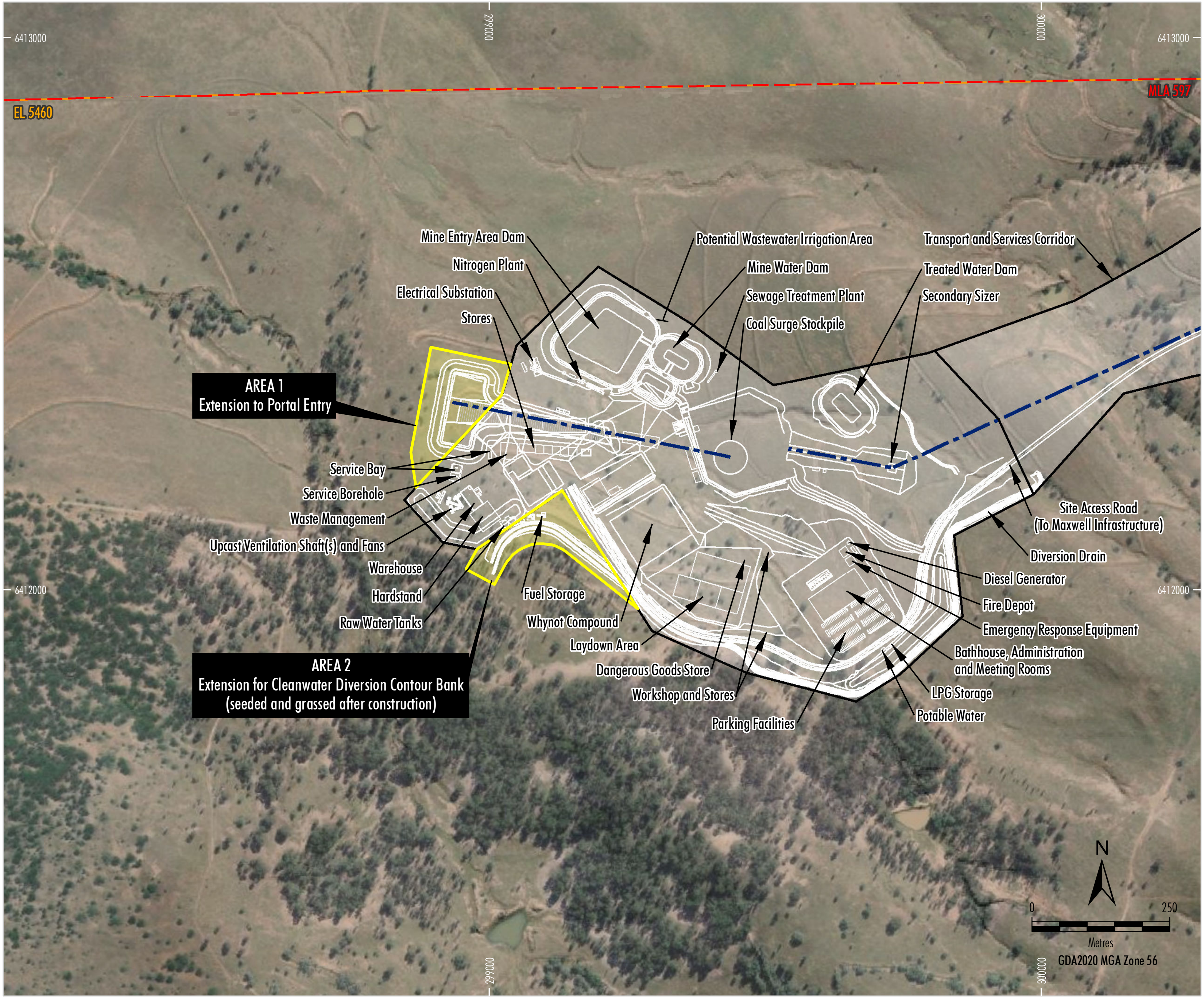
Modified Maxwell Underground Mine

Figure 1.1

SHM-20-04 MOD MEA_SW_201B



LEGEND
- Exploration Licence Boundary
- Mining Lease Application Boundary

Approved Maxwell Mine
- Indicative Mine Entry Infrastructure
- Indicative Surface/Overland Conveyor Location
- Indicative Surface Development Area

Proposed Modification
- Indicative Additional Surface Development Area

Source: NSW Spatial Services (2021); Arkhill (2021)
Orthophoto: ESRI World Imagery (2021)

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Modified Indicative Mine Entry Area Layout

Figure 1.2

SHM-20-04 MOD MEA_SW_202C

2 Surface Water Impact Assessment

The potential impacts of the Modification on the surface water management system include:

- minor changes to the mine site water balance as a result of minor changes in the catchments reporting to water storages; and
- loss of catchment runoff due to catchment excision.

These potential impacts are discussed in the following sections.

2.1 MINE SITE WATER BALANCE

The water balance model developed for the *Maxwell Project Environmental Impact Statement Surface Water Assessment* (WRM, 2019) was used as the base case scenario for comparison. The model was then adapted to reflect the proposed changes to the water management system.

The Project water management system would change over the life of the Project. To represent the progressive development of the Project over time (including the rehabilitation of the Maxwell Infrastructure), the site water balance was modelled in five discrete stages (Table 2.1).

The first stage of rehabilitation activities at Maxwell Infrastructure would be completed during the initial construction phase. From Stage 2, drainage works would be undertaken to work towards the final landform configuration. However, the western rehabilitation area would continue to drain into North Void until Stage 5, when a diversion drain would be constructed to divert the western rehabilitation area past North Void and into a tributary of Ramrod Creek.

Table 2.1 – Water Balance Model Stages

Stage	Representative Mine Configuration	Production Throughput (Mtpa ROM)	Number of Model Years
1	First Stage Rehabilitation Complete	0	1
2	First Stage Rehabilitation Complete	0.5 to 7.0	7
3	Final Landform Drainage Partially Complete	6.0 to 7.9	7
4	Final Landform Drainage Partially Complete	5.2 to 6.7	7
5	Final Landform Drainage Complete	3.0 to 5.5	5

Note: Mtpa = million tonnes per annum, ROM = run-of-mine.

2.1.1 Mine Entry Area Water Management System Configuration

The key components of the water management system for the Project and changes proposed as part of the Modification are summarised in Table 2.2. The water management system would continue to be operated to avoid overflows to the receiving environment. Figure 2.1 shows the water management system schematic for the modified Project.

Table 2.2 – Water Management System for the Modified Project

Name^	Infrastructure Type	Storage Capacity (ML)	Proposed Change
Mine Entry Area Dam (MEA Dam)	Mine affected water dam	110	No change
Mine Water Dam (formerly named Water Storage Dam)	Mine affected water dam	17	No change
Sediment Dam*	Mine affected water dam	4	No change
Portal Dam*	Mine affected water dam	7	New dam to complement Sediment Dam
Treated Water Dam	Treated water storage	15	No change
Brine Dam	Mine affected water dam	4	Repositioned to Maxwell Infrastructure
Water Treatment Facility	Water treatment plant	N/A	Repositioned to Maxwell Infrastructure
Clean Water Diversion	Clean water diversion	N/A	Repositioned at MEA

^ There would be no change to the following existing water storages: Access Road Dam, Industrial Dam, Rail Loop Dam, Savoy Dam, Pringles Dam, North Void, East Void and South Void.

* Not explicitly modelled, included in MEA Dam catchment.

ML = megalitres.

2.1.2 Access Road Realignment

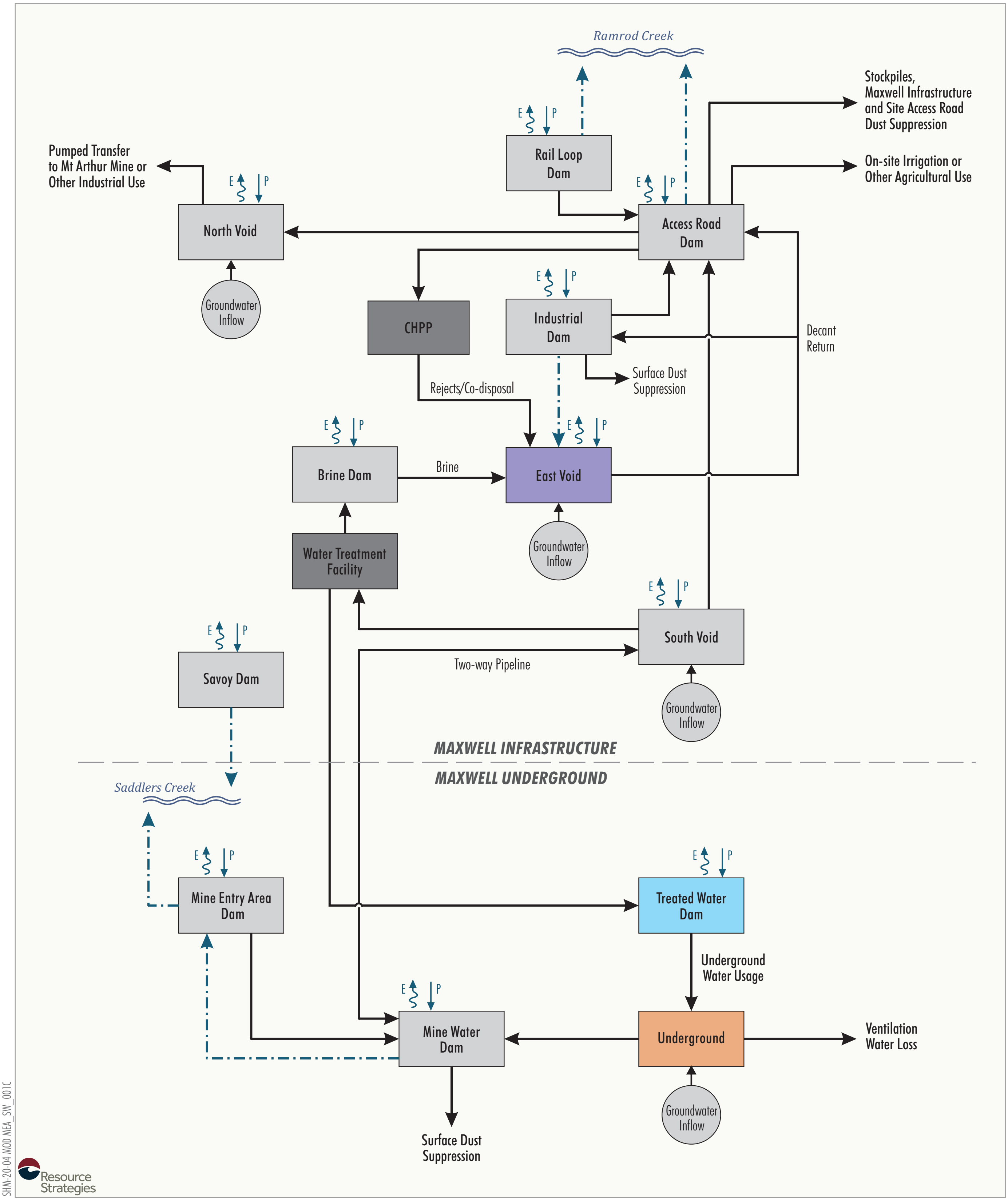
The Modification would also include the realignment of the site access road (within the transport and services corridor) along an existing internal haul road at the Maxwell Infrastructure. The revised alignment of the site access road is shown on Figure 1.1.

The existing internal haul road was already modelled as a hardstand in the *Maxwell Project Environmental Impact Statement Surface Water Assessment* (WRM, 2019). Accordingly, the proposed realignment of the site access road would not affect the site water balance modelling results.

2.1.3 Transport and Services Corridor

Sediment dams would also be established to manage runoff from the transport and services corridor. In accordance with Condition B40 of Development Consent SSD 9526, these sediment dams would be designed in accordance with *Managing Urban Stormwater: Soils and Construction Volume 1* (Landcom, 2004) and *Volume 2E Mines and Quarries* (Department of Environment and Climate Change, 2008).

Conditions B35 and B40 of Development Consent SSD 9526 require Malabar to design, install and maintain sediment dams to avoid off-site discharges, except as may be permitted by under an Environment Protection Licence and the relevant provisions of the *Protection of the Environment Operations Act 1997* (POEO Act). Accordingly, Malabar may dewater sediment dams by pumping to the South Void if water quality monitoring indicates that discharge is not appropriate (e.g. if water quality indicates that discharge would cause pollution to occur under section 120 of the POEO Act).



LEGEND

- Evaporation
- Precipitation/Catchment Runoff
- Pumped/Siphoned
- Overflow
- Treated Water Dam
- Underground Mine
- Mine Affected Water Storage
- Rejects/Co-disposal Storage

NOTES

Overflow Direction: Good engineering practice is to include a stabilised spillway as a contingency for dam safety. This arrow does not indicate that these discharges (overflows) will occur. The arrow is to show the direction of water flow (by gravity) should the dam water level exceed the dam spillway level.

Seepage between voids/storages may occur through previously emplaced waste rock, including seepage between voids and native water storages.

Water management system would change if Malabar pursue an alternative management option for excess water (refer excess water management hierarchy in Section 3.10.3 of the EIS).

Dirty water management system storages are not shown.

Portal Dam and Sediment Dam at the Mine Entry Area are not shown as these are located within the catchment of and report to the Mine Entry Area Dam.

Pringles Dam, which is used to supply water for livestock, is not shown as it does not form part of the mine water management system.

Source: WRM (2021)

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Indicative Water Management Schematic

Figure 2.1

2.2 WATER BALANCE MODELLING RESULTS

2.2.1 Overall Water Balance

Water balance results for all of the 103 model realisations of the base case (the approved Project) and Modification are presented in Table 2.3 and Table 2.4, averaged over each model phase. The results in Table 2.3 and Table 2.4 are the average of all realisations and would include wet and dry periods distributed throughout the Project life.

The Modification results in very small increases in catchment runoff and direct rainfall and evaporation between the two scenarios. There is a 11 to 13 megalitres per year (ML/year) increase (<1%) in catchment runoff and direct rainfall, and a 6 to 11 ML/year increase in evaporation. The change in volume increases by up to 6 ML/year across all stages.

Overall, the impact of the Modification on the average annual water balance is negligible.

Table 2.3 – Base Case Average Annual Water Balance – All Realisations

Component	Process	Average Annual Volume per Model Stage (ML/year)				
		Stage 1	**Stage 2**	**Stage 3**	**Stage 4**	**Stage 5**
Inflows	Catchment runoff & direct rainfall	1,635	1,579	1,643	1,708	1,634
	Underground groundwater inflows	0	408	939	851	829
	Total inflows	**1,635**	**1,987**	**2,582**	**2,559**	**2,463**
Outflows	Evaporation	797	722	739	818	921
	Dust suppression	0	26	25	21	16
	Net CHPP demand	0	727	755	332	307
	Vent/moisture losses	0	170	301	297	265
	Spillway overflows - off-site	1	1	0	0	0
	Total outflows	**798**	**1,646**	**1,820**	**1,468**	**1,509**
	Change in volume	**837**	**341**	**762**	**1,091**	**954**

Note: Totals may not add due to rounding.

Table 2.4 – Modification Annual Water Balance – All Realisations

Component	Process	Average Annual Volume per Model Stage (ML/year)				
		Stage 1	**Stage 2**	**Stage 3**	**Stage 4**	**Stage 5**
Inflows	Catchment runoff & direct rainfall	1,646	1,590	1,656	1,721	1,648
	Underground groundwater inflows	0	408	939	851	829
	Total inflows	**1,646**	**1,998**	**2,595**	**2,572**	**2,476**
Outflows	Evaporation	802	730	749	828	932
	Dust suppression	0	26	25	21	16
	Net CHPP demand	0	727	755	332	307
	Vent/moisture losses	0	170	301	297	265
	Spillway overflows - off-site	1	1	0	0	0
	Total outflows	**804**	**1,655**	**1,830**	**1,479**	**1,519**
	Change in volume	**842**	**343**	**765**	**1093**	**957**

Note: Totals may not add due to rounding.

2.2.2 Mine Affected Water Inventory

The South Void functions as the primary mine water storage for the Project. To prevent potential interaction between stored mine water and the surrounding groundwater system, a maximum operating level (MOL) of 174 metres (m) Australian Height Datum (AHD) has been set for South Void (i.e. the South Void is operated to a maximum water level of 174 m AHD to prevent spills occurring). This is 1 m below the Full Supply Level of 175 m AHD.

The forecast water levels in South Void and North Void for the modified Project (see Figure 2.2 and Figure 2.3) were similar to the base-case.

The minor increases in water level (less than 0.1 m) over the period of simulation are negligible.

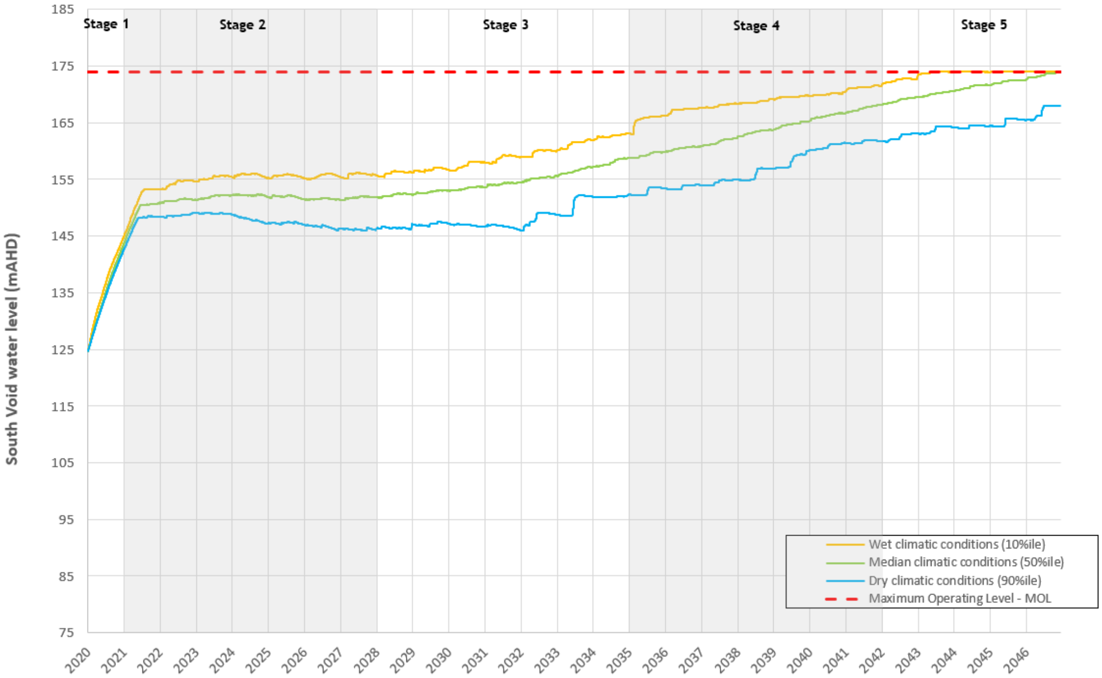

Figure 2.2 – Forecast South Void Water Level – Modified Project

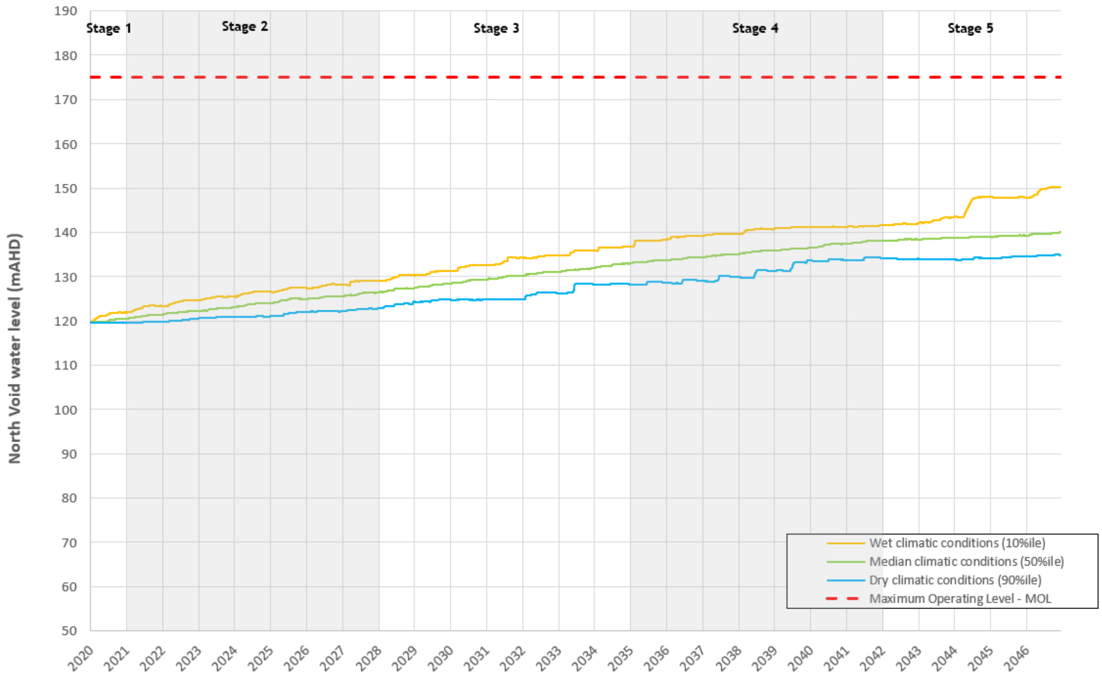

Figure 2.3 – Forecast North Void Water Level – Modified Project

2.2.3 Mine Entry Area Dam Inventory

The MEA Dam would be operated to avoid overflows to the receiving environment. To achieve this, the MEA Dam was set with a MOL around 1.6 m below the spillway level. The MEA Dam would pump to the Mine Water Dam as a priority to provide a storm buffer, before pumping to the South Void.

The water balance modelling shows that the MEA Dam would not overflow to the receiving environment under any of the modelled climatic conditions. Figure 2.4 shows the forecast water levels of the MEA Dam across the simulation period.

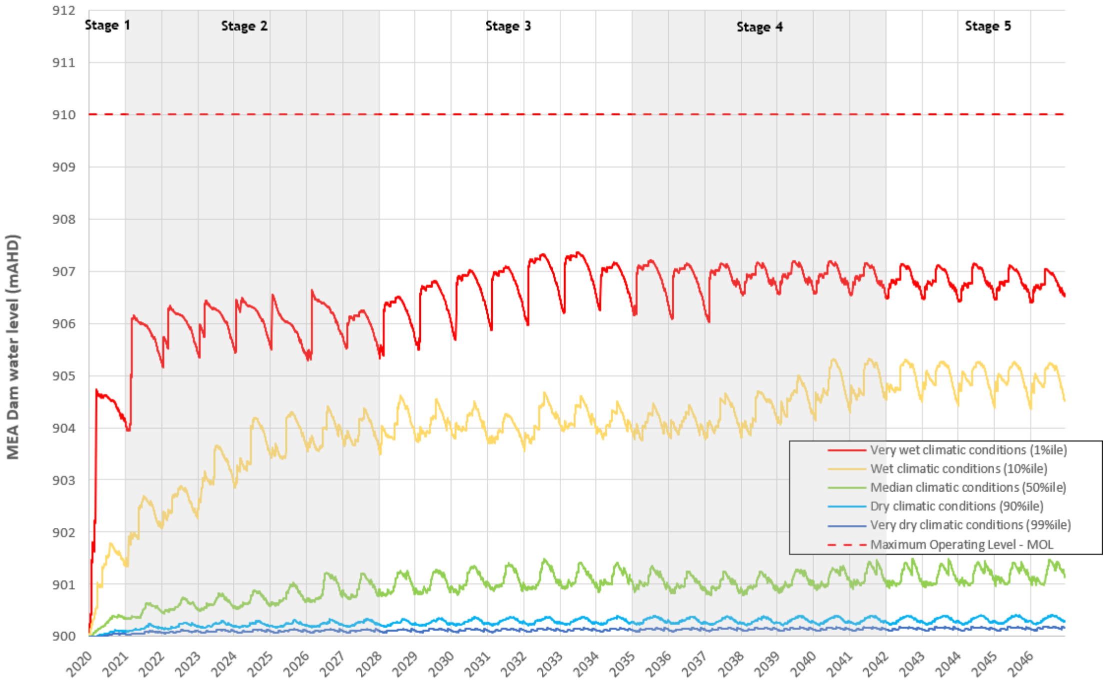

Figure 2.4 – Forecast MEA Dam Water Level - Modification

2.2.4 Uncontrolled Spillway Discharges

The water balance model was used to assess the risk of uncontrolled spillway discharges off-site from the mine water management system. The mine water dams that could potentially flow directly to the receiving environment include:

- Rail Loop Dam (to Ramrod Creek).
- Access Road Dam (to Ramrod Creek).
- Savoy Dam (to Saddlers Creek).
- MEA Dam (to Saddlers Creek).

There were no overflows modelled from MEA Dam, Treated Water Dam and the Savoy Dam. Consistent with the base case scenario, Rail Loop Dam and the Access Road Dam have a 1% Annual Exceedance Probability (AEP) of overflowing to the receiving environment. Consistent with Condition B36 of Development Consent SSD 9526, Malabar would operate Access Road Dam and Rail Loop Dam to avoid off-site discharges from these dams.

The Modification has no impact on the risk of uncontrolled spillway discharges to the receiving environment.

2.2.5 Transport and Services Corridor

The transport and services corridor is considered part of the dirty water management system and is therefore not modelled in the mine water management system (WRM, 2019).

Water may be pumped from sediment dams in the transport and services corridor to the South Void or MEA Dam (where water quality indicates discharge is not appropriate, refer Section 2.1.3). The volume of any water that may need to be periodically pumped to the South Void from these sediment dams is anticipated to be negligible in the context of the surplus available storage in the South Void and North Void.

3 Loss of Catchment Runoff due to Catchment Excision

As part of the Modification, there would be a small increase in surface development area at the MEA due to the repositioning of the underground portal and a clean water diversion. This results in a small increase in the catchment area excised from Saddlers Creek, and a subsequent increase in the loss of catchment runoff.

The Modification increases the catchment excised from Saddlers Creek by 4 hectares (ha). The total pre-development catchment area of Saddlers Creek is 9,714 ha. Therefore, the Modification increases the loss of catchment (and hence loss of catchment runoff) by around 0.04%.

The impact of the Modification on catchment excision (and loss of flows) in Saddlers Creek is negligible and would not be measurable.

4 Summary

The Modification results in negligible changes to the site water balance, including overall water balance, predicted mine affected water levels and overflows to the receiving environment.

The Modification increases the catchment excised from Saddlers Creek by 4 ha, which is around 0.04% of the Saddlers Creek pre-development catchment area. The impact of the Modification on catchment excision (and loss of flows) in Saddlers Creek is negligible and would not be measurable.

In summary, the impact assessment shows the Modification causes negligible additional impacts on surface water resources and the surrounding environment when compared to the approved Project.

5 References

Department of Environment and Climate Change (2008) *Managing Urban Stormwater Soils and Construction – Volume 2E Mines and Quarries*.

Landcom (2004) *Managing Urban Stormwater, Soils and Construction*.

WRM Water & Environment (2019) *Maxwell Project Surface Water Assessment*.