LAKE VERMONT RESOURCES ENVIRONMENTAL IMPACT STATEMENT

CHAPTER 5 LAND RESOURCES

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5 Land and visual amenity

This chapter describes the existing characteristics of the Project site with specific reference to land conditions, local and regional landscape settings and visual amenity characteristics. The potential impacts of the proposed land use are assessed, and measures required to mitigate and manage potential impacts are nominated and discussed.

This chapter is supported by technical information presented in the Soil and Land Suitability Assessment (Appendix C), the Subsidence Assessment (Appendix A) and the Surface Water Assessment (Appendix F).

5.1 Environmental objectives and performance outcomes

This chapter has been prepared to assist the DES in carrying out the environmental objective assessment in respect of the following environmental objectives prescribed in Schedule 8, Part 3, Division 1 and Division 2 of the EP Regulation (collectively, the land use environmental objectives):

- The activity is operated in a way that protects the environmental values of land, including soil, subsoils, landforms and associated flora and fauna.
- The choice of location of the Project site minimises serious environmental harm on areas of high conservation value and special significance and sensitive land uses at adjacent places.
- The choice of location for the activities proposed to be carried out at the Project site protects all environmental values relevant to adjacent sensitive land uses.
- The design of the facility permits the operation of the Project site in accordance with best practice environmental management.

The detailed assessment presented in this chapter and the Soil and Land Suitability Assessment (Appendix C) demonstrates that the Project will achieve a performance outcome for each land use environmental objective, as outlined in Schedule 8 of the EP Regulation.

Specifically, the Project will achieve item 2 of the performance outcomes for **land,** as listed in Schedule 8, Part 3, Division 1 of the EP Regulation as follows:

a) the activities that disturb land, soils, subsoils, landforms and associated flora and fauna will be managed in a way that prevents or minimises adverse effects on the environmental values of land;

b) the areas disturbed by the Project's activities will be rehabilitated or restored to ensure that the sites:

   i) are safe and stable;

   ii) do not cause environmental harm; and

   iii) are capable of sustaining an appropriate land use after rehabilitation or restoration;

c) the Project's activities will be managed to prevent or minimise adverse effects on the environmental values of land use to unplanned releases or discharges, including spills and leaks of contaminants; and

d) the application of water or waste to the land during the life of the Project will be sustainable and managed to prevent or minimise adverse effects on the composition or structure of soils and subsoils.

Further, the Project will achieve:

1) item 1 of the performance outcomes for land use in relation to **site suitability**, as follows:

   a) those areas on the Project site that are of high conservation value and special significance, and are likely to be affected by the proposed activities, are identified and evaluated, and any adverse effects on those areas are minimised (including any edge effects on the areas); and

b) beyond the Project site, there will not be an adverse effect.

2) item 2 of the performance outcomes for land use in relation to **location on-site**, as follows:

a) the activities, and its components, will be carried out on the Project site in the way that prevents or minimises adverse effects on the use of surrounding land and allows for effective management of the environmental impacts of the activity; and

b) the location of any areas used for storing environmentally hazardous materials in bulk will be decided with consideration to the likelihood of flooding.

3) item 2 of the performance outcomes for land use in relation to **critical design requirements**, as follows:

a) all storage provided for hazardous contaminants will include secondary containment to prevent or minimise releases to the environment from spillage or leaks;

b) regulated structures on-site will comply with the 'Manual for assessing consequence categories and hydraulic performance of structures', published by DES (2016);

c) where required, containers will be provided for the storage of hazardous contaminants and will be secured to prevent the removal of the containers from the site by a flood event;

d) the facility is designed to prevent or minimise the production of hazardous contaminants and waste; and

e) in the event that the production of hazardous contaminants and waste cannot be prevented or minimised (as specified under paragraph (d) above), the design of the facility is able to contain and treat the hazardous contaminants, rather than releasing them.

5.2 Local planning context

The Project is located 15 km north-east of Dysart and 160 km south-west of Mackay in the Bowen Basin region of central Queensland. The Project area is zoned as rural land use under the Isaac Regional Council Planning Scheme (Isaac Regional Council 2021a). The planning scheme permits mining activities in rural land use zones provided the activities:

- mitigate impacts on the environment and adjoining land uses;
- do not degrade Classes A or B agricultural land;
- rehabilitate sites upon completion of activities; and
- are supported by the necessary infrastructure.

The Isaac Regional Council Extractive Resources and Minerals Overlay Code is also relevant in assessing mining developments. The code provides outcomes with the purpose of protecting current or future extractive resources from inappropriate development that might prevent or severely constrain economic recovery from those resources.

The Project is within the Mackay, Isaac and Whitsunday Regional Council Plan (DLGP 2012) region. The plan identifies a regional framework and desired regional outcomes and establishes principles and policies to inform future planning decisions. Two principles are specifically relevant to the Project as follows:

> *4.3.1 Mineral, petroleum and extractive resources are managed for current and future use, and their extraction, processing, transport and downstream value-adding continue to contribute to the economy.*
>
> *6.5.1 Manage mining and extractive resources to maximise economic opportunities and other community benefits, while minimising negative environmental and social impacts for present and future generations.*

The plan identifies desired regional outcomes for the domains of regional landscapes, environment, natural resource management, communities, the economy, infrastructure and transport. The plan also outlines a principle regarding the competing interests of SCL with mining interests. SCL and other regional interests are discussed in section 5.3.7.

5.3 Description of existing values

5.3.1 Local topography and landforms

The topography of the Project area is generally flat to gently undulating, with elevations ranging between 160 mAHD and 190 mAHD above sea level. The topography of the Project area is representative of the surrounding region.

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 topography of the land between Phillips Creek and Boomerang Creek comprises a broad, flat floodplain that slopes gently to the east from approximately 180 mAHD in the west of the Project site to approximately 170 mAHD in the east.

Significant landforms (of higher elevation) within the region include Coxens Peak (415 mAHD) approximately 14 km to the north-east, Walkers Peak (438 mAHD) 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 within the Isaac-Connors sub-catchment, an area encompassing 22,325 km^2 within the greater Fitzroy Basin catchment. The Isaac River is the main watercourse in the Project region and flows in a north-west to south-east direction to the east of the Project site. 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 surface between Phillips Creek and Boomerang Creek is a broad, flat floodplain that slopes gently to the east from approximately 180 mAHD in the west to around 170 mAHD approximately in the east.

The primary watercourses associated with the Project area are Boomerang Creek (being a fifth order stream); Phillips Creek (being a fourth order stream); and One Mile Creek (being a third order stream). Ripstone Creek (also a third order stream) is further to the north of the Project area. (Figure 5.1). Boomerang Creek traverses the study area in an easterly direction before discharging into the Isaac River. One Mile Creek traverses the Project area in a north-easterly direction before discharging into Boomerang Creek. Phillips Creek flows in a north-easterly direction in the vicinity of the southern Project area boundary. Boomerang Creek, One Mile Creek, Phillips Creek and Ripstone Creek are all defined watercourses under the *Water Act 2000*. These waterways all drain into the Isaac River and east to the Coral Sea *via* the Mackenzie River and Fitzroy River. It is noted that the Olive Downs Coking Coal Project has approval to divert Ripstone Creek near the northern boundary of MDL 429. 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). Similarly, the Saraji Mine has an existing diversion/levee on Phillips Creek, with a diversion of Phillips Creek also having been approved at the Lake Vermont Mine (Figure 5.1). The Lake Vermont Mine diversion has not yet been constructed.

There are no HES wetlands within the Project area; however, there are 10 HES wetlands within the potential impact area of the Project, both to the north and east of the Project site. There are also eight vegetation management wetlands within the Project area (Figure 5.1). Impacts to environmental values of wetlands is assessed in Chapter 11, Aquatic Ecology and impacts to wetland-associated vegetation is assessed in Chapter 10, Terrestrial Ecology.

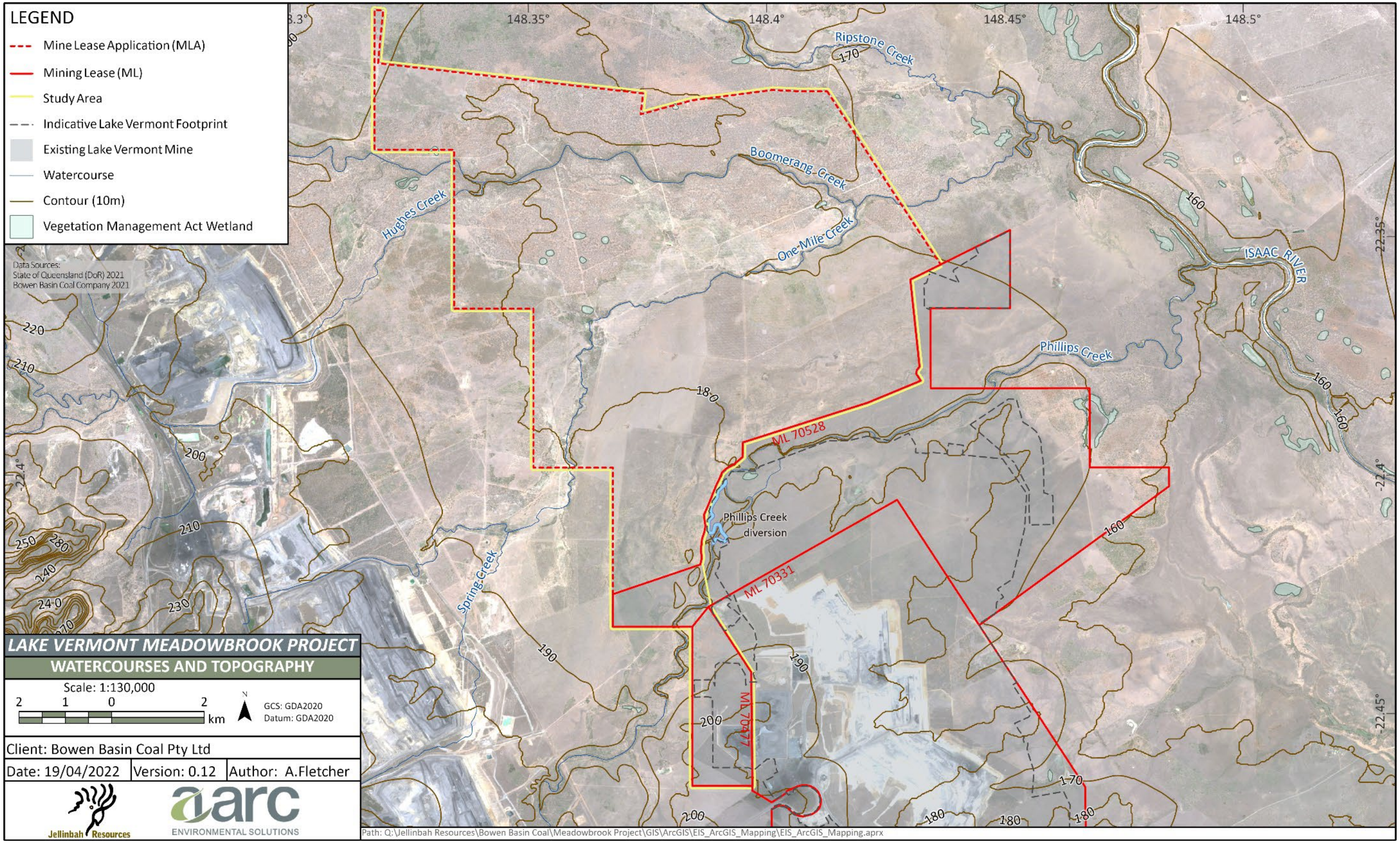

Figure 5.1: Local topography and watercourses

5.3.2 Geology

The Project is in the western limb of the Bowen Basin, one of Queensland's largest depositional zones, extending more than 250 km north to south and up to 200 km west to east.

Within the Project area, the Permian and Triassic-age sediments of the Bowen Basin are overlain by a veneer of unconsolidated to poorly consolidated Tertiary and Quaternary sediments. The area surrounding the Project is dominated by clastic sedimentary rocks of marine and lacustrine origin, including sandstones, mudstones, siltstones and coal (Geoscience Australia 2019).

The stratigraphic sequence within the Project area comprises the following:

- Cainozoic sediments—Quaternary and Tertiary alluvial sands, clayey sands and clays, with sand and gravel basal layers in some locations;
- Rewan Group—Early to Mid-Triassic sandstone, mudstone, and conglomerate;
- Blackwater Group—Late Permian Age (Fairhill Formation/Fort Cooper Coal Measures) sandstones, conglomerates, mudstones, carbonaceous shales, coal and cherty tuff; and
- Back Creek Group—Middle Permian conglomeratic sandy siltstone, mudstone and sandstone.

Surface geology includes the following:

- Qa–QLD (Qa)—Quaternary clay, silt, sand, gravel; floodplain alluvium; and
- TQa–QLD (TQa)—Late Tertiary to Quaternary poorly consolidated sand, silt, clay, minor gravel and high-level alluvial deposits.

Economic coal seams at the Project occur within the Rangal Coal Measures, a sub-group of the Late Permian-aged Blackwater Group. These coal seams are persistent, thick coal horizons with the following descending stratigraphic sequence:

- the Leichhardt seam and Leichhardt Lower seam; and
- the Vermont seam and Vermont Lower seam.

The Vermont Lower Seam extends across the Project underground mining area, while the Leichhardt Lower seam is limited to the northern half of the underground mining area. Open-cut mining of the satellite pit will target the Vermont Lower seam and Vermont seam where these subcrop to the west.

The underground mining area is limited to the west due to increasing seam gradients as the target seams dip more steeply approaching the western subcrop reaching gradients of approximately 1:6 (Figure 3.17). The dip progressively flattens across the underground mining area towards the east to typical gradients of 1:20. This flattening of the seam with depth away from the subcrop is characteristic of other deposits in the Rangal Coal Measures (Appendix A, Subsidence Assessment, Section 2.2).

The Project coal seams provide high-quality, hard coking coal and PCI coal products. The Project will recover a coal reserve of approximately 122 Mt of ROM coal using underground and open-cut mining methods.

5.3.3 Land systems

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

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

- Blackwater Land System—characterised by lowlands and plains and undulating terrain with a local relief of 3–8 m and developed cracking clays, including 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 a neutral to high alkaline subsoil.
- Comet Land System—characterised by alluvial clay plains with back-swamped sites or abandoned flow channels and minor occurrences of weathered clay and gilgai with cracking clay soils.
- Humboldt Land System—characterised by plains and lowlands with slopes of less than 2% gradient with thin, sandy surface soils and cracking clays to a lesser extent.

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 a neutral to high alkaline subsoil.
- Somerby Land System—characterised by plains and very gently undulating hills with gilgaied, deep cracking clays, alkaline surface horizons becoming acidic at depth and texture-contrast soils with high alkaline subsoils.

5.3.4 Soil characteristics

The SLSA for the Project disturbance area is provided in Appendix C, Soil and Land Suitability Assessment, (Section 4).

Soil mapping units have been 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 comprises 41 new soil profile observations and 47 new soil mapping observations across the Project site. Additionally, the survey has drawn 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 have been classified according to the nomenclature of the 1:100,000 soils mapping from the Windeyers Hill area (Burgess 2003).

Eight soil management units (SMUs) have been identified across the Project area. The spatial distribution of these soils is shown in Figure 5.2, and a summary of the landform characteristics of the SMUs is provided in Table 5.1.

Soil erodibility and the dispersion potential of soils have been assessed for SMUs using key soil characteristics. Soil erodibility, the susceptibility of soil to become detached and transported by erosive agents such as wind and water, is dependent on the mechanical, chemical and physical characteristics of the soil. It is also independent of other factors influencing soil erosion, such as topography and land use (DSITI and DNRM 2015). Erosion hazard and subsoil erodibility of SMUs from the 2020 field survey have been based on the 'Regional Land Suitability Frameworks for Queensland' (DSITIA and DNRM 2013). This assessment is based on the following characteristics:

- exchangeable sodium percentage that indicates soil sodicity when clays dominated by calcium ions are less likely to disperse compared to clays dominated by sodium ions;
- Ca:Mg ratio when higher Mg increases the dispersive nature of sodic clays; and
- Emerson aggregate test that determines the susceptibility of soils to surface sealing under rainfall or irrigation that is the dispersivity of the soil and predisposition of the soil to becoming erosive under natural conditions.

Erosion hazard for the Booroondarra, Mayfair and Moreton SMUs has been determined from the reported key soil characteristics from the previous SLSA findings (NQSA 2012 and Australasian Resource Consultants 2013). The assessment of soil erodibility and dispersivity is shown in Table 5.2.

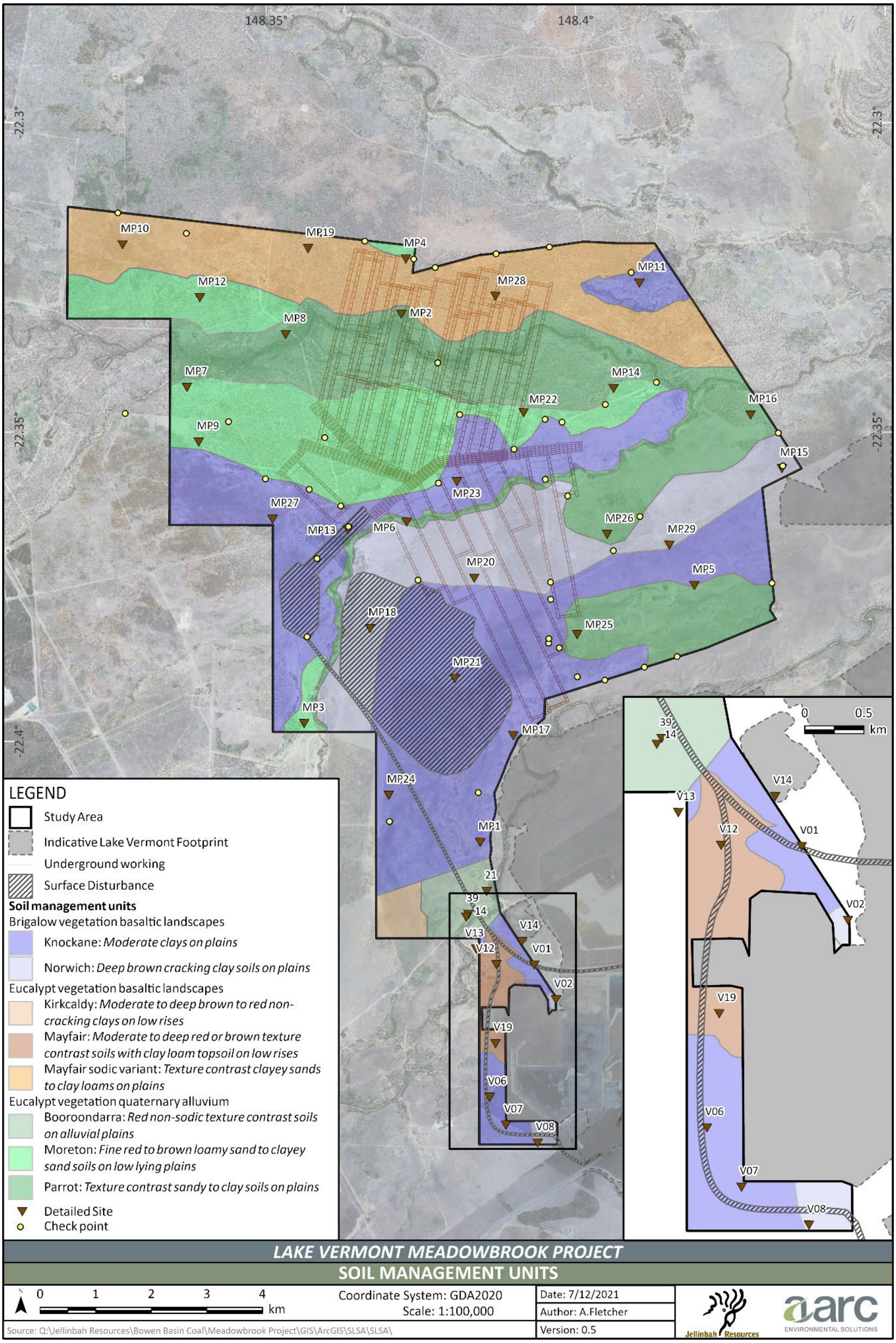

Figure 5.2: Soil management units

Table 5.1: Soil management units and landform characteristics

SMU	Per cent of Project area	Landform and drainage (slope)	Surface condition	Australian soil classification	Geology	Dominant vegetation
Booroondarra	2	Alluvial plains with moderate drainage (0-4%)	Soft	Red or Brown Dermosol	Quaternary sands, clays, gravels (Qa)	*Corymbia tessellaris, Eucalyptus populnea, Corymbia erythrophloia, Eucalyptus tereticornis*
Kirkcaldy	1	Low rises with moderate drainage (0-4%)	Cracking and hardsetting	Hypercalcic Brown Dermosol or Epipedal Brown Vertosol	Unconsolidated calcareous sediments (TQab)	*Eucalyptus* spp.
Knockane	33	Plains with moderate drainage (0-2%)	Cracking	Epipedal Brown Vertosol	Alluvium (TQa): Stratified unit, including volcanic and metamorphic material	*Carissa spinarum, Acacia harpophylla, Apophyllum anomalum*
Mayfair	1	Low rises with moderate to good drainage (0-2%)	Firm	Hypercalcic Red or Brown Chromosol	Unconsolidated, calcareous sediments (TQab)	*Eucalyptus* spp.
Mayfair Sodic Variant	14	Plains with good drainage (0-4%)	Hard setting	Brown Sodosol	Alluvium (TQa): Stratified unit, including volcanic and metamorphic material	*Acacia salicina, Cassia brewsteri, Eucalyptus populnea*
Moreton	15	Plains with good drainage (0-2%)	Soft	Brown Kandosol	Alluvium (TQa): Stratified unit, including volcanic and metamorphic material	*Corymbia tessellaris, Carissa spinarum*
Norwich	12	Plains with imperfect drainage (0-2%)	Cracking	Self-mulching Brown Vertosol	Alluvium (Tqa): Stratified unit, including volcanic and metamorphic material	*Acacia harpophylla* dominant in tree layer. Ground cover composed of various pasture grass species.
Parrot	22	Plains with moderate drainage (0-2%)	Firm and cracking	Brown Chromosol	Alluvium (Tqa): Stratified unit, including volcanic and metamorphic material	*Acacia salicina, Cassia brewsteri, Eucalyptus populnea*

Table 5.2: Soil sodicity and erodibility

SMU	Per cent 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

5.3.5 Current local 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 immediately to the south of the Project area, Saraji Mine and Saraji East project areas are to the west and the Olive Downs Coking Coal Project is to the north.

The vegetation of the Project area can be described as a combination of introduced pasture, natural bushland and regrowth of native bushland. Queensland Land Use Mapping (DES 2020b) classifies the Project area as *Grazing Native Vegetation* and 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 the riparian corridors of Hughes Creek, Boomerang Creek and One Mile Creek. These vegetation communities represent four major habitat types, namely:

1) Brigalow woodlands;

2) Eucalypt woodlands;

3) riparian woodlands; and

4) vegetation associated with wetlands.

These areas are currently used for cattle grazing 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 5.3.

There are no protected areas (nature refuges, national parks), state-controlled roads or rails and no land within the Project area reserved for stock routes, easements or quarries.

Further details on current local land uses are contained in Chapter 3, Project Description, Section 3.2.5.

5.3.6 Areas of state interest

The State Planning Policy defines specific matters of state interest in land use planning and development. The 'State interest guideline–Agriculture' (DILGP 2016b) nominates IAAs and the identification of Class A and Class B land, using the Agricultural Land Classification approach, as core concepts of which local government planning schemes should be informed.

5.3.6.1 The Golden Mile IAA

The Golden Mile IAA is a critical mass of land that satisfies the requirements for successful and sustainable agricultural activities (DAF 2018). The Golden Mile IAA covers 969,803 ha extending from Valkyrie 20 km north of the Project study area to Mackenzie River Locality approximately 120 km south (Figure 5.4). Grazing is the predominant land use of the Golden Mile IAA, comprising approximately 85% of the region. Other land uses, including mining, occupy 10% of the region, and intensive agriculture occupies the remainder.

The southern portion of the Project area intersects with the north-western portion of the Golden Mile IAA, constituting approximately 5,672 ha of the Project area. Disturbance associated with the Project area constitutes a potential disturbance of 896 ha, or less than 0.1%, of the Golden Mile IAA.

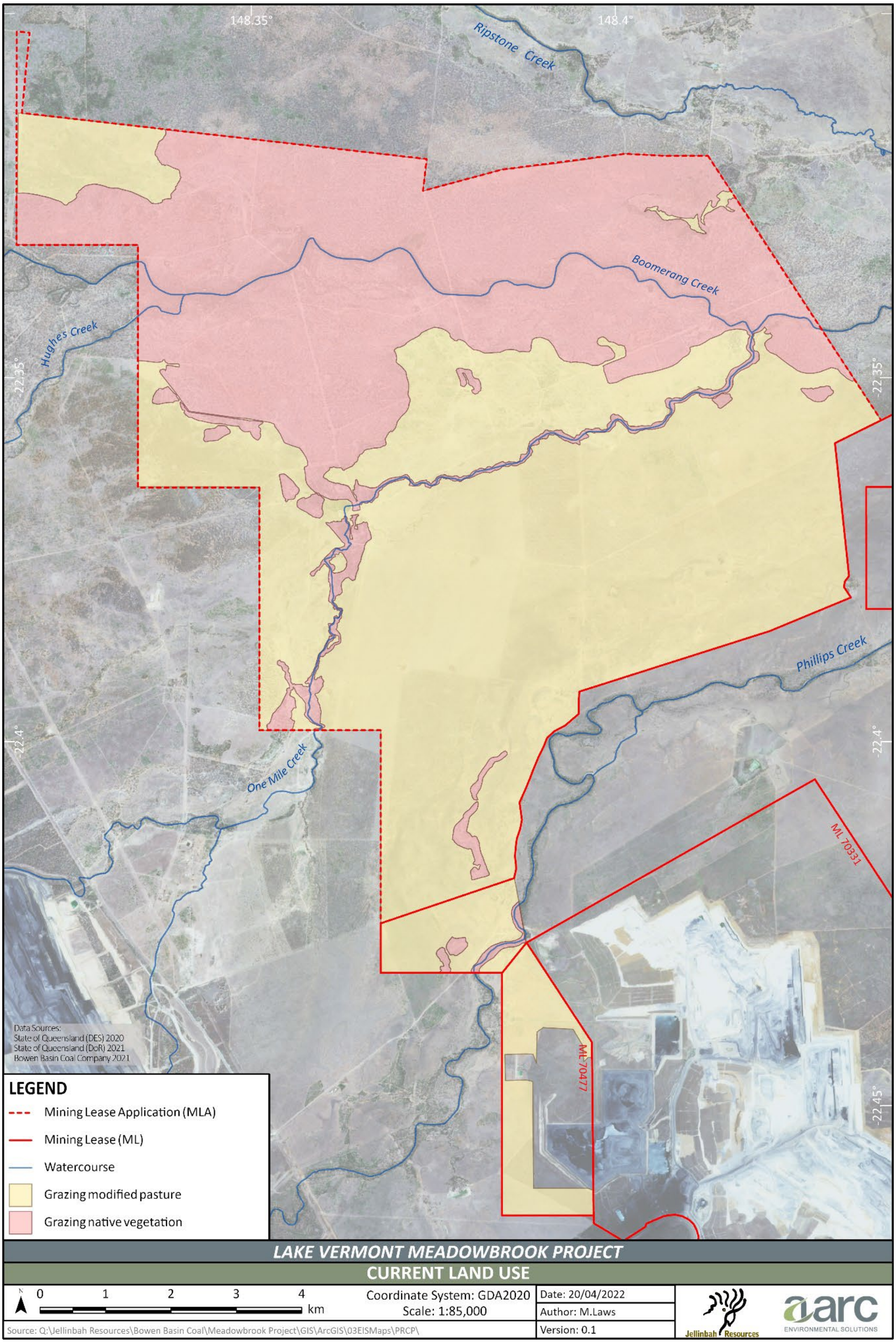

Figure 5.3: Current land use of the Project area

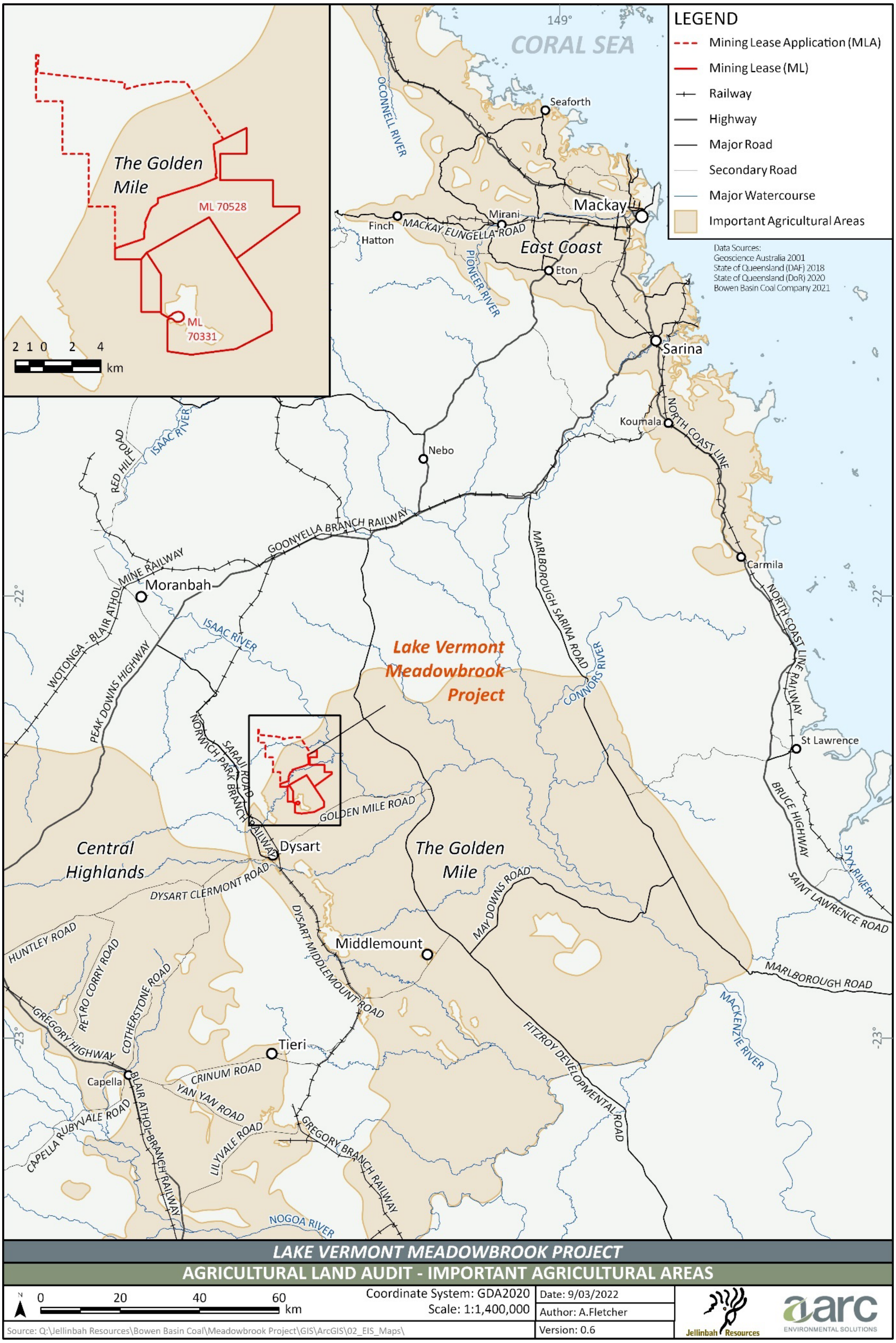

Figure 5.4: Queensland agricultural land audit–IAAs

5.3.6.2 Agricultural Land Classification

Agricultural Land Class (ALC) is a classification system developed in Queensland to assess land suitability for specific types of agricultural production (DSITI and DNRM 2015). ALCs are based on a simple hierarchical scheme that is applicable across Queensland and used to indicate the location and extent of agricultural land that can be used sustainably for a wide range of land uses with minimal land degradation.

ALC classes are determined based on:

- the results of the land suitability classes that are assigned to each SMU; and
- the variety of crops and/or grazing pastures for which the land is suitable.

Three classes of agricultural land and one class of non-agricultural land are defined in the 'Guidelines for agricultural land evaluation in Queensland' (DSITI and DNRM 2015):

- Class A: Crop land is suitable for current and potential crops with limited production ranging from none to moderate.
- Class B: Limited crop land is marginal for current and potential crops due to severe limitations but suitable for pastures. Engineering and/or agronomic improvements may be required before the land is considered suitable for cropping.
- Class C: Pasture land is suitable for grazing pastures.
- Class D: Non-agricultural land is unsuitable for agricultural uses due to extreme limitations. This may be undisturbed land with significant habitat and/or conservation.

Based on the agricultural land class assessment findings of the SLSA (Table 5.3), the Project area is predominantly classified as Class C, pasture land. Portions of potential Class B land on the Knockane and Norwich SMU, amounting to 4,049 ha, have been identified predominantly in the areas adjacent to Hughes Creek.

The Isaac Regional Planning Scheme mapping identifies a portion of the Project area in the south-east of ML70477 (approximately 6 ha) as Class A cropping agricultural land. The remainder of the Project area is mapped as Class C pasture land (Figure 5.5).

5.3.6.3 Land suitability assessment

The Project area soils have been assessed according to the 'Agricultural land suitability frameworks for Queensland' (DSITIA & DNRM 2013). The land suitability assessment, provided in Appendix C, Soil and Land Suitability Assessment, (Section 6), determined the Project area to be suitable for use as grazing land with or without limitations. The assessment identified nutrient deficiency, pH and water availability as the primary limitations across the Project area for cattle grazing.

The outcome of the land suitability assessment and the identified key constraints are presented in Table 5.3. The Parrot SMU, though potentially suitable for cropping, is identified as limited by flooding risk due to its proximity to watercourses and, therefore, is only suitable for grazing. Two SMUs (Norwich and Knockane) have been assessed as potentially suitable for use as dryland cropping land with limitations. Assessment of limitations to land suitability for dryland cropping has identified soil water availability and soil wetness to be limiting factors in cropping land use. Consideration of these limitations identified the Norwich and Knockane SMUs as unsuitable for dryland cropping. Considering the small size of this identified marginally suitable cropping land, the Project area is considered to be only suitable as grazing land with or without limitations.

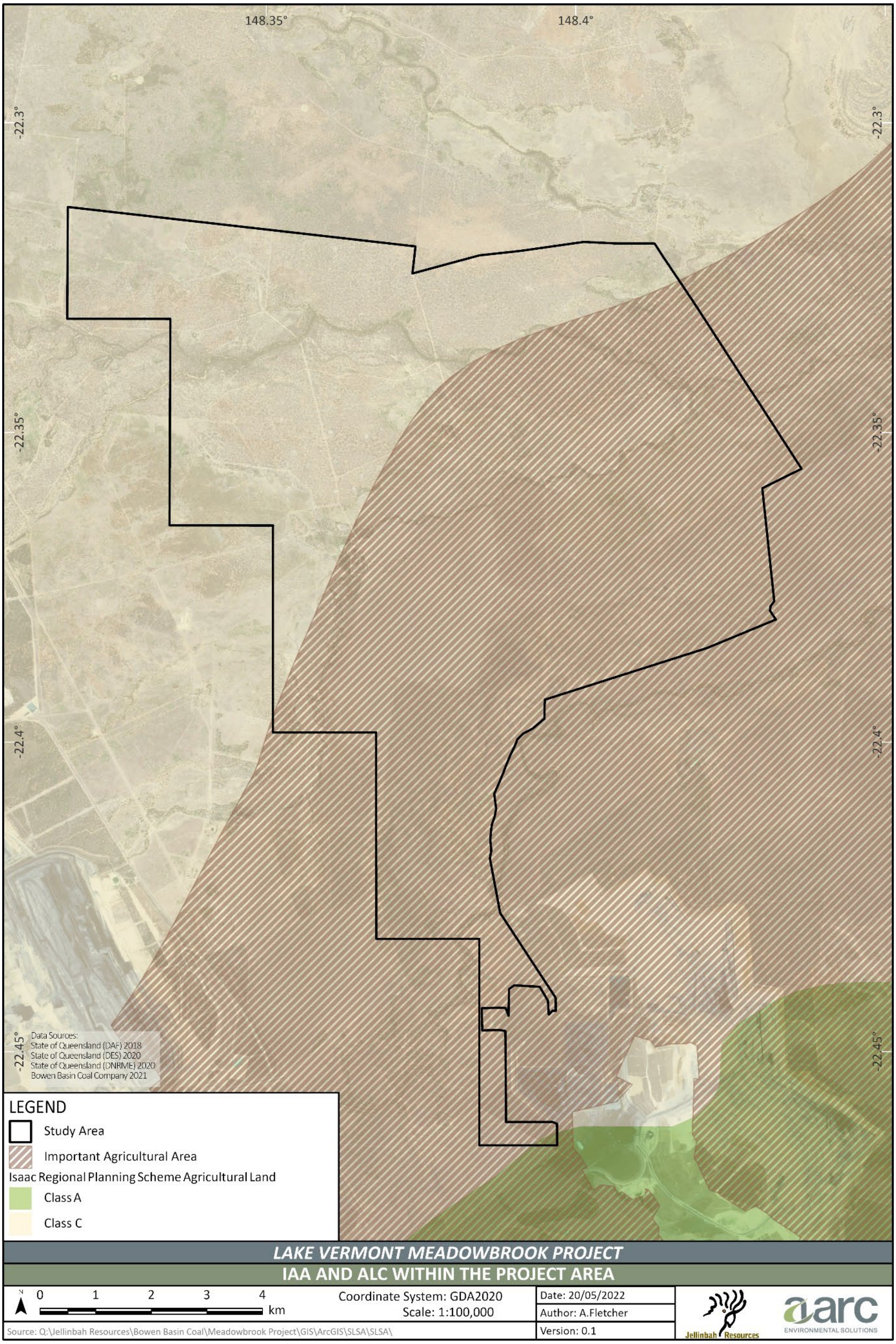

Figure 5.5: IAAs and agricultural land classes within the Project area

Table 5.3: Pre-mining land use suitability rating

SMU	Limiting factors (cropping)	ALC Class	Suitability rating (cropping)	Suitability rating (grazing)	Area (ha)
Booroondarra	Nutrient deficiency and water availability	C2	Unsuitable^	3	144
Kirkcaldy	Nutrient deficiency and water availability	C2	Unsuitable^	3	70
Knockane	Soil water availability and soil physical factors	B/C1	4	3	2,908
Mayfair	Nutrient deficiency and water availability	C3	Unsuitable^	4*	93
Mayfair Sodic Variant	Nutrient deficiency and water availability	C3	Unsuitable^	4*	1,248
Moreton	Nutrient deficiency and water availability	C2	Unsuitable^	4*	1,293
Norwich	Soil water availability and soil wetness	B/C1	5	3	1,009
Parrot	Flooding, water availability, wetness	C3	Unsuitable^	4*	1,917

* 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 guideline.

5.3.7 Areas of regional interest

The RPI Act regulates the impact of resource activities on areas of regional interest which contribute or are likely to contribute to Queensland's economic, social and environmental prosperity. Areas of regional interest that are specific to the Project area include:

- Priority Agricultural areas (PAAs);
- SCL;
- strategic environmental areas; and
- priority living areas (refer Figure 5.6).

5.3.7.1 Priority agricultural areas

PAAs are areas identified in a regional plan as being regionally significant for agricultural production. Identifying PAAs helps ensure that resource activities operated in these areas will not unreasonably constrain, restrict or prevent ongoing agricultural operations.

No PAAs are within the Project area. The Central Queensland PAA located 100 km south is the nearest PAA to the Project area.

5.3.7.2 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.

5.3.7.3 Strategic environmental areas

There are no strategic environmental areas within the Project area. The closest strategic environmental area is the North Queensland Strategic Environmental Area approximately 330 km west.

5.3.7.4 Priority living areas

No priority living areas have been identified in the Project area. The closest priority living area to the Project site is approximately 60 km south in the town of Tieri and will not be impacted by the Project (Figure 5.6).

5.3.8 Reserve land

5.3.8.1 Stock routes

No stock routes are within the Project area. The nearest stock route to the Project area is the minor and unused route 405ISAA. This route is approximately 8 km south of the Project. The proposed Project will not affect any stock route activities.

5.3.8.2 Other reserve land aspects

An easement associated with Lake Vermont Road borders part of the Project's southern border. There is no constructed road within this road easement (Figure 3.9). Various service easements exist to the south of the Project, refer section 3.2.1.

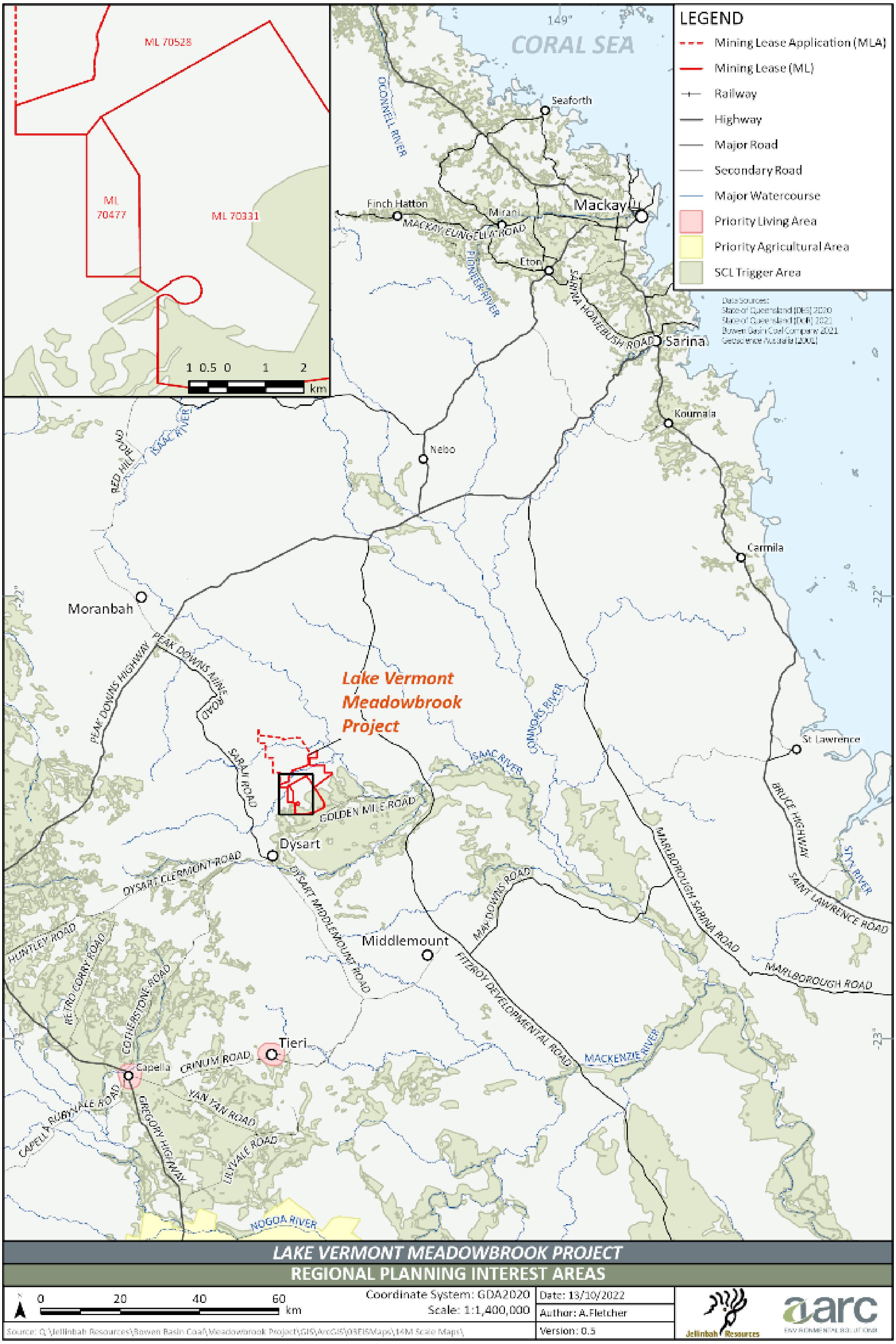

Figure 5.6: Areas of regional interest

5.3.9 Native title

The Project is within the Barada Barna People cultural heritage boundary. The Barada Barna People Native Title Determination Application Area (QCD2016/007) is outside the Project area (Figure 3.8, Chapter 3, Project Description). Native Title has been extinguished over all land the subject of the MLA. Native Title aspects of the Project are presented in Chapter 17, Cultural Heritage.

5.3.10 Existing resource tenure

As outlined in Section 3.2.1.3 of Chapter 3, Project Description, EPC 837 and EPC 850 held by other coal resource companies overlap a portion of Lot 102 on SP310393 or Lot 1 on SP190747; however, they do not overlap the Project. A number of EPs (EPC 747, EPC 721, EPC 688, EPC 1444) also overlap lots adjacent to the Project. Petroleum tenements ATP 1103 and ATP 1031 overlay Lot 102, SP310393 and/or Lot 1, SP190747. ATP 814 is adjacent to but does not overlap the MLA. No geothermal tenure or greenhouse gas tenements overlay or are adjacent to the Project area. There are several mining tenements surrounding the Project area.

5.3.11 Quarry resources

Queensland government mapping of state-owned quarry resources, including quarry areas and quarry reserves, indicates the following:

- No state-owned quarry resources have been identified within the Project MLA or off-lease infrastructure components.
- No State-declared Key Resource Areas have been identified within the Project MLA or the associated off-lease infrastructure components.

The nearest quarry resources to the Project include:

- Rankins quarry (QISAAC023), 19 km to the south-west;
- Mt Phillips quarry (QISAAC007), 23 km to the south-west; and
- Luxor quarry reserve, 21 km to the south-west.

If suitable material for construction (such as road base gravels, clay and rock materials) is identified on-site (e.g. from the underground box-cut spoil or drift construction), this will be used for the construction of roads or lay down areas. The local Tay Glen borrow pit will also be utilised to meet Project construction requirements. The Tay Glen borrow pit (south-west of the Saraji Mine) has previously provided construction aggregate for the Lake Vermont Mine. Access to the Tay Glen borrow pit is proposed to occur *via* local roads (existing private roads and tracks) with the consent of relevant landowners. Details of potential quarry material requirements are provided in Section 3.3.9 of Chapter 3, Project Description.

5.3.12 Contaminated land

5.3.12.1 Objective and scope

The contamination status of land within the Project area has been assessed with the purpose of identifying any contamination issues due to past land management and use. The assessment includes a preliminary desktop assessment of potential contamination types at the Project area, with a follow-up detailed site investigation when a contamination risk has been identified. The outcome of the preliminary desktop assessment (discussed in the following sections) is that a site investigation is not required.

The assessment was limited to existing contamination from past activities within the Project area. Contamination potentially arising from the development, operation and closure stages of the Project is discussed in section 5.4.4, including a discussion on notifiable activities occurring as part of the Project.

5.3.12.2 Regulatory framework

The EP Act regulates the investigation, reporting and management of contaminated land. An EIS does not require a formal submission unless any part of the Project site is:

- listed on the environmental management register (EMR) or the contaminated land register (CLR);
- potentially contaminated; or
- a location where a 'notifiable activity' (as listed in Schedule 3 of the EP Act) has taken place.

The 'Contaminated Land–EIS information guideline' (DES 2020b) has provided the framework for this contaminated land assessment.

5.3.12.3 Methodology

This preliminary desktop assessment has been conducted by reviewing site information and history from searches of Commonwealth, Queensland and Local Government databases. Specific information sources used are as follows:

- information sourced from relevant technical reports prepared for this EIS (e.g. Appendix C, Soil and Land Suitability Assessment and Appendix O, Non-indigenous Cultural Heritage Assessment);
- online databases of primary land use, tenure and zoning for properties within the Project area;
- database searches for current and historical titles;
- online searches of the EMR and CLR for relevant historical and current registrations;
- database searches for historical aerial photography; and
- online searches for Unexploded Ordinance (UXO).

5.3.12.4 Investigation outcomes

Historic land use

An assessment of Non-indigenous cultural heritage (Appendix O, Non-indigenous Cultural Heritage Assessment, Section 2.5) has included a review of the land use of the Project area since European colonisation. The Project area was largely used for pastoral purposes, and there is no evidence of mining prior to the late twentieth century. No significant sites or features that might be associated with contaminated land, such as homesteads, outbuildings, rubbish dumps, pastoral infrastructure, graves or evidence of early mining have been identified.

Zoning

The Project area includes five freehold land parcels:

1) Lot 101 on SP310393;
2) Lot 102 on SP310393;
3) Lot 9 on CNS98;
4) Lot 1 on SP190747; and
5) Lot 5 on SP190749).

The land is zoned *rural land use* under the Mackay, Isaac and Whitsunday Regional Plan 2011–2031 (DLGP 2012), and during recent history, was likely used primarily for grazing with some mining exploration activities.

The southern part of the proposed infrastructure corridor is within existing operational areas of the Lake Vermont Mine (ML 70331) and the Lake Vermont Western Extensions area (ML 70477). These areas are subject to existing Lake Vermont environmental management systems, and there are no unmanaged existing contamination issues present.

Current land use

Investigations have been conducted to find evidence of potentially contaminating activities within the Project area. Based on current and historical land uses within the Project area (refer section 5.3.5), activities that may have occurred include:

- livestock dip or spray race operations;
- waste storage or disposal;
- scrap yards or equipment laydown areas; and
- small scale mineral processing.

Database searches

Searches of the Environmental Management Register (EMR) and the Contaminated Land Register (CLR) have determined that no pre-existing contamination or notifiable activities are recorded within the Project area. A search of the Department of Defence unexploded ordinance mapping has determined that the Project area does not intersect any locations of known unexploded ordinance contamination.

The assessment of acid sulphate soils conducted as part of the SLSA (Appendix C, Section 8) has shown no indication of actual acid sulphate soils. Some very low indicators for potential acid sulphate soils have been recorded in the study area, but overall, the assessment has confirmed that the study area has a low probability to extremely low probability of acid sulphate soil occurrence in accordance with the 'Atlas of Australian Acid Sulphate Soils' (Fitzpatrick *et al.* 2011). The study area also exists outside the acid sulphate soils trigger area of the Isaac Regional Council's planning scheme's Acid Sulfate Soils Overlay Map (Isaac Regional Council 2021b).

Review of historical images

Digital copies of archived air photographs from 1957 to 2019 provide a land-use history for the Project area. Observations are detailed in Table 5.4. In summary, the Project site has been used for low-intensity cattle grazing for the whole of the period assessed. Water harvesting dams supporting this land use are visible in the photographs taken in 1957. By 1966, clearing in the south and east of the Project area had commenced, along with the construction of cattle holding yards near Phillips Creek. No other evidence of disturbance has been observed from the historical photographic records.

5.3.12.5 Findings

The review of historical aerial imagery shows evidence within the Project area of sustained cattle grazing prior to 1957, with improvements related to this use limited to vegetation clearing, dam construction and fencing. Cattle yards are evident adjacent to Phillips Creek, and it is possible that insecticides and other chemicals may have been utilised at this location. This location is not near any proposed disturbance or mining infrastructure development. There are no public register records of existing or potential contamination, and no notifiable activities are known to have occurred. It is considered highly unlikely that contamination is present within the Project area.

Table 5.4: Project site development interpreted from historical air photography

Year of photograph/s	Project land use	Surrounding land use
1957	The Project area is covered by native vegetation. Established water harvesting dam is visible.	Land surrounding the Project is covered by native vegetation.
1966	Land clearing in the south and east of the Project site with additional water capture weirs. Cattle yards near Phillips Creek are visible.	Small scale development to the south-west within the footprint of the current Saraji Mine (Saraji Colliery).
1978	Clearing for grazing has occurred within the southern portion of the Project. Some dam construction is apparent within the southern portion as well. Additional clearing for fence lines.	Saraji Mine developed to the east of the Project boundaries. Open-cut operations in place. Clearing for grazing occurring to the south.
1985	Much of the southern area clearing is completed by this date. Numerous additional water harvesting dams are visible. More clearing throughout for fence lines.	Saraji Mine developed further. Additional clearing to the east and the south of the Project.
2000	Additional clearing of Brigalow in the north-eastern and western corners the Project site. Dam construction throughout.	Additional clearing to the north, east and south.
2009	Land use within the Project relatively unchanged. Some above-ground storage tanks are evident near dams.	Lake Vermont Mine is operating to the south of the proposed Project area (since 2005); otherwise, there are no major changes to surrounding land use.
2019	No major changes to land use.	No major changes to land use. Lake Vermont Mine and Saraji Mine to the south and west, respectively, continue to operate.

5.3.13 Visual amenity

Impacts to visual amenity, including lighting, can be a concern for the surrounding community and/or other sensitive receptors of a development. The strategic outcomes of the Mackay, Isaac and Whitsunday Regional Council Plan (DLGP 2012) include that:

> *[E]xtractive resource operations are managed to avoid or mitigate to an acceptable standard, impacts on visual amenity.*

5.3.13.1 Landscape character

The local area is characterised by flat to gently undulating landscape. The nearest hills and outcrops are present to the west approximately 15 km from the Project boundary and have elevations up to 430 mAHD. Coal mining operations are visible in the local and regional landscape alongside low-intensity grazing activities. Nearby existing coal mining operations at Saraji Mine and Lake Vermont Mine include features which impact landscape character, including tailings storage facilities, coal handling facilities, built infrastructure, roads and associated lighting. The southern portion of the proposed infrastructure corridor directly adjoins the existing Lake Vermont Mine. The landscape character can be described as a combination of rural open plains and open forests and mined and rehabilitated land.

Any potential sensitive receptors for this Project are, therefore, likely to have low sensitivity to visual amenity impacts given the existing exposure to neighbouring projects.

There are no existing landscape features, panoramas or views with value to the local residents or community in the Project area surrounds. The nearest scenic or tourist route is the Great Inland Way approximately 70 km to the west of Dysart, and there are no views of the Project area from landmarks or lookouts.

5.3.13.2 Visual amenity sensitive receptors

Potential visual amenity sensitive receptors are identified in Table 5.5 and Figure 5.7. The majority of sensitive identified receptors are residents of homesteads with an expected high likelihood of having an interest in their surrounding landscape. There are no likely high sensitivity receptors associated with large numbers of viewers or well-used tourism or recreational facilities.

The nearest sensitive receptors to the Project are two homesteads owned by BMA:

1) the Meadowbrook Homestead (R5) located approximately 5 km south of the MIA and 3.5 km west of the infrastructure corridor; and

2) the Lake Vermont Homestead (R6) located approximately 2.5 km from the southern end of the infrastructure corridor.

Meadowbrook Homestead (R5) is unoccupied, and BMA has confirmed it will not be used as a residence in the future. Lake Vermont Homestead (R6) is occupied by an agistee grazier with appropriate agreements in place. Consequently, neither homestead has been included as a sensitive receptor for the visual amenity assessment.

The sensitive receptor Old Kyewong (R3) is approximately 5.5 km from the southern end of the infrastructure corridor. All other sensitive receptors are further than 7.5 km from the MIA.

Traffic on Lake Vermont Road is also a potentially impacted sensitive receptor, with some viewpoints approximately 4.5 km from the infrastructure corridor. Any traffic on this road is likely to be travelling to either the Lake Vermont Homestead (R6) or the Meadowbrook Homestead (R5), both of which are nearer to the Project than the public road. As such, the assessment of the sensitive receptors identified is considered representative of the potential impacts to traffic on Lake Vermont Road.

5.3.13.3 View shed analysis methodology

A view shed analysis for potential visual amenity impacts has been conducted. The analysis incorporates land elevation derived from a combination of the following digital elevation model data sets:

- a digital elevation model of the final landform for the Project and existing and approved Lake Vermont Mine;
- an airborne laser survey digital surface model created by AAM Pty Ltd between 7 and 17 April 2019 with vertical accuracy of 0.15 m; and
- the Japan Aerospace Exploration Agency Global Digital Elevation Model with a vertical accuracy of <5 m (JAXA 2021).

The digital elevation model layers have been resampled to 30 m precision using bilinear interpolation. The Project features with the potential to impact visual amenity were added to the digital elevation model. Screening provided by vegetation was derived from the laser survey digital surface model, and the effective vegetation screening was incorporated in the viewshed analysis for the extent of the laser survey digital surface model (presented in Figure 5.7). No vegetation screening has been modelled for the area outside the laser survey digital surface model.

The viewshed analysis has been conducted using the Geospatial Data Abstraction Library Viewshed Tool in QGIS 3.16.15 for a receptor height of 2 m and a target height of 1 m above the model. All viewsheds have been calculated in projected coordinates (AGD84 AMG55 datum 4203) and, therefore, do not include the earth’s curvature.

The potential impacts identified by the viewshed analysis are presented in section 5.4.8.

Table 5.5: Visual amenity sensitive receptors

Sensitive receptor	Receptor name	Easting	Northing	Distance from MIA
R1	Pownalls	653025	7512686	18.1
R2	Seloh Nolem 1	652696	7532404	15.2
R3	Old Kyewong	646743	7509949	16.5
R4	Mockingbird Downs	652135	7513934	16.6
R5	Meadowbrook Homestead	638086	7520400	4.6
R6	Lake Vermont Homestead	640116	7516958	7.9
R7	Willunga	666958	7529954	27.9
R8	Leichardt	656328	7515670	19.1
R9	Seloh Nolem 2	652770	7533482	15.8
R10	Old Bombandy	657506	7516682.47	29.1
R11	Vermont Park	647231	7537824	15.1
R12	Saraji homestead 1	629574	7519126.55	11.5
R13	Saraji Homestead 3	630689	7522987.44	9.0
R14	BMA Saraji	631499.99	7520239.06	9.3
R15	Iffley	647326.0397	7539855.648	17.0
R16	Tay Glen	635322	7509100.993	16.3
R17	Semple Residence	649876	7506696.685	20.8
R18	Saraji homestead 2	630424	7523432	9.2

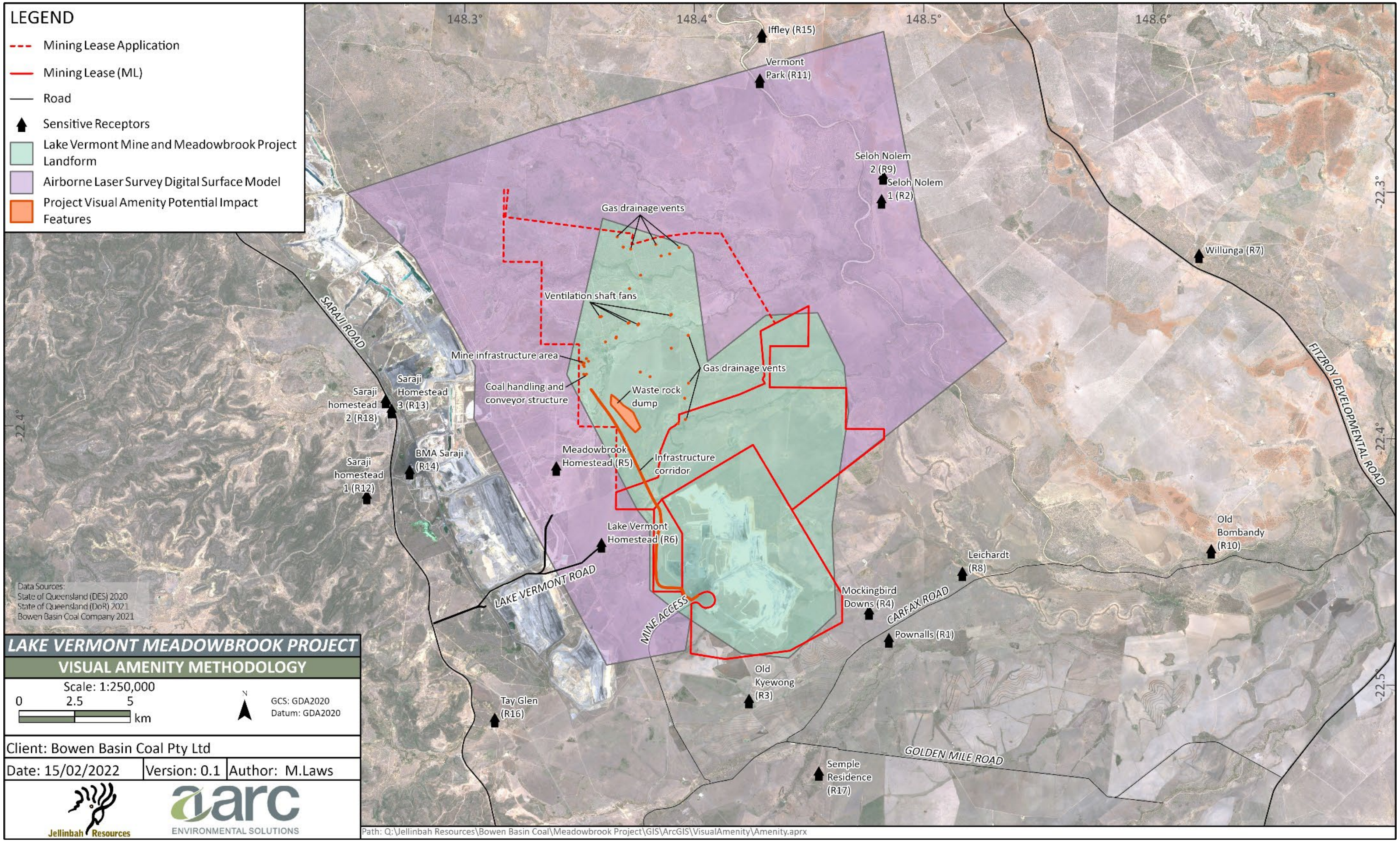

Figure 5.7: Visual amenity viewshed analysis methodology

5.4 Potential impacts

The area of Project disturbance is described in Chapter 3, Project Description, Section 3.1.4 with detail of construction phase and operations phase disturbance provided in Sections 3.3.9 and 3.4.7 respectively.

5.4.1 Subsidence

5.4.1.1 Subsidence prediction methodology

A subsidence assessment has been prepared by Gordon Geotechniques Pty Ltd and is presented in Appendix A, Subsidence Assessment. Subsidence refers to the movement of overburden and land surface as a result of the underground extraction of coal. The subsidence assessment makes predictions of subsidence effects resulting from the proposed underground longwall mining. These subsidence effects are summarised in section 5.4.1.2, the resulting impacts are described in section 5.4.1.3 and the proposed subsidence mitigation measures and monitoring are described in section 5.5.1.

Subsidence predictions resulting from the Project's underground mining operations have been determined using the influence function method (Appendix A, Subsidence Assessment, Section 4). Modelling was conducted over two areas:

1) an area spanning the northern dual seam mining operation (where the Leichhardt Lower seam and Vermont Lower seam are both mined); and
2) the southern single seam mining area (where the Vermont Lower seam is mined).

The model required input of existing calibration data from mine geometry and local geology and considered the following:

- panel layouts;
- seam thickness;
- depth of cover;
- influence angle;
- subsidence factor; and
- strain coefficient.

The influence function method is a proven prediction methodology and widely used to generate predictions of longwall mining subsidence. It is an established empirical method that depends on back-analysis of previous field measurements (COA 2014). Published subsidence references, including dual seam longwall mining references, have been used to validate model inputs and interpret model results. References were included from:

- Queensland (Crinum, Oaky Creek, German Creek, Kestrel, Goonyella and Northern Bowen Basin);
- New South Wales (Wyee and Cooranbong); and
- the United Kingdom.

Based on this information, as well as subsidence data from Gordon Geotechniques Pty Ltd, the following parameters have been used for modelling the Project:

- panel adjustment factor of 0.2;
- influence angle of 70°;
- maximum subsidence factor of 65% for extraction in virgin ground and 95% for Vermont Lower seam extraction below Leichhardt Lower Seam goaf areas; and

- strain coefficient of 0.35.

5.4.1.2 Predictions of subsidence effects

The subsidence modelling has produced predictions about changes to landforms based on well-established methodologies that have been validated through application at numerous similar mining operations. The subsidence modelling predictions are made with conservative assumptions when uncertainty exists and are considered suitable for assessing the potential impacts of subsidence on the environment.

The subsidence modelling predicts *subsidence*, referred to as the vertical movement of a point at the surface. Subsidence vertical movement is predicted to occur over the underground mining areas to a maximum depth of 2.9 m for the southern mining area and a maximum depth of 5 m for the northern mining area. The modelled vertical subsidence after underground mining is presented in Figure 5.8. Longwall mining subsidence typically results in an altered topography above the underground mining footprint, with ridges above chain pillars and troughs over the goaf, or mined-out areas. Subsidence predictions also indicate the extent of vertical movement along the watercourses in the Project area. The maximum displacement in watercourse surface level modelled is approximately 4 m for Boomerang Creek and 2.5 m for One Mile Creek.

Subsidence can also result in horizontal ground movements at the surface, being the absolute horizontal movement at a point on the surface. The maximum horizontal ground movements are typically less than 1 m in the southern mining area and up to 1.6 m in the northern mining area.

Surface strain is the relative change in horizontal distance between two points at the surface caused by bending or stretching of the land surface. The maximum tensile strains resulting from subsidence are modelled at 24 mm/m. The maximum compressive strains modelled are 28 mm/m.

Tilt is the change in the slope of a subsided land surface as a result of differential subsidence. The maximum tilt modelled to develop over the underground mining area is 3.8%, or 38 mm/m.

The subsidence predictions are final values after longwall mining is completed. Based on subsidence modelling at other mines in the Bowen Basin, more than 97% of the maximum subsidence is predicted to occur within six weeks after single seam longwall mining is completed. For those areas where sequential dual seam mining occurs, subsidence will occur as two discrete events, with 97% of maximum subsidence estimated to occur within 6 weeks of completion of longwall mining in the Vermont Lower seam.

5.4.1.3 Subsidence impacts

Subsidence is defined as the sinking or settlement of the land surface due to any of several processes. For this Project, subsidence arises from the extraction of a coal seam and the consequent downward movement of the overlying strata and surface. A subsidence assessment for this Project has been undertaken and is included in Appendix A, Subsidence Assessment. Subsidence is predicted to occur across approximately 2,168 ha of the Project area; the potential impacts of subsidence that may occur within this area are summarised in the following subsections. An assessment of potential subsidence impacts relevant to terrestrial ecology values is presented in Appendix G, Terrestrial Ecology Assessment, Section 10.2.

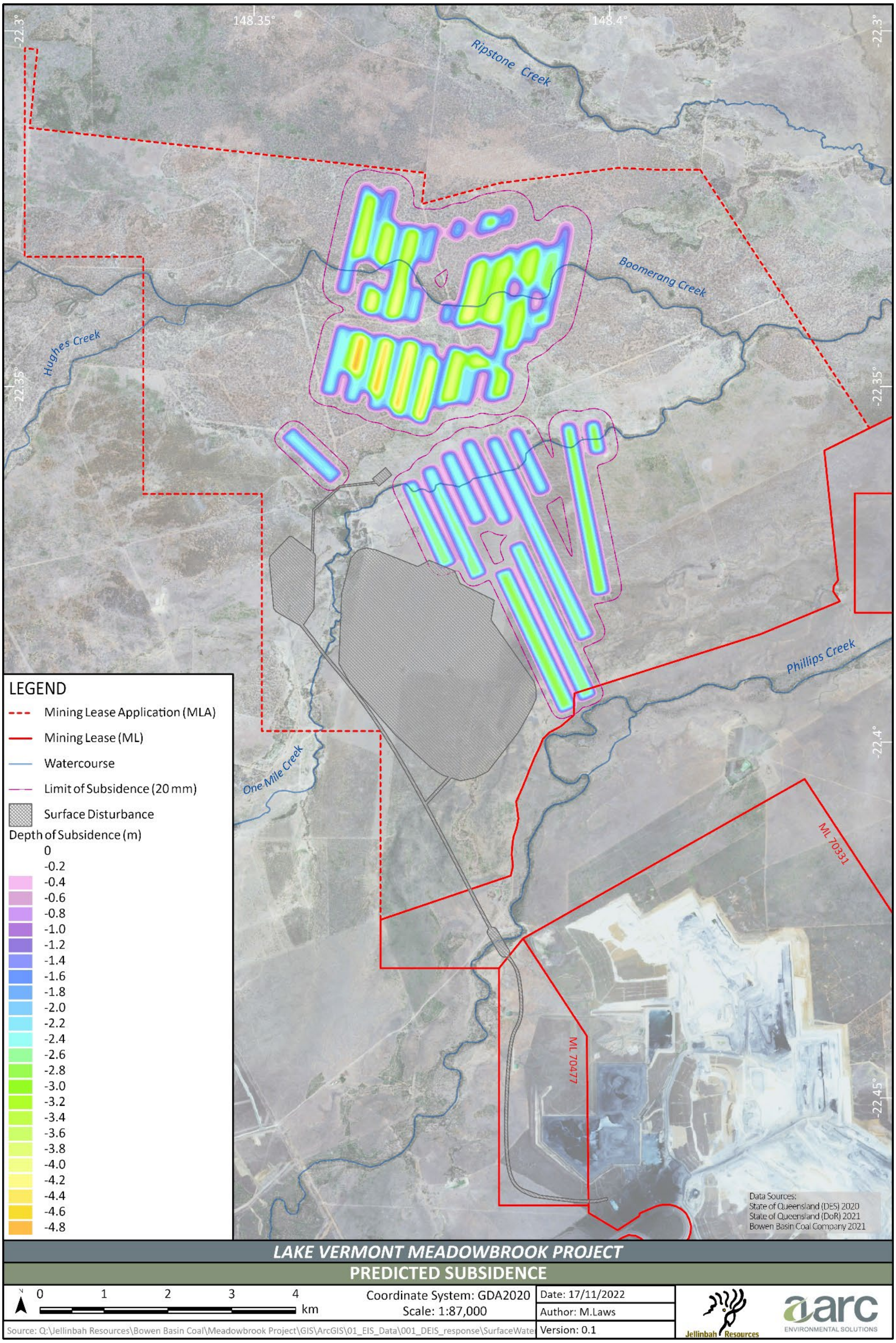

Figure 5.8: Predicted subsidence after underground mining

Sub-Surface cracking

Discontinuous sub-surface cracking can cause changes to the existing hydrogeological regime. Cracks in the rock mass can change the permeability and water storage capacity of the strata overlying the mined areas.

The estimation of the extent and behaviour of subsurface subsidence cracking is a complex undertaking and requires information from multiple approaches and multiple lines of evidence. Estimation of the subsurface cracking resulting from underground mining in the Project area (Appendix A, Subsidence Assessment, Section 5.1) is based on measured data, micro-seismic monitoring and empirical guidelines. The subsurface cracking predictions due to single seam longwall extraction can be summarised as:

- a zone of continuous cracking extending up to approximately 120 m above the extracted seam; and
- a zone of discontinuous cracking extending no higher than 180 m above the extracted seam.

For areas planned to undergo dual seam extraction, subsurface cracking is predicted as a zone of continuous cracking extending up to 180 m above the lower extracted seam (Vermont Lower Seam).

Based on a review of available information from underground mining operations in the Bowen Basin, the subsidence assessment (Appendix A, Subsidence Assessment, Section 5.1) has also identified that surface water inflows to mining areas have not occurred where depth of cover exceeds 120 m and that groundwater inflows have not occurred where distance to the aquifers exceeds 90 m. An assessment of the potential impacts of subsurface cracking on groundwater values is presented in Appendix E, Groundwater Impact Assessment, Section 5.8.

Connective cracking to surface

In areas where the depth of cover to the extracted coal seam is less than the combined height of connective cracking and surface crack depth, connective cracking could occur leading to inflows of potential water sources to the underground workings. Connective cracking is not anticipated to occur, as the depth of cover is greater than the expected height of subsurface cracking for all underground mining areas. Despite this, the possibility of a low conductivity fracture connection to the surface has been included in the groundwater model for the Project underground area.

Surface cracking

Cracking can occur at the ground surface where differential lowering of the ground surface results in areas of residual tensile strain, which are most likely to occur at the perimeter of subsidence troughs. While depth of cover, panel and pillar width and geology are factors, subsidence troughs typically align with the longwall panel layout. Surface cracks typically occur in areas under tensile strain, but they can also occur in areas under compressive strain.

While surface cracking is anticipated to occur, the visible extent of cracking is dependent on the soils overlying the underground mining area and the interaction between cracks, soil and water. For the Project, heavy cracking clay soils overlie much of the underground mining footprint, and it is anticipated that subsidence cracks will be reduced or diminish over time as a result of the self-mulching properties of these soils. The self-mulching vertosol SMU Norwich has properties with the most potential to resolve surface cracks, and other heavy clay SMUs Knockane, Kircaldy, despite being epipedal vertosols, presented polyhedral and platy surface horizon structure which will have some self-mulching abilities. In Queensland conditions, heavy cracking clay soils are able to self-mulch over developing subsidence caused surface cracks within three wetting and drying cycles (Lechner et al. 2016) and Knockane, Norwich and Kircaldy are all strongly cracking soils and are expected to display this response to surface cracking. Soils with weaker structures, such as Mayfair sodic variant, Moreton and Parrot, will retain surface cracks longer than heavy clay soils (Lechner et al. 2016).

Based on experience at a number of operating Bowen Basin longwall mines, maximum crack widths up to 200 mm could be expected above the shallower longwall panels, decreasing to less than 50 mm in the deeper parts of the Project longwall mining area during single seam extraction. Some reworking and widening of existing cracks is anticipated above dual seam mining areas. The maximum predicted depth of cracking above the longwall panels in the Meadowbrook longwall mining area is 10–15 m, with the majority of cracks predicted to be less than 1 m deep.

Cracks of this width and depth are amenable to small scale rehabilitation works that are routinely carried out at other longwall mines in the Bowen Basin. This typically involves stripping of the topsoil, excavating and backfilling the cracks. The topsoil is then respread over the area and the site is revegetated.

Buckling and heaving

Buckling or heaving may result where near-surface strata breaks occur, and the resulting blocks of rock interact to produce localised movement. This process may be exhibited above central areas of longwall panels but is less likely to occur than tension cracking.

Surface drainage effects

Localised depressions in the surface topography resulting from underground mining subsidence can result in areas of ponding depending on the local topography. Subsidence modelled has also indicated alteration to the bed levels of watercourses overlying the underground mining in the Project area, which may result in the changed watercourse flows. An assessment of the potential impacts of subsidence on the surface water features of the Project area are presented in Chapter 8, Surface Water and Appendix W, Geomorphological Assessment Report, (Section 3). An assessment of the potential impacts on aquatic ecology values is presented in Chapter 11, Aquatic Ecology and Appendix H, Aquatic Ecology Assessment (Section 9.2).

5.4.2 Landform and topography

The Project will alter the topography and landforms within the Project area. Some changes will be minor and temporary (e.g. sediment dams, bunds, levees and drains) and others will be permanent (e.g. the final rehabilitated spoil dumps and subsidence depressions). The maximum area proposed to be disturbed within the MLA footprint is 1,030 ha and includes:

- the infrastructure corridor area;
- the mine infrastructure area;
- the open-cut pit;
- waste rock emplacements; and
- areas impacted by ponding within the predicted subsidence footprint of the underground mining area.

Throughout the operational phase of the Project, mined waste rock will be progressively placed behind the advancing open-cut operation as well as being placed in out-of-pit spoil dumps. At the cessation of mining, a single out-of-pit emplacement will remain. Details relating to post-mining land uses and rehabilitation processes are provided in Chapter 6, Rehabilitation.

Achievement of the proposed post-mining land uses will ensure that impacts to land will be limited to the construction, operational and decommissioning phases of the Project. The management of consequent visual amenity impacts is discussed in sections 5.4.8 and 5.5.7. Soils (erosion and stability)

Modifications to landforms and topography have the potential to lead to an increased susceptibility of soils to localised erosion. SMUs at greater risk of susceptibility to erosion are those with weak structures, such as sands, loamy sands or massive structured soils; for this Project, erosion susceptible SMUs include:

- Mayfair sodic variant;
- Moreton; and
- Parrot.

The subsoils of the Knockane, Mayfair sodic variant and Norwich SMUs also display a relatively greater susceptibility to erosion should they become exposed as a consequence of Project disturbance activities.

Subsidence may result in surface cracking which may create conditions suitable for erosion. Erosion and stability management measures are provided in section 5.5.3 and subsidence management measures, including an outline of the Subsidence Management Plan is provided in section 5.5.1.

5.4.3 Land use and land use suitability

As per section 5.3.5, 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 immediately to the south;
- Saraji Mine and Saraji East project areas to the west; and
- Olive Downs Coking Coal Project to the north.

The SLSA (Appendix C, Soil and Land Suitability Assessment, Section 5) has determined that the Project area consists of land suitable for cattle grazing with moderate limitations (Class 3) and land considered marginal land (Class 4) (Appendix C, Soil and Land Suitability Assessment, Section 6). The current low-intensity grazing land use indicates that the entire Project area can sustain grazing activities.

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 following rehabilitation, 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 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.

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

Subsidence affected areas will have a final landform designed in consideration of appropriate drainage mitigations to minimise ponding. 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 class suitability. Some subsided areas will be subject to intermittent ponding, in the order of several months to every few years, over time functioning as ephemeral wetlands. Ephemeral wetlands are already present within the Project site, and ponded areas are expected to function similarly, thereby remaining suitable for low-intensity grazing land use.

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. Rehabilitation of subsidence-affected areas is discussed further in Chapter 6, Rehabilitation and Appendix B, Progressive Rehabilitation and Closure Plan (Section 3.5). The pre-mining land suitability class is based on the SMU, with areas of class 3 and class 4 identified across the Project site; as inundation is intermittent and not permanent, the ponding does not meet the threshold for class 5 (wetness limitation). Therefore, ponding will not change the suitability class. Given the remediation activities applicable, and that no change to the suitability class is expected, ponded areas will remain suitable for low intensity grazing.

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. Mine infrastructure areas are expected to be compacted, potentially inhibiting plant growth in addition to having high alkaline subsoils, which is expected to limit these areas to land suitability Class 4.

The Project site contains a large contiguous area of remnant or high-value regrowth vegetation 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 reinstating, as far as practicable, the existing vegetation communities.

5.4.4 Contaminated land

Certain activities that are ancillary to the proposed mining operation have the potential to contaminate land. These activities are referred to as 'notifiable activities' and are listed in Schedule 3 of the EP Act. The Project will involve the following notifiable activities:

- 1: Abrasive blasting;
- 7: Chemical storage (other than petroleum products or oil under item 29);
- 14: Engine reconditioning works;
- 15: Explosives production or storage;
- 23: Metal treatment or coating (spray painting);
- 24: Mine wastes; and
- 29: Petroleum product or oil storage.

There is a risk of contamination to land within the Project area as a result of the inappropriate storage and handling of chemicals, explosives and wastes. To address these concerns and mitigate the risk of contamination, hazardous material storage and handling measures and standards will be implemented.

Soil may be unexpectedly contaminated as a result of either:

- the prior land uses; and/or
- the operation of the Project itself, including incidents such as:
  - leakage or spills of sewage treatment plant effluent;
  - spills from the waste collection area; or
  - accidental spillage of chemicals or fuel.

The contaminated land assessment detailed in section 5.3.12 has determined a very low to no risk of existing land contamination arising from prior land uses. If any unexpected contamination due to prior land uses is identified, work will cease in that area and appropriate actions will be taken to delineate the contaminated area. If required, further investigation and/or remediation works will be undertaken. The proposed mitigation methods are outlined in section 5.5.6.

The proposed Project has potential to cause new contamination. Activities that are likely to occur at the site that have the potential to cause contamination are listed in Table 5.6.

As indicated by Table 5.6, the risk of significant residual contamination existing on the site post-closure is considered to be low. At cessation of operations, a phase 1 contamination assessment will be undertaken of the site and appropriate measures taken. All contaminated land requirements will be complied with in accordance with the EP Act.

As discussed in Chapter 3, Project Description, coal rejects will be managed at the existing Lake Vermont Mine. The results of the geochemical test work indicate that the characteristics of coal reject material to be produced from the Project are consistent with coal reject produced at the existing Lake Vermont Mine, and therefore, does not pose an increased risk of contamination. The existing co-disposal facilities are regulated structures and have been designed and certified by a suitably qualified and experienced person (RPEQ) in accordance with the relevant government regulations. Lake Vermont Mine currently operates under a Mine Waste Management Plan which incorporates a tailings disposal plan, in accordance with the existing EA conditions. This Mine Waste Management Plan will be updated to detail the procedures for the management of coal rejects generated during operation of the Project. In-pit disposal of coal rejects may be considered in future, subject to independent approvals.

5.4.5 Existing resource tenements

As identified in section 5.3.10, there are no coal tenements overlapping the Project MLA, and two overlapping petroleum exploration permits. The only impacts to existing tenure will be the modification of MDLs 3030 and 429 as a consequence of approving the Project. The Project is not expected to impact any adjacent MLs and MDLs due to the following:

- the mine layout has been designed so that the subsidence zone is wholly contained within the Project boundary, with the exception of a small area which overlaps the adjacent Lake Vermont ML 70528;
- the land management measures discussed in section 5.5 have been designed to minimise the risk of erosion and unnecessary disturbance, and to promote land stabilisation through rehabilitation; and
- the disturbed land will be rehabilitated to the post-mining land uses proposed in Section 6.3.2, Chapter 6, Rehabilitation, and Appendix B, Progressive Rehabilitation and Closure Plan (Section 3.3).

The Proponent will comply with all regulatory requirements to notify and consult overlapping tenure holders.

5.4.6 Native Title

Native Title areas exist to the east of the MLA (Figure 3.8, Chapter 3, Project Description), downstream of the Project area. No controlled releases will be used to manage stored site inventories, and consequently, there will be no impacts on surface water quality through controlled releases (Appendix Y, Site Water Balance and Water Management, Section 2). Additionally, sediment dam overflows, including the predicted salinity of overflows, have been determined to have minimal impact on downstream environmental values (Appendix Y, Site Water Balance and Water Management, Section 5.4.3). Therefore, the Project is not likely to impact native title areas located outside of the MLA.

5.4.7 Cumulative impacts

As described in section 5.4.2, The Project will result in approximately 1,030 ha of land disturbance, in addition to the disturbance footprints of currently operating mines and any future resource developments at early stages of assessment. As detailed in section 5.4.3, the majority of the disturbance footprint has been identified as being land suitable post-mining for cattle grazing with moderate limitations (Class 3) or land considered marginal land (Class 4) (Appendix C, Soil and Land Suitability Assessment Section 6). The Project proposes to reinstate the majority of disturbed land to at least these land suitability classes within 10 years following rehabilitation activities. However, approximately 240 ha of Class 3 land is planned to be rehabilitated to at least Class 4 land post-closure, by virtue of slope limitations associated with some rehabilitated areas.

Existing and potential future resource activities within the region (refer Chapter 3, Project Description) have been evaluated based on their cumulative (reversible or irreversible) disturbance of areas of regional agricultural importance (section 5.3.7). The closest operating resource permits to the Project are located approximately:

- 25 km north;
- 4.7 km east; and
- 1.7 km south of the Project boundary.

Table 5.6: Potential contaminating activities

Activity	Potential contaminant	Pathways and potential receptors	Controls
Notifiable activities			
Abrasive blasting	Airborne abrasive blasting products Wastewater, sludges from abrasive blasting	Airborne particulates: MIA—proximate to work area	SOPs limiting activity during adverse weather conditions
		Rainfall runoff: MIA dam	MIA dam capture
		Spills: MIA—proximate to work area	Work area controls, spill response
Chemical storage	Various chemicals (refer Chapter 16, Hazards and Safety)	Spills: Land, MIA or operational areas	Compliant storage facilities, handling SOPs, training
Engine reconditioning works	Solvents, paints, chemicals	Spills: Land, MIA or operational areas	Workshop collection equipment, engineered collection facilities, spill kits
Explosives storage	Explosive materials, blast residues	Spills: land	Licensed storage facilities, handling SOPs, training
		Rainfall runoff: land, surface waters	Operational area catchments flow to mine water dams
Metal treatment or coating	Paints and coatings	Airborne particulate fallout: land	SOPs limiting activity during adverse weather conditions
		Rainfall runoff: land, surface waters	MIA dam capture
Petroleum product or oil storage	Short and long chain hydrocarbons	Spills: land	AS1940 compliant storage facilities, handling SOPs, training
		Rainfall runoff: land, surface waters	MIA dam capture; operational area catchments flow to mine water dams
Mine wastes	Hazardous overburden or processing residues	Leachates: groundwater, surface water systems	No materials processing proposed Low hazard characteristic overburdens
Non-notifiable activities			
Mine water dust suppression	Salts	Leachates: groundwater, surface water systems	Controlled watering, burial of haul road materials

A database search of regional mining tenements undertaken on 20 May 2022 indicated that there are currently 178 resource tenements within approximately 45 km of the MLA (Table 5.7). With regard to areas of regional interest, and with reference to Table 5.7, Figure 5.4 and Figure 5.6, and Figure 3.10 and 3.11, there are currently:

- 45 resource tenements overlapping SCL trigger mapping;
- 43 resource tenements overlapping the Golden Mile IAA; and
- eight resource tenements overlapping the Central Highlands IAA.

Further detail regarding the location and ownership of the surrounding resource tenements is provided in Chapter 3, Project Description.

Table 5.7: Resource tenements and regional interests

Tenement type	Existing tenements	Tenements containing SCL	Tenements overlapping the Golden Mile IAA	Tenements overlapping the Central Highlands IAA
Mineral Lease	87	16	21	0
Petroleum Lease	7	0	0	0
Mineral Development Licence	29	7	9	0
Exploration Permits Coal	42	14	9	3
Exploration Permit Minerals	8	5	0	5
Petroleum Exploration Permit	5	3	4	0
Total	**178**	**45**	**43**	**8**

The Project, as proposed, will result in a potential conversion of up to 240 ha of Class 3 to Class 4 grazing land. As the Agricultural Land Audit distinguishes between land suitability Classes 3 and 4 (DAF 2018), there will be a similar downgrading of Class 3 land to Class 4 land; equivalent to less than 0.05% of the Golden Mile IAA. There will also be a permanent impact to approximately 3 ha of trigger mapped SCL for which a RIDA application has been submitted (see section 5.3.7.2).

Apart from the direct impacts to land outline above and given that the proposed Project maintains the current production rate of the Lake Vermont Mine, there will not be any other cumulative impacts to land as a consequence of this Project. However, the duration of any current impacts to land would be extended for the life of the Project.

5.4.8 Visual amenity

This section assesses the impacts on the landscape character of the site and the impacts of the components of the Project to the visual amenity of sensitive receptors in the surrounding area.

5.4.8.1 Landscape character

As described at section 5.3.13, the topography of the Project area is generally flat to gently undulating with few prominent landscape features proximate to the Project. The visual amenity in the vicinity of the Project can be described as being of low to moderate scenic quality, akin to that typically associated with an agricultural setting having low topographic variation and scattered stands of remnant vegetation. Given the close proximity of a number of significant neighbouring mining operations, the current visual amenity is not likely to be significantly impacted by landscape changes resulting from the Project. The proposed Project will not create a distinct landscape character and is unlikely to change the general landscape character of the local area.

5.4.8.2 Visual amenity and lighting potential impact features

The Project includes the construction of features that have the potential to impact the visual amenity of the area. The visual amenity assessment analysed the potential impact of the visible Project features presented in Table 5.8 also includes prominent lighting facilities required for safety, security and night-time operations that have the potential to result in light impacts to sensitive receptors, and which have also been assessed. Vegetation clearing will be limited to those areas with prominent Project features; therefore, the visual impact assessment is considered adequate to assess the impact of vegetation clearing.

Table 5.8: Project features with potential to impact visual amenity

Feature	Description	Maximum height	Lighting
MIA structures	Buildings including administration, operations, workshop buildings, storage areas and overhead crane will be constructed within the MIA.	Typical height of admin buildings 2.5 m. 8 m high overhead crane.	15 m flood lights
Coal handling and conveyor structures	A ROM product stockpile and conveyor will be established, and the height of the conveyor and ROM stockpile will vary during operation.	Radial stacker to 22 m. ROM stockpile to maximum 17 m.	20 m flood lights
Gas drainage vents and flares	Mobile mine gas vents will be operated over the proposed underground mining area.	3 m	Flared vents
Fan on vent shafts	Vent shaft fans will be constructed at two locations above the underground mining area.	7 m	10 m flood lights
Drift entrances	Concrete arches extending out from drift entrance.	5 m	
Infrastructure corridor – haul road, road lighting and power transmission lines	The haul road will be a feature potentially impacting visual values. Intermittent traffic will be active on the haul road. The southern haul road section connects with the Lake Vermont site with existing mining impacts to visual values.	Haul road structure height from design up to 1.5 m. Vehicle height 5 m additional. 66kv overhead ETL parallel to road 8 m.	Mobile plant lights
Fencing	Industrial fencing will be established in areas previously fenced for agricultural purposes.	1.5 m	nil
Subsidence features	Subsidence features may develop to an extent visible at the surface.	Negative height	nil
Open-cut pit	May cause visible alteration of land surface for receptors.	Negative height	nil
Waste material emplacements	Waste material including waste rock and topsoil will be generated by the Project.	10 m drift waste stockpile in MIA 40 m waste rock dump (WRD) adjoining open-cut pit with additional 5 m vehicle height.	nil

Feature	Description	Maximum height	Lighting
Final landform or rehabilitation structures	Features to remain after site decommissioning.	40 m.	nil

5.4.8.3 Visual amenity impacts

The assessment undertaken determined that some Project features are located within the viewshed of four sensitive receptors as presented in Figure 5.9. The viewshed analysis indicates that the waste rock emplacement—and for the operational phase, any mine vehicles working on the emplacement—may be in the viewshed of following three sensitive receptors:

1) R7 (Willunga);
2) R8 (Leichardt); and
3) R15 (Iffley).

These sensitive receptors are outside the area and covered by the airborne laser survey digital surface model that was used to model vegetation screening for the analysis. These three sensitive receptors are located 27.9 km (R7), 19.1 km (R8) and 17.0 km (R15) from the Project area, which is likely too far distant to have any substantial visual impact associated with the waste rock emplacement. While not able to be modelled, it is known that screening vegetation is within the viewshed of these receptors, further mitigating any impact on the visual amenity of sensitive receptors R7, R8 and R15.

Sensitive receptor R17 (Semple Residence) is indicated to contain a small portion of the infrastructure corridor in its view shed. This sensitive receptor is also outside the airborne laser survey digital surface model used to model vegetation screening. Substantial screening vegetation is known to be in the viewshed of this sensitive receptor, and the portion of the infrastructure corridor that may be visible is small in the context of the visual environment created by the features of the existing Lake Vermont Mine. It is, therefore, considered unlikely that the visual amenity of sensitive receptor R17 will be impacted by the Project.

The potential impacts to visual amenity of these homesteads are, therefore, considered insignificant, and the Project is considered to be not incompatible with the existing visual amenity of the sensitive receptors in the area.

5.4.8.4 Lighting impacts

The viewshed analysis indicates that a portion of the infrastructure corridor may be partially visible to sensitive receptors approximately 10 km away (R17, Semple Residence). Lighting will be required for vehicles using the infrastructure corridor at night-time; however, it is unlikely that this will be visible at R17. No other sensitive receptors have been determined to have Project lighting within their viewshed. The Project is, therefore, considered unlikely to have any lighting impacts on the sensitive receptors.

The potential impacts of Project lighting on environmental values are assessed in Chapter 10, Terrestrial Ecology.

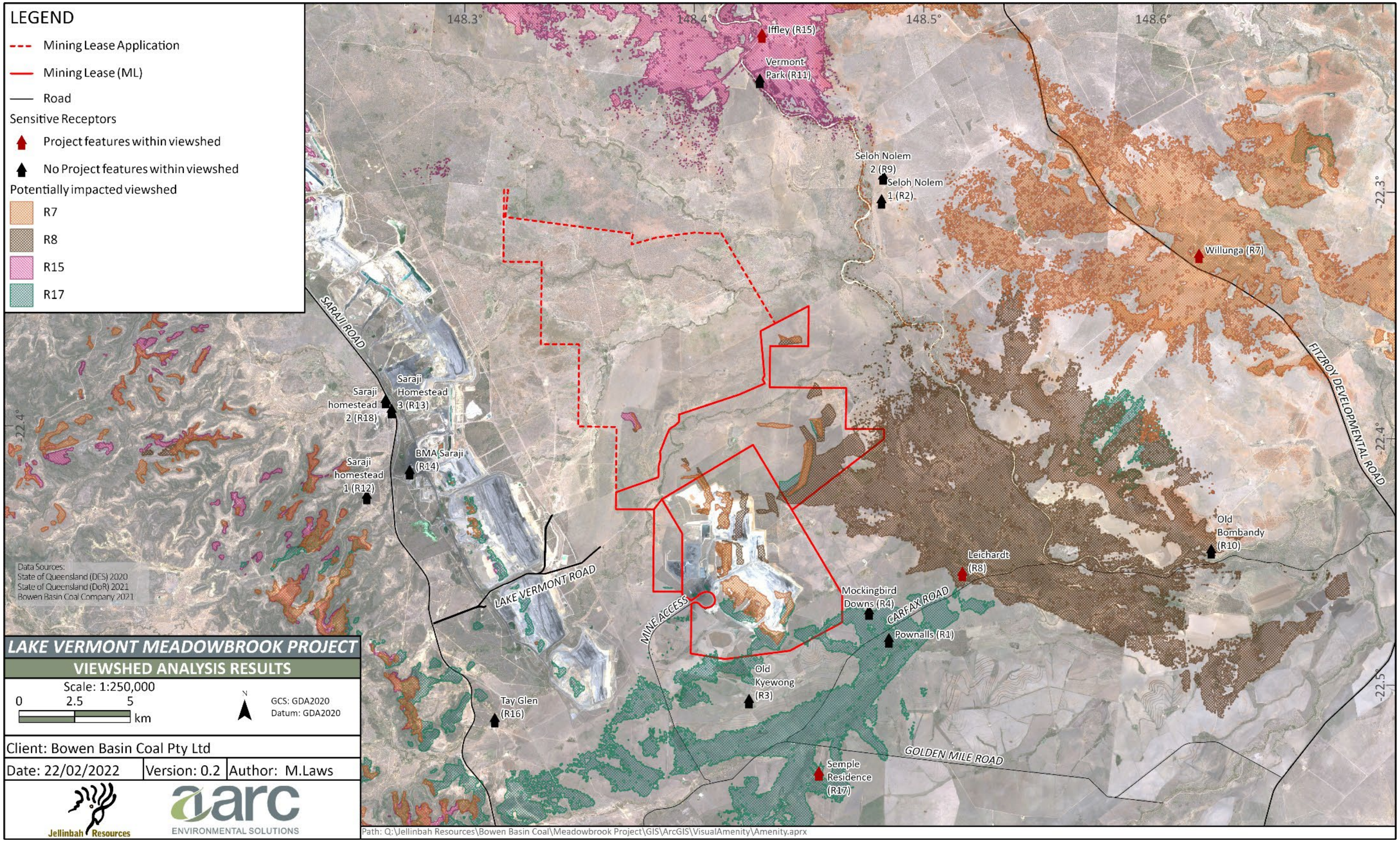

Figure 5.9: Viewshed analysis results of potentially impacted sensitive receptors

5.5 Monitoring and management

5.5.1 Subsidence

During the development of the Project, areas predicted to be subject to subsidence impacts will be monitored to assess the occurrence and severity of any of the potential impacts described in section 5.4.3. On the basis of monitoring outcomes, an adaptive management approach will be pursued with measures implemented to predict, mitigate and monitor areas affected by subsidence.

5.5.1.1 Management measures

A Subsidence Management Plan (SMP) will be prepared to satisfy regulatory obligations, as outlined in the following guidelines and policies:

- application requirements for activities with impacts to land (ESR/2015/1839);
- application requirements for activities with impacts to water (ESR/2015/1837); and
- the Queensland environmental offsets policy.

The SMP will include monitoring, management and mitigation measures for potential subsidence impacts of the Project. It will include:

- a description of the landform and environment of the area to be affected by subsidence;
- predictions of the magnitude of subsidence for the mining areas;
- a risk assessment that will include the likelihood and consequence of each of the impacts and priority of actions to be implemented in the mitigation process;
- a description of measures to minimise and remediate impacts; and
- an ongoing subsidence monitoring program.

The subsidence monitoring program will provide data to assist with the management of associated risks, validate subsidence predictions and analyse the relationship between subsidence effects and impacts on the surrounding environment. A trigger action response plan as well as contingency plans will be described in the SMP whenever there are variations with respect to predicted subsidence.

5.5.1.2 Mitigation measures

Subsidence impacts on the land surface will be assessed and, where necessary, remediated through the implementation of one or a combination of the following measures (discussed further in Chapter 6, Rehabilitation, Section 6.5.3.1):

- scarifying or ripping of exposed surfaces to fill minor surface cracks, control erosion and assist revegetation;
- rehabilitation of persistent surface cracks through removal of topsoil, backfilling, re-spreading of topsoil and natural vegetation regeneration and recruitment;
- regrading of isolated depressions, highpoints, and slopes;
- livestock access control;
- channel reprofiling and bank protection if erosion impacting channel form occurs;
- ponding mitigation measures; and
- revegetation.

Subsidence impacts reporting on existing impacts and the status of mitigation actions will be undertaken to ensure a record of actions is retained and so that continuous improvement of mitigation measures is achieved. Internally, these reports will serve as an ongoing assessment of subsidence conditions and the effectiveness of mitigation actions. Reporting outcomes will be taken in consideration when updating the SMP.

5.5.2 Land disturbance

Operational surface disturbance will be managed using a land disturbance permit system, which includes the following aspects:

- identification of the location of proposed surface disturbance activities and confirmation that activities are within the approved disturbance footprint;
- identification of any existing services or environmental or cultural heritage features in proximity to any proposed disturbance;
- assessment and authorisation of the proposed disturbance, including nomination of necessary controls, rehabilitation requirements and inspections; and
- a workflow to ensure appropriate communication occurs between the various parties involved.

Progressive rehabilitation of disturbed land will proceed in accordance with the approved progressive rehabilitation and closure plan and as per the methodology described in Chapter 6, Rehabilitation.

5.5.3 Erosion and stability

Erosion and sediment controls will be implemented during the construction, operational and rehabilitation phases to reduce the risk and impacts of erosion. The existing Lake Vermont Water Management Plan will be updated by an appropriately qualified person to incorporate erosion and sediment control strategies to minimise erosion, minimise the release of sediment to receiving waters and minimise contamination of stormwater. The erosion and sediment control strategies will include the following measures:

- Deep ripping of topsoiled areas will be carried out to reduce compaction from heavy machinery, encourage infiltration of water and prevent erosion. Areas will be ripped along the contour to reduce the velocity of run-off water down the slope. Ripping depths will vary depending on the type of spoil material, depth of topsoil and equipment used for rehabilitation operations.
- Revegetation of disturbed areas will be carried out as soon as practicable following completion of works, subject to weather forecasts.
- Placement of topsoil stockpiles will be away from drainage areas, roads, machinery, transport corridors and stock grazing areas.
- Strategic application of vegetation debris to rehabilitation areas will occur.
- Upslope diversion drains will be used to reduce run-off from undisturbed areas onto disturbed areas.
- Downslope collection drains will be used to divert surface water to sediment dams (e.g. mulch berms, sediment ponds and/or drop inlet protection) to contain sediment-laden run-off from disturbed areas.
- Sediment fences and filters will be used to retain and filter suspended solids.

Installed erosion and sediment control structures will not be removed until disturbed areas have been stabilised.

With respect to rehabilitation works, the final landform is expected to be stable and suitable for the proposed post-mining land use of low-intensity cattle grazing. Rehabilitation methodologies for disturbed land are described in Chapter 6, Rehabilitation.

5.5.4 Topsoil management

Soil stripping, stockpiling and placement will be carried under a land disturbance permit or similar system and be in accordance with a Topsoil Management Plan. The Topsoil Management Plan will include an inventory of topsoil resources on site, describe recommended maximum stripping depths, topsoil volumes required for rehabilitation purposes and the placement and management of stripped soil.

Topsoil management should include the following aspects:

- Soil stripped for reuse should be revegetated as soon as practicable.
- Where practicable, topsoil should be directly placed in prepared rehabilitation areas rather than stockpiled.
- Topsoil stockpiles should be less than 2 m high.
- Groundcover vegetation should be established on stockpiles to prevent erosion and maintain soil biological function while stockpiled.
- Stockpiles are to be monitored for weeds and control measures implemented as appropriate.
- Topsoil placement should occur at a minimum thickness of 0.2 m to establish a growth medium conducive to plant growth.
- Knowledge of potentially dispersive SMUs should be incorporated into appropriate erosion and sediment control methods.
- Gypsum treatment should be used to reduce dispersion where practicable.
- Stripped topsoils from SMUs with alkaline pH (Booroondarra, Kirkcaldy, Knockane, Mayfair, Norwich and Parrot) are likely to require fertiliser application to compensate for low pH available nitrogen deficiency.
- SMUs with weak structures, such as sands, loamy sands or massive structured soils (Booroondarra, Mayfair, Mayfair sodic variant, Moreton, and Parrot), may pose an erosion risk if material is placed in steeper areas. These materials should preferentially be placed in less steep areas to reduce erosion risk.
- Grass and woody vegetation collected from land clearing should be incorporated into the rehabilitation measures at strategic locations to help limit runoff and erosion, retain active biological activity and provide fauna habitat.
- Topsoils applied to rehabilitation areas should be contour ripped where erosion risk and hard-setting surfaces may impede revegetation success.

5.5.5 Land use suitability

Post-mining land use will aim to maintain the existing land use of low-intensity grazing by returning the land to a similar suitability to that existing prior to mine disturbance and supporting nature conservation. The management measures proposed to achieve the target PMLUs, including land use suitability criteria, are detailed in Chapter 6, Rehabilitation.

To mitigate impacts to surrounding land uses, related management measures will include:

- management of fugitive dust emissions through:
  - regular watering of haul roads;
  - coal stockpile watering;
  - early rehabilitation of waste rock dumps and/or temporary revegetation to minimise the extent of bare ground; and
  - continuous monitoring of weather conditions to ensure that operations are adjusted during periods of adverse weather;
- regular visual checking of light spill to ensure that fixed and mobile lights are located and shielded sufficiently to mitigate excessive light spill;

- planning and consultation with neighbours to ensure that all operations that may result in herbicide, pesticide or fertiliser drift are conducted in a manner that reduces the potential for impact to neighbouring properties;
- monitoring of blast vibration and airblast overpressure to ensure that predicted levels of both parameters are achieved and within limits; and
- management measures proposed to manage surface water in and around the Project area, as detailed in Chapter 8, Surface Water.

5.5.6 Land contamination

Management measures to be implemented to prevent or reduce the risk of land degradation or contamination will include, where appropriate, the following:

- All unexpected contamination will be remediated and validated under supervision of a suitably qualified person in accordance with an Emergency Response Plan predefined for all hazardous materials stored on-site. The administering authority will be notified within 24 hours of detection being known.
- A CLR and map will be maintained detailing any contamination events, subsequent locations and remediation protocols issued.
- Chemical and hydrocarbon storage areas will be designed and bunded in accordance with AS 1940:2017, 'The storage and handling of flammable and combustible liquids' (Standards Australia 2017).
- Staff will be trained on the prevention of spills and the use of spill kits.
- A register of spill kits will be maintained, and all kits will be inspected for completeness at an appropriate interval.
- Sediment dams will be constructed and adhere to the design parameters of the 'Manual for assessing consequence categories and hydraulic performance of structures' (DES 2016a).
- Explosives storage will be managed in accordance with AS 2187:2006 'Explosives—Storage, transport and use' (Standards Australia 2006).
- Waste products, including oil and other chemicals, will be stored and disposed of according to the relevant material data safety sheets to minimise contamination risk.
- Any installed STP will be designed to cater for the maximum number of personnel that can be accommodated on-site at any one time and will be in accordance with the recommendations contained in Appendix S, Land Based Effluent Disposal Assessment, Section 3.
- Waste management strategies will be implemented to reduce the risk of land contamination from waste generated during the life of the Project, including waste associated with the STP, as outlined in detail in Chapter 15, Waste Management.

5.5.7 Visual amenity and lighting

The potential visual amenity and lighting impacts of the Project to sensitive receptors is considered insignificant, and no specific monitoring or adaptive management program is considered to be required. Regardless, the Project will adopt a number of measures to assist with limiting any impact to visual amenity including the following:

- Retain vegetation and delay the removal of vegetation wherever practicable to maximise available vegetation screening.
- Shield lighting to minimise lighting spill, and limit lighting to the requirements of safety and security.
- Maintain the Project site such that the frontage to potential viewers is in a condition of good repair.
- Conduct progressive rehabilitation of the Project site in accordance with the PRCP to a landform consistent with the baseline landscape character.