Contents

MALABAR COAL

MAXWELL PROJECT

SECTION 3

Project Description

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3 PROJECT DESCRIPTION

3.1 COAL RESOURCE AND GEOLOGICAL FEATURES

The Project would target coal seams within the Wittingham Coal Measures.

The Project would produce high-quality coals with at least 75% of coal produced capable of being used in the making of steel (known as coking or metallurgical coals). The balance would be export thermal coals suitable for the new-generation High Efficiency, Low Emissions power generators.

Further information on the characteristics of the coal resource and geological features and resource recovery are provided below.

Malabar's understanding of the coal resource has been informed by extensive exploration across the target underground mining area.

In total, more than 950 exploration boreholes have been drilled. In addition to this, approximately 75% of the area is also covered by three-dimensional (3D) seismic survey.

3.1.1 Stratigraphy and Seam Characteristics

The Project is located in the Hunter Coalfield in the northern part of the Permo-Triassic Sydney Basin, which forms the southern portion of the Sydney-Gunnedah-Bowen Basin (DMR, 1988).

The Wittingham Coal Measures occur widely within the Hunter Coalfield and contain many recoverable seams. The Project targets mining of the Whynot, Woodlands Hill, Arrowfield and Bowfield Seams.

The target seams are within the Jerrys Plains Subgroup, forming part of the upper and middle units of the Wittingham Coal Measures (Figure 3-1).

Above the target seams, the stratigraphy of the area consists of a sequence of sandstone, siltstone and laminate units within the Wittingham Coal Measures (Figure 3-1).

A summary of the characteristics of the target seams is provided in Table 3-1.

Table 3-1
Seam Characteristics of the Maxwell Underground Area

Seam	Depth of Cover (m)	Working Section Thickness (m)
Whynot*	40 – 180	1.3 – 2.3 (average 2.0)
Woodlands Hill	125 – 365	1.7 – 3.5 (average 2.7)
Arrowfield	165 – 415	2.1 – 3.7 (average 2.9)
Bowfield	215 - 425	2.2 – 3.3 (average 2.8)

* Partial pillar extraction would not occur at depths of cover less than 50 m.

3.1.2 Geological Features

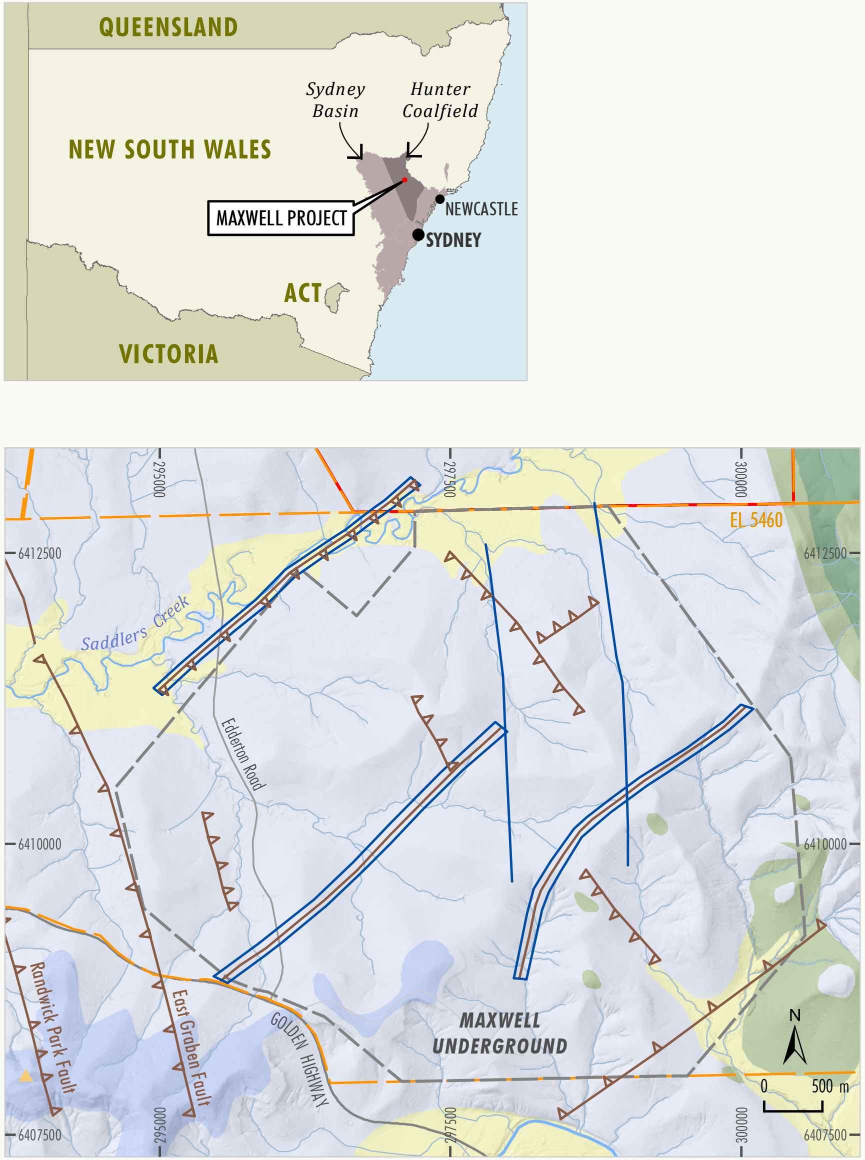
The target underground mining area sits on the western side of the Muswellbrook Anticline, which is a prominent regional geological feature. The strata in the area (including the coal seams) dip gently, with gradients varying between 3% and 5%.

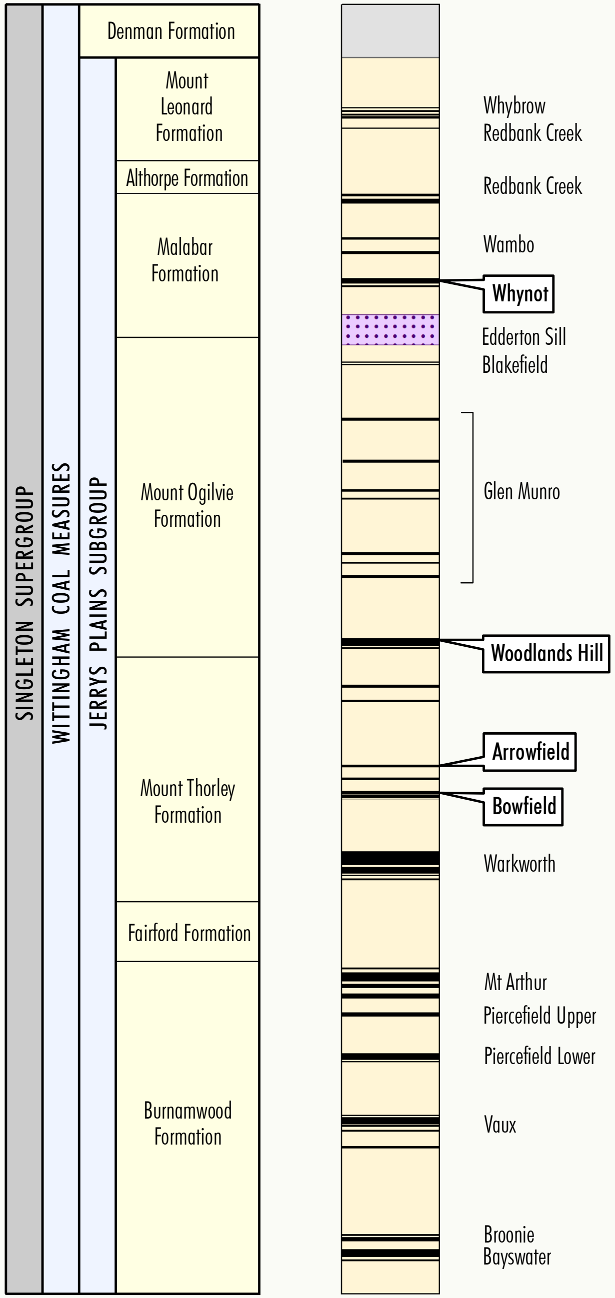
Geological features identified in the target underground mining area and surrounds include:

- a north-northwest-orientated regional graben structure to the west of the Maxwell Underground;
- a north-east-trending fault located to the south-east of the Maxwell Underground with a throw of approximately 10 m;
- smaller faults within the mining area with throws of between approximately 2 m to 6 m;
- igneous dykes;
- dolerite sills intruded into the Whynot, Arrowfield and Bowfield Seams; and
- the Edderton Sill intruded into the interburden between the Whynot and Blakefield Seams, with a thickness of approximately 20 m.

The regional graben structure to the west of the Maxwell Underground comprises the East Graben Fault and the Randwick Park Fault (Figure 3-1).

The East Graben Fault is sub-vertical and has a downthrow of up to 20 m to the west into the graben which forms with the sub-parallel Randwick Park Fault, which has a throw of up to 50 m to the east.





LEGEND
Exploration Licence Boundary
Mining and Coal Lease Boundary
Indicative Extent of Underground Development
Stratigraphic Unit
Quaternary
Newcastle Coal Measures
Wittingham Coal Measures
Ungrouped Cenozoic Igneous Units
Mulbring Siltstone
Geological Features
Dolerite Sill
Fault
Dyke

Source: © NSW Department of Planning and Environment (2019); Department of Finance, Services & Innovation (2019); Department of Resources & Energy (2019); MBGS (2018)

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Geology of the Project Area

Figure 3-1

Resource Strategies

SHM-18-03 Maxwell_EIS_Sect 3_201D

Igneous dykes have been observed as part of surface exploration (Figure 3-1). In-seam drilling would occur during the life of the Project (Section 3.15.2) to characterise the presence of any dykes at seam level.

Extraction through smaller identified faults and dykes is expected to be feasible with the implementation of specific management measures (including the installation of additional ground support or grouting).

Geological features in the Project area are described and considered in detail as part of the Subsidence Assessment (Appendix A) and the Groundwater Assessment (Appendix B).

3.1.3 Coal Resource and Resource Recovery

The Maxwell Underground area is located entirely within EL 5460. The total measured, indicated and inferred coal resource within EL 5460 is approximately 770 Mt.

The Project would recover approximately 148 Mt of ROM coal from the target coal seams.

Extraction in the Whynot Seam is constrained by a dolerite sill to the north-west, west, south, and east. Extraction in the north-east is constrained by depth of cover to the Whynot Seam.

The proposed longwalls in the Woodlands Hill, Arrowfield and Bowfield Seams are constrained by the following (Figure 3-1):

- the East Graben Fault to the south-west;
- the extent of EL 5460 in the south; and
- the north-east-trending fault to the south-east.

The north-eastern extents of the longwall layouts are constrained by seam dip in the Woodlands Hill Seam, by a dolerite sill in the Arrowfield Seam and by technical constraints associated with interburden thickness in the Bowfield Seam.

Malabar would seek to maximise resource recovery within geological, environmental and tenement constraints.

Further exploration or technical assessment may result in changes to the recoverable coal resource. Malabar also recognises that mining technology will advance over the life of the Project, influencing the ultimate coal reserves.

There is the potential to recover additional coal beyond the life of the Project, which would be subject to separate assessments and approvals. The Project would not be expected to have a significant impact on future extraction or recovery of coal in either deeper seams or beyond the proposed Maxwell Underground area.

3.2 PROJECT GENERAL ARRANGEMENT

The Project would involve an underground mining operation that would produce high-quality coals over a period of approximately 26 years.

Table 3-2 provides a tabulated summary of the key characteristics of the Project.

The main activities associated with the development of the Project would include:

- underground bord and pillar mining with partial pillar extraction in the Whynot Seam;
- underground longwall extraction in the Woodlands Hill, Arrowfield and Bowfield Seams;
- development and use of mine access drifts and underground roadways and shafts to access and service the underground mining areas;
- development and use of a mine entry and associated infrastructure, services and facilities that support underground mining and coal handling activities and provide for personnel and materials access to the underground mine;
- establishment of a site access road from Thomas Mitchell Drive to the underground mine entry;
- establishment of power transmission infrastructure, including power lines and substations;
- establishment of infrastructure associated with mine ventilation and gas management;
- use of the existing water management systems;
- progressive development of dams, sumps, pumps, pipelines, water storages, water treatment and other water management infrastructure;
- production of up to 8 Mtpa of ROM coal;

Table 3-2
Overview of the Maxwell Project

Component	Description
Mining Method	Underground extraction using "bord and pillar" and "longwall" mining methods.
Resource	Coal seams in the Wittingham Coal Measures within EL 5460 (Whynot Seam, Woodlands Hill Seam, Arrowfield Seam and Bowfield Seam).
Annual Production	Up to 8 million tonnes of ROM coal per annum.
Mine Life	26 years of coal extraction.
Total Resource Recovered	Approximately 148 million tonnes of ROM coal (i.e. an annual average of approximately 5.7 million tonnes of ROM coal, yielding an annual average of approximately 4.8 million tonnes of product coal).
Coal Handling and Preparation	Handling and processing of up to 8 million tonnes of ROM coal per annum. Transport of coal from underground faces to the MEA (mine entry area) via an underground conveyor network. Use of a surge stockpile and coal sizing facilities at the underground MEA prior to transporting ROM coal to the Maxwell Infrastructure CHPP. Transportation of early ROM coal via internal roads to the Maxwell Infrastructure CHPP, while a covered, overland conveyor is constructed and commissioned. Subsequently, ROM coal would be transported via the covered, overland conveyor system. Use of the existing Maxwell Infrastructure CHPP with upgrades to coal handling and processing infrastructure.
Management of Reject Material (i.e. Stone-derived Material)	Emplacement of coarse rejects and tailings primarily within the existing "East Void" in ML 1531 at the Maxwell Infrastructure precinct.
General Infrastructure	Use of the existing Maxwell Infrastructure with upgrades. Development of an underground MEA and associated facilities that support the underground mining activities and provide for personnel and materials access to the underground mine. Development of infrastructure for power supply, ventilation and gas management for the underground mine.
Product Transport	Transport of product coal to market or to the Port of Newcastle for export via the existing Antiene Rail Spur and Main Northern Railway or via conveyor to the Bayswater and/or Liddell Power Stations.[1] Transport of up to 7 million tonnes of product coal per annum along the rail loop (up to 12 train movements per day).
Water Management	On-site water management system, including: recycling of water on-site; storage of water on-site (including in voids); water treatment; irrigation; and sharing of water with Mt Arthur Mine and other users. Augmentations and extensions to existing water management infrastructure and development of new water management storages, sumps, pumps, pipelines, sediment control, mine dewatering, water treatment and wastewater treatment infrastructure.
Workforce	During operation, the Project would directly employ approximately 350 personnel. Initial construction activities would require an average of approximately 90 personnel, and a maximum of approximately 250 personnel. Additional contractors would also be required during short periods over the life of the Project; for example, during longwall change-outs, periods of higher underground development activities, scheduled plant shutdowns or other maintenance programs. These activities may require up to approximately 80 additional personnel.
Hours of Operation	Operated on a continuous basis, 24 hours per day, seven days per week.
Capital Investment Value	$509,000,000.

[1] Consistent with the current approval for the Antiene Rail Spur (DA 106-04-00), coal may be hauled on public roads under emergency or special situations with the prior written permission of the Secretary of the DPIE, RMS and Muswellbrook Shire Council.

- construction and use of a conveyor system to transport coal from the MEA to the existing CHPP at the Maxwell Infrastructure for processing;
- transportation of early ROM coal via internal roads from the MEA to the existing CHPP;
- handling and processing of coal and loading of coal onto trains at the existing Maxwell Infrastructure;
- transport of product coal via the existing Antiene Rail Spur and Main Northern Railway to market or to the Port of Newcastle for export, or via conveyor to the Bayswater and/or Liddell Power Stations;
- emplacement of coarse rejects, tailings and brine within existing voids in CL 229 and ML 1531;
- continued use of existing facilities and services at the Maxwell Infrastructure, with upgrades to coal handling infrastructure along with other minor upgrades;
- monitoring, rehabilitation and remediation of subsidence and other mining effects;
- management of subsidence impacts on Edderton Road;
- rehabilitation activities within CL 229, ML 1531 and CL 395, including the rehabilitation of reject and tailings emplacement areas;
- exploration activities within EL 5460 and A 173; and
- other associated minor infrastructure, plant, equipment and activities.

The Project area comprises the following main domains:

- Maxwell Underground – comprising the proposed area of underground mining operations and the MEA within EL 5460.
- Maxwell Infrastructure – the area within existing mining leases comprising the substantial existing infrastructure (including the CHPP) and previous mining areas.
- The transport and services corridor between the Maxwell Underground and Maxwell Infrastructure – this would comprise a site access road, a covered, overland conveyor, power supply and other ancillary infrastructure and services.
- A potential realignment of Edderton Road (Section 3.15.1).

An indicative Project general arrangement showing the Maxwell Underground and Maxwell Infrastructure, respectively, is provided on Figures 3-2 and 3-3.

A description of the potential interactions between the Project and surrounding mining developments is provided in Section 2.3. Potential cumulative impacts associated with these developments have been considered in this EIS (Section 6).

The final landform and rehabilitation strategy for the Project is presented in Section 7 and Appendix U.

3.3 PROJECT SCHEDULE

Malabar anticipates that construction and operational activities associated with the Project would commence as soon as practicable after all necessary consents, approvals and licences for the Project have been obtained.

A provisional Project schedule is provided in Figure 3-4. The actual timing and sequence may vary to take account of: detailed design, project capital decisions, market conditions and contractor requirements. For example, commencement of longwall mining operations may also occur earlier, should conditions allow for this.

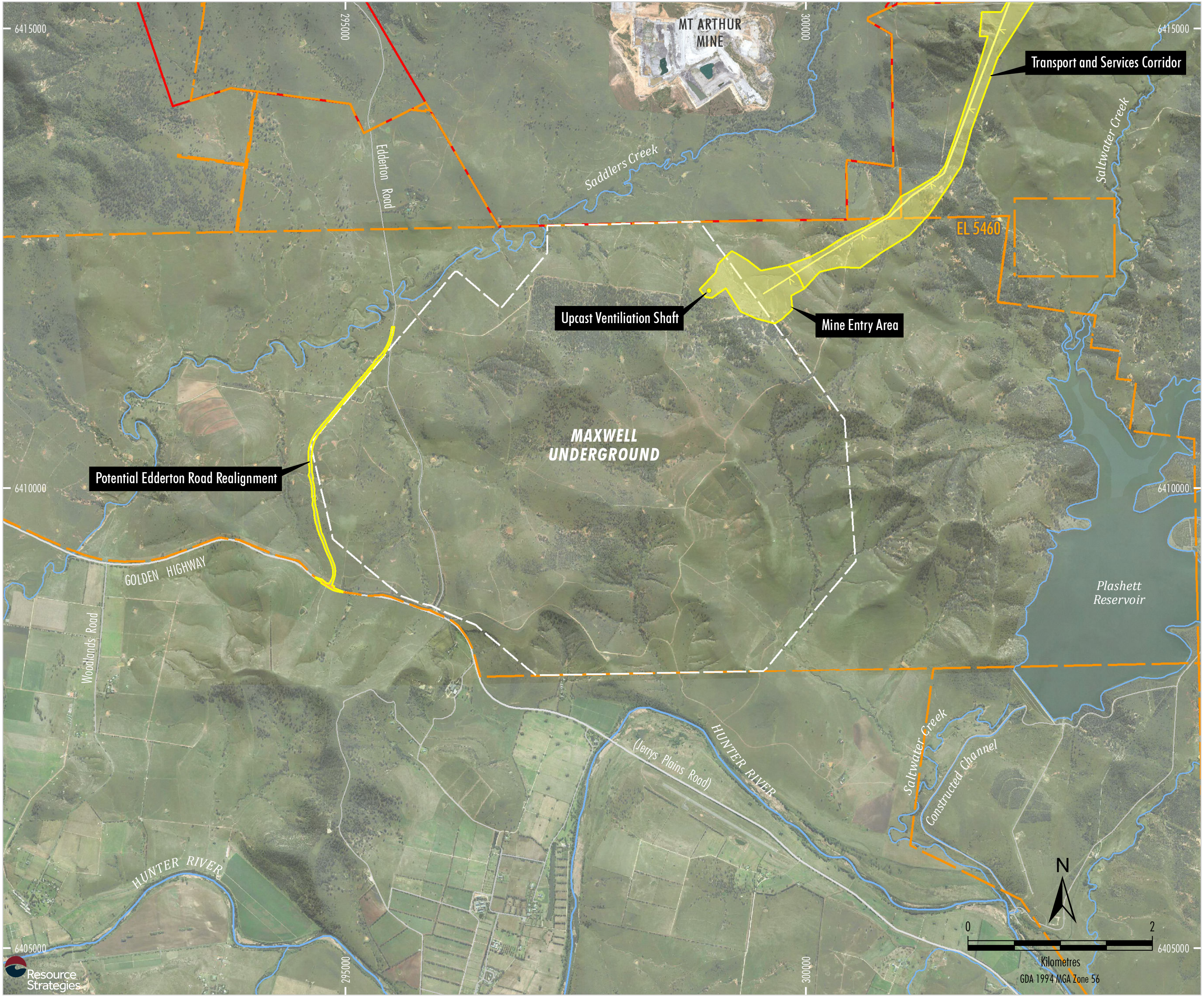
The Project would extract coal over a period of approximately 26 years.

3.4 PROJECT CONSTRUCTION AND OTHER DEVELOPMENT ACTIVITIES

The level of construction activity for the Project is reduced through the use of the substantial, existing Maxwell Infrastructure.

Additional infrastructure and upgrades to existing infrastructure required to support the Project would be progressively developed during the life of the Project, including:

- extension of the existing site access road to provide access to the MEA, and sealing along the full length;
- development of the MEA for the Maxwell Underground and its access drifts;
- establishment of infrastructure associated with mine ventilation and gas management;
- development of a transport and services corridor from the Maxwell Underground to Maxwell Infrastructure, including a covered, overland conveyor system;



LEGEND

- Exploration Licence Boundary
- Mining and Coal Lease Boundary
- Indicative Extent of Underground Development
- Indicative Surface Development Area
- Proposed 66 kV Power Supply

Source: © NSW Department of Planning and Environment (2019); NSW Department of Finance, Services & Innovation (2019) Orthophoto Mosaic: 2018, 2016, 2011

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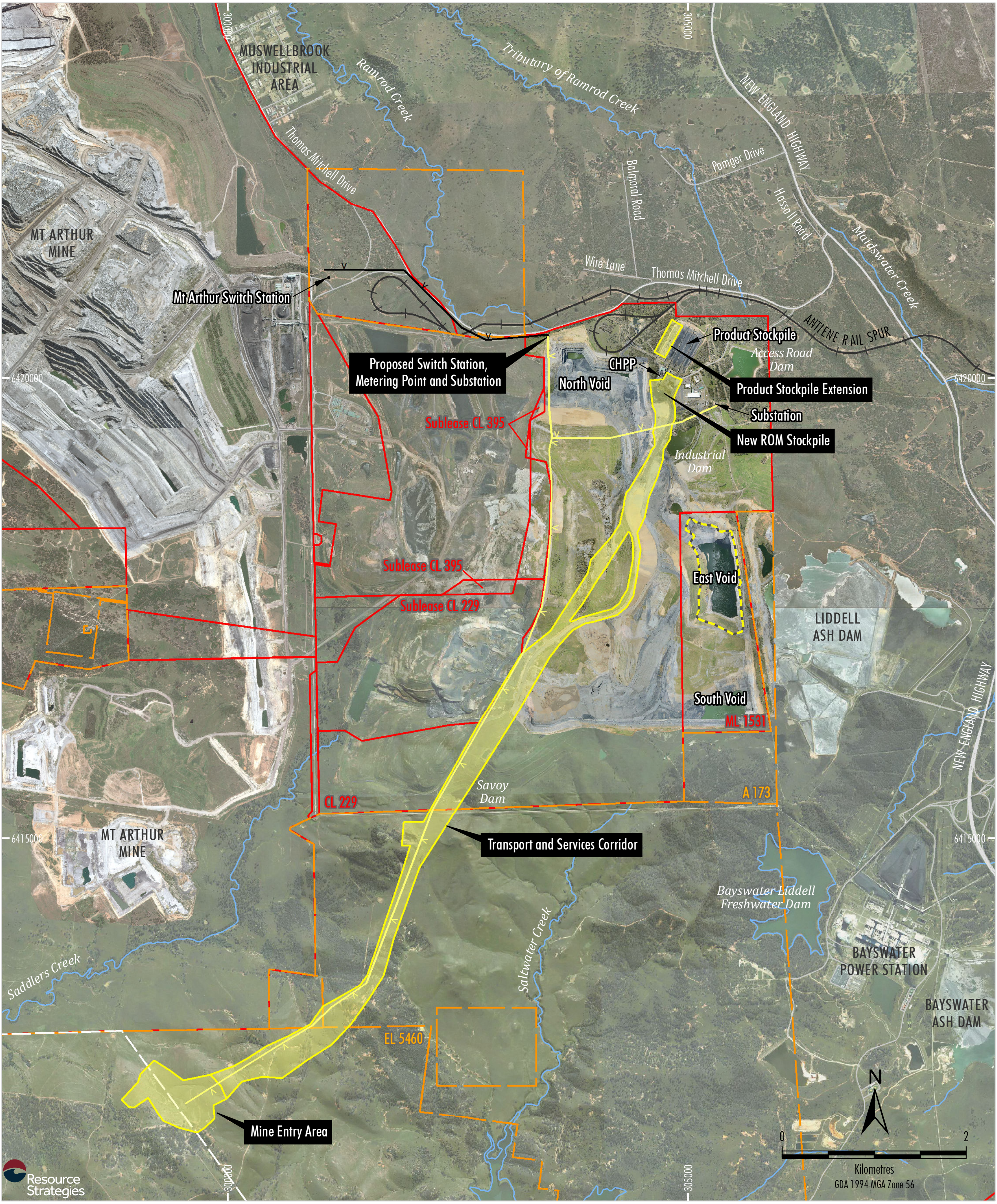
General Arrangement - Maxwell Underground

Figure 3-2



LEGEND
- Railway
- Exploration Licence Boundary
- Mining and Coal Lease Boundary
- Indicative Extent of Underground Development
- Indicative Surface Development Area
- CHPP Reject Emplacement Area
- Proposed 66 kV Power Supply
- Ausgrid 66 kV Power Supply Extension #

Subject to separate assessment and approval.

Source: © NSW Department of Planning and Environment (2019); NSW Department of Finance, Services & Innovation (2019) Orthophoto Mosaic: 2018, 2016, 2011

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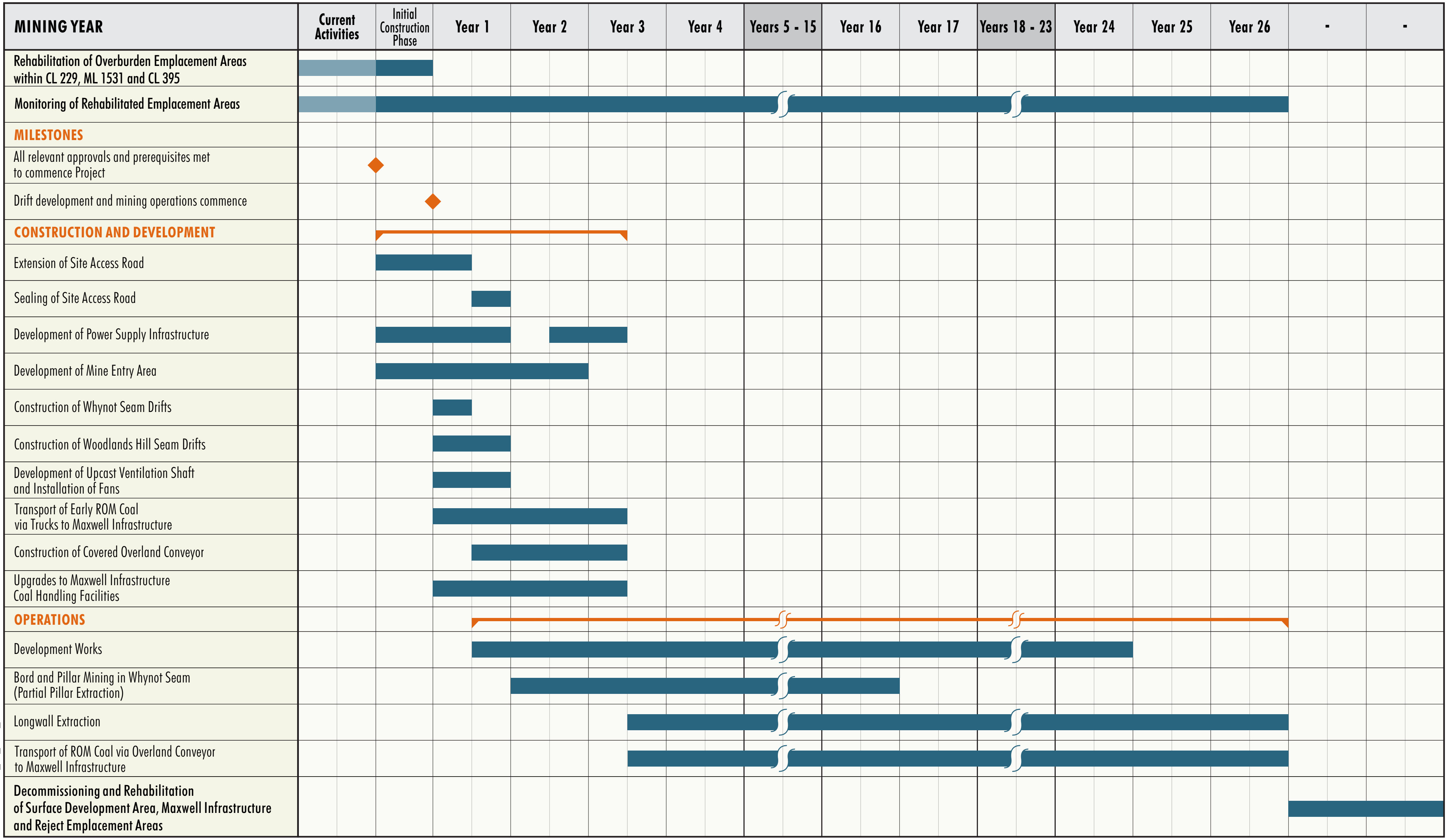
General Arrangement - Maxwell Infrastructure

Figure 3-3



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Resource Strategies

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LEGEND

Current Maxwell Infrastructure Activities (Project Approval 06_0202)

Maxwell Project Activities (SSD 18_9526)

Source: Malabar (2019)

M A X W E L L P R O J E C T

Provisional Project Schedule

Figure 3-4

- upgrades to ROM and product coal handling facilities at the Maxwell Infrastructure;
- construction of power transmission infrastructure, including power lines and substations;
- progressive development and augmentation of sumps, pumps, pipelines, water storages, water treatment and other water management equipment and structures;
- delivery, assembly and installation of specialised underground mining equipment, including a longwall machine;
- progressive development of underground conveyor systems and services;
- off-site maintenance, replacements and upgrades to roadway development machines and longwall mining machinery;
- the potential realignment of Edderton Road; and
- other minor upgrades at the existing Maxwell Infrastructure and removal of redundant infrastructure.

Construction activities may be undertaken up to 24 hours per day, 7 days per week, including surface construction activities. Upgrades at the Maxwell Infrastructure would be limited to 7.00 am to 6.00 pm Monday to Sunday.

Consideration of construction activities and their potential for noise generation and air quality impacts are provided in the Noise Impact Assessment (Appendix I) and Air Quality and Greenhouse Gas Assessment (Appendix J).

Further detail on construction and other development activities is provided below.

3.4.1 Site Access Road

The Project would use the existing site access to the Maxwell Infrastructure from Thomas Mitchell Drive (Plate 3-1). The site access road would be extended along the transport and services corridor to the MEA.

The site access road would be progressively sealed during the first year of mining operations (Figure 3-4).

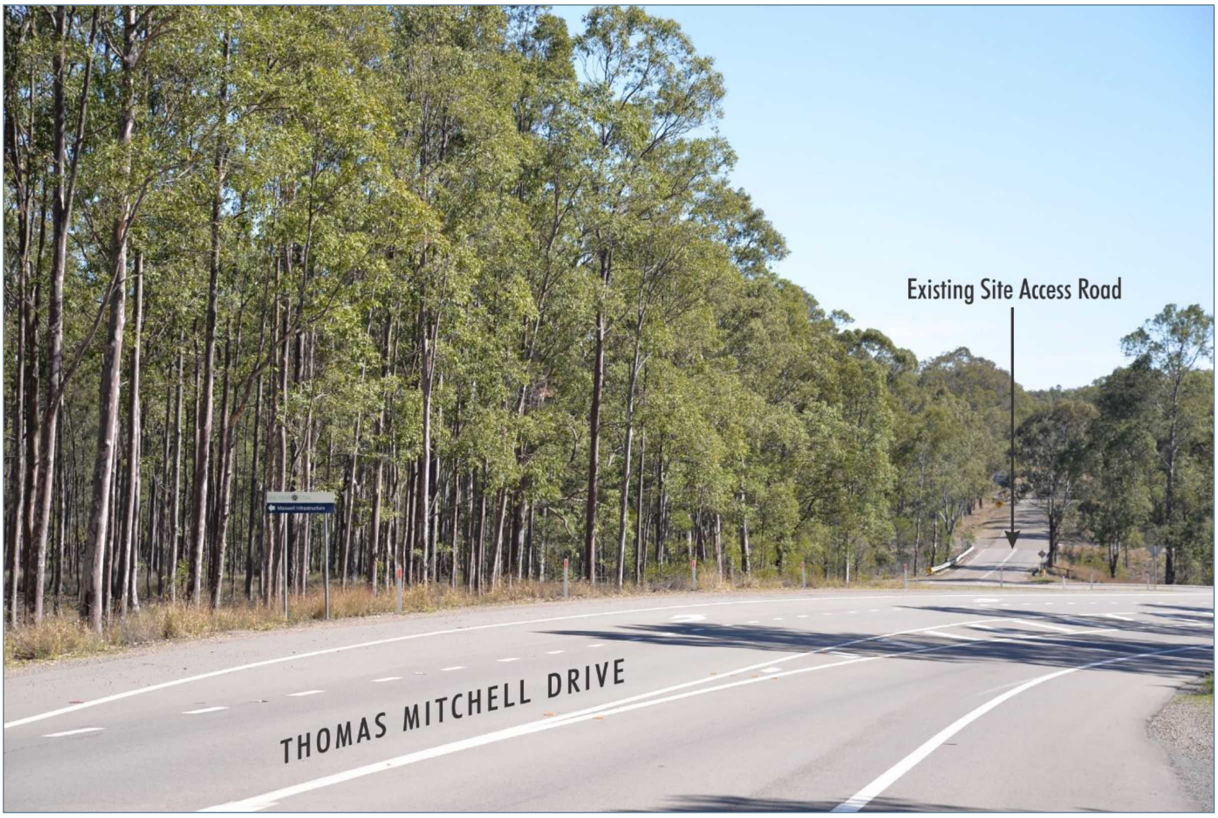


Plate 3-1 – Existing Site Access Road from Thomas Mitchell Drive

Source: VPA (2019).

3.4.2 Mine Entry Area, Mine Access and Underground Development

Early preparatory works would occur at the MEA prior to the commencement of construction activities, including, but not limited to:

- site survey and demarcation activities;
- upgrades of existing access tracks;
- geotechnical testing to inform detailed design;
- salvage of Aboriginal artefacts;
- installation of temporary erosion and sediment controls; and
- installation of temporary buildings and site security to support construction activities.

Construction and development of the MEA would involve:

- vegetation clearance and topsoil stripping;
- construction of internal roads;
- excavation of the MEA (access floor and wall above the portal), portals and mine access drifts;
- construction of water management infrastructure, including sumps, pumps, drains, pipelines and water storages;
- construction and development of surface conveyors, ROM coal surge stockpiles and a coal sizing facility;
- construction of administration buildings, meeting rooms, bathhouse, workshop, fuel storage, laydown and parking facilities and other ancillary infrastructure;
- construction and installation of ancillary infrastructure and services for the MEA (e.g. power transmission infrastructure, site security); and
- other miscellaneous activities.

An indicative general arrangement of the MEA is provided in Figure 3-5.

Access to the underground workings would be via four drifts constructed from the MEA. The drifts would be constructed by road headers, tunnel boring machine or continuous miners. Drift conveyors would be installed in two of the drifts to transport coal from underground to the surface.

The topsoil stripped during construction activities would be stockpiled for use on areas disturbed during the construction phase. The volume of topsoil stockpiled would be modest given the modest extent of the MEA.

Virgin excavated natural material excavated during development of the MEA and access drifts would preferentially be used as construction fill (e.g. for hardstand areas, dam embankments and road construction). Excess material would be emplaced in the existing South Void at the Maxwell Infrastructure.

Malabar would seek to eliminate or minimise the need for construction blasting, with material preferentially removed through the use of dozers and excavators only. Blasting of material may be required during construction activities; for example, to develop the coal surge stockpile area, site access road, access to the underground workings and/or water storage dams.

The requirement for blasting would be dictated by the geotechnical properties of the material being excavated.

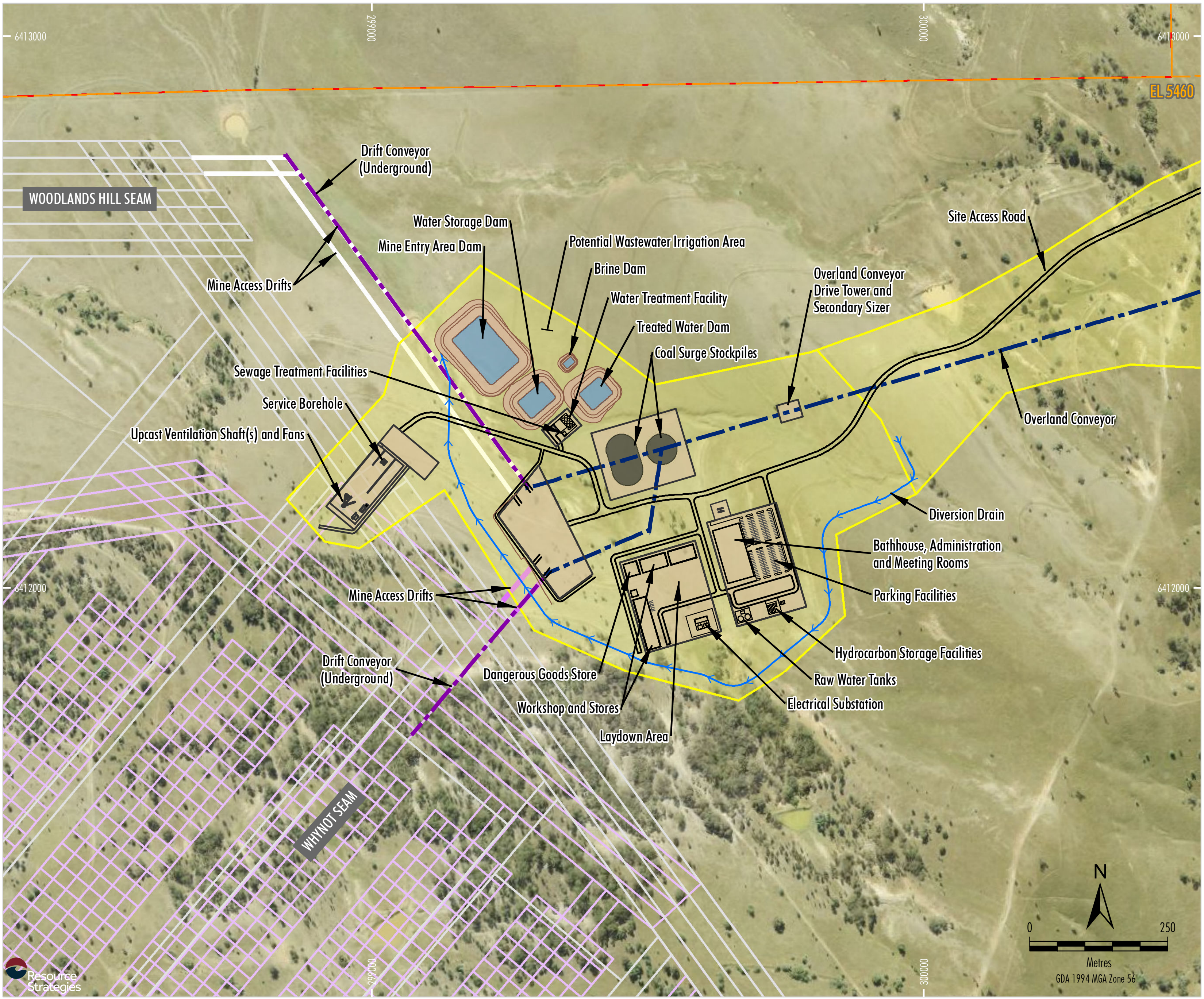
Any blasts required for construction activities would be limited to a Maximum Instantaneous Charge (MIC) of approximately 500 kilograms (kg). This is substantially smaller than blasting that would occur in an open cut mining operation (an MIC typically in the order of 2,000 kg to 4,000 kg).

3.4.3 Mine Ventilation and Gas Management System

An upcast ventilation shaft site, including shaft(s), associated fans and ancillary infrastructure, would be constructed and installed at the MEA to provide adequate ventilation of the underground workings.

Development of the upcast ventilation shaft infrastructure would involve:

- development of concrete-lined or steel-lined shaft(s) (approximately 5.5 m in diameter);
- installation of ventilation fans;
- installation of a centralised gas management system;
- installation of a power supply and associated electrical switchroom, transformer and ancillary infrastructure for the ventilation fans;



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Indicative Mine Entry Area Layout

Figure 3-5

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- installation of appropriate security (i.e. fencing) to prevent unauthorised access to the ventilation shaft site; and
- installation of erosion and sediment control infrastructure.

It is expected that the ventilation shaft(s) would be constructed using the “blind bore” method. Using this method, the drilling would take place in advance of development workings, with material from the excavation being removed from the top of the shaft. The construction footprint of the shaft would be within the footprint of the MEA (Figure 3-5).

The excavated material resulting from the construction of the shafts would be used as construction fill or stockpiled on-site, revegetated and used for future rehabilitation of the shaft site upon decommissioning.

Further information on ventilation and gas management is provided in Section 3.5.6.

3.4.4 Transport and Services Corridor

A covered, overland conveyor and ancillary infrastructure would be developed to transport ROM coal from the MEA to the existing Maxwell Infrastructure.

The conveyor would be commissioned prior to transporting coal extracted by longwall mining machinery.

Early ROM coal would be transported to the existing Maxwell Infrastructure via truck on the site access road while the overland conveyor is constructed and commissioned.

Other site services and ancillary infrastructure would be developed within the transport and services corridor including, but not limited to, pipelines, pumps, telecommunication infrastructure, power transmission infrastructure and erosion and sediment controls.

A conceptual cross-section through a portion of the transport and services corridor is shown on Figure 3-6.

Borrow pits may be developed within the surface development area to provide excavated material for use during construction activities.

3.4.5 Maxwell Infrastructure Upgrades

The existing product coal stockpile area at the Maxwell Infrastructure would be extended to allow for better management of different product coal blends and to provide sufficient capacity during longwall moves (Figure 3-7). The combined capacity of the product coal stockpiles would increase from approximately 320,000 tonnes (t) to approximately 500,000 t.

Construction of the product coal stockpile area would involve:

- vegetation clearance, topsoil stripping, grading and levelling;
- installation of coal reclaim valves and tunnel; and
- installation of a skyline conveyor system.

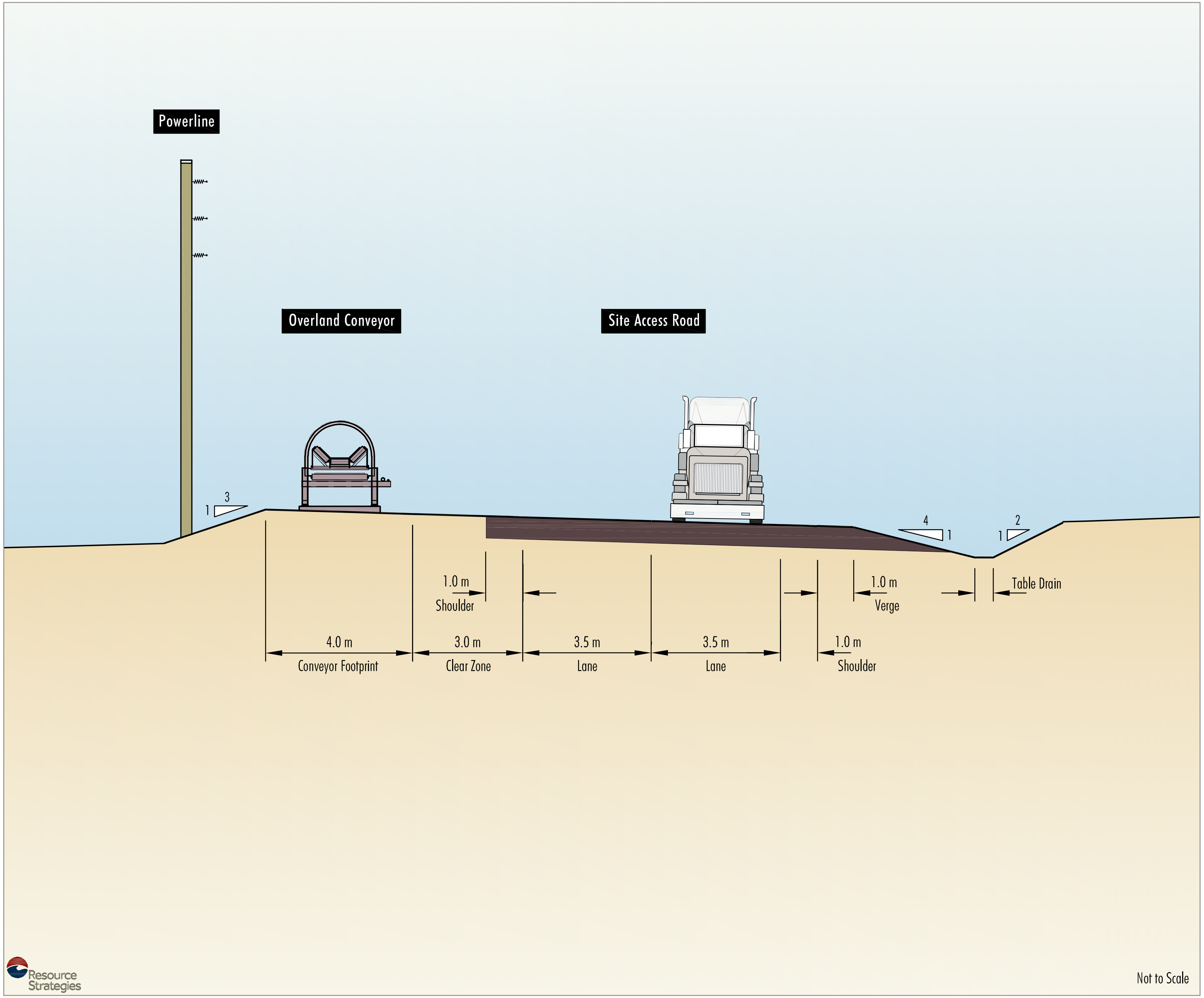
An additional ROM stockpile would also be developed adjacent to the coal processing plant to cater for delivery of ROM coal via the covered overland conveyor (Figure 3-7).

Material excavated during construction would preferentially be used as construction fill. Excess material would be emplaced in the existing North Void at the Maxwell Infrastructure.

In addition to the above, other works at the Maxwell Infrastructure may include:

- installation of additional conveyors to allow for bypass of coal around the existing coal processing plant;
- replacement, upgrades and augmentation of other conveyor systems;
- upgrade and/or replacement of the train load-out bin and transfer conveyors;
- upgrade and/or replacement of screens and other components within the coal processing plant;
- upgrades and/or replacement of CHPP reject handling infrastructure;
- augmentation of sumps, pumps, pipelines, water storages and other water management equipment and structures;
- other minor upgrades and ancillary works; and
- removal of redundant infrastructure, such as primary and secondary sizers and hoppers at the CHPP.

Source: GHD (2019)



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Typical Cross-section
- Transport and Services Corridor

Figure 3-6

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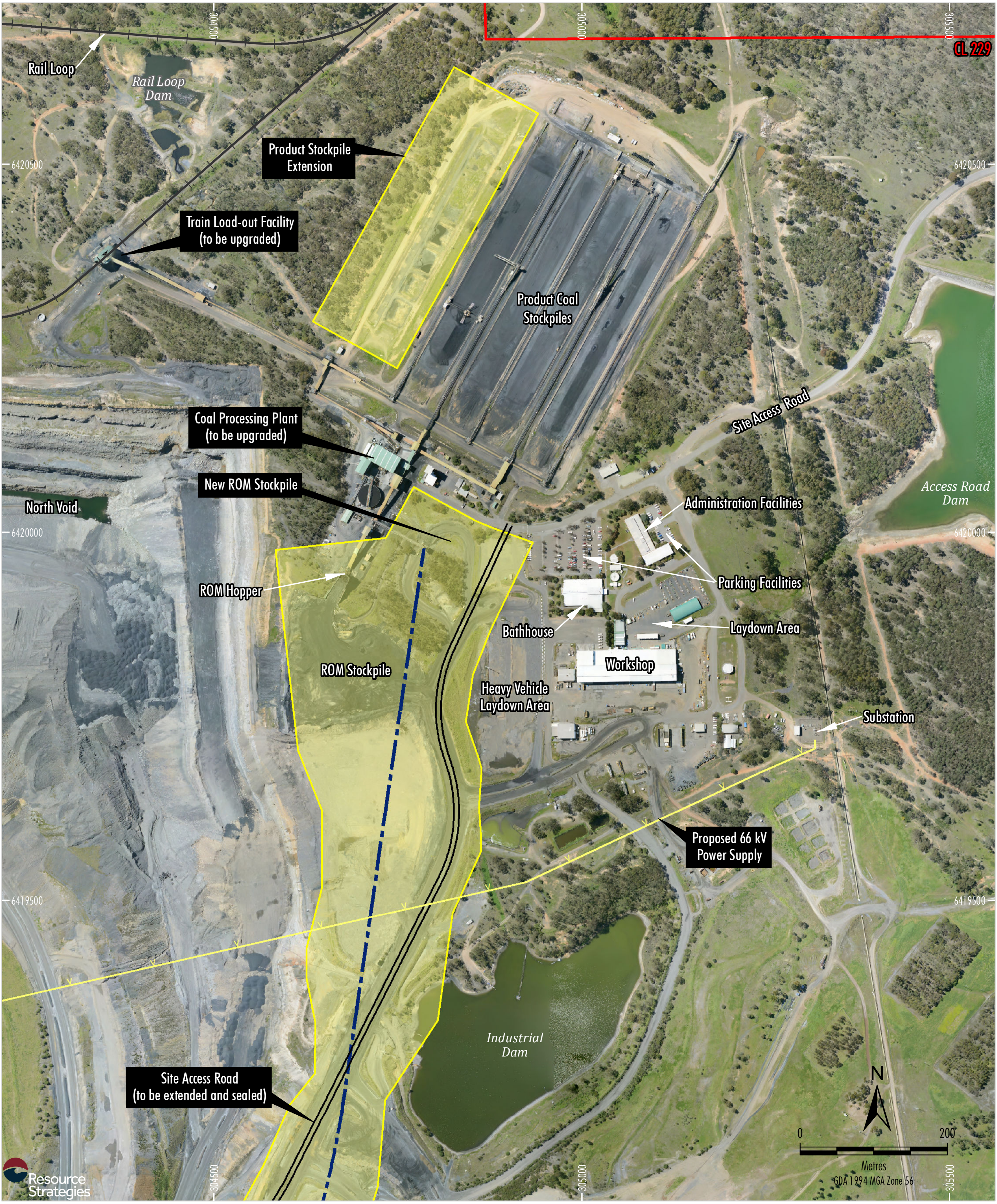

LEGEND
- Railway
- Mining and Coal Lease Boundary
- Indicative Surface Development Area
- Indicative Overland Conveyor
- Proposed 66 kV Power Supply

Source: © NSW Department of Planning and Environment (2019); NSW Department of Finance, Services & Innovation (2019) Orthophoto Mosaic: 2016

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Maxwell Infrastructure - Indicative Layout of Coal Handling and Processing Facilities

Figure 3-7

3.4.6 Power Supply

An overhead 66 kilovolt (kV) power line and associated switch station may be constructed from the Ausgrid network to the MEA to support Project activities (Figures 3-2 and 3-3).

If required, Ausgrid would separately construct an extension from an existing Ausgrid 66 kV power line to a proposed switch station, metering point and substation in the north-west of the existing Maxwell Infrastructure (Figure 3-3). This would be subject to separate assessment under Part 5 of the EP&A Act.

A power line would be established along the transport and services corridor.

Electricity would be supplied to the Maxwell Infrastructure via existing overhead power lines, with maintenance and upgrades undertaken as required.

3.4.7 Maxwell Underground

Underground mining equipment, including a longwall machine and continuous miners, would be delivered to the MEA via the site access road. Equipment would be assembled and installed on-site.

Over the life of the Project, a range of underground mining equipment would be replaced or upgraded as a component of general maintenance or to increase efficiency.

Underground roadways would be developed to access and support the Maxwell Underground (i.e. for access, ventilation and coal conveying).

Coal clearance infrastructure and other ancillary infrastructure would also be developed for the Maxwell Underground, including conveyors, sizers, drives, winders and supporting systems.

Other ancillary infrastructure required to support the Maxwell Underground would also be developed over the life of the Project (Section 3.5).

3.4.8 Management of Subsidence Impacts on Edderton Road

Potential subsidence impacts on Edderton Road would be managed through either road maintenance along the existing alignment or the construction of a realignment of the road around the Maxwell Underground area.

The potential Edderton Road realignment is discussed further in Section 3.15.1.

3.5 UNDERGROUND MINING OPERATIONS

The Project would involve extraction of coal from four seams within the Wittingham Coal Measures using the following underground mining methods:

- bord and pillar with partial pillar extraction in the Whynot Seam; and
- longwall extraction in the Woodlands Hill, Arrowfield and Bowfield Seams.

The annual average ROM coal production from the Project would be approximately 5.7 Mtpa, yielding an annual average of approximately 4.8 Mtpa of product coal. Underground mining activities would be undertaken 24 hours per day, seven days per week.

The full working section of each coal seam (Table 3-1) would be extracted where practicable.

3.5.1 Indicative Mining Schedule

An indicative mining schedule for the Project is presented in Table 3-3. The maximum amount of ROM coal produced in any one year would be 8 Mt.

The actual timing, mining sequence and annual coal production profile may vary to take account of: localised geological features, coal quality characteristics, detailed mine design, mine economics, market volume requirements, and/or adaptive management requirements.

3.5.2 Coal Mining

The underground mining operations for the Project would extract approximately 148 Mt of ROM coal.

Bord and Pillar Mining Operations

Bord and pillar mining methods (with partial pillar extraction) are proposed for extraction of coal in the Whynot Seam.

Bord and pillar mining is an underground mining method that involves the extraction of coal using first workings from a network of underground roadways (known as panels), followed by the extraction of a portion of the remaining coal (secondary extraction).

Table 3-3
Indicative Mining Schedule

Project Year	Project ROM Coal Production (Mt)					CHPP Reject Material (Mt)	Product Coal (Mt)
	Whynot Seam	Woodlands Hill Seam	Arrowfield Seam	Bowfield Seam	Total ROM Coal		
1	0.2	0.2	-	-	0.5	0.2	0.3
2	1.1	0.5	-	-	1.6	0.6	1.2
3	0.8	1.2	-	-	2.0	0.8	1.4
4	<0.1	8.0	-	-	8.0	2.7	5.9
5	0.5	7.4	-	-	7.9	2.8	5.8
6	1.0	6.2	-	-	7.2	2.5	5.3
7	0.8	6.2	-	-	7.0	2.3	5.3
8	0.7	6.7	-	-	7.4	2.4	5.6
9	0.3	7.0	-	-	7.4	2.2	5.7
10	0.3	5.5	0.2	-	5.9	1.8	4.6
11	0.2	7.0	0.7	-	7.8	2.2	6.2
12	0.2	3.6	4.1	-	7.9	1.7	6.7
13	0.4	-	6.2	-	6.6	0.9	6.0
14	0.8	-	5.4	-	6.2	0.9	5.6
15	0.8	-	5.2	-	6.0	0.7	5.5
16	0.3	-	6.4	-	6.7	0.8	6.1
17	-	-	5.2	<0.1	5.2	0.6	4.8
18	-	-	5.2	0.8	6.0	0.7	5.5
19	-	-	6.0	0.4	6.4	0.7	5.9
20	-	-	2.9	3.1	6.0	0.8	5.4
21	-	-	-	5.7	5.7	0.8	5.1
22	-	-	-	5.1	5.1	0.8	4.5
23	-	-	-	4.3	4.3	0.6	3.9
24	-	-	-	5.5	5.5	0.8	4.9
25	-	-	-	4.8	4.8	0.7	4.3
26	-	-	-	3.0	3.0	0.6	2.6
Total	**8.5**	**59.3**	**47.4**	**32.7**	**147.9**	**32.5**	**123.8**

Notes: The combined total of product coal and CHPP reject material is greater than total ROM coal due to changes in moisture content (data are presented on an "as received" moisture basis).

Other totals may not add exactly due to rounding.

The bord and pillar mining method would involve the following three stages:

- *Formation of Main Roadways (first workings)* – coal would be extracted to create stable and non-subsiding main roadways to provide access to groups of mining panels. Generally, this is a 4 or 5 heading layout with roadways for ventilation, coal conveyors and access for employees and materials.
- *Formation of Panels (first workings)* – from the main roadways, panels approximately 185 m wide would be developed to a logical boundary such as the limit of a conveyor, a geological constraint or a depth of cover constraint. Individual panels would be separated by a barrier pillar of approximately 55 m that would be left intact.
- *Partial Extraction of Panels (secondary extraction)* – from the panel boundary and retreating back to the main roadways, coal pillars that were formed during panel development would be removed, known as 'partial pillar extraction'.

Partial extraction of the pillars would occur to achieve approximately 55% to 70% coal recovery based on both first and secondary workings. There are various partial extraction methods that could achieve this level of coal recovery, including:

- partial extraction from remaining coal pillars; or
- removing alternate pillars.

Partial pillar extraction would not occur at depths of cover of less than 50 m.

Whynot Seam Layout

An indicative bord and pillar panel layout in the Whynot Seam is shown on Figure 3-8.

The actual layout of the workings in the Whynot Seam may vary due to localised geological features, detailed mine design and/or adaptive management requirements. The final layout would be subject to review and approval as a component of future Extraction Plans developed in consultation with the relevant authorities and to the satisfaction of the Secretary of the DPIE.

Longwall Mining Operations

Longwall mining methods are proposed for extraction of coal in the Woodlands Hill, Arrowfield and Bowfield Seams.

Longwall extraction is an underground mining method that involves the extraction of rectangular panels of coal defined by underground roadways constructed around each longwall (Figure 3-9). The longwall mining machine travels back and forth across the width of the coal face, progressively removing coal in slices from the panel.

As each slice of the coal face is removed from the longwall face, the hydraulic roof supports move forward, allowing the roof and a section of the overlying strata to collapse behind the longwall machine (referred to as forming the 'goaf') (Figure 3-9).

Extraction of coal by longwall mining methods results in the vertical and horizontal movement of the land surface. The land surface movements are generically referred to as subsidence effects. The type and magnitude of subsidence effects predicted as a result of the Project are described in Section 6.3 and the Subsidence Assessment (Appendix A).

Subsidence-related monitoring and remediation activities for the Project are detailed in Sections 3.15.3 and 3.14.2, respectively.

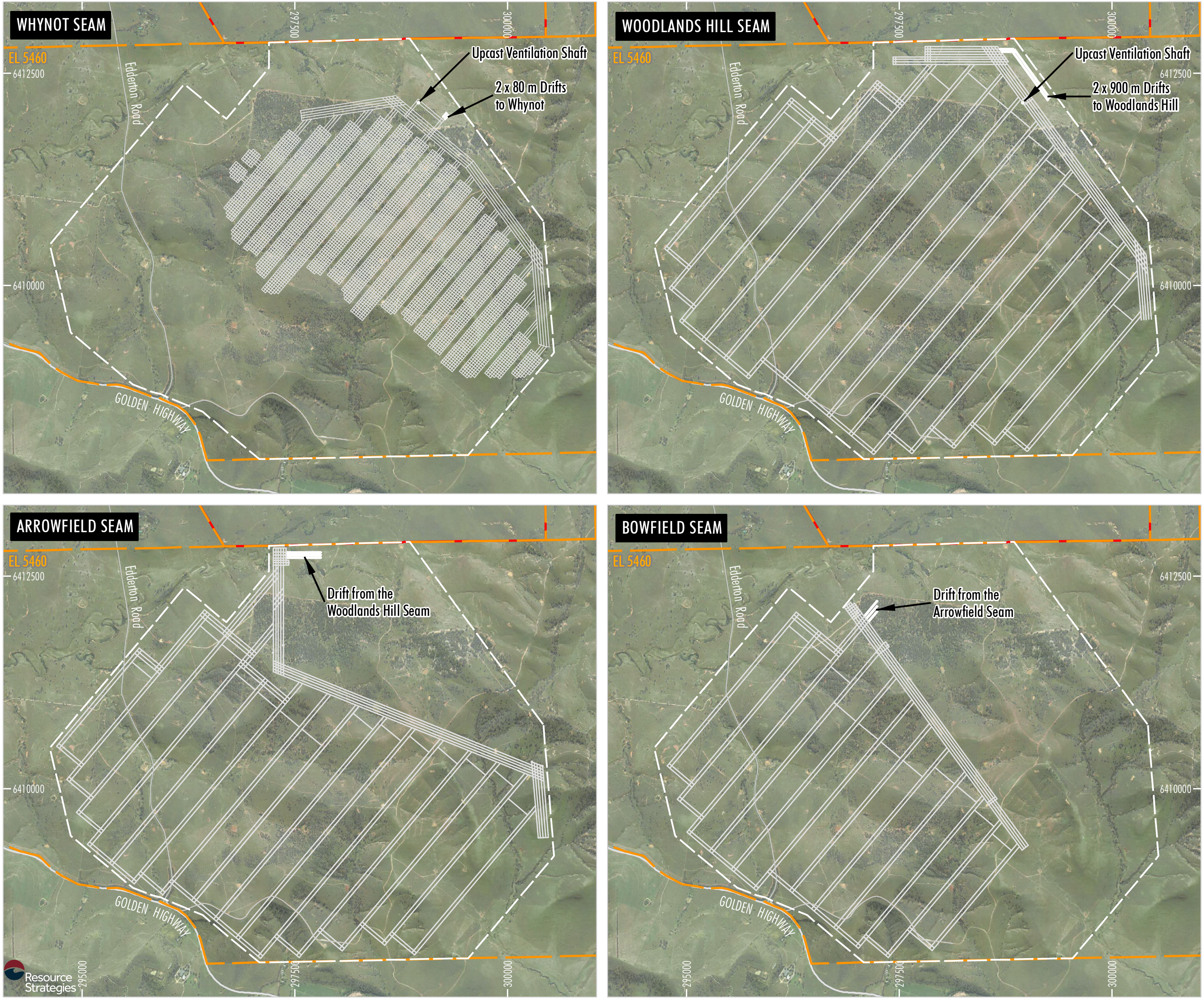
Longwall Mining Layout

The longwalls would have overall void widths of approximately 305 m (including first workings), and lengths of between approximately 1,300 m and 4,100 m.

The longwalls would be staggered between seams so that the chain pillars would not align. This would reduce total subsidence at the surface.

Indicative longwall layouts in the Woodlands Hill, Arrowfield and Bowfield Seams are shown on Figure 3-8.

Malabar may extract coal from the Woodlands Hill Seam prior to, during, or following completion of extraction in the overlying Whynot Seam. A geotechnically stable and safe environment would be able to be maintained during either an undermining or overmining scenario. An adequate offset distance would be maintained between active working areas in the event of extraction occurring in both seams concurrently (nominally 1 km).



LEGEND
Exploration Licence Boundary
Mining and Coal Lease Boundary
Indicative Extent of Underground Development
Indicative Underground Mining Layout

Source: © NSW Department of Planning and Environment (2019); Department of Finance, Services & Innovation (2019) Orthophoto Mosaic: 2016, 2011

N

0 2

Kilometres

GDA 1994 MGA Zone 56

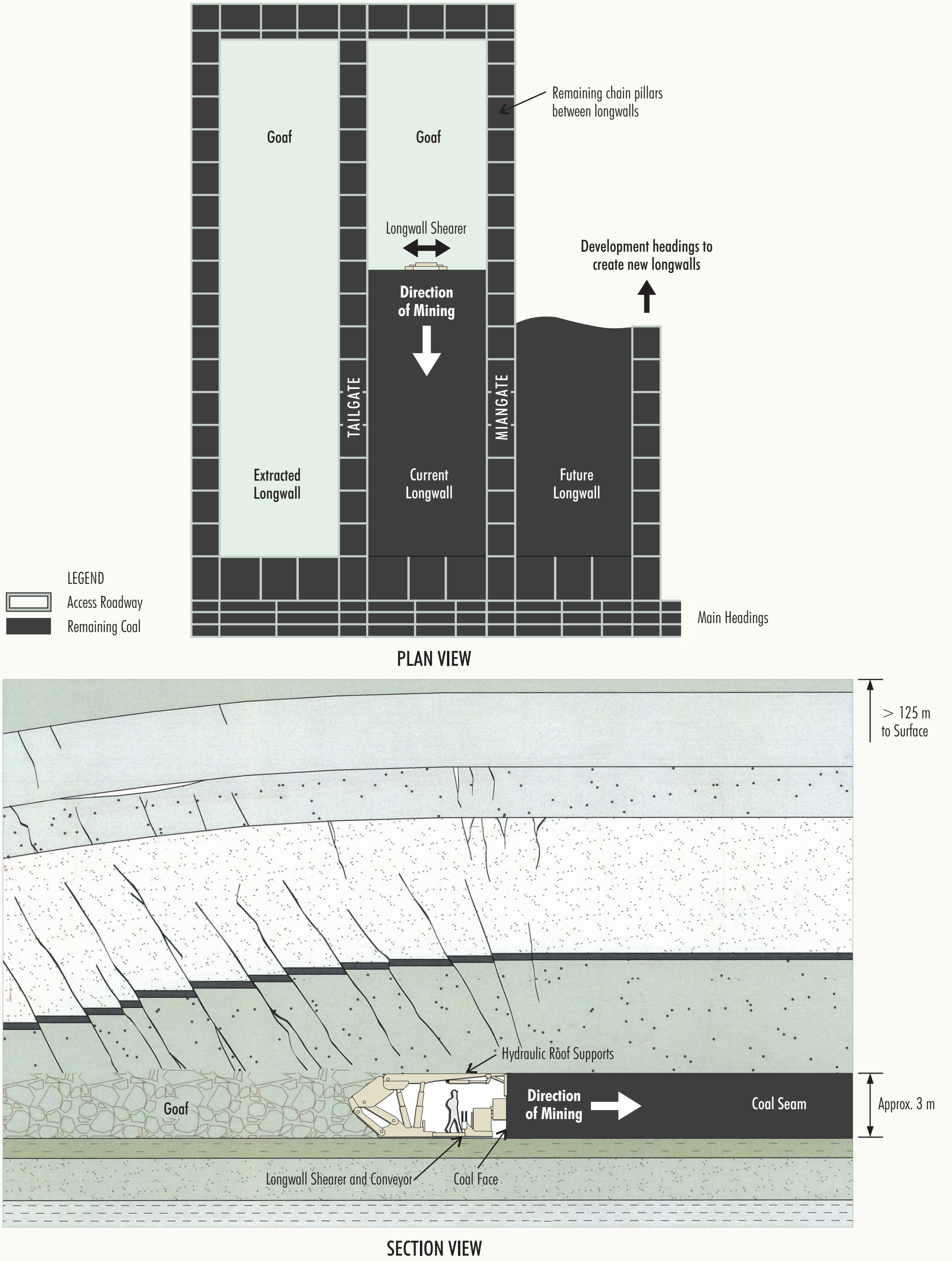
MALABAR COAL

M A X W E L L   P R O J E C T

Indicative Underground Mining Layout

Figure 3-8

SHM-18-03 Maxwell_EIS_Sect 3_204B



SHM-18-03 Maxwell_EIS_Sect 3_003B

Resource Strategies

Source: After Hansen Consulting (2008)

MALABAR COAL

MAXWELL PROJECT

Longwall Mining Method - Conceptual Cross-section and Plan

Figure 3-9

The actual mining order and layout of the longwalls may vary due to localised geological features, detailed mine design and/or adaptive management requirements. The final mining order and layout would be subject to review and approval as a component of future Extraction Plans developed in consultation with the relevant authorities and to the satisfaction of the Secretary of the DPIE.

3.5.3 Underground Mine Access and Materials Handling

The drifts at the MEA (Figure 3-5) would be used:

- for personnel, materials and equipment access;
- to convey coal from the longwall and development faces to the surface; and
- for ventilation of the underground workings.

3.5.4 Major Underground Equipment and Mobile Fleet

The major underground equipment and mobile fleet for underground mining activities would comprise:

- continuous miners;
- longwall shearers and roof supports;
- conveyors;
- transfer bins;
- feeder breakers;
- load haul dump vehicles;
- drill rigs;
- shuttle cars; and
- personnel carriers.

Over the life of the Project, a range of underground mining equipment would be replaced or upgraded as a component of general maintenance or to increase efficiency (Section 3.4.7).

3.5.5 Mine Ventilation Systems

Ventilation fans and associated surface infrastructure would be required for the Project to maintain a safe working environment within the underground workings.

The Project would use an upcast ventilation shaft site to provide adequate ventilation of the underground workings. This site would be located adjacent to the MEA (Figure 3-5). The upcast (or exhaust) ventilation shaft site would use fans to draw air out of the underground workings.

This site may also be used for downcast (or intake) ventilation during the life of the Project.

The upcast ventilation shaft site would have the following infrastructure:

- up to two concrete-lined or steel-lined shafts;
- up to three ventilation fans with combined flow rates of up to 600 cubic metres per second (m^3/s);
- electrical infrastructure;
- a centralised gas management system (Section 3.5.6);
- sediment control infrastructure; and
- other associated minor ancillary infrastructure (such as fencing and service boreholes).

The mine access drifts would also be used for ventilation. Auxiliary fans would be used on the mine access drifts early in the Project life.

No surface ventilation infrastructure is proposed in the southern portion of the Maxwell Underground.

3.5.6 Mine Safety Gas Management

Gas monitoring systems, and gas management and abatement activities would be required for the Project to maintain gas content at levels suitable for underground mining operations. The key gases monitored and managed in the underground workings would be carbon dioxide and methane.

Gas Drainage

Pre-mining gas drainage and goaf gas drainage would occur underground to reduce the gas content in the coal seams.

Gas would be drained from the coal seams, and adjacent strata, by drilling in-seam (i.e. horizontal) boreholes into the coal seam in advance of mining. Pre-mining gas drainage would generally be facilitated by underground cross-panel drilling. Gas would be drained through an underground collection system and delivered to the centralised gas management infrastructure at the surface.

Gas would also be drained from the goaf area post-mining to ensure safe operations and maintain the rate of longwall mining operations. Post-mining gas drainage would be undertaken via underground drilling methods into the goaf. Gas drained from the goaf areas would also be collected through an underground collection system for management at the surface.

Centralised Gas Management System

Centralised gas management infrastructure would be constructed in the vicinity of the upcast ventilation shaft.

Gas would be delivered to the centralised gas management infrastructure via a network of underground pipes and a shaft.

Gas would be flared or, if the gas was too low in methane content for flaring (or other operational reasons), vented to the atmosphere.

The majority of gas management infrastructure would be fully contained within a modular, purpose-built room (with the exception of vents and/or flares).

The centralised gas management infrastructure could consist of pumps, gas generators, nitrogen tanks, monitoring equipment, flares, water collection equipment and surface pipes.

Where there is sufficient methane content in the deeper coal seams, a small gas-powered plant (less than 5 MW) may be installed to generate power from gas drained in the underground workings. Power generated in any gas-powered plant would be used to supplement Project power supply.

3.5.7 Water Management

Water would be supplied to the underground mining operations for equipment cooling and dust suppression.

Groundwater and operational water that accumulates in the underground workings would be pumped to the surface via underground sumps, access drifts and/or boreholes. Overlying and adjacent workings may also be dewatered, if required for safety reasons.

Further discussion on the site water management system is provided in Section 3.10.

3.5.8 Other Supporting Infrastructure

Other infrastructure and activities associated with underground mining operations would include:

- infrastructure at the MEA, such as administration, bathhouse and parking facilities (Section 3.11.2);
- infrastructure for service delivery (e.g. drop-holes);
- infrastructure for servicing of underground mining equipment;
- infrastructure for electricity distribution and communication systems; and
- storage and handling of materials used by underground mining equipment (e.g. hydraulic fluids, roof bolts, wear plates, miscellaneous consumables and safety equipment).

3.6 ROM COAL HANDLING AND PROCESSING

The Project would include the use of the substantial existing Maxwell Infrastructure for handling, processing and transportation of coal for the life of the Project.

An indicative coal handling and processing schematic is provided on Figure 3-10.

3.6.1 ROM Coal Stockpiling and Transport

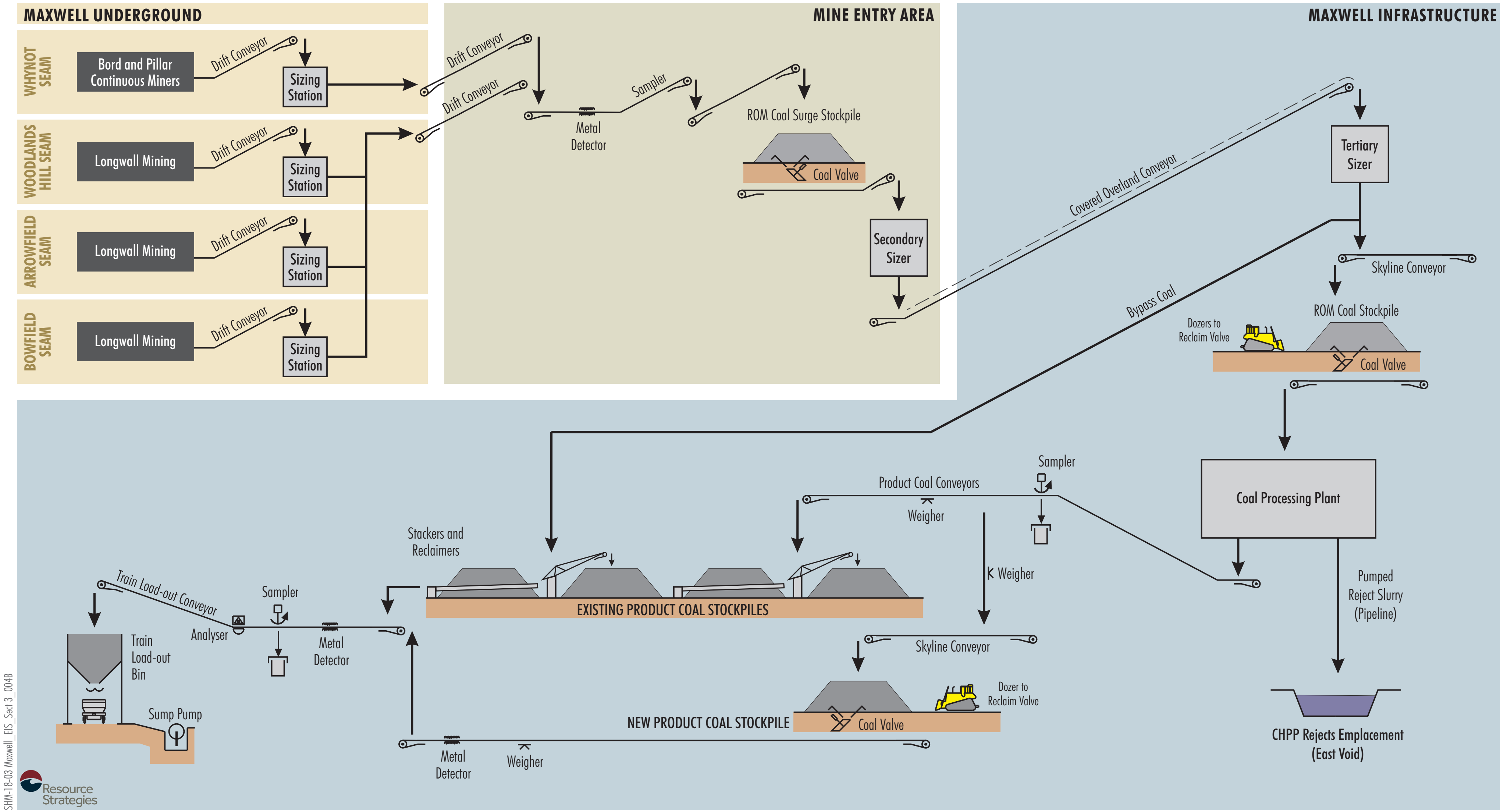
ROM coal from the Maxwell Underground would be temporarily placed on surge stockpiles at the MEA prior to reclaiming and transportation to the CHPP at the Maxwell Infrastructure.

Sized ROM coal would be transported to the Maxwell Infrastructure via:

- a single-flight, covered, overland conveyor, which would be operational prior to the commencement of transport of coal extracted by longwall mining machinery; or
- trucking along the site access road while the overland conveyor is constructed and commissioned.

ROM coal would be fed directly into the CHPP, or would be temporarily stockpiled adjacent to the CHPP prior to processing (Section 3.6.2).

TOC



Source: Malabar (2019)

MALABAR COAL

M A X W E L L   P R O J E C T

Indicative Coal Handling and Processing Schematic

Figure 3-10

Trucks used for coal haulage would be units that are purpose-built for the transport of bulk materials, such as the truck shown in Plate 3-2. The large off-road coal haul trucks in general use at open cut mines would not be used.

Plate 3-2 – Road Registerable Bulk Haulage Truck

Source: Oldknow Earthmoving & Haulage (2019).

3.6.2 Coal Processing Plant

ROM coal would be handled and sized via a secondary/tertiary crusher at the existing CHPP. It would then be either beneficiated through the coal processing plant or bypassed directly to the product coal stockpile.

The CHPP would produce the following main streams:

- coking coal (also known as metallurgical coal);
- export-quality thermal coal; and
- CHPP reject material.

During the early development stage of the Project, the CHPP would operate up to 24 hours per day, six days per week. At full development, the CHPP would operate 24 hours per day, seven days per week.

The existing coal processing plant comprises a range of components that can be generally classified into four major circuits: bypass and the coarse coal, medium coal and fine coal circuits. These circuits include components that separate coal materials on the basis of size (e.g. screens, classifying cyclones) and on the basis of material type (e.g. cyclones, teetered bed separator, jig/drum).

The medium coal and fine coal circuits also include components that mechanically dewater coal products (e.g. centrifuges) and components that are used to dewater CHPP reject material (e.g. thickeners and filters).

Further details on product coal handling and transportation and CHPP reject material management are provided in Sections 3.7 and 3.8, respectively.

3.7 PRODUCT COAL HANDLING AND TRANSPORTATION

An indicative schedule for product coal production is provided in Table 3-3.

Product coal would be stacked at the product coal stockpiles using a combination of stackers and a skyline conveyor.

The four existing product coal stockpiles, combined with the product coal stockpile extension, would have a combined capacity of approximately 500,000 t.

Coal would be reclaimed from the stockpiles using a combination of bucket-wheel type reclaimers and a coal reclaim tunnel with coal valves. Dozers would be used as required to manage coal at the coal stockpiles.

Coal would then be transferred to an overhead bin at the train load-out facility for filling the trains on the rail loop (Plate 3-3).

Plate 3-3 – Existing Train Load-out Facility

Product coal would be transported via the existing Antiene Rail Spur and Main Northern Railway to local markets or to the Port of Newcastle for export.

Loaded trains would be sprayed with water (or other suitable dust suppressant) to reduce dust emissions during transportation.

Coal transported along the Maxwell Infrastructure rail loop would be limited to 7 Mtpa. The peak number of train movements along the Maxwell Infrastructure rail loop would be limited to 12 movements per day.

Consistent with the current approval for the Antiene Rail Spur (DA 106-04-00), coal may be hauled on public roads under emergency or special situations with the prior written permission of the Secretary of the DPIE, RMS and Muswellbrook Shire Council.

A portion of coal may also be reclaimed from the product coal stockpile and transported via conveyor or rail to the Bayswater and/or Liddell Power Stations.

3.8 MANAGEMENT OF CHPP REJECT MATERIAL

3.8.1 CHPP Reject Material Production

Approximately 22 million bank cubic metres (Mbcm) of CHPP reject material would be produced over the life of the Project, including coarse rejects and tailings.

An indicative CHPP reject material production schedule is provided in Table 3-3. Whilst the total CHPP reject material quantities are based on planned maximum production, the actual quantity produced in any one year may vary with ROM coal production and product coal specifications.

This CHPP reject material would primarily be emplaced within the existing East Void in ML 1531 at the Maxwell Infrastructure.

3.8.2 Geochemical Characteristics of CHPP Reject Material

CHPP reject material generated by the Project would generally consist of a mixture of carbonaceous shale and mudstone with minor proportions of sandstone and coal.

The Geochemistry Assessment (Appendix P) characterised CHPP reject material that would be generated by the four coal seams in the Jerrys Plains Subgroup being targeted for the Project (GEM, 2019).

The CHPP reject material from processing of coal mined as part of the Project is likely to have low acid neutralising capacity (ANC). The material would typically be potentially acid forming (PAF), with only a low capacity to generate acid. This is consistent with the geochemical characteristics of CHPP rejects generated by other mining operations targeting the Jerrys Plains Subgroup in the Hunter Valley (GEM, 2019).

Processing of coal mined from the Greta Coal Measures occurred at the Maxwell Infrastructure from late 2004 to 2016 (Section 2.2.2). CHPP reject material was emplaced in the East Void from 2012.

Monitoring of the decant water from the CHPP reject emplacement area in 2018 and 2019 indicates that electrical conductivity (EC) is approximately 8,000 microSiemens per centimetre (µS/cm) and the pH is slightly alkaline (range of 7.9 to 8). Consideration of metal concentrations in the East Void is presented in the Surface Water Assessment (Appendix C).

3.8.3 CHPP Reject Emplacement Area

The Project would involve pumping CHPP rejects slurry into the existing East Void within the Maxwell Infrastructure, via a pipeline. Both coarse rejects and tailings would be disposed of in the East Void.

CHPP reject material would be progressively emplaced in the East Void from the south to the north. The CHPP rejects would be disposed below the estimated post-mining groundwater level.

Decant water from the CHPP rejects emplacement area would be collected in sump(s) and pumped to the Access Road Dam or Industrial Dam for re-use (Section 3.10). If required, decant water would be treated prior to use in the CHPP.

Infrastructure for the transfer of CHPP rejects and decant water would be developed and relocated progressively over the life of the Project and, as such, this minor ancillary infrastructure is not shown on Figure 3-3.

Brine that is produced as a by-product of water treatment (reverse osmosis or similar technologies) would also be stored in the East Void with the CHPP rejects.

At the conclusion of the Project, emplacement areas would be capped and rehabilitated, unless consent for continued emplacement is granted.

Malabar will continue to investigate beneficial uses for the voids in CL 229 and ML 1531. This will include emplacing CHPP reject material from possible future underground mining activities undertaken by Malabar within EL 5460 and EL 7429 (Spur Hill Underground Coking Coal Project) and engagement with other mining and industrial facilities in the region (subject to separate assessments and approvals).

3.9 WORKFORCE

3.9.1 Construction and Development

Initial construction activities would occur over a period of approximately 12 months. These activities would be expected to require an average of approximately 90 personnel, and a maximum of approximately 250 personnel.

Additional contractors would also be required during short periods over the life of the Project; for example, during longwall change-outs, periods of higher underground development activities, scheduled plant shutdowns or other maintenance programs. These activities may require up to approximately 80 additional personnel.

3.9.2 Operations

At full development, the Project would employ approximately 350 operational personnel.

Additional employment may also be generated through support functions (e.g. cleaners, security personnel).

Operations would occur 24 hours per day, seven days per week.

Shift arrangements may be adjusted to meet operational and industry best practice requirements. Indicative shift arrangements for the Project would be:

- Production day shift personnel – 6.30 am to 5.00 pm.
- Afternoon maintenance shift personnel – 1.00 pm to 11.00 pm.
- Production night shift personnel – 9.00 pm to 7.30 am.
- CHPP day shift personnel – 6.30 am to 6.30 pm.
- CHPP night shift personnel – 6.30 pm to 6.30 am.

Management and support personnel would primarily work daytime hours.

A description of Malabar's approach to local employment is provided in Section 6.17.4. This approach would include policies and strategies to:

- prioritise recruitment of personnel from the Muswellbrook, Singleton and Upper Hunter LGAs; and
- recruit operational employees from outside the underground mining sector, supported by appropriate workforce training and development.

3.10 WATER MANAGEMENT

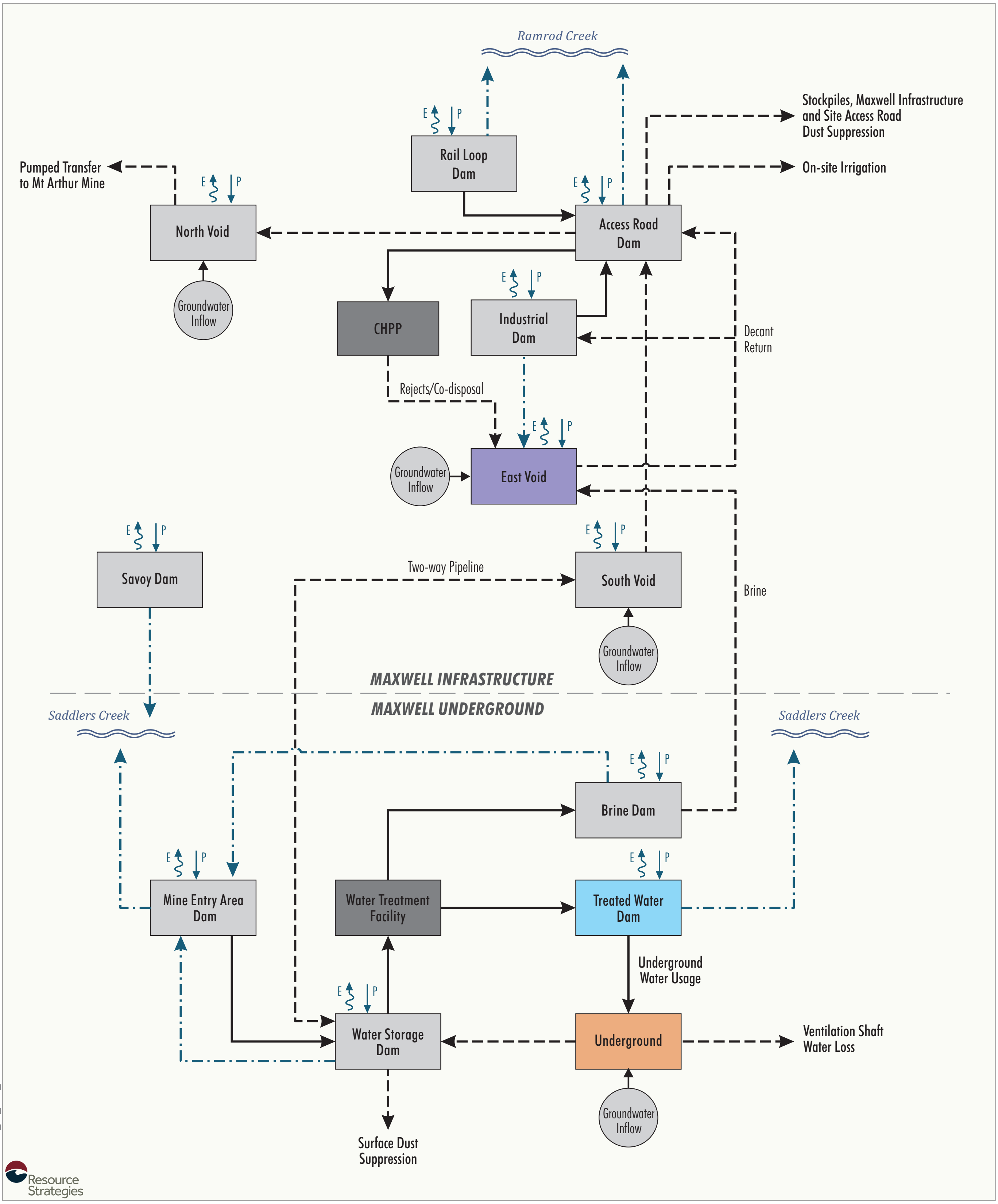
A detailed description of the operation and predicted performance of the site water management system is provided in the Surface Water Assessment (Appendix C) prepared by WRM (2019).

An indicative water management schematic, providing an overview of the water management strategy, is presented as Figure 3-11.

3.10.1 Project Site Water Management System

The objectives and design criteria of the Project site water management system would be 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 CHPP process water on-site.



LEGEND

- E — Evaporation
- P — Precipitation/Catchment Runoff
- Gravity Driven
- Pumped/Siphoned
- Overflow
- Reverse Osmosis 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).

Source: WRM (2019)

MALABAR COAL

MAXWELL PROJECT

Indicative Water Management Schematic

Figure 3-11

The Project would involve the use of a combination of mine water, recycled treated mine water and potable water in underground and surface operations.

Water would 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.

Post-mining water management would incorporate some aspects of the site water management system (i.e. some storages and water management structures would be retained as permanent features) (Section 7).

Up-catchment Runoff Control

Temporary and permanent up-catchment diversion structures would be constructed over the life of the Project to divert runoff from undisturbed areas around the MEA (Figure 3-5) and the transport and services corridor.

Stabilisation of up-catchment diversions would 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.

Rehabilitated Areas

Malabar is progressing the rehabilitation of previous mining areas at the Maxwell Infrastructure, including overburden emplacement areas (Section 3.14).

As vegetation establishes on these areas, Malabar would 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.

Water Storages

Contained water storages for the Project would include the existing storages at the Maxwell Infrastructure and the development of additional storages at the Maxwell Underground (Table 3-4).

Table 3-4
Water Storage Details

Storage Name	Approximate Storage Volume (Megalitres)
Maxwell Infrastructure – Existing Storages	
Access Road Dam	750
Industrial Dam	750
Rail Loop Dam	18
Savoy Dam[1]	140
North Void[2]	17,000
East Void[2]	24,000 [reducing to 5,900] [3]
South Void[2]	18,000
Maxwell Underground – Proposed Storages at the MEA	
Mine Entry Area Dam	110
Water Storage Dam	17
Treated Water Dam	15
Brine Dam	4

1 Savoy Dam may be removed as part of the transport and services corridor. This would not materially affect the performance of the site water management system (Appendix C).

2 Approximate storage volume of open void. Additional storage would be available within the in-pit spoil adjacent to the open void (Appendix C).

3 The volume of the East Void available for water storage would reduce over the life of the Project as CHPP reject material is progressively placed in the void.

Water Treatment

The Project would include the development of water treatment facilities at the MEA, 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 would be stored at the MEA in the Treated Water Dam.

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

Transfer of Water

The transfer of water between water storages is integral to the site water management system.

Water transfer infrastructure would include pumps, pipelines and associated power supply. This infrastructure would be developed and relocated progressively over the life of the Project and, as such, this minor ancillary infrastructure is not shown on Figures 3-2 and 3-3.

Providing appropriate commercial terms are in place between Malabar and BHP, water may also be transferred between the Project and BHP's Mt Arthur Mine. Any transfer infrastructure between the two sites would be located along previously disturbed land and would be documented in the MOPs for both operations.

3.10.2 Groundwater Inflows

Groundwater and operational water that accumulates in the underground workings would be pumped to the surface via underground sumps, access drifts and/or boreholes. Overlying and adjacent workings may also be dewatered, if required for safety reasons.

Predicted groundwater inflows to the underground workings over the life of the Project are predicted to be up to approximately 3 megalitres per day (ML/day) (Appendix B).

Groundwater inflows would continue to accumulate in the North, South and East Voids at the Maxwell Infrastructure until an equilibrium water level is reached.

Licensing of the predicted groundwater inflows for the Project is assessed and described in Appendix B, Section 6.4 and Attachment 8.

3.10.3 Water Consumption

The water consumption requirements and water balance of the system would fluctuate with climatic conditions, production rate and as the extent of the mining operation changes over time.

Underground Mining Operations

Water used in underground mining operations would be treated water.

Treated water used in underground mining operations would peak at approximately 1.5 ML/day.

Coal Handling and Preparation Plant Make-Up

Water used in the CHPP would be recycled from the CHPP rejects with any necessary make-up water obtained from mine water storages.

The CHPP make-up water demand is related directly to the rate of ROM coal feed to the CHPP, the amount of coal bypassed around the coal processing plant, and the rate of production and moisture content of CHPP rejects. The estimated make-up demand varies between less than 1 ML/day up to approximately 3.5 ML/day over the life of the Project (Appendix C).

Dust Suppression and Washdown Usage

Dust suppression would be required along the site access road in the first year of operations, prior to it being sealed (Section 3.4.1). Water would also be required for construction activities and dust suppression of coal stockpiles at the MEA and the Maxwell Infrastructure.

Following the commissioning of the overland conveyor, dust suppression and washdown usage would be in the order of approximately 0.05 ML/day to 0.08 ML/day.

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).

3.10.4 Simulated Performance of the Site Water Management System

A simulated site water balance based on 129 years of climatic data has been prepared by WRM (2019) to simulate the performance of the water management system over the life of the Project (incorporating the Maxwell Infrastructure and the Maxwell Underground).

The site water balance modelling demonstrates the proposed water management system has sufficient capacity and flexibility to accommodate a wide range of groundwater inflows and climate scenarios while (Appendix C):

- providing security of supply for mine operations;
- containing mine-affected water on-site, with no uncontrolled off-site release; and
- avoiding controlled release of water to the Hunter River.

3.11 INFRASTRUCTURE AND SERVICES

The Project would include the use of the existing Maxwell Infrastructure and the development of new infrastructure.

An indicative operational surface mobile equipment fleet that would be used during operations is provided in Table 3-5. Additional surface fleet may be present for short periods; for example, during longwall change-outs, scheduled plant shutdowns or other maintenance programs.

3.11.1 Maxwell Infrastructure

Key existing infrastructure at the Maxwell Infrastructure includes:

- site access road from Thomas Mitchell Drive;
- CHPP, which includes:
  - ROM coal stockpile and ROM hopper;
  - coal processing plant; and
  - product coal stockpiles;
- train load-out facility and rail loop (connecting to the Antiene Rail Spur);
- administration, employee amenities, training centre, emergency services, workshops, washdown bays, store and parking facilities;
- explosives storage facilities;
- electrical distribution infrastructure; and
- site water management infrastructure (including water storages, pumps and pipelines and a wastewater treatment facility).

Table 3-5
Indicative Operational Surface Mobile Equipment Fleet

Fleet Item	Early ROM Coal Stage [prior to commissioning of the covered, overland conveyor]			Full Development Stage [following commissioning of the covered, overland conveyor]	
	Mine Entry Area	Maxwell Infrastructure	Site Access Road	Mine Entry Area	Maxwell Infrastructure
Personnel Transporters	8	-	-	12	-
Dozers	1	-	-	1	3
Front End Loaders	1	1	-	-	-
Graders	-	-	1	-	-
Water Trucks	-	-	1	-	-
Coal Haulage Trucks	-	-	5	-	-
Utilities/Light Vehicles	As required	As required	As required	As required	As required

The Project would utilise the existing surface facilities (such as administration buildings, training facilities, bathhouses, workshops and storage areas) at the Maxwell Infrastructure.

Some existing buildings at the Maxwell Infrastructure may be relocated to the MEA.

The Project would involve upgrades to ROM and product coal handling facilities at the Maxwell Infrastructure, and other minor upgrades.

The existing workshop facilities at the Maxwell Infrastructure may be used for maintenance of underground mining equipment throughout the life of the Project.

3.11.2 Maxwell Underground

Key infrastructure at the Maxwell Underground (at the MEA) would include (Figure 3-5):

- site access road;
- mine access drifts;
- surface conveyors, ROM coal surge stockpiles and coal sizing facility;
- administration, meeting rooms, bathhouse, workshop, fuel storage, laydown, first aid, parking facilities and helipad (primarily for emergency use);
- ventilation and gas management infrastructure;
- electrical distribution infrastructure; and
- site water management infrastructure (including water storages, pumps and pipelines, water treatment facilities and a sewage treatment facility).

3.11.3 Site Access

The Project would use the existing site access road at the Maxwell Infrastructure, which would be extended to the MEA.

The site access road would be used for personnel and visitor access and deliveries. The southern (internal) portion of the road from the MEA to the Maxwell Infrastructure would also be used for haulage of early ROM coal and material excavated during construction activities.

Construction activities to realign Edderton Road would access the construction area via the Golden Highway or via Denman Road from the north.

Agricultural and other land management activities would continue on Malabar-owned properties throughout the life of the Project. Access for these activities would continue to use existing access points on the Golden Highway and Edderton Road.

3.11.4 Electricity Supply and Distribution

Energy consumption would be predominantly electricity. Diesel fuel would also be used.

The main electricity requirements for the Project would include;

- mine ventilation fans;
- longwall and continuous miners;
- conveyors (including the overland conveyor);
- compressors and pumps;
- bathhouse heating;
- coal handling and processing at the CHPP;
- product coal stockpile reclaiming and train loading; and
- other activities associated with underground mining operations.

Electricity would be supplied to the Maxwell Infrastructure via existing overhead power lines. A new 66 kV power supply may be constructed to the MEA (Section 3.4.6).

Electricity would be distributed around the site using a combination of overhead and underground power lines.

Diesel fuel demand would be associated with the use of mobile equipment (such as stockpile dozers, personnel and material transporters and vehicles supporting underground mining operations).

3.11.5 Service Boreholes

Services such as compressed air and water required by underground mining operations would be delivered from the surface via the MEA and service boreholes.

As the mining operations progress, additional service boreholes (also known as drop-holes) may be installed, and would generally be located adjacent to other surface infrastructure areas (e.g. ventilation shafts), resulting in minimal additional disturbance.

Service boreholes of typically less than 25 centimetres (cm) in diameter, located outside of the MEA would:

- restrict disturbance to the practical minimum;
- avoid disturbance of mature shrubs and trees;
- avoid verified Biophysical Strategic Agricultural Land (BSAL);
- incorporate erosion and sediment control and site water management measures in accordance with applicable guidelines;
- manage Aboriginal heritage sites in accordance with a Heritage Management Plan; and
- be decommissioned, sealed and rehabilitated when no longer required.

A typical service borehole is shown in Plate 3-4.

Plate 3-4 – Typical Service Borehole Site

Source: Imagineering.

3.11.6 Site Security and Communications

Site security measures would be maintained for the Project. Additional security fencing for the Project would be erected where necessary (for example, at the upcast ventilation shaft site).

The existing communications systems at the Maxwell Infrastructure would be retained for the Project and augmented as necessary.

Surface and underground communications at the MEA would be developed. The provision of any additional external connections for the Project would be the subject of a separate assessment approvals process.

3.11.7 Water Supply and Use

Underground and surface operations would use a combination of potable and recycled water. Potable water to the Maxwell Infrastructure would continue to be supplied by pipeline from Muswellbrook.

Further details on water supply and use for the Project are provided in Section 3.10.

3.12 WASTE MANAGEMENT

The key waste streams for the Project would comprise:

- CHPP reject materials (as described in Section 3.8);
- general solid waste and recyclables;
- waste oil and grease;
- sewage and effluent; and
- minor quantities of other waste from mining and workshop activities (e.g. worn tyres and used oil filters).

To minimise waste, Malabar would apply general waste minimisation principles (i.e. reduce, re-use and recycling where practicable).

An overview of the waste types likely to be generated by the Project is presented in Table 3-6.

Further details on the management of general waste and sewage and effluent are provided below.

3.12.1 General Waste

General waste produced by the Project would be deposited into general waste bins. General waste bins would then be transported to an off-site approved waste handling facility for sorting and recycling or disposal.

3.12.2 Sewage and Effluent

At the Maxwell Infrastructure, the existing wastewater treatment plant would continue to be used to treat effluent on-site, with the treated water discharged to a rehabilitation area. Effluent disposal at the Maxwell Infrastructure area would continue to be regulated under EPL No. 1323.

Table 3-6
Waste Types Likely to be Generated by the Project

Waste Stream	Indicative Waste Class	Management Method
CHPP Reject Materials	-	Refer to Section 3.8.
Timber, cardboard, paper, steel, scrap metal, commingle, food waste, etc.	General Solid Waste (non-putrescible and putrescible)	Transported to an approved waste handling facility and recycled or disposed.
Used oil filters	General Solid Waste (non-putrescible)	Temporarily stored on-site in designated bins prior to removal by licensed waste contractor(s).
Used particulate filters	General Solid Waste (non-putrescible)	Temporarily stored on-site in designated bins prior to removal by licensed waste contractor(s).
Other workshop wastes (e.g. rags and oil-absorbent materials that only contain non-volatile hydrocarbons and do not contain free liquids)	General Solid Waste (non-putrescible)	Temporarily stored on-site in designated bins prior to removal by licensed waste contractor(s).
Worn tyres	Special	Worn tyres would be segregated and collected for either repair (if possible) or disposal by licensed waste contractor(s).
Bathhouse water	Liquid	On-site treatment at either the MEA or Maxwell Infrastructure water treatment facility for reuse as recycled water.
Sewage and effluent	Liquid	Refer to Section 3.12.2.
Waste oil and grease	Liquid	Used containers would be drained into bulk containers and temporarily stored prior to collection by licensed contractor(s) for processing off-site.
Hazardous waste (e.g. lead-acid or nickel-cadmium batteries and containers that have not been cleaned containing residue of dangerous goods)	Hazardous	Temporarily stored on-site in the designated area prior to removal by licensed hazardous waste contractor(s).
Contaminated waste or asbestos (if identified)	-	Further assessment and advice would be sought regarding waste classification, handling, treatment, disposal and reporting requirements prior to appropriate disposal.

Sewage and wastewater from the MEA ablution facilities would be collected and treated in a biocycle sewage treatment system and serviced by a licensed waste disposal contractor on an as-needed basis. Treated effluent would be irrigated in accordance with the *Environmental Guidelines: Use of Effluent by Irrigation* (NSW Department of Environment and Conservation, 2004).

3.13 MANAGEMENT OF DANGEROUS GOODS

The transportation, handling and storage of all dangerous goods for the Project would be conducted in accordance with the requirements of the NSW *Work Health and Safety Regulation, 2017* (or its latest equivalent).

The dangerous goods stored for the Project would include compressed gases, flammable and combustible liquids, and corrosive substances.

Based on the quantities proposed to be stored for the Project, it is not anticipated that a Dangerous Goods Licence would be required.

3.13.1 Transport

Dangerous goods required for the Project would be transported in accordance with State legislation.

3.13.2 Hydrocarbon Storage

Hydrocarbons used at the Project during construction and operation would include fuels (diesel and petrol), liquid petroleum gas (LPG), oils, greases, degreaser, kerosene and minor quantities of other hydrocarbons (e.g. acetylene).

Currently one 860 kilolitre (kL) tank near the main fuelling area and two 110 kL tanks at the in-pit refuelling area are used to store diesel at the Maxwell Infrastructure.

A diesel storage facility capable of storing up to approximately 50 kL would be established at the MEA for the refuelling of underground support and transport vehicles.

All fuel storage facilities would be constructed and operated in accordance with Australian Standard (AS) 1940 *The Storage and Handling of Flammable and Combustible Liquids*.

3.13.3 Explosives Storage

Section 3.4.2 describes the situations where blasting may be required during construction activities.

Explosives storage would be conducted in accordance with the NSW *Explosives Act, 2003* and *Explosives Regulation, 2013* (or their latest versions). The *Explosives Regulation, 2013* details the requirements for the safe storage, land transport and handling, and disposal of the explosive, with reference to AS 2187.2:2006 *Explosives – Storage and Use – Use of Explosives* for specific guidelines.

Explosives would continue to be stored at the Maxwell Infrastructure in a licensed explosives magazine (licence XSTR100017) in accordance with Workcover requirements and applicable Australian Standards. The current maximum capacity of ammonium nitrate stored at the Maxwell Infrastructure is 80 t. Given the future limited requirement for blasting, the quantity of explosives stored at the Maxwell Infrastructure would be substantially less than this maximum capacity.

3.13.4 Safety Data Sheets and Chemical Storages

The management and storage of chemicals at the Project would be conducted in accordance with Australian Standards and relevant codes.

No chemical or hazardous material would be permitted on-site unless a copy of the appropriate Safety Data Sheet (SDS) is available on-site or, in the case of a new product, it is accompanied by an SDS.

3.14 REHABILITATION AND REMEDIATION ACTIVITIES

The Project would include ongoing rehabilitation and remediation activities within the Maxwell Infrastructure, and rehabilitation of any remaining disturbance areas at mine closure.

A summary of the key components is provided below. Further details of the Project rehabilitation and mine closure activities are provided in Section 7.

3.14.1 Rehabilitation of Previous Mining Areas

The Project would also include the continued rehabilitation of previous mining disturbance areas within CL 229, ML 1531 and CL 395, including overburden emplacement areas, and eventual relinquishment of areas not required to support the Project.

3.14.2 Subsidence Monitoring and Remediation

Remediation and rehabilitation of subsidence impacts and associated environmental consequences would occur in accordance with approved Extraction Plans and in consultation with DPIE.

3.14.3 Decommissioning and Rehabilitation of Surface Facilities

Surface facilities used for the Project would be decommissioned when they are no longer required or at the end of the mine life where no further ongoing beneficial use is identified.

At closure, works would include the decommissioning and removal of infrastructure, the sealing of mine entrances and land rehabilitation.

3.14.4 CHPP Reject Emplacement Areas and Final Voids

At the conclusion of the Project, emplacement areas would be capped and rehabilitation completed, unless consent for continued emplacement is granted.

Remaining final voids would be made safe, stable and non-polluting.

Malabar will continue to investigate beneficial uses for the voids in CL 229 and ML 1531. This will include CHPP reject material from possible future underground mining activities undertaken by Malabar within EL 5460 and EL 7429 (Spur Hill) and engagement with other mining and industrial facilities in the region (subject to separate assessments and approvals).

3.15 OTHER ACTIVITIES

3.15.1 Potential Edderton Road Realignment

Potential subsidence impacts on Edderton Road would be managed through either: (i) road maintenance along the existing alignment; (ii) or the realignment of the road around the Maxwell Underground area.

Any realignment of Edderton Road would be subject to necessary approvals under the NSW *Roads Act, 1993* and consultation with RMS and Muswellbrook Shire Council.

The potential realignment of Edderton Road would intersect the Golden Highway at a new T-intersection, located approximately 1.2 km west along the Golden Highway from the existing T-intersection.

The realignment would be approximately 3.2 km from the Golden Highway to the existing alignment of Edderton Road.

The realigned portion of Edderton Road would have a two-way sealed carriageway and would be designed to comply with Austroads (2016) or an alternative agreed standard.

The new T-intersection with the Golden Highway would include a channelised right turn lane and an auxiliary left turn lane in the Golden Highway for vehicles turning into Edderton Road.

3.15.2 Exploration Activities

Exploration activities would continue over the life of the Project to progressively refine the understanding of geological structures and seam gas content, so providing input to detailed mine planning and engineering.

Exploration activities would include in-seam drilling, surface-to-seam drilling, low-impact seismic acquisition, surface mapping and airborne and ground-based geophysical surveys.

Surface-to-seam drilling activities would require only small surface areas and would involve the use of typical truck-mounted surface drilling rigs and supporting equipment.

3.15.3 Monitoring Activities

Collection of environmental baseline data and monitoring of subsidence effects, subsidence impacts and associated environmental consequences would occur throughout the life of the Project.

Proposed monitoring is summarised in Section 8. The location, extent and methods adopted for monitoring would be adjusted throughout the life of the Project based on results and stakeholder feedback.