PROGRESSIVE REHABILITATION AND CLOSURE PLAN

LAKE VERMONT MEADOWBROOK PROJECT

PREPARED FOR
BOWEN BASIN COAL PTY LTD

February 2022

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Cover Page

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AEP	Annual exceedance probability
ATP	Authority to Prospect
BoM	Bureau of Meteorology
CSEP	Community and Stakeholder Engagement Plan
DSDMIP	Department of State Development, Manufacturing, Infrastructure and Planning
EA	Environmental Authority
EC	Electrical conductivity
EIS	Environmental Impact Statement
EP Act	*Environmental Protection Act 1994*
ERA	Environmentally relevant activity
FOS	Factor of safety
GDE	Groundwater dependent ecosystems
HES	High ecological significance
LOD	Land outcome document
MIA	Mine infrastructure area
ML	Mining Lease
MLA	Mining Lease Application
MDL	Mineral Development Licence
MNES	Matters of National Environmental Significance
MSES	Matters of State Environmental Significance
NAF	Non-acid-forming
NUMA	Non-use management area
PFC	Projective foliage cover
PRC	Progressive rehabilitation and closure
PMF	Probable maximum flood
PMLU	Post-mining land use
PoO	Plan of Operations
PRCP	Progressive Rehabilitation and Closure Plan
RA	Rehabilitation area
ROM	Run of mine
RUSLE	Revised Universal Soil Loss Equation
SEP	Stakeholder Engagement Plan
SCL	Strategic cropping land
SMART	Specific, measurable, achievable, realistic and timely
SMU	Soil management units
TDS	Total dissolved salts
TEC	Threatened ecological community
TSSC	Threatened Species Scientific Committee
WoNS	Weeds of National Significance

1 Introduction

AARC Environmental Solutions Pty Ltd (AARC) has been commissioned by Bowen Basin Coal Pty Ltd (Bowen Basin Coal) to develop a Progressive Rehabilitation and Closure Plan (PRCP) for the Lake Vermont Meadowbrook Project (the Project) in accordance with the requirements of the *Environmental Protection Act 1994* (EP Act) and the Project environmental impact statement (EIS) Terms of Reference.

The Project is located approximately 25 km north-east of Dysart and approximately 160 km south-west of Mackay in the Bowen Basin region of central Queensland. The Project location is shown in Figure 1.

This PRCP is applicable to the Lake Vermont Meadowbrook Project, which is a proposed extension to the existing Lake Vermont Mine. The Project comprises underground longwall mining and open cut coal mining of coal seams to the immediate north of the existing Lake Vermont Mine. The Project will utilise existing infrastructure and facilities at the Lake Vermont Mine.

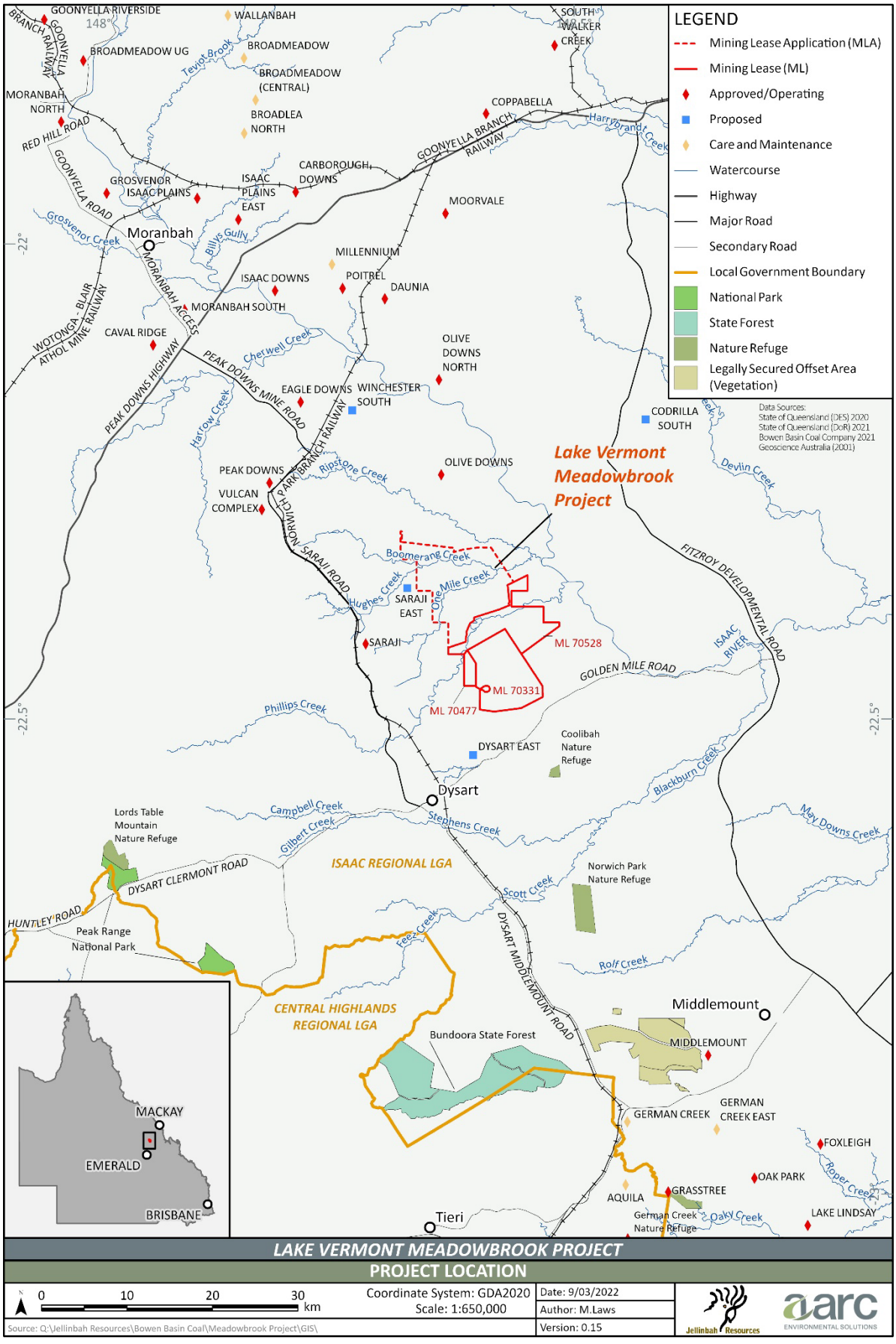

Figure 1: Project location

2 Scope and objective

The purpose of this PRCP is to describe how progressive rehabilitation will be carried out at the Project. The PRCP has been developed in accordance with the requirements of the *Progressive Rehabilitation and Closure Plan Guideline* (DES 2021, PRCP Guideline). The PRCP Guideline states that the PRCP must include the following parts:

Rehabilitation Planning part:

The purpose of the rehabilitation planning part of the PRCP is to support and justify the development of the proposed PRCP schedule. This part must detail how progressive rehabilitation and closure will be carried out over the entire Project site and on both a rehabilitation area basis and improvement area basis. The key components of the rehabilitation planning part for the Project are:

- community consultation information (refer Section 3.2);
- post-mining land use (PMLU) and/or non-use management area (NUMA) determination (refer Section 3.3);
- rehabilitation and management methodology (refer Section 3.5);
- risk assessment (refer Section 3.6); and
- a monitoring and maintenance program (refer Section 3.7).

Rehabilitation Schedule part:

The rehabilitation schedule is a required element of a PRCP. Once approved, the schedule becomes a legally binding and enforceable instrument with which the Project must comply. The schedule must include:

- nomination of either a PMLU or NUMA for all land within the relevant resource tenures, including land uses for undisturbed land;
- identification of when land becomes available for rehabilitation or improvement;
- rehabilitation or management milestones to achieve the PMLU or NUMA outcomes;
- milestone criteria that demonstrate when each milestone has been completed;
- completion dates for each milestone to be achieved;
- any conditions considered necessary or desirable; and
- a final site design.

The administering authority may impose a condition on a draft PRCP schedule or a PRCP schedule if it considers the condition is necessary or desirable (Section 4.2 of the PRCP Guideline). Two deemed conditions are to be included in all PRCP schedules in accordance with Section 206A of the EP Act. The first condition states that when carrying out a relevant activity under the PRCP schedule, the holder must comply with a requirement stated in the environmental authority (EA) relevant to carrying out the activity.

The second condition states that the holder must comply with the following matters stated in the schedule:

- each rehabilitation milestone and management milestone, and
- when each rehabilitation milestone and management milestone is to be achieved.

3 Project planning part

3.1 Project planning

3.1.1 Project description

The Project comprises an extension to the north of the existing Lake Vermont Mine. It will involve underground longwall mining and open cut coal mining and utilise the existing infrastructure and facilities at the Lake Vermont Mine.

The Project will enable the future Lake Vermont Complex (defined as the existing Lake Vermont Mine and extension Project) to maintain production at approximately 9 Mtpa (of product coal) from 2028 through to 2048, with the overall lifespan of the combined Project along with the existing opencut operations being approximately 53 years (inclusive of final rehabilitation). Approximately 108.6 Mt of underground run of mine (ROM) coal, plus 13.3 Mt of open cut ROM coal is estimated to be mined over the life of the Project, producing approximately 122 Mt of total ROM coal.

The Project lies within mineral development licence (MDL) MDL 303, MDL 429 and mining lease (ML) ML 70477. Bowen Basin Coal will submit a Mining Lease Application (MLA) over MDL 303 and MDL 429, as part of the approvals required to authorise this Project.

3.1.1.1 Project activities

The prescribed environmentally relevant activities (ERA), resource activities and notifiable activities applicable to the existing Lake Vermont Mine will also apply to the Project. The Project will be authorised by an amendment to the existing Lake Vermont Mine EA which authorises the ERA of mining black coal under Schedule 3 of the Environmental Protection Regulation 2019. ERAs and notifiable activities relevant to the Project are listed in Table 1and Table 2 respectively. No additional ERAs or notifiable activities are anticipated to be carried out in association with the Project.

Table 1: ERAs applicable to the Project

ERA	ERA description
Schedule 2 of the EP Regulation	
8(3)(1)(c) Chemical storage	Chemical storage (the relevant activity) consists of storing more than 500 m^3 of class C1 or C2 combustible liquids under AS1940 or dangerous goods class 3.
16(1)(c) Extraction and screening	Screening 5,000 t or more of material, in a year.
31(2)2(b) Mineral processing	Processing, in a year, the following quantities of mineral products, other than coke (b) more than 100,000 t.
33(1) Crushing, milling, grinding or screening	Crushing, milling, grinding or screening (the relevant activity) consists of crushing, grinding, milling or screening more than 5,000 t of material in a year.
38(1)(b) Surface coating	Surface coating, using more than 100 t of surface coating materials for coating or painting or powder coating in a year.
56 Regulated Waste Storage	Receiving and storing regulated waste
60(1)(a) Waste disposal	Operating a facility for disposing of less than 50,000 t in a year

ERA	ERA description
63(1)(b-i) Sewage Treatment	Operating a sewage treatment works at a site that has a total daily peak design capacity of more than 100 but not more than 1500 equivalent persons.
Schedule 3 of the EP Regulation	
13 Mining Black Coal	Mining black coal

Table 2: Notifiable activities applicable to the Project

Notifiable activity	Notifiable activity description
Schedule 3 of the EP Act	
1 Abrasive blasting	Carrying out abrasive blast cleaning (other than cleaning carried out in fully enclosed booths) or disposing of abrasive blasting material.
7 Chemical storage	Storing more than 10 t of chemicals (other than compressed or liquefied gases) that are dangerous goods under the dangerous goods code.
15 Explosives production or storage	Operating an explosives factory under the *Explosives Act 1999*.
24 Mine wastes	a) Storing hazardous mine or exploration wastes, including, for example, tailing dams, overburden or waste rock dumps containing hazardous contaminants; or b) Exploring for, or mining or processing, minerals in a way that exposes faces, or releases groundwater, containing hazardous contaminants.
29 Petroleum product or oil storage	Storing petroleum products or oil: c) In underground tanks with more than 200 L capacity; or d) In above ground tanks: i. for petroleum products or oil in class 3 in packaging groups 1 and 2 of the dangerous goods code – more than 2,500 L capacity; or ii. for petroleum products or oil in class 3 in packaging groups 3 of the dangerous goods code – more than 5,000 L capacity; or iii. for petroleum products that are combustible liquids in class C1 or C2 in Australian Standard AS 1940, 'The storage and handling of flammable and combustible liquids' published by Standards Australia – more than 25,000 L capacity.
37 Waste storage, treatment of disposal	Storing, treating, reprocessing or disposing of waste prescribed under a regulation to be regulated waste for this item (other than at the place it is generated), including operating a nightsoil disposal site or sewage treatment plant where the site or plant has a design capacity that is more than the equivalent of 50,000 persons having sludge drying beds or on-site disposal facilities.

3.1.1.2 Resource tenements

The Project is an extension to the existing Lake Vermont Mine which operates within ML 70331, ML 70477 and ML 70528 under EA EPML00659513 (Figure 2). The proposed Project extension footprint lies within MDL 303, MDL 429 and ML 70331 (Figure 2). All of these tenements (refer Table 3) are held by the proponent. Bowen Basin Coal will submit an MLA over a portion of MDL 303 and MDL 429 comprising a total area of approximately 8,238 ha. All land within the footprint of the MLA is owned by the proponent. The Project also includes construction of an infrastructure corridor within ML 70477 and ML 70528 to link the Project to the existing Lake Vermont Mine coal handling and processing plant. Native title has been extinguished over all land the subject of the MLA.

The coal and petroleum resource tenements that overlap, or are adjacent to the Project are listed in Table 4 and shown in Figure 2 and Figure 3.

Exploration Permits for Coal (EPC) 837 and 850 held by other coal resource companies overlap a portion of Lot 102, SP310393 or Lot 1, SP190747 (Figure 2 and Table 4) however do not overlay the Project. A number of EPCs (EPC 747, EPC 721, EPC 688, EPC 1444) overly lots located adjacent to the Project.
Petroleum Authority to Prospect (ATP) tenements ATP 1103 and ATP 1031 also overlie Lot 102, SP310393 and/or Lot 1, SP190747 (Figure 3 and Table 4). ATP 814 overlies a lot located adjacent to the Project.
No geothermal tenure or greenhouse gas tenements overly or are adjacent to the Project.

Table 3: Resource tenement details

Resource tenement	Grant date	Expiry date	Area (ha)
MDL 303	31 August 2000	31 August 2022^	6,701
MDL 429	8 May 2012	31 May 2022^	9,496
ML 70331	9 July 2004	31 October 2035	4,897
ML 70477	16 August 2014	31 December 2044	452.9
ML 70528	21 March 2016	31 March 2041	3,748

Note: ^ indicates MDL renewal application has been lodged.

Table 4: Coal and petroleum tenements

Authorised tenement holder	Tenement number	Location in relation to the Project
Coal tenements		
Bowen Basin Coal	ML 70331, ML 70477, ML 70528, MDL 303, MDL 429, MDL 3001	Overlying Lots 102/SP310393 or 1/SP190747
Aquila Exploration Pty Ltd	MDL 519	Adjacent to Lot 102/SP310393
Pembroke Olive Downs Pty Ltd	ML 700033, ML 700034, MDL 3012, MDL 3013, MDL 3014	Adjacent to Lot 102/SP310393

Authorised tenement holder	Tenement number	Location in relation to the Project
BHP Coal Pty Ltd	MLA 70383, MDL 454, EPC 1444 EPC 837	Adjacent to Lots 102/SP310393 or 1/SP190747 A portion of EPC 837 overlaps Lot 1/SP190747, and is located on the adjacent lot
Anglo Coal (German Creek) Pty Ltd	EPC 747	Adjacent to Lot 1/SP190747
Peabody BB Interests Pty Ltd	EPC 721, EPC 688	Adjacent to Lot 102/SP310393
Peabody BB Interests Pty Ltd	EPC 850	Adjacent and overlaps a portion of Lot 102/SP30393
Petroleum tenements		
CH4 Pty Ltd	ATP 1103	Overlying Lots 102/SP310393 and 1/SP190747
Bow CSG Pty Ltd	ATP 1031	Overlying Lots 102/SP310393 and 1/SP190747
Eureka Petroleum Pty Ltd	ATP 814	Adjacent to Lot 102/SP310393

3.1.1.3 Mining operations and site layout

The Project includes underground single and dual seam longwall mining, open cut mining activities and supporting infrastructure. The proposed underground longwall and open cut mining areas are shown on Figure 4. The depth and thickness of the coal seams across the Project are such that underground longwall mining provides the most effective method of extraction as the operation moves to the northern deeper resources. The underground mine will target the Vermont Lower Seam in the southern portion of the underground resource area and both the Vermont Lower and Lower Leichhardt seams in the northern portion of the underground resource area.

A small open cut is planned to mine shallower resources not amenable to underground mining. The open cut pit will be mined as a 'satellite' pit to the existing Lake Vermont Mine and use traditional truck and excavator methods. Mining within the open cut pit has been designed to minimise disturbance associated with waste rock emplacements. Overburden and interburden will be disposed of using both in-pit and out-of-pit waste rock emplacements located on-site and contiguous with the pit excavation. The open cut pit behind the advancing operations will be progressively backfilled and rehabilitated.

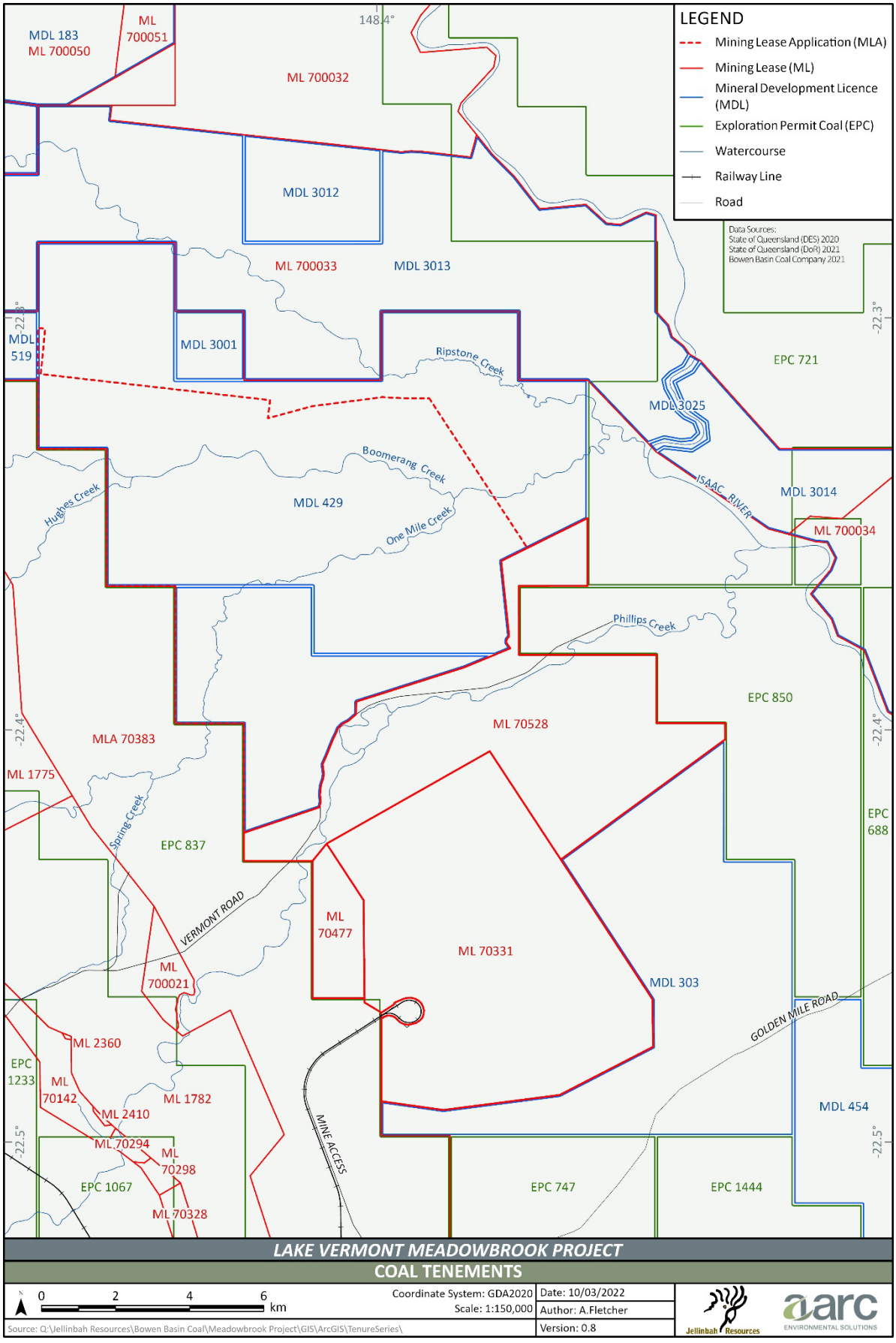

Figure 2: Coal tenements

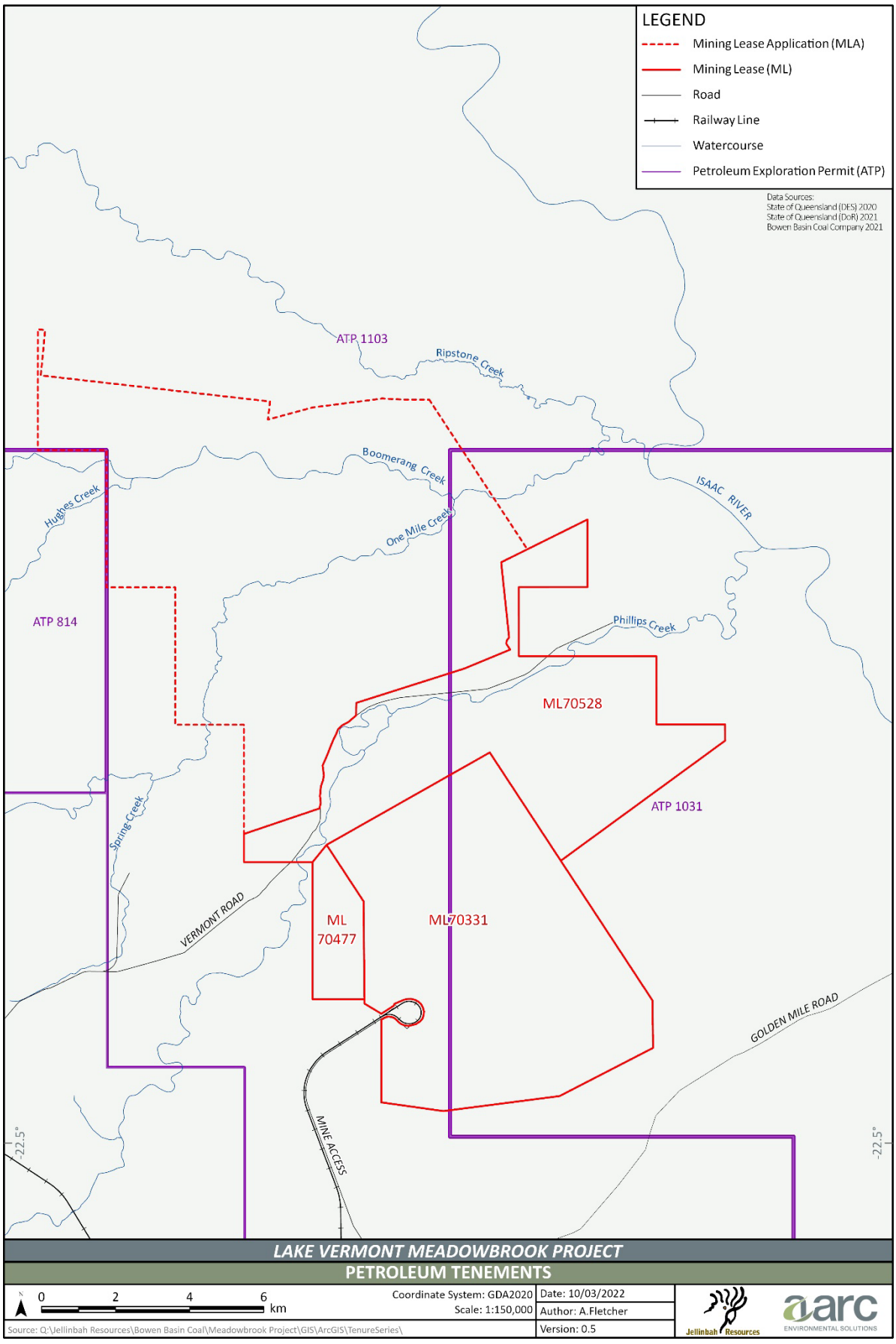

Figure 3: Petroleum tenements

The Project includes the development of (on existing Bowen Basin Coal tenements):

- an infrastructure corridor linking the new mining area to existing infrastructure at the Lake Vermont Mine, to provide for access, coal haulage, power and water supply, and telecommunications infrastructure for the new mining activities ;
- a mine infrastructure area (MIA);
- ROM coal conveying and handling system;
- boreholes to support the delivery of materials to the underground operations;
- infrastructure for electricity supply;
- mine water management infrastructure;
- underground portal, drifts and shafts for underground operations; and
- gas drainage bores and associated surface infrastructure.

The general arrangement of the Project (Figure 4) utilises existing infrastructure and facilities at the Lake Vermont Mine to minimise Project disturbance. The Project will use the existing coal handling facilities, coal handling and preparation plant (CHPP) and train load out facilities at the Lake Vermont Mine. Handling of CHPP rejects will continue in accordance with current management practices using the existing and approved reject co-disposal areas at the Lake Vermont Mine. Product coal will continue to be railed *via* the Blackwater or Goonyella/Newlands Rail Systems to the RG Tanna Coal Terminal in Gladstone, Dalrymple Bay Coal Terminal in Mackay, or the Abbot Point Coal Terminal in Bowen for export.

No off-lease infrastructure is required by the Project, however, works to upgrade and extend facilities at the existing Lake Vermont accommodation village are required to meet current manning levels which will be maintained for the duration of the Project. The Lake Vermont Accommodation Village is located in Dysart, approximately 25 km to the south-west of the Project.

Construction and mine development activities are scheduled to commence subject to and following the approval of the proposed amendments to the EA and the grant of the ML. Construction of the underground extension is forecast to commence in fiscal year 2024 (being Project Year -1) and continue for a period of approximately 24 months (Project Year -1 and Project Year 0). In-seam development of the underground headings up to the commencement of longwall extraction will be undertaken in Project Year 1 and Project Year 2, with the commencement of longwall mining operations commencing in Project Year 3. Mining of the open cut satellite pit does not commence until Project Year 20 and will have a life of 11 years. In total, the combined underground and open cut resource areas support a production life of up to 30 years, commencing in Project Year 1 (indicatively 2026) and completed in Project Year 30 (indicatively 2055). Rehabilitation will occur progressively as land becomes available. Operational stage plans are provided in Figure 5 to Figure 11.

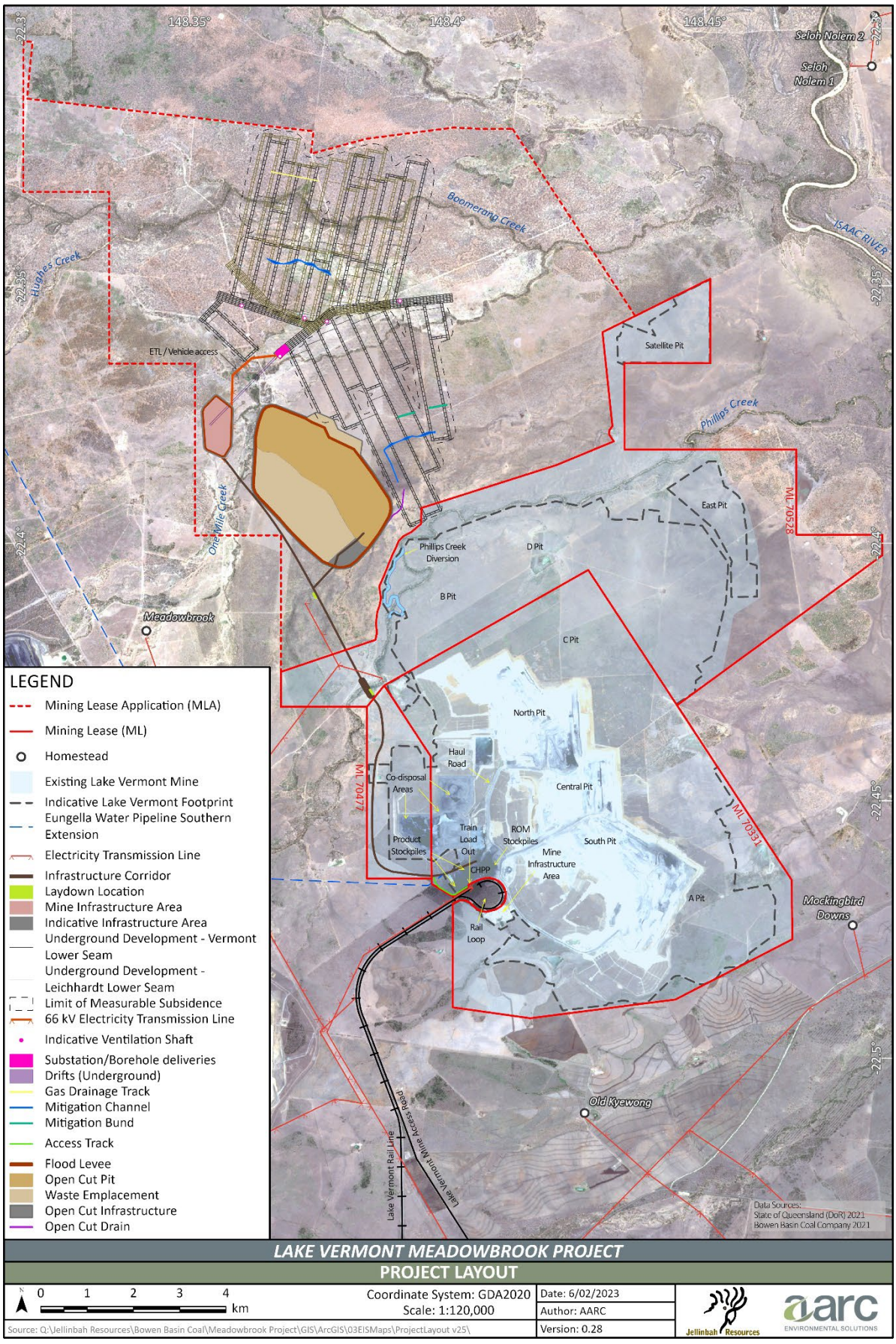

Figure 4: Conceptual Project Layout

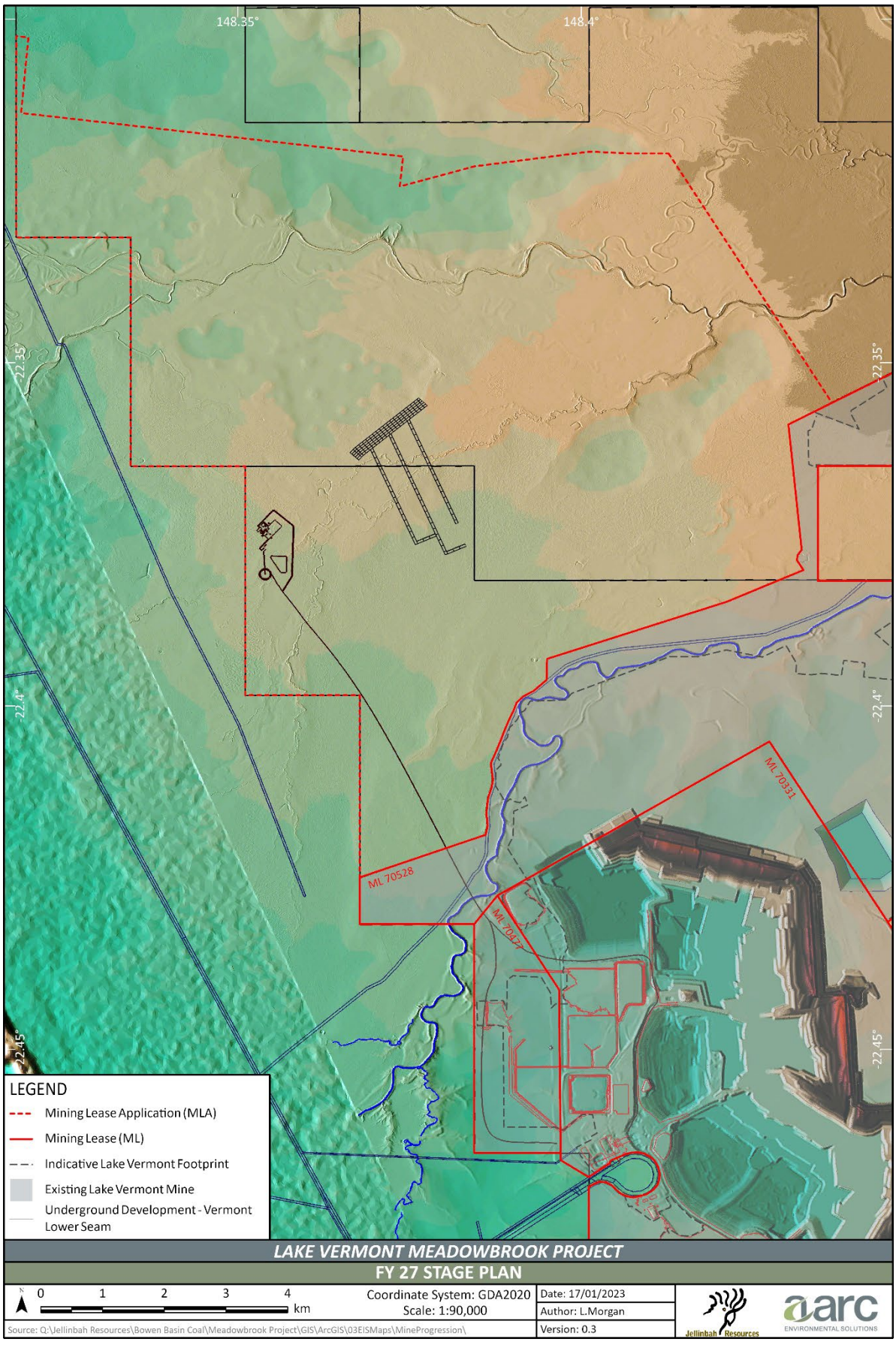

Figure 5: Mine stage plan - Project Year 2

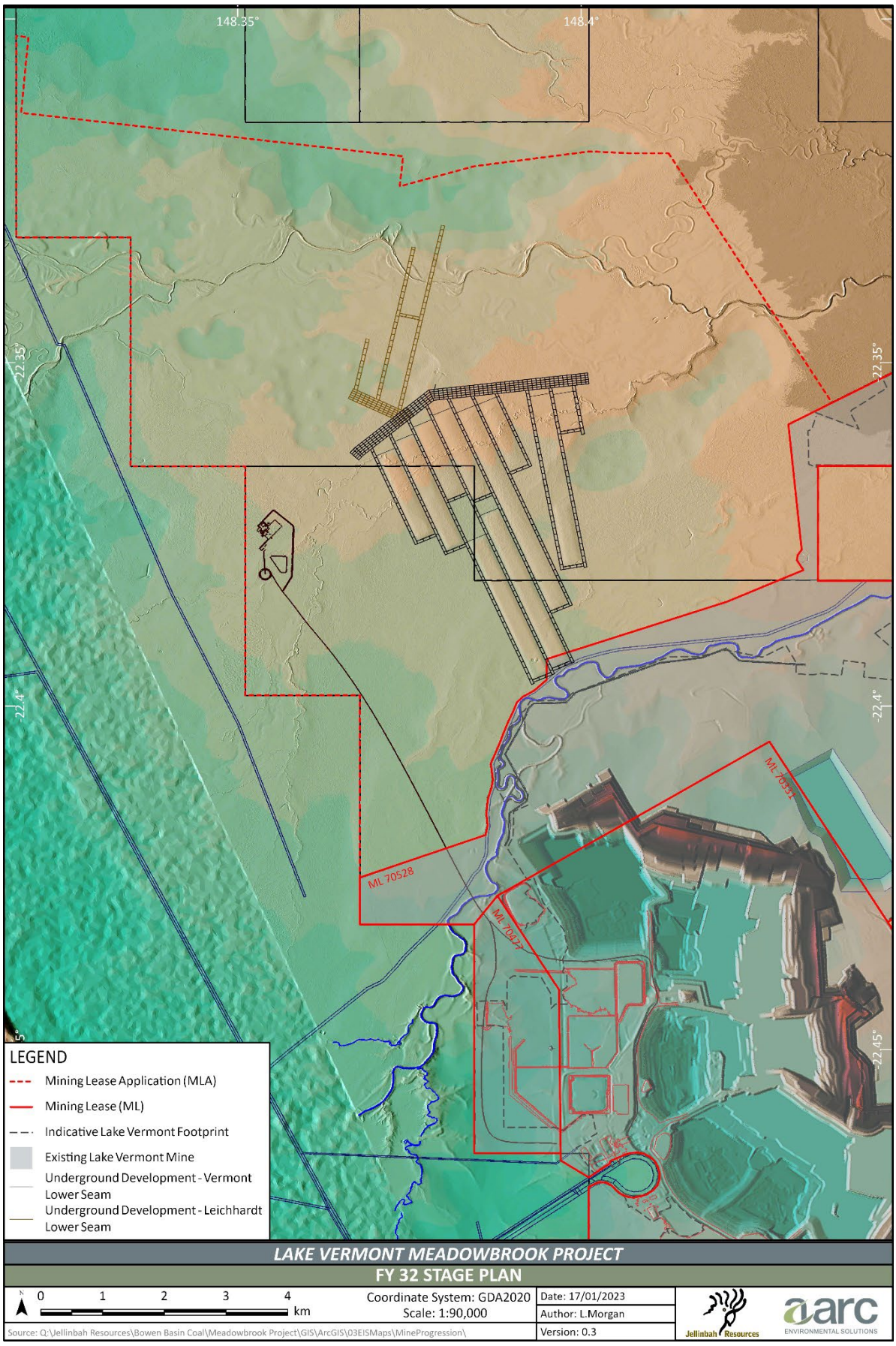

Figure 6: Mine stage plan—Project Year 7

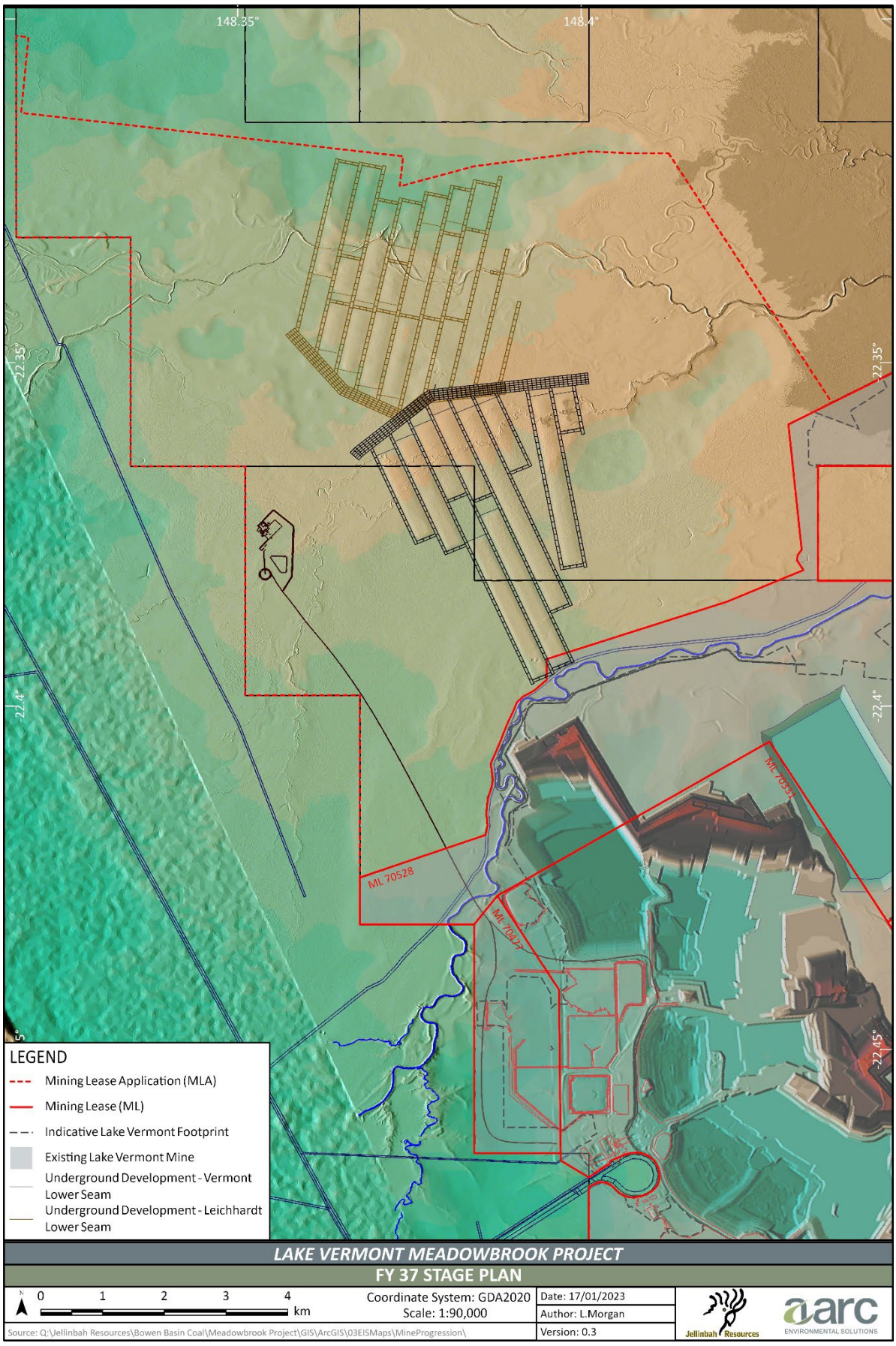

Figure 7: Mine stage plan—Project Year 12

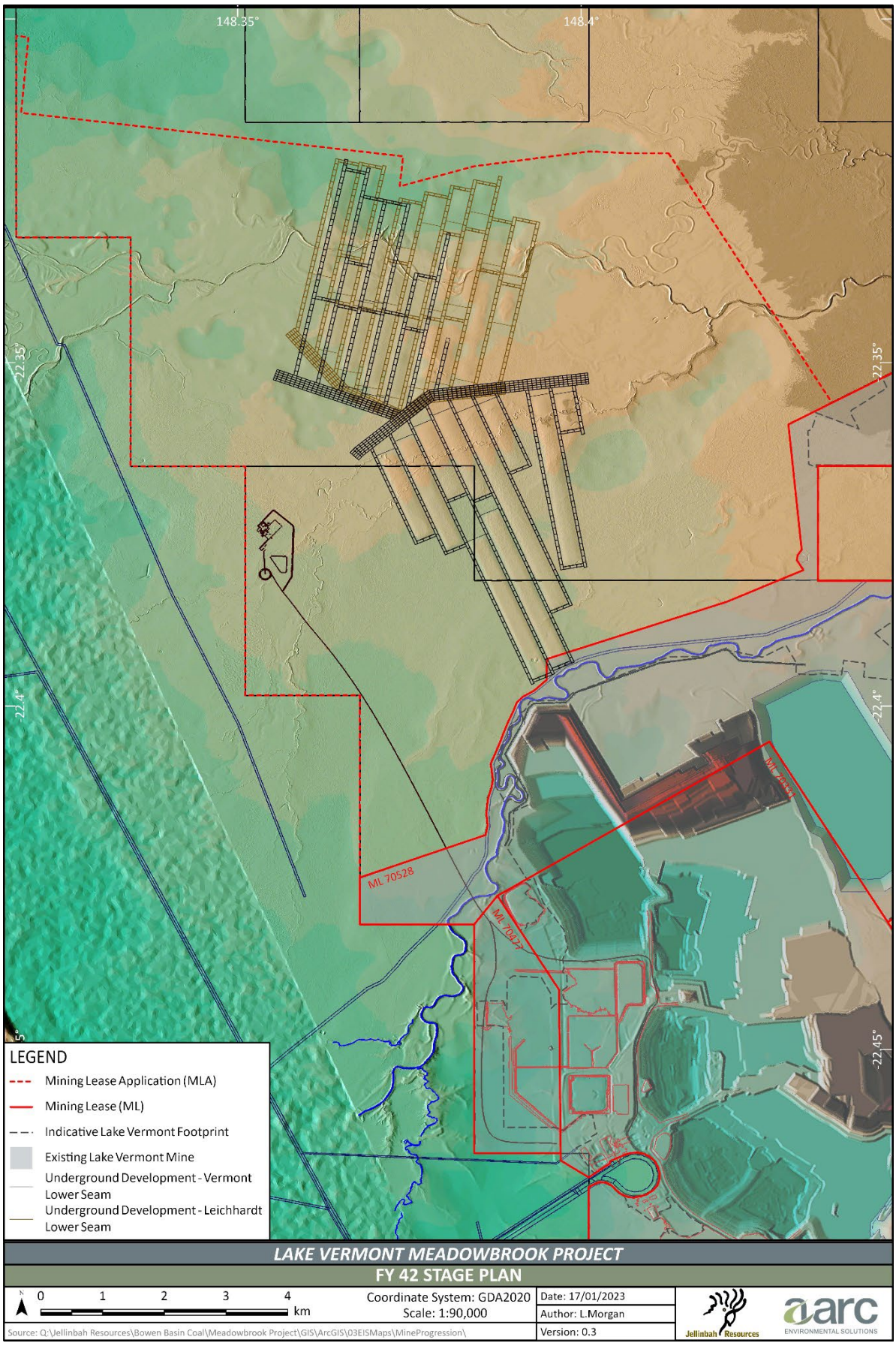

Figure 8: Mine stage plan—Project Year 17

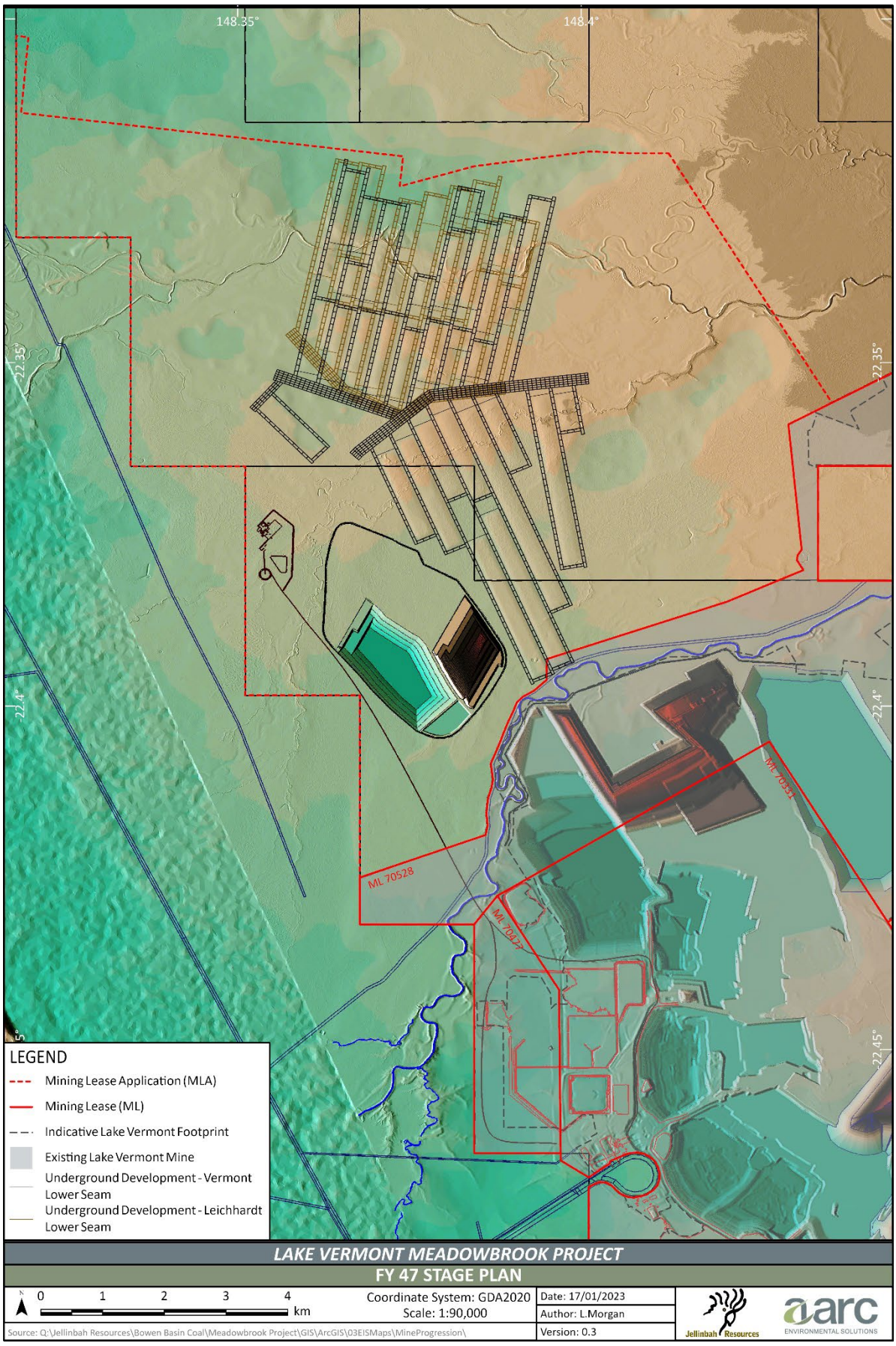

Figure 9: Mine stage plan—Project Year 22

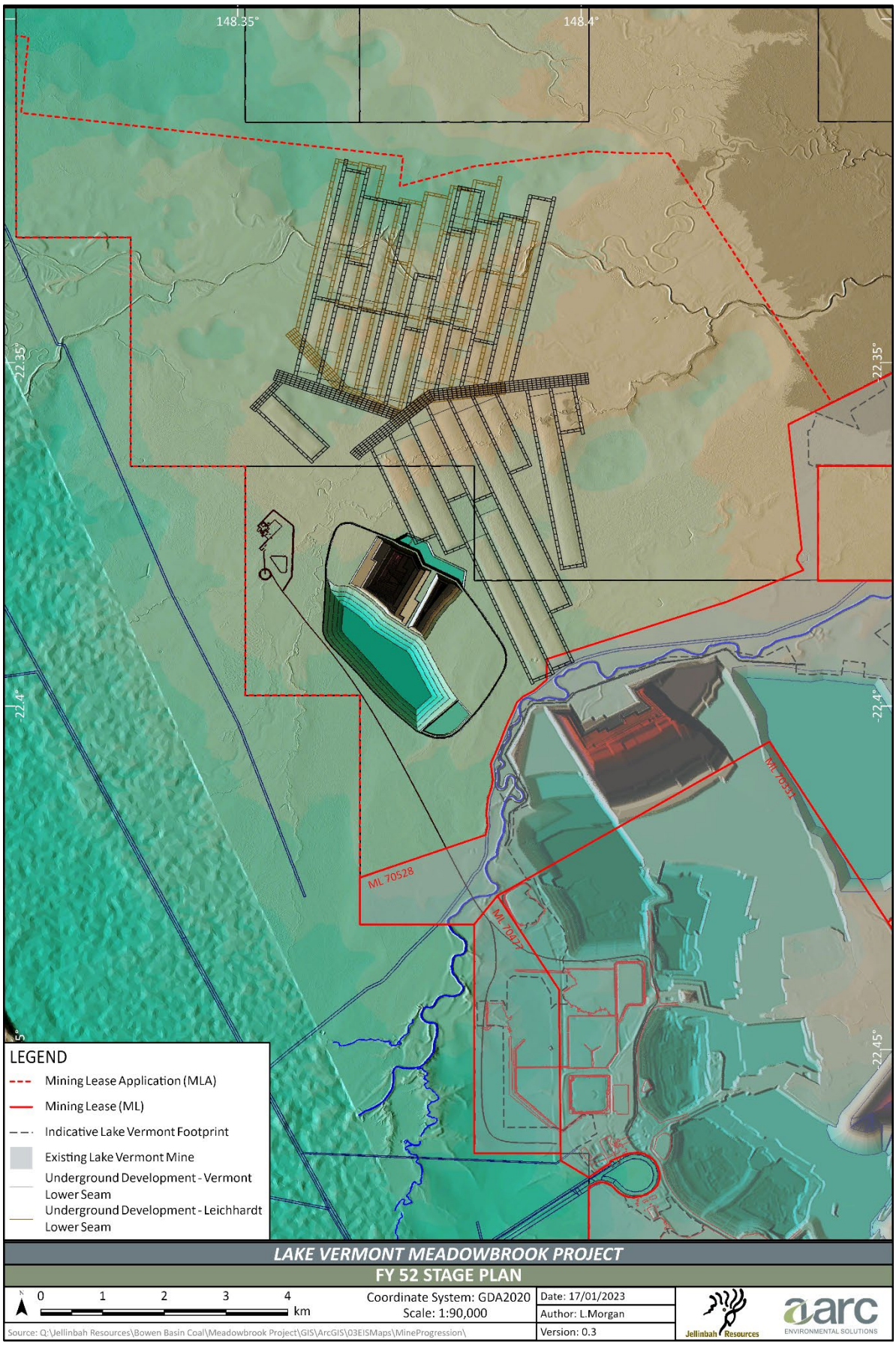

Figure 10: Mine stage plan—Project Year 27

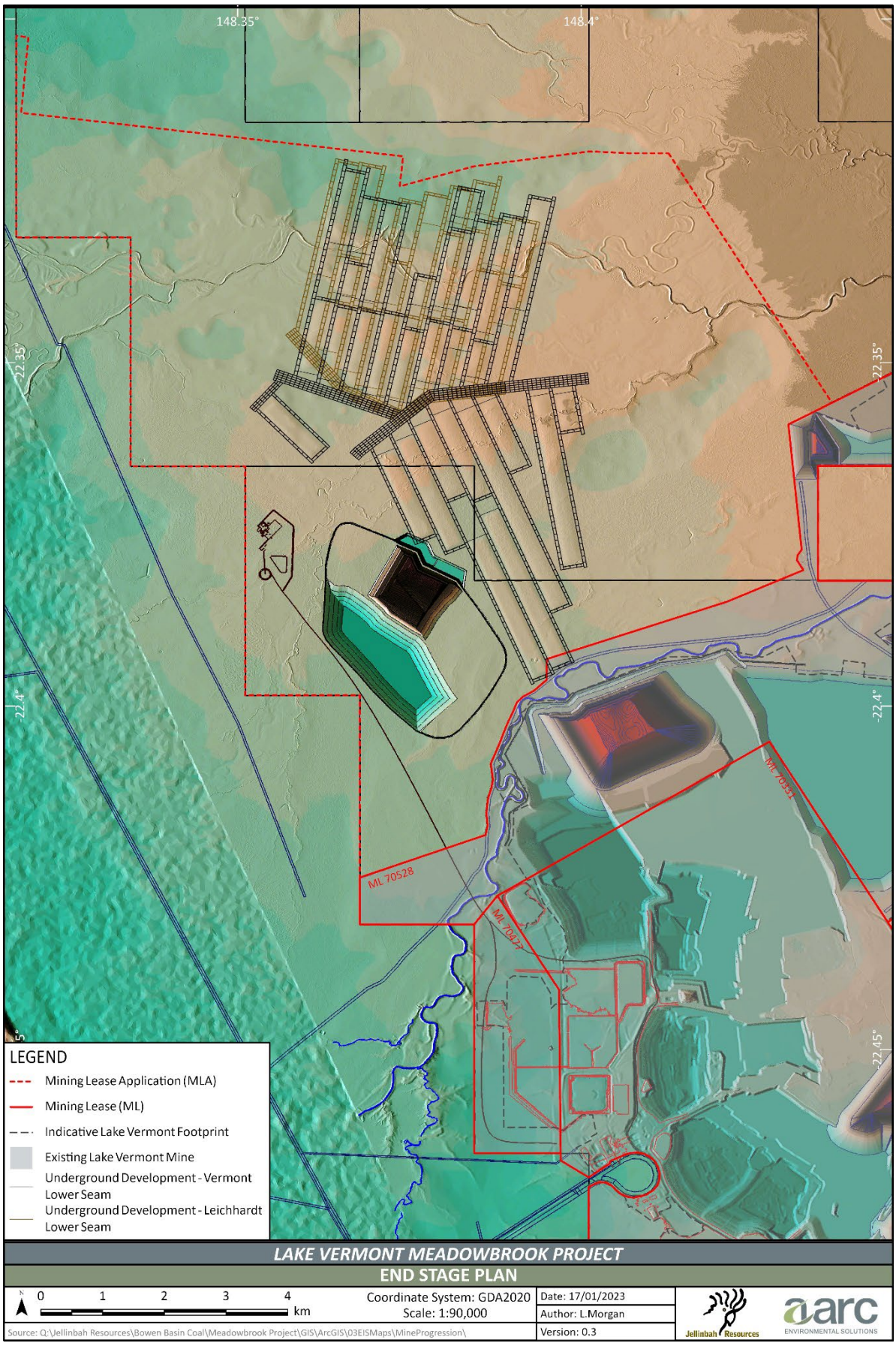

Figure 11: Mine stage plan—end of all mining

3.1.2 Climate

3.1.2.1 Rainfall

The climate of the Project region is subtropical with a moderately dry winter. The wet season for the region generally aligns with the November to March period, with rainfall during these months contributing approximately 70% to the region's total annual rainfall. The dry season generally occurs from April through to October, with monthly rainfall totals generally less than 25 mm.

In the Project region, recorded mean annual rainfall totals during 1953 to 2021 were 623.5 mm at Booroondarra Station (035109), and 547.1 mm at Moranbah Airport (034035) (Figure 12).

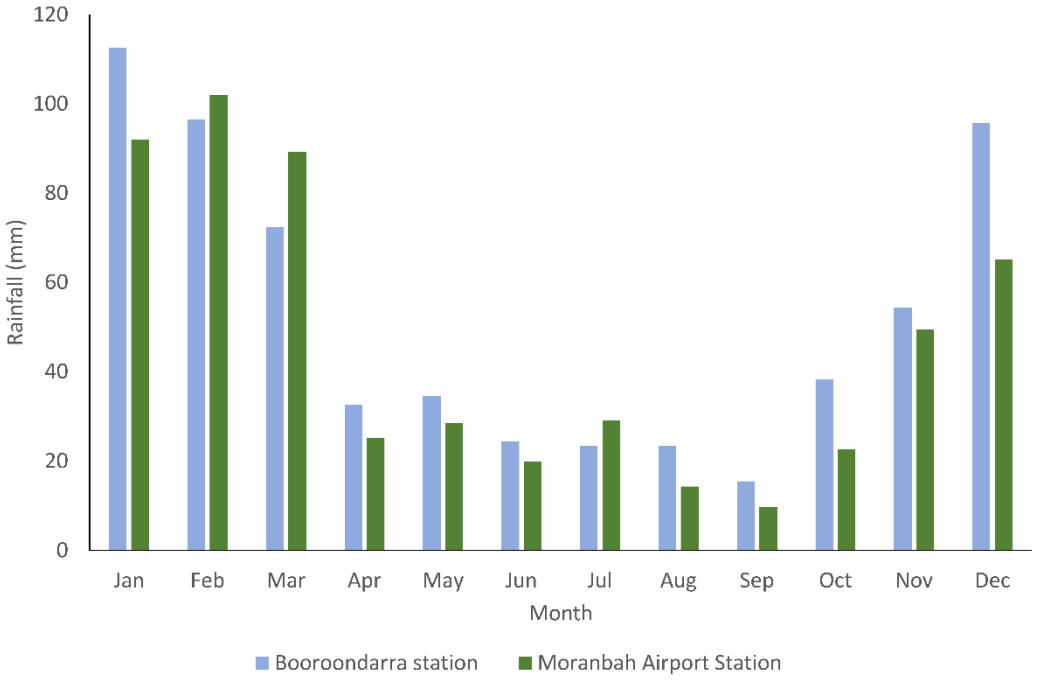

Figure 12: Mean monthly rainfall in the Project area and surrounds

3.1.2.2 Evaporation

Interpolated Evaporation data is available from SILO. The mean annual evaporation estimated from the SILO Meadowbrook Grid is 2,013 mm, approximately three times higher than average rainfall. Monthly evaporation summary statistics are shown in Figure 13.

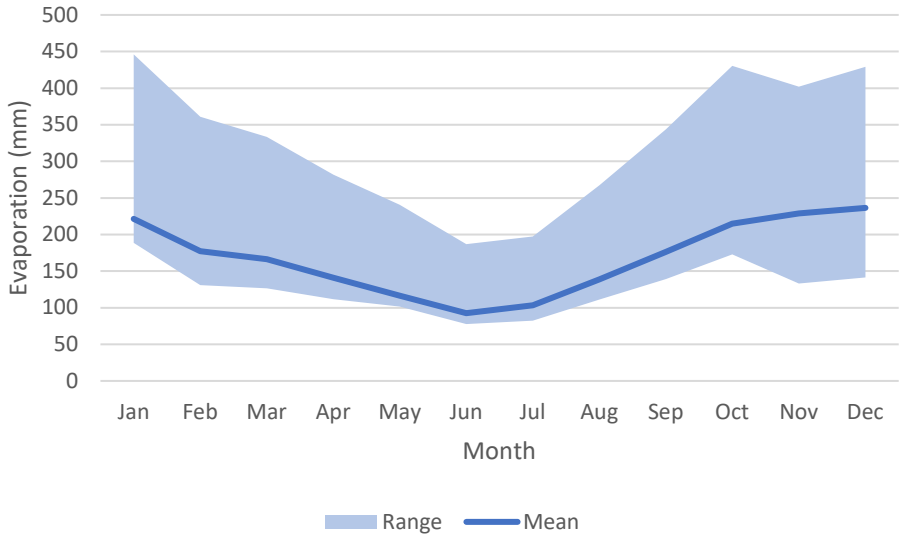

Figure 13: Monthly evaporation summary at Meadowbrook

3.1.2.3 Temperature

Daily temperature records are available from the BoMs Clermont Airport (035124) and Moranbah Airport (034035) weather stations, and interpolated data from SILO. For the 2012 to 2021 period, recorded mean daily temperatures range between 14.7°C (min.) to 29.9°C (max.) at Clermont Airport, and 15.7°C (min.) to 30.6°C (max.) at Moranbah Airport. The SILO Meadowbrook Grid calculates mean daily temperatures of approximately 16.3°C (min.) to 29.3°C, during the years between 1968 and 2018.

Temperature data from the BoMs Clermont Airport (035124) and Moranbah Airport (034035) weather stations is presented in Figure 14.

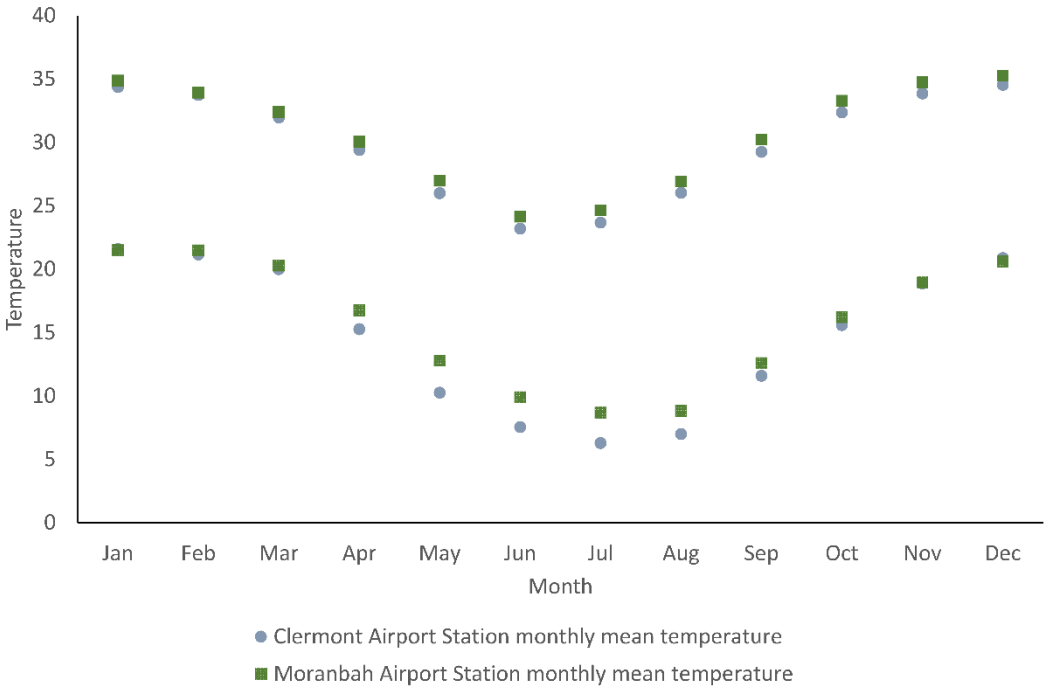

Figure 14: Mean monthly maximum and minimum temperatures in the study area and surrounds

3.1.3 Geological setting

The Project is located in the western limb of Queensland's Bowen Basin, a north-south trending retro-arc basin that extends more than 250 km north to south and up to 200 km west to east. The Project lies at the eastern end of the Collinsville Shelf, which is characterised by a thin accumulation of sediments, gently dipping easterly, with minor structural deformations. The eastern boundary of the Collinsville Shelf occurs at the Isaac Fault, a major thrust fault which has throws of 150–400 m in the Project area.

Geological maps showing the surface geology and solid geology within the Project area are provided at Figure 15 and Figure 16 respectively. The solid geology map has been prepared by removing the Cainozoic (Quaternary and Tertiary) cover sediments (Figure 15), to reveal the faulted relationship between the underlying Permian and Triassic rocks of the Project area (Figure 16). Figure 16 is based on the Bowen Basin solid geology of Sliwa *et al.* (2008) but has been modified based on work undertaken by the Project geologists (Minserve 2017) based on geological drilling and interpretation within the Project area.

Figure 16 also shows the location of a number of local scale faults, that have been mapped from seismic and drilling data collected for the Project. Both normal and reverse faults have been identified by 3D seismic surveys, consistent with neighbouring mining areas in the Rangal Coal Measures. A higher number of reverse style structures occur closer to the Isaac Fault. These faults can be significant in terms of the deposit geology where the throws of the faults are in the order of 10–15 m (having the potential to completely offset the coal seams). As the coal seams tend to be the conduits for groundwater flow in the Permian sediments, these faults also have the potential to disrupt groundwater flow.

The regional stratigraphy of the Bowen Basin contains a number of lateral equivalents which are referred to by different names in the northern and southern areas of the Bowen Basin (JBT 2022). The stratigraphic relationship is summarised in Table 5.

Table 5: Bowen Basin regional stratigraphy

Age	**Group**	**Formation**	
		Southern Bowen Basin	**Northern Bowen Basin**
Quaternary		Alluvium	Alluvium
Tertiary		Alluvium	Alluvium
		Main Range Basalt	Main Range Basalt
		Duaringa Formation	Duaringa Formation
Triassic	Rewan Group	Arcadia Formation	Arcadia Formation
		Sagittarius Sandstone	Sagittarius Sandstone
Late Permian	Blackwater Group	Rangal Coal Measures	Rangal Coal Measures
		Burngrove Formation	Fort Cooper Coal Measures
		Fairhill Formation	
		MacMillan Formation	Moranbah Coal Measures
		German Creek Formation	
Middle Permian	Back Creek Group	Ingelara Formation	Blenheim Formation

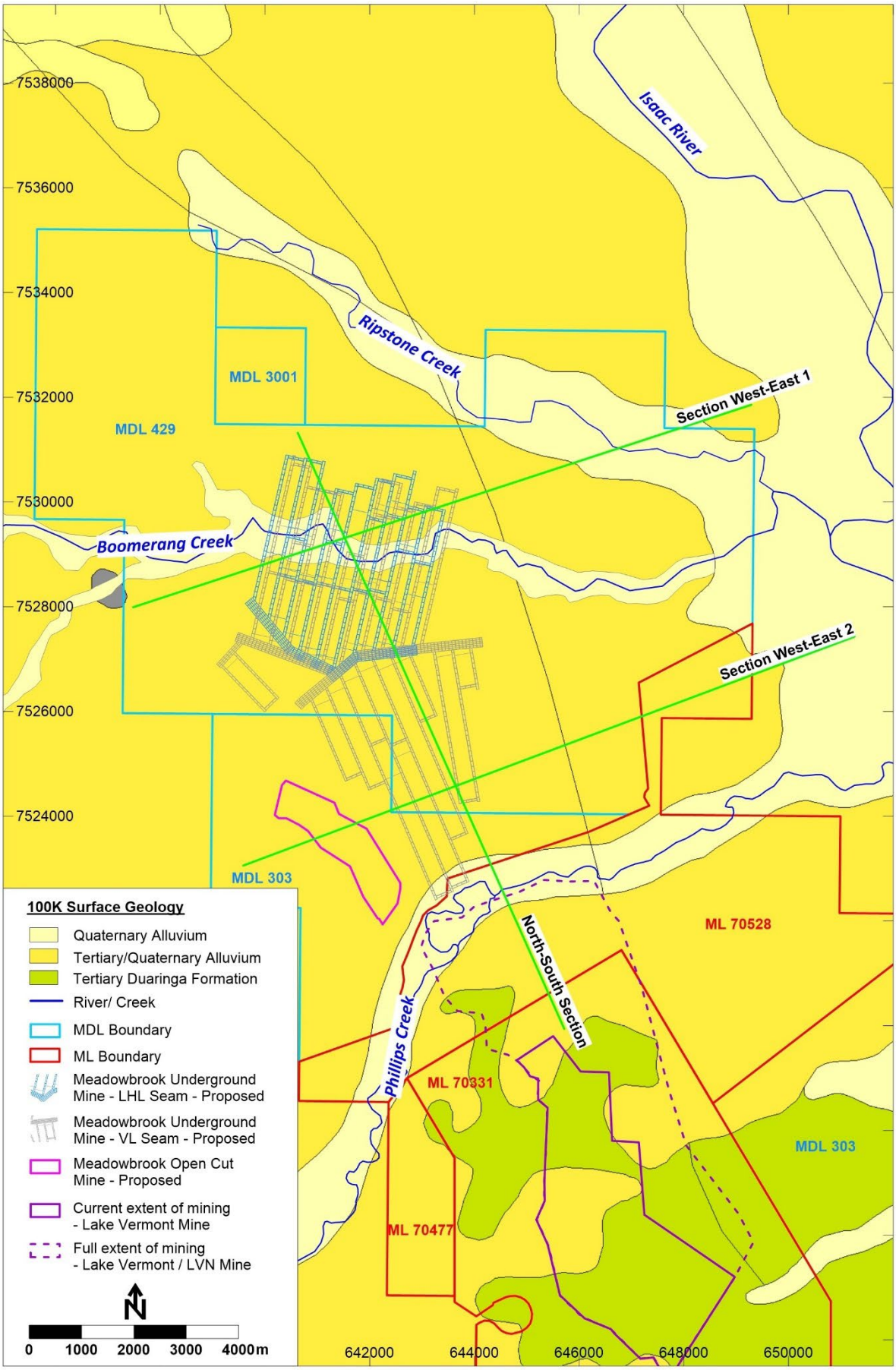

Figure 15: Surface geology of the Project area

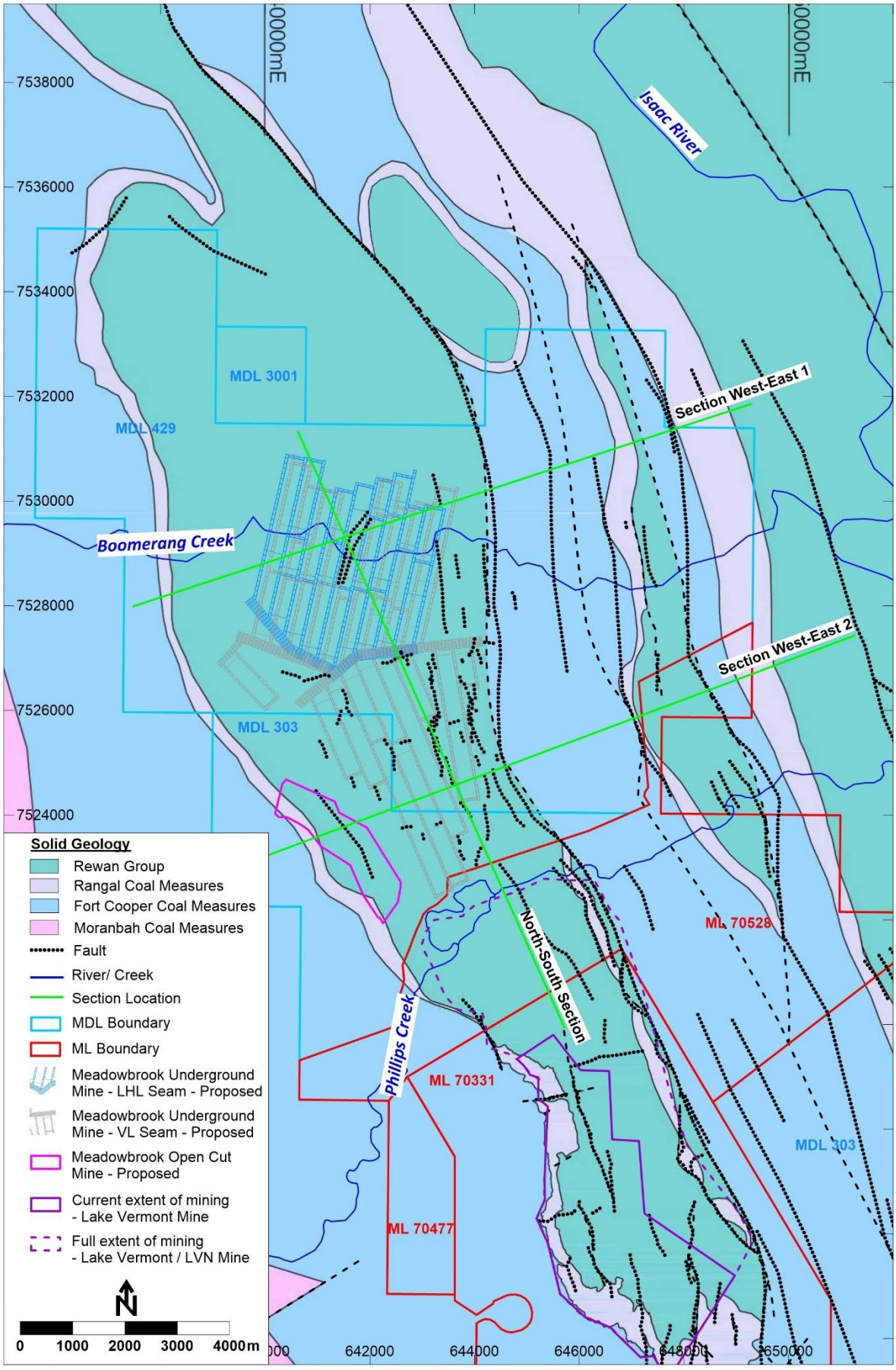

Figure 16: Solid geology of the Project area

The indicative stratigraphy of the Project area is demonstrated in the conceptual geological cross-section shown on Figure 17.

Within the Project area, a veneer of unconsolidated Tertiary and Quaternary sediments overlay the Permian and Triassic-age sediments. The Rangal Coal Measures are the coal-bearing sediments that contain the target coal seams for the Meadowbrook Project, the Leichhardt Lower and Vermont Lower seams.

3.1.4 Topography and surface hydrology

Ground elevations to the west of the Project are marginally higher in elevation (approximately 10 mAHD), with the Project generally draining west to east towards the Isaac River. The ground between Phillips Creek and Boomerang Creek, consists of a broad, flat floodplain that slopes gently to the east from approximately 180 mAHD in the west to around 170 mAHD in the east.

Significant landforms within the greater region with higher elevations include Coxens Peak (415 mAHD) located approximately 14 km to the north-east, Walkers Peak (438 mAHD) located approximately 15 km to the south-west and Campbell Peak (430 mAHD) approximately 26 km to the south-west. Harrow Range occurs approximately 17 km to the west.

The Project site is located within the Isaac Connors sub-catchment, an area encompassing 22,325 km^2 within the greater Fitzroy Basin catchment (Figure 18). The Isaac River is the main watercourse proximate to the Project and flows in a north-west to south-east direction to the east of the Project boundary (Figure 18).

The Project is traversed by watercourses that flow in an easterly direction to the Isaac River (Figure 19). Hughes Creek (a fourth order stream), Boomerang Creek (a fifth order stream) and One Mile Creek (a third order stream), flow into the Project area from the west and south-west through the neighbouring BMA leases (Saraji Mine, Saraji East Project). The confluence of Hughes Creek with Boomerang Creek occurs in the west of the Project area, with One Mile Creek flowing into Boomerang Creek in the east of the Project area. These streams are defined as watercourses under the Water Act. These watercourses all drain into the Isaac River and east to the Coral Sea via the Mackenzie River and Fitzroy River.

Ripstone Creek, a third order stream, is located to the north of the Project and flows eastward before flowing into Boomerang Creek to the east of the Project area, and then into the Isaac River (Figure 19). The Olive Downs Coking Coal Project has approval to divert Ripstone Creek near the northern boundary of the Project MLA. The Surface Water Assessment for the Olive Downs Coking Coal Project concluded that the Ripstone Creek diversion would not significantly change the hydraulic behaviour of this watercourse (Hatch 2018b).

Phillips Creek (a fourth order stream) traverses the proposed infrastructure corridor and meanders to the south of the Project underground mining area to the Isaac River (Figure 19). The Saraji Mine has an existing diversion/levee on Phillips Creek, and a diversion of Phillips Creek has been approved at the Lake Vermont Mine. The Lake Vermont Mine diversion has not yet been constructed.

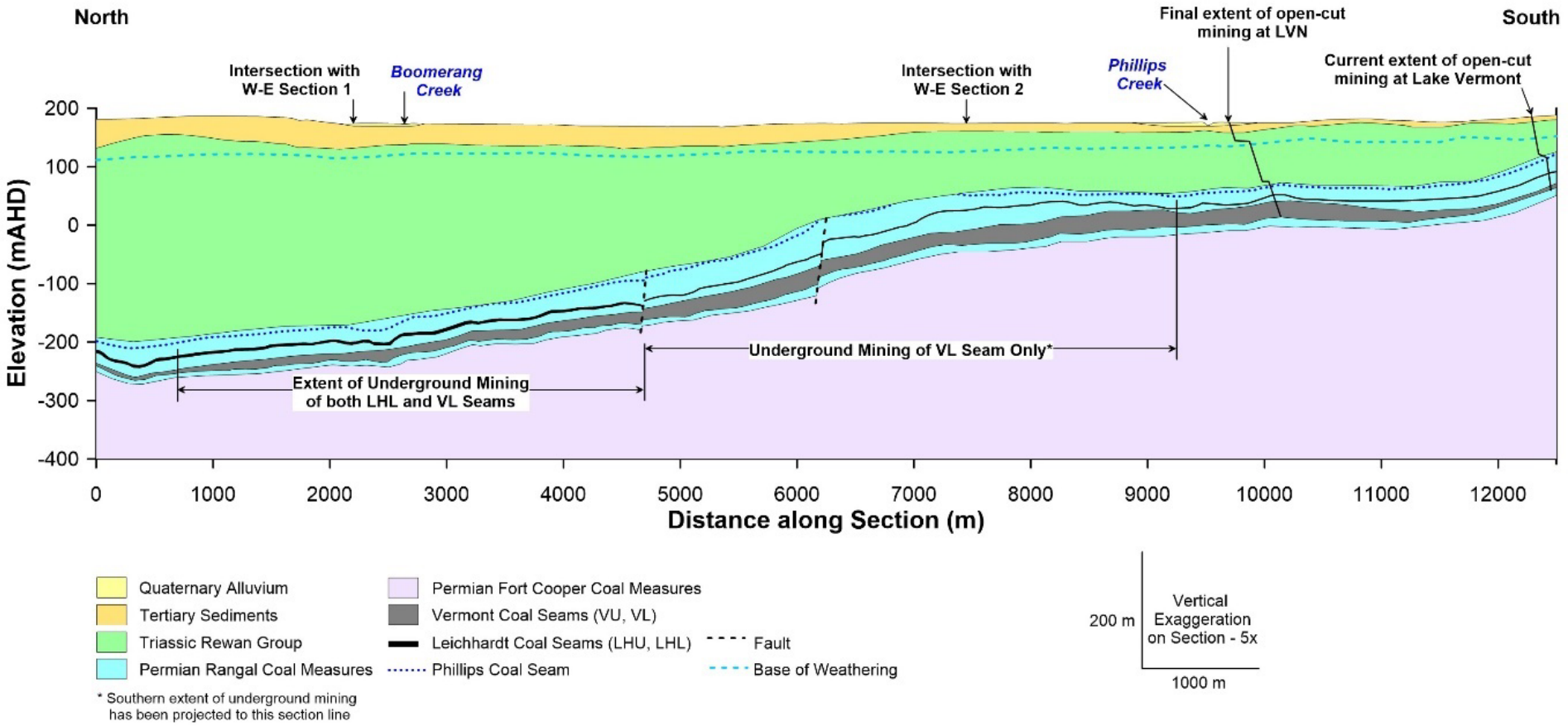

Figure 17: Indicative cross-section of Project geology

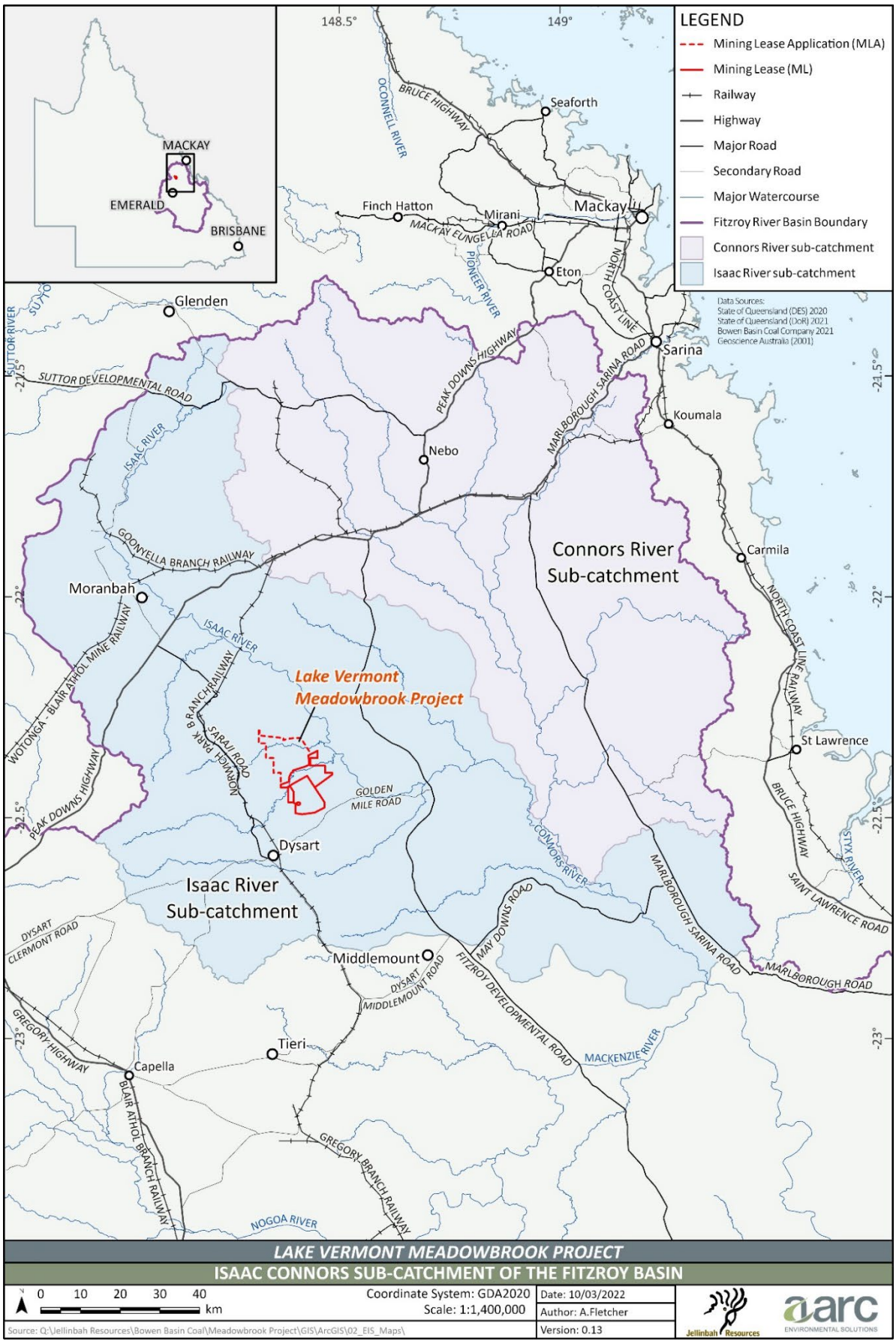

Figure 18: Isaac Connors sub-catchment of the Fitzroy Basin

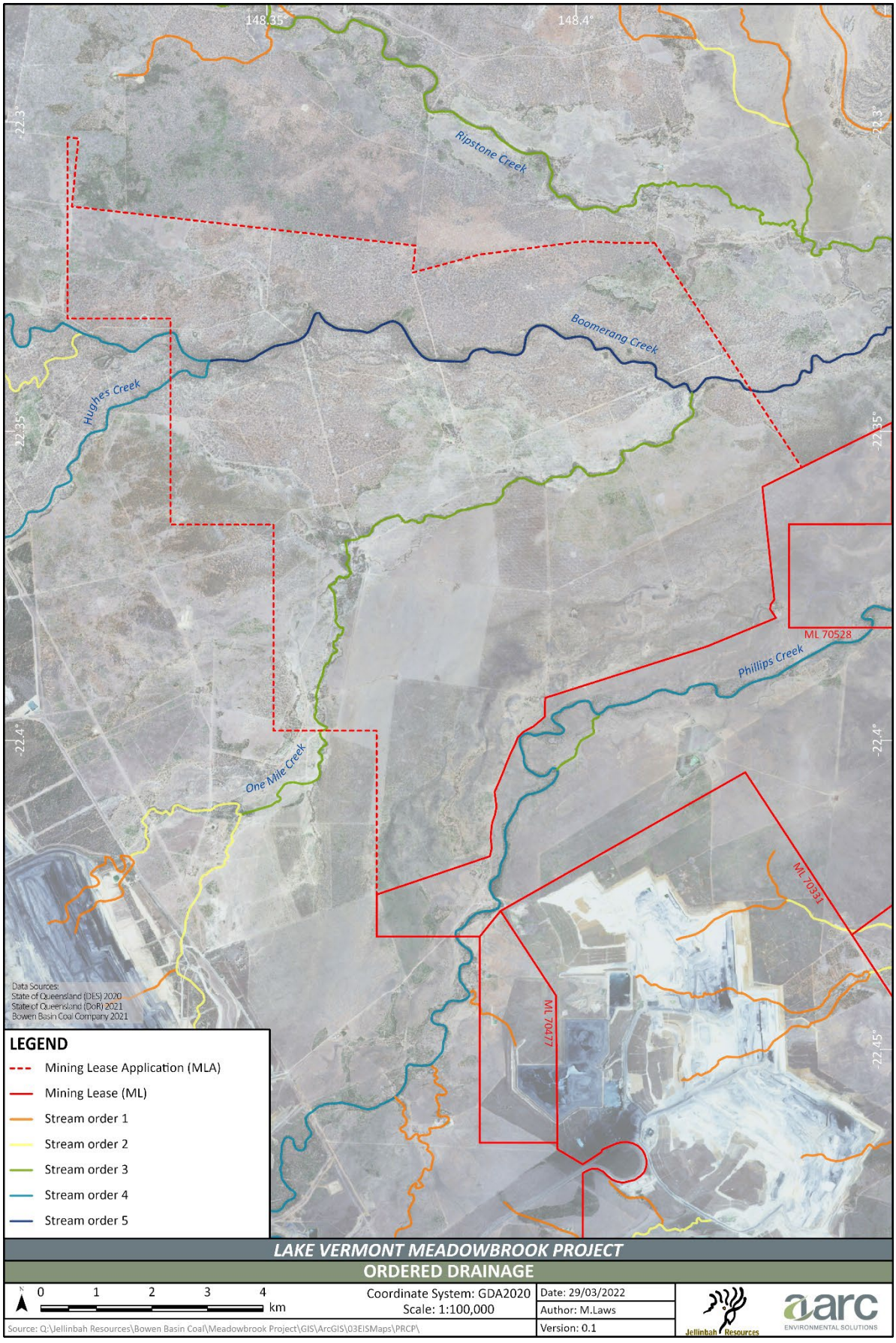

Figure 19: Local watercourses by Strahler stream order

3.1.5 Groundwater

3.1.5.1 Hydrogeological domains

The groundwater system in the region of the Project is compartmentalised by faulting and the dip in the strata; into the following discrete hydrogeological domains:

- Quaternary alluvium;
- Tertiary sediments;
- Triassic Rewan Group;
- Permian overburden;
- Permian coal seam; and
- Permian sediments.

These domains are described in the Groundwater Impact Assessment Report (JBT 2022) and summarised in the following sections. The geological sections discussed are presented in Figure 20 and Figure 21.

Cainozoic (Quaternary and Tertiary) sediments

The thickness of Cainozoic sediments, which occur across the entire Project area, is highly variable, ranging from 2–80 m and averaging 26 m (Minserve 2017). The Cainozoic sediments mainly comprise alluvial sands, clayey sands and clay, with a basal layer in some locations of sand and gravel related to prior channels of the various creeks (Minserve 2017). Tertiary sediments are generally sandier (and therefore have higher hydraulic conductivity), in the north of the Project site and in the vicinity of Boomerang Creek than the area to the south of the Project site and adjacent to Phillips Creek.

Based on interpretation of available data, it is concluded that:

- The thickness of the Boomerang Creek alluvium may be up to 14 m, but at some locations the sand can be up to 26 m thick from the surface and it is not possible to determine the interface between Quaternary and Tertiary sand.
- The regional water table is generally developed in the Tertiary sediments below the base of alluvium, and the alluvium is likely to be seasonally saturated following direct rainfall recharge and especially following flow events in the Boomerang Creek that will provide more direct charge of the alluvium.

Triassic Rewan Group

The Rewan Group comprises greyish-green sandstone, siltstone and mudstone. The unit is up to 300 m thick and underlies the Cainozoic sediments over much of the Project site. The Rewan Group is a regional aquitard and acts as a confining layer for the underlying coal measures (Commonwealth of Australia 2014).

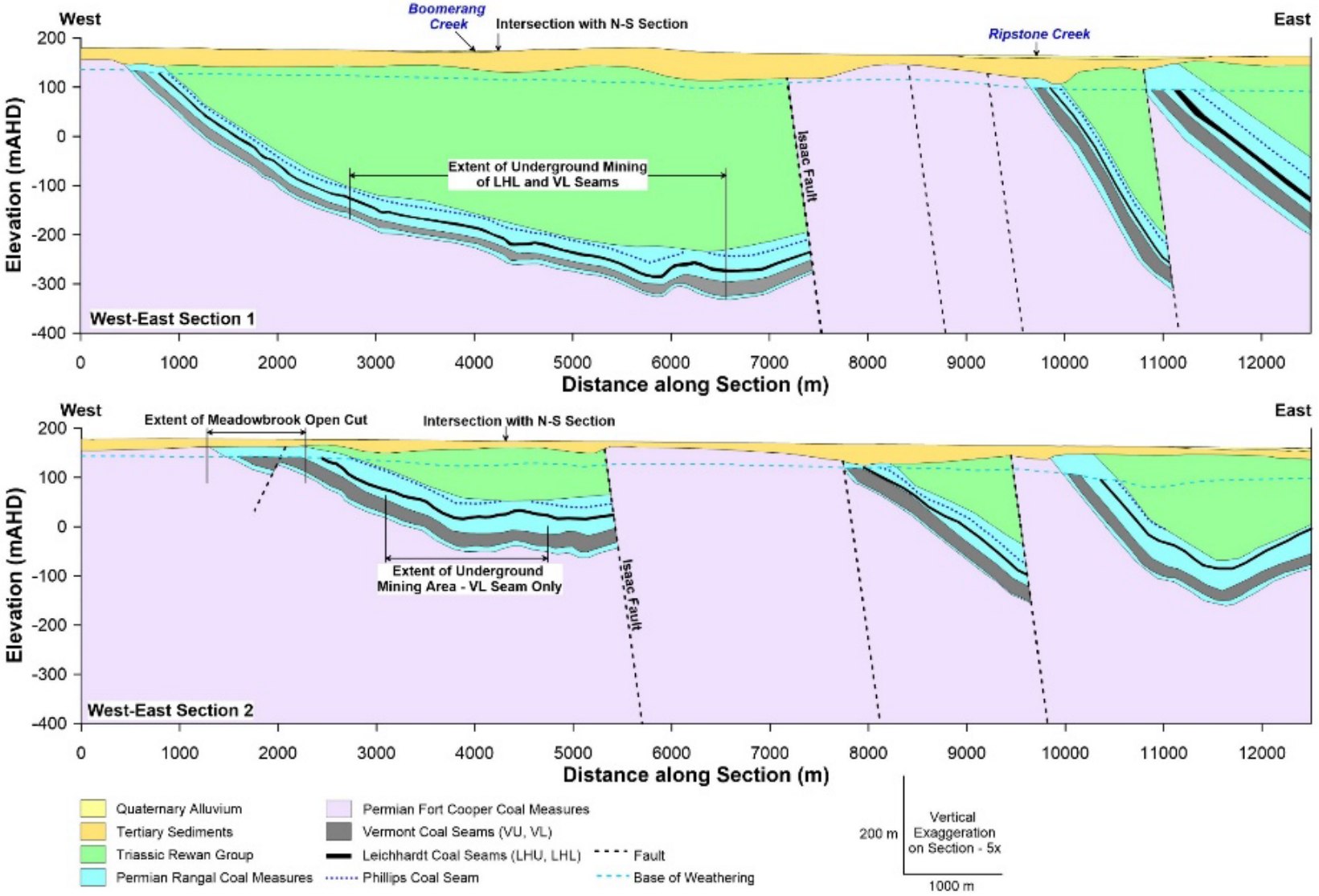

Figure 20: West-east geological sections (source: JBT 2022)

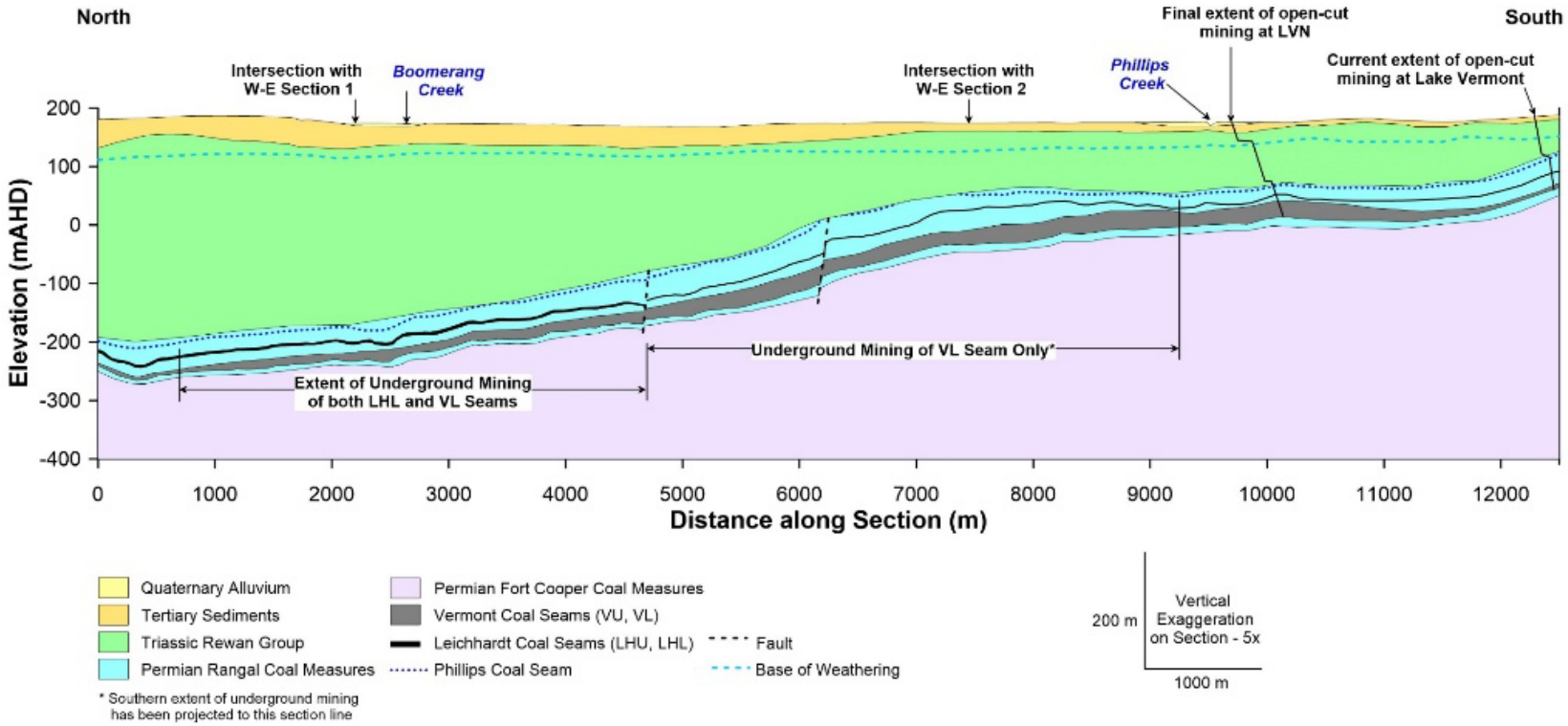

Figure 21: North-south geological section (source: JBT 2022)

Rangal Coal Measures

The Late Permian Rangal Coal Measures are coal-bearing sediments that contain the target coal seams for the Meadowbrook Project, namely the Leichhardt Lower and Vermont Lower seams. The dip of the coal seams is relatively steep, but flattens out to the west, as shown in Figure 20. In descending stratigraphic order, the coal seams comprise:

- The Phillips Seam, which generally comprises <1 m thickness of inferior coal;
- Leichhardt / Leichhardt Lower Seam, the secondary commercial seam mined in the Project area. The Leichhardt Seam thins and deteriorates north of Phillips Creek, with the Leichhardt Lower Seam appearing within MDL 426 as two thin, clean coal seams that coalesce to the north to form one seam of 2.5 to 4.5 m thickness;
- Vermont / Lower Vermont Seam, the principal commercial seam mined in the Project area. The Vermont Seam comprises two relatively minor upper plies which have split away from the two plies of the Vermont Lower Seam. The combined thickness of the two Vermont Lower Seam plie within MDL 303 and MDL 429 is in the order of 3.0 to 4.5 m.

Recharge of the Rangal Coal seams occurs where they subcrop beneath Cainozoic sediments, with enhanced recharge occurring beneath Ripstone Creek where seams subcrop beneath alluvium. Groundwater movement within the coal seams is generally down-dip away from the subcrop recharge areas. The Rangal Coal Measures truncate against the Isaac Fault, which forms an eastern limit to underground mining.

Fort Cooper Coal Measures

The Fort Cooper Coal Measures stratigraphically underlie the Rangal Coal Measures, but subcrop beneath Tertiary sediments within the Project area due to either the dip of the strata or due to faulting.

3.1.5.2 Groundwater recharge and discharge

Based on the conceptual groundwater model (JBT 2022), the study area is overlain by Tertiary sediments with overlying Quaternary alluvium deposits in the vicinity of Boomerang Creek and Ripstone Creek (refer Figure 22). Groundwater recharge to the Quaternary alluvium is predominantly via rainfall and downward seepage from ephemeral creeks during stream flow events. The occurrence of groundwater within the alluvium is seasonal, with the occurrence of downward seepage to underlying Tertiary sediments resulting in the Quaternary alluvium being dry for the majority of the year. Groundwater within Tertiary sediments occurs where the base is low, resulting in a lack of lateral connection and high residence times for water.

Recharge to coal seams occurs where seams subcrop beneath Tertiary sediments, with enhanced recharge occurring beneath Ripstone Creek where seams subcrop beneath alluvium. Groundwater movement within the coal seams is generally down-dip away from the subcrop recharge areas, but flow is terminated against faults where the seams are completely truncated. In these cases, the groundwater movement is expected to be towards areas of lower pressure, which may involve upward movement to shallower groundwater systems where lateral movement can occur, generally in the direction of topography. Groundwater quality degrades along the flow line with increased residence time.

Groundwater occurrence within the Rewan Group and Permian sediments is compartmentalised by faulting, with major faults (such as the Isaac Fault) completely truncating the sediments of the Rewan Group and Rangal Coal Measures so that the underlying Fort Cooper Coal Measures subcrop beneath Tertiary sediments to the east of the Isaac Fault.

Groundwater generally flows from west to east towards the Isaac River, following the local topography, therefore discharge to major surface water systems such as the Isaac River is expected to occur.

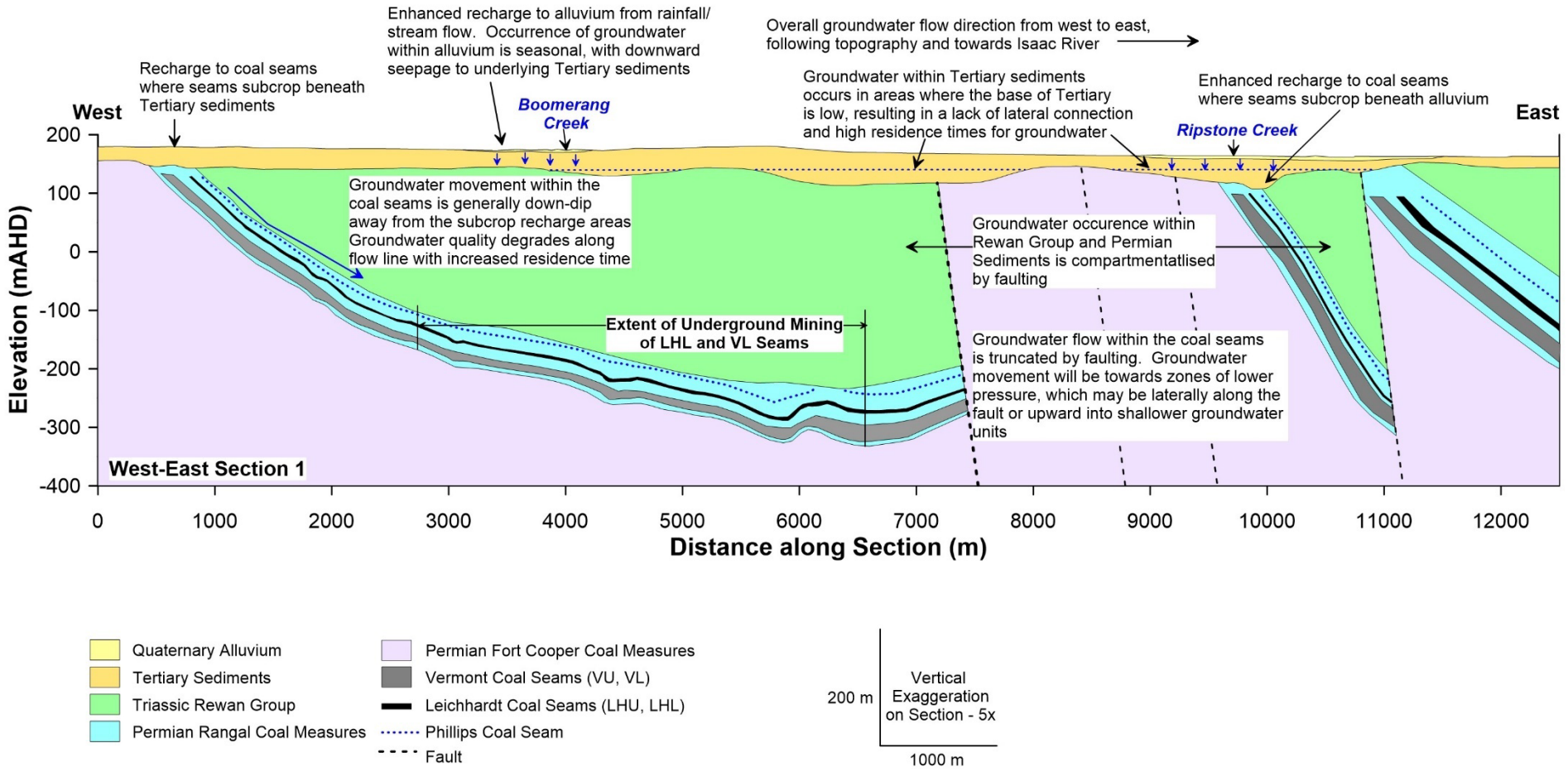

Figure 22: Pre-mining groundwater conceptual model

3.1.5.3 Groundwater levels

Groundwater level data was collected from monitoring bores within the Project area and in the adjacent Lake Vermont North site immediately to the south (JBT 2022). The bore network (refer Figure 23) provides:

- spatial coverage across the groundwater domains present in the Meadowbrook/ Lake Vermont North area;
- coverage of all groundwater units present at site; and
- vertical coverage of different groundwater units at each location, to establish variability in groundwater quality and water level that can be used to provide information on groundwater recharge and the vertical direction of groundwater flow.

The groundwater level trend over the period for which data is available is relatively flat and there is no evidence to date of water level variation that could be attributed to either groundwater extraction (from bores), groundwater flow to the Lake Vermont open pit, or groundwater recharge. An exception is site W11, where the water level in bore W11-MB1 recorded a significant decrease, followed by a slow recovery towards the initial groundwater level, which was concluded to be likely due to extremely low hydraulic conductivity for this site. Groundwater levels for each hydrogeological domain are summarised in Table 6

Table 6: Groundwater levels

Hydrogeological domain	Approximate groundwater level (mAHD)
Quaternary alluvium	170
Tertiary sediments	146–168
Rewan Group	160
Permian overburden	162
Leichhardt Lower Seam	144–160
Vermont Upper and Lower Seams	140–168

3.1.5.4 Groundwater quality

Groundwater quality across the majority of the site is generally poor, with the majority of groundwater monitoring bores recording electrical conductivity (EC) >10,000 µS/cm and in many cases >20,000 µS/cm, making groundwater unsuitable as livestock drinking water. According to Livestock drinking water guidelines (ANZG 2018), beef cattle are expected to tolerate and adapt to EC levels ≤7,463 µS/cm (medium-risk), while EC levels ≥ 7,463 µS/cm (high risk) are considered unsuitable as livestock drinking water long-term due to impacts on animal health and production.

The majority of bores recorded are representative of a sodium-chloride (Na-Cl) water type while a number of bores are characterised as a sodium-bicarbonate water type, or a mixed water type (sodium-bicarbonate-chloride). As recharge water moves further along a flow line, and with increasing residence time, the salinity of groundwater increases significantly due to water-rock interactions and transitions to a sodium-chloride (Na-Cl) water type. Consequently, groundwater in the Permian unit typically records higher EC values than overlying units. However, at a number of sites the EC recorded for Tertiary, Permian Coal Measure and Rewan bores is distinctly lower, with these sites interpreted to be influenced by recharge from Phillips Creek.

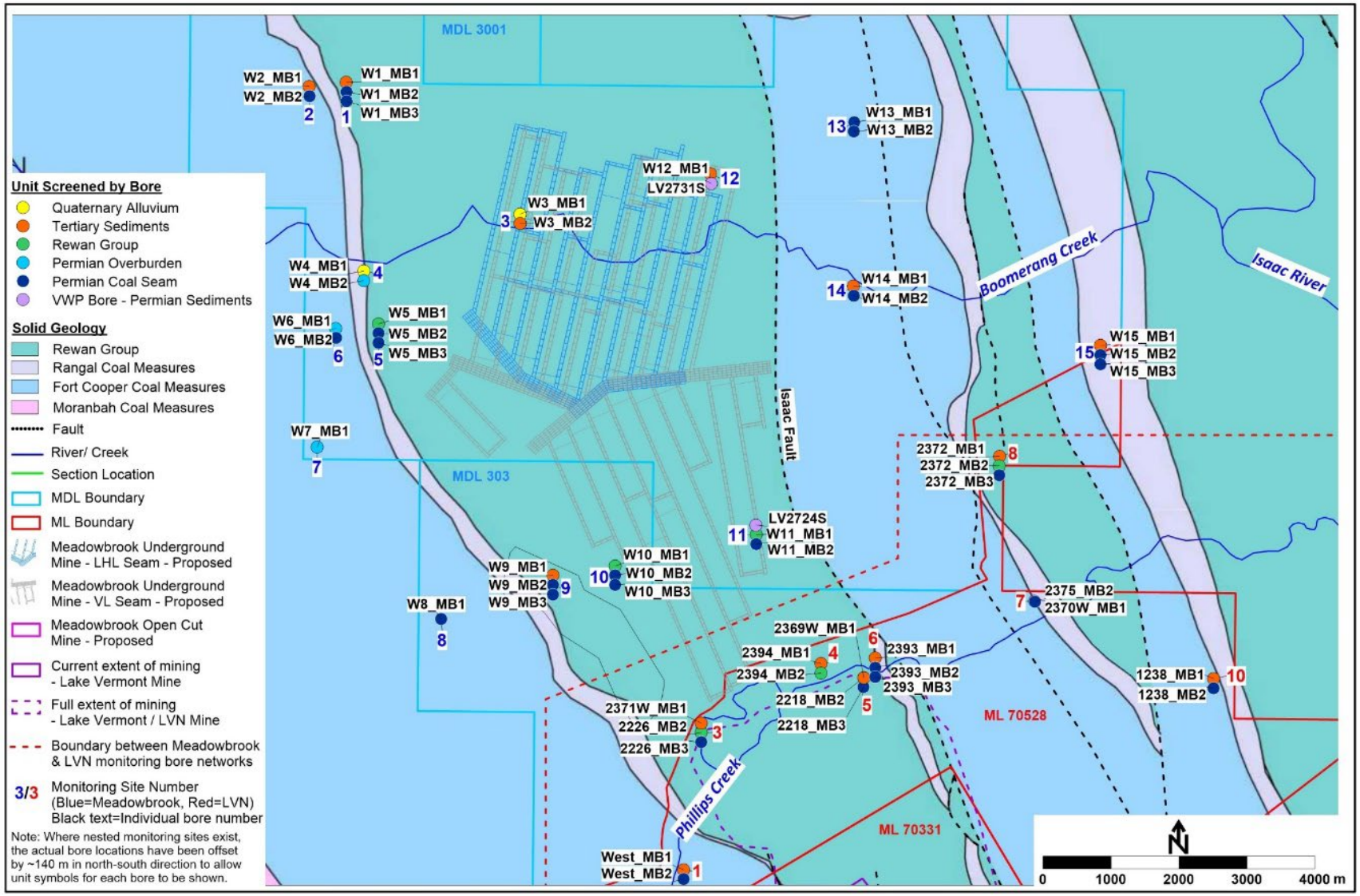

Figure 23: Locations of groundwater monitoring bores (JBT 2022)

Groundwater quality characteristics for each hydrogeological unit are summarised below:

- Groundwater in the Tertiary unit is saline with a median EC value of 20,716 µS/cm and a neutral to slightly acidic median pH of 6.59.
- Groundwater in the Rewan unit is saline with a median EC value of 23,667 µS/cm and a neutral median pH value of 6.78.
- Groundwater in the Permian unit is considerably saline with a median EC value of 29,837 µS/cm and a neutral to slightly acidic median pH value of 6.60.

Occurrences of lower EC groundwater (i.e. <4,000 µS/cm) are associated with groundwater recharge along features such as Phillips Creek and Boomerang Creek. The water type at the lower EC sites tends to be sodium-bicarbonate water type, rather than the sodium-chloride water type that is observed in higher EC bores.

Groundwater quality is discussed in more detail in the *Meadowbrook Groundwater Impact Assessment* (JBT 2022).

3.1.5.5 Regional groundwater use

Groundwater use in the region primarily consists of livestock watering and domestic use. Groundwater units that are utilised by landowner bores include the Isaac River alluvium, and Tertiary and Permian sediments. The Department of Resources Groundwater Database (version current to October 2021) indicates that the majority of bores within the Isaac River alluvium have water quality described as 'good'. Bores within the Permian sediments have EC values ranging from 4,000 to approximately 7,000 µS/cm, making the bores of marginal value as a source of livestock drinking water.

3.1.6 Land and soil

3.1.6.1 Underlying landholders

The Project disturbance area is located on two freehold properties (Figure 24):

- Lot 102, SP310393 owned by Bowen Basin Coal; and
- Lot 1, SP190747 owned by Marubeni Coal, Jellinbah Group, Coranar (Australia) and CHR Vermont, a related entity to the proponent.

No stock routes, State Forests, National Parks or conservation tenure are located within or on land adjacent to the Project.

3.1.6.2 Current land use

The current land use of the Project area is rural with low intensity cattle grazing and resource exploration activities. The Project area adjoins several existing coal mining operations. Lake Vermont Mine is located to the south of the Project area. Saraji Mine and Saraji East project areas are located to the west. Olive Downs Coking Coal Project is located to the north.

Dominant land uses in the surrounding region are grazing of native vegetation, improved pasture grazing, mining and cropping. The built infrastructure in the local area includes stock fencing, unsealed access tracks, stock watering dams, roads, power transmission lines, pipelines and coal mining operation infrastructure.

Within the planned extension area, there are no protected areas (nature refuges, national parks), state-controlled roads or rails, and no land that is reserved for stock routes, easements or quarries.

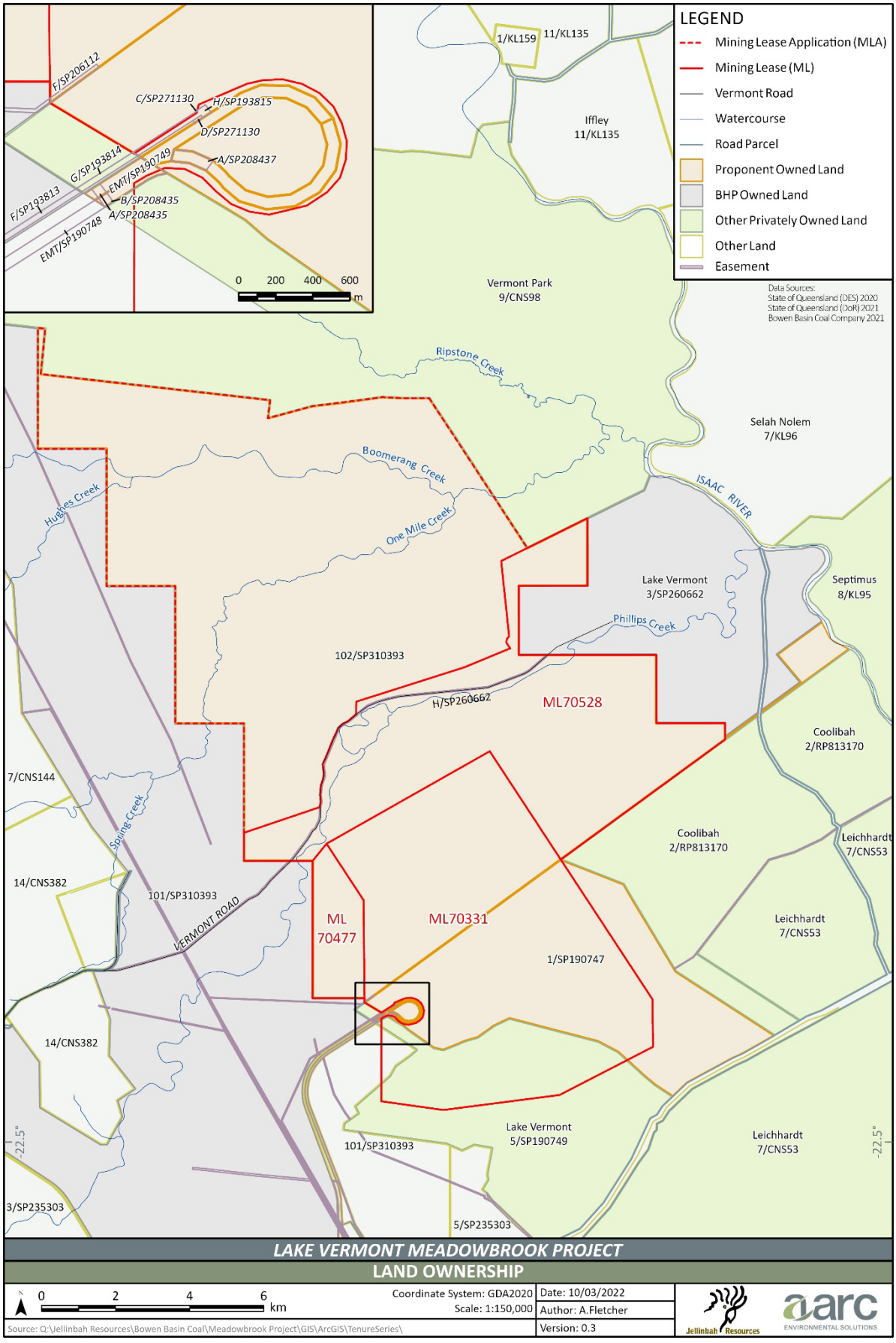

Figure 24: Land ownership

3.1.6.3 Land systems

The land systems of the Project area are described by reference to the report *Lands of the Isaac-Comet Area* (Story *et al.* 1967).

The Project area is characterised as lowlands and plains extending to areas of low rises. The lowlands and plains land systems comprise the following:

- Blackwater Land System; characterised by lowlands and plains with undulating terrain that has a local relief between 3–8 m with developed cracking clays with occasional gilgai on weathered Tertiary-aged clay and Pre-Tertiary rock;
- Connors Land System; characterised by alluvial plains composed of terraces and levees up to 3 km wide with thick sandy topsoil and neutral to strongly alkaline subsoil; and
- Humboldt Land System; characterised by plains and lowlands with slopes of less than 2% gradient with thin sandy surface soils and to a lesser extent cracking clays.

The areas of low rises are comprised of the following land systems:

- Monteagle Land System; characterised by low-lying plains and colluvial foot slopes with local relief generally below 6 m with thick sandy topsoil and neutral to strongly alkaline subsoils; and
- Somerby Land System; characterised by plains and very gently undulating hills with gilgaied deep cracking clays with alkaline surface horizons becoming acidic at depth to texture-contrast soils with strongly alkaline subsoils.

3.1.6.4 Strategic cropping land

SCL is defined in the RPI Act as land that is highly suitable for cropping, or likely to be suitable for cropping, based on a particular combination of soil, climate and landscape features. Impacts on these areas are regulated under the RPI Act.

A 6 ha portion in the south-eastern corner of ML70477, proposed to be disturbed for the infrastructure corridor, is designated as potential SCL according to the Queensland Government SCL trigger map. This area was assessed in the 2012 SLSA (NQSA 2012) as meeting the SCL criteria against the RPI Act Statutory Guideline 'How to demonstrate that land in the strategic cropping area does not meet the criteria for strategic cropping land' (DILGP 2017). While this assessment determined that 3 ha of the mapped area was non-SCL on the basis of the slope criterion, no application or decision has been made validating this assessment. The 2012 assessment further determined that the remaining 3 ha, while meeting the SCL criteria, failed soil map unit aggregation rules due to its small size and inability to amalgamate into a larger 100 ha SCL area, as permitted by the original 2011 'Guidelines for applying the proposed strategic cropping land criteria' (DERM 2011) and was, therefore, regarded as non-SCL.

The 2012 assessment has been reviewed to verify the findings and assess the area against the current statutory guidelines. Recent LIDAR data confirms that the 3 ha portion identified as not meeting the slope criterion in the 2012 assessment, has a slope greater than 3%. The decision on *RPI21/001 BMA – Saraji East* on 18 October 2021 resulted in an amendment to the SCL trigger map to remove an area of mapped SCL immediately adjacent to ML70477. This decision and the subsequent amendment to the SCL trigger map isolated the area of SCL on ML70477 from the nearest mapped SCL resulting in an isolated 3 ha portion of trigger mapped SCL.

The Proponent is submitting a Regional Interests Development Approval application to amend the SCL trigger map to accurately reflect areas of verified SCL and to remove areas that do not meet the criteria for SCL.

3.1.6.5 Soil types, properties and productivity

A Soil and Land Suitability Assessment for the Project disturbance area (AARC 2021) was conducted for the Project EIS. Soil mapping units were developed and characterised based on contiguous soils around which boundaries are drawn. These soil mapping units are composed of a dominant soil according to an Australian

Soil Classification class. The survey comprised 41 new soil profile observations and 47 new soil mapping observations across the Project site. Additionally, the survey drew on the findings of the 2012 SLSA for ML 70331 (NQSA 2012) and the 2013 Soil Characterisation and Land Suitability Assessment of ML 70528 (Australasian Resource Consultants 2013). Soils were classified according to nomenclature of the 1:100,000 soils mapping from the Windeyers Hill area (Burgess 2003).

Eight soil management units (SMUs) were identified within the study area. The spatial distribution of these soils is shown in Figure 25 and a summary of the landform characteristics, soil properties and land suitability are provided in Table 7.

The assessment of land suitability for cattle grazing and rainfed broadacre cropping was conducted in accordance with the methodologies described in Technical Guidelines for the *Environmental Management of Exploration and Mining in Queensland—Land suitability Assessment Techniques* (QDME 1995). The five land suitability classes used for assessing land are described in Table 8. The Knockane and Norwich SMUs were identified as suitable for rainfed broadacre cropping and were subsequently assessed according to the *Regional Land Suitability Frameworks for Queensland* (DSITIA and DNRM 2013). The findings of the land suitability assessment are presented in Table 7.

The Knockane SMU was assessed to be marginally suitable for cropping (Class 4), and the Norwich SMU was assessed to be unsuitable (Class 5) due to land and soil limitations. This assessment determined that the SMUs identified as suitable for cropping under the QDME (1995) guideline are not suitable according to the region specific framework guideline (DSITIA and DNRM 2013). Consequently, there is no suitable cropping land within the study area.

3.1.6.6 Land stability

Soil erodibility and the dispersion potential of soils were assessed for SMUs using key soil characteristics. The assessment of soil erodibility and dispersivity is shown in Table 9.

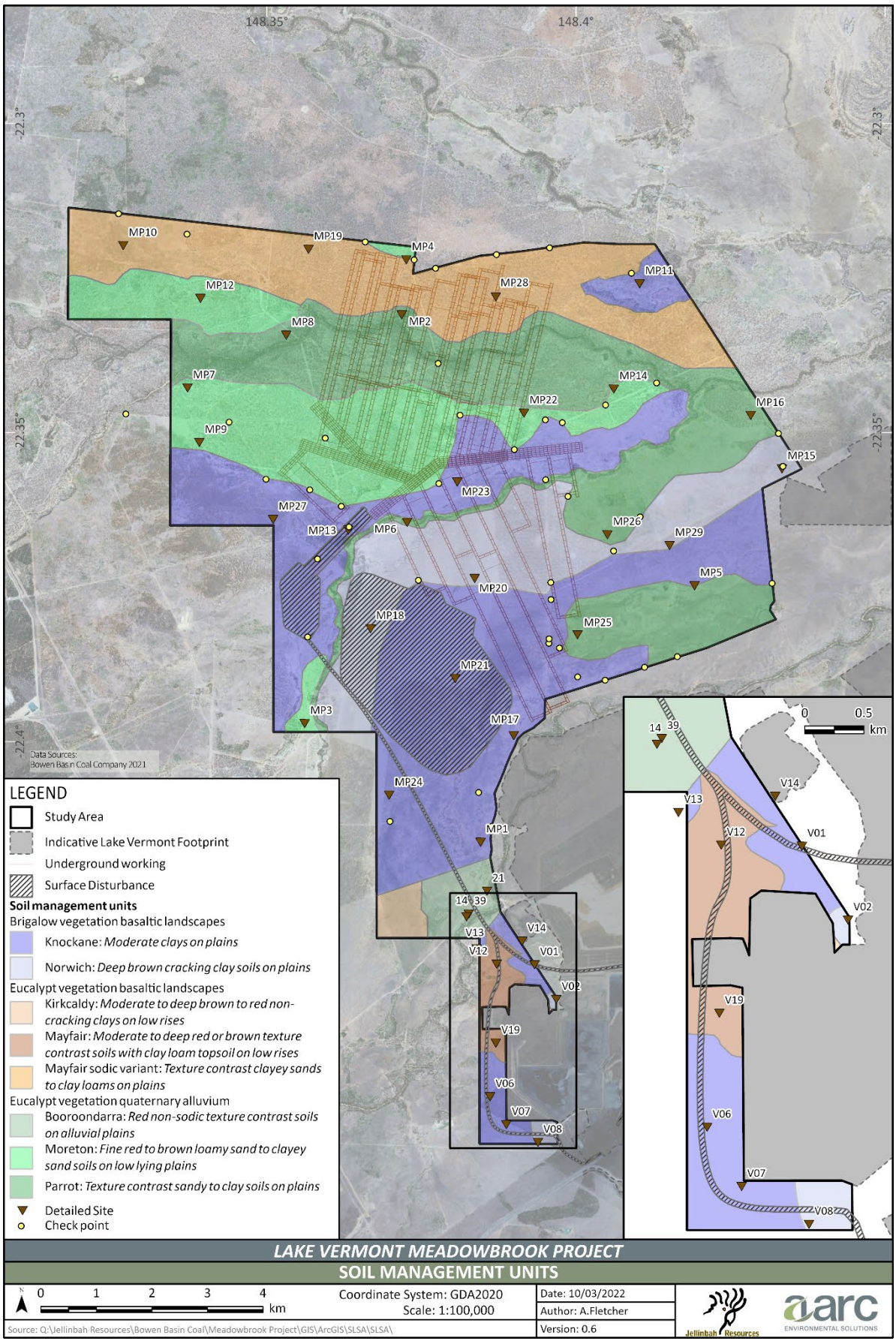

Figure 25: Distribution of soil management units

Table 7: Soil management units, landform characteristics and pre-mining land suitability

SMU	Percent of Project area	Landform	Properties	Australian soil classification	Land suitability class (grazing)	Land suitability class (cropping)
Booroondarra	2	Alluvial plains with moderate drainage	• Soil texture is sandy loam to light clay topsoil and light-medium to heavy clay subsoil with course sandy material between pore space • pH >9 • Relatively high Ca/Mg ratios, low Nitrate N and B	Red or Brown Dermosol	3	Unsuitable^
Kirkcaldy	1.0	Low rises with moderate drainage	• Soil texture is cracking clay • pH >9.0 • EC limiting below 0.5m • Relatively high levels of plant-available nutrients with the exception of Nitrate N, K and B	Hypercalcic Brown Dermosol or Epipedal Brown Vertosol	3	Unsuitable^
Knockane	33	Plains with moderate drainage	• Soil texture is light-medium to medium-heavy clays • pH 7.8-9.2 • EC 0.071-0.846 dS/m • All cations slightly below levels ideal for plant growth	Epipedal Brown Vertosol	3	4
Mayfair	1	Low rises with moderate to good drainage	• Soil texture is sandy clay loam to clay loam topsoil and light-medium to medium clay subsoil • pH 6.60-8.0 • EC 0.02-0.17 dS/m • Concentration of exchangeable cations is low in the topsoil but moderate in the subsoil	Hypercalcic Red or Brown Chromosol	4*	Unsuitable^
Mayfair Sodic Variant	14	Plains with good drainage	• Soil texture is clayey sand is the topsoil to clay loam, and sandy in deeper horizons • pH 6.0-7.2 • EC 0.006-0.169 dS/m • Exchangeable cations (Ca, Mg, K, Na) low in upper 0.3m, Mg concentration increases to high levels below 0.5m	Brown Sodosol	4*	Unsuitable^

SMU	Percent of Project area	Landform	Properties	Australian soil classification	Land suitability class (grazing)	Land suitability class (cropping)
Moreton	15	Plains with good drainage	• Soil texture is loamy- to clayey-sand • pH 6.2-7.0 • EC 0.005-0.017 dS/m • Below ideal concentrations for Ca, Mg, K and Na	Brown Kandosol	4*	Unsuitable^
Norwich	12	Plains with imperfect drainage	• Soil texture is medium to medium-heavy clays • pH 6.8-8.6 • EC00.60-1.03 dS/m • Concentration of exchangeable cations in topsoil is adequate but decreases at depth to slightly below suitable ranges for plant growth	Self-mulching Brown Vertosol	3	5
Parrot	22	Plains with moderate drainage	• Sandy topsoil, clay-rich subsoil • pH 7.6-8.5 • EC 0.013-0.101 dS/m • Ca, Mg, Na and K are well below suitable soil concentrations which may limit plant growth	Brown Chromosol	4*	Unsuitable^

Note: Green = suitable, red = unsuitable. Items displayed with an asterisk [*] are considered suitable based on current land use of low-intensity grazing. [^] assessed to be unsuitable according to QDME (1995) and therefore not assessed under regionally specific framework.

Table 8: Agricultural and conservation land class descriptions

Class	Agricultural description	Conservation description
Class 1	Suitable land with negligible limitations. This is highly productive land requiring only simple management practices to maintain economic production.	Areas well suited for conservation uses must possess significant conservation benefits in the pre-mining environment and be capable of being returned to that use post-mining
Class 2	Suitable land with minor limitations which either reduce production or require more than the simple management practices of class 1 land to maintain economic production.	Areas suited to conservation use in that a significant component of the pre-mining conservation values can be restored post-mining. There will, however, be some loss in conservation values where soil terrain or hydrological post-mining conditions may inhibit the full replication of the pre-mining values.
Class 3	Suitable land with moderate limitations which either further lower production or require more than those management practices of class 2 land to maintain economic production.	These lands contain significant conservation values pre-mining, however, restoration of all of these values may not be feasible. These areas could, however, be restored to a form of conservation use that provides alternative conservation benefits.
Class 4	Marginal land, which is presently considered unsuitable due to severe limitations. The long-term significance of these limitations on the proposed land use is unknown or not quantified. The use of this land is dependent upon undertaking additional studies to determine whether the effect of the limitation(s) can be reduced to achieve sustained economic production.	These lands contain limited conservation value pre-mining and/ or are incapable of being effectively restored post-mining to any alternative conservation use which provides similar benefits. The area could, however, be restored to provide a stable form of use which does not impact on surrounding conservation values.
Class 5	Unsuitable land with extreme limitations that preclude its use.	These lands contain no significant conservation values.

Table 9: Soil sodicity and erodibility

SMU	Percent of Project area (%)	Depth	Erodibility and dispersion potential
Booroondarra	2	Topsoil	Potentially highly dispersive and erodible
		Subsoil	Potentially highly dispersive and erodible
Kirkcaldy	1.0	Topsoil 0.1–0.3 m	Non-sodic and moderate erodibility
		Subsoil 0.3–1.5 m	Potentially dispersive
Knockane	33	Topsoil 0–0.1 m	Non-sodic and not dispersive
		Subsoil 0.1–0.3m	Dispersive
		Subsoil 0.3–0.8 m	Highly dispersive
Mayfair	1	Topsoil	Non-sodic and not dispersive
		Subsoil	Non-sodic and not dispersive
Mayfair Sodic Variant	14	Topsoil 0–0.3 m	Non-sodic and not dispersive
		Subsoil 0.3–0.8 m	Strongly sodic and dispersive
Moreton	15	Topsoil	Non-sodic and not dispersive
		Subsoil	Non-sodic and not dispersive
Norwich	12	Topsoil 0–0.1 m	Non-sodic and not dispersive
		Subsoil 0.1–0.8 m	Strongly sodic and dispersive
Parrot	22	Topsoil 0–0.3 m	Non-sodic and not dispersive
		Subsoil 0.3–0.8 m	Non-sodic and not dispersive

3.1.7 Flora and fauna

3.1.7.1 Remnant vegetation

Terrestrial flora surveys (AARC 2022a) were conducted for the Project in autumn 2019 (11–21 March), spring 2019 (6-19 November), autumn 2020 (23–25 March and 1–8 April) and autumn 2021 (16–25 April).

The field surveys were conducted in accordance with the following guidelines:

- *Methodology for surveying and mapping regional ecosystems and vegetation communities in Queensland (V5.0)* (Neldner *et al*. 2019);
- *Flora Survey Guidelines - Protected Plants (V2.01)* (DES 2020); and
- *Management of endangered plants* (Cropper 1993).

A total of 16 vegetation communities associated with remnant or high value regrowth vegetation were identified across the study area during the field surveys. The vegetation communities are summarised in Table 10 and the distribution is shown on Figure 26.

Table 10: Ground-truthed vegetation communities within the study area

Map unit	Area (ha)	Vegetation community	Associated RE	VM Act status[1]	BD status[2]	EPBC Act status
1: Brigalow Woodlands						
VC 1a	106.2	Remnant Brigalow woodland on alluvial plains.	11.3.1	Endangered	Endangered	Endangered
VC 1b	51.4	Remnant Dawson Gum woodland with Brigalow on undulating Cainozoic clay plains.	11.4.8	Endangered	Endangered	Endangered
VC 1c	19.4	Remnant Brigalow with Yellowwood woodland with occasional Dawson Gum on Cainozoic clay plains.	11.4.9	Endangered	Endangered	Endangered
VC 1d	110.3	High value regrowth Brigalow.	11.4.9	-	-	-
2: Eucalypt Woodlands						
VC 2a	960.2	Remnant Poplar Box woodland on alluvial plains.	11.3.2	Of Concern	Of Concern	Endangered
VC 2b	12.2	Remnant Coolibah woodland on alluvial plains.	11.3.3	Of Concern	Of Concern	-
VC 2c	178.0	Remnant Eucalypt and Bloodwood spp. woodland on alluvial plains.	11.3.4	Of Concern	Of Concern	
VC 2d	22.8	Remnant Poplar Gum and Clarkson's Bloodwood woodland on floodplains.	11.3.9	Least Concern	No Concern at Present	-
VC 2e	1,593.8	Remnant Poplar Box with occasional Clarkson's Bloodwood and Silver-leaved Ironbark woodland on sand plains.	11.5.3	Least Concern	No Concern at Present	-
VC 2f	126.5	Remnant Poplar Gum woodland on Cainozoic sand plains	11.5.8c	Least Concern	No Concern at Present	-
VC 2g	28.0	Remnant Narrow-leaved Red Ironbark woodland on Cainozoic sand plains	11.5.9c	Least Concern	No Concern at Present	
VC 2h	94.5	Remnant Clarkson's Bloodwood and Poplar Gum woodland, often with a dense	11.5.12	Least Concern	No Concern at Present	

Map unit	Area (ha)	Vegetation community	Associated RE	VM Act status[1]	BD status[2]	EPBC Act status
		low tree layer dominated by Paperbark Tea-tree.				
3: Riparian Woodlands						
VC 3a	135.8	Remnant River Red Gum or Blue Gum woodland fringing drainage lines.	11.3.25	Least Concern	Of Concern	-
4: Vegetation Associated with Wetlands						
VC 4a	10.6	Remnant River Red Gum, Poplar Gum and/or Blue Gum fringing lacustrine wetlands.	11.3.27b	Least Concern	Of Concern	-
VC 4b	11.1	Remnant Coolibah open woodland fringing palustrine wetlands.	11.3.27f	Least Concern	Of Concern	-
VC 4c	21.3	Palustrine swamp with fringing Blue Gum woodland in depressions on Cainozoic sand plains and remnant surfaces.	11.5.17	Endangered	Endangered	-

[1] Endangered; Of Concern; Least Concern
[2] Endangered; Of Concern; No Concern at Present

Approximately 5,557 ha in the study area is not associated with remnant or high value regrowth vegetation. These cleared areas include areas with a sparse shrubby layer of Brigalow (< 1 m), with a ground layer of introduced pasture species (predominantly Buffel Grass).

Four vegetation communities listed as Endangered and three communities listed as Of Concern under the *Vegetation Management Act 1999* (Qld) (VM Act) were identified within the study area (Table 10).

The field-validated vegetation mapping identified vegetation that could potentially represent two threatened ecological communities (TECs) listed as Endangered under the *Environmental Protection and Biodiversity Conservation Act 1999* (Commonwealth) (EPBC Act), namely the Brigalow (*Acacia harpophylla* dominant and co-dominant) TEC and the Poplar Box Grassy Woodland on Alluvial Plains TEC (Table 10). The distribution of the TECs that meet the condition thresholds and key diagnostic characteristics (TSSC 2001) within the study area is shown on Figure 27.

A total of 188 flora species were recorded during the field surveys representing 58 families and 133 genera. The dominant family group was Poaceae (38 species) with Fabaceae (9 species), Myrtaceae (15 species) and Malvaceae (12 species) also prominent.

No Endangered, Vulnerable, or Near Threatened Flora species listed under the *Nature Conservation Act 1992* (Qld) (NC Act) or the EPBC Act were identified within the study area.

A total of 35 introduced species were identified. Of these, seven are listed as restricted matters under the *Biosecurity Act 2014* (Qld) (Harrisia Cactus [*Harrisia martinii*], Balloon Vine [*Cardiospermum grandiflorum*], Parthenium [*Parthenium hysterophorus*], Lantana [*Lantana camara*], Rubber Vine [*Cryptostegia grandiflora*], Common Prickly Pear [*Opuntia stricta*] and Velvety Tree Pear [*Opuntia tomentosa*]). No species listed as prohibited matters were identified within the study area. Four species identified within the study area are classed as Weeds of National Significance (WoNS) (Parthenium, Lantana, Rubber Vine and Velvety Tree Pear). The species identified as restricted matters or as WoNS within the study area are known to occur commonly

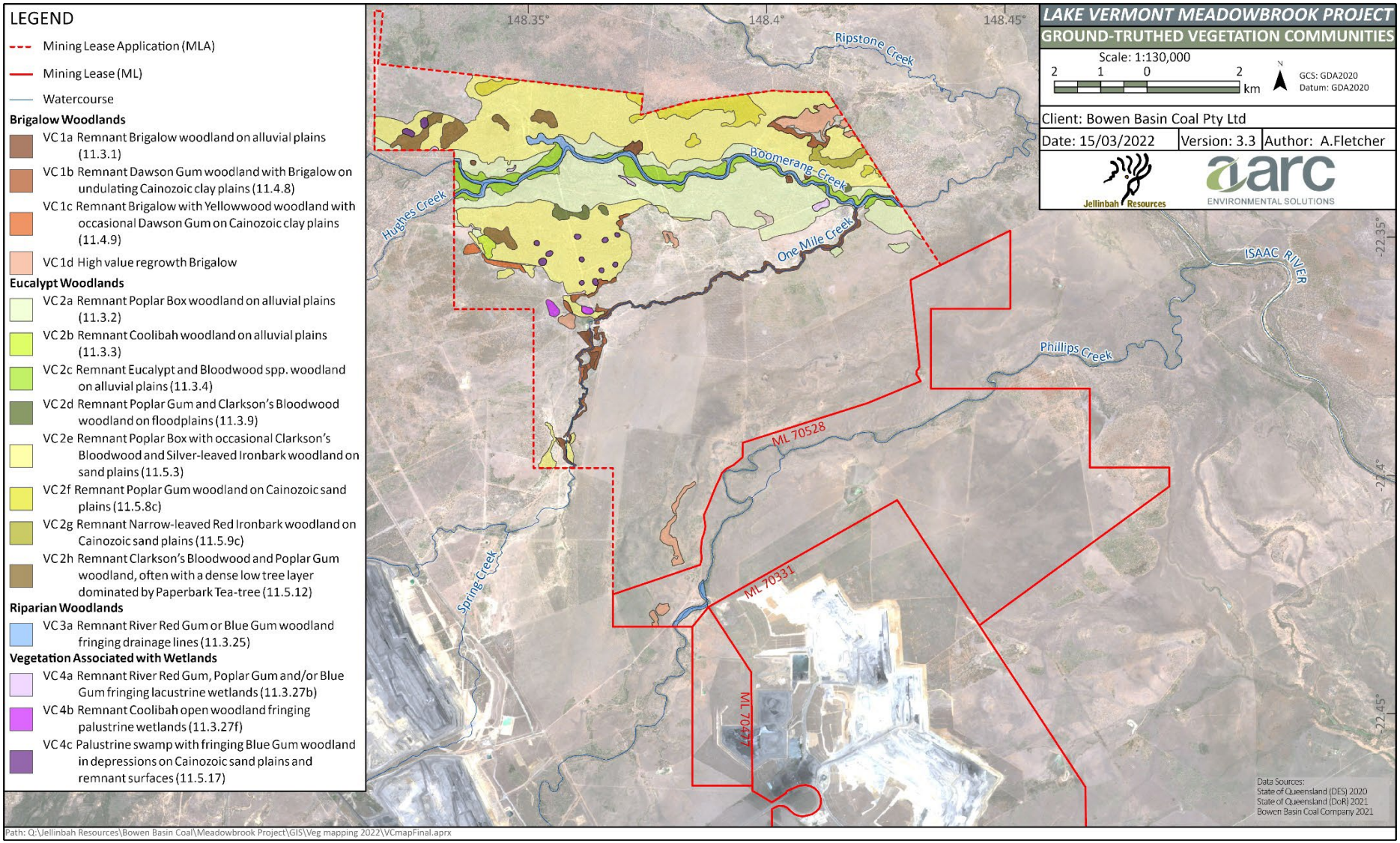

Figure 26: Ground-truthed vegetation communities within the study area

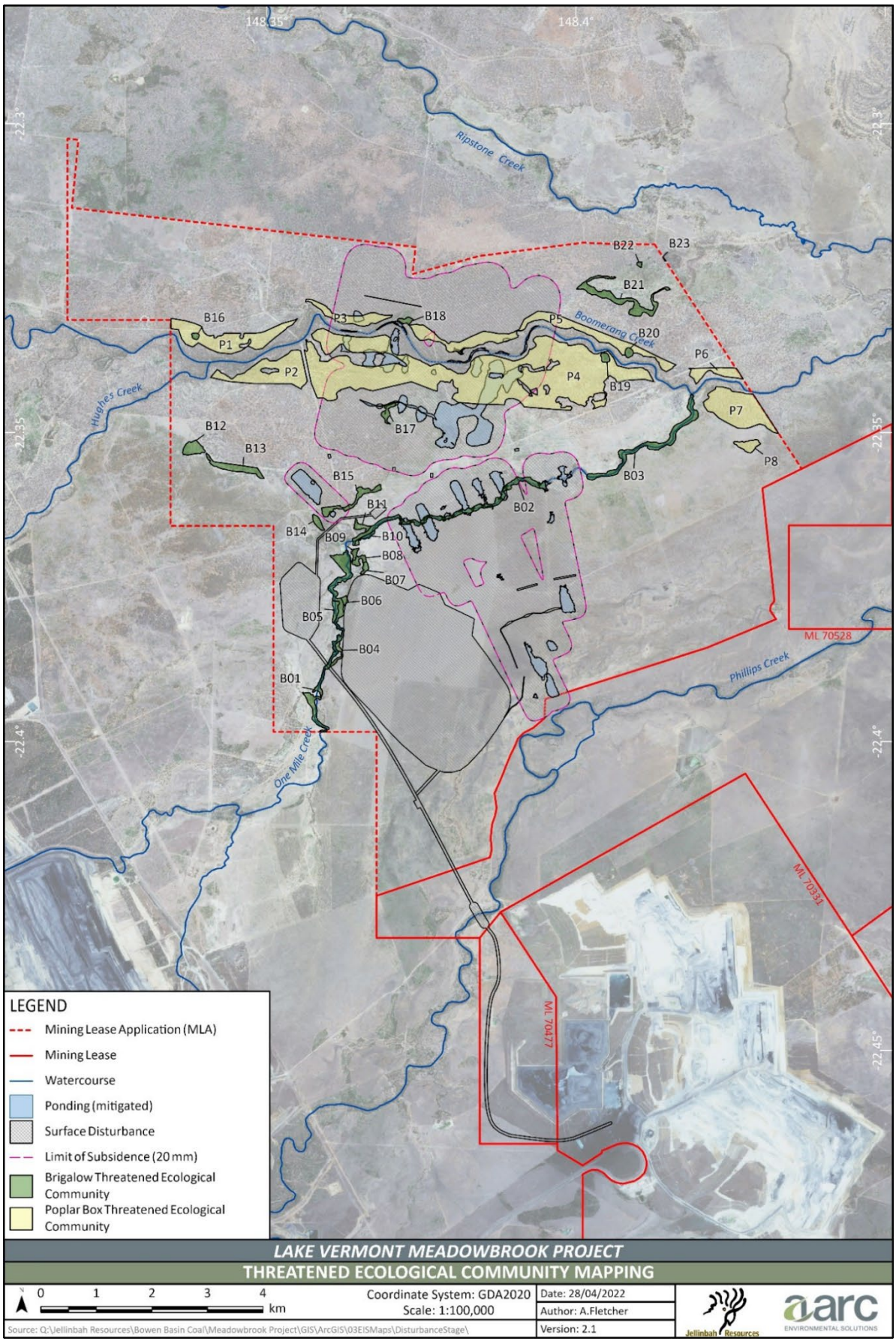

Figure 27: Threated ecological communities within the study area

throughout the broader region. Exotic pasture grasses such as Buffel Grass dominated the ground layer, both within remnant and non-remnant vegetation. A range of other introduced grasses and forbs were also present across the study area in low to moderate abundance.

3.1.7.2 Groundwater dependent ecosystems

A groundwater dependent ecosystems (GDE) assessment conducted at the Project site (3D Environmental 2022) identified two types of groundwater dependent ecosystems (GDEs) present within the Project area, namely:

1) groundwater dependent vegetation developed on drainage features and associated alluvial landforms present along Boomerang Creek and Hughes creek in the Project area (and Phillips Creek and Isaac River outside the Project area); and
2) groundwater dependent wetland vegetation developed on perched groundwater lenses to the east of the Project area.

The GDEs present on alluvial landforms use groundwater that is seasonally recharged by surface flows and flooding. The GDEs on perched groundwater lenses use water which is recharged from percolating surface water captured at the alluvial unconformity. Neither identified GDE type uses water held in regional tertiary aquifers or coal seams.

The Project has the potential to alter natural groundwater regimes and impact groundwater quality, with subsequent impacts on ecosystems that are reliant on a groundwater resource (i.e. GDEs). Potential impacts to GDEs are discussed in Section 3.5.5.1.

3.1.7.3 Fauna observations

Terrestrial fauna

Terrestrial fauna surveys (AARC 2022a) were conducted for the Project in autumn 2019 (11–21 March), spring 2019 (6–19 November), autumn 2020 (23–25 March and 1–8 April) and autumn 2021 (16–25 April). The field surveys were conducted in accordance with State and Commonwealth guidelines.

Field surveys identified five major habitat types for fauna within the study area:

- Brigalow woodlands on clay soils;
- Eucalypt dry woodlands on inland depositional plains;
- Eucalypt open forest to woodlands on floodplains;
- Freshwater wetlands; and
- Cleared agricultural areas.

A total of 167 native vertebrate species were identified within the study area, comprising 11 amphibians, 20 reptiles, 109 birds and 27 mammals.

Five fauna species listed as threatened under the EPBC Act and NC Act were identified during the field surveys, namely, the Ornamental Snake (*Denisonia maculata*), Squatter Pigeon (Southern) (*Geophaps scripta scripta*), White-throated Needletail (*Hirundapus caudacutus*), Koala (*Phascolarctos cinereus*) and Greater Glider (*Petauroides Volans*). All of these species are listed as Vulnerable under the EPBC Act and NC Act, with the exception of the Greater Glider, which is listed as Endangered under the NC Act. The EPBC Act listing for the Koala changed to Endangered in 2022 after the controlled action decision for the proposed Project was made. However, the Terrestrial Ecology Report (AARC 2022a) produced for the Project Environmental Impact Statement considers the impacts to the Koala as an EPBC Act Vulnerable listed species in accordance with its listing at the time of the controlled action decision for the Project.

One additional species listed as threatened, the Australian Painted Snipe (*Rostratula australis*), was considered to have a moderate likelihood of occurring within the terrestrial ecology study area.

Two species listed as migratory under the EPBC Act and as Special Least Concern (migratory) species under the NC Act were recorded during field surveys, the White-throated Needletail (also listed as Vulnerable) and Crested Tern (*Thalasseus bergii*).

The Short-beaked Echidna (*Tachyglossus aculeatus*), listed as a non-migratory Special Least Concern species under the NC Act was also recorded during the surveys.

Nine introduced fauna species were recorded within the study area. Introduced fauna species included the Cane Toad (*Rhinella marina*), European Cattle (*Bos taurus*), Wild Dog (*Canis lupus*), European Red Fox (*Vulpes vulpes*), Red Deer (*Cervus elaphus*), Feral Cat (*Felis catus*), House Mouse (*Mus musculus*), Rabbit (*Oryctolagus cuniculus*) and Feral Pig (*Sus scrofa*). All of these introduced species are listed as either a prohibited matter or restricted matter under the *Biosecurity Act (Qld)*.

Aquatic fauna

Aquatic ecology surveys (AARC 2022b) were conducted within the study area in late wet season 2020 (20-23 March 2020), and late wet season 2021 (14–19 April 2021). The survey timings were considered appropriate to maximise the likelihood of detecting aquatic species of significance. The field surveys were conducted in accordance with State and Commonwealth guidelines.

A total of nine fish and five crustacean species were identified within the study area. Markedly more individuals and species of both fish and crustacean were captured during the 2021 survey than the 2020 survey. The taxonomic richness was relatively even across the survey sites sampled in 2021, ranging between four and seven different species recorded per site.

Due to the ephemeral nature of the waterways present in study area, the overall habitat available for freshwater species is relatively low. For most of the year, the waterways on-site are unconnected with other aquatic habitats resulting in shallow pools of water with limited refuge, breeding or feeding areas.

No listed (EVNT) aquatic species were recorded at any of the survey sites during any of the surveys. All fish species recorded in the study area are considered common or widespread species in the Isaac River Sub-basin. No pest fish species were recorded during any of the surveys.

No turtle species listed under the EPBC Act or NC Act were recorded during surveys. No Least Concern turtle species were recorded during the 2020 or 2021 surveys. A single Krefft's River Turtle (*Emydura macquarii krefftii*) was recorded during the preliminary survey in 2019.

The Platypus (*Ornithorhynchus anatinus*) is listed as Special Least Concern under the NC Act and has been recorded from the Isaac River drainage sub-basin (DES 2013). However, the Platypus was not detected during the aquatic ecology surveys. The ephemeral watercourses in the study area do not contain the specific habitat required by the species, and while the Isaac River is the watercourse within the study area that has the greatest potential to contain habitat for and support the Platypus, no suitable habitat for the species was observed at the survey sites along the Isaac River. There are no records of the species within 50 km of the Project, and there are no records from within the Isaac River sub-catchment of the Fitzroy River Basin.

3.1.7.4 Environmental offsets requirements

Matters of National Environmental Significance

Under the EPBC Act, environmental offsets are required if residual impacts to Matters of National Environmental Significance (MNES) are significant (DSEWPC 2012). The assessments of significance indicate that the Project is unlikely to result in a significant impact on the White-throated Needletail, Australian Painted Snipe, Squatter Pigeon and migratory birds. The assessments of significance (AARC 2022a) indicate that the Project is likely to have a significant impact on the following MNES and offsets will be required in accordance with the 'Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy' (DSEWPaC 2012b):

- Brigalow TEC

- Poplar Box TEC
- Ornamental Snake
- Koala
- Greater Glider

A Biodiversity Offset Strategy has been prepared for the Project under the EPBC Act (Appendix U, Biodiversity Offsets Strategy). The strategy includes habitat quality information for the proposed disturbance areas and habitat quality information for the proposed offset sites located on Bowen Basin Coal-owned land adjacent to the Project and outlines the proposed provision of offsets for impacted matters. The proposed offsets sites within the Project area are shown in Figure 29.

Matters of State Environmental Significance

The Queensland environmental offsets framework requires environmental offsets be delivered where an activity is likely to result in significant residual impact on a prescribed environmental matter. Assessments of significance for Matters of State Environmental Significance (MSES) (AARC 2022a) indicate that the Project will have significant residual impacts and require offsets on regulated vegetation (Endangered and Of Concern REs), REs within mapped vegetation management wetlands and REs within the defined distance of a vegetation management watercourse. The impacts to MSES requiring offsets are outlined in Table 11. The locations of proposed MSES offset sites within the Project area are shown in Figure 29.

The Biodiversity Strategy (Appendix U) prepared for the Project under the EPBC Act presents the offset requirements for the MSES (not already offset under the EPBC Act) and proposed provision of offsets for impacted matters.

3.2 Community consultation

3.2.1 Stakeholder and community engagement activities

Community and stakeholder consultation has been undertaken during preparation of the EIS to ensure that all relevant stakeholders are aware of the Project, its aspects and potential impacts; and that they are provided the opportunity to comment on issues of relevance to them. Community and stakeholder engagement undertaken for the SIA has been participatory, transparent and inclusive. Participatory engagement is defined as being respectful, meaningful, available to all and tailored to the needs of potentially impacted individuals and groups. Objectives of Project consultation have included the following principles:

- Provide local stakeholders with the opportunity to define the local values and characteristics of potentially affected communities.
- Ensure stakeholders have understood the Project details, timing and workforce arrangements so that discussions about impacts and benefits are meaningful.
- Provide stakeholders with the opportunity to identify and assess potential social impacts and applicable management measures.
- Ensure the SIA has considered the interests and perspectives of stakeholders who may be affected by Project-related impacts.
- Integrate the broader EIS and Project engagement activities to provide a range of opportunities for community members and key stakeholders to provide feedback.
- Ensure transparent and inclusive community and stakeholder engagement to facilitate the ongoing management and monitoring of potential social impacts during construction of the Lake Vermont Meadowbrook Project and the ongoing operations and rehabilitation of the Lake Vermont Meadowbrook Complex.

Table 11: Summary of offset requirements for MSES

Matter of State Ecological Significance			**Extent of disturbance (ha)**	**Offset required**
Regulated Vegetation	Endangered REs	RE 11.3.1	12.1[1] (4.8 ha of which represents the Brigalow TEC assessed under the EPBC Act)	For the 4.8 ha of RE 11.3.1 not assessed as Brigalow TEC under the EPBC Act
		RE 11.4.8	3.9[2] (3.3 ha of which represents the Brigalow TEC assessed under the EPBC Act)	For the 3.3 ha of RE 11.4.8 not assessed as Brigalow TEC under the EPBC Act
		RE 11.3.4	4.9	For 4.9 ha
	REs within mapped vegetation management wetlands		Significant hydrological change impacts to three wetland areas of RE 11.5.17	For 4.7 ha of RE 11.5.17 wetland areas
	REs within the defined distance of a vegetation management watercourse	RE 11.3.1	8	For 8.0 ha (and assessed as Brigalow TEC under the EPBC Act)
		RE 11.3.25	6.1	For 6.1 ha
Protected Wildlife Habitat	Essential habitat	Ornamental Snake	Refer to *Lake Vermont Meadowbrook Project Terrestrial Ecology Report* (AARC 2022a), significance assessment for the Ornamental Snake under the EPBC Act	Under EPBC Act EO Policy
	Habitat for Endangered, Vulnerable or Special Least Concern Animal	Ornamental Snake		
		Koala	Refer to *Lake Vermont Meadowbrook Project Terrestrial Ecology Report* (AARC 2022), significance assessment for the Koala under the EPBC Act	Under EPBC Act EO Policy
		Greater Glider	Refer to Section *Lake Vermont Meadowbrook Project Terrestrial Ecology Report* (AARC 2022), significance assessment for the Greater Glider under the EPBC Act	Under EPBC Act EO Policy

[1] Of this, 4.8 ha of RE 11.3.1 represents the Brigalow TEC under the EPBC Act.
[2] Of this, 3.3 ha of RE 11.4.8 represents the Brigalow TEC under the EPBC Act.
[3] Of this, 58.3 ha of RE 11.3.2 represents the Poplar Box TEC under the EPBC Act.

- Provide a complaint mechanism to allow affected communities and stakeholders to register complaints, queries or comments and address them in a timely manner by the Meadowbrook Project.
- Ensure Project planning and delivery are informed by stakeholder views.
- Ensure post-mining land use is consistent with community expectations (Appendix P, Social Impact Assessment).

Bowen Basin Coal is committed to involving the community during the planning, construction, operation and decommissioning of the Project. There is also a commitment to understand all stakeholder concerns in respect of environmental and social impacts anticipated from the Project.

Bowen Basin Coal has developed a Community Consultation Register that meets the requirements of Section 126C(1)(c)(iii) of the EP Act, and the PRCP Guidelines. This register has been used to record consultation date(s), engaged community member(s), consultation type, information provided, key issues raised, response actions and/or outcomes and any commitments made by Jellinbah or Thiess Mining. A summary of key consultation activities undertaken with parties that may have an interest in rehabilitation and closure planning is provided in Table 12. A detailed summary of all stakeholder engagements is provided in the Lake Vermont Resources EIS, Appendix P, Social Impact Assessment.

Following the approval of the PRCP, the register will continue to be maintained to document each stakeholder consultation event, including meetings, presentations, feedback, phone calls and written submissions. Due consideration will be given to privacy and publication of personal information.

The PRCP and EIS approvals processes occur concurrently, and public notification and consultation is a key stage of the environmental impact assessment process. This stage is a significant opportunity for submissions regarding rehabilitation and closure to be made. The primary consideration in developing the proposed post-mining land uses (refer Section 3.3) was to reinstate the land use of grazing, which is consistent with the pre-mining land use and surrounding land uses, and to maintain the environmental benefits provided by native vegetation present on-site. As the Proponent is the owner of all land underlying the Project area, and the existing land use will be reinstated post-mining, targeted consultation was deemed not to be necessary in developing the proposed post-mining land uses; the public notification stage constitutes the key community consultation activity to be undertaken with regard to rehabilitation and closure planning for the Project. Any properly made submissions that relate to rehabilitation and closure will be considered when finalising the PRCP and will be recorded in the Community Consultation Register.

3.2.2 Community and stakeholder engagement plan

As part of the development of the EIS for the Project, Bowen Basin Coal has developed a Social Impact Management Plan that incorporates a Community and Stakeholder Engagement Plan (CSEP) that meets the requirements of Section 126C(1)(c)(iv) of the EP Act, and the PRCP Guideline. The CSEP outlines the proposed measures for ongoing engagement with communities and stakeholders during construction and ongoing operations of the Project, including in relation to the rehabilitation to be carried out under the PRCP. The CSEP is provided in Appendix D.

The CSEP provides for:

- stakeholder identification;
- development of an engagement action plan;
- development of a complaints management process;
- undertaking of rehabilitation and closure engagement; and
- development of a community consultation register.

Table 12: Consultation register

Category	Entity	Consultation record	Means of engagement	Key matters discussed/issued raised
Landholders		• Written correspondence to provide notice of Draft ToR—mailed 6 Jan 2020. • Letter/flyer update on EIS—mailed 18 Nov 2021. • Bore census request—mailed 18 Nov 2021 (potentially impacted landholders only).	Written correspondence	• Notice of Draft ToR. • Letter/flyer update on EIS. • Bore census request.
Tenement holders		• Written correspondence to provide notice of Draft ToR—mailed 6 Jan 2020. • Face-to-face meetings with BMA on 16 July 2020 and Mar 2022. • Face-to-face meetings with Arrow Energy (CH4) on 5 Nov 2019, 15 Dec 2021 and 23 Mar 2022. • Letter/Flyer update on EIS—mailed on 18 Nov 2021. • Bore census request mailed on 18 Nov 2021 (potentially impacted tenement holders only). • Data sharing agreements have also been entered into with relevant tenement holders (BMA, Whitehaven, Peabody and Pembroke).	Written correspondence and face-to-face meetings	• Notice of Draft ToR. • Bore census request. • Data sharing agreements.

Category	Entity	Consultation record	Means of engagement	Key matters discussed/issued raised
Indigenous Group	Barada Barna	• Written correspondence to provide notice of Draft ToR—mailed to Barada Barna on 6 Jan 2020. • Face-to-face meeting with Barada Barna representatives held in Moranbah on 22 Nov 2021.	Written correspondence and face-to-face meetings	• There have been ongoing negotiations between Jellinbah and the Barada Barna regarding the resolution of the Native Title over the parcel of land adjacent to the Lake Vermont Workers Accommodation Village. • The Barada Barna are looking to build long-term relationships with proponents, such as Jellinbah. They are looking to build an understanding of their culture (e.g. connection to land) with mining companies. • The Barada Barna are looking to maximise employment opportunities, particularly opening up training and skills development opportunities for Barada Barna People. This is not just about technical training but also all the other levels of support that deliver sustained employment outcomes. • The Barada Barna would like to see proponents prioritise sustainable employment pathways for traditional owners and not just employ Aboriginal people from anywhere to meet targets/quotas. • Mentoring is the key to generating successful employment outcomes for young people. This is what the Barada Barna is focusing on. • Recording history and language is very important to the Barada Barna, as much of their history has been lost. Suicide prevention is also a focus, as rates are too high for Indigenous people. • Any support the Proponent could make to trainees and employment pathways would be greatly appreciated. • Barada Barna acknowledged they are in the process of developing their own rehabilitation capabilities to support mine rehabilitation through their associated consulting entity. • An interest was expressed by the Proponent to update the existing 'Cultural Heritage Management Plan' relevant to the Lake Vermont Complex. This proposal was supported by Barada Barna.

Category	Entity	Consultation record	Means of engagement	Key matters discussed/issued raised
Local Government	Isaac Regional Council—elected representatives and key Council staff	• Written correspondence to provide notice of Draft TOR—mailed 6 Jan 2020. • Face-to-face meeting undertaken on 12 October 2020 in Moranbah (Project overview and introductions). • Face-to-face Project update meeting in Moranbah on 22 Nov 2021. • Face-to-face Project update meeting in Moranbah on 11 Apr 2022.	Face-to-face meetings; Standing Committee meeting and subsequent discussion	• The IRC appreciated the opportunity to learn about the Project and looks forward to an ongoing relationship with Jellinbah. • Council recognised that Jellinbah is an existing operator, and the Project is essentially an underground extension of the existing Lake Vermont operation. • Council appreciated that without the underground extension, operations at Lake Vermont would scale back significantly and result in the workforce being reduced by 50%, which would have a negative social impact on Dysart. • Council provides a broad range of services and facilities in Dysart. It was recognised that a diminishing rate base makes service delivery increasingly difficult. • Council recognises the ongoing dialogue regarding the planning approvals for the expansion of the Lake Vermont Workers Accommodation Village. It was recognised that camps could generate economic activity and benefit for local businesses. • Council is committed to advocating wherever possible for opportunities to be provided to local businesses. • A preference of Council is to support existing infrastructure and services rather than coming up with new initiatives. It is preferable for projects to invest in supporting the sustainability of existing facilities, services and networks. • Council acknowledged the Project would create impacts on local housing and accommodation, if not in isolation, through the cumulative impact on multiple Projects planned within the region. Strategies should, therefore, be proposed to support the management of these challenges. • Mental health is a major issue in the workforce. Council's position is that local living greatly reduces mental health issues, as workers get to enjoy the social connections and facilities that are provided locally. • Council seeks further dialogue regarding potential extra usage and maintenance contributions regarding the Golden Mile Road.

The key objectives of the CSEP are to achieve the following:

- Ensure transparent and inclusive community and stakeholder engagement to facilitate the ongoing management and monitoring of potential social impacts during construction of the Lake Vermont Meadowbrook Project and ongoing operations and rehabilitation of the Lake Vermont Meadowbrook Complex.
- Provide a complaint mechanism to allow affected communities and stakeholders to register complaints, queries or comments and have them addressed in a timely manner by the Project.
- Ensure Project planning and delivery are informed by stakeholder views.
- Ensure the PMLU is consistent with community expectations.

A range of commitments have been made by Bowen Basin Coal to facilitate successful engagement, including:

- designating a Project Officer who will undertake community liaison;
- establishing and maintaining a Project website/webpage that will allow people to make enquires and seek information regarding the Project;
- continuing to engage with local and affected landholders to monitor impacts;
- continuing to identify issues and disseminating information throughout the life of the Project and providing a forum for discussions;
- providing various communication channels (e.g. signage, advertisements in local papers, construction materials) about changes to local access, potential road hazards and expected traffic volumes during construction;
- facilitating open and transparent engagement with local communities;
- establishing, publicising and maintaining a readily accessible community complaints and resolution process;
- Publishing bi-annual publications and disseminating Project Community Updates *via* the website;
- maintaining long-term respectful relations with the Barada Barna people, including managing cultural heritage in accordance with the Cultural Heritage Management Plan and meeting the requirements of any native title agreement;
- engaging regularly with the Isaac Regional Council to monitor SIMP implementation;
- engaging with the community through implementation of community investment initiatives, as outlined in the SIMP and;
- engaging with interested and affected parties on activities related to rehabilitation and closure.

The community consultation register, that will be maintained by the Project Officer, will inform ongoing development of the PRCP. As part of rehabilitation and closure engagement, discussions with relevant stakeholders will include aspects such as:

- proposed post-mining land use;
- rehabilitation methods;
- rehabilitation timeframes and scheduling; and
- proposed amendments to the PRCP schedule

3.3 Post-mining land use

This section of the PRCP describes and discusses the PMLUs proposed for the Project in accordance with Section 126C(1)(d) of the EP Act.

In accordance with the Queensland Government's policy objectives defined in the *Mined land rehabilitation policy* (Queensland Government 2018), the general rehabilitation goals for the Project are to leave an area that is safe, stable, does not cause environmental harm and is able to sustain the PMLU.

3.3.1 Existing land use

The current land use of the Project site is low intensity cattle grazing. The vegetation is a combination of introduced pasture, natural bushland and regrowth of native bushland. Queensland Land Use Mapping (DES 2020) classifies the Project area as 'Grazing Native Vegetation' which is defined as (ABARES 2016):

> *Land uses based on grazing domestic stock on native vegetation where there has been limited or no deliberate attempt at pasture modification.*

This description is consistent with the vegetation communities associated with remnant or high value regrowth vegetation which are predominantly located in the north of the Project site and in the riparian corridors of Hughes Creek, Boomerang Creek and One Mile Creek. These vegetation communities represent four major habitat types, namely Brigalow woodlands, Eucalypt woodlands, Riparian woodlands and vegetation associated with wetlands. These areas are currently used for cattle grazing land use and are subject to grazing related disturbance.

The remainder of land within the Project area can be more accurately described as 'Grazing Modified Pastures' (ABARES 2016):

> *Pasture and forage production, both annual and perennial, based on significant active modification or replacement of the initial vegetation.*

The current land use for the Project area is shown in Figure 28.

The dominant non-mining land uses in the surrounding region are grazing of native vegetation, improved pasture grazing and cropping.

3.3.2 Planning scheme conformance

The 'Isaac Regional Planning Scheme' identifies the Project area as being zoned as rural land use which has a purpose defined as to:

> *a) provide for rural uses and activities; and*
>
> *b) provide for other uses and activities that are compatible with:*
>
> *(i) existing and future rural uses and activities; and*
>
> *(ii) the character and environmental features of the zone; and*
>
> *c) maintain the capacity of land for rural uses and activities by protecting and managing significant natural resources and processes; and*
>
> *d) ensure sensitive land uses do not encroach into areas affected by hazardous levels of dust associated with mining activity*

The rural zone accommodates a wide range of rural uses, including cropping, intensive horticulture, aquiculture, grazing and intensive animal industries, and the Scheme encourages the retention of natural features such as creeks and bushland in this zone.

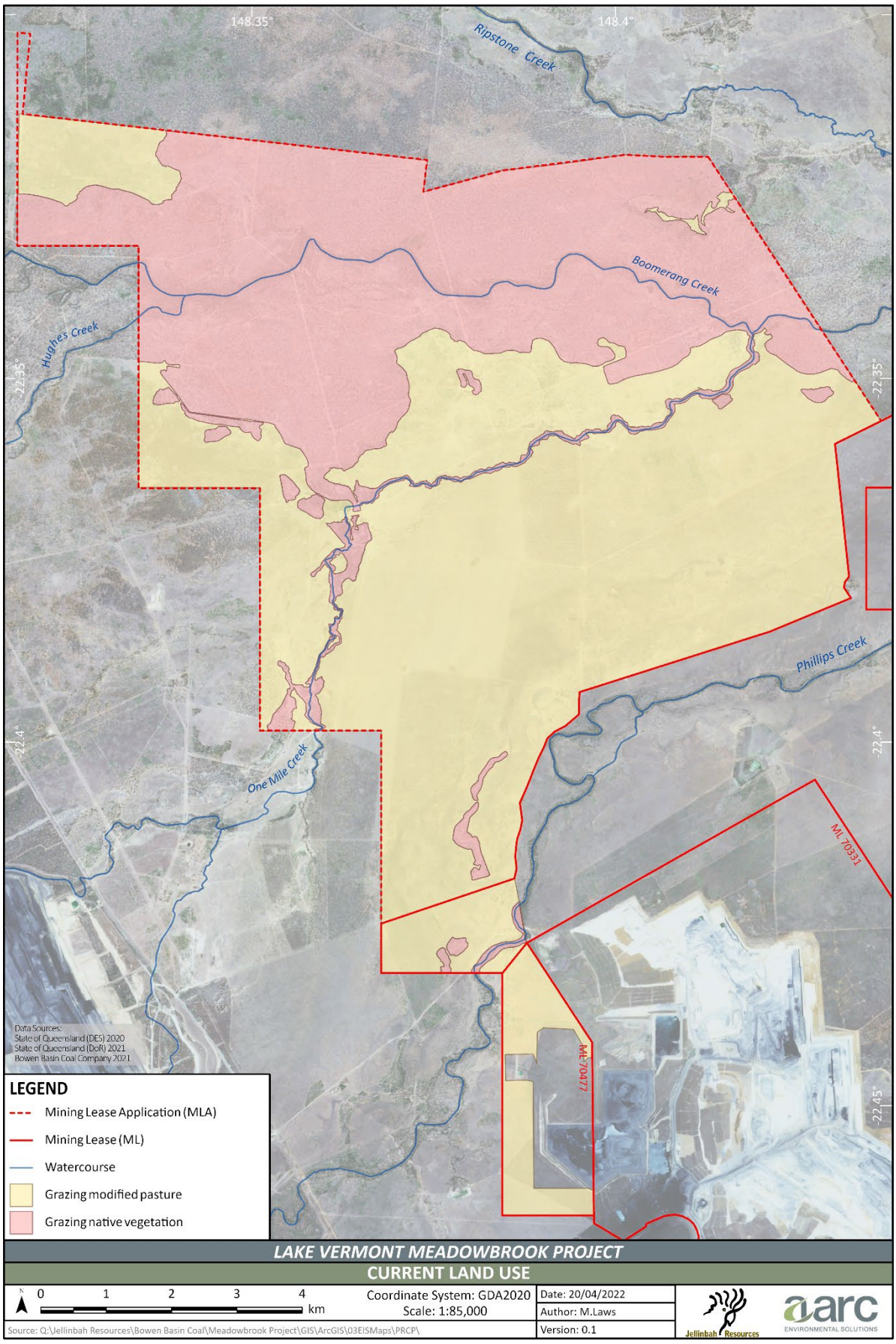

Figure 28: Current land use of Project area

3.3.3 Rehabilitated landforms

Land disturbance associated with mining activities will result from land clearing associated with open cut mining operations and subsidence resulting from the progression of the longwall underground. Progressive rehabilitation of disturbed land will commence as soon as practicable following areas becoming available for rehabilitation (refer to Section 3.5.4 for rehabilitation timeframe justification and Appendix A for the Milestone Schedule). The key disturbance areas and associated final landforms are described below.

3.3.3.1 Open cut disturbance area

The open cut disturbance area incorporates the open cut satellite pit, two out-of-pit waste rock emplacements and the flood levee. The majority of disturbance associated with the open cut operation will be to previously cleared agricultural land located on the Knockane and Norwich clay SMUs.

Two out-of-pit waste rock emplacements are proposed, a temporary waste rock emplacement to the east of the open cut satellite pit and a permanent waste rock emplacement to the west. Waste rock will also be placed as infill in the pit behind the advancing mining operations. Waste rock from the eastern out-of-pit waste rock emplacement will be used to partially backfill the pit following completion of mining, resulting in a landform similar to that existing prior to mining. Some waste rock material from the western out-of-pit waste rock emplacement will also be used to partially backfill the pit, leaving a residual raised landform with rehabilitated slopes designed to not exceed 20% and typically less than 15%, and slope lengths typically less than 70 m.

Waste rock materials are non-acid-forming (NAF) and unlikely to pose significant risk to the quality of surface and groundwater resources (RGS 2021). However, interburden and overburden materials are strongly sodic and may be prone to dispersion and erosion. Waste rock materials therefore pose negligible risk of acid mine drainage and are amenable to revegetation as part of rehabilitation activities, with soil ameliorants potentially required only for sodic materials to limit dispersion and erosion and to support plant growth.

Partially backfilling the pit will result in a depression in the landscape; allowing the open cut disturbance area to be rehabilitated to a safe and stable condition capable of sustaining a grazing PMLU. The depression will be subject to intermittent periods of ponding but is not expected to be a permanent water body.

The geochemical assessment of waste rock material (RGS 2021) found that water quality parameters are well within the applied livestock drinking water quality guideline levels (ANZG 2018). It is therefore expected that the potential risk to the quality of surface water and groundwater resources influenced by mining waste materials at the Project will be low. Surface preparations of the waste rock emplacements will include recontouring, placement of topsoil and ameliorants (as required), ripping and seeding to prevent surface water interactions with waste rock material.

A bund will be constructed around the open cut satellite pit to act as a flood levee to reduce the risk of floodwater entering the mine area during the operational and initial rehabilitation stages. The flood levee will be constructed using nondispersive, low permeable engineered fill. The bund batters and surrounding disturbed areas will be revegetated with grasses to stabilise the structure and prevent the generation of sediment-laden runoff. Once landform development of the open cut disturbance area is complete, the flood levee will be reshaped to lower the final landform profile and revegetated to ensure compatibility with the surrounding landform and PMLU.

3.3.3.2 Water management infrastructure

Proposed water management infrastructure will include sediment dams and other sediment control infrastructure, and mine affected water storages. Water management infrastructure will be decommissioned as soon as practicable once the service life of the infrastructure has passed. Dams will be dewatered and rehabilitated to the final PMLU, with the exception of the Mine Infrastructure Area (MIA) dam. The MIA dam is to be retained as a livestock drinking water dam and may require water treatment and/or sediment removal to achieve the final PMLU.

3.3.3.3 Areas affected by subsidence

The subsidence footprint is defined by surface area above the longwall panel mining area, which will impact areas of cleared agricultural land and remnant or high value regrowth bushland, including parts of the riparian zones along Boomerang Creek and One Mile Creek. Subsidence is expected to result in some surface cracking, changes to surface topography where slopes form between ridges above chain pillars and subsidence troughs above goaf areas. Consequent changes in local topography may result in the alteration of overland flow paths, including the intermittent pooling of water isolated from pre-existing drainage paths.

Rehabilitation of these areas will include surface remediation to repair cracking, erosion management, the installation of bunds and permanent or semi-permanent drainage channels to redirect flow and minimise ponding where required. Revegetation and monitoring activities will be undertaken following any required earthworks.

3.3.3.4 Other disturbance areas

As a predominantly underground mine, the need for surface land clearing will be minimised. The use of existing Lake Vermont Mine infrastructure further reduces the need for disturbance associated with surface mine infrastructure; reducing the Project's overall disturbance footprint. Regardless, some vegetation clearance will be required for Project development including for the infrastructure corridor, the mine infrastructure area (MIA) and for supporting infrastructure such as gas wells, ventilation shafts and access tracks. A network of farm tracks already exists within the Project boundary, and these will be utilised where possible to minimise new disturbance. Project infrastructure has been positioned so that the majority of disturbance associated with land clearing is located on land previously cleared for agriculture. Surface disturbance will primarily occur on the Knockane clay SMU, with the haul road also traversing the Norwich and Booroondarra SMUs.

The construction of the access/coal haul road will require causeways to be constructed at the watercourse crossings of One Mile Creek and Phillips Creek. The watercourse crossings would be constructed with consideration of the *Accepted Development Requirements for Operational Work that is Constructing or Raising Waterway Barrier Works* (DAF 2018) using box culverts to permit navigation of fish during low flow events and maintaining fish passage across the Project area. It is noted that the disturbance required to support construction of the Phillips Creek crossing will be approximately 100 m wide. This width is required to facilitate excavation and grading of the channel bed, to maintain existing flow velocities through this section of stream (including the proposed culverts). Revegetation works will be undertaken as part of culvert construction activity, with causeways and culverts to remain post mine closure.

All mine infrastructure not being retained will be removed and the land rehabilitated to the proposed PMLU as soon as practicable once the service life of the infrastructure has passed. Ventilation shafts and the underground drift portals will be sealed with waste material or concrete, and the gas wells plugged in accordance with standard procedures prior to revegetation consistent with the PMLU.

3.3.4 Post mining land use options

3.3.4.1 Grazing

The current land use of the Project site is low intensity cattle grazing (refer section 3.3.1). The Soil and Land Suitability Assessment (AARC 2021) found that the land suitability of the Project area for cattle grazing is predominantly limited by water availability, pH and nutrient availability. The examination of the land suitability limitations for cattle grazing indicate that the Project area consists of land suitable for cattle grazing with moderate limitations (Class 3) and land considered marginal land (Class 4) (AARC 2021). The current low intensity grazing land use indicates that the entire Project area can sustain grazing activities. However, the proposed PMLUs for the site differentiate between Class 3 (grazing PMLU) and Class 4 (marginal grazing PMLU). The land is expected to retain its pre-mining land class suitability except for the following areas:

- areas of the out-of-pit waste rock emplacement that have slopes greater than 10% and develop water erosion limitations that result in Class 4 grazing suitability;
- areas of the in-pit waste rock emplacement that have slopes greater than 10% and develop water erosion limitations that result in Class 4 grazing suitability; and
- the footprint of the mine infrastructure area, which may be subject to characteristics that limit plant growth (i.e. soil compaction and strongly alkaline subsoils), resulting in Class 4 grazing suitability.

Given that waste rock materials are NAF, rehabilitated in-pit and out-of-pit waste rock emplacements are considered suitable for grazing PMLU, with amelioration activities potentially required to reduce erosion risk only for certain materials. Where slopes are less than 10%, land will be limited to Class 3, and where slopes are greater than 10% but do not exceed 20%, land will be limited to Class 4.

The open cut pit will be partially backfilled and revegetated with pasture species suited to the target PMLU. It is expected that the depression will be subject to intermittent periods of ponding; consequently, the land suitability for grazing is limited to Class 3 (wetness limitation).

Once landform development of the waste rock emplacements and open cut pit is complete, the flood levee will be reshaped to lower the profile and reduce slopes to be consistent with PMLU of grazing. The area will then be revegetated with pasture grasses to minimise erosion and the generation of sediment-laden runoff.

Subsidence affected areas will have a final landform designed in consideration of appropriate drainage mitigations to minimise ponding (discussed further in Section 3.5.10.3). The pre-mining land suitability class for these areas is based on the SMU and is limited to areas of Class 3 and Class 4 land suitability. These areas are expected to retain their pre-mining land suitability class. Some subsided areas will be subjected to intermittent ponding, over time functioning as ephemeral wetlands. Ephemeral wetlands are already present within the Project site, and as ponded areas are expected to function similarly, these areas are expected to remain suitable for the low intensity grazing PMLU.

Areas cleared of vegetation for the mine and supporting infrastructure areas are proposed to be rehabilitated to reinstate the pre-existing low intensity grazing land use. The haul road, including the culverts, is proposed to be retained to support the grazing PMLU. Topsoil stripped and stockpiled is predominantly from SMUs limited to Class 3 and is suitable for use as seed surface material and root zone material and is therefore compatible with the PMLU. Mine infrastructure areas are expected to be compacted, potentially inhibiting plant growth, in addition to having strongly alkaline subsoils which are expected to limit these areas to land suitability Class 4.

Infrastructure will be removed unless compatible with the PMLU and able to provide a benefit or improvement to the use of the land once mining has ceased. The haul road and access roads are consistent with the PMLU of grazing and are proposed to be retained to facilitate site access. One dam is proposed to be retained at closure as a stock water dam. It will be rehabilitated to meet livestock drinking water quality guideline levels (ANZG 2018) and is therefore consistent with the PMLU and will provide a tangible benefit.

The Project site contains a large contiguous area comprised both of remnant vegetation and high value regrowth in the northern portion of the site as well as along riparian corridors associated with Boomerang Creek and One Mile Creek. Some of these areas will be subject to disturbance from subsidence and vegetation clearing. The rehabilitation of these areas involves restoring, as far as practicable, the existing vegetation communities.

In summary, the proposed PMLU of low intensity cattle grazing is achievable given the rehabilitation works to be done and is a compatible land use that retains the existing economic benefits realised pre-mining. Additionally, restoring existing native vegetation will manage potential impacts on flora and fauna and maintain wildlife corridors.

3.3.4.2 Cropping

The pre-mining land use assessment (AARC 2021) determined that the cropping suitability classes ranged between Class 4 (marginal land considered unsuitable due to severe limitations) and Class 5 (unsuitable land

with severe limitations). No suitable cropping land was identified in the pre-mining assessment, and none will be created through rehabilitation works. Therefore, cropping is not considered a feasible alternative PMLU.

3.3.4.3 Undisturbed land and environmental offset requirements

A portion of undisturbed land within the MLA has been nominated for biodiversity offsets, as shown in Figure 29. The proposed offsets area is currently used for cattle grazing of native vegetation. Following the necessary approvals, the area will be fenced to exclude livestock, and the area managed in accordance with the Biodiversity Offsets Strategy.

The remainder of undisturbed land within the Project boundary will retain the current land use of grazing of native vegetation and modified pasture.

3.3.5 Post mining land use outcomes

The proposed PMLUs have been developed with consideration for the existing local and regional land use, the *Isaac Regional Planning Scheme* (Isaac Regional Council 2021), local ecological values, and site characteristics. The proposed PMLUs aim to reinstate the existing land use of low intensity grazing by returning the land to similar vegetation type and land class suitability to that existing prior to mine disturbance and delivering a beneficial environmental outcome by restoring, as far as practicable, existing native vegetation communities. In summary, areas previously cleared for pasture will be returned to 'Grazing Modified Pasture', and most areas of remnant vegetation will be returned to 'Grazing Native Vegetation'.

While the pre-mining land use of low intensity cattle grazing is proposed to be reinstated post-mining, for the purpose of developing the PRCP schedule, further granularity is required to differentiate between rehabilitation areas to which different rehabilitation methods and milestone criteria apply. PMLUs have been proposed based on the Queensland Land Use Mapping descriptions (refer Section 3.3.1), which differentiate between grazing domestic stock on native vegetation and grazing of pasture; and with reference to the post-mining land suitability class. The pre-mining land use of grazing is proposed to be retained across the Project site, and the pre-mining vegetation types, namely, pasture or native vegetation, are proposed to be reinstated, as far practicable. The proposed PMLUs also differentiate between post-mining land suitability Class 3 (grazing PMLU) and Class 4 (marginal grazing PMLU).

The proposed PMLUs outlined in Table 13 and Figure 29:

- are considered viable, having regard to the use of land in the surrounding region;
- are consistent with how the land was used before a mining activity was carried out; and
- will deliver, or aim to deliver, a beneficial environmental outcome.

3.4 Non-use management areas

No non-use management areas are proposed for the Project.

Table 13: Post-mining land outcomes

Disturbance type		Rehabilitation areas	Pre-mining land use	Post-mining land use	Post-mining land description	Post-mining land suitability (grazing)
Mine infrastructure areas	Surface disturbance associated with mine infrastructure areas, including the MIA flood levee	RA1	Low intensity cattle grazing	Marginal grazing modified pasture	Low intensity cattle grazing	Class 4
Water management infrastructure	Dams and diversion drains (rehabilitated to pasture)	RA2a		Marginal grazing modified pasture	Low intensity cattle grazing	Class 4
	Dams (retained for stock watering)	RA2b		Water body (stock watering and native ecosystem)	Dams to remain as water body	N/A
infrastructure corridor and access roads	Infrastructure corridor and access roads	RA3		Retained infrastructure	Retained infrastructure	N/A
Open cut disturbance area	Open cut disturbance area including in-pit and out-of-pit waste rock emplacements and flood levee (slopes >10%)	RA4		Marginal grazing modified pasture	Pasture typically on slopes with limited grazing potential (slopes >10%)	Class 4
	Open cut disturbance area including in-pit and out-of-pit waste rock emplacements and flood levee (slopes <10%)	RA5		Grazing modified pasture	Low intensity cattle grazing (slopes <10%)	Class 3
Areas subject to subsidence	Grazing native vegetation subject to subsidence and some surface disturbance associated with gas drainage bores and access tracks (Class 4 grazing land suitability)	RA6		Marginal grazing native vegetation	Low intensity cattle grazing of native vegetation	Class 4
	Pasture subject to subsidence and some surface disturbance associated with gas drainage bores and access tracks (class 3 grazing land suitability)	RA7		Grazing modified pasture	Low intensity cattle grazing	Class 3
	Pasture subject to subsidence and some surface disturbance associated with gas drainage bores and access tracks (class 4 grazing land suitability)	RA8		Marginal grazing modified pasture	Low intensity grazing of pasture typically	Class 4

Disturbance type		Rehabilitation areas	Pre-mining land use	Post-mining land use	Post-mining land description	Post-mining land suitability (grazing)
					limited by soil characteristics	
	Grazing native vegetation on Boomerang Creek riparian zone subject to subsidence	RA9		Marginal grazing native riparian vegetation	Low intensity cattle grazing of native vegetation in riparian zone	Class 4

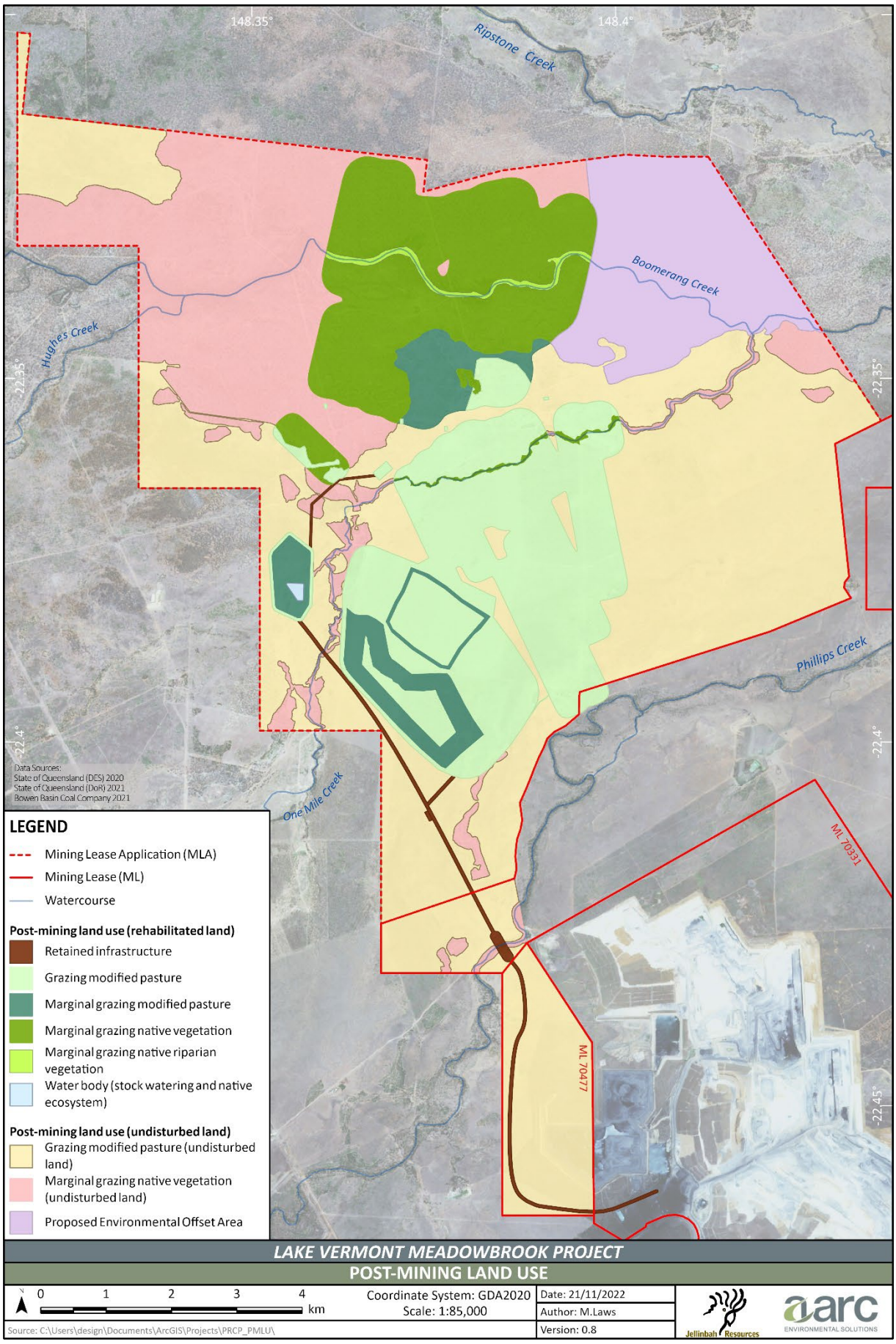

Figure 29: Proposed post-mining land use

3.5 Rehabilitation management methodology

3.5.1 Rehabilitation objectives

In Queensland, mine rehabilitation is required under the EP Act. Amendments to the EP Act in late 2018 implemented key elements of the State Government's Mined Land Rehabilitation Policy (Queensland Government 2018) which intends to ensure that, for land disturbed by mining activities:

- the land is safe and structurally stable;
- there is no environmental harm being caused by anything on or in the land; and
- the land can sustain a post-mining land use (Section 111A of the EP Act).

These three objectives are the general rehabilitation goals for all areas disturbed by mining in Queensland.

3.5.2 Rehabilitation areas

To allow the development of a PRCP schedule that satisfies the requirements of the PRCP Guideline, discrete rehabilitation areas (RAs) have been defined for the Project. An RA is defined in the EP Regulation as an area of land in the PMLU to which a rehabilitation milestone for the post-mining use relates. RAs have been nominated for areas of disturbance within the Project with consideration for the disturbance type and the proposed PMLU and are shown in Table 14 and Figure 30.

Table 14: Identified rehabilitation areas

Rehabilitation area reference	Rehabilitation area	Description	PMLU
RA1	Mine infrastructure area	• MIA (except water management infrastructure footprint) • MIA flood levee • electrical substation • drift portals and ventilation shafts	Marginal grazing modified pasture
RA2a	Water management infrastructure (rehabilitated to pasture)	• Mine dams rehabilitated to pasture • Diversion drains rehabilitated to pasture	Marginal grazing modified pasture
RA2b	Water management infrastructure (retained)	• Mine dams retained as stock watering points	Water body (stock watering and native ecosystem)
RA3	Infrastructure corridor and access roads	• Access/coal haul road and infrastructure corridor • laydown yard • infrastructure corridor linking the MIA to the electrical substation • Pit access road	Retained infrastructure
RA4	Open cut disturbance area (marginal grazing modified pasture)	Open cut disturbance area including in-pit and out-of-pit waste rock emplacements and flood levee (slopes >10%)	Marginal grazing modified pasture
RA5	Open cut disturbance area (grazing modified pasture)	Open cut disturbance area including in-pit and out-of-pit waste rock emplacements and flood levee (slopes <10%)	Grazing modified pasture
RA6	Subsidence (marginal grazing native vegetation)	Grazing native vegetation subject to subsidence and some surface disturbance associated with gas	Marginal grazing native vegetation

Rehabilitation area reference	Rehabilitation area	Description	PMLU
		drainage bores and access tracks (Class 4 grazing land suitability)	
RA7	Subsidence (grazing modified pasture)	Pasture subject to subsidence and some surface disturbance associated with gas drainage bores and access tracks (Class 3 grazing land suitability)	Grazing modified pasture
RA8	Subsidence (marginal grazing modified pasture)	Pasture subject to subsidence and some surface disturbance associated with gas drainage bores and access tracks (Class 4 grazing land suitability)	Marginal grazing modified pasture
RA9	Subsidence (marginal grazing riparian native vegetation)	Grazing native vegetation on Boomerang Creek riparian zone subject to subsidence	Marginal grazing native vegetation in riparian zone

3.5.3 Rehabilitation milestone criteria and completion criteria

Rehabilitation milestones are defined as each significant event or step necessary to rehabilitate an area of land to a stable condition (section 112, EP Act). Key to assessing the success of rehabilitation is the definition of milestone criteria. Milestone criteria must be consistent with the SMART (specific, measurable, achievable, realistic and timely) principles. They should:

- be outcome-based (linked to the end land use);
- be flexible to adapt to changing circumstances;
- be able to evolve as the mine life progresses;
- include metrics suitable to demonstrate that rehabilitation is trending positively;
- undergo periodic review; and
- include a measurement approach that details how the criterion will have been met (CoA 2016, ANZMEC and MCA 2000).

A set of milestone criteria has been identified for the Project to provide a clear definition of milestone completion and successful rehabilitation for each rehabilitation area. The milestone criteria demonstrate the completion of progressive rehabilitation steps and events. The completion criteria for each PMLU will be used as the milestone criteria for the final milestone in the proposed schedule, which shows achievement of the PMLU to a stable condition at surrender. Completion criteria nominated in the Lake Vermont Rehabilitation Plan have been integrated with the Meadowbrook milestone criteria to maintain consistency in rehabilitation outcomes.

The nominated rehabilitation milestones considered relevant to the Project are outlined Table 15. It should be noted that not all rehabilitation milestones are applicable to all RAs; the applicability of rehabilitation milestones to the various RAs are also indicated in Table 15.

Rehabilitated areas will be assessed against target criteria and, where applicable, compared with analogue sites of similar characteristics and land use. The location of, and methodology for determining appropriate analogue sites is discussed in Section 3.7.1.

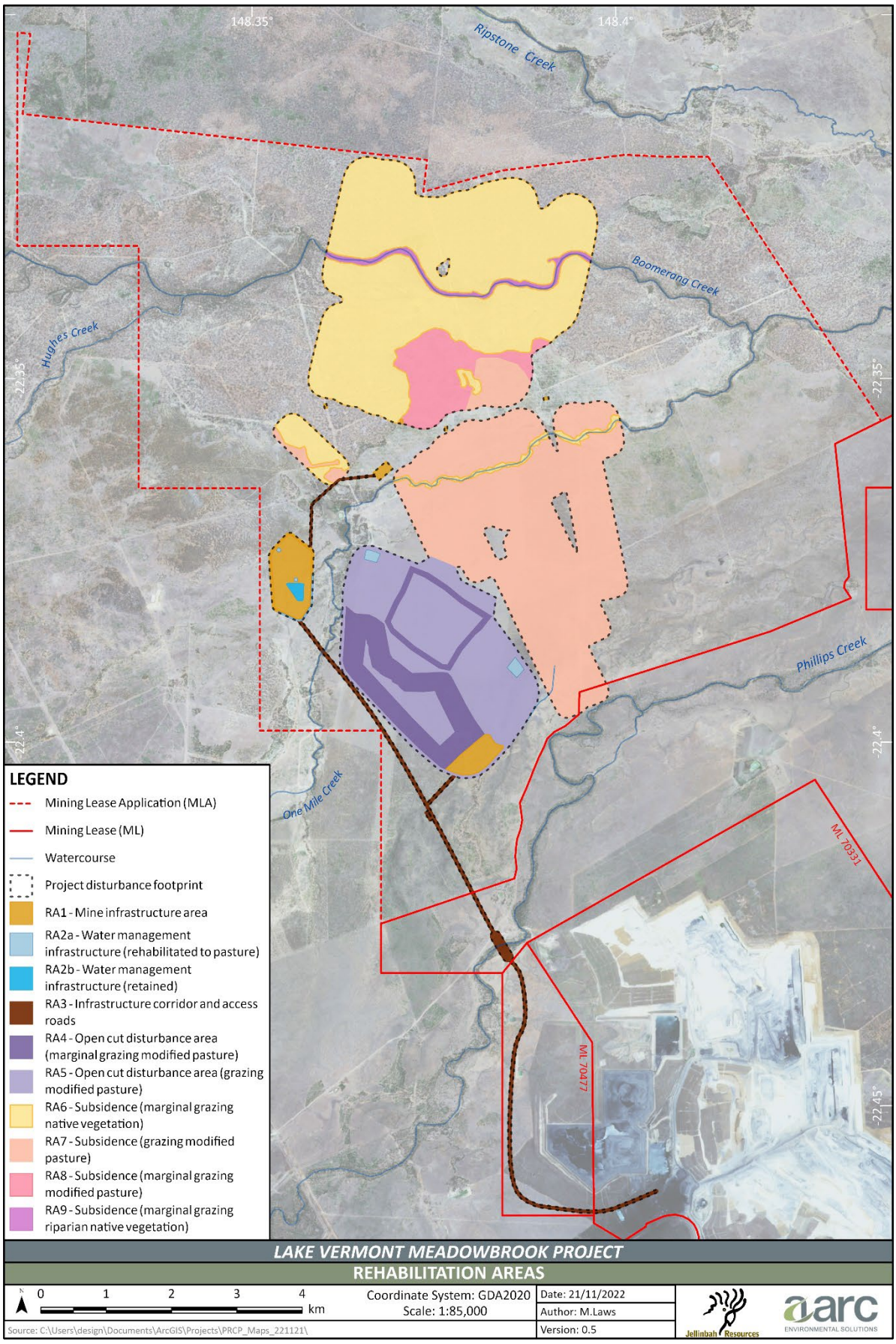

Figure 30: Project rehabilitation areas

Table 15: Rehabilitation Milestone criteria

Milestone reference	Rehabilitation milestone	Applicable RAs	Milestone criteria
RM1	Infrastructure decommissioning and removal	RA1 RA2a RA2b RA3	• All non-required services disconnected and removed. • Underground drifts portals and shaft entrances sealed. • All concrete, bitumen and gravel roads removed (where not to be retained). • All non-required operational pipelines drained and removed. • All fencing that is not part of PMLU requirements removed. • All non-required buildings and footings demolished and/or removed off-site. • All machinery and equipment removed. • All surface water drainage infrastructure that is not retained in the final landform removed. • All rubbish removed.
RM2	Management of contaminated land status	RA1 RA3	• Contaminated material either remediated in situ or removed/transported to an approved landfill for disposal and waste tracking information recorded and submitted. • Contaminated land assessment undertaken by an appropriately qualified person[1]. If required, a site investigation report including a site suitability statement prepared and submitted in accordance with the provisions of Chapter 7, Part 8 of the EP Act.
RM3	Landform development (re-profiling / re-shaping) of land affected by subsidence	RA6 RA7 RA8 RA9	• All earthworks and landform reshaping / re-profiling works completed to design specifications. • Certification provided by an appropriately qualified person[1] confirms that drainage features are constructed to design specifications. • Geotechnical assessment by an appropriately qualified person[1] confirms that long-term geotechnical stability has been achieved for all land affected by subsidence.

Milestone reference	Rehabilitation milestone	Applicable RAs	Milestone criteria
RM4	Landform development (re-profiling / re-shaping) of land affected by surface disturbance	RA1 RA2a RA4 RA5	**Landform development works** • All bulk earthworks and landform reshaping/re-profiling works have been completed to design specifications. • Certification provided by an appropriately qualified person[1] confirms that drainage features have been constructed to design specifications. • Geotechnical assessment by an appropriately qualified person[1] confirming that long-term geotechnical stability has been achieved for each relevant landform. **Landform constructed to the following design parameters, where relevant:** • Waste rock emplacement: o slopes ≤11° (20%) o uninterrupted batter length ≤70 m o stable berms or bunds (≥5 m wide) • Flood levee slopes ≤8.5° (15%). • Rehabilitated pit slopes ≤11° (20%).
RM5	Surface preparation (topdressing, contour ripping, soil amelioration)	RA1 RA2a RA4 RA5 RA6 RA7 RA8 RA9	• Prior to each rehabilitation event, soil health and suitability is assessed and documented by an appropriately qualified person[1], and a recommendation made for ameliorants to ensure sodicity, salinity, pH and fertility levels are suitable to achieve the relevant PMLU. • Records of ameliorants applied and incorporated into surface, as recommended by an appropriately qualified person[1]. • Where necessary to support revegetation activities, topsoil placed to achieve a minimum depth of 0.2 m. • Where topsoil is applied, ripping undertaken along the contour of slopes.

Milestone reference	Rehabilitation milestone	Applicable RAs	Milestone criteria
RM6	Revegetation (seeding and / or planting)	RA1 RA2a RA4 RA5 RA6 RA7 RA8 RA9	**Surface disturbance (RA1, RA2a, RA4, RA5)** • Seeding of target species and/or planting of tube stock in accordance with *Table 19: Grazing PMLU seed mix* of PRC plan. **Subsidence disturbance - pasture (RA7, RA8)** • For each area identified through monitoring in accordance with the Subsidence Management Plan as requiring revegetation, a revegetation plan has been prepared by an appropriately qualified person, with reference to *Table 19: Grazing PMLU seed mix* or *Table 20: Grazing PMLU seed mix for areas subject to intermittent ponding* of the PRC plan. • Seeding of target species and/or planting of tube stock in accordance with the applicable revegetation plan. **Subsidence disturbance – native vegetation (RA6, RA9)** • For each area identified through monitoring in accordance with the Subsidence Management Plan as requiring revegetation, a revegetation plan has been prepared by an appropriately qualified person, with reference to *Table 20: Revegetation species list for subsidence area* and/or *Table 21 Revegetation species list for subsidence areas subject to intermittent ponding* of the PRC plan. • Seeding of target species and/or planting of tube stock in accordance with the applicable revegetation plan.
RM7	Achievement of grazing modified pasture and marginal grazing modified pasture PMLUs to stable condition	RA1 RA2a RA4 RA5 RA7 RA8	• For rehabilitation areas not subject to ponding, rehabilitation polygons have a median fractional vegetation cover greater than the first quartile of reference polygons for at least 85% of all sample times, as determined using the satellite-derived fractional vegetation cover method[5] (not applicable to RA4). • In revegetated areas, ground foliage cover comprises at least 3 pasture grass and/or forb species. • No 'Severe' or 'Extreme' [6] erosion, and drainage follows appropriate paths. • Weed cover is ≤15% (excluding exotic pasture grasses).
RM8	Achievement of marginal grazing native vegetation PMLU to stable condition	RA6	• In revegetated areas, establishment of ≥50% of species within each functional group planted. • Weed cover is ≤15% (excluding exotic pasture grasses). • No 'Severe' or 'Extreme' [6] erosion and drainage follows appropriate paths. • Evidence of native fauna utilisation (i.e. fauna sightings, scats and tracks records).

Milestone reference	Rehabilitation milestone	Applicable RAs	Milestone criteria
RM9	Achievement of grazing modified pasture and marginal grazing modified pasture PMLUs to a sustainable condition	RA1 RA2a RA4 RA5 RA7 RA8	• Land suitability assessment by an appropriately qualified person[1] certifies that land has achieved a minimum post-mine land suitability[4] class of 3 (RA2a, RA5 and RA7) or class 4 (RA1, RA4 and RA8). • Weed cover is ≤10% (excluding exotic pasture grasses). • In revegetated areas, ground foliage cover comprises at least 3 pasture grass and/or forb species. • Within revegetated areas subject to periodic inundation, field-based monitoring data demonstrates that: o water quality parameters are below the trigger values for livestock drinking water defined in Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018). • No 'Severe' or 'Extreme' [6] erosion, and drainage follows appropriate paths. • A hazard and safety assessment completed by an appropriately qualified person[1] demonstrates hazards in RAs are consistent with the type and severity of hazards typical of neighbouring equivalent land use. Remaining hazards are considered to be low risk with no significant increase in risk expected over time. • Water quality from direct rainfall runoff or surface seepage from rehabilitated spoil (RA4 and RA5) has: o pH 6.5–9.0 o EC <2,000 µS/cm

Milestone reference	Rehabilitation milestone	Applicable RAs	Milestone criteria
RM10	Achievement of marginal grazing native vegetation PMLU to sustainable condition	RA6	• Land suitability assessment by an appropriately qualified person[1] certifies that land has achieved a minimum post-mine land suitability[4] class of 4. • Within areas of natural drainage, field-based monitoring data provided in the final rehabilitation report demonstrates that the following attributes are greater than 70% of the mean values of representative analogue sites: o species richness of tree, shrub and groundcover functional groups; o tree canopy cover; o shrub canopy cover; and o perennial grass cover. • Within areas subject to periodic inundation where revegetation activities have been undertaken, the final rehabilitation report demonstrates that: o species richness of tree, shrub and groundcover functional groups is greater than 70% of the mean values of baseline data; o the percentage of ground cover[2] (i.e. foliage, woody debris, litter and rock) is ≥80%; and o the percentage of ground foliage cover[3] achieves the greater than or equal to the 25th percentile of analogue site(s) AS19 and AS20. • Weed cover is ≤10% (excluding exotic pasture grasses). • Erosion classification is no worse than the erosion classifications[6] from representative analogue sites. • Hazard and Safety Assessment completed by an appropriately qualified person[1] demonstrates hazards in RAs are consistent with the type and severity of hazards typical of the adjacent equivalent land use. Remaining hazards are considered to be low risk with no significant increase in risk expected over time.
RM11	Achievement of retained infrastructure PMLU to sustainable condition	RA3	• No 'Severe' or 'Extreme' [6] erosion, and drainage follows appropriate paths. • Hazard and Safety Assessment completed by an appropriately qualified person[1] demonstrates hazards in RAs are consistent with the type and severity of hazards typical of neighbouring equivalent land use. Remaining hazards are considered to be low risk with no significant increase in risk expected over time. • Final landform survey confirms no built structures remain other than those that form part of a landholder agreement.
RM12	Achievement of water body PMLU to sustainable condition	RA2b	• All retained water storages assessed as safe and stable by appropriately qualified person[1]. • Retained water storage water quality parameters are below the trigger values for livestock drinking water defined in Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018). • Hazard and Safety Assessment completed by an appropriately qualified person[1] demonstrates hazards in RAs are consistent with the type and severity of hazards typical of neighbouring equivalent land use. Remaining hazards are considered to be low risk with no significant increase in risk expected over time.

Milestone reference	Rehabilitation milestone	Applicable RAs	Milestone criteria
RM13	Achievement of marginal grazing native riparian vegetation PMLU to stable condition	RA9	• In revegetated areas, establishment of ≥50% of species within each functional group. • Weed cover is ≤15% (excluding exotic pasture grasses). • No 'Severe' or 'Extreme'[6] erosion, and drainage follows appropriate paths. • Assessment by an appropriately qualified person confirms that creek beds and banks are trending toward a geomorphically stable condition, and recommendations for management and mitigation actions have been implemented.
RM14	Achievement of marginal grazing native riparian vegetation PMLU to sustainable condition	RA9	• Land suitability assessment by an appropriately qualified person[1] certifies that land has achieved a minimum post-mine land suitability[4] class of 4. • Weed cover is ≤10% (excluding exotic pasture grasses). • Field-based monitoring data provided in the final rehabilitation report demonstrates that the following attributes are greater than 70% of the mean values of representative analogue sites: o species richness of tree, shrub and groundcover functional groups; o tree canopy cover; o shrub canopy cover; and o perennial grass cover. • Assessment by an appropriately qualified person confirms that creek beds and banks are trending toward a geomorphically stable condition and do not require active management. • Assessment by an appropriately qualified person that streamflow impacts from subsidence do not prohibit fish passage. • Erosion classification is no worse than the erosion classifications from representative analogue sites. • Hazard and Safety Assessment completed by an appropriately qualified person[1] demonstrates hazards in RAs are consistent with the type and severity of hazards typical of the adjacent equivalent land use. Remaining hazards are considered to be low risk with no significant increase in risk expected over time.

Footnotes:

1. Appropriately qualified person means a person who has professional qualifications, training, skills or experience relevant to the nominated subject matter and can give authoritative assessment, advice and analysis on performance relating to the subject matter using the relevant protocols, standards, methods, or literature.
2. Ground cover comprises the cover of ground foliage (grasses, forbs and shrubs <1 m in height), woody debris, organic litter and rock.
3. Ground foliage cover refers to the percentage of the ground occupied by the vertical projection of ground foliage and branches (i.e. grasses, forbs and shrubs <1 m in height).
4. Department of Science, Information Technology and Innovation and Department of Natural Resources and Mines (2015) Guidelines for Agricultural Land Evaluation in Queensland (Second edition), State of Queensland or later version. <https://www.publications.qld.gov.au/dataset/qld-agricultural-land-evaluation-guidelines/resource/d6591386-08e2-453f-a6fa-dff2a756215f>
5. The method for satellite-derived fractional vegetation cover is outlined in Section 3.7.2.4.
6. Erosion classification:

Erosion classification	Minor	Moderate	Severe	Extreme
No. of rill/gully*	< 15	15–30	31–50	> 50
Average depth (cm)	< 10	10–30	30–60	> 60

**Gully: highly visible form of soil erosion, with steep-sided, incised drainage lines greater than 30 cm deep.*

3.5.4 Rehabilitation timeframes

The rehabilitation milestones must be achieved as soon as practicable after land becomes available for rehabilitation. Land is considered to become available for rehabilitation at the completion of mining, except where land is being used for operating infrastructure or topsoil stockpiles or is identified as being retained infrastructure post-closure. Justification of when land becomes available for rehabilitation is provided in Sections 3.5.8 to 3.5.11.

Rehabilitation milestone timeframes have been developed with consideration for the size of the rehabilitation area, the activities applicable to the milestone and interim rehabilitation activities that are scheduled to occur or anticipated to be required prior to the area becoming available for rehabilitation. Timeframes for milestones applicable to the subsidence zones are based on modelling estimates of the scale and location of impacts, and will ultimately rely on post-subsidence monitoring to identify areas requiring rehabilitation. Similarly, milestones that involve revegetation activities, including monitoring of revegetation, make provision for unfavourable growing seasons and unforeseen extreme events such as droughts or storms that could negatively impact vegetation establishment; requiring longer timeframes for the milestone to be achieved.

The nominated rehabilitation timeframes considered for scheduling the rehabilitation milestones are shown in Table 16.

3.5.5 General rehabilitation practice

The rehabilitation practices to be used has evolved from increasing knowledge gained from experience in the following areas:

- early rehabilitation successes and failures;
- weather, subsoils, soils, local flora and fauna and revegetation species; and
- site preparation and seeding practices.

The rehabilitation practices outlined in the following subsections should be interpreted as the general method that will be used, which may evolve and develop as knowledge is gained from further rehabilitation activities.

While rehabilitation objectives and completion criteria for the Project are detailed at sections 3.5.1 and 3.5.3, from the perspective of operational rehabilitation planning and practice, the following overarching principles are considered key:

- Ensuring that reshaped areas proposed for rehabilitation meet the required landform design principles, that prepared areas meet the rehabilitation design specification for the area, and that local site drainage has been considered and surrounding areas graded to mitigate any rainfall runoff from adjacent areas to run-on to prepared rehabilitation areas.
- Topdressing materials and final surface preparation methods have the objective of supporting vegetative growth.
- Revegetation species selection, seeding and/or planting methods, and fertiliser applications target rapid vegetative ground cover effective at mitigating soil erosion, during the period of initial revegetation when areas are most at risk.
- Ongoing monitoring is used to assess rehabilitated area performance against completion criteria and inform future rehabilitation practices; and to identify rehabilitation methodology adjustments such that RAs are proceeding along a trajectory towards the designated PMLU.

Table 16: Rehabilitation milestones timeframe justification

Rehabilitation milestones	Applicable RAs	Summary rehabilitation methodology	Associated risks	Risk level assigned	Nominated time frame (years)	Justification for assigned timeframe
RM1: Infrastructure decommissioning and removal	RA1 RA2a RA2b RA3	• Infrastructure decommissioning and disposal	• No risks were associated with infrastructure decommissioning	• NA	1	Some mine infrastructure (e.g. haul road) will be required to facilitate rehabilitation activities and will therefore not become available for rehabilitation for several years post-closure. Decommissioning activities are considered low risk, therefore decommissioning is expected to take less than 1 year.
RM2: Management of contaminated land status	RA1 RA3	• Remediation or removal of contaminated material (where applicable) • Determination of contaminated land status by appropriately qualified person	• Contaminated land	• Class II	1	A contaminated land assessment will be undertaken by an appropriately qualified person. If contaminated land is identified, remediation works will be undertaken promptly. Given the low risk classification associated with this activity, the timeframe assigned is 1 year.
RM3: Landform development (re-profiling / reshaping) of land affected by subsidence	RA6 RA7 RA8 RA9	• Drainage assessment and installation of drainage features • Earthworks and re-profiling • Geotechnical assessment of stability	• Surface cracking	• Class II	1	Monitoring and interim rehabilitation works will be undertaken prior to the land becoming available. Therefore, the timeframe assigned is less than 1 year.
			• Erosion	• Class I–II		
			• Increase in slope steepness	• Class II		
			• Ponding	• Class II		
RM4: Landform development (re-profiling / re-shaping) of land affected by surface disturbance	RA1 RA2a RA4 RA5	• Installation of drainage features • Bulk earthworks re-shaping • Final re-profiling	• Excessive slope steepness	• Class II	1	As land becomes available, all bulk earthworks and installation of drainage features will be completed to design specifications and assessed as geotechnically stable by an appropriately qualified person.
			• Erosion	• Class I–II		

Rehabilitation milestones	Applicable RAs	Summary rehabilitation methodology	Associated risks	Risk level assigned	Nominated time frame (years)	Justification for assigned timeframe
		• Geotechnical assessment of stability	• Slope failure	• Class II		The majority of the open cut area is considered to become available upon completion of the bulk earthworks associated with partially backfilling the pit. Given the size of areas becoming available at any point in time is highly variable and the need to coordinate works with climatic seasons, the timeframe assigned is a year.
RM5: Surface preparation (topdressing, contour ripping, soil amelioration)	RA1 RA2a RA4-RA9	• Surface preparation (e.g. topsoiling, contour ripping, soil amelioration activities as required)	• Surface roughness in excess of that expected for the PMLU	• Class I–II	1	Subsoil and topsoil amelioration and prompt vegetation establishment are key processes to minimise the identified risks. The timeframe assigned is 1 year.
			• Erosion	• Class I–II		
			• Insufficient density of/diversity of vegetation	• Class I		
RM6: Revegetation (seeding and / or planting)	RA1 RA2a RA4-RA9	• Revegetation with seed and / or tube stock consistent with the PMLU	• Erosion	• Class I–II	1	The seeding and / or planting of suitable target species is classified as Low Risk. The assigned timeframe of 1 year allows time for vegetation establishment.
			• Insufficient density of/diversity of vegetation	• Class I		
RM7: Achievement of grazing and marginal grazing modified pasture PMLUs to stable condition	RA1 RA2a RA4 RA5 RA7 RA8	• Vegetation monitoring; maintenance as required	• Erosion	• Class I–II	5	Achievement of target revegetation criteria is dependent on good climatic conditions and soil preparation. Allowance is made for poor growing seasons and extreme events such as droughts or storms that will negatively impact vegetation establishment, and consequent maintenance actions that may be required. Given these factors and the Low Risk classification, the timeframe assigned is 5 years.
			• Insufficient density of/diversity of vegetation	• Class I		

Rehabilitation milestones	Applicable RAs	Summary rehabilitation methodology	Associated risks	Risk level assigned	Nominated time frame (years)	Justification for assigned timeframe
RM8: Achievement of marginal grazing native vegetation PMLU to stable condition	RA6	• Vegetation monitoring	• Erosion	• Class I–II	5	Achievement of target revegetation criteria is dependant on good climatic conditions and soil preparation. Allowance is made for poor growing seasons and extreme events such as droughts or storms that could negatively impact vegetation development, and consequent maintenance actions that may be required. Given these factors and the Low Risk classification, the timeframe assigned is 5 years.
			• Insufficient density of/diversity of vegetation	• Class I		
RM9: Achievement of grazing and marginal grazing modified pasture PMLUs to sustainable condition	RA1 RA2a RA4 RA5 RA7 RA8	• Vegetation monitoring	• Erosion	• Class I–III	5	Achievement of a sustainable and non-polluting target PMLU is dependent on establishment of mature, self-sustaining vegetation demonstrated through multiple seasons of growth and evidence of successful recruitment. The timeframe of 5 years considers the time necessary for establishment of mature, self-sustaining vegetation and the various risks identified.
			• Impacts to groundwater	• Class I		
			• Impacts to surface water quality	• Class I		
			• Pests and weeds	• Class I		
			• Insufficient density/diversity of vegetation	• Class I		
RM10: Achievement of marginal grazing native vegetation PMLU to sustainable condition	RA6	• Vegetation monitoring	• Erosion	• Class I–II	15	Achievement of a sustainable and non-polluting target PMLU is dependent on establishment of mature, self-sustaining vegetation demonstrated through multiple seasons of growth and evidence of successful recruitment. The timeframe of 15 years considers the time necessary for establishment of mature, self-sustaining vegetation and the various risks identified.
			• Alteration to aquatic habitats	• Class III		
			• Pests and weeds	• Class II		
RM11: Achievement of retained infrastructure PMLU to sustainable condition	RA3	• Monitoring • Safety and geotechnical assessments	• Erosion	• Class I	1	Given the minimal active rehabilitation work required to achieve a stable condition for retained infrastructure, the timeframe assigned is 1 year.

Rehabilitation milestones	Applicable RAs	Summary rehabilitation methodology	Associated risks	Risk level assigned	Nominated time frame (years)	Justification for assigned timeframe
RM12: Achievement of water body PMLU to sustainable condition	RA2b	• Monitoring and maintenance • Safety and geotechnical assessments	• Dam failure of retained structures • Wall failure/dam, break of retained structures • Water quality in retained storages not meeting PMLU water quality parameters • Pests and weeds	• Class I	4	Allowance is made for uncertainty associated with maintenance activities, the likelihood of natural hazard events, and challenges associated with pest/weed control. The timeframe assigned is 4 years.
RM13: Achievement of marginal grazing native riparian vegetation PMLU to stable condition	RA9	• Vegetation monitoring; maintenance as required • Stream monitoring; maintenance as required	• Erosion	• Class I-II	10	Achievement of a sustainable and non-polluting target PMLU is dependent on establishment of mature, self-sustaining vegetation demonstrated through multiple seasons of growth and evidence of successful recruitment. Local incision and bank erosion is expected over the pillars between subsidence troughs. However, aggradation is expected to occur over time, given the abundant sediment supplies. The timeframe of 10 years considers the time necessary for vegetation to establish and stream beds and banks to show evidence of trending towards stabilisation.
			• Insufficient diversity/density of vegetation	• Class I		

Rehabilitation milestones	Applicable RAs	Summary rehabilitation methodology	Associated risks	Risk level assigned	Nominated time frame (years)	Justification for assigned timeframe
RM14: Achievement of marginal grazing native riparian vegetation PMLU to sustainable condition	RA9	• Vegetation monitoring; maintenance as required • Stream monitoring; maintenance as required	• Erosion • Insufficient riparian habitat • Pests and weeds	• Class II	10	Achievement of a sustainable and non-polluting target PMLU is dependent on establishment of mature, self-sustaining vegetation demonstrated through multiple seasons of growth and evidence of successful recruitment. Local incision and bank erosion is expected over the pillars between subsidence troughs. However, aggradation is expected to occur over time, given the abundant sediment supplies. The timeframe of 10 years considers the time necessary for establishment of mature, self-sustaining vegetation, and stream beds and banks to show evidence of trending towards stabilisation and no longer requiring active management.

Erosion management is a key rehabilitation consideration for the Project due to the presence of dispersive soil and waste rock material. Erosion potential will be managed through a combination of landform design to minimise slopes, soil ameliorants (see Section 3.5.5.3) and vegetation..

There will be circumstances when rehabilitation practices outside of those discussed within this PRCP are utilised. For example, discrete areas of steeper slopes, rehabilitation failures or other scenarios that may necessitate more intensive rehabilitation practices. These circumstances will be identified, assessed and rehabilitation activities planned for as required.

3.5.5.1 Hydrogeology

A three-dimensional groundwater model has been developed for the Project by SLR Consulting Australia Pty Ltd (SLR) and reported in SLR (2022). The model has been expanded over time to include other mining projects in the vicinity of the Meadowbrook and Lake Vermont North Projects, thus allowing assessment of cumulative impacts of mining operations (SLR 2022). A cross-section of the hydrogeological model is provided as Figure 31. The potential impacts to groundwater from the Project are described in the Groundwater Impact Assessment Report (JBT 2022) and summarised below.

Impacts on existing groundwater users

The groundwater model predicts potential groundwater level impacts to registered groundwater bores located outside the boundaries of MDL 429 and MDL 303.

The potential water level impacts to the Cainozoic (Quaternary and Tertiary sediment) extend to the west towards a group of registered bores owned by BHP Coal Pty Ltd, but located outside the boundaries of MDL 429 and MDL 303 but within the Meadowbrook property. The potential groundwater level impact is predicted to be less than 2 m, and it is understood that there is no concern with potential groundwater impacts at these bores by the owner.

For the consolidated groundwater units, there are no registered Rewan Group or Permian groundwater bores within the zone of predicted 5 m water level impact. One registered bore (122458) occurs relatively close to the eastern extent of drawdown. It is noted that this bore is located within land owned by Jellinbah Resources and therefore impacts have not been further assessed.

Potential impact areas exist to the east where Tertiary bore 132627 is located and to the north, where both the 2 m drawdown contour (for the Tertiary aquifer) and 5 m drawdown contour (for consolidated strata) extend into private land. A make-good agreement will potentially be required for bore 132627.

Impacts to groundwater dependent ecosystems

A groundwater dependent ecosystem assessment has been undertaken by 3D Environmental (3D Environmental, 2022) and concluded that two types of GDEs are present within the Project Area as follows:

1) Type 1 GDEs: including drainage features with developed alluvial landforms that host variable groundwater volumes and are seasonally recharged via surface flows and flooding. Type 1 GDEs include Phillips Creek, Boomerang Creek, and the Isaac River.

2) Type 2 GDEs: representing a conceptualised perched groundwater lens that lies below a mapped HES wetland (GDE Assessment Site 3). Percolation of groundwater through the alluvial soils occurs when surface water is recharged, and the infiltrating surface water is captured above an aquitard at the alluvial unconformity. Tree roots of River Red Gum and Coolibah are utilising this freshwater lens, which possibly only remains viable for several months following rainfall. The perched freshwater lens is inferred to be >6 m below the base of the wetland. Groundwater drawdown associated with development of the underground mining infrastructure and mine pit development will result in drawdown within the Tertiary aquifer, with modelling indicating >5 m of drawdown propagated beneath a 6 km long reach of Boomerang Creek. Drawdown below Phillips Creek is predicted to be of lower intensity. Drawdown in the Tertiary may result in more rapid drainage in the perched alluvial groundwater systems which characterise both

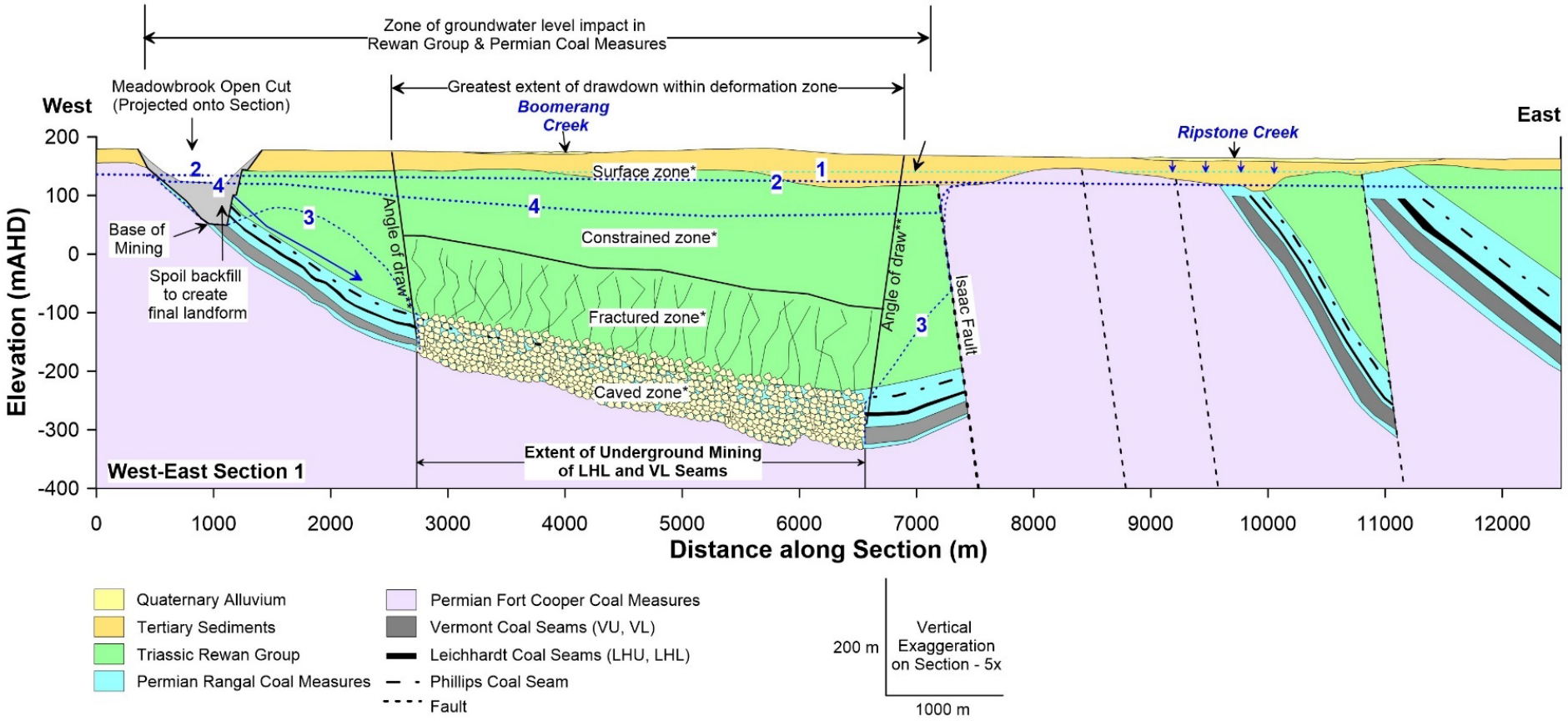

Figure 31: Hydrogeological model cross-section

Boomerang and Phillips Creek, focused o areas where drawdown intensity is greatest and where sandier alluvial soils promote increased rates of surface water percolation and drainage.

The risk of impact to GDEs occurring within the influence of the Project is assessed as 'Low' to 'Insignificant' (3D Environmental 2022) for the following reasons:

- the recharge of perched lenses sustaining GDEs is controlled by surface flows and surface water infiltration into the soil profile which will not be impacted by the Project;
- the groundwater perched in the alluvial systems is subject to natural fluctuations in volume in response to changing seasonal conditions and may dry for significant periods; and
- tree species characterising both GDE types are resilient to the possible reductions in soil moisture availability that may propagate in areas of predicted drawdown.

Impacts to groundwater quality and contaminant transport

The Groundwater Impact Assessment Report (JBT 2022) has made the following observations with respect to potential impacts on groundwater quality:

- The predicted rate of seepage from the rehabilitated pit landform is estimated to be approximately 1.8 L/s, equivalent to approximately 56 ML/year.
- The maximum salinity of water seeping from the rehabilitated pit landform is predicted to be approximately 1,000 mg/L, equivalent to an EC of approximately 1,500 µS/cm. This compares to the mean EC of the existing groundwater system of:
    - 17,518 µS/cm in the Tertiary sediments;
    - 23,197 µS/cm in the Rewan Group sediments; and
    - 29,995 µS/cm in the Permian sediments.

On balance, it is assessed that the seepage of water with an EC of approximately 1,500 µS/cm at the relatively low rate of about 1.8 L/s to a groundwater system that has a background EC of generally >17,000 µS/cm is unlikely to present a significant risk.

Cumulative impacts

A cumulative impact assessment has been undertaken as part of the groundwater modelling study for the Project (SLR 2022). The assessment included all current and known future coal mining operations, as well as the operation of the Arrow Energy CSG borefield.

Cumulative drawdown is not assessed for the Quaternary alluvium as the unit is generally dry in the Project area and the modelling report (SLR 2022) predicts little to no drawdown to alluvial groundwater units in the area, including no impacts from the Project to the Isaac River alluvium. Therefore, the units subject to the cumulative impact assessment are the Tertiary sediments, the Rewan Group, the Leichhardt Coal Seam and the Vermont Coal Seam.

Cumulative impacts on the Tertiary sediments include:

- Drawdown from Olive Downs South and Eagle Downs extend southward to coalesce with the drawdown from the Meadowbrook operation, resulting in an additional 2–10 m of drawdown beneath Boomerang Creek and an additional 2–15 m of drawdown beneath Ripstone Creek.
- Cumulative drawdown from the operations at Olive Downs South and Willunga extend beneath the Isaac River, however, none of the drawdown beneath Isaac River is attributable to the Meadowbrook Project.

Cumulative impacts to the Rewan Group include:

- The drawdown in the area south of Boomerang Creek which is attributable to the Project.

- To the north of the Meadowbrook underground mining area, the drawdown contours from Eagle Downs and Olive Downs South coalesce with the drawdown from Meadowbrook to increase the drawdown in this area by 5–50 m.
- The drawdown observed in the eastern block of the Rewan Formation which is attributable to Olive Downs South and Wilunga. The Project does not contribute to the drawdown as the Rewan Group sediments are truncated by to the east of the Project by the Isaac Fault.

Cumulative impacts to the Leichhardt Seam include:

- To the north of the Meadowbrook underground mining area, the drawdown contours from Eagle Downs and Olive Downs South coalesce with the drawdown from Meadowbrook to increase the drawdown in this area by 10–50 metres.
- The drawdown that is observed in the eastern block of Permian Coal Measures is attributable to Olive Downs South and Wilunga. The Project does not contribute to the drawdown as the Rangal Coal Measures are truncated by to the east of the Project by the Isaac Fault.

Cumulative impacts to the Vermont Seam include:

- To the north of the Meadowbrook underground mining area, the drawdown contours from Eagle Downs and Olive Downs South coalesce with the drawdown from Meadowbrook to increase the drawdown in this area by 10–50 m.
- The drawdown that is observed in the eastern block of Permian Measures is attributable to Olive Downs South and Wilunga. The Project does not contribute to the drawdown as the Rangal Coal Measures are truncated to the east of the Project by the Isaac Fault.

In summary, groundwater level drawdown contours for all assessed groundwater units at the Project site coalesce to the north of the Project site with the drawdown contours from the Olive Downs South and Eagle Downs mining areas.

3.5.5.2 Flooding

The Project area is crossed by the floodplains of Phillips Creek, Ripstone Creek, Boomerang Creek and One Mile Creek near their confluence with the Isaac River, which is located immediately to the east of the Project. Ripstone, One Mile, and Boomerang Creeks all have relatively shallow channels that experience flow breakouts even in relatively frequent floods. Through much of the Project area, the catchment boundary of One Mile Creek extends to a natural levee along the southern bank of Boomerang Creek. Minor indistinct floodplain flow paths direct runoff from the catchment boundary southeast across the proposed mining area towards One Mile Creek.

The depth of Isaac River floodplain flow is significantly greater than for local creek flooding, however, the increased flood levels do not significantly impact flood levels in the Project area. In the absence of large local creek flows, breakouts flowing overland from the Phillips Creek northern floodplain to One Mile and Boomerang Creeks are not evident in flows less than the 0.1% annual exceedance probability (AEP) event.

The flood modelling assessment undertaken by WRM (2022b) modelled flood depths, extents and velocities for 1%, 0.1% AEP and probable maximum flood (PMF) design flood events under the following post-closure conditions:

- the incorporation of the final landform of the western out-of-pit waste rock emplacement;
- removal of the flood levees around the MIA and open cut pit;
- reshaping of the footprint area of the eastern out-of-pit emplacement with a retained final landform that limits any ingress of extreme flood event waters to the rehabilitated pit area;
- removal of the MIA; and

- removal of site drainage works (with the exception of ponding mitigation measures discussed in Section 3.5.10).

Figure 32 shows the depth of local flooding under post-closure conditions for the 0.1% AEP event. Flood level impacts and mitigation measures are discussed below.

Final landform design of open cut disturbance area

During operation and the initial rehabilitation phases, the MIA and open cut pit will be protected from inundation by temporary flood levees which will locally reduce floodplain conveyance and storage. This will have the effect of locally increasing upstream flood levels, and redistributing downstream flow to the opposite floodplains until the levees are decommissioned (see Section 3.5.9.1) and the floodplain landform returned to pre-mining levels. Following the decommissioning of the flood levee around the pit, modelling shows that the 0.1% AEP flood event may just encroach onto the area proposed to have a topography lower than that existing prior to mining. Consequently, the final landform of the open cut disturbance area will be designed to mitigate the risk of inundation of the depression from floods not exceeding the 0.1% AEP flood event.

Underground mining subsidence zone

Modelling shows that flood conditions would be altered by the following mechanisms associated with underground mining subsidence:

- local reduction in flood levels but increase in the depth and extent of flooding;
- redirection of floodplain flow along subsidence panels;
- increase in floodplain storage, which has the effect of reducing downstream flood flows, levels and extents.

For the 2% AEP and greater flood events, northern Phillips Creek floodplain flow could be diverted along the subsidence panels towards One Mile Creek. This effect would be mitigated by the construction of bunds across the subsidence panels - limiting afflux in the One Mile and Boomerang Creek floodplains to 50–100 mm. The subsidence would result in a small reduction in flood levels downstream of the subsidence zone.

3.5.5.3 Soil and capping material assessment

Site clearing within the proposed footprint for the infrastructure corridor, MIA, open cut satellite pit and waste rock emplacements will generate stripped topsoil able to be used in rehabilitation works. Soil studies conducted in the Project area (NQSA 2012, AARC 2013, AARC 2021) have concluded that topsoils are suitable for use as plant growth medium for rehabilitation while some subsoils were found to be limited for rehabilitation use due to increased potential for erosion and dispersion.

Topsoils in the Project area are generally suitable for use as seed surface material or root zone material, although some topsoil was identified as having alkaline pH likely requiring fertiliser to compensate for high pH and nitrogen deficiency. Soil fertility in the Project area is generally poor to moderate with soils typically having moderate cation exchange capacity and low concentrations of several essential nutrients such as nitrate and phosphorous. Soils with alkaline pH (Booroondarra, Kirkcaldy, Knockane, Mayfair, Norwich and Parrot) are likely to require fertiliser application to compensate for a deficiency of available nitrogen caused by high pH. Prior to topsoil application and seeding in rehabilitation areas, soil nutrient status will be confirmed to identify potential limitations to revegetation success.

Soils with weak structures such as sands, loamy sands or massive structure soil (Booroondarra, Mayfair, Mayfair Sodic Variant, Moreton and Parrot) may pose an erosion risk as a result of slopes forming due to subsidence. These soils can be treated with gypsum to overcome dispersive properties.

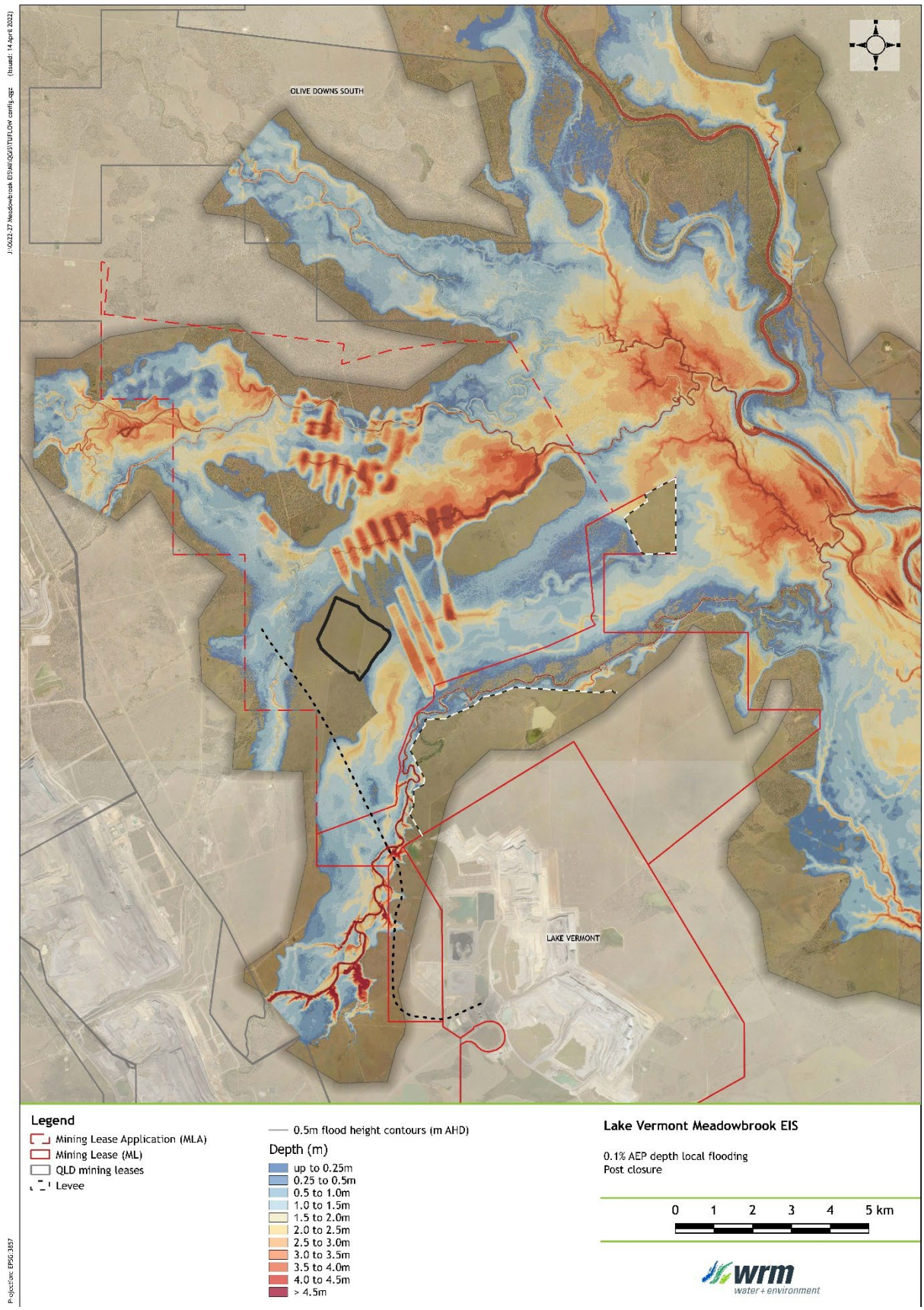

Figure 32: Flood modelling of 0.1% AEP depth of flooding under post-closure conditions

The intention of the rehabilitation plan is to reinstate the pre-mining land use, and the soil is considered to be suitable for supporting existing vegetation. However, topsoil stripping and management of stripped topsoil has the potential to impact the land suitability of rehabilitated areas. Stripped topsoil will be directly placed on rehabilitation areas where practicable, or stockpiled for use in the rehabilitation of the site. Where possible, stripped topsoil will be stockpiled to prevent mixing of different SMUs, and stockpiles will, where possible, have a maximum average height of 2 m to allow oxygen to diffuse through the stockpile, maintaining the viability of the seed and micro-organisms.

Topsoil stripping depths and amounts are presented in Table 17. The predicted topsoil amounts required for rehabilitation presented in Table 18 are based on a recommended minimum thickness of 0.2 m required to establish a growth medium conducive to plant growth. It is anticipated that all topsoil material required for rehabilitation will be sourced from the Project area.

It should be noted that it is expected that topsoil will not be required in subsidence impacted areas except those areas cleared for the construction of gas drainage wells and associated access tracks. In these areas, topsoil will be stripped and stockpiled at the site of disturbance for use in rehabilitation.

Table 17: Available topsoil resources

SMU	Topsoil Stripping Depth (m)	Area likely to be disturbed under open cut disturbance area (ha)	Area likely to be disturbed under MIA (incl. vent shafts and substation) (ha)	Area likely to be disturbed under infrastructure corridor and access roads (ha)	Total topsoil volume available (m3)
Booroondarra	0.00–0.30	0.0	0.0	10.2	**30,660**
Knockane	0.00–0.20	513.7	67.4	32.9	**1,227,980**
Mayfair	0.00–0.25	0.0	0.0	14.5	**36,250**
Moreton	0.00–0.50	0.0	0.9	0.9	**8,900**
Norwich	0.00–0.20	149.2	0.0	7.1	**312,720**
Parrot	0.00–0.60	0.2	0.0	0.4	**3,480**
Total		**663.1**	**68.3**	**66.0**	**1,619,990**

Table 18: Anticipated rehabilitation topsoil requirements

Disturbance area	Volume of topsoil required (m^3)
Mine infrastructure area (incl. vent shafts and substation)	136,600
Open cut disturbance area	1,326,200
Total material volume	**1,462,800**

3.5.5.4 Revegetation

The primary objective of the revegetation plan is to reinstate self-sustaining vegetation communities suitable for the target grazing PMLU and to maintain wildlife corridors across the Project site. The plant species have been selected with the aim of restoring grazing land and pre-existing native vegetation communities.

Growth media and ameliorants

Topsoils are generally suitable for supporting plant growth. However, some topsoils were identified as having alkaline pH and low fertility, and soils with weak structure and/or dispersive properties, namely the Mayfair Sodic Variant, Moreton, Parrot, Knockane and Norwich SMUs which are susceptible to erosion. Prior to topsoil application and seeding in rehabilitation areas, soil nutrient status will be confirmed, and fertiliser applied at recommended rates where soil nutrient status is limiting to revegetation success. Erosion-prone soils should be treated with gypsum to overcome dispersive properties. Soil ameliorants will also be utilised where necessary to bring soil pH values within the range of 5.5–9.0, the range most suitable for plant growth (Hazelton and Murphy 2016).

Surface preparation

Following land reshaping and profiling (where applicable), topsoil will be placed to achieve a minimum overall thickness of 0.2 m. Where possible, topsoil from the local SMU will be used. Ripping of the landform shall be undertaken along contours.

Areas affected by subsidence are unlikely to require significant surface preparation except where the surface has been cleared of vegetation, or altered slopes cause an increase in erosion. Where revegetation is required to meet the minimum ground cover requirements, surface preparation activities will be undertaken as necessary.

Species mix and application

To maximise revegetation success, revegetation activities will be scheduled during spring before the heavy wet season rainfall begins. Seeding may also occur during the summer months, depending on rainfall. Seeds will be sown using direct seeding or tube stock depending on the species, slope gradients and areas to be revegetated.

Grazing pasture

Grazing areas will be evenly seeded with pasture grass species at the rates indicated in Table 19. Where dieback of vegetation impacts due to subsidence are identified, these areas will be infill planted with pasture species better suited to the changed conditions (see Table 20). These seed mixes are indicative only and are subject to change due to seasonal availability, and/or experience from previous rehabilitation performance. All species listed suit the central highlands climate and site-specific environmental conditions. In addition to pasture species, seeds of native overstory trees such as Acacia spp. and Eucalypts will be sown to provide shade for livestock.

Table 19: Grazing PMLU seed mix

Scientific name	Common name	Minimum application rate (kg/ha)
Cassia rotundifolia	Wynn Cassia	2
Cenchrus ciliaris	Gayndah Buffel	5
Chloris gayana	Katembora Rhodes	4
Echinochloa frumentacea	Japanese Millet	4
Machroptilium atropurpureum	Siratro	3
Stylosanthes scabra	Seca Stylo	2
Total		**20**

Table 20: Grazing PMLU seed mix for subsidence areas subject to intermittent ponding

Scientific name	Common name	Minimum application rate (kg/ha)
Dicanthium aristatum	Bluegrass	6
Echinochloa frumentacea	Japanese Millet	3
Echinochloa turneriana	Channel Millet	5
Panicum coloratum var. *makarikariense*	Bambatsi	6
Total		**20**

Native vegetation

Large-scale revegetation of areas impacted by subsidence is not expected to be required (see Section 3.5.10.2); for any localised areas requiring supplementary planting of native vegetation, native species will be either direct seeded or planted from tube stock. When sourcing native seed stock, the use of local provenance native seed will be prioritised, being better adapted to the edaphoclimatic conditions.

The rehabilitation outcome for areas of native vegetation is to reinstate, as far as practicable, the vegetation communities existing pre-mining. Consequently, species lists have been developed based on vegetation surveys conducted on-site, rather than Regional Ecosystem technical descriptions. Where vegetation impacts due to subsidence is identified, these areas will be infill planted to replace lost species with comparable flora species to maintain ecosystem structure and function, and to stabilise soil and minimise erosion. Where vegetation impacts occur due to ponding, these areas will be revegetated with species better adapted to the changed hydrological conditions.

For the purposes of defining target revegetation species lists for each regional ecosystem, revegetation zones have been established based on the species composition of floristically similar vegetation communities across subsidence impacted areas (see Figure 33). Species lists have been developed for the vegetation communities that will potentially be impacted by subsidence and are based on vegetation community mapping undertaken at the Project site (see Table 21). To develop the species list, the dominant species of each stratum were selected from the species lists compiled from the baseline vegetation surveys undertaken on-site (AARC 2022a). A species list has also been developed for subsidence zones subject to intermittent ponding (discussed further in Section 3.5.10.3) and is shown in Table 22. These species lists are provisional, and subject to change based on species suitability and availability and as new information becomes available from rehabilitation monitoring and research.

Areas requiring revegetation will be identified through monitoring undertaken through the Subsidence Management Plan. A revegetation plan will be developed for each impacted area, including the location of each area to be revegetated and the proportion of each species to be seeded/planted in any given area. The latter aspect is to be based on the species richness, woody stem count and groundcover density of comparable analogue site/s; the baseline data for which will be collected from the analogue sites prior to RA6 and RA9 requiring revegetation per the rehabilitation milestone schedule (2039 and 2054 respectively).

Milestone criteria (RM10 and RM14) have been developed to assess the rehabilitation of native vegetation areas impacted by subsidence to a state comparable with analogue sites of the same regional ecosystem. The milestone criteria were developed with reference to the *BioCondition Assessment Framework* (Eyre *et al.* 2015), specifically measuring species richness, canopy cover, groundcover and weed cover. Analogue sites will be monitored at least every five years to collect data with which to compare vegetation and erosion performance of rehabilitated areas.

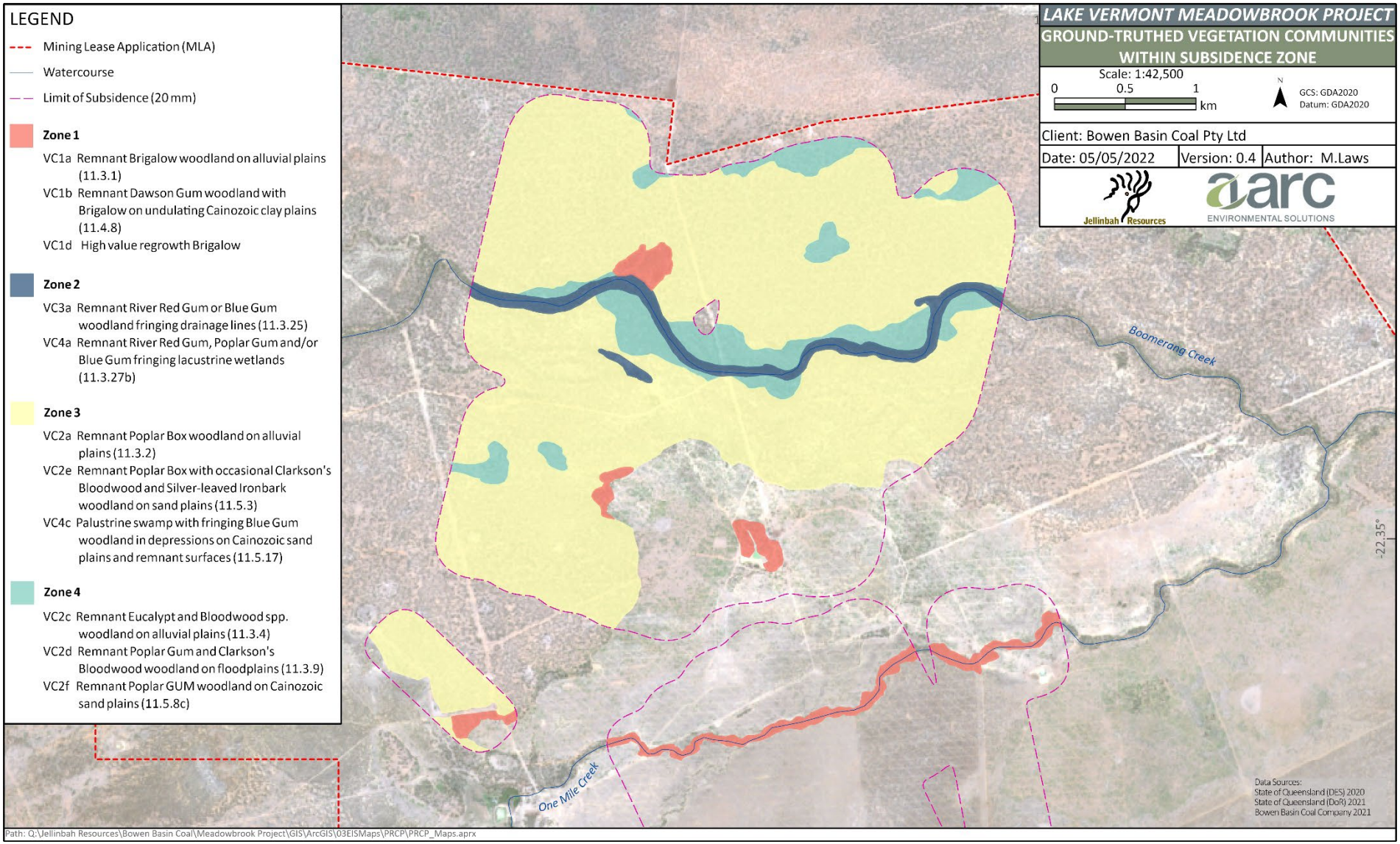

Figure 33: Ground-truthed vegetation communities potentially impacted by subsidence

Table 21: Revegetation species list for subsidence area

Scientific name	Common name	Rehabilitation Zone			
		Zone 1 (VC 1a, VC 1b and 1d)	Zone 2 (VC 3a and 4a)	Zone 3 (VC 2a, 2e and 4c)	Zone 4 (VC 2f and 2c)
Grasses and forbs					
Aristida latifolia	Feathertop Wiregrass	X	X		
Sporobolus australasicus	Australian Dropseed	X			
Alternanthera nodiflora	Common Joyweed	X			
Lomandra longifolia	*Longleaf Matrush*		X		
Aristida calycina	Dark Wiregrass			X	
Melhania oblongifolia	Velvet Hibiscus			X	
Enteropogon ramosus	Curly Windmill Grass			X	
Heteropogon contortus	Black Speargrass				X
Ecinochloa turneriana	Channel Millet				X
Urochloa mosambicensis	Sabi Grass				X
Shrubs					
Cassia brewsteri	Brewster's Cassia		X		X
Ficus coronata	Creek Sandpaper Fig		X		
Grewia retusifolia	-		X		X
Carissa ovata	Currant Bush			X	
Acacia salicina	Sally Wattle			X	
Grewia latifolia	-			X	
Trees					
Acacia harpophylla	Brigalow	X			
Acacia salicina	Sally Wattle	X			
Bauhinia carronii	Ebony Tree	X			X
Eucalyptus cambageana	Dawson Gum	X			
Eucalyptus coolabah	Coolibah	X			
Eucalyptus tereticornis	Queensland Blue Gum		X		X
Eucalyptus camaldulensis	River Red Gum		X		
Melaleuca leucadendra	Broad Leafed Tea-tree		X		

Scientific name	Common name	Rehabilitation Zone			
		Zone 1 (VC 1a, VC 1b and 1d)	Zone 2 (VC 3a and 4a)	Zone 3 (VC 2a, 2e and 4c)	Zone 4 (VC 2f and 2c)
Eucalyptus populnea	Poplar Box			X	
Corymbia clarksoniana	Clarkson's Bloodwood			X	X
Eucalyptus melanophloia	Silver-leaved Ironbark			X	
Corymbia tessellaris	Moreton Bay Ash				X
Eucalyptus platyphylla	Poplar Gum				X

Table 22: Revegetation species list for subsidence areas subject to intermittent ponding

Scientific name	Common name	Native Wetland indicator species
Grasses and forbs		
Cyperus difformis	Dirty Dora	Y
Cyperus exaltatus	Tall Flatsedge	Y
Cyperus gracilis	Slender Sedge	Y
Echinochloa turneriana	Channel Millet	Y
Juncus aridicola	Tussock Rush	Y
Juncus usitatus	Rush	Y
Lomandra longifolia	Longleaf Matrush	Y
Shrubs		
Sida rohlenae	Shrub Sida	Y
Acacia salicina	Sally Wattle	Y
Melaleuca nervosa	Paperbark Tea-tree	Y
Trees		
Melaleuca leucadendra	Broad-leaved Tea-tree	Y
Acacia harpophylla	Brigalow	Y
Eucalyptus platyphylla	Poplar Gum	Y
Lophostemon suaveolens	Swamp Box	Y
Corymbia clarksoniana	Clarksons Bloodwood	Y
Corymbia tessellaris	Moreton Bay Ash	Y

3.5.5.5 Waste characterisation

A geochemical assessment of waste rock materials assessed overburden, interburden, roof, floor and parting materials at the Project site (RGS 2021). The median content of sulphur from the analysis of Project material was 0.01%, being lower than the background median crustal abundance in unmineralised soils (of 0.07% sulphur). Materials containing less than 0.1% sulphur are generally considered to be barren of sulphur. Sulphur is a central element within waste characterisation, with the oxidation of sulphidic mine wastes (such as waste rock and coal reject material) presenting a risk of releasing acid mine drainage (also known as acid rock drainage) to the receiving environment. The majority of sulphur present in the Project material analysed was also in non-sulphide form, therefore having negligible capacity to generate acidity.

Waste rock materials analysed have excess acid neutralising capacity and are classified as NAF with a negative median net acid producing potential value of -41.2 kg H_2SO_4/t (sulphuric acid per tonne). Waste rock is expected to generate slightly alkaline to alkaline and low salinity runoff or seepage and have low salinity characteristics. Metal or metalloid concentrations of Project waste rock is not enriched relative to guideline values or median values for unmineralised soils. Metals and metalloids have low solubility at the pH of leachate expected from bulk NAF waste rock and dissolved metal concentrations in surface runoff are expected to be low and unlikely to pose significant risk to the quality of surface and groundwater resources. Interburden and overburden materials are sodic and may be susceptible to dispersion and erosion.

Given that waste rock materials are NAF and therefore pose negligible risk of acid mine drainage, no specific mitigation measures are required to support the PMLU proposed for the rehabilitated in-pit and out-of-pit waste rock emplacement areas. However, the monitoring network may be expanded to monitor seepage impacts from waste rock storage areas on receptors such as creeks. The dispersive characteristics of the interburden and overburden materials may be improved with the addition of gypsum where required, a cover of topsoil spread to the recommended depth and revegetation to further stabilise slopes.

Coal processing and tailings management is proposed to occur at the existing Lake Vermont Mine and handled as per current processing procedures. The results of geochemical test work on potential coal reject materials indicate that materials will be NAF, slightly alkaline to alkaline, have a relatively low level of salinity, and have no significant metal/metalloid enrichment (RGS 2021). This is consistent with the characteristics of coal reject material at the existing Lake Vermont Mine. There is sufficient space to accommodate waste materials associated with coal processing in existing facilities. Rehabilitation of areas at the Lake Vermont Mine containing waste materials from the Project will be undertaken in accordance with existing rehabilitation practices.

3.5.5.6 Cover design

The geochemical characterisation of waste rock material demonstrates that there is negligible risk of acid mine drainage or saline mine drainage from rehabilitated landforms containing waste rock material. Consequently, a low permeability cover system is not required to successfully rehabilitate waste rock materials to create a safe, stable and non-polluting landform. Where waste rock is susceptible to dispersion and erosion, a suitable growth medium that facilitates vegetation establishment and growth is required to minimise the erosion risk.

The open cut satellite pit and waste rock emplacements are located in areas with subsoils that have dispersive, alkaline and saline properties and are therefore considered unsuitable for use as growing medium. Where subsoil is stripped for the open cut satellite pit, it will be stockpiled for use in rehabilitating the in-pit waste rock emplacements. Gypsum may be added to mitigate dispersive properties. Waste rock will be covered with a layer of topsoil approximately 0.2 m thick to provide growing medium for vegetation, which is expected to stabilise the landform surface.

Surface water runoff from rehabilitated waste rock emplacements will be monitored as described in section 3.7.2.8 to enable the detection of potential acid or saline mine drainage impacts to water quality.

3.5.6 Final landform design

The final landform design and the sequencing of landform development (and hence the resultant rehabilitation milestone schedule) are influenced by the nature of the mining practices proposed, including the use of

existing infrastructure at Lake Vermont Mine, and the proposed mine progression. The final landform has also been designed with consideration for the pre-mining landscape, proposed PMLU and post-mining visual amenity. The final landform design was determined from:

- analysis of the existing topography of undisturbed areas;
- subsidence prediction modelling;
- flood modelling;
- in-pit and out-of-pit waste rock emplacement planning;
- landform shaping and rehabilitation post-mining.

Landform design principles and rehabilitation methods for each of the key mine RAs are discussed in Sections 3.5.8 to 3.5.11.

Predicted stability of the final landform design

The final landform is expected to be stable and suitable for the proposed PMLU of low intensity cattle grazing on the basis that the slopes of rehabilitated land will generally be ≥8.5° (15%) and erosional stability will be maintained by a progressive vegetative cover.

Previous studies conducted in central Queensland have investigated the percentage groundcover required to minimise erosion on slopes. Erosion risk on rehabilitated landforms is greatest during the establishment phase, especially on steeper gradients. The greatest erosional risk is typically observed when >50% of the surface is exposed to rainfall and overland flow. In a study conducted on three open cut coal mines in central Queensland, Carroll, Merton and Burger (2000) found that erosion rates declined rapidly on slopes when vegetation cover was >50%, with erosion rates reduced to negligible levels by Year 6, even on steeper slopes. A literature review of erosion research conducted in the Fitzroy Basin region of Queensland (Carroll *et al.* 2010) also concluded that foliage surface cover of 40–60% reduces erosion to <0.5 t/ha, regardless of slope. Similarly, Loch *et al*. (2000) found that approximately 50% foliage groundcover was sufficient to limit erosion rates to >0.5 t/ha on <15% slopes, for slopes up to 70 m long.

In areas proposed for PMLU of grazing modified pasture, the target percentage vegetation ground foliage cover (≥50th percentile of that of representative analogue sites [with similar landform parameters]) is considered sufficient to provide long-term surface stability to rehabilitated landforms. As this level of cover is expected to take 1–3 years, additional erosion control methods will be implemented as necessary until the target cover has been achieved. Rehabilitation performance at the Lake Vermont Mine has demonstrated that these levels of vegetative cover can be achieved.

Method of construction

The final landform will be shaped to support the PMLU of grazing. The specific methods of construction are described in Sections 3.5.8 to 3.5.11.

Quality assurance / quality control

Quality assurance and quality control activities are included at various stages of the rehabilitation process. These typically include:

- ground survey control of authorised disturbance footprints, waste rock emplacement footprints and elevations, and the locations of water management system components;
- sampling and analysis of placed topsoil for agronomic; and
- requirements for seed certification.

Rehabilitation activities will be carried out in accordance with the applicable methods described in this document and records maintained to demonstrate achievement of rehabilitation milestones. The Monitoring

and Maintenance Program (Appendix E) has been developed to ensure that rehabilitation progresses towards achievement of milestone criteria and ultimately relinquishment. Regular rehabilitation monitoring will allow for timely identification of the need for corrective action or maintenance work, and changes to the rehabilitation strategy based on past rehabilitation successes and failures, and as new information becomes available. Notably, reviews of subsidence predictions will be conducted as any new geological/geotechnical data becomes available, and subsidence monitoring will be undertaken both pre- and post-subsidence to assess and validate subsidence predictions. This review process will be implemented through the Subsidence Management Plan.

Methodology to verify predicted success of final landform design

The rehabilitation methodologies described in this PRCP are closely modelled on those currently employed at the Lake Vermont Mine where approximately 213 ha of rehabilitation has been completed; demonstrating the effectiveness of the methodology and landform design. Regardless, rehabilitation strategies will be continually refined as the outcomes of earlier rehabilitation events are monitored and evaluated.

Limitations and assumptions of landform design

The only limitations identified with respect to final landform design are associated with the subsidence prediction modelling. The Surface Deformation Prediction System methodology used to model subsidence can only predict the overall or systematic deformations (Gordon Geotechniques 2022). All subsidence surveys reveal small scale variations from the smooth profile predicted by this method. These deformations can be related to localised movements of blocky rock that is a feature of all coal mine overburdens. Based on the available data for the Meadowbrook longwall mining area, there are no localised features or variations in the geology, geotechnical conditions or surface topography that are considered likely to result in any significant deviations from the modelled subsidence predictions.

3.5.7 Tailings storage facilities

ROM coal will be transferred to Lake Vermont Mine for processing, and tailings will be managed on-site at Lake Vermont Mine. Rehabilitation of areas at the Lake Vermont Mine containing waste materials from the Project will be undertaken in accordance with existing rehabilitation practices and the Lake Vermont PRCP.

3.5.8 In-pit and out-of-pit waste rock emplacements

Spoil produced by the excavation of the open cut satellite pit will be placed in two out-of-pit waste rock emplacements adjacent to the pit, and in-pit as operations progress. Mining of the open cut satellite pit will commence initially in the south, and subsequently the north extremities of the defined mining area and progress toward the centre. Excavated waste rock will initially be placed in the southern end of the western out-of-pit waste rock emplacement area with dumping progressing to the northwest. Waste rock will also be placed as fill in the pit behind the advancing mining operations. A temporary out-of-pit waste rock emplacement area will be established to the east of the pit. Material from the out-of-pit waste rock emplacements will be used to partially backfill the remaining pit at the completion of mining, reducing the footprint of the residual western out-of-pit waste rock emplacement and returning the pit area to a landform that is commensurate with the PMLU of grazing. Consequently, the final landform of the partially backfilled pit (referred to hereafter as the in-pit waste rock emplacement) will be relatively flat in the northwest and southeast with a localised, central depression.

Sections of the open cut disturbance area will become available for rehabilitation progressively; the southeast and northwest extremities of the in-pit waste rock emplacement, and southern batters of the western out-of-pit waste rock emplacement becoming available prior to the completion of the open cut operation. Active mining of the open cut pit is scheduled for completion in 2055, with a further seven years required to partially backfill the pit with waste rock from the eastern and western out-of-pit waste rock emplacements. The remainder of the open cut disturbance area is then considered to become available for rehabilitation, with the exception of a portion of the southeast in-pit waste rock emplacement. This area will be used for topsoil stockpiling and retention of the flood levee until the final landform is constructed.

Survey control will be utilised to manage the development of waste rock emplacements and bulk pushing of waste rock to the final design slopes. Final slopes will be assessed by a geotechnical engineer to confirm that the final landform is stable. The final landform of the open cut disturbance area will be designed to mitigate the risk of inundation of the depression from floods not exceeding the 0.1% AEP flood event.

The in-pit and out-of-pit waste rock emplacements will be revegetated in accordance with the methods described in Section 3.5.5.4 to achieve a PMLU of low intensity grazing (Class 3) in areas where slopes are less than 5.7° (10%), and marginal grazing (Class 4) on slopes greater than 5.7° (10%).

3.5.8.1 Out-of-pit waste rock emplacements

The western out-of-pit waste rock emplacement will be progressively rehabilitated, with the southern section becoming available for rehabilitation several years before completion of the open cut operation. The batter slopes will be designed to have:

- A maximum slope angle of 11° (20%) and typically less than 8.5° (15%);
- a maximum of 70 m uninterrupted batter length; and
- stable berms or bunds (minimum 5 m wide) incorporated into final landforms where necessary to manage the flow of water down the slope.

This rehabilitation technique has been successfully employed at the Lake Vermont Mine for several years. A geotechnical assessment will be undertaken to confirm the long-term geotechnical stability of all slopes associated with the out-of-pit-waste rock emplacement.

Where practicable, concentration of surface water ponding and runoff will be minimised in the rehabilitated landform. In some cases, water may need to be redirected from the top of the waste rock emplacement via sufficiently sized drainage channels. Such channels act to direct concentrated surface runoff, while minimising the potential for erosion. Similar drainage processes can be observed in natural landforms, where exposed rock drainages are formed on steeper hills and outcrops. A small area of the eastern waste rock emplacement overlies the underground mining subsidence zone. Consequently, this area will be subject to subsidence impacts several years prior to surface disturbance associated with the open cut mining operation. This area will be monitored and, where necessary, undergo interim rehabilitation consistent with the rehabilitation methods discussed in Section 3.5.10.3. Following the completion of open cut mining, the rehabilitation sequence proper will commence. The final landform of the eastern waste rock emplacement will have maximum slopes of 1.2° (2%), blending with the surrounding topography.

3.5.8.2 In-pit waste rock emplacement

The final landform of the in-pit waste rock emplacement has been designed to reinstate the pre-mining land use of grazing and to locate the rehabilitated pit outside of the floodplain. The area accommodating the south-east in-pit waste rock emplacement will be formed to mitigate the risk of inundation of the depression from floods not exceeding the 0.1% AEP flood event. The north-west and south-east landform of the in-pit waste rock emplacement will have maximum slopes of 1.2° (2%), blending with the surrounding land, while the regraded batter slopes of the rehabilitated pit will be approximately 8.5° (15%), with a small area to the west with slopes of approximately 11° (20%). Slopes of these angles are well within those documented as utilised by cattle (Mueggler 1965).

A geotechnical assessment will be undertaken to confirm the long-term geotechnical stability of all slopes associated with the in-pit-waste rock emplacement. Table 23 outlines the key landform design criteria of the rehabilitated pit landform.

Table 23: Rehabilitated pit design criteria

Parameter	Value
Projected area (ha)	130
Maximum batter slope angle (°)	11

Interburden and overburden materials that will be used to partially backfill the pit are strongly sodic and may be prone to dispersion and erosion (RGS 2021). Therefore, while waste rock materials are generally amenable to revegetation, as part of rehabilitation activities, gypsum, fertiliser, organic matter and rock mulch may be required to limit dispersion and erosion and to support plant growth. The batter slopes and rehabilitated pit floor will be revegetated with pasture species to further minimise erosion risk. Percentage foliage groundcover of >50% provides adequate protection against erosion (Carroll *et al.* 2010), however, as this level of cover is expected to take 1–3 years to establish, additional erosion control methods will be implemented as necessary until the target cover has been achieved. Rehabilitation performance at the Lake Vermont Mine has demonstrated that these levels of vegetative cover can be achieved.

Hydrology

The design of the final landform is premised on achieving a final elevation above the anticipated recovered groundwater level. A water balance model has been developed to assess the behaviour of the rehabilitated pit landform under various climate scenarios (WRM 2022e). Runoff from the surrounding out-of-pit emplacement areas post-closure will be directed away from the central pit area, to limit the catchment area flowing into the depression to principally that of the depression itself; an area of approximately 175 ha. As a consequence, it is anticipated that a shallow intermittent water body will occur within the depressed landform, with its existence dependent upon antecedent rainfall and related climate conditions. Water depths are expected to fluctuate within a 1.2 m range above the floor level, well below the overflow level of the rehabilitated pit landform.

The water balance model outcomes indicate that water quality will not accumulate salts over time given losses to groundwater and that water quality will meet stock water quality guidelines, thereby being compatible with the PMLU.

Groundwater modelling (JBT 2022) predicts that groundwater levels will be temporarily reduced in the Project area during underground and open cut mining operations, and will take up 250 years for the local groundwater levels to return to pre-mining levels in the vicinity of the underground operations, but at a more rapid rate beneath the open cut area.

In summary, the rehabilitated pit will be subject to intermittent periods of ponding and will therefore be limited to land suitability Class 3 (wetness limitation), however, the rehabilitated pit is not expected to be a permanent water body.

Water quality

The geochemical assessment of waste rock materials (RGS 2021) found that surface runoff and seepage from NAF mining waste materials are likely to be slightly alkaline to alkaline in pH and have a low EC value indicating low salinity levels (and low concentrations of dissolved solids). Surface runoff and seepage from mining waste materials is likely to be towards the upper end of the range (pH 6–9) recommended for 95% species protection in freshwater aquatic ecosystems as set out in Australian Water Quality Guidelines (AWQG) (ANZG 2018).

The major ion concentrations in leachate from mining waste materials are relatively low and dominated by sodium, chloride, sulphate and bicarbonate. Lower concentrations of other major ions are also likely to be present in leachate from the materials. The sulphate concentration in leachate from all mining waste samples is well below the applied AWQG (ANZG 2018) livestock water quality guideline criterion (1,000 mg/L).

Static water extract tests suggest that some dissolved metal/metalloid concentrations (e.g. aluminium and arsenic) may be elevated compared to the applied guideline values for 95% species protection in freshwater

aquatic ecosystems (at 0.055 and 0.024 mg/L respectively) but are well within applied livestock drinking water quality guideline levels (ANZG 2018).

It is therefore expected that the potential risk to the quality of surface water and groundwater resources from surface water and groundwater in contact with mining waste materials at the Project will be relatively low.

The salinity of the rehabilitated pit landform has been simulated under high and low salinity runoff scenarios (WRM 2022e) to estimate water salinity within the final pit landform. Catchment runoff and groundwater inflows provide sources of dissolved salts, but these are balanced by seepage outflows into the waste rock used to backfill the pit. The rehabilitation of the pit includes regrading, topsoiling and revegetation with pasture species, with subsequent improvement of surface water runoff quality. Leaching of salts from the root zone is expected to result in runoff salinities reducing to background levels. The modelled high and low runoff salinity is summarised in Table 24. As the rehabilitated pit landform would be relatively shallow, with large fluctuations in water volume, the salinity would also fluctuate significantly due to concentration with evaporation. While salinity is expected to increase over time, the maximum total dissolved salts (TDS) values remain well below the 'low risk' trigger value (4,000 mg/L) of the applied livestock drinking water quality guideline (ANZG 2018).

Table 24: Modelled median salinity measured as TDS – low and high runoff salinity scenarios

Timeline	TDS (mg/L) under low-salinity scenario			TDS (mg/L) under high salinity scenario		
	Minimum	**Median**	**Maximum**	**Minimum**	**Median**	**Maximum**
Long term (>200 years)	144	270	552	249	465	950

Water quality in the various sediment dams at the existing Lake Vermont Mine has been monitored for several years with water stored in these dams immediately following rainfall being representative of the quality of runoff from areas not disturbed by mining activities. Typical values of EC at these times have been around 225 µS/cm, which is equivalent to TDS of approximately 145 mg/L.

3.5.9 Water management

The water management system has been designed to minimise environmental impacts on the receiving environment, as well as provide runoff containment and to supply the water demands of the Project.

The site water management system separates water into the following segregated management systems:

- containment of mine affected water in dedicated storages;
- capture and treatment of disturbed runoff in sediment basins and other sediment control infrastructure;
- drainage diversions of clean catchment runoff around mine infrastructure and other disturbed land; and
- protection and mitigation of flood flows by the construction of flood protection levees.

For the purposes of the milestone schedule, water storages have been split into two sub-rehabilitation areas, namely dams and diversion drains that will be rehabilitated to pasture (RA2a – Water management infrastructure [rehabilitated]) and dams retained at closure as a water body for stock watering and native ecosystem (RA2b – Water management infrastructure [retained]). The flood levees are also discussed below, but for the purposes of the rehabilitation schedule are included in RA1 – Mine infrastructure area.

3.5.9.1 Water storages

The Project proposes to operate a water management system based on separation of the 'clean water' catchment from the 'dirty water' catchment. Mine affected waters are captured in designated storages and reused within the mine. Rainfall runoff from disturbed areas which is expected to contain sediment and

dissolved solids is captured by sediment dams. The proposed water management system is described in detail in the Site Water Balance and Water Management Report (WRM 2022d).

The mine affected water system will manage the runoff and groundwater inflows from the underground workings, open cut pit, ROM stockpile and MIA. Water accumulating in the underground workings and in in-pit sumps in the open cut pit will be pumped to the Dewatering Dam, a turkey's nest style dam located in the MIA. Runoff from disturbed areas within the MIA will be contained within the levee system and directed to the Mine Infrastructure Area Dam (MIA Dam) also located within the MIA. In detailed design, the site drainage system may be configured to minimise the area captured and to direct clean runoff from undisturbed parts of the MIA away from the MIA Dam.

The Dewatering Dam will be operated to avoid any overflows, however, emergency overflows via the spillway would be captured in the Infrastructure Area Dam. The mine affected water system is a closed system designed to prevent release of mine affected water to the environment and will be utilised during both underground and open cut operations phases. Once no longer required, the Dewatering Dam will be dewatered, sediment will be removed and placed in-pit, the lining will be removed and disposed of in accordance with the Waste Management Plan and the bunds will be removed to flatten the profile. The area will then be topsoiled and revegetated in accordance with the methods described in Section 3.5.5.4.

The MIA Dam is proposed to be retained at closure as a stock watering dam. Once no longer required, sediment will be tested against the toxicant default guideline values for sediment quality (ANZG 2018) and removed if above the default values. Water quality will be tested against the Release Contaminant Trigger Levels and Receiving Waters Contaminant Trigger Levels specified in the EA and the trigger values for livestock drinking water defined in Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018). If water quality parameters are above the low risk trigger values, water will be treated to an acceptable level.

A Raw Water Dam located within the MIA will receive untreated water from the Lake Vermont Mine via a raw water supply pipeline constructed within the infrastructure corridor. This dam will temporarily store raw water for use where relatively high-quality water is required, for example, within the underground operations, in equipment requiring clean water for cooling, and feed water for the potable water treatment plant. The Raw Water Dam will be utilised during the underground and open cut operations. Once no longer required, the Raw Water Dam will be dewatered, sediment will be removed and placed in-pit and the bunds removed to flatten the profile. The area will then be topsoiled and revegetated in accordance with the methods described in Section 3.5.5.4.

A series of sediment dams will capture runoff from the waste rock emplacements during the open cut operation. As overburden runoff is expected to be relatively benign, the sediment dams could potentially discharge directly into the environment with minimal impact to downstream water quality. However, the stored water will be returned to the MIA Dam for blending with mine affected water before reuse during operations. A perimeter drain will divert runoff from the north-eastern waste rock emplacement into the sediment dams during operations.

The North Sediment Dam 1 will be constructed by pre-excavating overburden material near the northern corner of the open cut pit levee and will be in use until 2052 when the open cut operation progresses to the north and the northern end of the pit, including the North Sediment Dam 1, is excavated as part of mining operations. The South Sediment Dam and North Sediment Dam 2 will be formed into localised depressions in the southern and northern extremities of the in-pit waste rock emplacement areas in 2052 and 2054 respectively. Once no longer required, the sediment dams will be dewatered and reprofiled to be compatible with the surrounding landform. The area will then be topsoiled and revegetated in accordance with the methods described in Section 3.5.5.4.

Key parameters of water storages that comprise the water management system are detailed in Table 25. Figure 34 provides a schematic of the water management system for the Project. Water management infrastructure locations are shown in Figure 35.

Table 25: Project water storages (WRM 2022a)

Water storage	Storage type	Volume (ML)	Description	Regulated structure	Retained at closure
Raw Water Dam	Raw water	20	Receives raw water from the Lake Vermont Mine via the raw water pipeline.	No	No
Dewatering Dam	Mine affected water	20	Receives water from the underground and open cut mining operations.	No	No
MIA Dam	Mine affected water	440	Receives water from disturbed areas within the MIA, including runoff from the ROM stockpile, laydown areas and workshop areas.	No	Yes
Northern Sediment Dam 1	Sediment dam	650	Captures runoff from waste rock emplacements. Sediment dams will be designed and operated in accordance with the *Guideline – Stormwater and environmentally relevant activities* (DEHP 2017).	No	No
Northern Sediment Dam 2	Sediment dam	420		No	No
Southern Sediment Dam	Sediment dam	500		No	No

3.5.9.2 Flood levees and diversion drains

Two temporary flood levees are proposed for the Project to protect the open cut satellite pit and the MIA from flood water ingress in the 0.1% AEP design flood event during the operational and initial rehabilitation stages. The flood levees will be regulated structures and will be designed, constructed and decommissioned in accordance with the 'Manual for assessing consequence categories and hydraulic performance of structures' (ESR/2016/1933; DES 2016) and 'Structures which are dams or levees constructed as part of environmentally relevant activities' (ESR/2016/1934; DES 2022).

The flood levee around the open cut will be progressively reprofiled in conjunction with the adjacent rehabilitation works as sections become obsolete due to re-profiling of the surrounding land. The southeast section of the levee will be retained until landform development of the south-east in-pit waste rock emplacement is complete. The flood levee will be reshaped to lower the profile to be compatible with the surrounding landform. The area will then be revegetated with pasture grasses to prevent erosion and the generation of sediment runoff.

The flood levee around the MIA will undergo the same rehabilitation process as soon as practicable following infrastructure decommissioning of the MIA.

Two temporary diversion drains are proposed, one for the toe of the open cut flood levee to allow the free drainage of flood water in the vicinity of this feature, and another adjacent to the MIA. The diversion drains will be rehabilitated in conjunction with the associated flood levee as they are no longer needed.

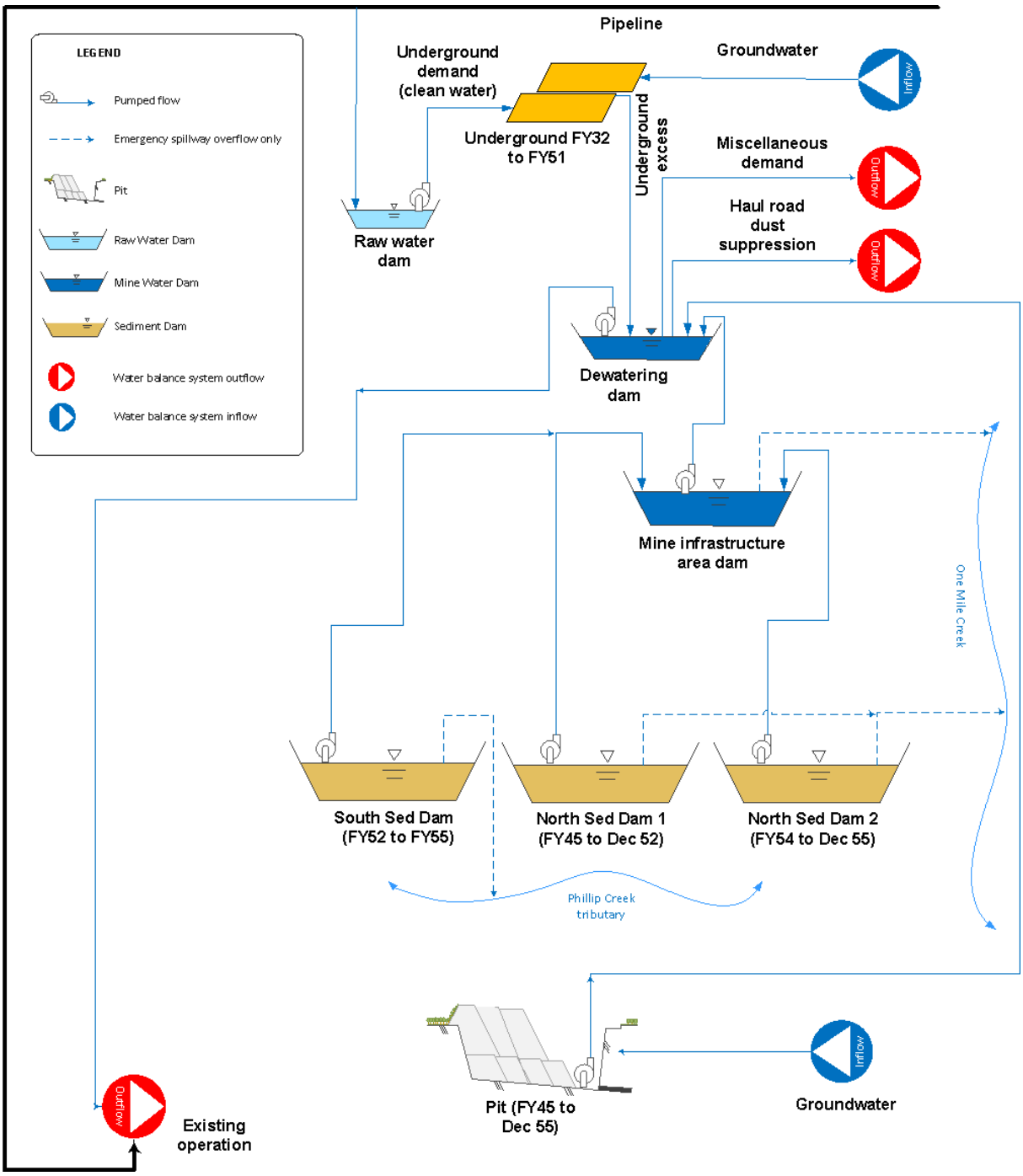

Figure 34: Project water management system schematic (WRM 2022d)

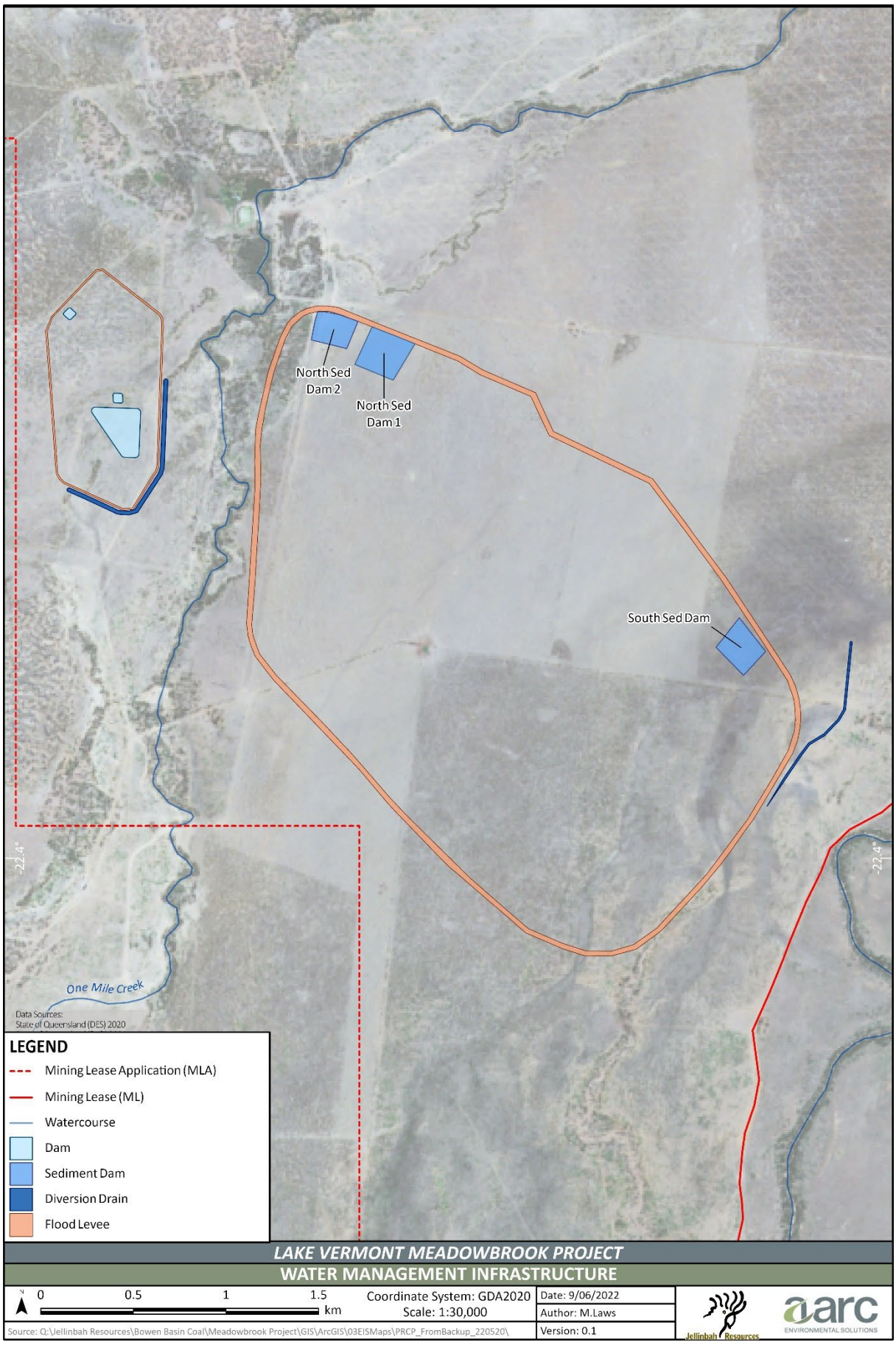

Figure 35: Location of water management infrastructure

3.5.10 Underground mining

3.5.10.1 Description of underground mining

Longwall mining operation

The Vermont Lower Seam occurs at depths greater than 500 m in the north-east of the underground mining area. In the south of the underground mining area, depths of the Vermont Lower Seam decrease to <150 m. The Leichhardt Lower Seam occurs at depths from 250 m in the west of the underground mining area and approaches 500 m in the far north-east of the mining area.

The underground mining layout has longwall panels oriented approximately north-south. This configuration minimises subsidence effects and impacts on key environmental values. Conventional longwall coal mining methods will be used to extract coal from the underground mining area.

Longwall extraction is planned in both the Leichhardt Lower Seam and underlying Vermont Lower Seam. Longwalls in the Leichhardt Lower Seam will have widths of up to approximately 310 m (solid). Three panels have been narrowed to 270 m wide (solid) to maximise recovery between faults. The chain pillars in the Leichhardt Lower Seam are 45 m wide (solid). The extraction height of the Leichhardt Lower Seam will be approximately 3.5–5 m.

Longwalls in the Vermont Lower Seam will also have widths of up to approximately 310 m, except in the two narrower 290 m wide (solid) panels in the northern part of the area. In the deeper area north of the Mains, the solid dimension of the chain pillars will be 45 m, while in the shallower southern part of the area, the solid dimension of the chain pillars will be 35–40 m (solid). The extraction height will be approximately 3–4.5 m for the Vermont Lower Seam, increasing from west to east.

The longwall system utilises a shearer to cut a slice of coal from the coal face and the broken coal is then transferred to the main gate conveyor via an armoured face conveyor. The longwall face equipment utilises a series of hydraulic roof supports to provide a working area for the shearer and the machine operators. Once each slice of coal is removed from the longwall face, the hydraulic roof supports are moved forward, allowing the roof and a section of the overlying strata to collapse behind the longwall machine (referred to as forming the ‘goaf’).

Underground mining will commence in the southern longwall panels in the Vermont Lower Seam and will progress to the northern panels in the overlying Leichhardt Lower Seam, then to the northern panels of the Vermont Lower Seam.

Underground mine access

Access to the underground will be via underground drifts. The drift portal entrance will be located near the western boundary of the underground mining area, within the MIA. Waste rock excavated for the drift construction will be stockpiled within the MIA, close to the portal area and will be utilised for Project construction activities. Waste rock that cannot be utilised on-site for construction and development activities will be disposed of in the open cut pit (as part of the backfilling operations). Following the completion of portal/drift construction, underground main roads (or headings) will be developed in seam along the approximate centre of the underground mining area to provide access, ventilation and main coal conveyors. Each longwall panel will be formed by developing gate roads (the tail gate and main gate roads) extending from the main heading to the limits of the mine footprint. To construct the gate roads, two parallel roadways will be driven using continuous miners. The dimensions of the roadways will be approximately 5.0 m wide and 3.2 m in height. The headings will be connected approximately every 100 m by driving a cut-through from one heading to the other. This leaves a series of coal pillars along the length of the gate road which support the overlying strata.

Coal seam gas management

Pre-mining gas drainage and post drainage of goaf areas following longwall extraction will be required for the Project to reduce the gas content in the coal seams to levels suitable for safe underground mining operations.

The footprint of the environmental impact will be similar to an exploration drilling program, with a series of drill pad locations (each pad approximately 0.1 ha and total disturbance approximately 20 ha) and temporary access tracks. The gas drainage wells will be developed over each panel as mining progresses through the underground area and the relocatable control equipment will be transported on the surface to new locations as necessary. There will be some flexibility in the location of gas pre-drainage infrastructure, where the wells could be situated to avoid ecologically sensitive areas. The locations of gas post-drainage infrastructure and wells are not quite as flexible as these must be placed in more specific locations along the edge of the mining panels. However, a degree of latitude will exist to locate boreholes to minimise environmental impacts. Gas drainage will preferentially avoid areas of Brigalow TEC, Poplar Box TEC, areas of conservation significant fauna habitat and vegetation in proximity to watercourses. The total area of surface disturbance associated with drill pads will be in the order of 20 ha.

Ventilation shafts

An upcast ventilation shaft will be sunk to intersect the pit bottom area at a depth of 240 m. The shaft will be sunk using blind bore technology, concrete lined and will be constructed in parallel with the drift construction. Additional ventilation shafts will be sunk, and fan relocations will occur during the life of the underground mine to ensure adequate ventilation is maintained.

Approximately 2,500 m^3 of in situ rock material will be excavated from the construction of the initial ventilation shaft and will be used to build the site pad and/or bunding around the ventilation shafts and supporting infrastructure.

Access tracks

A series of unsealed tracks will provide access to surface infrastructure required for underground mining, namely, ventilation shafts and gas drainage bores, as well as providing access for rehabilitation and monitoring activities. A network of tracks already exists within the Project boundary, and these will be utilised where practicable to minimise new disturbance.

3.5.10.2 Potential impacts of underground mining

The underground mining activities at Meadowbrook have the potential to cause land disturbance impacts associated with subsidence and with surface infrastructure development.

Subsidence impacts

Subsidence refers to the movement of overburden and land surface as a result of the underground extraction of coal. A subsidence assessment was prepared by Gordon Geotechniques Pty Ltd (2022) to predict the subsidence effects resulting from the underground longwall mining. Predicted maximum vertical subsidence ranges from 2.9 m in the southern part of the area where the Vermont Lower Seam is extracted, up to a maximum of 5 m in the northern part of the area where both the Leichhardt Lower and Vermont Lower seams are extracted. The modelled vertical subsidence after underground mining is presented in Figure 36. Some horizontal movement may also occur, up to 1 m in the southern area and up to 1.6 m in the northern area. The maximum tilt modelled to occur resulting from subsidence is 38 mm/m. Subsidence impacts will generally be restricted to the MLA area, although subsidence impacts are predicted to extend approximately 250 m into ML 70528. The subsidence and its mitigation are predicted to impact land through changes to erosion, surface cracking and alteration of overland flow.

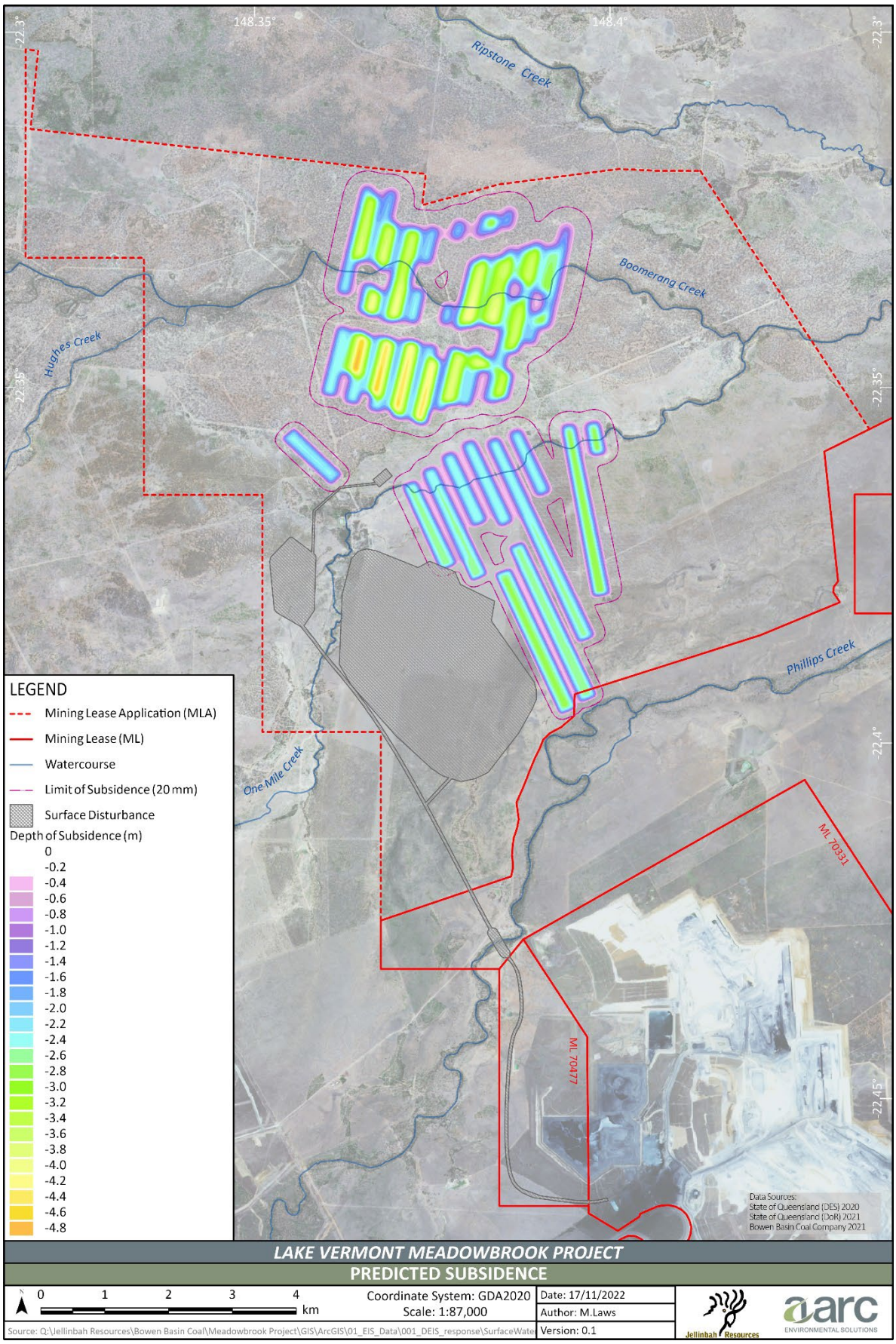

Figure 36: Predicted subsidence after underground mining

The nature of the longwall mining method means that subsidence does not increase further over time. It is expected that greater than 97% of the maximum subsidence will occur within 6 weeks after single seam longwall mining is completed, assuming an industry average retreat rate of 100 m/week. It is therefore inferred that for areas where dual seam mining occurs in the Project, 97% of maximum subsidence will occur within 6 months of longwall mining completion in the Vermont Lower Seam.

Erosion

Changes to surface topography are predicted to occur as a result of subsidence, with slopes forming between ridges above chain pillars and subsidence troughs above goaf areas. The maximum slopes predicted resulting from subsidence is 3.8 % and the majority of slopes created will be less than approximately 2 %. Erosion risk is minimal, but is higher in areas of increased slope, potentially requiring mitigation to prevent and minimise erosion.

Surface cracking

Surface cracks are predicted to develop in the proposed longwall mining areas. The areas with the highest potential for cracking are those located above the panel edges where the maximum tensile strain occurs. The widest of these cracks are predicted to extend to no more than 10-15 m below ground level, with the majority <1 m deep, and maximum surface crack widths up to 200 mm. Cracks of this size can be readily remediated. Heavy cracking clay soils are resilient to underground mining induced surface cracking, the non-rigid soils are capable of self-mulching over cracks which develop and are likely to not exhibit any surface cracking beyond three wetting and drying cycles (Lechner *et al.* 2016). Soils in the southern area of the Project site exhibit these properties.

Overland flow and waterway channels

Surface subsidence is predicted to alter routes of overland flow. Ephemeral gilgai wetlands are present in the Boomerang Creek, One Mile Creek and Phillips Creek flood plains, but the changes to the local topography resulting from the predicted subsidence are expected to result in an increase in the extent of areas which are not free draining (WRM 2022c). These ponded areas are likely to undergo changes to soil characteristics and vegetation and are likely to function as ephemeral wetlands similar to those already present within the Project site.

The profiles of Boomerang and One Mile Creeks are predicted to change as mining progresses, potentially altering the rate of water flow and subsequent erosion rates (WRM 2022c). Subsidence will result in a series of troughs in the channel bed due to the interaction of the differential settlement across the longwall panels and the intervening unmined pillars. This is predicted to result in channel velocity, bed shear and stream power decreasing in some areas and increasing in others. However, these impacts will be temporary, with the troughs expected to silt up over time. Parts of the One Mile Creek channel appear to be sediment-limited, which will take longer to silt up. The channel of Phillips Creek will not be directly affected by subsidence.

Terrestrial flora and fauna

The impacts of subsidence upon terrestrial flora and fauna have been assessed in the 'Terrestrial Ecology Assessment' (AARC 2022a). Monitoring results from similar mining operations in the Bowen Basin have demonstrated that subsidence has no broad patterns of impact on vegetation in the Bowen Basin region (AARC 2022a). Assessments of underground mining impacts on vegetation and habitat for comparable operations indicate that subsidence impacts tend to be minor and non-deleterious. The vegetation in subsided areas not subject to ponding is therefore expected to remain viable. However, the areas predicted to be subject to periodic ponding are expected to be impacted, potentially requiring revegetation with species adapted to the changed hydrological conditions. The conditions in residual ponding areas in the Eucalypt Woodland vegetation may become more suitable to water tolerant vegetation communities such as Eucalypt vegetation fringing ephemeral wetlands and watercourses. The habitat values provided by cleared agricultural areas are considered to be retained despite residual ponding. In those cleared agricultural areas that are currently vegetated with low Brigalow regrowth, the residual ponding areas are likely to function as large deep gilgai ecosystems, largely compatible with existing vegetation.

Aquatic fauna

Erosion and scouring of the watercourses of One Mile Creek and Boomerang Creek could cause localised loss of instream habitat at the point where erosion and scouring occurs (AACR 2022b). This could have localised impacts on habitat availability for macroinvertebrates and aquatic flora, but will not impact habitat availability for other aquatic species such as fish and turtles as there is currently limited in-stream habitat for these species. Given the ephemeral nature of these watercourses and the expected infilling of troughs, the creation of subsided areas of the streambeds are not expected to create a barrier for fish or turtles that may migrate along the watercourses.

The creation of additional areas of ponding connected to existing stream channels may provide seasonal refugia habitat for aquatic fauna between flow events, and at times across the dry season. Similarly, areas of ponding on the floodplains are likely to provide habitat for invertebrates and small amphibians and reptiles, especially during periods of inundation. Given inundation of the ponding areas will persist for several months at times, this additional water within the local landscape could provide habitat and foraging resources for both aquatic and terrestrial fauna species.

Supporting surface infrastructure impacts

The main impact from constructing supporting surface infrastructure is vegetation clearance. The underground portal is located within the MIA to minimise clearance of remnant vegetation. While some vegetation clearance will be required, the majority of vegetation clearing will occur on land previously cleared for agriculture, with small areas of remnant vegetation cleared for gas wells, ventilation shafts and tracks developed to access surface infrastructure. The underground drift will not result in any surface disturbance.

3.5.10.3 Management and rehabilitation

Subsidence

The rehabilitation objective for areas affected by subsidence is to return the land to its pre-mining grazing suitability and to reinstate the key environmental values of the landscape. Management and rehabilitation of subsided land will be undertaken where subsidence causes landform changes such as ponding, erosion or cracking that are unacceptable in extent or impact.

Monitoring will be undertaken both pre- and post-subsidence to assess and validate subsidence predictions. It is expected that greater than 97% of the maximum subsidence will occur within 6 weeks after longwall mining is completed in each panel. However, as mining progresses, water flow may be impacted in previously subsided land, preventing the full impact of subsidence being evident until mining of each collection of panels is complete. Mining in the northern portion of the site will occur in two stages resulting in subsidence from the mining of the overlying Leichhardt Lower Seam followed by further subsidence from the mining of the underlying Vermont Lower Seam. Consequently, land will not be considered as becoming available for rehabilitation until after the completion of mining of the Vermont Lower Seam in the south and the north respectively. Land subject to subsidence will be observed for an additional period of three wet seasons to allow time for surface cracking to naturally rehabilitate, at which time the land is considered to become available for rehabilitation and the rehabilitation sequence will commence.

Mitigation activities may be necessary prior to the commencement of the rehabilitation sequence proper to prevent environmental harm, as indicated by monitoring. Subsidence impacts will be managed and monitored in accordance with the Subsidence Management Plan.

It should be noted that where planned surface disturbance overlays the subsidence zone, the surface disturbance is considered to take precedence, and therefore only the surface disturbance is shown in rehabilitation area mapping and the milestone schedule. For rehabilitation planning purposes, one vent shaft (approximately 0.3 ha in area), a portion of the eastern waste rock emplacement area (approximately 4 ha) and a section of the infrastructure corridor linking the MIA to the electrical substation (approximately 0.4 ha) have been clipped from the subsidence footprint, and are managed as part of a separate rehabilitation area.

Erosion management

Erosion risk will increase in areas of increased slope, particularly in areas where soils have weak structure or dispersive properties (Booroondarra, Mayfair Sodic Variant, Moreton, Parrot, Knockane and Norwich). Where subsidence results in slope increases sufficient to initiate erosion, the following mitigation measures may be implemented:

- regrading of slopes;
- ripping of exposed surfaces;
- revegetation as soon as practicable;
- placement of erosion mitigation features such as rock or large woody debris; and
- management of livestock to ensure that adequate vegetation cover establishes.

Surface cracking

Where surface cracking is identified, these areas will be monitored according to the Subsidence Management Plan. Soils in the southern portion of the Project site are heavy cracking clays capable of self-mulching over cracks and are unlikely to require further rehabilitation works. Minor cracks are not expected to require remediation and will resolve through geomorphological processes over time. However, where minor surface cracks do not resolve within three wet seasons, the area will be scarified or ripped to fill minor cracks, control erosion and assist revegetation. Larger or persistent cracks that are identified as requiring remediation will be rehabilitated through removal of topsoil, backfilling, re-spreading of topsoil, and natural regeneration and recruitment. Remediation works will be initiated in consideration of locations of conservation significant species and ecosystems, and remediation without machinery undertaken where beneficial. The Subsidence Management Plan will integrate an adaptive management approach such that where unpredicted subsidence impacts and environmental consequences occur, previously approved processes will be considered to prevent their re-occurrence. Livestock may be excluded from areas undergoing active subsidence.

Ponding and drainage works

Subsidence is predicted to result in some pooling of water isolated from main drainage paths, forming ephemeral wetlands. Drainage works are proposed to manage these changes to surface water flow, reducing both the extent and the duration of ponding (Figure 37). Drainage works will include:

- a drainage channel to alleviate the extent of downstream ponding within the subsidence panels immediately to the north of Phillips Creek that diverts flow downstream to a tributary of Phillips Creek;
- the strategic placement of two small bunds (each approximately 1 ha) across the subsidence panels to prevent floodwater flowing north and into One Mile Creek; and
- a drainage channel to alleviate the extent of ponding in the subsidence panels to the south of Boomerang Creek.

The channel features will be a maximum depth of 2.8 m and base width of 5 m in the northern underground area and a maximum depth of 3 m and base width of 5 m in the southern underground area. The proposed drainage works include disturbance outside the unmitigated ponding footprint, however the mitigated ponding and drainage works combined are substantially less than the unmitigated ponding footprint, as shown in Figure 37. The drainage works are expected to reduce the area subject to intermittent ponding from 370 ha to 213 ha, with an additional 4 ha for the drainage channels. The duration of ponding in these depressions depends on the depth and duration of rainfall, with ponded water persisting until it evaporates or seeps into the underlying soil. In the absence of seepage, depending on their depth, the ponds can be expected to persist for several months post-filling. The mitigation works will reduce the depth of ponds, reducing the time expected for water to seep or evaporate.

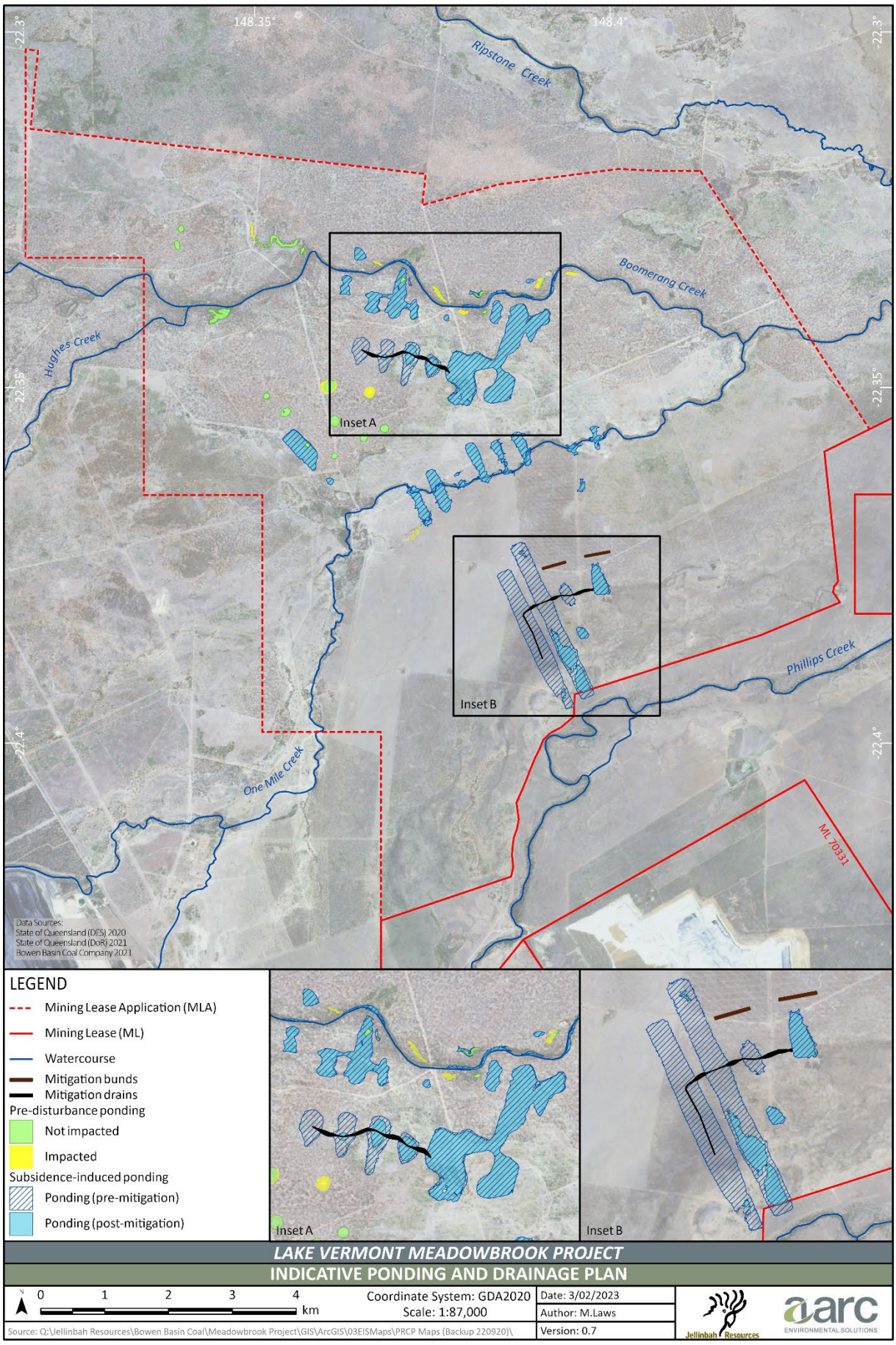

Figure 37: Indicative ponding and drainage plan

Areas of residual ponding will be monitored for changes to existing vegetation communities. Where dieback occurs due to ponding, native vegetation areas will be revegetated with suitable native species adapted to the changed conditions to maintain ecosystem structure and function, as far as practicable. The indicative revegetation species list in Table 22 has been developed based on the native vegetation communities already present at the Project site, with the selected species considered to be tolerant of the predicted ephemeral ponding conditions.

Some areas expected to be subject to intermittent ponding occur on sodic soils, which have a higher risk of erosion due to the dispersive qualities of the soil. These areas are predominantly on land to be rehabilitated to pasture. The ponded areas are expected to be deposition zones, however there is a risk of tunnel and gully erosion occurring on the slopes. This risk will be minimised by instigating erosion control measures as soon as any areas of high erosion potential are identified and revegetating with appropriate pasture species to achieve sufficient groundcover to stabilise soils (see Section 3.5.5.4).

Creek channels

The subsidence areas underlying Boomerang Creek and One Mile Creek are associated with the Parrot SMU, a sandy loam with weak structure. These areas are at high risk of erosion due to predicted temporary increases in flow rates compounded by the dispersive character of soils. Stabilisation of watercourses is expected to occur over time and with the implementation of effective rehabilitation strategies. The rehabilitation milestone criteria and PRCP schedule reflect that mitigation and maintenance measures are expected to be required in some areas for several years following longwall retreat, with continued monitoring to assess the trajectory towards a stable condition. The Subsidence Monitoring Plan will assess the changes in bed levels and the impact of increased localised sedimentation, and mitigation activities will be undertaken as necessary. Rehabilitation activities may commence prior to the land becoming available to stabilise banks, prevent erosion and maintain streamflow. Temporary or permanent erosion management will be implemented as needed and may include:

- revegetation of stream banks;
- exclusion of stock from stream bed and banks; and
- construction of rock armouring.

Supporting surface infrastructure

All underground mining surface infrastructure will be removed as soon as practicable at the end of its service life and land will be progressively rehabilitated as it becomes available. The gas wells and associated access tracks will be developed progressively over the life of the mine. Each pre-drainage surface borehole site will be active for a period of a few years, after which they will be progressively rehabilitated as the drainage operation periodically relocates with the progressive advancement of the mining faces. Post drainage goaf holes will be rehabilitated more frequently, aligning with the completion of each longwall block. As a result, at any given time, small areas within the subsidence footprint are likely to be disturbed (in the order of 2 ha), while previously disturbed areas will be in various stages of natural regeneration / rehabilitation.

The gas well decommissioning process will involve:

- disconnecting and removing all surface and downhole equipment;
- plugging/capping the well so it is not to have any connection with the surface atmosphere;
- removing any protruding casing/piping to below surface level;
- ensuring the surveyed location of the hole is recorded;
- revegetating the site in accordance with the methods described in Section 3.5.5.4.

Ventilation shafts and the underground drift portal entrances will be backfilled with waste material and sealed prior to revegetation works suitable for the PMLU. The sealing of drifts and shafts will be carried out using standard design practices to mitigate the risk of unplanned subsidence (Gordon Geotechniques 2022). The design of the bulkhead seals will consider aspects such as the materials used, the requirement for additional

ground support and the impact of groundwater (Gordon Geotechniques 2022). Backfilling and sealing of the underground portals will begin as soon as practicable following completion of underground mining. As the portals are located within the MIA footprint which will remain in use until completion of mining of the open cut operation, topsoiling and revegetation will be delayed until the remainder of the MIA becomes available for rehabilitation. The area will be graded, topsoiled, ripped and seeded in accordance with revegetation processes described in Section 3.5.5.4.

Any new tracks developed for mining operations will be rehabilitated to the PMLU nominated for the associated infrastructure. Existing tracks do not constitute new disturbance and therefore do not require rehabilitation.

3.5.10.4 Post-closure stabilisation of underground workings

An assessment of the post-closure stabilisation requirements for the underground workings is provided in the Subsidence Prediction Report (Gordon Geotechniques 2022) and is summarised here.

Subsidence monitoring at other longwall mines, indicates that greater than 97% of the maximum subsidence will typically occur within 6 weeks after mining is completed, assuming an industry average retreat rate of 100 m/week. Residual subsidence above the longwall panels is therefore not anticipated once the longwall goaf areas have compacted.

The Mains development pillars have been designed with factors of safety of greater than 2.11 and high width: height ratios, to ensure long term stability. Furthermore, after mining is completed the buoyancy effect of water can reduce the vertical load on the pillars by up to 40%.

Based on experience at other mining operations around the world, the risk of sinkhole subsidence occurring in the Project area, where the depth of cover is greater than 120 m, is considered to be without known precedent.

The potential for unplanned subsidence is therefore not anticipated.

3.5.11 Built infrastructure

At the end of the Project life, all remaining infrastructure will be decommissioned and removed, with the exception of infrastructure that is subject to an agreement with the post-mining landholder that they will accept liability for that infrastructure. The haul road, including the causeways across Phillips Creek and One Mile Creek, and access roads are consistent with grazing PMLU and are proposed to be retained. The following components are located within the MIA footprint (Figure 38):

- mine administration and operations buildings including crib room, ablution, first aid and emergency management facilities;
- bathhouse facilities;
- warehouse and stores compound;
- equipment hardstand and laydown areas;
- equipment maintenance workshop and service bays;
- diesel storage and refuelling bay;
- underground transport mustering area;
- underground portal access to a personnel and transport drift, as well as a conveyor drift;
- ROM coal stockpile and associated infrastructure, including coal haulage loading area;
- raw water, clean water and mine water dams (discussed in Section 3.5.9.1);
- substation and electricity distribution infrastructure;
- diesel backup generator;

- main surface fan installation;
- potable water treatment plant;
- sewage treatment plant; and
- other associated minor ancillary infrastructure.

The infrastructure corridor comprises an access and coal haulage road, an overhead 66 kV electricity transmission line, a raw water supply pipeline and telecommunications infrastructure.

Other built infrastructure includes access roads, ventilation shafts, electrical substation, gas wells and access tracks.

All mine infrastructure within the MIA (except the underground drifts and portals; see Section 3.5.10.3) is expected to be required at least until mine closure, with some facilities likely to be required to support rehabilitation works. The infrastructure corridor and associated infrastructure will be required until the backfilling of the open cut satellite pit is complete. All infrastructure not being retained will be decommissioned as soon as practicable once the service life of the infrastructure has passed.

Equipment decommissioned from the Project will be repurposed to other operations where practical. The Lake Vermont facilities will continue to operate and facilitate disposal of regulated and non-regulated waste as the Project is rehabilitated.

A phase 1 land contamination investigation will be undertaken by an appropriately qualified person and any identified contaminated material incompatible with the proposed PMLU will be either treated in situ or on-site, confined by burial, or removed and transported to an approved landfill for disposal.

Disturbed land will be rehabilitated following the surface preparation and revegetation methods described in Section 3.5.5.4.

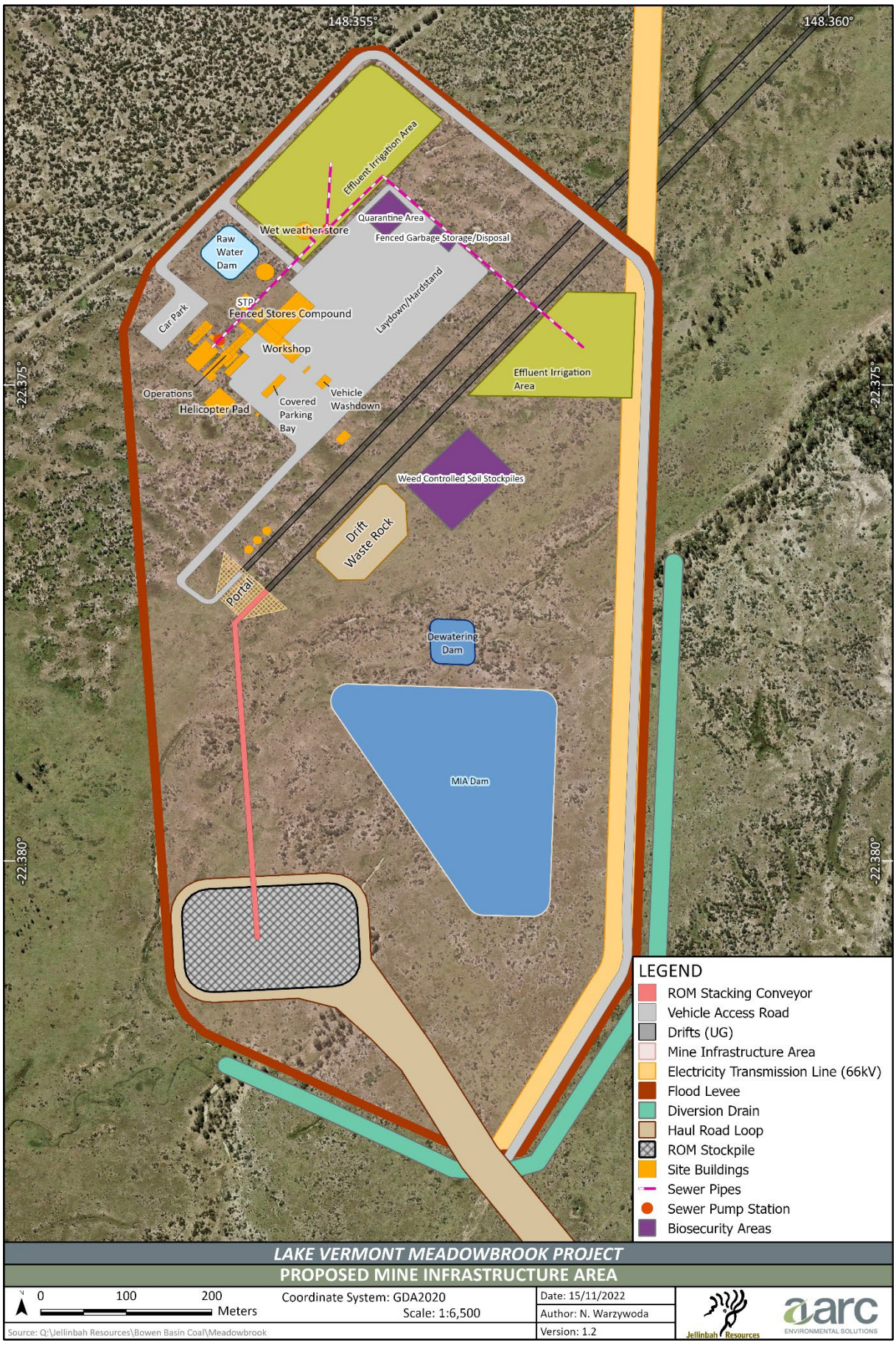

Figure 38: Proposed layout of the Mine Infrastructure Area

3.6 Risk assessment

3.6.1 Risk assessment requirements

Section 126C(1)(f) of the EP Act requires the PRCP to identify the risks, for each PMLU, of a stable condition not being achieved and how the applicant intends to manage or minimise the risk.

A risk assessment has been carried out in accordance with the following standards:

- AS/NZS ISO 31000:2018 Risk management - Guidelines; and
- HB203:2012 Managing environment-related risk.

3.6.2 Risk assessment process

Any risk assessment needs to be undertaken with consideration of the scope, context and criteria relevant to the assessment. For this risk assessment, the following scope and purpose was discussed and agreed to:

> *The purpose of this risk analysis is to identify the risks of a stable condition for land not being achieved for the agreed PMLUs nominated, and the approach to be taken to manage and minimise the risks identified.*

For this risk assessment, risk scenarios (or 'threats') were identified and considered for each rehabilitation area associated with the Project. The causes attributable to each risk scenario were documented as well as the potential impacts. Existing controls were noted, defined as those reasonably expected to be in place for a Project of this nature and having appropriate and contemporary management systems. Each risk scenario was then assessed with respect to health, safety, the environment and compliance against the risk assessment schema outlined in Section 3.6.3.

3.6.3 Risk assessment schema

Risks specific to the rehabilitation of the Lake Vermont Meadowbrook Project were classified using the risk classification schema described below. The risk assessment schema used is comparable to those used widely within the mining industry and comprises the following components:

- a control effectiveness ranking (Table 26) used for assessing the operational controls expected to be in place for a project of this type;
- a likelihood classification descriptors table (Table 27); and
- a consequence classification descriptors table (Table 28) intended to guide a consistent assessment of consequence.

Following a consensus determination of likelihood and consequence, the risk level was determined using the matrix shown in Table 29. For any risks classified as 'significant' or above, additional mitigation and management measures were identified and documented. Mitigation and management measures were also documented for some lower-level risks, where these were considered to be feasible if required.

Table 26: Control effectiveness ranking

Control Rank	Description	Guidance
C1	Substantially effective/adequate design	Controls considered adequate and operating effectively on almost all occasions
C2	Mostly effective/adequate design	Controls considered adequate and operating effectively on most occasions
C3	Inadequate design/partially effective	Controls considered inadequate or only operating to partial effectiveness on most occasions
C4	No controls/ineffective	There are no controls, or the existing controls are operating ineffectively on all occasions

Table 27: Likelihood of exposure to the hazard

Level of Risk Probability	Descriptive Guidance	Probability	Frequency
Highly Likely	The event is expected to occur in most circumstances	>25%	The event and consequence is expected to occur at least twice per year
Likely	The event will probably occur in most circumstances	10% - 25%	The event and consequence is expected to occur once to twice per year
Possible	The event could occur at some time	1% - 10%	The event and consequence is expected to occur at least once in 1 to 10 years
Unlikely	Not expected but the event may occur at some time in the future	0.1% - 1%	The event and consequence is expected to occur at least once in 10 to 100 years
Rare	The event may occur only in exceptional circumstances	<0.1%	The event and consequence is expected to occur less than once in every 100 years

3.6.4 Risk assessment outcomes and management

In total, 51 risk scenarios or hazards were identified and assessed. Any identified Class III risks were then re-assessed to identify if additional controls that could be introduced to lower the risk ranking. As a consequence of this further assessment, all Class III risks were able to be re-ranked to Class II or Class I. The final outcomes of the risk assessment are detailed in Table 30 which provides a summary of the risk classifications made by rehabilitation area. The detailed risk assessment outcomes are included at Appendix G.

Table 28: Consequence classification descriptors

Category	Consequence Scale				
	1. Very Low	**2. Low**	**3. Moderate**	**4. High**	**5. Very High**
Safety & Health	• Reversible health effects of little concern • Low-level, short-term subjective symptoms • First aid treatment	• Reversible health effects of concern • Medical treatment • Reversible injuries requiring treatment, but not leading to restricted duties	• Severe reversible health effects of concern • Lost time illness/injury • Reversible injury or moderate irreversible damage to one or more persons	• Single fatality or irreversible health effects or disabling illness or severe impairment to one or more persons	• Multiple fatalities or serious disabling illness to multiple people
Environmental	• Near-source confined and promptly reversible impact (a shift)	• Near-source confined and short-term, promptly reversible impact (a week)	• Near-source confined and medium-term recovery impact (on-site a month, off-site a week)	• On-site impact that is unconfined and requiring long-term recovery or residual impact • off-site impact that is near-source confined • recovery on-site = years, off-site a month	• Impact that is widespread unconfined and requiring long-term recovery, leaving major residual damage
Legal/ Compliance/ Regulatory	• Non-conformance with internal requirement with very low potential for impact • Non-compliance with community commitment goes unnoticed by external parties, minimal effort to correct	• Non-compliance with external or internal requirement with low potential for impact • Formal censure • Non-compliance with community commitment, requiring limited effort to correct	• Non-compliance with internal/external requirement with moderate impact • Moderate penalties for breach of permit • Non-compliance with community commitment reported formally	• Breach of licence(s), regulation with high potential for prosecution • Systemic internal standards breach-high impact • Community commitment breach	• Suspended or severely reduced operations imposed by regulators • Breach of community commitment results in direct loss of established consents

Table 29: Risk level classification matrix

Likelihood	Consequence				
	Very Low	**Low**	**Moderate**	**High**	**Very High**
Highly Likely	Class II	Class III	Class IV	Class IV	Class IV
Likely	Class II	Class III	Class III	Class IV	Class IV
Possible	Class I	Class II	Class III	Class IV	Class IV
Unlikely	Class I	Class I	Class II	Class III	Class IV
Rare	Class I	Class I	Class II	Class III	Class III

Table 30: Risk assessment outcomes by rehabilitation area

Rehabilitation area	Risk level				
	Class I	**Class II**	**Class III**	**Class IV**	**Total**
Waste rock emplacement and flood levee(s)	4	7	0	0	**11**
Subsidence areas (riparian)	1	5	0	0	**6**
Rehabilitated pit	7	4	0	0	**11**
Retained water storage	4	0	0	0	**4**
Mine infrastructure area (including rehabilitated water storage infrastructure)	7	1	0	0	**8**
Subsidence areas (terrestrial)	4	7	0	0	**11**
Total	**27**	**24**	**0**	**0**	**51**

3.7 Monitoring and maintenance

For the purposes of developing the PRCP schedule, 14 rehabilitation milestones have been proposed as being applicable for the Project. The PRCP Guideline (DES 2021) requires consideration of measures to be undertaken to demonstrate that milestones and milestone criteria have been achieved.

With respect to determining the achievement of rehabilitation milestones, a clear definition of milestone criteria have been developed for each rehabilitation milestone (see Section 3.5.3). Assessment of rehabilitation against the milestone criteria will be incorporated into the ongoing environmental management for the

Project. The Monitoring and Maintenance Program (Appendix E) has been developed to monitor and assess rehabilitation progresses towards achievement of milestone criteria and ultimately relinquishment.

Monitoring of areas predicted to be affected by subsidence will commence prior to disturbance to identify where mitigation activities may be necessary prior to commencement of the rehabilitation sequence proper. Monitoring of surface disturbance rehabilitation will commence following completion of activities of the first rehabilitation milestone applicable to the relevant rehabilitation area.

The completion criteria for each PMLU will be used as the milestone criteria for the final milestone in the proposed schedule, which shows achievement of the PMLU to a stable condition at surrender. When the final rehabilitation milestone applicable to the rehabilitation area is deemed to be satisfied, a final rehabilitation assessment will be undertaken before an application for progressive certification or ML surrender is made.

3.7.1 Analogue site locations

Pasture and native vegetation analogue or reference transects should provide sufficient replication to allow for statistical testing that is rigorous enough to determine differences between analogue site and rehabilitation values, and to demonstrate the achievement of rehabilitation milestone criteria. Baseline data will be collected from the Vegetation Community analogue sites listed in Table 32 prior to RA6 and RA9 requiring revegetation (2039 and 2054 respectively), then every 5 years. Baseline data collected from analogue sites will include species richness, woody stem count and groundcover density. Permanent monitoring transects will be installed according to the methodology described in Section 3.7.2.1. Results from analogue sites will also be used to compare and assess monitoring results obtained from rehabilitated site transects.

Analogue sites for native vegetation PMLUs have been selected for Regional Ecosystems (REs) within the Limit of Measurable Subsidence (LOMS). The number and distribution of analogue sites per RE is based on the recommendations in the *BioCondition Assessment Framework* (Eyre *et al.* 2015; 2 plots for less than 60 ha, 5 plots for less than 500 ha), as shown in Table 31. Where appropriate, analogue sites have been selected from established Secondary survey plots within the MLA previously assessed for the Terrestrial Ecology Assessment (AARC 2022a), in areas under the same land management (i.e. grazing native vegetation). Sites have been selected in accordance with the following parameters, in descending order of prioritisation:

- existing Secondary plots in target REs;
- not located near boundaries, where possible;
- not located near planned disturbance;
- located near access tracks; and
- dispersed (sites located in different patches or separated within larger patches) to assess true condition across site.

Where appropriate Secondary plots that meet the above parameters do not exist, sites have been proposed that meet the remaining parameters, although these sites will need to be ground-truthed to confirm their suitability.

The location of analogue sites is shown in Table 32 and Figure 39.

Table 31: Number of BioCondition analogue sites per Vegetation Community

Vegetation Community	Impact RE LOMS (ha)	Reference RE available (ha)	Number of BioCondition analogue sites
VC1a (11.3.1)	33.2	69.1	3
VC2a (11.3.2)	371.5	282.6	4
VC3a (11.3.25)	40.7	51.8	2
VC4a (11.3.27b)	2.5	2.4	2
VC2c (11.3.4)	65.9	73.2	3
VC2d (11.3.9)	10.5	9.3	2
VC1b (11.4.8)	7.5	23.6	2
VC4c (11.5.17)	4.5	16.8	2
VC2e (11.5.3)	516	809.2	5
VC2f (11.5.8c)	32.2	95	3
Total plots			**28**

Table 32: Analogue site locations

Vegetation Community	Site ID	Location (GDA2020)	
		Longitude	Latitude
Vegetation Community			
VC1a (11.3.1)	AS1	148.3567332	-22.39354695
VC1a (11.3.1)	AS2	148.416266	-22.34916102
VC1a (11.3.1)	AS3	148.357869	-22.39542201
VC2a (11.3.2)	AS4	148.3555374	-22.33820188
VC2a (11.3.2)	AS5	148.4297372	-22.34554797
VC2a (11.3.2)	AS6	148.3370054	-22.33416407
VC2a (11.3.2)	AS7	148.3452016	-22.34244881

Vegetation Community	Site ID	Location (GDA2020)	
		Longitude	Latitude
VC3a (11.3.25)	AS8	148.3566849	-22.33416999
VC3a (11.3.25)	AS9	148.350197	-22.32910695
VC4a (11.3.27b)	AS10	148.3461831	-22.33601413
VC4a (11.3.27b)	AS11	148.3309393	-22.33160208
VC2c (11.3.4)	AS12	148.3532692	-22.33404342
VC2c (11.3.4)	AS13	148.3429347	-22.3396525
VC2c (11.3.4)	AS14	148.3532209	-22.33653689
VC2d (11.3.9)	AS15	148.3560538	-22.34388113
VC2d (11.3.9)	AS16	148.3569798	-22.34441026
VC1b (11.4.8)	AS17	148.3648753	-22.3651727
VC1b (11.4.8)	AS18	148.3578805	-22.36402329
VC4c (11.5.17)	AS19	148.3528012	-22.354928
VC4c (11.5.17)	AS20	148.3280174	-22.32563374
VC2e (11.5.3)	AS21	148.3472281	-22.34673498
VC2e (11.5.3)	AS22	148.3593782	-22.35499658
VC2e (11.5.3)	AS23	148.3422215	-22.34537663
VC2e (11.5.3)	AS24	148.3494445	-22.32201848
VC2e (11.5.3)	AS25	148.3455354	-22.33138104
VC2f (11.5.8c)	AS26	148.3880942	-22.32172596
VC2f (11.5.8c)	AS27	148.3463591	-22.31730399
VC2f (11.5.8c)	AS28	148.3720062	-22.32026598

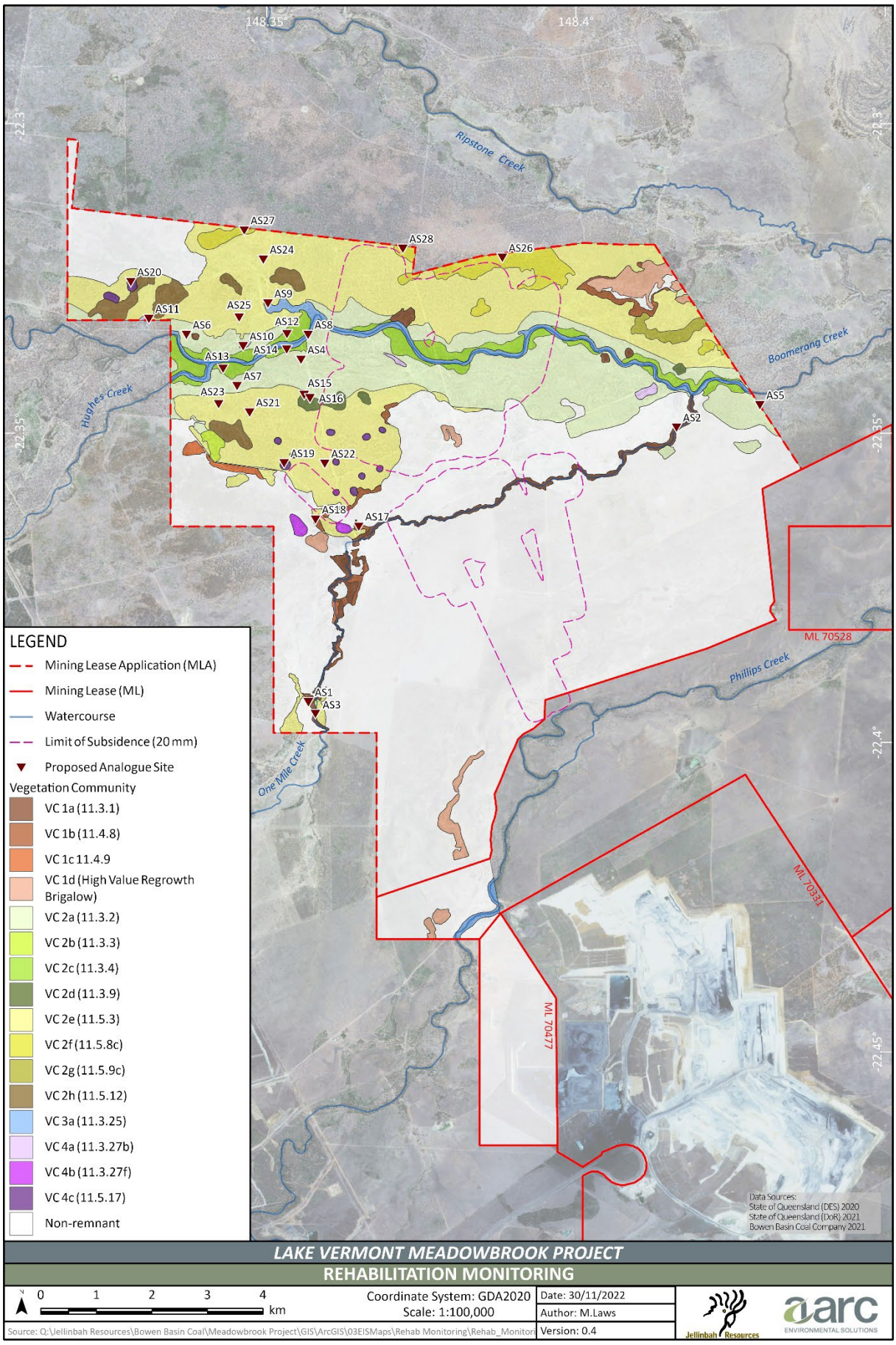

Figure 39: Analogue site locations

3.7.2 Annual rehabilitation monitoring

Rehabilitation will be monitored on an annual basis, with the survey period occurring post wet season, as monitoring at this time allows for more accurate identification of the species present and a clearer understanding of species richness on-site. Where sufficient data is acquired that demonstrates that rehabilitation is clearly on a trajectory to achieve milestone criteria, the frequency of monitoring may be reviewed.

The rehabilitation monitoring program aims to achieve data collection at sufficient spatial and temporal resolution to ensure statistically valid results. The following methods are employed at each monitoring site and described in detail in the following sections:

- permanent vegetation monitoring transects (ground cover monitoring and species richness);
- photographic monitoring;
- erosion monitoring;
- topsoil characterisation (every 2–3 years).

In conjunction with walking between transects, rehabilitation areas will be visually assessed to identify signs of fauna utilisation, noticeable issues such as erosion, vegetation cover deficiencies, or weed and / or pest infestations. Satellite imagery technology may also be employed. These observations are incorporated with the results of each rehabilitation progress report.

3.7.2.1 Permanent vegetation monitoring transects

This method involves the collection of quantitative data on ground cover, species richness, and tree and shrub density within each plot at monitoring sites. Each monitoring site is demarcated by a 50 m long transect and observations/ measurements are taken 5 m on either side of the transect, thereby representing an effective plot size of 50 m by 10 m. A plastic delineator post guide is installed at each end of the transect to ensure the exact location of the permanent transect can be identified, ensuring robust sampling repetition.

To measure species richness, all vascular plants occurring within 5 m of either side of the 50 m transect are recorded. Any species unable to be identified are collected for later identification. Percentage ground foliage cover for each species is recorded within ten 1 m x 1 m quadrats placed every 5 m along the 50 m transect, alternating sides. In each quadrat, the percentage cover of rock, bare ground, organic litter, and each plant species present is recorded. Species are classified into one of the following six groups for reporting purposes:

- native pasture species;
- exotic pasture species;
- trees;
- shrubs;
- forbs; and
- noxious weeds.

This methodology is used to record species richness and the projective foliage cover (PFC) on the transects to assess against milestone criteria. It should be noted that due to the pastoral nature of rehabilitation sites, the PFC is inferred from the vegetation cover measured at each transect.

The above methodology has been adapted based on information contained within the *BioCondition Assessment Framework* (Eyre *et al.* 2015), the *Vegetation Assessment Guide* (DoE 2013), and the *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland* (Neldner *et al.* 2022).

3.7.2.2 Recruitment monitoring

Recruitment will be assessed using the methodology adapted from Eyre *et al.* (2015), whereby recruitment is assessed over the 10 m x 50 m plot (5 m either side of each 50 m transect). Within this plot, the proportion of dominant species found to be regenerating are counted. A regenerating individual is identified as a woody stem species at breast height, with a diameter of less than 5 cm. For each dominant canopy species present, at least one individual must be present as a sapling or seedling for the species to be considered as regenerating. The presence of all dominant species in the regenerative state would make up 100% recruitment.

3.7.2.3 Photographic monitoring

Photographic monitoring at monitoring sites shows a visual comparison over time of the vegetation, ground cover, erosion, and general appearance of each monitoring site.

A digital camera is used to take photos. Photos will be retained in a database to provide a permanent record for each monitoring site. The process consists of taking one photograph from the beginning of the transect facing towards the end of the transect, and another from the end of the transect facing towards the beginning.

3.7.2.4 Satellite-derived fractional vegetation cover

Fractional vegetation cover (FVC) is defined as that fraction of a satellite imagery pixel representing ground condition across three ground cover classes being:

1) photosynthetic vegetation;
2) non-photosynthetic vegetation; and
3) bare ground.

A median value of FVC can be determined for all satellite imagery pixels within a defined polygon area (or set of combined polygons). Subject to certain limitations, a median FVC value can be determined for polygons enclosing a rehabilitation area which is then able to be compared with polygons enclosing a reference/analogue area that is representative of unmined land having similar landform, land cover and land use.

Satellite-derived indices will be reported annually based on one imagery acquisition per calendar month (12 per annum). Except where cloud cover or cloud shadow occlude the study area in a calendar month, imagery of the study area and acquisition metadata are assessed.

FVC is reported in graphical form with median and interquartile ranges for each rehabilitation polygon and combined reference area polygons. In addition, dates and duration of failure to achieve the target are reported in tabular form with mapping information for sources of non-compliance.

Source data:

Satellite imagery from the Sentinel 2 global earth observation mission acquires imagery on a five-to-12-day interval at wavelengths between 400-2,500 nm. Reflectance indices based on the spectral reflectance profiles of photosynthetic vegetation, non-photosynthetic vegetation and bare ground is calculated and directly correlated with field-collected data to calculate fractional vegetation cover for each rehabilitation and reference polygon. Field calibration and validation are required to be re-established if a significant disturbance occurs (e.g. fire/drought).

Calibration and validation:

Calibration and validation of FVC is to be conducted every 5 years, in wet season and in dry season, at fixed transect monitoring sites using either (a) point intercept transects per Muir et al. (2011) modified to 50 m or (b) sub-10 cm UAV imagery captured as 1 ha blocks (refer also Section 3.7.2.1). ISODATA clustering and supervised spectral class assignment provide FVC where UAV imagery is available.

Limitations:

Currently, this method is only to be utilised for relatively low slopes (i.e. not defined waste emplacement batter slopes).

Rehabilitation area polygons should be:

- selected with a sufficient buffer to exclude edge effects compromising the outcome; and
- selected to exclude engineered structures, e.g. internal drainage basins and spine drains.

Reference areas should be:

- areas having the same target land use as the rehabilitation area;
- the equivalent extent in hectares to target rehabilitation polygon areas; and
- a selection of at least four non-contiguous polygons.

3.7.2.5 Fauna observations

Observations of any fauna species or indicators of fauna presence (e.g. scats, tracks or other signs of fauna activity) within or in the vicinity of the rehabilitation areas will be noted as part of rehabilitation monitoring.

3.7.2.6 Erosion monitoring

Erosion at survey sites is monitored through visual assessment over time. Assessment is undertaken by traversing the 50 m transects and recording the number and average depth of any erosion features, rill lines or gullies. It should be noted that the placement of permanent transects may not be representative of the level of erosion across the entire rehabilitated landform. To compensate for this, general observations undertaken during the survey are also utilised in assessing rehabilitation performance.

Table 33 outlines how erosion observed on site is classified. The overall classification of the erosion on each transect is determined by the highest classification attributed to either the number of rills/gullies or the average depth. For example, a transect may present only one or two rills but if these are recorded as being 25 cm deep, the transect will be classified as presenting a Moderate erosion classification.

Some erosion is expected in the first years due to topsoil ripping, an absence of vegetation and the frequency and severity of storm events. Therefore, erosion stability will be assessed from year four following seeding/planting. Monitoring will commence in the first year and the first three years will represent landform establishment.

Table 33: Erosion classification

Erosion classification	Minor	Moderate	Severe	Extreme
No. of rill/gully*	< 15	15–30	31–50	> 50
Average depth (cm)	< 10	10–30	30–60	> 60

**Gully: highly visible form of soil erosion, with steep-sided, incised drainage lines greater than 30 cm deep.*

The following information is recorded at each site:

- GPS reading of location;

- general description of type of erosion (gully [> 30 cm], rill line [<30 cm]) and possible causes;
- depth of erosion;
- width of erosion;
- length of erosion;
- where eroded material is being deposited; and
- whether the erosion line is stabilised by vegetation.

3.7.2.7 Topsoil characterisation

Topsoil sampling is not considered to be an annual requirement of the rehabilitation monitoring program. It is, however, to be undertaken approximately every 2–3 years to monitor development of the soil profile or to address any deficiencies in the chemical composition of the soil that may be detrimental to vegetation health.

Topsoil analysis will typically include the following suite of parameters:

- pH;
- EC/chloride concentration;
- exchangeable sodium percentage;
- cation exchange capacity;
- soil carbon;
- macronutrients (nitrogen, phosphorus, potassium and sulphur); and
- micronutrients.

Topsoil data collected as part of the monitoring program will ultimately be compiled into a land suitability assessment of the rehabilitated land.

3.7.2.8 Surface water and groundwater monitoring

Surface water and groundwater sampling will be carried out in accordance with the *Queensland Monitoring and Sampling Manual* (DES 2018) methodology. *In situ* measurements will be taken with a multi-parameter water quality meter that has been calibrated to the manufacturer's specifications. Monitoring locations will include:

- toe of the rehabilitated waste rock emplacement;
- within recreated drainage features;
- One Mile Creek and Boomerang Creek; and
- water within the footprint of the in-pit waste rock emplacement.

Measurements will be taken following the wet season and/or after a significant rainfall event that enables surface water runoff to be collected from the surface of rehabilitated waste rock material. Field readings of pH, EC and TDS will be measured and compared against the milestone criteria for RM9 and RM10. Measurements will also be taken from retained dams and compared against the milestone criteria for RM12. Data for each monitoring event will be compiled and used to identify trends in water quality over time.

3.7.2.9 Canopy cover

Tree canopy cover can be used to characterise stand productivity and the distribution and abundance of biomass (Eyre *et al*. 2017). It refers to the estimation of the percentage canopy cover of the living, native tree layer along a 50 m transect, using the line intercept method (Greig-Smith 1964). For this attribute, the vertical projection of tree canopy cover of the species making up the tree canopy cover is assessed. The vertical

projection of the tree canopy over the 50 m transect is recorded as illustrated in Figure 40. The total length of the projected canopy of each layer is then divided by the total length of the tape to give an estimate of percentage canopy cover on the site.

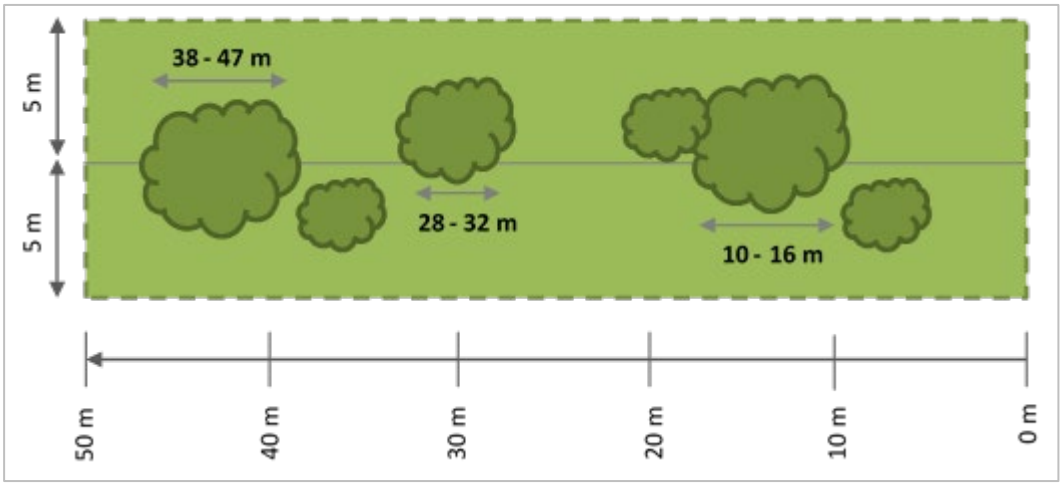

Figure 40: Guide to monitoring canopy cover (after Eyre et al. 2017)

3.7.3 Maintenance

Rehabilitation indicators and visual observations will be used to identify any aspects of the rehabilitated area that are of concern or suggest rehabilitated land is not on a trajectory of meeting the required completion criteria. These may include:

- evidence of active erosion;
- inadequate vegetation cover or growth;
- invasive weed or pest species;
- soil dispersion / instability; and
- soil infertility.

Following the annual monitoring process, areas of rehabilitation will be assessed for maintenance. An annual visual inspection of all rehabilitated areas will be undertaken to provide an overview of the status of the rehabilitation, and identify any noticeable issues such as erosion or inadequate vegetation cover or growth. This information, along with monitoring results, will be used to inform the maintenance schedule.

Maintenance may include repairing areas of excessive soil erosion, or undertaking supplementary plantings or seeding to increase floristic diversity and cover to assist in achieving completion criteria.

If issues re-occur, an investigation will be carried out to determine the reason and allow for remediation. Modification of rehabilitation methods and specifications may be required, and rehabilitation and maintenance planning updated accordingly.

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Appendix A. PRCP Schedule

Post-mining land uses (PMLU)										
Rehabilitation area	RA1									
Relevant activities	Mine Infrastructure Areas									
Total rehabilitation area size (ha)	91.1									
Commencement of first milestone: <insert milestone reference>	10/12/2048									
PMLU	Marginal grazing modified pasture									
Date area is available	10/12/48		10/12/55			10/12/63	10/12/xxxx	10/12/xxxx	10/12/xxxx	10/12/xxxx
Cumulative area available (ha)	1.1		66			91.1				
Milestone completed by	10/12/50	10/12/53	10/12/2058	10/12/60	10/12/2063	10/12/65	10/12/2068	10/12/70	10/12/73	10/12/78
Milestone Reference	**Cumulative area achieved (ha)**									
RM1	1.1		66			91.1				
RM2	1.1		66			91.1				
RM4		1.1	66				91.1			
RM5		1.1		66			91.1			
RM6		1.1		66			91.1			
RM7			1.1			66			91.1	
RM9					1.1			66		91.1

Post-mining land uses (PMLU)										
Rehabilitation area	RA2a									
Relevant activities	Water Management Infrastructure (rehabilitated to pasture)									
Total rehabilitation area size (ha)	10.3									
Commencement of first milestone: <insert milestone reference>	10/12/2055									
PMLU	Grazing modified pasture									
Date area is available	10/12/55		10/12/65	10/12/xxxx	10/12/xxxx	10/12/xxxx	10/12/xxxx	10/12/xxxx	10/12/xxxx	10/12/xxxx
Cumulative area available (ha)	2.7		10.3							
Milestone completed by	10/12/59	10/12/64	10/12/68	10/12/2069	10/12/73	10/12/78		xx/xx/xxxx	xx/xx/xxxx	xx/xx/xxxx
Milestone Reference	**Cumulative area achieved (ha)**									
RM1	2.7		10.3							
RM4	2.7		10.3							
RM5	2.7		10.3							
RM6	2.7		10.3							
RM7		2.7			10.3					
RM9				2.7		10.3				

Post-mining land uses (PMLU)										
Rehabilitation area	RA2b									
Relevant activities	Water Management Structure (retained)									
Total rehabilitation area size (ha)	4.5									
Commencement of first milestone: <insert milestone reference>	10/12/2055									
PMLU	Water body (stock watering and native ecosystem)									
Date area is available	10/12/55	10/12/xxxx	10/12/xxxx	10/12/xxxx	10/12/xxxx	10/12/xxxx	10/12/xxxx	10/12/xxxx	10/12/xxxx	10/12/xxxx
Cumulative area available (ha)	4.5									
Milestone completed by	10/12/56	10/12/61	xx/xx/xxxx	xx/xx/xxxx	xx/xx/xxxx	xx/xx/xxxx	xx/xx/xxxx	xx/xx/xxxx	xx/xx/xxxx	xx/xx/xxxx
Milestone Reference	**Cumulative area achieved (ha)**									
RM1	4.5									
RM12		4.5								

Post-mining land uses (PMLU)										
Rehabilitation area	RA3									
Relevant activities	Infrastructure Corridor and Access Roads									
Total rehabilitation area size (ha)	66.1									
Commencement of first milestone: <insert milestone reference>	10/12/2062									
PMLU	Retained infrastructure									
Date area is available	10/12/62	10/12/xxxx	10/12/xxxx	10/12/xxxx	10/12/xxxx	10/12/xxxx	10/12/xxxx	10/12/xxxx	10/12/xxxx	10/12/xxxx
Cumulative area available (ha)	66.1									
Milestone completed by	10/12/65	xx/xx/xxxx	xx/xx/xxxx	xx/xx/xxxx	xx/xx/xxxx	xx/xx/xxxx	xx/xx/xxxx	xx/xx/xxxx	xx/xx/xxxx	xx/xx/xxxx
Milestone Reference	**Cumulative area achieved (ha)**									
RM1	66.1									
RM2	66.1									
RM11	66.1									

Post-mining land uses (PMLU)										
Rehabilitation area	RA4									
Relevant activities	Open Cut Disturbance Area (marginal grazing modified pasture)									
Total rehabilitation area size (ha)	186.8									
Commencement of first milestone: <insert milestone reference>	10/12/2052									
PMLU	Marginal grazing modified pasture									
Date area is available	10/12/52	10/12/56	10/12/62	10/12/xxxx	10/12/xxxx		10/12/xxxx	10/12/xxxx	10/12/xxxx	10/12/xxxx
Cumulative area available (ha)	48.9	92.9	186.8							
Milestone completed by	10/12/55	10/12/60	10/12/65	10/12/70	10/12/75		xx/xx/xxxx	xx/xx/xxxx	xx/xx/xxxx	xx/xx/xxxx
Milestone Reference	**Cumulative area achieved (ha)**									
RM4	48.9	92.9	186.8							
RM5	48.9	92.9	186.8							
RM6	48.9	92.9	186.8							
RM7		48.9	92.9	186.8						
RM9			48.9	92.9	186.8					

Post-mining land uses (PMLU)											
Rehabilitation area	RA5										
Relevant activities	Open Cut Disturbance Area (grazing modified pasture)										
Total rehabilitation area size (ha)	444.3										
Commencement of first milestone: <insert milestone reference>	10/12/2052										
PMLU	Grazing modified pasture										
Date area is available	10/12/52	10/12/56		10/12/62		10/12/65	10/12/xxxx	10/12/xxxx	10/12/xxxx	**10/12/xxxx**	**10/12/xxxx**
Cumulative area available (ha)	56.7	93.4		208.2		444.3					
Milestone completed by	10/12/55	10/12/59	10/12/2060	10/12/2064	10/12/65	10/12/2068	10/12/2069	10/12/70	10/12/2073	10/12/75	11/12/78
Milestone Reference	**Cumulative area achieved (ha)**										
RM4	56.7	93.4		208.2		444.3					
RM5	56.7	93.4		208.2		444.3					
RM6	56.7	93.4			208.2	444.3					
RM7			56.7	93.4				208.2	444.3		
RM9					56.7		93.4			208.2	444.3

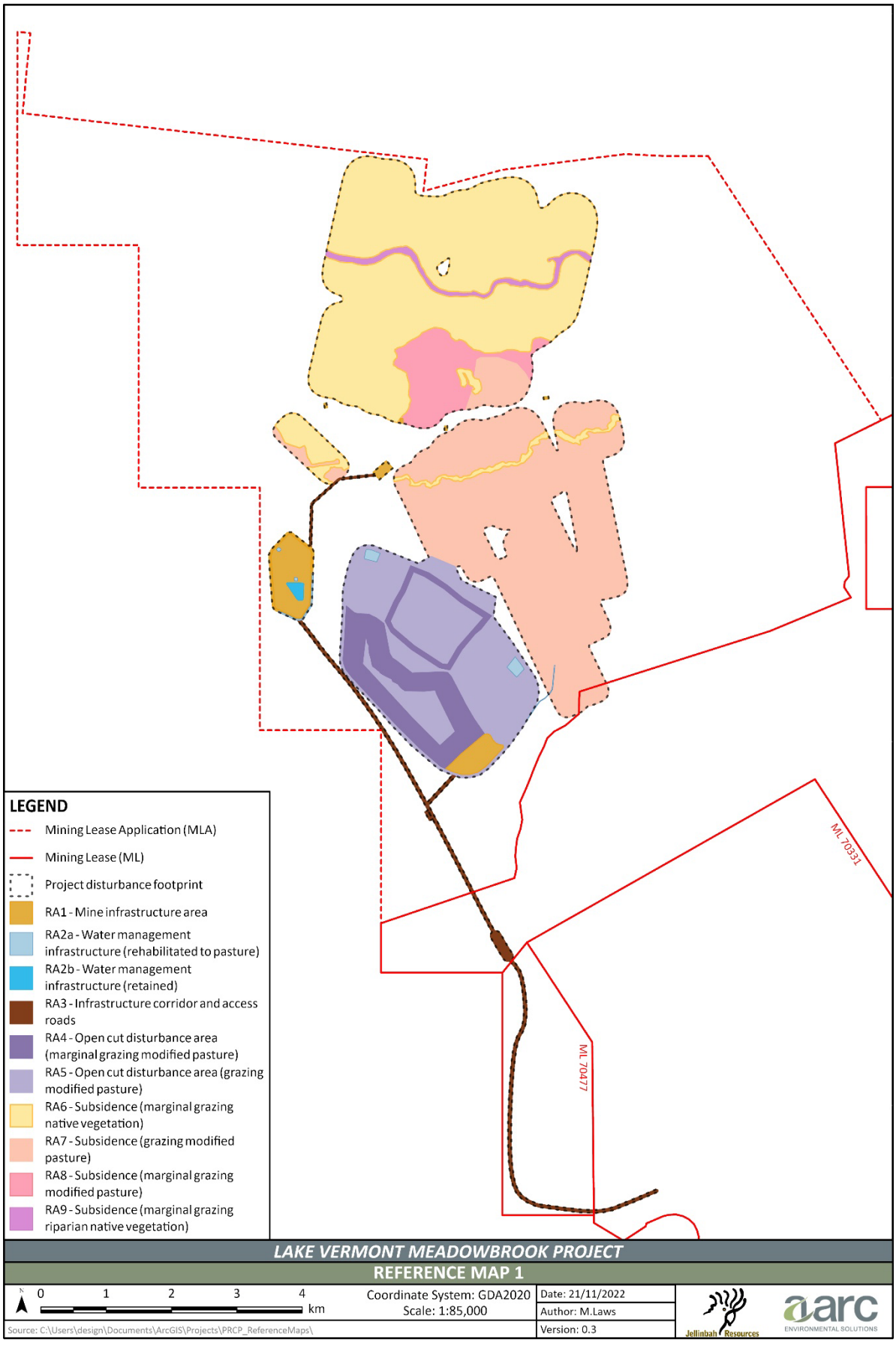
Post-mining land uses (PMLU)										
Rehabilitation area	RA6									
Relevant activities	Subsidence (marginal grazing native vegetation)									
Total rehabilitation area size (ha)	1050.6									
Commencement of first milestone: <insert milestone reference>	10/12/2036									
PMLU	Marginal grazing modified pasture									
Date area is available	10/12/36	10/12/xxxx	10/12/51	10/12/xxxx	10/12/xxxx	10/12/xxxx		10/12/xxxx	10/12/xxxx	10/12/xxxx
Cumulative area available (ha)	24.9		1050.6							
Milestone completed by	10/12/40	10/12/44	10/12/55	10/12/59	10/12/74	xx/xx/xxxx		xx/xx/xxxx	xx/xx/xxxx	xx/xx/xxxx
Milestone Reference	**Cumulative area achieved (ha)**									
RM3	24.9		1050.6							
RM5	24.9		1050.6							
RM6	24.9		1050.6							
RM8		24.9		1050.6						
RM10				24.9	1050.6					

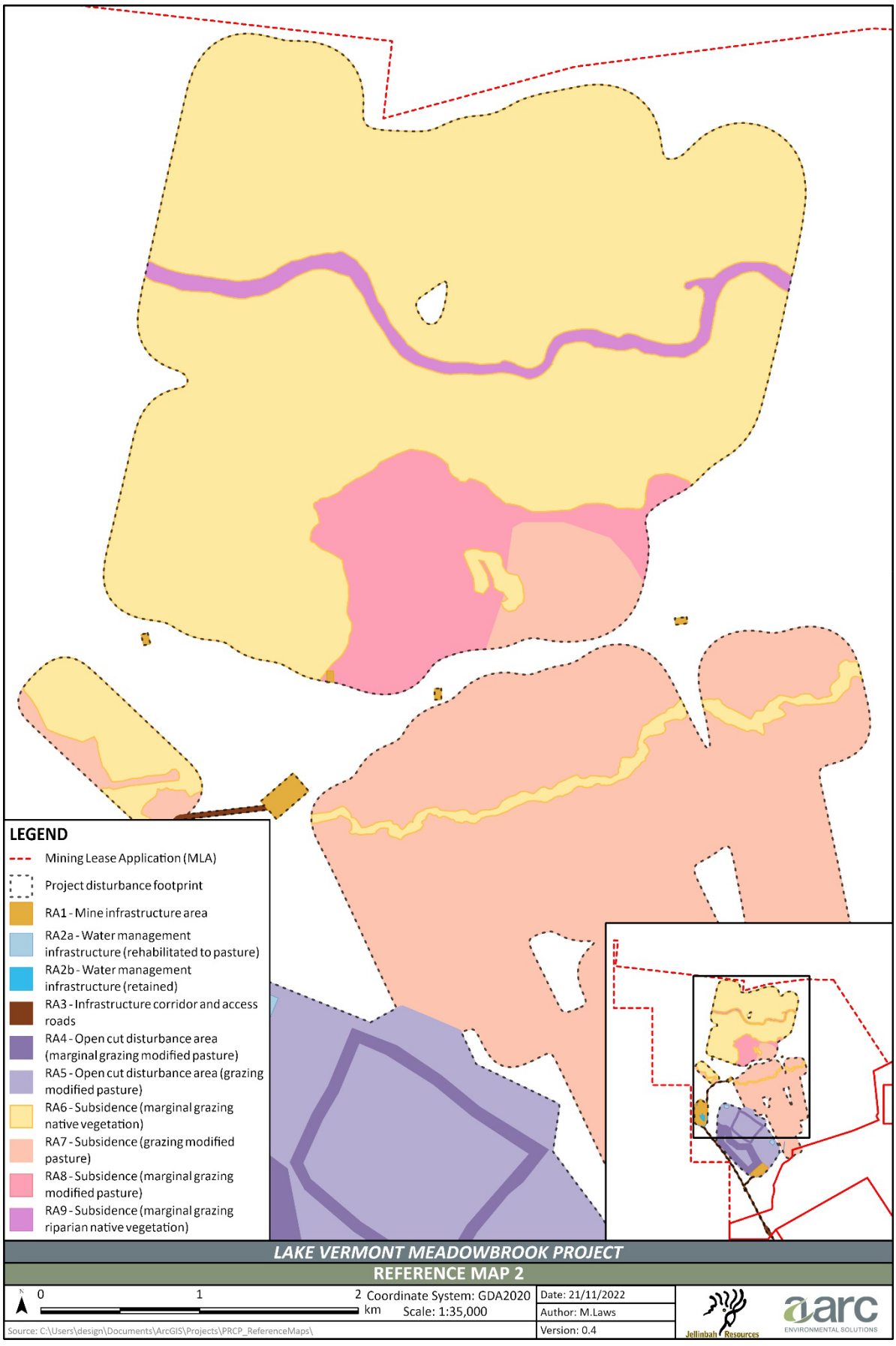
Post-mining land uses (PMLU)										
Rehabilitation area	RA7									
Relevant activities	Subsidence (grazing modified pasture)									
Total rehabilitation area size (ha)	934.9									
Commencement of first milestone: <insert milestone reference>	10/12/2036									
PMLU	Grazing modified pasture									
Date area is available	10/12/36	10/12/xxxx	10/12/xxxx	10/12/51	10/12/xxxx	10/12/xxxx	10/12/xxxx	10/12/xxxx	10/12/xxxx	10/12/xxxx
Cumulative area available (ha)	870.7			934.9						
Milestone completed by	10/12/40	10/12/45	10/12/50	10/12/55	10/12/60	10/12/64	xx/xx/xxxx	xx/xx/xxxx	xx/xx/xxxx	xx/xx/xxxx
Milestone Reference	**Cumulative area achieved (ha)**									
RM3	870.7			934.9						
RM5	870.7			934.9						
RM6	870.7			934.9						
RM7		870.7			934.9					
RM9			870.7			934.9				

Post-mining land uses (PMLU)										
Rehabilitation area	RA8									
Relevant activities	Subsidence (marginal grazing modified pasture)									
Total rehabilitation area size (ha)	137.7									
Commencement of first milestone: <insert milestone reference>	10/12/2051									
PMLU	Marginal grazing modified pasture									
Date area is available	10/12/51	10/12/xxxx	10/12/xxxx	10/12/xxxx	10/12/xxxx	10/12/xxxx	10/12/xxxx	10/12/xxxx	10/12/xxxx	10/12/xxxx
Cumulative area available (ha)	137.7									
Milestone completed by	10/12/54	10/12/60	10/12/64	xx/xx/xxxx	xx/xx/xxxx	xx/xx/xxxx	xx/xx/xxxx	xx/xx/xxxx	xx/xx/xxxx	xx/xx/xxxx
Milestone Reference	**Cumulative area achieved (ha)**									
RM3	137.7									
RM5	137.7									
RM6	137.7									
RM7		137.7								
RM9			137.7							

Post-mining land uses (PMLU)										
Rehabilitation area	RA9									
Relevant activities	Subsidence (marginal grazing native riparian vegetation)									
Total rehabilitation area size (ha)	40.2									
Commencement of first milestone: <insert milestone reference>	10/12/2051									
PMLU	Marginal grazing native riparian vegetation									
Date area is available	10/12/51	10/12/xxxx	10/12/xxxx	10/12/xxxx	10/12/xxxx	10/12/xxxx	10/12/xxxx	10/12/xxxx	10/12/xxxx	10/12/xxxx
Cumulative area available (ha)	40.2									
Milestone completed by	10/12/54	10/12/64	10/12/74	xx/xx/xxxx	xx/xx/xxxx	xx/xx/xxxx	xx/xx/xxxx	xx/xx/xxxx	xx/xx/xxxx	xx/xx/xxxx
Milestone Reference	**Cumulative area achieved (ha)**									
RM3	40.2									
RM5	40.2									
RM6	40.2									
RM13		40.2								
RM14			40.2							

Appendix B. PRCP Reference Map and Final Site Design

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Mining Lease Application (MLA)
Project disturbance footprint
RA1 - Mine infrastructure area
RA2a - Water management infrastructure (rehabilitated to pasture)
RA2b - Water management infrastructure (retained)
RA3 - Infrastructure corridor and access roads
RA4 - Open cut disturbance area (marginal grazing modified pasture)
RA5 - Open cut disturbance area (grazing modified pasture)
RA6 - Subsidence (marginal grazing native vegetation)
RA7 - Subsidence (grazing modified pasture)
RA8 - Subsidence (marginal grazing modified pasture)
RA9 - Subsidence (marginal grazing riparian native vegetation)
LAKE VERMONT MEADOWBROOK PROJECT
REFERENCE MAP 2
N
0
1
2
km
Coordinate System: GDA2020
Scale: 1:35,000
Date: 21/11/2022
Author: M.Laws
Version: 0.4
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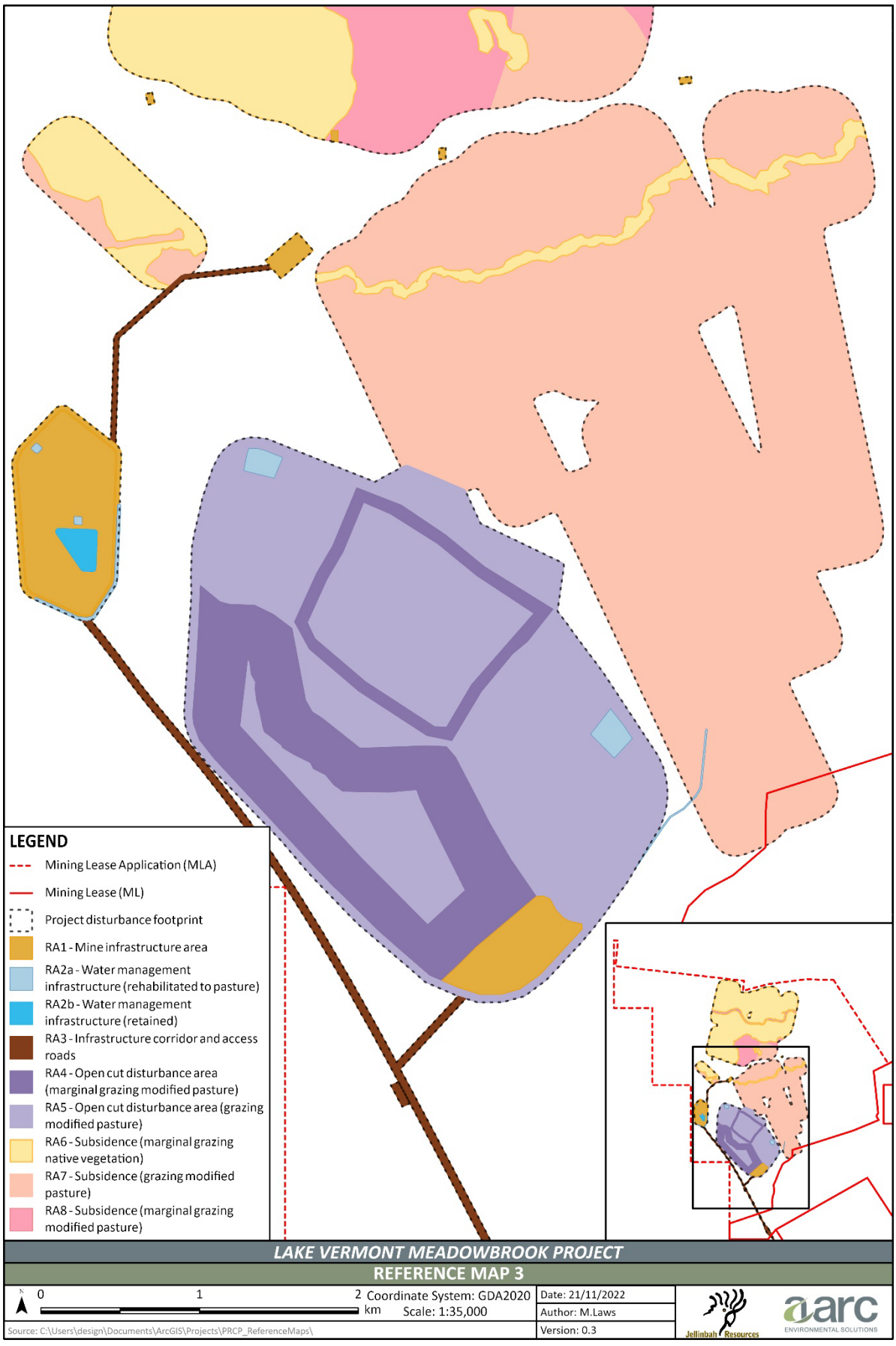
Jellinbah Resources
ENVIRONMENTAL SOLUTIONS


LEGEND
Mining Lease Application (MLA)
Mining Lease (ML)
Project disturbance footprint
RA1 - Mine infrastructure area
RA2a - Water management infrastructure (rehabilitated to pasture)
RA2b - Water management infrastructure (retained)
RA3 - Infrastructure corridor and access roads
RA4 - Open cut disturbance area (marginal grazing modified pasture)
RA5 - Open cut disturbance area (grazing modified pasture)
RA6 - Subsidence (marginal grazing native vegetation)
RA7 - Subsidence (grazing modified pasture)
RA8 - Subsidence (marginal grazing modified pasture)
LAKE VERMONT MEADOWBROOK PROJECT
REFERENCE MAP 3
N
0
1
2
km
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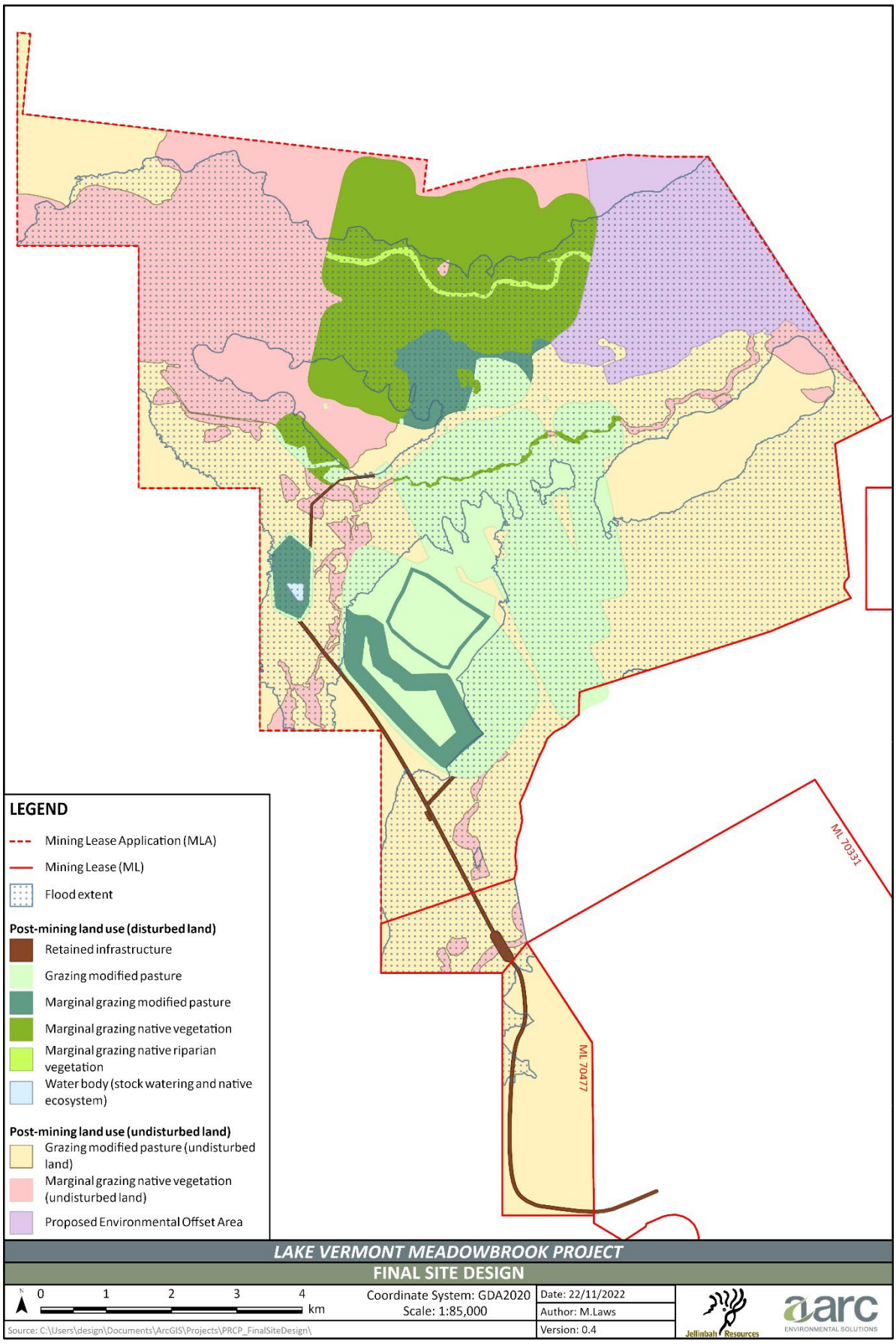
Jellinbah Resources
ENVIRONMENTAL SOLUTIONS


LEGEND
Mining Lease Application (MLA)
Mining Lease (ML)
Flood extent
Post-mining land use (disturbed land)
Retained infrastructure
Grazing modified pasture
Marginal grazing modified pasture
Marginal grazing native vegetation
Marginal grazing native riparian vegetation
Water body (stock watering and native ecosystem)
Post-mining land use (undisturbed land)
Grazing modified pasture (undisturbed land)
Marginal grazing native vegetation (undisturbed land)
Proposed Environmental Offset Area
ML 70331
ML 70477
LAKE VERMONT MEADOWBROOK PROJECT
FINAL SITE DESIGN
N
0 1 2 3 4 km
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Author: M.Laws
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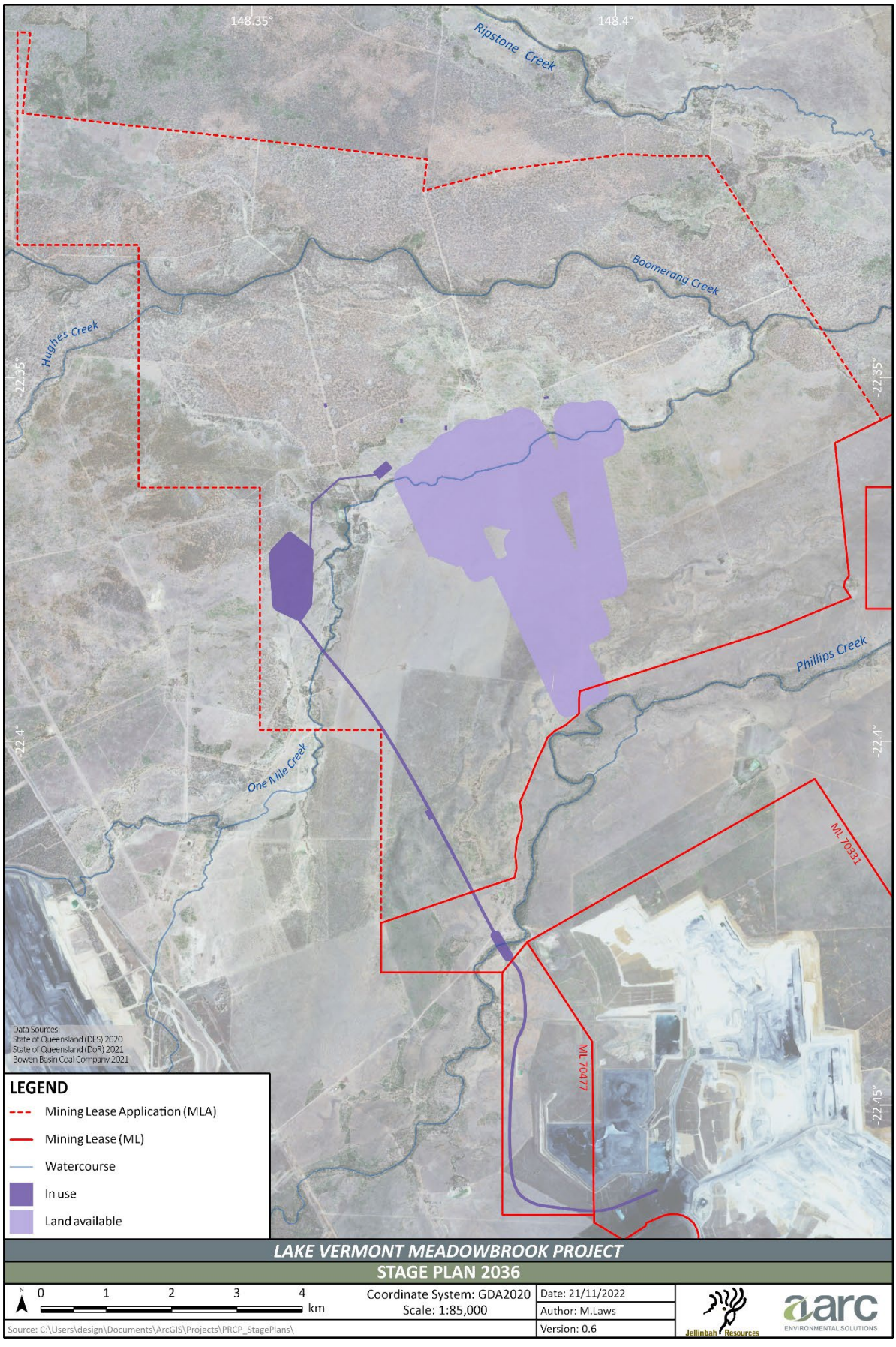
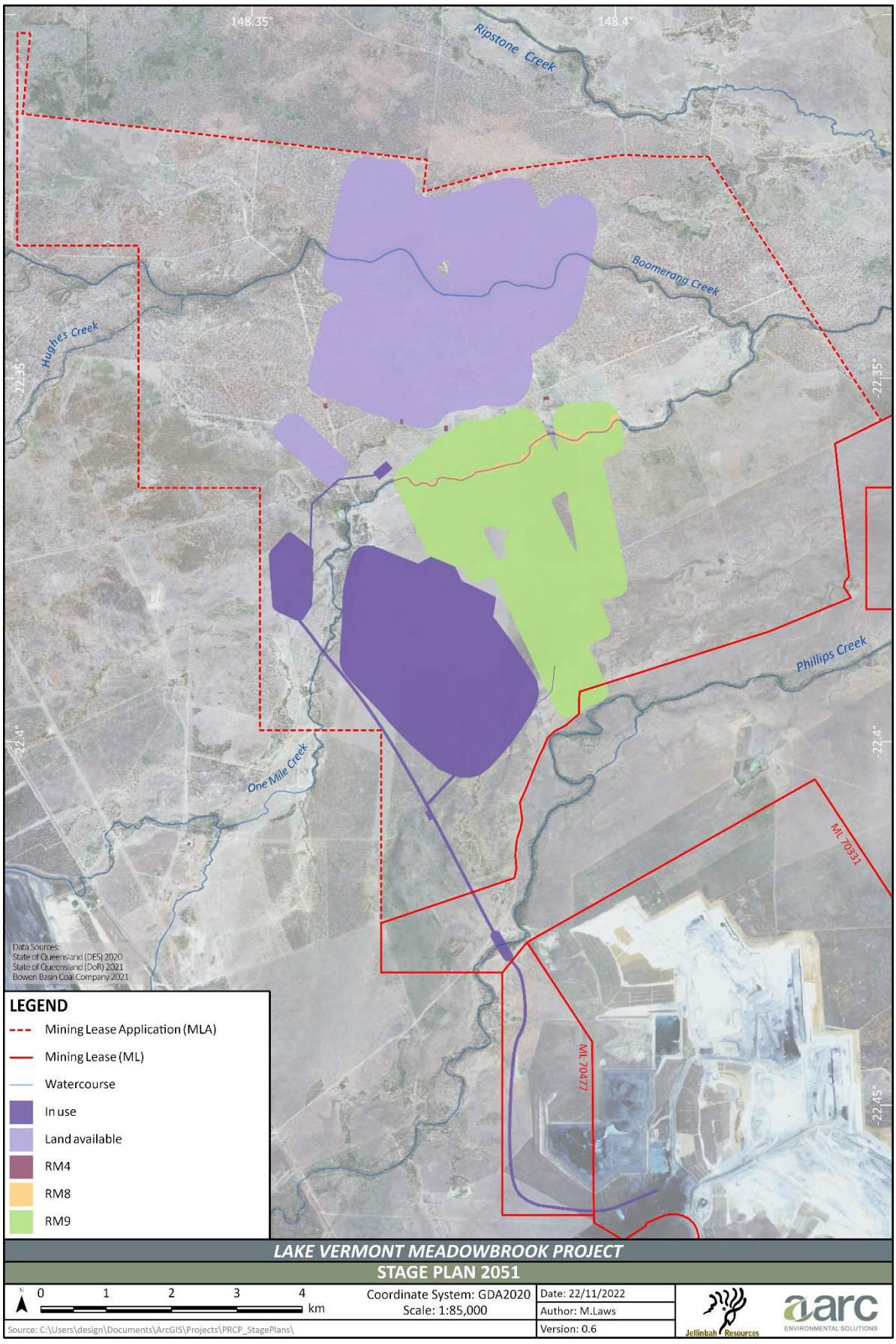
Jellinbah Resources
ENVIRONMENTAL SOLUTIONS

Appendix C. Schedule stage plans




148.35°
148.4°
Ripstone Creek
Boomerang Creek
Hughes Creek
Phillips Creek
One Mile Creek
-22.35°
-22.4°
-22.45°
ML 70331
ML 7047
Data Sources:
State of Queensland (DES) 2020
State of Queensland (DoR) 2021
Bowen Basin Coal Company 2021
LEGEND
Mining Lease Application (MLA)
Mining Lease (ML)
Watercourse
In use
Land available
RM4
RM8
RM9
LAKE VERMONT MEADOWBROOK PROJECT
STAGE PLAN 2051
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Coordinate System: GDA2020
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Date: 22/11/2022
Author: M.Laws
Version: 0.6
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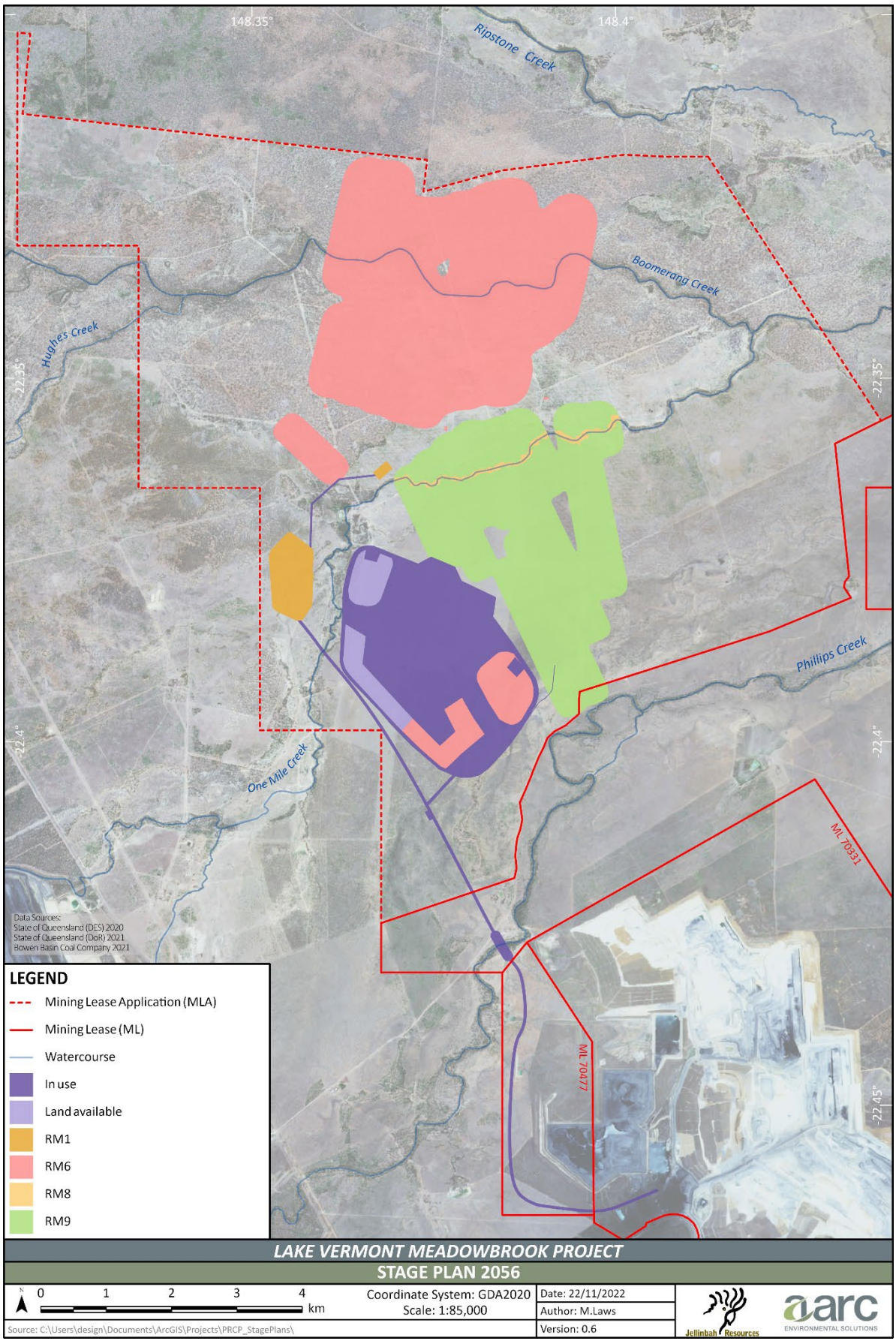
Jellinbah Resources
ENVIRONMENTAL SOLUTIONS


148.35°
148.4°
Ripstone Creek
Boomerang Creek
Hughes Creek
Phillips Creek
One Mile Creek
-22.35°
-22.4°
-22.45°
ML 70331
ML 70477
Data Sources:
State of Queensland (DES) 2020
State of Queensland (DoR) 2021
Bowen Basin Coal Company 2021
LEGEND
Mining Lease Application (MLA)
Mining Lease (ML)
Watercourse
In use
Land available
RM1
RM6
RM8
RM9
LAKE VERMONT MEADOWBROOK PROJECT
STAGE PLAN 2056
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Coordinate System: GDA2020
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Date: 22/11/2022
Author: M.Laws
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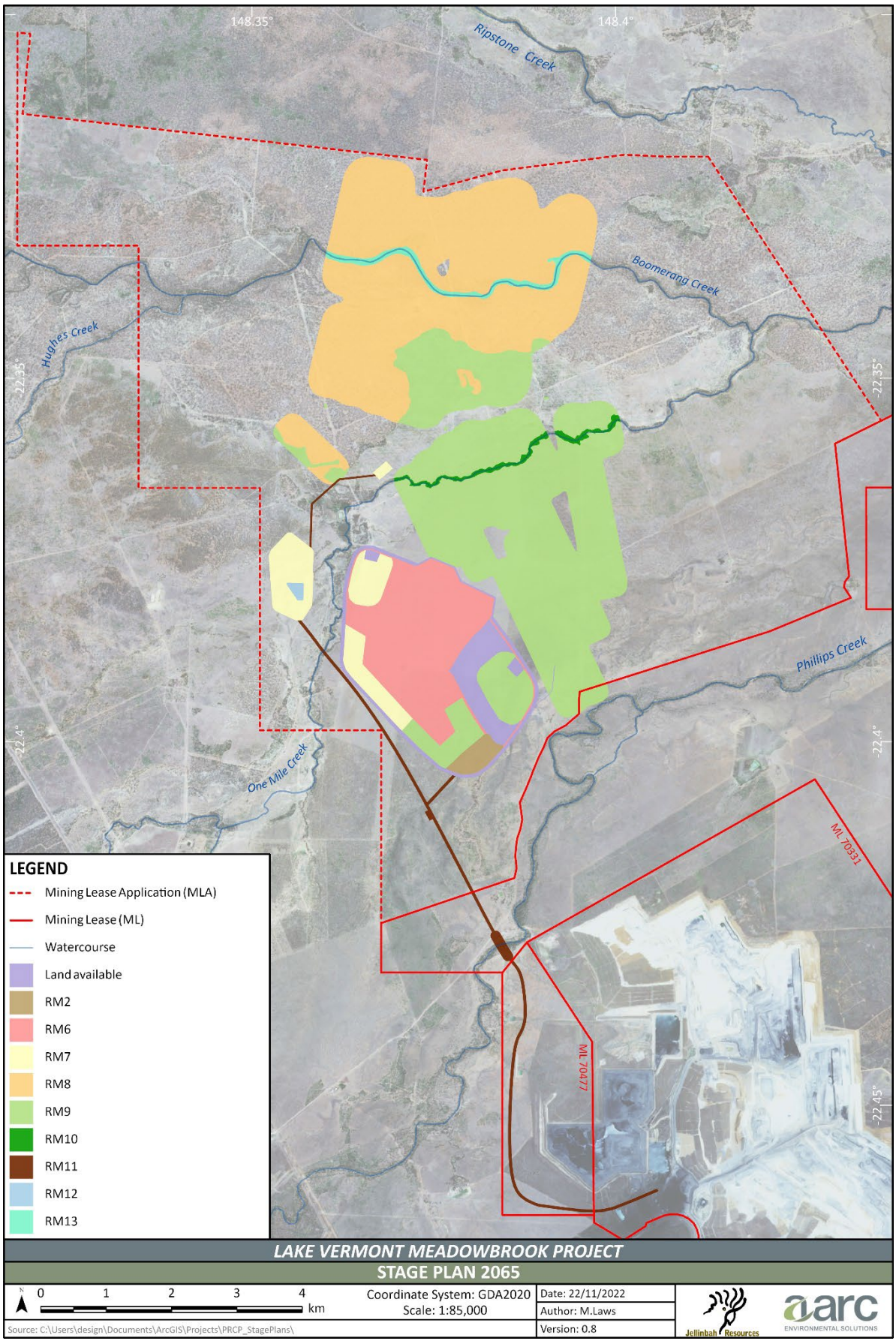
Jellinbah Resources
ENVIRONMENTAL SOLUTIONS


148.35°
148.4°
Ripstone Creek
Boomerang Creek
Hughes Creek
Phillips Creek
One Mile Creek
-22.35°
-22.4°
-22.45°
ML 70331
ML 7047
LEGEND
Mining Lease Application (MLA)
Mining Lease (ML)
Watercourse
Land available
RM2
RM6
RM7
RM8
RM9
RM10
RM11
RM12
RM13
LAKE VERMONT MEADOWBROOK PROJECT
STAGE PLAN 2065
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Coordinate System: GDA2020
Scale: 1:85,000
Date: 22/11/2022
Author: M.Laws
Version: 0.8
Source: C:\Users\design\Documents\ArcGIS\Projects\PRCP_StagePlans\
Jellinbah Resources
ENVIRONMENTAL SOLUTIONS

Appendix D. Community and Stakeholder Engagement Plan

6 Community and Stakeholder Engagement Plan

The Community and Stakeholder Engagement Plan applies to the requirement for engagement with communities and stakeholders. It outlines the proposed measures for ongoing engagement during construction of the Lake Vermont Meadowbrook Project and ongoing operations and rehabilitation of the Lake Vermont Meadowbrook Complex.

6.1 Objectives

The objectives of the community and stakeholder engagement plan are to:

- Ensure transparent and inclusive community and stakeholder engagement to facilitate the ongoing management and monitoring of potential social impacts during construction of the Lake Vermont Meadowbrook Project and ongoing operations and rehabilitation of the Lake Vermont Meadowbrook Complex.
- Provide a complaint mechanism to allow affected communities and stakeholders to register complaints, queries or comments and have them addressed in a timely manner by the Project.
- Ensure project planning and delivery are informed by stakeholder views.
- Ensure post-mining land use is consistent with community expectations.

Actions and processes have been developed to complement these objectives.

6.2 Engagement principles

Jellinbah will seek to involve the community during the planning, construction, operation and decommissioning of the Project in accordance with the SIA Guideline (2018), the Project's Terms of Reference and general good engagement practice such as outlined in Queensland Government's Community Engagement Toolkit for Planning (2017). In particular, Jellinbah will seek to understand and address community concerns about the environmental and social impacts of the Project's activities. Jellinbah will also seek to actively and effectively deal with community expectations around employment, economic, and community development opportunities.

The approach to stakeholder and community engagement involvement as outlined in the community and stakeholder engagement plan is based on the principles of respect, inclusion, proactiveness, responsiveness, sensitivity to those impacted, opened and honesty.

6.3 Stakeholder profile

The key stakeholder groups and stakeholders addressed in this community and stakeholder engagement plan are outlined in Table 6-1.

Table 6-1 Key stakeholder groups

Stakeholder group	Stakeholder	Primary interest
State Government	Office of the Coordinator-General, Department of State Development, Infrastructure, Local Government and Planning	• Application of SSRC Act and SIA Guideline (2018) • Implementation of SIMP
	Department of Transport and Main Roads	• Changes to road infrastructure • Traffic management planning
	Department of Seniors, Disability Services and Aboriginal and Torres Strait Islander Partnerships	• Employment and business opportunities for Aboriginal and/or Torres Strait Islander peoples
	Department of Communities, Housing and Digital Economy	• Potential for cumulative impacts to generate volatile impacts on housing availability and affordability • Any demand locally for social housing • Social and health infrastructure capacity
	Department of Employment, Small Business and Training	• Training opportunities for young people • Competition for skilled labour

Stakeholder group	Stakeholder	Primary interest
	Department of Resources	• Worker health and Safety
Local Government	Isaac Regional Council	• Workforce recruitment, management and accommodation • Changes to housing market • Impacts on community facilities and service access • Local supply and procurement opportunities • Road safety • Implementation of SIMP
	Mackay Regional Council	• Workforce recruitment and management • Regional supply opportunities
Coordinated groups	Dysart Interagency Network	• Bring stakeholders together and communicate any issues or shared challenges that may require a coordinated response
Social and public services providers	Dysart State School	• Community investment initiatives
	Dysart State High School	• Amenity impacts due to expansion of Lake Vermont Accommodation Village • Community investment initiatives
	Dysart Police Station	• Workforce behaviour • Emergency response • Traffic management
	Dysart Hospital	• Demand on services
	Dysart Ambulance Service	• Emergency response
	Lady Gowrie Childcare Centre	• Demand on services
Housing and accommodation providers	Housing providers in Dysart	• Potential for cumulative impacts to generate volatile impacts on housing availability and affordability
	Real estate agencies in Dysart	• Potential for cumulative impacts to generate volatile impacts on housing availability and affordability
	WAV Providers	• Worker health and safety
Industry groups and businesses	CFMEU Mining and Energy	• Worker health and safety
	Moranbah Traders Association	• Supply and procurement opportunities
	Resource Industry Network and ICN	• Supply and procurement opportunities
	Local business owners	• Increase in patronage
Aboriginal and Torres Strait Islander peoples	Barada Barna Aboriginal Corporation	• Changes to Native Title arrangements
	Indigenous businesses	• Supply and procurement opportunities
Local communities	Residents in Dysart	• Changes to amenity and community cohesion • Community investment opportunities
Workforce	Project workforce	• Health and safety • Access to quality accommodation

6.4 Engagement action plan

The engagement program outlined in Table 6-2 summarises key engagement activities during the construction, operation and rehabilitation phases of the Project following the approval of the Project. The program is by no means definitive and Jellinbah will adapt these stakeholder engagement activities to reflect local concerns as they arise.

Table 6-2 Community and stakeholder engagement action plan

Action	Responsibility	Relevant stakeholder groups	Timeframe
Continue to delegate the responsibility for community liaison to be the primary community contact point	Jellinbah	All	Ongoing during construction, operations and rehabilitation
Establish and maintain a project website which allows people to make enquiries and seek information regarding the Project	Jellinbah	All	Ongoing during construction, operations and rehabilitation
Continue to engage with local and affected landholders to monitor impacts	Jellinbah	Landholders Dysart community	Ongoing during construction, operations and rehabilitation
Continue in identifying issues, disseminating information throughout the life of the Project and providing a forum for discussion	Jellinbah	All	Ongoing during construction, operations and rehabilitation
Provide various communication channels (e.g. signage, advertisements in local papers, construction materials) about changes to local access, potential road hazards and expected traffic volumes during construction	Jellinbah and Thiess	Road users Isaac Regional Council	Ongoing during construction and operations
Facilitate open and transparent engagement with local communities	Jellinbah	All	Ongoing during construction, operations and rehabilitation
Establish, publicise and maintain a readily accessible community complaints and resolution process	Jellinbah	All	Ongoing during construction, operations and rehabilitation
Bi-annual publication and dissemination of Project Community Updates via the web site	Jellinbah	All	Ongoing during construction, operations and rehabilitation
Maintain long-term respectful relations with the Barada Barna including managing cultural heritage in accordance with the Cultural Heritage Management Plan and meeting the requirements of any native title agreement	Jellinbah	Barada Barna Aboriginal Corporation	Ongoing during construction, operations and rehabilitation
Regular engagement with the Isaac Regional Council in the monitoring of SIMP implementation	Jellinbah	Isaac Regional Council	Ongoing during construction, operations and rehabilitation
Engage with the community through implementation of community investment initiatives as outlined in the SIMP	Jellinbah	Dysart community Social services	Ongoing during construction, operations and rehabilitation

Action	Responsibility	Relevant stakeholder groups	Timeframe
Engage with interested and affected parties on activities related to rehabilitation and closure	Jellinbah	All	Ongoing during operations, closure and rehabilitation

6.5 Complaints Management Process

To facilitate open communication and active complaint resolution, it is important that local stakeholders can raise issues and complaints in a formal way.

Jellinbah and Thiess Mining Services will work proactively towards preventing complaints through the implementation of impact mitigation and through community liaison. The Project will be supported by a Project Officer who will provide a dedicated contact point for the community and stakeholders and be available to receive and respond to complaints. This officer will ensure that all issues are conveyed to the appropriate management in the event an issue relates to operational issues. Anyone will be able to submit a complaint to the Project if they believe a practice is having a detrimental impact on the community, the environment, or their quality of life. They may also submit comments and suggestions.

Concerns and issues raised by stakeholders will be recorded and responded to in a timely and consistent manner, and in accordance with regulatory standards. A summary of the procedure for processing complaints is depicted in Figure 6-1.

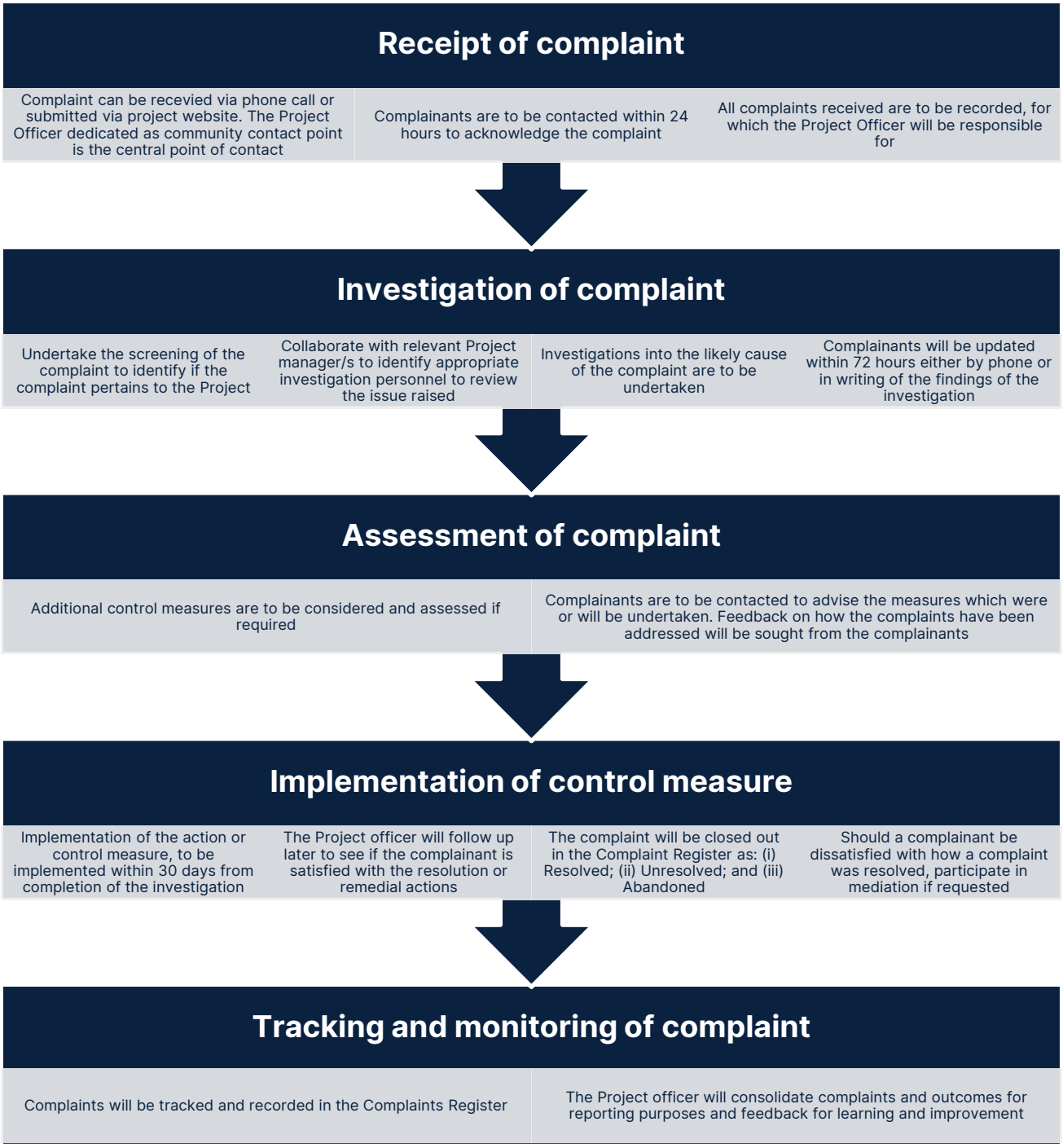

Figure 6-1 Complaints management process

A range of complaints channels will be established, including through telephone contacts, Jellinbah's website and during the construction and early operation phases of the Project, the presence of a project office in Dysart.

A Community Contact number for the purpose of receiving complaints and enquiries from stakeholders in relation to project activities will be provided. This Community Contact number will be provided to:

- Isaac Regional Council.
- Emergency services in Dysart, including Queensland Police Service and Queensland Ambulance Service.
- Landholders in the vicinity of the Lake Vermont Meadowbrook Complex and its infrastructure, including Lake Vermont Accommodation Village.
- The public.

All incoming calls will be logged into the stakeholder database. Jellinbah will maintain its website which will provide the community with up-to-date information on the Project and its activities. The website will also provide contact details.

6.6 Rehabilitation and closure engagement

Amendments to the EP Act in 2018 introduced a package of reforms relating to the progressive rehabilitation and closure of mined lands. A critical element of these reforms is a requirement for the development of a progressive rehabilitation and closure plan (PRCP) detailing how, where and when rehabilitation activities will be carried out on land in a way that maximises the progressive rehabilitation of the land to a stable condition.

Specifically, as part of the progressive rehabilitation planning requirements introduced, section 126C(1)(c)(iv) of the EP Act requires '*details of how the applicant will undertake ongoing consultation in relation to the rehabilitation to be carried out under the plan*'.

The supporting guideline 'Progressive rehabilitation and closure plans' (DES, 2019), states that a community consultation plan must include details of:

- The objectives for community consultation plans (refer to Section 6.4).
- The proposed consultation frequency (refer to Section 6.4).
- What information will be released for community consultation (refer to Section 6.6).
- How feedback and comments will be considered (refer to Section 6.5).

Community consultation and engagement will be ongoing throughout the development of the PRCP as well as the construction, operations, rehabilitation and closure phases of the Project. In relation to the actions identified in Table 6-2, the following aspects of rehabilitation and closure will be discussed:

- Proposed post-mining land use for the Project.
- Rehabilitation methods.
- Progressive rehabilitation timeframes and milestone scheduling.
- Any proposed amendments to the PRCP schedule.

6.7 Community consultation register

The Project Officer will maintain a community consultation register. The community consultation register will record the following information for each contact with a community member or stakeholder group:

- Consultation date(s).
- Identification of community member or stakeholder group.
- Description of consultation type.
- Information provided to community member or stakeholder group.
- Issues raised and/or discussed by the community member or stakeholder group.
- How issues have been considered.
- Decisions and outcomes of consultation.
- Any actions made by Jellinbah or Thiess Mining.

All complaints received will be included in the community consultation register. The community consultation register will also inform ongoing development of the PRCP.

7 SIMP implementation plan

Management measures presented in the SIMP will be implemented through a range of proponent initiatives and strategies.

7.1 Roles and responsibilities of SIMP implementation

Implementation of the SIMP requires collaborative input with key stakeholders, including local and state government and communities.

Table 7-1 outlines the roles and responsibilities relevant to the development, coordination and implementation of this SIMP.

Table 7-1 Roles and responsibilities of SIMP implementation

Key stakeholder group	Role in SIMP development and review	Responsibility in SIMP implementation
Office of the Coordinator-General	• Provide input into adequacy of proposed management measures • Provide input on development of management measures to respond to cumulative social impacts	• Approve SIMP under the EP Act • Coordinate management measures developed to respond to cumulative social impacts
The Proponent	• Review and provide input into adequacy of proposed management measures	• Approve SIMP for lodgement under EP Act • Proactively coordinate with stakeholders on SIMP implementation
Jellinbah	• Develop management measures in collaboration with relevant stakeholders • Review and provide input into adequacy of proposed management measures	• Implement management measures developed to respond to social impacts • Ongoing monitoring of overall SIMP effectiveness • Adopt relevant management measures into operations and procedures • Proactively coordinate with stakeholders on SIMP implementation
Thiess Mining Services	• Provide input into development of management measures	• Implement management measures developed to respond to social impacts • Ongoing monitoring of overall SIMP effectiveness • Adopt relevant management measures into operations and procedures • Proactively coordinate with stakeholders on SIMP implementation
Isaac Regional Council	• Provide input on adequacy of proposed management measures	• Notify Jellinbah if management measure is not effective when implemented during regular one-on-one meetings with Jellinbah / Thiess Mining Services
WAV operator	• Provide input on adequacy of proposed management measures	• Adopt relevant management measures into operations and procedures • Notify Jellinbah if management measure is not effective when implemented during regular one-on-one meetings with Jellinbah / Thiess Mining Services
Dysart community	• Provide input on adequacy of proposed management measures	• Notify Jellinbah if management measure is not effective when implemented
Emergency Services in Dysart	• Provide input on adequacy of proposed management measures	• Notify Jellinbah if management measure is not effective when implemented
Social infrastructure and services in Dysart (including schools, childcare, GP clinic)	• Provide input on adequacy of proposed management measures	• Notify Jellinbah if management measure is not effective when implemented during regular one-on-one meetings with Jellinbah / Thiess Mining Services

Key stakeholder group	Role in SIMP development and review	Responsibility in SIMP implementation
Dysart Interagency Group	• Provide input on adequacy of proposed management measures	• Notify Jellinbah if management measure is not effective when implemented during regular one-on-one meetings with Jellinbah / Thiess Mining Services
Housing and accommodation providers	• Provide input on adequacy of proposed management measures	• Notify Jellinbah if management measure is not effective when implemented
Industry groups and businesses	• Provide input on adequacy of proposed management measures	• Notify Jellinbah if management measure is not effective when implemented
Barada Barna Aboriginal Corporation	• Provide input on adequacy of proposed management measures	• Notify Jellinbah if management measure is not effective when implemented

7.2 Partnerships with stakeholders

Implementation of management measures require establishing new or maintaining existing partnerships with stakeholders. Partnerships with stakeholders are essential to ensure:

- Effective implementation of management measures.
- Monitoring of social impacts and identify any changes to the significance of the social impact.
- Provision of an engagement medium through which stakeholders can voice their feedback on implementation of management measures or raise new social impacts as a result of the Lake Vermont Meadowbrook Complex.

Maintaining partnerships with stakeholders would also benefit the management of cumulative social impacts, such as in relation to monitoring demand on housing and social services in Dysart. Table 6-2 outlines the partnerships with stakeholders, including the objective of partnership and the engagement medium and frequency.

Table 7-2 Partnerships with stakeholders

Stakeholder	Objective of partnership	Engagement medium	Frequency
Isaac Regional Council	• Address any cumulative issues to housing market • Identify skills gaps in local and regional opportunities	One-on-one meetings	As required
Barada Barna Aboriginal Corporation	• Managing Cultural Heritage	One-on-one meetings	As required
Queensland Ambulance Service	• Provision of advance notice of workforce mobilisation and operational changes	Letter	As required
Queensland Police Service	• Monitor workforce behaviour • Provision of advance notice of workforce mobility and operational changes	One-on-one meetings	Six-monthly
Dysart Hospital	• Provision of advance notice of workforce mobility and operational changes	Letter	As required
Dysart Interagency Group	• Quarterly meetings bring stakeholders together and communicate any issues or shared challenges that may require a coordinated response	Attendance at and participation in Dysart Interagency Group events	Quarterly
Dysart State High School	• Support youth career enhancement opportunities through interaction with people from the mining workforce	Participation in school events	As required
Dysart State School	• Support delivery of school events and initiatives	Participation in school events	As required

Stakeholder	Objective of partnership	Engagement medium	Frequency
Department of State Development, Infrastructure, Local Government and Planning	• Identify skills gaps in local and regional opportunities	One-on-one meetings	As required
Moranbah Traders Association	• Ensure local and regional supplier listing is relevant and tailored to existing context and economic trends	One-on-one meetings	Annually
Dysart Business Group	• Ensure the Lake Vermont Meadowbrook Complex maximises engagement with local businesses, where feasible	One-on-one meetings	As required
Lady Gowrie Childcare Centre	• Support stakeholder to facilitate expansion of capacity • Monitor demand on places • Address any cumulative issues to capacity	One-on-one meetings	Annually
BMA (proponent of Saraji East Mining Lease Project)	• Address any cumulative issues to housing market in Dysart • Address any cumulative issues to capacity of social services in Dysart • Understand timing of workforce mobilisation and operational activities	One-on-one meetings	As required
Dysart Housing Providers	• Address any cumulative issues to housing market • Provision of advance notice of workforce mobility and operational changes	One-on-one meetings	As required

Appendix E. Monitoring and Maintenance Program

Milestone reference	Milestone criteria	Methodology	Sampling Design	Timing / Frequency	Replication	Analysis Methods	Location
RM1 – Infrastructure decommissioning and removal	All non-required services disconnected and removed	Visual inspection following decommissioning and removal	n/a	following decommissioning and removal	n/a	n/a	RA1 RA2 RA3
	Underground drifts portals and shaft entrances sealed						
	All concrete, bitumen and gravel roads removed (where not to be retained)						
	All non-required operational pipelines drained and removed						
	All fencing that is not part of PMLU requirements removed						
	All non-required buildings and footings demolished and/or removed						
	All machinery and equipment removed						
	All surface water drainage infrastructure that is not retained in the final landform removed						
	All rubbish removed						
RM2 – Management of contaminated land status	Contaminated material either remediated in-situ or removed/transported to an approved landfill for disposal and waste tracking information recorded and submitted	Visual inspection to identify potential areas of land contamination and/or certify land as free of contaminants or contaminating materials.	Visual inspection of potential sites or sources of contaminated material. Samples to be collected as required and follow-up with material removal if required.	following decommissioning and infrastructure removal	n/a	n/a	RA1 RA3
	Contaminated land assessment undertaken by an appropriately qualified person. If required, a site investigation report including a site suitability statement prepared and submitted in accordance with the provisions of Chapter 7, Part 8 of the EP Act	Provide certification from an appropriately qualified person that contaminated land assessment has been undertaken, and site investigation report prepared and submitted, if required.	n/a	following decommissioning and infrastructure removal	n/a	n/a	
RM3 – Landform development and re-profiling / re shaping of land affected by subsidence	All earthworks and landform reshaping/reprofiling works completed to design specifications	Visual inspection and document activities.	n/a	Following completion of earthworks	n/a	n/a	RA6 RA7 RA8 RA9
	Certification provided by an appropriately qualified person1 confirms that drainage features are constructed to design specifications	Provide certification from an appropriately qualified person that design criteria have been met.	n/a	Following completion of earthworks	n/a	n/a	
	Geotechnical assessment undertaken by an appropriately qualified person confirms that long-term geotchnical stability has been achieved for all land affected by subsidence	Provide certification from an appropriately qualified person that long-term stability has been achieved for all land affected by subsidence.	n/a	Following completion of earthworks	n/a	n/a	

Milestone reference	Milestone criteria	Methodology	Sampling Design	Timing / Frequency	Replication	Analysis Methods	Location
RM4 – Landform development (re-profiling / re shaping) of land affected by surface disturbance	**Landform development works:**						RA1 RA2a RA4 RA5
	All bulk earthworks and landform reshaping/reprofiling works completed to design specifications	Visual inspection and document activities.	n/a	Following completion of earthworks	n/a	n/a	
	Certification provided by an appropriately qualified person1 confirms that drainage features are constructed to design specifications	Provide certification from an appropriately qualified person that design criteria have been met.	n/a	Following completion of earthworks	n/a	n/a	
	Geotechnical assessment undertaken by appropriately qualified person confirms that long-term stability has been achieved for each relevant landform	Provide certification from an appropriately qualified person that long-term stability has been achieved for each relevant landform.	n/a	Following completion of earthworks	n/a	n/a	
	Landform constructed to the following design parameters, where relevant:						
	Waste rock emplacements: - slopes ≤11° (20%) - uninterrupted batter length ≤70 m - stable berms or bunds (≥5 m wide)	Obtain LiDAR survey and produce DEM post construction works. Provide certification from an appropriately qualified person that design criteria have been achieved.	Obtain LiDAR, produce DEM and quantify post-rehabilitation slope gradients.	Following completion of earthworks	n/a	Quantify and analyse final rehabilitated slope gradients and lengths and compare to milestone criteria	RA4 (waste rock emplacement)
	Flood levee slopes: ≤8.5° (15%)	Obtain LiDAR survey and produce DEM post construction works. Provide certification from an appropriately qualified person that design criteria have been achieved.	Obtain LiDAR, produce DEM and quantify post-rehabilitation slope gradients.	Following completion of earthworks	n/a	Quantify and analyse final rehabilitated slope gradients and compare to milestone criteria	RA5 (flood levee)
	Rehabilitated pit slopes: ≤11° (20%)	Obtain LiDAR survey and produce DEM post construction works. Provide certification from an appropriately qualified person that design criteria have been achieved.	Obtain LiDAR, produce DEM and quantify post-rehabilitation slope gradients.	Following completion of earthworks	n/a	Quantify and analyse final rehabilitated slope gradients and compare to milestone criteria	RA4 (rehabilitated pit)
RM5 – Surface preparation (topdressing, contour ripping, soil amelioration)	Prior to each rehabilitation event, soil health and suitability assessed and documented by an appropriately qualified person1, and a recommendation made for ameliorants to ensure sodicity, salinity, pH and fertility levels are suitable to achieve the relevant post-mining land use	Record of soil health and suitability assessment undertaken by an appropriately qualified person.	n/a	Prior to each rehabilitaton event	n/a	n/a	RA1 RA2a RA4 RA5 RA6 RA7 RA8 RA9
	Records of topsoil placement and origin, and photographic evidence indicating achievement of a target depth of 0.2 m	Document placement of topsoil or suitable substitute across reshaped areas. Records to include source, analysis results and any pre-treatments applied.	n/a	During or at the completion of topsoil placement	n/a	n/a	
	Ripping undertaken along the contour of slopes	Visually inspection and documentation of contour ripping including depth, spacing and machinery used.	n/a	During or at the completion of ripping activities	n/a	n/a	
	Records of ameliorants applied and incorporated into surface, as recommended by an appropriately qualified person1	Documentation of ameliorants application across reshaped areas. Records to include types, rates and timing of applications.	n/a	During or following the application of ameliorants	n/a	n/a	
RM6 – Revegetation (seeding and / or planting)	**Analogue sites:**						Analogue sites
	For each analogue site (see *Table 32: Analogue site locations* of PRCP), collect baseline data to inform revegetation plans.	Species richness is assessed per the Eyre et al. (2015) methodology. All flora species within a 10 m x 50 m plot area are recorded [i.e. all trees, shrubs (<1m in height), forbs/other species, and grasses occurring within 5 m of either side of the transect]. Woody stem count within 10 m x 50 m plot recorded. Groundcover within ten 1 m x 1 m quadrat recorded.	Visual assessment to record all flora species present and the woody stem count within 50 m x 10 m plot area of each permananent transect. Visual assessment of groundcover recorded across ten 1 m x 1 m quadrats at each rehabilitation site. Refer to *3.7.2.1 Permanent vegetation monitoring transects* of PRCP.	Prior to RA6 and RA9 requiring revegetation (Year 2039 and 2054 respectively)	Number of replicates required for each RE based on BioCondition monnitoring standards	Statistical analysis will be performed to obtain an average of replicate analogues for each RE	
	Surface disturbance (RA1, RA2a, RA4, RA5):						RA1 RA2a RA4 RA5
	Seeding of target species and/or planting of tube stock (where relevant) in accordance with Table 19: Grazing PMLU seed mix of PRC plan.	Document seeding and planting rates/densities	n/a	During revegetation works	n/a	n/a	
	Subsidence disturbance - pasture (RA7, RA8):						RA7 RA8
	For each area identified through monitoring in accordance with the Subsidence Management Plan as requiring revegetation, a revegetation plan has been prepared by an appropriately qualified person with reference to Table 19: Grazing PMLU seed mix or Table 20: Grazing PMLU seed mix for areas subject to intermittent ponding of the PRC plan.	Prepare revegetation plan for each area requiring revegetation	n/a	Prior to revegetation works	n/a	n/a	

Milestone reference	Milestone criteria	Methodology	Sampling Design	Timing / Frequency	Replication	Analysis Methods	Location
	Seeding of target species and/or planting of tube stock (where relevant) in accordance with the applicable revegetation plan.	Document seeding and planting rates/densities	n/a	During revegetation works	n/a	n/a	
	Subsidence disturbance - native vegetation (RA6, RA9):						RA6 RA9
	For each area identified through monitoring in accordance with the Subsidence Management Plan as requiring revegetation, a revegetation plan has been prepared by an appropriately qualified person, with reference to Table 20: Revegetation species list for subsidence area and/or Table 21 Revegetation species list for subsidence areas subject to intermittent ponding of the PRC plan.	Prepare revegetation plan for each area requiring revegetation	n/a	Prior to revegetation works	n/a	n/a	
	Seeding of target species and/or planting of tube stock (where relevant) in accordance with the applicable revegetation plan.	Document seeding and planting rates/densities	n/a	During revegetation works	n/a	n/a	
RM7 – Achievement of grazing and marginal grazing modified pasture PMLUs to stable condition	For rehabilitation areas not subject to ponding, rehabilitation polygons have a median fractional vegetation cover greater than the first quartile of reference polygons for at least 85% of all sample times, as determined using the satellite-derived fractional vegetation cover method5.	Satellite imagery from the Sentinel 2 global earth observation mission acquires imagery on a five-to-12-day interval at wavelengths between 400-2500nm. Reflectance indices based on the spectral reflectance profiles of photosynthetic vegetation, non-photosynthetic vegetation and bare ground will be calculated and directly correlated with field-collected data to calculate fractional vegetation cover for each rehabilitation and reference polygon (refer to Section 3.7.2.4 *Satellite-derived fractional vegetation monitoring* of the PRCP).	Satellite imagery from the Sentinel 2 global earth observation mission. Calibration and validation of fractional cover will be conducted during annual fixed transect monitoring using either (a) point intercept transects from Muir et al. (2011) modified to 50 m or (b) sub-10cm UAV imagery captured as 1 ha blocks. ISODATA clustering and supervised spectral class assignment provide fractional cover for UAV imagery.	Satellite-based monitoring will be reported annually using one acquisition per calendar month (12 per annum). Except where cloud cover or cloud shadow occlude the study area in a calendar month, imagery of the study area and acquisition metadata are reported.	n/a	Reflectance indices based on the spectral reflectance profiles of photosynthetic vegetation, non-photosynthetic vegetation and bare ground will be calculated and directly correlated with field-collected data to calculate fractional vegetation cover for each rehabilitation and reference polygon.	RA1 RA2a RA5 RA7 RA8
	In revegetated areas, ground foliage cover comprises at least 3 pasture grass and/or forb species	Species inventory and richness to be recorded at revegetation monitoring sites (refer to Section 3.7.2.1 *Permanent vegetation monitoring transects* of PRCP).	Monitoring of all perennial plants within 5 m of either side of a 50 m transect (refer to 3.7.2.1 *Permanent vegetation monitoring transects* of PRCP).	Annually following establishment period.	Minimum of 3 transects per landform type (slope, flat, inundation areas) per RA.	Ongoing monitoring and analysis of temporal variation.	RA1 RA2a RA4 RA5 RA7 RA8
	No 'Severe' erosion, and drainage follows appropriate paths	Erosion monitoring to be conducted at rehabilitation sites and general observations of 'Severe' erosion across each RA are to be recorded (refer to Section 3.7.2.4 *Erosion monitoring* of the PRCP). Extent of erosion features and severity rating recorded across 50 m transect. These attributes are used to classify erosion according to the classification system in (refer to Section 3.7.2.4 *Erosion monitoring* of the PRCP).	Visual assessment conducted along each permanent 50 m transect to detect any existing or new erosion features. General observations of severe erosion(i.e. tunnels, mass wasting, large gullies) outside the transect are also recorded.	Annually. Erosion stability to be assessed from year four following seeding/planting.	Minimum of 3 transects per landform type (slope, flat, inundation areas) per RA.	Qualitative classification system applied. Erosion results to be analysed both categorically and temporally to compare with analogue sites and determine stabilisation of erosion rates over time.	
	Weed cover is ≤15% (excluding exotic pasture grasses)	Monitoring of weed species and percentage foliage cover is to be conducted at rehabilitation sites as described in the PRCP (Section 3.7.2.1 Permanent vegetation monitoring plots). Record of weed management activities undertaken (where recommended in rehabilitation monitoring reports)	Recording all weed species within a 10 m x 50 m plot area (i.e. all introduced species occurring within 5 m of either side of the transect centre-line) and monitoring of weed percentage foliage cover across ten 1 m x 1 m quadrats at each rehabilitation site. Refer to 3.7.2.1 Permanent vegetation monitoring transects of PRCP.	Annually following seeding/planting.	Minimum of 3 transects per landform type (slope, flat, inundation areas) per RA.	Temporal analyses will be used to identify any outliers or ongoing trends.	

Milestone reference	Milestone criteria	Methodology	Sampling Design	Timing / Frequency	Replication	Analysis Methods	Location
RM8 – Achievement of marginal grazing native vegetation PMLU to stable condition	In revegetated areas, establishment of ≥50% of species within each functional group planted	Species inventory and richness to be recorded at revegetation monitoring sites (refer to Section 3.7.2.1 *Permanent vegetation monitoring transects* of PRCP).	Monitoring of all perennial plants within 5 m of either side of a 50 m transect (refer to 3.7.2.1 *Permanent vegetation monitoring transects* of PRCP).	Annually following seeding/planting.	Minimum of 1 transect per revegetated area OR as per BioCondition density per RE where revegetation area within a given RE is greater than 60ha	Compare monitoring data to seeding/planting records to determine survival rates of each perennial species	RA6
	Weed cover is ≤15% (excluding exotic pasture grasses)	Monitoring of weed species and percentage foliage cover is to be conducted at rehabilitation sites as described in the PRCP (Section 3.7.2.1 Permanent vegetation monitoring plots). Record of weed management activities undertaken (where recommended in rehabilitation monitoring reports)	Recording all weed species within a 10 m x 50 m plot area (i.e. all introduced species occurring within 5 m of either side of the transect centre-line) and monitoring of weed percentage foliage cover across ten 1 m x 1 m quadrats at each rehabilitation site. Refer to 3.7.2.1 Permanent vegetation monitoring transects of PRCP.	Annually following seeding/planting.	Minimum of 1 transect per revegetated area OR as per BioCondition density per RE where revegetation area within a given RE is greater than 60ha	Temporal analyses will be used to identify any outliers or ongoing trends.	
	No 'Severe' erosion, and drainage follows appropriate paths	Erosion monitoring to be conducted at rehabilitation sites and general observations of 'Severe' erosion across each RA are to be recorded (refer to Section 3.7.2.4 *Erosion monitoring* of the PRCP). Extent of erosion features and severity rating recorded across 50 m transect. These attributes are used to classify erosion according to the classification system in (refer to Section 3.7.2.4 *Erosion monitoring* of the PRCP).	Visual assessment conducted along each permanent 50 m transect to detect any existing or new erosion features. General observations of severe erosion(i.e. tunnels, mass wasting, large gullies) outside the transect are also recorded.	Annually. Erosion stability to be assessed from year four following seeding/planting.	Minimum of 1 transect per revegetated area OR as per BioCondition density per RE where revegetation area within a given RE is greater than 60ha	Qualitative classification system applied. Erosion results to be analysed both categorically and temporally to compare with analogue sites and determine stabilisation of erosion rates over time.	
	Evidence of fauna utilisation (i.e. fauna sightings, scats and tracks records)	Ad hoc observations of fauna or indicators of fauna presence (e.g. scats, tracks or other signs of fauna activity)	n/a	Observations recorded during rehabilitation monitoring activities or at other times	n/a	n/a	

Milestone reference	Milestone criteria	Methodology	Sampling Design	Timing / Frequency	Replication	Analysis Methods	Location
RM9 – Achievement of grazing and marginal grazing modified pasture PMLUs to sustainable condition	Land suitability assessment by an appropriately qualified person1 certifies that land has achieved a minimum post-mine land suitability4 class of 3 (RA1, RA2a, RA5 and RA7) or class 4 (RA4 and RA8).	Provide certification from an appropriately qualified person that land suitability targets have been met.	n/a	Prior to milestone completion date	n/a	n/a	RA1 RA2a RA4 RA5 RA7 RA8
	Weed cover is ≤10% (excluding exotic pasture grasses).	Monitoring of weed species and percentage foliage cover is to be conducted at rehabilitation sites as described in the PRCP (Section 3.7.2.1 Permanent vegetation monitoring plots). Record of weed management activities undertaken (where recommended in rehabilitation monitoring reports)	Recording all weed species within a 10 m x 50 m plot area (i.e. all introduced species occurring within 5 m of either side of the transect centre-line) and monitoring of weed percentage foliage cover across ten 1 m x 1 m quadrats at each rehabilitation site. Refer to 3.7.2.1 Permanent vegetation monitoring transects of PRCP.	Annually following seeding/planting.	Minimum of 3 transects per landform type (slope, flat, inundation areas) per RA.	Temporal analyses will be used to identify any outliers or ongoing trends.	
	For rehabilitation areas not subject to ponding, rehabilitation polygons have a median fractional vegetation cover greater than the first quartile of reference polygons for at least 85% of all sample times, as determined using the satellite-derived fractional vegetation cover method5.	Satellite imagery from the Sentinel 2 global earth observation mission acquires imagery on a five-to-12-day interval at wavelengths between 400-2500nm. Reflectance indices based on the spectral reflectance profiles of photosynthetic vegetation, non-photosynthetic vegetation and bare ground will be calculated and directly correlated with field-collected data to calculate fractional vegetation cover for each rehabilitation and reference polygon (refer to Section 3.7.2.4 *Satellite-derived fractional vegetation monitoring* of the PRCP).	Satellite imagery from the Sentinel 2 global earth observation mission. Calibration and validation of fractional cover will be conducted during annual fixed transect monitoring using either (a) point intercept transects from Muir et al. (2011) modified to 50 m or (b) sub-10cm UAV imagery captured as 1 ha blocks. ISODATA clustering and supervised spectral class assignment provide fractional cover for UAV imagery.	Satellite-based monitoring will be reported annually using one acquisition per calendar month (12 per annum). Except where cloud cover or cloud shadow occlude the study area in a calendar month, imagery of the study area and acquisition metadata are reported.	NA	Reflectance indices based on the spectral reflectance profiles of photosynthetic vegetation, non-photosynthetic vegetation and bare ground will be calculated and directly correlated with field-collected data to calculate fractional vegetation cover for each rehabilitation and reference polygon.	
	In revegetated areas, ground foliage cover comprises at least 3 pasture grass and/or forb species	Species inventory and richness to be recorded at revegetation monitoring sites (refer to Section 3.7.2.1 *Permanent vegetation monitoring transects* of PRCP).	Monitoring of all perennial plants within 5 m of either side of a 50 m transect (refer to 3.7.2.1 *Permanent vegetation monitoring transects* of PRCP).	Annually following establishment period.	Minimum of 3 transects per landform type (slope, flat, inundation areas) per RA.	Ongoing monitoring and analysis of temporal variation.	
	Within revegetated areas subject to periodic inundation, field-based monitoring data demonstrates that water quality parameters are below the trigger values for livestock drinking water defined in Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018)	Surface water sampling will be carried out in accordance with the Queensland *Monitoring and Sampling Manual* (DES 2018). Field readings of pH and EC will be recorded and results will be assessed against relevant milestone criteria.	Water samples will be collected from subsided areas subject to intermittent ponding	Annually following the wet season and / or after significant rainfall events.	Minimum of 3 samples per RA.	Water quality data in rehabilitated sites to be compared to trigger values for livestock drinking water Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018)	
	No 'Severe' erosion, and drainage follows appropriate paths	Erosion monitoring to be conducted at rehabilitation sites and general observations of 'Severe' erosion across each RA are to be recorded (refer to Section 3.7.2.4 *Erosion monitoring* of the PRCP). Extent of erosion features and severity rating recorded across 50 m transect. These attributes are used to classify erosion according to the classification system in (refer to Section 3.7.2.4 *Erosion monitoring* of the PRCP).	Visual assessment conducted along each permanent 50 m transect to detect any existing or new erosion features. General observations of severe erosion(i.e. tunnels, mass wasting, large gullies) outside the transect are also recorded.	Annually. Erosion stability to be assessed from year four following seeding/planting.	Minimum of 3 transects per landform type (slope, flat, inundation areas) per RA.	Qualitative classification system applied. Erosion results to be analysed both categorically and temporally to compare with analogue sites and determine stabilisation of erosion rates over time.	
	Hazard and Safety Assessment completed by an appropriately qualified person demonstrates hazards in rehabilitation areas are consistent with the type and severity of hazards typical of neighbouring equivalent land use. Remaining hazards are considered to be low risk with no significant increase in risk expected over time.	Hazards to be assessed by an appropriately qualified person as part of a Hazard and Safety Assessment.	Visual inspection to be conducted throughout rehabilitation areas to identify any remaining hazards or safety concerns.	Prior to milestone completion date.	n/a	n/a	
	Water quality from direct rainfall run-off or surface seepage from rehabilitated spoil (RA4 and RA5) has: - pH 6.5 to 9.0 - EC <2,000 µS/cm	Surface water and groundwater sampling will be carried out in accordance with the Queensland *Monitoring and Sampling Manual* (DES 2018). Field readings of pH and EC will be recorded and results will be assessed against relevant milestone criteria.	Water samples will be collected from monitoring locations identified in Section 3.7.2.8 *Surface water and groundwater monitoring* of the PRCP	Annually following the wet season and / or after significant rainfall events.	One sample collected at each sampling point identified in Section 3.7.2.8 *Surface water and groundwater monitoring* of the PRCP	Water quality data in rehabilitated sites to be compared to relevant milestone criteria	RA4 RA5

Milestone reference	Milestone criteria	Methodology	Sampling Design	Timing / Frequency	Replication	Analysis Methods	Location
RM10 – Achievement of marginal grazing native vegetation PMLU to stable condition	Land suitability assessment by an appropriately qualified person1 certifies that land has achieved a minimum post-mine land suitability4 class of 4	Provide certification from an appropriately qualified person that land suitability targets have been met.	n/a	Prior to milestone completion date	n/a	n/a	RA6 Analogue sites (where applicable)
	Weed cover is ≤10% (excluding exotic pasture grasses).	Monitoring of weed species and percentage foliage cover is to be conducted at rehabilitation sites as described in the PRCP (Section 3.7.2.1 Permanent vegetation monitoring plots). Record of weed management activities undertaken (where recommended in rehabilitation monitoring reports)	Recording all weed species within a 10 m x 50 m plot area (i.e. all introduced species occurring within 5 m of either side of the transect centre-line) and monitoring of weed percentage foliage cover across ten 1 m x 1 m quadrats at each rehabilitation site. Refer to 3.7.2.1 *Permanent vegetation monitoring transects* of PRCP.	Annually following seeding/planting.	Minimum of 1 transect per revegetated area OR as per BioCondition density per RE where revegetation area within a given RE is greater than 60ha	Temporal analyses will be used to identify any outliers or ongoing trends.	
	Within areas of natural drainage, field-based monitoring data provided in the final rehabilitation report demonstrates that the following attributes are comparable to representative analogue sites: o species richness of tree, shrub and groundcover functional groups; o tree canopy cover; o shrub canopy cover; and o perennial grass cover.	Species richness is assessed per the Eyre et al. (2015) methodology. All flora species within a 10 m x 50 m plot area are recorded [i.e. all trees, shrubs (<1m in height), forbs/other species, and grasses occurring within 5 m of either side of the transect centre-line]. Refer to detailed methodology in Section 3.7.2.1 *Permanent vegetation monitoring transects* of PRCP. Tree and shrub canopy cover assessed per the Eyre et al. (2017) methodology. Refer to detailed methodology in Section 3.7.2.9 *Canopy cover* of PRCP. Perrenial grass cover within ten 1 m x 1 m quadrats is recorded. Refer to 3.7.2.1 *Permanent vegetation monitoring transects* of PRCP.	Visual assessment to record all flora species present within 50 m x 10 m plot area of each permananent transect. Visual assessment of perennial grass cover recorded across ten 1 m x 1 m quadrats at each rehabilitation site. Refer to 3.7.2.1 *Permanent vegetation monitoring transects* of PRCP. Visual assessment of shrub and tree canopy cover along 50 m transect.	Annually following establishment period (RA6). Every 5 years following establishment period (analogue sites)	Minimum of 1 transect per revegetated area OR as per BioCondition density per RE where revegetation area within a given RE is greater than 60ha	Statistical analyses will be performed to provide a comparative analysis of rehabilitation sites against analogue site values. Temporal analyses will be used to identify any outliers or ongoing trends.	
	Within subsidence areas subject to periodic inundation where revegetation activities have been undertaken, the final rehabilitation report demonstrates that: o species richness of tree, shrub and groundcover functional groups is comparable to baseline data; o the percentage of ground cover2 (i.e. foliage, woody debris, litter and rock) is ≥80%; and o the percentage of ground foliage cover3 achieves the ≥25th percentile of that at analogue site(s) AS19 and AS20.	Species richness is assessed per the Eyre et al. (2015) methodology. All flora species within a 10 m x 50 m plot area are recorded [i.e. all trees, shrubs (<1m in height), forbs/other species, and grasses occurring within 5 m of either side of the transect centre-line]. Refer to detailed methodology in Section 3.7.2.1 *Permanent vegetation monitoring transects* of PRCP. Percentage ground cover (foliage, woody debris, litter and rock) within ten 1 m x 1 m quadrats is recorded. Refer to 3.7.2.1 *Permanent vegetation monitoring transects* of PRCP.	Visual assessment to record all flora species present within 50 m x 10 m plot area of each permananent transect. Visual assessment of ground cover recorded across ten 1 m x 1 m quadrats at each rehabilitation site. Refer to 3.7.2.1 *Permanent vegetation monitoring transects* of PRCP.	Annually following establishment period (RA6). Every 5 years following establishment period (analogue sites)	Minimum of 1 transect per revegetated area OR as per BioCondition density per RE where revegetation area within a given RE is greater than 60ha	Statistical analyses will be performed to provide a comparative analysis of rehabilitation sites against analogue and baseline data site values. Temporal analyses will be used to identify any outliers or ongoing trends.	
	Erosion classification is comparable with erosion classifications from representative analogue sites	Erosion monitoring to be conducted at rehabilitation sites and general observations of 'Severe' erosion across each RA are to be recorded (refer to Section 3.7.2.4 *Erosion monitoring* of the PRCP). Extent of erosion features and severity rating recorded across 50 m transect. These attributes are used to classify erosion according to the classification system in (refer to Section 3.7.2.4 *Erosion monitoring* of the PRCP).	Visual assessment conducted along easch permanent 50 m transect to detect any existing or new erosion features. General observations of severe erosion(i.e. tunnels, mass wasting, large gullies) outside the transect are also recorded.	Annually. Erosion stability to be assessed from year four following seeding / planting.	Minimum of 1 transect per revegetated area OR as per BioCondition density per RE where revegetation area within a given RE is greater than 60ha	Qualitative classification system applied. Erosion results to be analysed both categorically and temporally to determine stabilisation of erosion rates over time.	
	Hazard and Safety Assessment completed by an appropriately qualified person1 demonstrates hazards in rehabilitation areas are consistent with the type and severity of hazards typical of neighbouring equivalent land use. Remaining hazards are considered to be low risk with no significant increase in risk expected over time.	Hazards to be assessed by a suitably qualified person as part of a Hazard and Safety Assessment.	Visual inspection to be conducted throughout rehabilitation areas to identify any remaining hazards or safety concerns.	Prior to milestone completion date.	n/a	n/a	
RM11 – Achievement of retained infrastructure PMLU to stable condition	No 'Severe' erosion, and drainage follows appropriate paths	General observations of 'Severe' erosion across retained infrastructure areas are to be recorded (refer to Section 3.7.2.4 *Erosion monitoring* of the PRCP).	n/a	Observations recorded during rehabilitation monitoring activities or at other times	n/a	n/a	RA3

Milestone reference	Milestone criteria	Methodology	Sampling Design	Timing / Frequency	Replication	Analysis Methods	Location
	Hazard and Safety Assessment completed by an appropriately qualified person1 demonstrates hazards in rehabilitation areas are consistent with the type and severity of hazards typical of neighbouring equivalent land use. Remaining hazards are considered to be low risk with no significant increase in risk expected over time.	Hazards to be assessed by a suitably qualified person as part of a Hazard and Safety Assessment.	Visual inspection to be conducted throughout rehabilitation areas to identify any remaining hazards or safety concerns.	Prior to milestone completion date.	n/a	n/a	
	Final landform survey confirms no built structures remain other than those that form part of a landholder agreement	Visual inspection following decommissioning and removal	n/a	following decommissioning and removal	n/a	n/a	
RM12 - achievement of water body PMLU to sustainable condition	Retained water storage water quality parameters to be below the trigger values for livestock drinking water defined in Australian and New Zealand Guidelines for Fresh and Marine	Water quality samples will be collected from retained water storage(s) and sent to a NATA certified laboratory for analysis of water quality parameters	Surface water samples will be collected from retained water storage(s).	Annually following a wet period and as part of Final Rehabilitation Report prior to	One sample collected from each retained water storage.	Water quality data to be compared to guideline levels for livestock drinking water quality	RA2b
	All retained water storages assessed as safe and stable by appropriately qualified person1	Hazards to be assessed by an appropriately qualified person as part of a Hazard and Safety Assessment.	Visual inspection to be conducted throughout rehabilitation areas to identify any remaining hazards or safety concerns.	Prior to milestone completion date.	n/a	n/a	
	Hazard and Safety Assessment completed by an appropriately qualified person1 demonstrates hazards in RAs are consistent with the type and severity of hazards typical of neighbouring						
RM13 - achievement of marginal grazing native riparian vegetation PMLU to stable condition	In revegetated areas, establishment of ≥50% of species within each functional group planted	Species inventory and richness to be recorded at revegetation monitoring sites (refer to Section 3.7.2.1 *Permanent vegetation monitoring transects* of PRCP).	Monitoring of all perennial plants within 5 m of either side of a 50 m transect (refer to 3.7.2.1 *Permanent vegetation monitoring transects* of PRCP).	Annually following seeding/planting.	Minimum of 1 transect per revegetated area OR as per BioCondition density per RE where revegetation area within a given RE is greater than 60ha	Compare monitoring data to seeding/planting records to determine survival rates of each perennial species	RA9
	Weed cover is ≤15% (excluding exotic pasture grasses).	Monitoring of weed species and percentage foliage cover is to be conducted at rehabilitation sites as described in the PRCP (Section 3.7.2.1 Permanent vegetation monitoring plots). Record of weed management activities undertaken (where recommended in rehabilitation monitoring reports)	Recording all weed species within a 10 m x 50 m plot area (i.e. all introduced species occurring within 5 m of either side of the transect centre-line) and monitoring of weed percentage foliage cover across ten 1 m x 1 m quadrats at each rehabilitation site. Refer to 3.7.2.1 *Permanent vegetation monitoring transects* of PRCP.	Annually following seeding/planting.	Minimum of 1 transect per revegetated area OR as per BioCondition density per RE where revegetation area within a given RE is greater than 60ha	Temporal analyses will be used to identify any outliers or ongoing trends.	
	No 'Severe' erosion, and drainage follows appropriate paths	Erosion monitoring to be conducted at rehabilitation sites and general observations of 'Severe' erosion across each RA are to be recorded (refer to Section 3.7.2.4 *Erosion monitoring* of the PRCP). Extent of erosion features and severity rating recorded across 50 m transect. These attributes are used to classify erosion according to the classification system in (refer to Section 3.7.2.4 *Erosion monitoring* of the PRCP).	Visual assessment conducted along each permanent 50 m transect to detect any existing or new erosion features. General observations of severe erosion(i.e. tunnels, mass wasting, large gullies) outside the transect are also recorded.	Annually. Erosion stability to be assessed from year four following seeding/planting.	n/a	Qualitative classification system applied. Erosion results to be analysed both categorically and temporally to compare with analogue sites and determine stabilisation of erosion rates over time.	
	Creek beds and banks are trending toward a geomorphically stable condition and recommendations for management and mitigation actions have been implemented	Creek condition survey undertaken by appropriately qualified person and report prepared with recommendations for management and mitigation measures required	Visual assessment of creek condition to assess the effects of subsidence on bed and bank stability	Pre-subsidence, post-subsidence, then minimum once every 3 years	TBA	Comparison of pre-subsidence and post-subsidence creek conditions	

Milestone reference	Milestone criteria	Methodology	Sampling Design	Timing / Frequency	Replication	Analysis Methods	Location
RM14 - achievement of marginal grazing native riparian vegetation PMLU to sustainable condition	Land suitability assessment by an appropriately qualified person1 certifies that land has achieved a minimum post-mine land suitability4 class of 4	Provide certification from an appropriately qualified person that land suitability targets have been met.	n/a	Prior to milestone completion date	n/a	n/a	RA9
	Weed cover is ≤10% (excluding exotic pasture grasses).	Monitoring of weed species and percentage foliage cover is to be conducted at rehabilitation sites as described in the PRCP (Section 3.7.2.1 Permanent vegetation monitoring plots). Record of weed management activities undertaken (where recommended in rehabilitation monitoring reports)	Recording all weed species within a 10 m x 50 m plot area (i.e. all introduced species occurring within 5 m of either side of the transect centre-line) and monitoring of weed percentage foliage cover across ten 1 m x 1 m quadrats at each rehabilitation site. Refer to 3.7.2.1 *Permanent vegetation monitoring transects* of PRCP.	Annually following seeding/planting.	Minimum of 1 transect per revegetated area OR as per BioCondition density per RE where revegetation area within a given RE is greater than 60ha	Temporal analyses will be used to identify any outliers or ongoing trends.	
	Field-based monitoring data provided in the final rehabilitation report demonstrates that the following attributes are comparable to representative analogue sites: o species richness of tree, shrub and groundcover functional groups; o tree canopy cover; o shrub canopy cover; and o perennial grass cover.	Species richness is assessed per the Eyre et al. (2015) methodology. All flora species within a 10 m x 50 m plot area are recorded [i.e. all trees, shrubs (<1m in height), forbs/other species, and grasses occurring within 5 m of either side of the transect centre-line]. Refer to detailed methodology in Section 3.7.2.1 *Permanent vegetation monitoring transects* of PRCP. Tree and shrub canopy cover assessed per the Eyre et al. (2017) methodology. Refer to detailed methodology in Section 3.7.2.9 *Canopy cover* of PRCP. Perrenial grass cover within ten 1 m x 1 m quadrats is recorded. Refer to 3.7.2.1 *Permanent vegetation monitoring transects* of PRCP.	Visual assessment to record all flora species present within 50 m x 10 m plot area of each permananent transect. Visual assessment of perennial grass cover recorded across ten 1 m x 1 m quadrats at each rehabilitation site. Refer to 3.7.2.1 *Permanent vegetation monitoring transects* of PRCP. Visual assessment of shrub and tree canopy cover along 50 m transect.	Annually following establishment period.	Minimum of 1 transect per revegetated area OR as per BioCondition density per RE where revegetation area within a given RE is greater than 60ha	Statistical analyses will be performed to provide a comparative analysis of rehabilitation sites against analogue site values. Temporal analyses will be used to identify any outliers or ongoing trends.	
	Creek beds and banks are trending toward a geomorphically stable condition and do not require active management	Creek condition survey undertaken by appropriately qualified person and report prepared with recommendations for management and mitigation measures required	Visual assessment of creek condition to assess the effects of subsidence on bed and bank stability	Minimum once every 3 years	TBA	Comparison of post-subsidence creek conditions against previous creek condition surveys to identify trends.	
	Erosion classification is comparable with erosion classifications from representative analogue sites	Erosion monitoring to be conducted at rehabilitation sites and general observations of 'Severe' erosion across each RA are to be recorded (refer to Section 3.7.2.4 *Erosion monitoring* of the PRCP). Extent of erosion features and severity rating recorded across 50 m transect. These attributes are used to classify erosion according to the classification system in (refer to Section 3.7.2.4 *Erosion monitoring* of the PRCP).	Visual assessment conducted along easch permanent 50 m transect to detect any existing or new erosion features. General observations of severe erosion(i.e. tunnels, mass wasting, large gullies) outside the transect are also recorded.	Annually. Erosion stability to be assessed from year four following seeding / planting.	Minimum of 1 transect per revegetated area OR as per BioCondition density per RE where revegetation area within a given RE is greater than 60ha	Qualitative classification system applied. Erosion results to be analysed both categorically and temporally to determine stabilisation of erosion rates over time.	
	Hazard and Safety Assessment completed by an appropriately qualified person1 demonstrates hazards in rehabilitation areas are consistent with the type and severity of hazards typical of neighbouring equivalent land use. Remaining hazards are considered to be low risk with no significant increase in risk expected over time.	Hazards to be assessed by a suitably qualified person as part of a Hazard and Safety Assessment.	Visual inspection to be conducted throughout rehabilitation areas to identify any remaining hazards or safety concerns.	Prior to milestone completion date.	n/a	n/a	

Appendix F. Provided technical studies

3D Environmental 2022, *Lake Vermont Meadowbrook Project, Groundwater Dependent Ecosystem Assessment*, prepared for Bowen Basin Coal Pty Ltd, 3D Environmental, Brisbane, Queensland.

AARC 2021, *Lake Vermont Meadowbrook Project: Soil and Land Suitability Assessment*, prepared for Bowen Basin Coal Pty Ltd, December 2021.

AARC 2022a, *Lake Vermont Meadowbrook Project: Terrestrial Ecology Assessment*, prepared for Bowen Basin Coal Pty Ltd.

AARC 2022b, *Lake Vermont Meadowbrook Project: Aquatic Ecology Assessment*, prepared for Bowen Basin Coal Pty Ltd.

Gordon Geotechniques 2022, *Subsidence Prediction Report for the Meadowbrook Underground Project*, prepared for Lake Vermont Resources.

JBT Consulting 2022, *Meadowbrook Project groundwater impact assessment*, prepared for Jellinbah Resources, JBT Consulting, Brisbane.

RGS 2021, *Geochemical Assessment of Mining Waste Materials: Lake Vermont Meadowbrook Project*, report prepared for Bowen Basin Coal Pty Ltd.

SLR 2022, *Meadowbrook Underground – Groundwater Modelling Technical Report*, report prepared for Jellinbah Group Pty Ltd, March 2022.

WRM 2022a, *Lake Vermont Meadowbrook Project Surface Water Assessment Report*, prepared for Bowen Basin Coal Pty Ltd.

WRM 2022b *Lake Vermont Meadowbrook Project Flood Modelling Assessment Report*, prepared for Bowen Basin Coal Pty Ltd.

WRM 2022c *Lake Vermont Meadowbrook Project Geomorphology Assessment Report*, prepared for Bowen Basin Coal Pty Ltd.

WRM2022d *Lake Vermont Meadowbrook Project Site Water Balance and Water Management System Report*, prepared for Bowen Basin Coal Pty Ltd.

WRM2022e *Lake Vermont Meadowbrook Project Rehabilitated Landform Water Balance Report*, prepared for Bowen Basin Coal Pty Ltd.

Appendix G. Rehabilitation Risk Assessment

Ref.				Risk Description				Control Effectiveness	Risk Evaluation						Risk Rating				Count				Final Risk Rating
Risk Type (T=Threat)	Category	Subcategory	Item	Risk Scenario/Threat Title	Causes (Triggers / Indicators)	Impacts (Consequences)	Controls		Likelihood - Frequency	Likelihood - Probability	Health	Safety	Environment	Compliance	Health	Safety	Environment	Compliance	IV	III	II	I	
T	A			**Waste rock emplacements and flood levee(s)**																			
T	A	01		**Safe**																			
T	A	01	01	Surface roughness (rockiness, depressions) in excess of that expected for the PMLU	Erosion gullies etc due to some dispersive subsoils/ topsoils, inadequate surface preparation, localised settlement	Safety hazard for personnel, stock and wildlife	Surface preparation measures (initial), maintenance controls (pre-closure), rehabilitation monitoring and assessment, undertake repairs and maintence as required	C2	P			L				II			0	0	1	0	II
T	A	01	02	Slope steepness in excess of that expected for the PMLU	Landform not constructed to design	Safety hazard for personnel, stock and wildlife	Dump and slope survey controls, reshaping to design	C1	P			L				II			0	0	1	0	II
T	A	02		**Stable - geotechnical risk**																			
T	A	02	01	Significant slope failure	Landform not constructed to design, excessive slope steepness, physical material properties, inadequate drainage controls, adverse rainfall event	Localised land impacts and downstream water quality impacts	Slope moderation, maximum slopes subject to engineered design, provision of adequate drainage infrastructure, rapid revegetation, rehabilitation monitoring and assessment, undertake repairs and maintenance as required	C1	R			M				II			0	0	1	0	II
T	A	03		**Stable - erosional risk**																			
T	A	03	01	Initial/ongoing gully, pipe and/or sheet erosion of rehabilitated areas	Dispersive topsoils and subsoils, adverse weather events	Localised land impacts and downstream water quality impacts	Landform design moderating slope, adequate/effective subsoil and topsoil amelioration, prompt revegetation establishment,sediment controls during vegetation establishment, revegetation monitoring, revegetation maintenace and repairs as required, modify revegetation methods and techniques and other contributing factors to improve the likelihood of revegetation success on rehabilitated slopes where required	C2	U				M				II		0	0	1	0	II
T	A	03	02	Initial/ongoing gully, pipe and/or sheet erosion of rehabilitated areas	Inadequate rehabilitation drainage capacity and/or design	Localised land impacts and downstream water quality impacts	Drainage network design with acceptable design standards for drainage structures, avoidance of flow concentration, sub-catchment delineation, sufficient water storage structures, engineered flow channels, effective revegetation techniques, rehabilitation monitoring, regular (typically annual) review of water management design parameters, monitoring of drainage network performance, prompt remediation and causal feedback loop to water management system review	C2	U				M				II		0	0	1	0	II
T	A	03	03	Initial/ongoing gully, pipe and/or sheet erosion of rehabilitated areas	Adverse climatic events and/or climatic sequences beyond design capacity	Localised land impacts and downstream water quality impacts	Existing rehabilitation of waste rock emplacements, downstream sedimentation controls, prompt revegetation, regular (typically annual) review of water management design parameters, monitoring of drainage network performance, undertake repairs and maintenance as required, prompt remediation and causal feedback loop to water management system review	C2	U				M				II		0	0	1	0	II
T	A	03	04	Initial/ongoing gully, pipe and/or sheet erosion of rehabilitated areas (medium-long term risk)	Rehabilitation failure/ vegetation disease/loss, climatic events (drought), other	Localised land impacts and downstream water quality impacts	Landform design moderating slope, adequate/effective subsoil and topsoil amelioration, prompt revegetation establishment, modify revegetation methods and techniques and other contributing factors to improve the likelihood of revegetation success on rehabilitation slopes, rehabilitation area monitoring and assessment, undertake repairs and maintenance as required	C2	U				M				II		0	0	1	0	II
T	A	04		**Non-polluting - geochemical risk**																			

Ref.				Risk Description				Control Effectiveness	Risk Evaluation						Risk Rating				Count				Final Risk Rating
Risk Type (T=Threat)	Category	Subcategory	Item	Risk Scenario/Threat Title	Causes (Triggers / Indicators)	Impacts (Consequences)	Controls		Likelihood - Frequency	Likelihood - Probability	Health	Safety	Environment	Compliance	Health	Safety	Environment	Compliance	IV	III	II	I	
T	A	04	01	Acid and saline drainage generation	Adverse waste rock geochemistry	Revegetation performance impacts, downstream receiving environment water quality and dependent ecosystem impacts	Confirmed non-NAPP materials and low risk of saline drainage. Routine confirmatory geochemical testing, regular water quality monitoring and assessment	C1		U			L				I		0	0	0	1	I
T	A	04	02	Impacts to groundwater	Adverse waste rock geochemistry	Groundwater impacts (incl. GDEs)	Negative NAPP materials and low risk of saline drainage. Routine confirmatory geochemical testing, regular water quality monitoring and assessment	C2		U			L				I		0	0	0	1	I
T	**A**	**05**		**Non-polluting - other environmental harm**																			
T	A	05	01	Not applicable															0	0	0	0	
T	**A**	**06**		**Sustainable - PMLU**																			
T	A	06	01	Insufficient pasture density/diversity and recruitment	Weather, poor soil characteristics, poor management practices impacting germination, vegetation establishment and PMLU density metrics, and shortage of topsoil resources	Insufficient pasture productivity	Improving rehabilitation methodologies, rehabilitation area monitoring and assessment, undertake repairs and maintenance works as required	C2	U				L				I		0	0	0	1	I
T	A	06	02	Pests and weeds	Poor local, regional or site property management practices.	Increased risk of not achieving designated PMLU	Pest and weed management practices, monitoring programs to allow early detection and management, intensify monitoring and management measures as appropriate	C2		U			L				I		0	0	0	1	I
T	**B**			**Subsidence areas (riparian)**																			
T	**B**	**01**		**Safe**																			
T	B	01	01	Surface roughness (rockiness, depressions) in excess of that expected for the PMLU	Erosion gullies etc due to some dispersive subsoils/ topsoils, inadequate surface preparation, localised settlement	Safety hazard for personnel, stock and wildlife	Surface preparation measures (initial), maintenance controls (pre-closure), rehabilitation monitoring and assessment, undertake repairs and maintence as required	C2		U		L				I			0	0	0	1	I
T	**B**	**02**		**Stable - geotechnical risk**																			
T	B	02	01	Not applicable															0	0	0	0	
T	**B**	**03**		**Stable - erosional risk**																			
T	B	03	01	Creek does not achieve geomorphic stability within scheduled timeframe	Erodible topsoils and subsoils, Adverse climatic events and/or climatic sequences beyond modelled capacity, rehabilitation failure/ vegetation disease/loss	Ongoing watercourse erosion, water quality impacts, bank stability impacts	Geomorphic monitoring program pre- and post-subsidence, adequate/effective subsoil and topsoil amelioration, prompt revegetation establishment, revegetation monitoring, revegetation maintenance and repairs as required, sediment controls as required, bank stabilisation / engineering controls if required.	C2	U				M	M			II	II	0	0	2	0	II
T	**B**	**04**		**Non-polluting - geochemical risk**																			
T	B	04	01	Not applicable															0	0	0	0	
T	**B**	**05**		**Non-polluting - other environmental harm**																			
T	B	05	01	Downstream water quality impacts and sedimentation	Erodible topsoils and subsoils, Adverse climatic events and/or climatic sequences beyond modelled capacity, Rehabilitation failure/ vegetation disease/loss	Water quality impacts, bank stability impacts	Geomorphic monitoring program pre- and post-subsidence, adequate/effective subsoil and topsoil amelioration, prompt revegetation establishment, revegetation monitoring, revegetation maintenance and repairs as required, sediment controls as required, bank stabilisation / engineering controls if required.	C2	U				M				II		0	0	1	0	II
T	**B**	**06**		**Sustainable - PMLU**																			
T	B	06	01	Pests and weeds	Poor local, regional or site property management practices.	Increased risk of not achieving designated PMLU	Pest and weed management practices, monitoring programs to allow early detection and management.	C2		U			M				II		0	0	1	0	II

Ref.				Risk Description				Control Effectiveness	Risk Evaluation						Risk Rating				Count				Final Risk Rating
Risk Type (T=Threat)	Category	Subcategory	Item	Risk Scenario/Threat Title	Causes (Triggers / Indicators)	Impacts (Consequences)	Controls		Likelihood - Frequency	Likelihood - Probability	Health	Safety	Environment	Compliance	Health	Safety	Environment	Compliance	IV	III	II	I	
T	B	06	02	Insufficient riparian habitat (native vegetation) density/diversity and recruitment	Weather, poor soil characteristics, poor management practices impacting germination, vegetation establishment and PMLU density/diversity metrics	Insufficient vegetation productivity	Adaptive rehabilitation methodologies, management and maintenance activities, rehabilitation performance monitoring and assessment, undertake revegetation improvement works as required.	C2		U			M				II		0	0	1	0	II

Ref.				Risk Description				Control Effectiveness	Risk Evaluation						Risk Rating				Count				Final Risk Rating
Risk Type (T=Threat)	Category	Subcategory	Item	Risk Scenario/Threat Title	Causes (Triggers / Indicators)	Impacts (Consequences)	Controls		Likelihood - Frequency	Likelihood - Probability	Health	Safety	Environment	Compliance	Health	Safety	Environment	Compliance	IV	III	II	I	
T	C			**Rehabilitated pit**																			
T	C	01		**Safe**																			
T	C	01	01	Surface roughness (rockiness, depressions) in excess of that expected for the PMLU	Erosion gullies etc due to some dispersive subsoils/ topsoils, inadequate surface preparation, localised settlement	Safety hazard for personnel, stock and wildlife	Surface preparation measures (initial), monitoring, maintenance controls (pre-closure), risk assess controls when designed and placed and modify as required, post-closure monitoring	C2	P			L			II			0	0	1	0	II
T	C	01	02	Slope steepness in excess of that expected for the PMLU	Landform not constructed to design	Safety hazard for personnel, stock and wildlife	Dump and slope survey controls	C2	P			L			II			0	0	1	0	II
T	C	02		**Stable - geotechnical risk**																			
T	C	02	01	rehabilitated pit slopes subject to slope failure	Landform not constructed to design, excessive slopes, inadequate drainage controls, adverse weather event	Localised land impact	Slope moderation, final landform design, assess high wall materials during construction and modify design as required, geotechnical assessment at closure, drainage infrastructure	C1		U			M				II		0	0	1	0	II
T	C	03		**Stable - erosional risk**																			
T	C	03	01	Initial/ongoing gully, pipe and/or sheet erosion of rehabilitated areas	Dispersive topsoils and subsoils, adverse weather events	Localised land impacts	Adequate/effective subsoil and topsoil amelioration, prompt revegetation establishment, revegetation monitoring and management as required	C2		P			L				II		0	0	1	0	II
T	C	03	02	Initial/ongoing gully, pipe and/or sheet erosion of rehabilitated areas	Inadequate rehabilitation drainage capacity and/or design	Localised land impacts	Reduced catchment drainage away from void. Evolving revegetation techniques	C2		U			L				I		0	0	0	1	I
T	C	03	03	Initial/ongoing gully, pipe and/or sheet erosion of rehabilitated areas	Adverse climatic events and/or climatic sequences beyond design capacity	Localised land impacts and in-pit water quality impacts	Existing rehabilitation of void slope, sedimentation controls, revegetation, monitoring and maintenance, post-weather event monitoring of rehabilitated pit, prompt remediation as required	C2	U				L				I		0	0	0	1	I
T	C	03	04	Initial/ongoing gully, pipe and/or sheet erosion of rehabilitated areas (medium-long term risk)	Rehabilitation failure/ revegetation disease, climatic events (drought)	Localised land impacts and in-pit water quality impacts	Landform design moderating slope, adequate/effective subsoil and topsoil amelioration, prompt revegetation establishment, modify revegetation methods and techniques and other	C2		U			L				I		0	0	0	1	I
T	C	04		**Non-polluting - geochemical risk**																			
T	C	04	01	Intermittent surface water salinity	Leaching of salts contained in overburden materials to void surface water and concentration of salts by evaporation	Adverse water quality; accession to groundwater	Inundation anticipated to be intermittent, low salinity overburden materials, adequate/effective subsoil and topsoil amelioration, prompt revegetation establishment, revegetation monitoring and management as required, pit lake water quality monitoring, physical removal of salts during dry periods, water treatment	C2	U				L				I		0	0	0	1	I
T	C	04	02	Impacts to downstream water quality	Leaching from overburden materials to void surface water, adverse weather events resulting in overtopping	Adverse water quality impacts downstream receiving environment and dependent ecosystem; accession to groundwater	Inundation anticipated to be intermittent with extremely low risk of overtopping, low salinity overburden materials, adequate/effective subsoil and topsoil amelioration, prompt revegetation establishment, revegetation monitoring and management as required	C2	U				L				I		0	0	0	1	I
T	C	05		**Non-polluting - other environmental harm**																			
T	C	05	01	Not applicable															0	0	0	0	
T	C	06		**Sustainable - PMLU**																			
T	C	06	01	Insufficient density/diversity of vegetation in grazing PMLU	Adverse weather, poor soil characteristics and slopes impacting germination, vegetation establishment and PMLU density/diversity metrics	Reduced pasture production due to unsuitable conditions	Inundation anticipated to be intermittent, topsoil amelioration, improving rehabilitation methodologies, management and maintenance activities, rehabilitation performance monitoring and assessment, undertake repairs and improvement works as required	C2	U				L				I		0	0	0	1	I
T	C	06	02	Pests and weeds	Poor local, regional or site property management practices.	Increased risk of not achieving designated PMLU	Pest and weed management practices, monitoring programs to allow early detection and management, intensify monitoring and management measures as appropriate	C2	U				L				I		0	0	0	1	I

Ref.				Risk Description				Control Effectiveness	Risk Evaluation						Risk Rating				Count				Final Risk Rating
Risk Type (T=Threat)	Category	Subcategory	Item	Risk Scenario/Threat Title	Causes (Triggers / Indicators)	Impacts (Consequences)	Controls		Likelihood - Frequency	Likelihood - Probability	Health	Safety	Environment	Compliance	Health	Safety	Environment	Compliance	IV	III	II	I	
T	**D**			**Retained water storage**																			
T	**D**	**01**		**Safe**																			
T	D	01	01	Dam failure (overtopping) of retained structures	Extreme rainfall events	Downstream hazard to public	Only engineered water storage to be retained at closure; dam will be assessed as safe and stable by appropriately qualified person prior to relinquishment; volume is relatively small and water will be free of contaminants	C1		U		L				I			0	0	0	1	I
T	**D**	**02**		**Stable - geotechnical risk**																			
T	D	02	01	Wall failure/dam break of retained structures	Extreme rainfall events	Downstream hazard to public	Only engineered water storage to be retained at closure; dam will be assessed as safe and stable by appropriately qualified person prior to relinquishment; volume is relatively small and water will be free of contaminants	C1		U		L				I			0	0	0	1	I
T	**D**	**03**		**Stable - erosional risk**																			
T	D	03	01	Not applicable															0	0	0	0	
T	**D**	**04**		**Non-polluting - geochemical risk**																			
T	D	04	01	Poor water quality in retained water storages	Adverse geochemical characteristics of disturbed materials in catchment	Downstream water quality impacts	Mine affected water to be removed from dam, water quality monitoring program to allow early detection and management of poor water quality	C2		U			L				I		0	0	0	1	I
T	**D**	**05**		**Non-polluting - other environmental harm**																			
T	D	05	01	Not applicable															0	0	0	0	
T	**D**	**06**		**Sustainable - PMLU**																			
T	D	06	01	Water quality in retained storages not meeting PMLU water quality requirements	Adverse geochemical characteristics of disturbed materials in catchment	Livestock health	Mine affected water to be removed from dam, water quality monitoring program to allow early detection and management of poor water quality	C2		U			L				I		0	0	0	1	I

Ref.				Risk Description				Control Effectiveness	Risk Evaluation						Risk Rating				Count				Final Risk Rating
Risk Type (T=Threat)	Category	Subcategory	Item	Risk Scenario/Threat Title	Causes (Triggers / Indicators)	Impacts (Consequences)	Controls		Likelihood - Frequency	Likelihood - Probability	Health	Safety	Environment	Compliance	Health	Safety	Environment	Compliance	IV	III	II	I	
T	**E**			**Mine infrastructure area (including rehabilitated water storage infrastructure)**																			
T	**E**	**01**		**Safe**																			
T	E	01	01	Surface roughness (rockiness, depressions) in excess of that expected for PMLU	Inadequate surface preparation, localised settlement, erosion gullies	Safety hazard for personnel, stock and wildlife	Surface preparation measures (initial), monitoring, maintenance controls (pre-closure)	C1		U		L				I			0	0	0	1	I
T	**E**	**02**		**Stable - geotechnical risk**																			
T	E	02	01	Not applicable															0	0	0	0	
T	**E**	**03**		**Stable - erosional risk**																			
T	E	03	01	Initial/ongoing gully, pipe and/or sheet erosion of rehabilitated areas	Erodible topsoils and subsoils, adverse weather events	Localised land impacts and downstream water quality impacts	Landform design moderating slope, adequate/effective subsoil and topsoil amelioration, prompt revegetation establishment, revegetation monitoring and management as required	C2		U			L				I		0	0	0	1	I
T	E	03	02	Initial/ongoing gully, pipe and/or sheet erosion of rehabilitated areas	Inadequate rehabilitation drainage capacity and/or design	Localised land impacts and downstream water quality impacts	Drainage network design with acceptable design standards for drainage structures, avoidance of flow concentration, sub-catchment delineation, sufficient water storage structures, engineered flow channels (where required), effective revegetation techniques, rehabilitation monitoring and	C2		U			L				I		0	0	0	1	I
T	E	03	03	Initial/ongoing gully, pipe and/or sheet erosion of rehabilitated areas	Adverse climatic events and/or climatic sequences beyond design capacity	Localised land impacts and downstream water quality impacts	Existing rehabilitation of infrastructure disturbance areas, downstream sedimentation controls, revegetation, monitoring and maintenance	C2	U				L				I		0	0	0	1	I
T	E	03	04	Initial/ongoing gully, pipe and/or sheet erosion of rehabilitated areas (medium-long term risk)	Rehabilitation failure/ vegetation disease/loss, climatic events (drought)	Localised land impacts and downstream water quality impacts	Landform design moderating slope, adequate/effective subsoil and topsoil amelioration, prompt revegetation establishment, revegetation monitoring and management as required	C2		U			L				I		0	0	0	1	I
T	**E**	**04**		**Non-polluting - geochemical risk**																			
0	0	0	01	Not applicable															0	0	0	0	
T	**E**	**05**		**Non-polluting - other environmental harm**																			
T	E	05	01	Contaminated land	Operational phase industrial use of land	Land contamination, surface water impacts	Appropriate infrastructure management; storage and bunding of hazardous materials, housekeeping and proactive spills management. Phase 1 assessment at closure	C2		U			M				II		0	0	1	0	II
T	**E**	**06**		**Sustainable - PMLU**																			
T	E	06	01	Insufficient pasture density/diversity and recruitment	Weather, poor soil characteristics, poor management practices impacting germination, vegetation establishment and PMLU density/diversity metrics	Insufficient pasture productivity	Improving rehabilitation methodologies, management and maintenance activities, rehabilitation performance monitoring and assessment, undertake repairs and improvement works as required	C2		U			L				I		0	0	0	1	I
T	E	06	02	Pests and weeds	Poor local, regional or site property management practices.	Increased risk of not achieving designated PMLU	Pest and weed management practices, monitoring programs to allow early detection and management, intensify monitoring and management measures as appropriate	C2		U			L				I		0	0	0	1	I
T	**F**			**Subsidence areas (terrestrial)**																			
T	**F**	**01**		**Safe**																			
T	F	01	01	Initial/ongoing surface cracking	Tensile strain around perimeter of subsidence troughs	Trip hazard for personnel, stock and wildlife	Monitoring and maintenance (pre- and post-mining), rehabilitation activities (infilling, regrading, revegetation etc) commencing after 3 wet seasons if required, rehabilitation area monitoring and assessment, undertake repairs and improvement works as required	C2		P		L				II			0	0	1	0	II
T	F	01	02	Localised increases in slope	Subsidence	Trip hazard for personnel, stock and wildlife	Monitoring and maintenance (pre- and post-mining), rehabilitation activities (infilling, regrading, revegetation etc) commencing after 3 wet seasons if required, early assessment and localised remediation of assessed hazards	C2		P		L				II			0	0	1	0	II

Ref.				Risk Description				Control Effectiveness	Risk Evaluation						Risk Rating				Count				Final Risk Rating
Risk Type (T=Threat)	Category	Subcategory	Item	Risk Scenario/Threat Title	Causes (Triggers / Indicators)	Impacts (Consequences)	Controls		Likelihood - Frequency	Likelihood - Probability	Health	Safety	Environment	Compliance	Health	Safety	Environment	Compliance	IV	III	II	I	
T	**F**	**02**		**Stable - geotechnical risk**																			
T	F	02	01	Surface land disturbance beyond predicted subsidence	Unknown geological anomalies	Unpredicted surface disturbance, trip hazard for personnel, stock and wildlife	Surface monitoring to validate expected subsidence	C1		R		L				I			0	0	0	1	I
T	F	02	02	Post-closure residual subsidence	Potential long-term settlement	Unpredicted surface	Medium term monitoring surveys of additional subsidence	C1		R		L				I			0	0	0	1	I
T	**F**	**03**		**Stable - erosional risk**																			
T	F	03	01	Initial/ongoing gully, pipe and/or sheet erosion of rehabilitated areas	Surface cracking exposing dispersive subsoils	Localised land impacts and downstream water quality impacts	Landform reshaping to moderate slope, infilling or regrading to stabilise cracks, prompt revegetation establishment, revegetation monitoring and management as required, sediment controls during establishment	C2		U			L				I		0	0	0	1	I
T	F	03	02	Initial/ongoing gully, pipe and/or sheet erosion of rehabilitated areas	Inadequate rehabilitation drainage capacity and/or design	Localised land impacts and downstream water quality impacts	Drainage network design with acceptable design standards for drainage structures, avoidance of flow concentration, sub-catchment delineation, sufficient water storage structures, engineered flow channels, effective revegetation techniques, rehabilitation monitoring and management as required, regular (typically annual) review of water management design parameters, monitoring of drainage network performance, prompt remediation and causal feedback loop to water management system review	C2		U			M				II		0	0	1	0	II
T	F	03	03	Initial/ongoing gully, pipe and/or sheet erosion of rehabilitated areas	Adverse climatic events and/or climatic sequences beyond design capacity	Localised land impacts and downstream water quality impacts	Landform design moderating slope, adequate/effective subsoil and topsoil amelioration, prompt revegetation establishment, revegetation monitoring and management as required, regular (typically annual) review of water management design parameters, monitoring of drainage network performance, prompt remediation and causal feedback loop to water management system review	C2		U			M				II		0	0	1	0	II
T	F	03	04	Initial/ongoing gully, pipe and/or sheet erosion of rehabilitated areas (medium-long term risk)	Rehabilitation failure/ vegetation disease/loss, climatic events (drought), other	Localised land impacts and downstream water quality impacts	Landform design moderating slope, adequate/effective subsoil and topsoil amelioration, prompt revegetation establishment, revegetation monitoring and management as required, modify revegetation methods and techniques and other contributing factors to improve the likelihood of revegetation success on rehabilitation slopes, rehabilitation area monitoring and assessment, undertake repairs and maintenance as required	C2		U			L				I		0	0	0	1	I
T	**F**	**06**		**Sustainable - PMLU**																			
T	F	06	01	Reduction in the area of Class 3 pasture productivity	Inadequate rehabilitation drainage capacity and/or design	Localised ponding impacting vegetation establishment and land use suitability	Drainage network design with acceptable design standards for drainage structures, avoidance of flow concentration, sub-catchment delineation, engineered flow channels, appropriate species selection, effective revegetation techniques,	C2		U			M				II		0	0	1	0	II
	F	06	02	Alteration to existing aquatic habitats beyond area predicted	Inadequate rehabilitation drainage capacity and/or design	Changes to local catchment drainage patterns resulting in localised ponding impacting on aquatic habitat connectivity	Drainage network design with acceptable design standards for drainage structures, avoidance of flow concentration, sub-catchment delineation, engineered flow channels, appropriate species selection, effective revegetation techniques, LiDAR survey and development of detailed remedial drainage design plan as required	C2		U			M				II		0	0	1	0	II
0	F	06	03	Pests and weeds	Poor local, regional or site property management practices.	Increased risk of not achieving designated PMLU	Pest and weed management practices, monitoring programs to allow early detection and management, intensify monitoring and management measures as appropriate	C2		P			L				II		0	0	1	0	II
				End of record																			