Kestrel Management Plan

Restoration Plan: LW500

Status: Active
Revision: 1.1 (15.12.2022)
Business Owner: Environment

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Abbreviations

AARC	AARC Environmental Solutions Pty Ltd
ACARP	Australian Coal Association Research Program
CH	Cultural heritage
DSDMIP	Department of State Development, Manufacturing, Infrastructure and Planning
DSITI	Department of Science, Information Technology, and Innovation
EA	Environmental Authority
GDP	Ground Disturbance Permit
Kestrel Mine	Kestrel Coal Mine
Kestrel Coal Resources	Kestrel Coal Resources Pty Ltd
Mitsui	Mitsui Coal Pty Ltd
ML	Mining Lease
PED	Personal Emergency Device
RIDA	Regional Interests Development Approval
RP	Restoration Plan
RPI Act	*Regional Planning Interests Act 2014*
RPI Regulation	Regional Planning Interests Regulation 2014
RUSLE	Revised Universal Soil Loss Equation
SCA	Strategic Cropping Area
SCL	Strategic Cropping Land

1 Purpose

As part of the assessment process associated with Regional Interests Development Approval (RIDA) application RPI22/008 Kestrel – LW500, the Department of State Development, Infrastructure, Local Government and Planning has requested the provision of a stand-alone restoration plan.

This restoration plan (RP) is required to demonstrate how permanent impacts to SCL as a result of the proposed activities will be avoided or mitigated. The RP is required to demonstrate that SCL disturbed by the resource activity will be returned to pre-activity condition. RPI Act Statutory Guideline 9/14 (DSDMIP 2019b) indicates that the information requirements are best presented through a detailed restoration plan which contains the following:

1) information on the nature of impact on the land and methods used to determine impact;
2) characterisation of the pre-activity (current) condition of the land and soils;
3) evaluation of the nature and risk of any predicted impacts on the land;
4) evidence that scientifically proven and practical methods do exist for restoring the land;
5) detail on the application of the restoration methods including timeframes;
6) a monitoring program including benchmarking and progress milestones;
7) a fully costed estimate of identified restoration works; and
8) restoration criteria against which successful restoration can be demonstrated.

1.1 Background

The Kestrel Coal Mine (Kestrel Mine) is located in the Bowen Basin, approximately 51 km northeast of Emerald in central Queensland, Australia – refer (Figure 1).

Currently mining within the 400-series panels, coal extraction and production occurs at depths of 300–450 m, with production rates of 8–10 Mt run of mine coal per year. The current approved life of mine includes mining of a further series of longwall panels, referred to as the 500 series, which extends into ML70481 at depths of between 360 m and 470 m. Typical mining seam thickness ranges between 2.5–3.1 m with the longwall minimum extraction height being 2.6 m.

Mining operations up to and including the 400 series longwall panels have occurred on ML1978, ML70301, ML70302, and ML70330, none of which were subject to RPI Act approval requirements.

In 2016, ML70481 was granted to enable operation of the 500 series longwall panels. An SCL protection decision (SCLRD2012/000090) was issued for ML70481; one of the first issued under the new SCL regulatory environment. In March 2016, the SCL protection decision was transitioned to a RIDA under Section 53 of the RPI Act, referred to as RPI16/002/Rio Tinto - Kestrel Extension #4 Coal Project (RPI16/002).

The area of trigger-mapped SCL within ML70481 is shown in Figure 2. Kestrel holds all of the freehold titles for all surface properties associated with the Mining Leases (MLs) with the exception of a parcel of State-owned land (lot 8 on TT424), which lies within a watercourse reserve not mapped as SCL trigger land on ML70481. Kestrel manages agricultural lessees carrying out pastoral activities across all freehold lands not utilised for mining activities.

To optimise coal resource recovery, an additional longwall panel (LW500) is proposed covering an additional area of 88.0 ha of ML70481 (Figure 2). Longwall mining of LW500 is planned to commence in August 2023 and be complete by mid-2024.

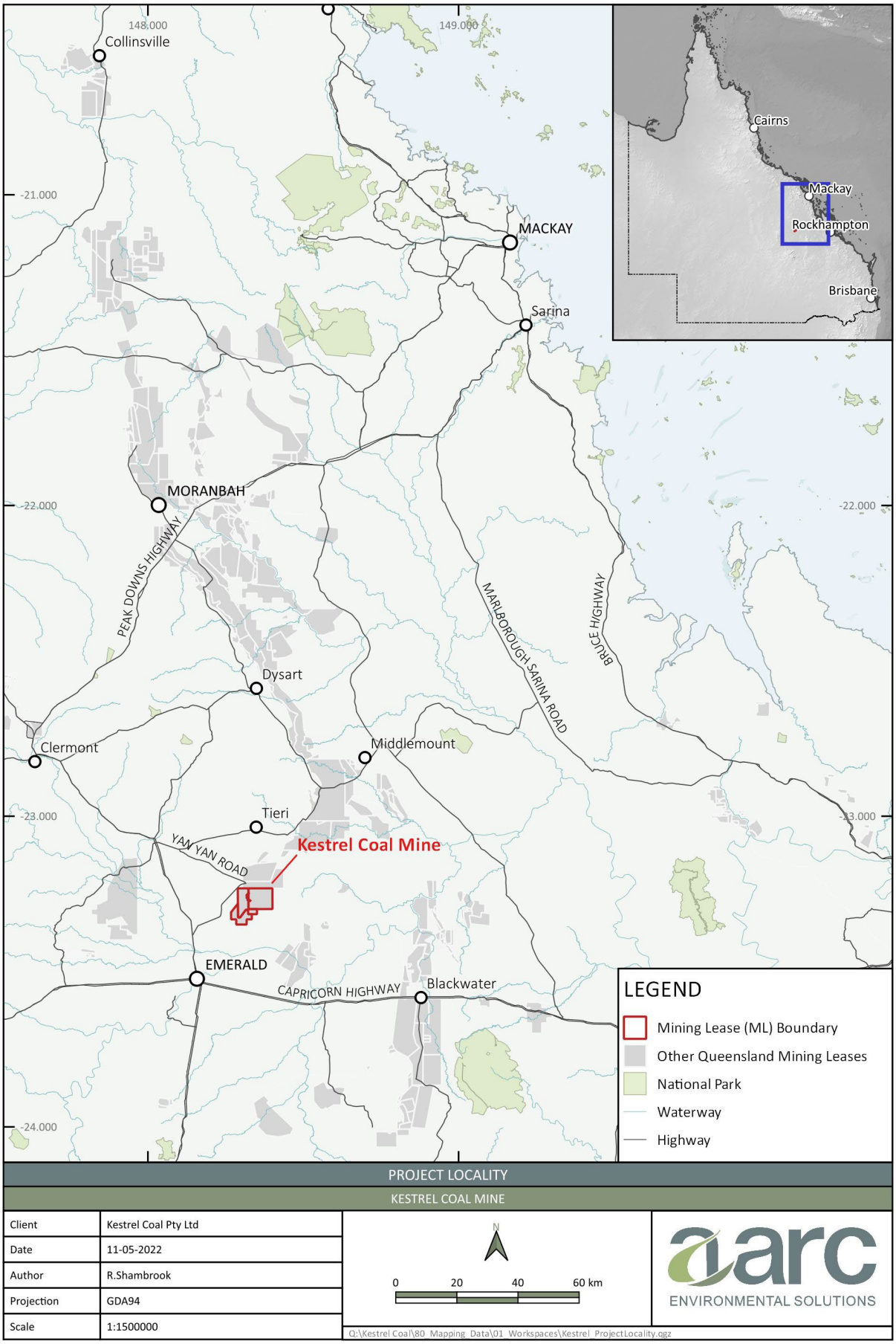

Figure 1: Project location

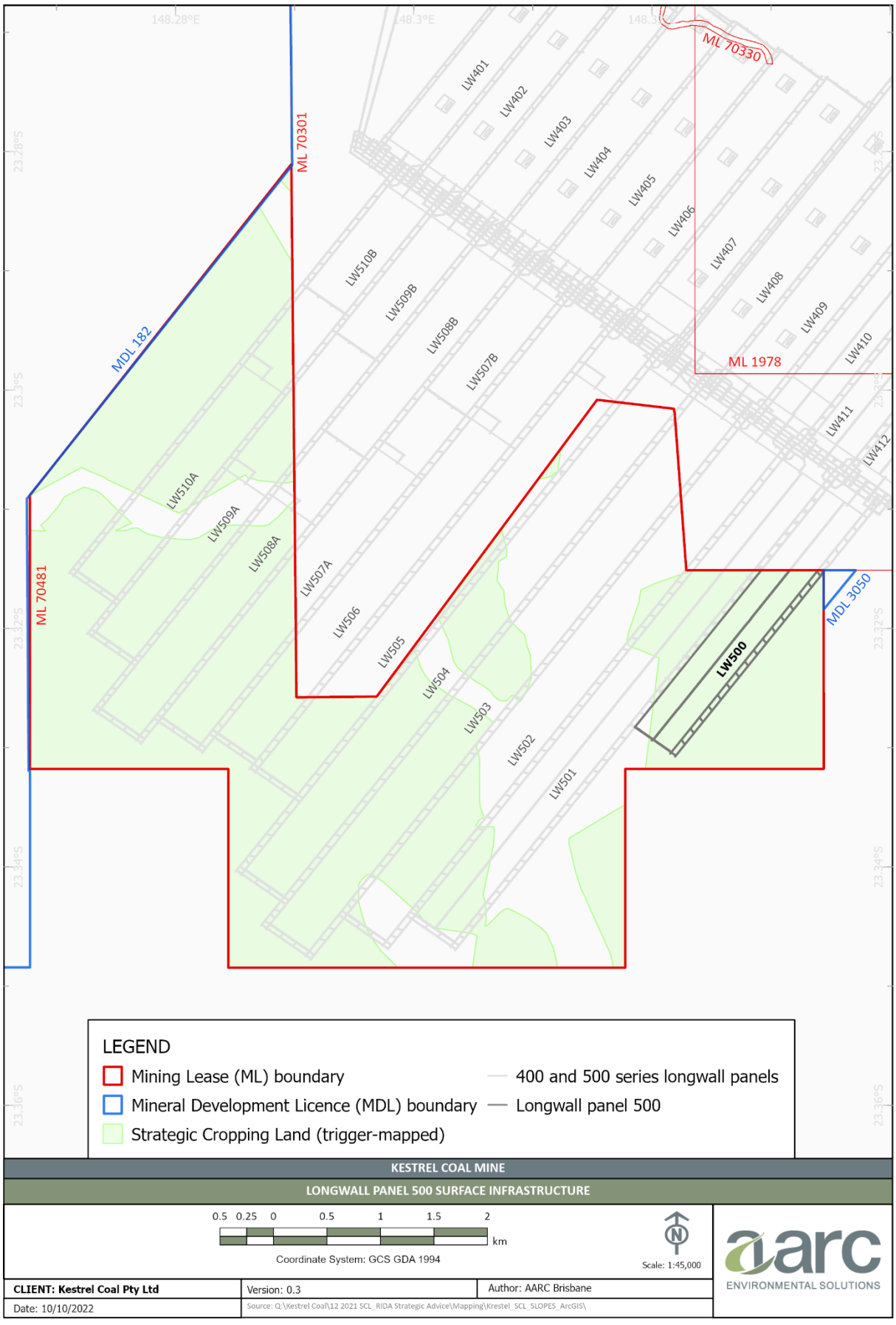

Figure 2: 500 series mine plan showing LW500

2 Scope

This RP is to demonstrate that mining activities proposed on LW500 within ML70481 will be returned to pre-activity condition. RP information requirements are presented in RPI Act Statutory Guideline 09/14, (DSDMIP 2019b). This RP satisfies these information requirements as indicated in Table 1.

Table 1: Restoration plan information requirements

Ref.	RPI 09/14 (2019) Information Requirements	Section
1	Information on the nature of impact on the land and methods used to determine impact	3
2	Characterisation of the pre-activity (current) condition of the land and soils	4, 5
3	Evaluation of the nature and risk of any predicted impacts on the land	6
4	Evidence that scientifically proven and practical methods do exist for restoring the land	6.2.1
5	Detail on the application of the restoration methods including timeframes	7, 7.1, 7.2, 7.3.1
6	A monitoring program including benchmarking and progress milestones	7.3, 7.4
7	A fully costed estimate of identified restoration works	7.4
8	Restoration criteria against which successful restoration can be demonstrated	7.5

3 Proposed resource activities

Resource activities associated with LW500 having the potential to cause land disturbance include:

- surface subsidence resulting from underground longwall panel progression; and
- disturbance associated with supporting surface infrastructure development and operation.

Exempt resource activities associated with LW500 have also been identified, as detailed below:

- the disturbance footprint of LW500 that extends to the north, beyond the boundary of ML70481 (Figure 3), is exempt by virtue of being a pre-existing resource activity as defined by Section 24 of the RPI Act; and,
- the small area (<5 ha) of potential subsidence on MDL3050 (Figure 3), is addressed under a separate EA (P-EA-100207898). If impacted at all, this small area will be restored within 12 months, and is therefore exempt under Section 23 of the RPI Act.

3.1 LW500 longwall panel progression

The key resource activity associated with LW500 will be the progression of a longwall panel at depth, commencing from the western end of LW500 and proceeding to the east, progressively extracting the coal seam. Subsidence predictions have been undertaken for LW500 showing the maximum vertical subsidence is predicted to range from between 1.6 m mid-panel to 0.1 m over longwall inter-panel pillars.

The nature of impacts to the land resulting from subsidence are a progressive lowering of ground surface resulting from goafing behind the longwall within the mining panels. Soils and vegetation on the surface remain in place as this process occurs. Potential impacts from subsidence may include minor surface cracking, altered drainage patterns and some change to existing temporary ponding locations. There may also be positive impacts associated with subsidence similar to a light scarification of compacted soils.

To determine if any permanent impact has occurred, Kestrel would propose to undertake pre-mining and post-mining soil surveys in accordance with RPI Guideline RPI Act Statutory Guideline 9/14 (DSDMIP 2019b). If the post-mining soil survey, which is undertaken following any rehabilitation works completed by Kestrel, does not indicate any change to land capability and productivity, Kestrel would propose that no permanent impact has occurred. If the survey indicates some areas of permanent impact has occurred, these areas would be mitigated in accordance with an agreed Mitigation Deed.

3.2 Supporting surface infrastructure

Underground mining operations at Kestrel Mine are supported by a range of surface-located services and infrastructure, however, the LW500 application area only includes the proposed following infrastructure types:

- Exploration and pre-production drilling;
- Pre-drainage and dewatering infrastructure consisting of vertical production wells and flaring infrastructure, end of hole and laterals drill locations;
- Post production gas drainage consisting of vertical goaf wells, goaf reticulation pipelines and access roadway; and
- PED surface lines installed along the line of the longwall panel.

The indicative surface infrastructure required for LW500 activities is shown at Figure 3. Potential surface disturbance activities have been or will be subject to an internal environmental management approval process (Ground Disturbance Permit), as such, the location and installation of surface infrastructure is managed to minimise any potential impacts.

Surface infrastructure will remain either for the life of mine, the life of the panel series, or the life of the panel. Removal of surface infrastructure will be undertaken once the service life of the infrastructure has passed and the mining area is rehabilitated and returned to its former productive capacity.

The nature of potential impacts to the land resulting from supporting infrastructure include clearing of vegetation, stockpiling of topsoil, construction and ongoing use of infrastructure, until the infrastructure is no longer required and is removed, topsoil replaced and appropriate seeding applied, as required. The only permanent infrastructure that would remain at the end of mine life would be anything identified as beneficial for any future potential land uses.

To determine if any permanent impact has occurred, Kestrel would propose to undertake pre-mining and post-mining soil surveys in accordance with RPI Act Statutory Guideline 9/14 (DSDMIP 2019b). If the post-mining soil survey, following any rehabilitation works undertaken by Kestrel, does not indicate any change to land capability and productivity, Kestrel would propose that no permanent impact has occurred. If the survey indicates some areas of permanent impact has occurred, these areas would be mitigated in accordance with an agreed Mitigation Deed.

3.3 Activities not related to resource activities

Where land is not required for mining purposes, the land continues to be operated as pastoral stock farming or dryland agricultural farming.

Kestrel Mine currently leases all lands to a large reputable, commercial agricultural enterprise. The lease requires regular property maintenance, weed control and land improvement programs.

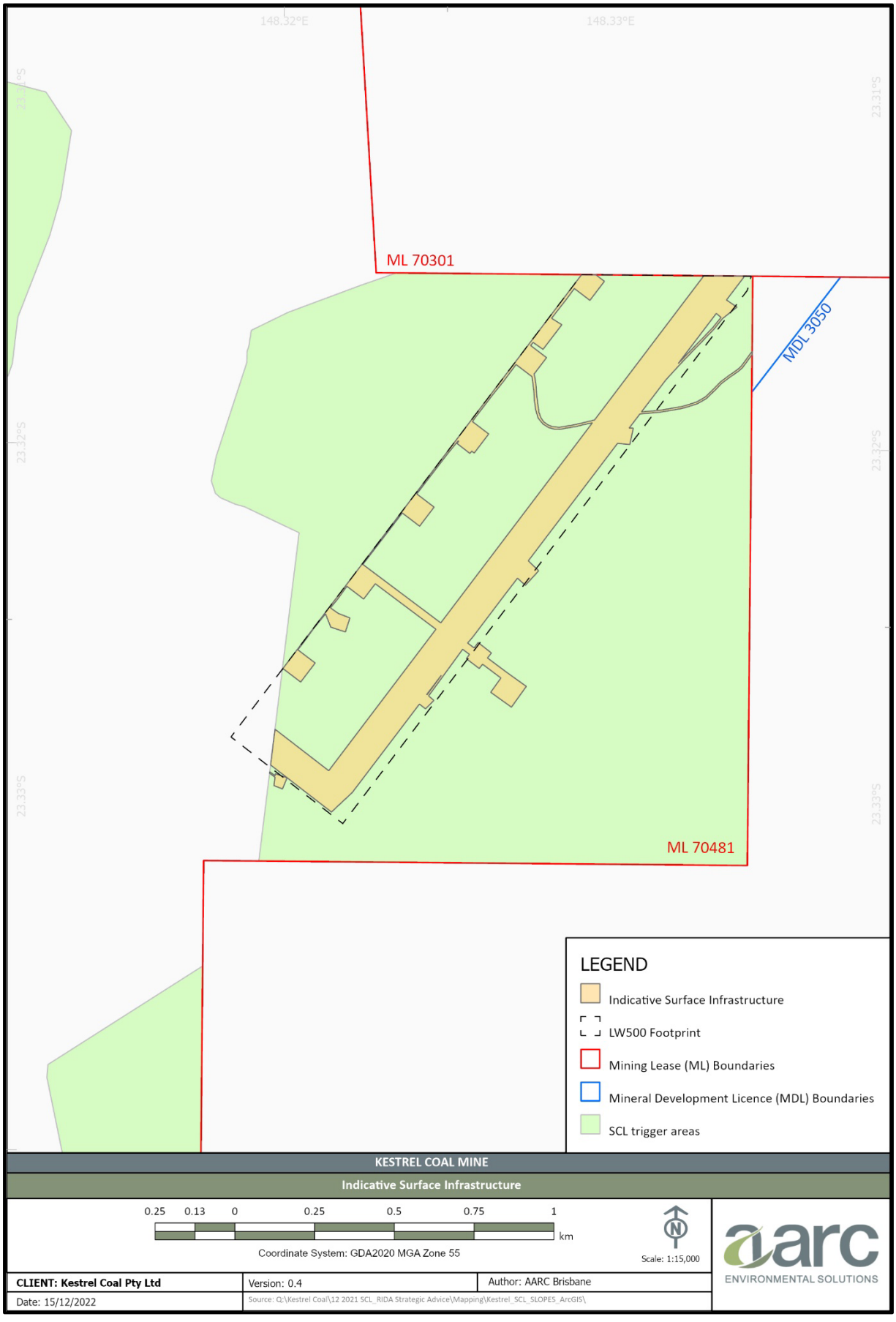

Figure 3: Surface infrastructure for LW500

4 Pre-activity land use and capability

4.1 Current land use

4.1.1 Land use

The *Central Highlands Regional Council Planning Scheme 2016* (CHRC 2016) includes Kestrel Mine and the surrounding region within the Rural zone code which has as its purpose to:

- provide for rural uses including cropping, intensive horticulture, intensive animal industries, animal husbandry, animal keeping and other primary production activities;
- provide opportunities for non-rural uses that are compatible with agriculture, the environmental features, and landscape character of the rural area where the uses do not compromise the long-term use of the land for rural purposes; and
- protect or manage significant natural resources and processes to maintain the capacity for primary production.

Prior to mining, regional, and local land use comprised grazing of native and improved pastures, and cropping. In 1983 approximately 4% of ML70481 was subject to cropping activity, increasing in 1993 to approximately 13% and again in 2004 to approximately 21%. Since 2004, cropping activity has diminished such that there is not currently any cropping activity occurring in ML70481. The property is now predominantly used for grazing based on native and naturalised grasses, as well as the forage crop Leucaena (*Leucaena leucocephala*).

The majority of Kestrel mining area land (outside of infrastructure areas) operates as an independent, productive pastoral beef property. Kestrel Coal Resources manages grazing practices through commercial agreements with the lessee, including requirements for responsible land management.

5 Land and Soils Characterisation

The RPI Act identifies and protects areas of regional interest throughout Queensland. The RPI Act outlines the requirements for a RIDA application for resource activities carried out in areas of regional interest, which includes SCA. Of the areas of regional interest protected by the RPI Act, only SCL is mapped within the application footprint of LW500.

The LW500 footprint is wholly situated on Lot 11 SP178401, which has an area of 9,135 ha (refer Figure 4). However, Kestrel owns a number of contiguous properties that are managed as a single enterprise (defined as an SCL Property under the RPI Act) totalling 18,028 ha and containing 14,247 ha of trigger-mapped SCL (refer Figure 5). As such, the maximum proportion of SCL disturbed by virtue of LW500 constitutes 0.6% of the total Kestrel SCL property area.

5.1 Geology and landform

Kestrel Mine extracts coal from the German Creek coal seam, which is part of the Bowen Basin, a significant Permian coal basin stretching 600 km long and 250 km wide. The mine is situated within a predominant north–south trending syncline. A series of faults form boundaries to the coal resources with the Woolshed Fault to the west and Boundary Fault to the east. The solid geology of the mine area comprises of Permian to late Permian stratified sedimentary sequences. The surface geology around the mine is primarily Tertiary to Quaternary stratified colluvium as well as volcanic sequences.

Regionally, the topography surrounding Kestrel Mine gently undulates with moderate relief and drains to shallow ephemeral creeks. Existing land uses are described in Section 4.1.1.

5.2 Soils

5.2.1 Previous soils studies

Current soils knowledge is based on a number of soil surveys that have been undertaken across the various Kestrel MLs as follows:

- 1993 (Emmerton): conducted a soils and land suitability assessment for dryland cropping in the Gordonstone West area (1:25,000 scale). Note that the prior name of Kestrel Mine was the Gordonstone Mine;
- 1996 (Cannon): addressed soils and land suitability for the Gordonstone Mine, Gordonstone Extension and Gordonstone West Mines (1:25,000 scale);
- 2002 (MWH): conducted a pre-mining condition soil and land capability study of Gordon Downs; effectively covering ML1978, ML70301, ML70302, ML7030 and parts of ML70481 excluding the immediate area of existing surface infrastructure, and improving the mapping scale to 1:10,000; and
- 2011 (MWH): surveyed the remainder of ML70481 at 1:10,000 scale as part of the *Environmental Assessment Report Kestrel Extension #4 November 2012* (EMM 2012). This study also addressed land capability, land suitability and SCL aspects.
- 2022 (Highlands Environmental): Agricultural land evaluation on Mining Lease 70481, Gordon Downs, central Queensland. This study includes an agricultural land evaluation, land suitability assessment and SCL zonal criteria assessment and determination.

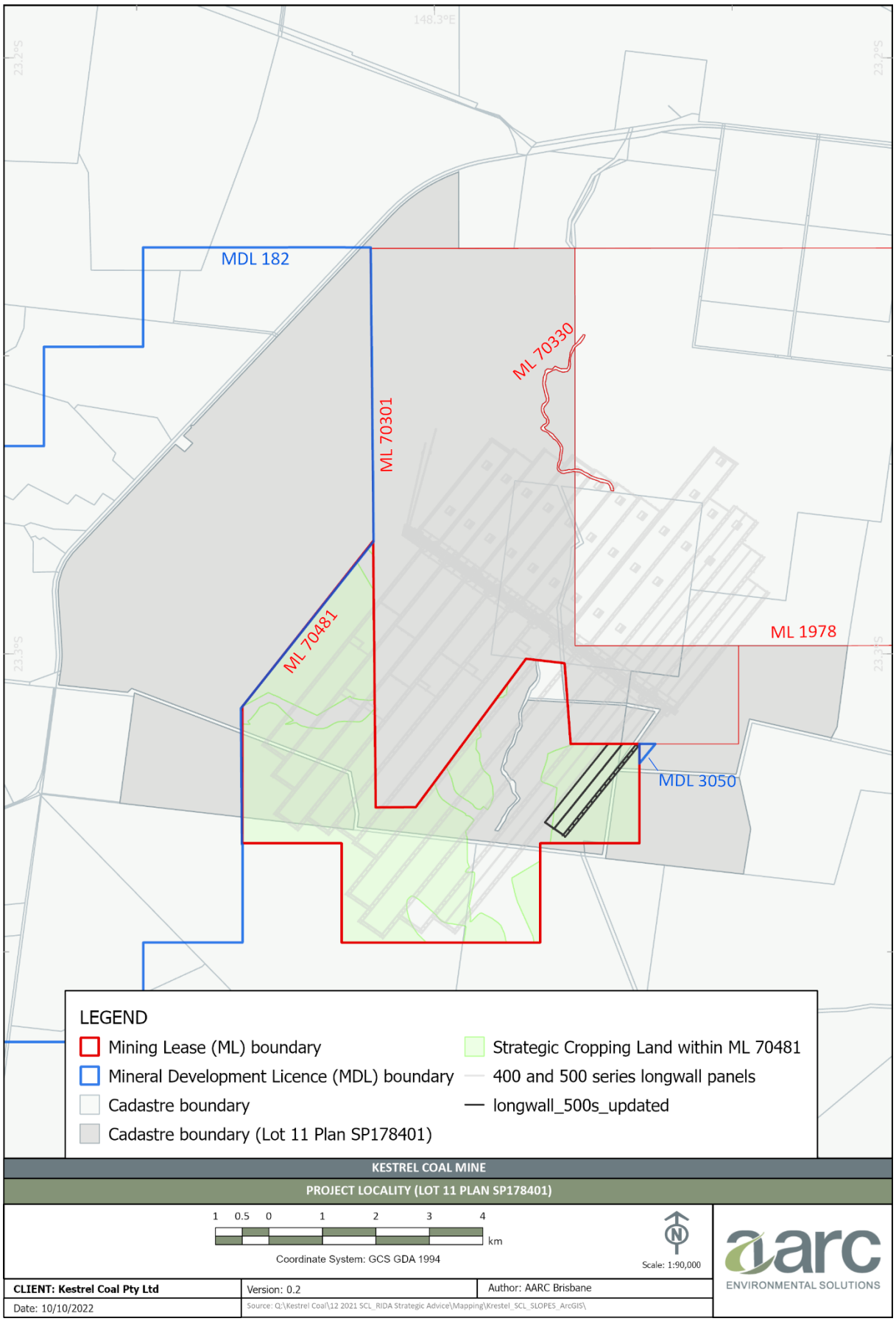

Figure 4: LW500 Trigger-mapped SCL in relation to Lot 11 SP178401

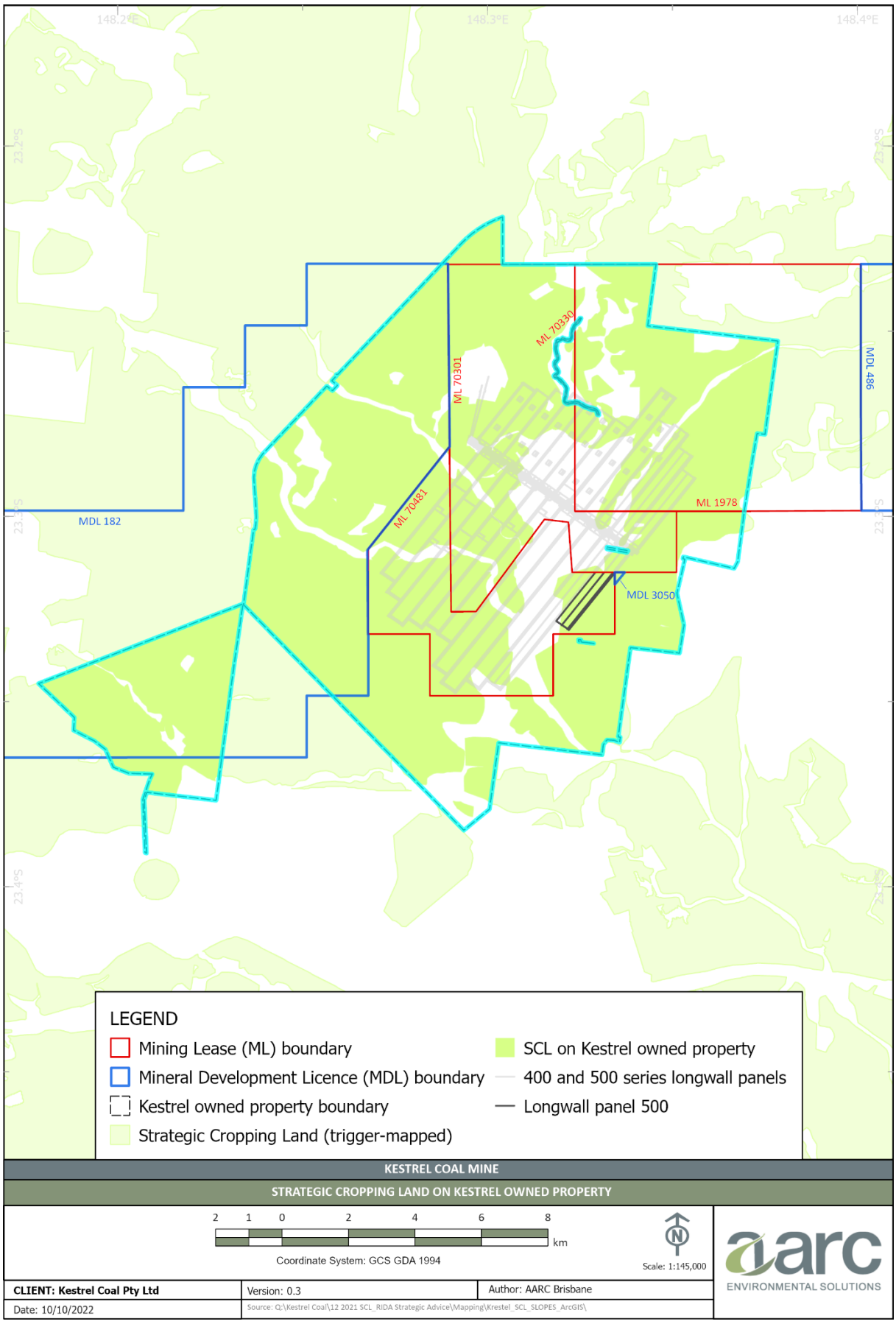

Figure 5: Kestrel-owned properties and trigger-mapped SCL

5.2.2 Soil characterisation

Based on the 2002 and 2011 MWH studies which are relevant to the ML70481 area, the distribution of soil types within Kestrel Mine includes soils formed on:

- alluvium (Quaternary Alluvium);
- Cainozoic Sediments;
- Tertiary Basalt;
- Colluvium (mainly basalt derived); and
- highly calcareous materials.

Specifically, the soils of LW500 are formed on Tertiary Basalt, and are shown in Figure 6 and described in Table 2.

Table 2: Soil types - MLs to ML70481 (MWH 2002; 2011)

Soil and classification	Brief description
Soils formed in situ on Basalt	
B – Basalt Black, Brown, and GreyVertosols	Strongly self-mulching black or occasionally grey or brown medium to medium heavy clay or occasionally light medium clay A horizon over black medium heavy clay or occasionally medium clay B horizon. Alkaline to strongly alkaline throughout or alkaline soil reaction trend. Carbonate nodules or soft segregations may occur throughout the profile. Massive or occasionally weakly lenticular pan present in upper B horizon in intensively cultivated situations. Weathered basalt. C horizon not encountered before 0.6m.
Bs – Shallow Basalt Black, Brown and Grey Vertosols	Strongly self-mulching black or occasionally brown medium clay to medium heavy clay or occasionally light medium clay A horizon over black medium heavy clay or occasionally medium clay B horizon. Alkaline or occasionally neutral soil reaction trend. Carbonate nodules or soft segregations may occur below about 0.2m. Massive or occasionally weakly lenticular pan present in upper B horizon in intensively cultivated situations. Weathered basalt C horizon encountered at or below 0.45m but before 0.6m.
Bvs – Very Shallow Basalt, Black or Brown Dermosols and Black or Brown Vertosols	Strongly self-mulching black or brown medium clay or occasionally light medium clay or medium heavy clay A horizon over black medium to medium heavy clay B horizon. Profile neutral to alkaline. Massive pan present in intensively cultivated situations. Weathered basalt C horizon encountered before 0.45 m.
Bvsb – Brown Very Shallow Basalt, Brown Dermosols or Brown Tenosols	Weakly crusting brown, reddish brown or occasionally black light clay to light medium clay A horizon over brown or occasionally black moderately structured light clay to light medium clay. Profile neutral or alkaline. Weathered or hard basalt C horizon encountered before 0.45 m.

5.2.3 Soil erodibility

For the soil types within LW500, the estimated pre-mining soil loss ranges from 0.29–0.45 t/ha/year. By way of comparison, the mean pre-disturbance soil loss across the whole of the ML70481 area is 1.02 t/ha/year. Figure 7 indicates the mean soil loss estimates for the various soil types identified within the LW500 area within ML70481. Post-mining erosion rates are not anticipated to change from the estimated pre-disturbance rates.

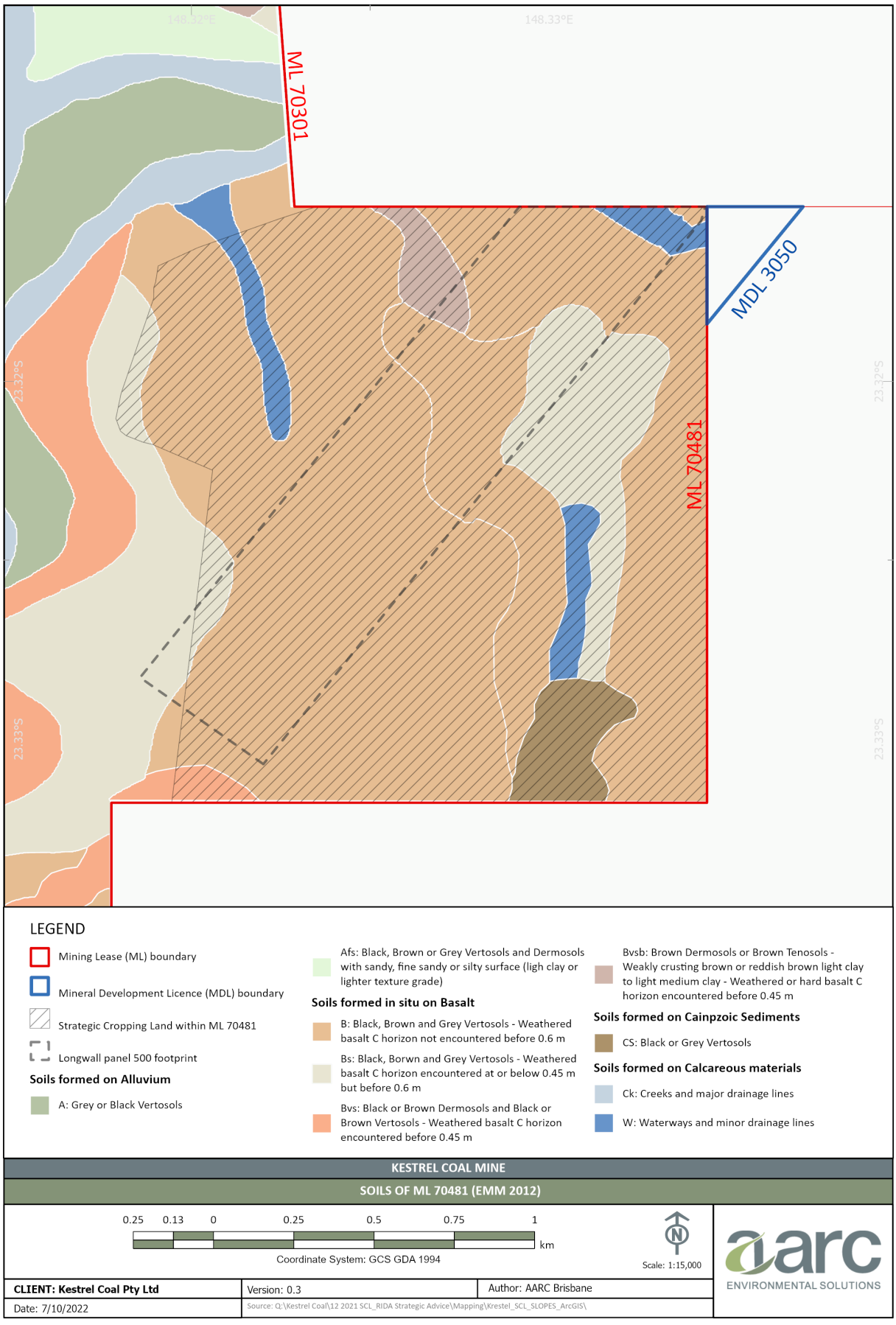

Figure 6: Soils of ML70481 (EMM 2012)

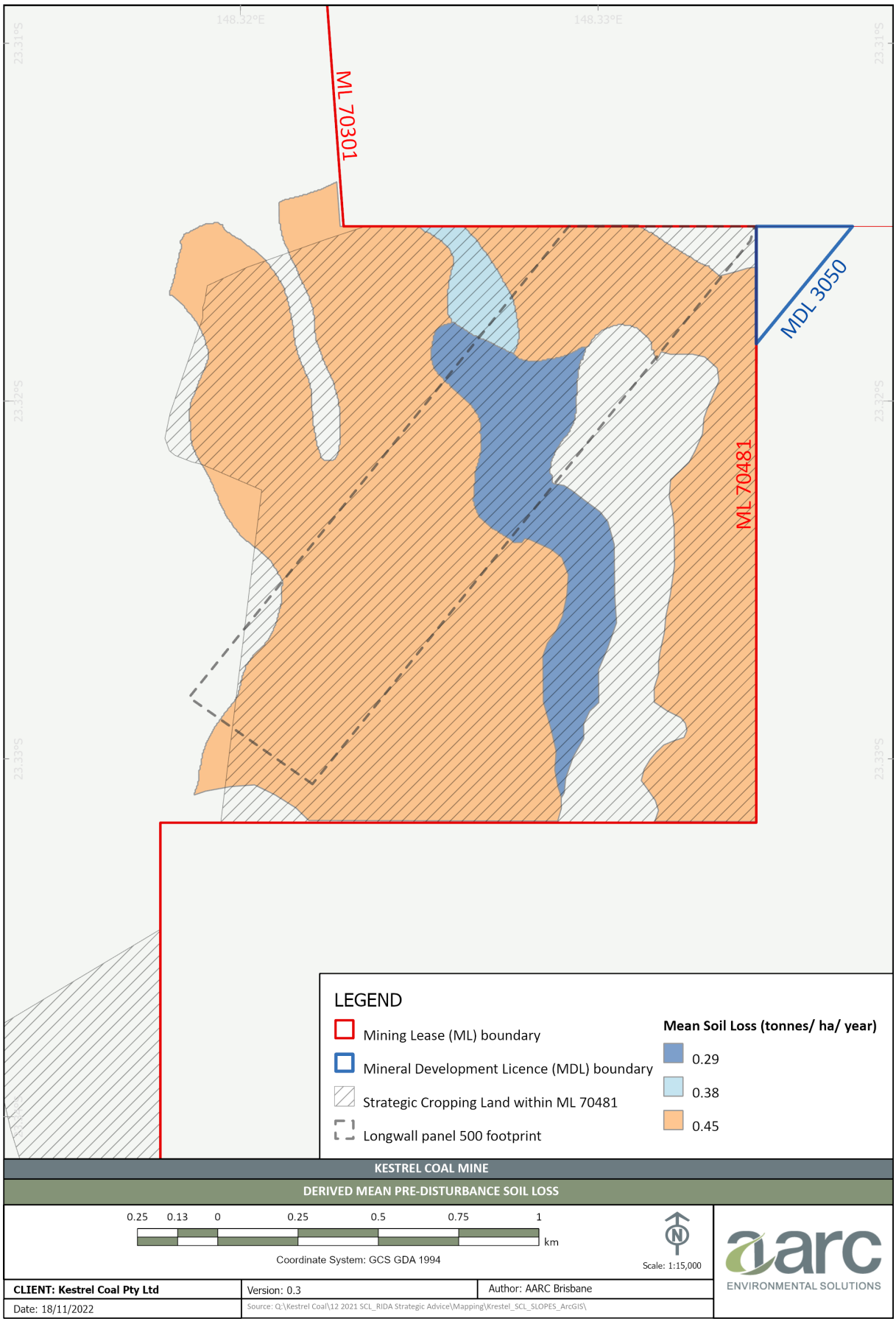

Figure 7: Derived mean pre-mining soil loss (tonnes/ha/yr.)

The small area of 'Bs' type soil did not have an erodibility factor determined given that this soil type only differs from the B type with respect to depth to the C-horizon. As such this soil type was assessed to have the same range of erosion rates as shown for B type soils. An assessment of these soil erosion rates is considered best guided by Lu *et al.* (2001) and Roswell (1996), which have attempted to quantify erosion rates across Australia. Against an average Australian erosion rate of 6.3 t/ha/year, the study suggested that:

- a low rate of erosion could be defined as less than 0.5 t/ha/year; and
- a high erosion rate could be defined as greater than 10 t/ha/year.

Against this guidance, erosion rates for the LW500 area would be categorised as well below the average Australian erosion soil loss rate. Coupled with the soil erodibility data provided at Section 2.3, the erosion risk for the LW500 area at Kestrel for both pre- and post- mining is classified as low.

Despite the favourable inherent erodibility characteristics of the soils, localised instances of erosion and/or increases in erosion rates occurring post-disturbance are still risks that require monitoring and may in some cases require remediation.

5.3 Land suitability assessment

Relevant land suitability assessments have been undertaken in 1996 and 2002 and summarised for the ML70481 area in MWH (2011), considering both pre-mining and post-mining scenarios. For the LW500 panel, the available data does not indicate whether the deeper soils formed on Basalt (B type soils) in the LW500 area have a land suitability of 3, 4 or 5. However, the combined land suitability assessments do identify at least 10.4 ha of land having both pre- and post-mining land suitability classifications of '5' for both winter and summer rainfed cropping. Limitations are annotated as being shallow soil depths and/or surface rock presence.

Highlands Environmental (2022), identified similar areas of LW500 within ML70481 as being of suitability Class 5, with the remainder being mapped as suitability Class 3.

6 Potential impacts to areas of SCA

6.1 Temporary disturbance area, extent, and duration

The area of potential disturbance associated with the proposed resource activities is identified as the LW500 panel footprint beyond the mining footprint already approved under RPI16/002. This additional mining area constitutes 88.0 ha, of which 85.9 ha is indicated as trigger-mapped SCL (refer Figure 2). An additional 1.5 ha of trigger-mapped SCL lying just outside the eastern boundary of LW500 is indicated as subject to disturbance from surface infrastructure development (refer Figure 3).

In accordance with the definitions provided in RPI Guideline 11/16, as potential impacts are confined to the application area, they are considered to be only of a property-scale; in other words, no SCA impacts occur at a regional scale.

As detailed in the following sections, all mining areas will be subject to appropriate management and restoration measures with the objective of restoring any disturbed land to its pre-activity condition (refer Section 7).

6.2 Nature and risk of potential property-scale impacts

6.2.1 Longwall panel subsidence

The principal land disturbance associated with underground mining activities at Kestrel Mine is subsidence arising as the longwall progressively extracts the coal seam. Subsidence predictions have been undertaken for LW500 showing the maximum vertical subsidence is predicted to range from between 1.6 m mid-panel to 0.1 m over longwall inter-panel pillars.

Timing of subsidence at Kestrel Mine is well understood from subsidence monitoring undertaken across the prior series longwall footprints. Monitoring demonstrates that at mining rates of 80–100 m per week, the majority of the subsidence on the surface occurs about 300 m behind the mining face with minor residual subsidence (subsoil settlement) of approximately 20–30 mm shortly thereafter. At these rates of longwall retreat, 97% of maximum subsidence is achieved between four and six weeks of the longwall face retreating past any given point on the surface.

Maximum slopes arising from subsidence typically occur within 100–150 m of the panel edge. Subsidence predictions for LW500 indicate maximum predicted slopes resulting from LW500 as approximately 1.5–2% (or approximately 1°) – refer Figure 8 (Kestrel Coal Resources 2022).

The results of subsidence at Kestrel Mine are subtle and not easily distinguishable from the surrounding topography, as the range of movement associated with subsidence is within the range of natural elevation variation. In other words, the topography of subsided areas is consistent with the surrounding un-subsided topography (i.e. gently rolling country with low relief).

Potential land impacts associated with subsidence-induced changes in elevation and slope may include changed erosion rates, changes to soil physical and/or chemical characteristics, localised surface tensile cracking, and changed drainage systems, sometimes including localised ponding.

These potential impacts are discussed in the subsections following, with conclusions drawn on the extensive experience associated with subsidence impacts on all Kestrel MLs. As per RPI Act Statutory Guideline 03/14 (DSDMIP 2019a), the impacts associated with longwall panel subsidence for the LW500 area are not expected to have a significant impact on the overlying area of SCA, and will be subject to management and restoration measures.

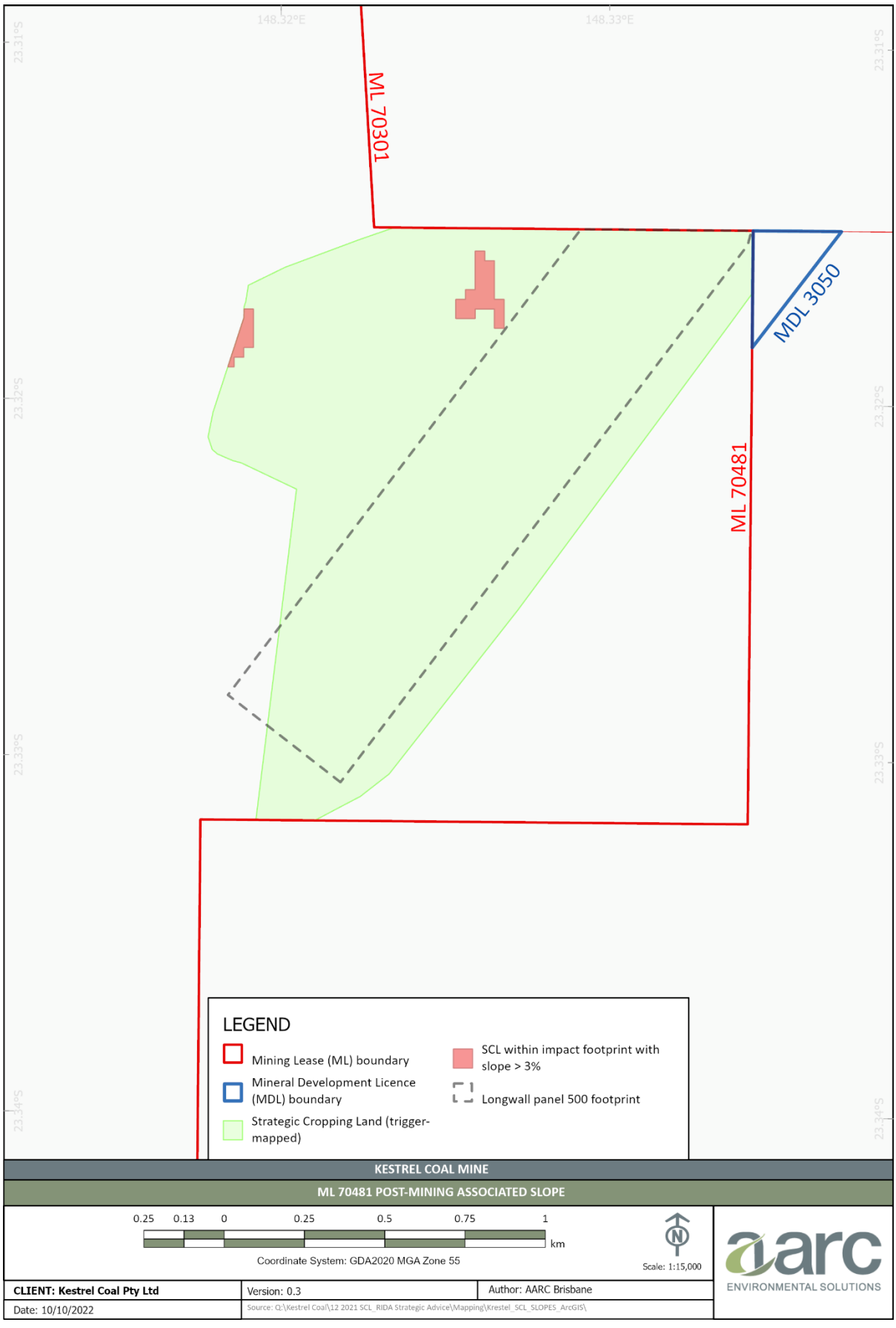

Figure 8: Inferred slopes >3% post-mining (MSEC [2022] predicted subsidence DEM)

Appropriate restoration processes are described later in this document (refer to Section 7), but typically, any area subject to subsidence, is allowed to 'rest' for two to three wet seasons to allow for any settlement to finalise and any minor surface cracking to self-heal. Assessments of any impacts arising are undertaken through this period prior to targeted restoration activities being planned and implemented as required.

6.2.1.1 Erosion

With respect to slope change impacts to SCL, an assessment by AARC Environmental Solutions Pty Ltd (Kestrel Coal Resources 2022) comparing actual pre-mining slopes and predicted post-mining slope indicates that post-mining, the area of LW500 subject to this application **will not** exceed the 3% Western Cropping Zone slope criteria as a direct consequence of subsidence (refer Figure 8).

6.2.1.2 Hydrological

Kestrel Mine is located in the upper to mid reaches of the Crinum Creek catchment and is drained by a number of small ephemeral gullies and tributaries of Crinum, Belcong and Homestead Creeks. It should be noted that watercourses and riparian zones are not mapped as SCL.

Predictions of subsidence changes on the existing topography provide an indication of areas where ponding may occur, and indicates that no ponding is predicted (refer Figure 8) to occur in response to resource activities associated with LW500.

It is noted there are no waterways contained within the LW500 application area, therefore no specific consideration is given to waterways within this application.

6.2.1.3 Subsidence-induced surface cracking

Surface tension cracks may occur as a result of longwall panel subsidence. Tension cracks are more likely to occur along the line of the inter-panel pillars and at the ends of each longwall panel. For previous, shallower Kestrel Mine panel series (e.g. the 300 series), a very limited number of minor tension cracks were observed over longwall panels in areas with Vertosols. These areas were monitored and observed to self-heal over two to three wet seasons.

Given the depth of cover of LW500, which averages approximately 200m deeper than the 300 panels, it is considered unlikely that any surface expression of tension cracks will occur as a result of subsidence.

In addition, LW500 soils are dominated by Vertosols, characterised as expansive soils with a high shrink-swell potential that change volume with changes in soil water content. The nature of these expansive cracking clays is such that, within one to two wet seasons, natural soil movement will compensate for any minor subsidence-induced cracking that could occur, resulting in no measurable impact on the soil.

In summary, the soils contained within LW500 are Vertosols considered to be at low risk of any residual impact from subsidence-induced surface cracking.

6.2.1.4 Subsidence-induced changes to soils and agricultural productivity

Monitoring of subsidence-induced changes to soil physical characteristics was undertaken at Kestrel Mine over the course of two years, between 2007 - 2009 as part of ACARP project C15013 (ACARP 2010), designed to quantify the impacts of mine subsidence on the production and quality of agricultural vegetated environments. Monitoring was undertaken above longwall panels 301 to 305, comparing pillars, transition areas and areas of maximum subsidence within the panels.

The research program utilised a variety of traditional ground-based sampling techniques including biomass harvests and techniques, leaf area index, pasture height, species composition and soil sampling along with proximal sensor data capture using a proximal crop reflectance sensor. Satellite imagery was also collected, and

the high-resolution imagery used to monitor large areas of subsidence-affected areas and adjacent unmined land. A forage Sorghum crop and a 'Butterfly-Pea' improved pasture were monitored over the two-year project.

The outcomes of the research concluded there was no significant variance between subsided land and unmined areas with respect to soil physical and chemical characteristics, and to agricultural production.

Based on the outcomes of this Kestrel-based research program, and the subsequent 12 plus years of operations that support this position, the same outcomes are expected for the LW500 area.

6.2.2 Supporting surface infrastructure

Activities having the potential to cause temporary surface disturbance are described at Section 3.2. Potential surface impacts associated with these activities is confined to clearing of vegetation and, in some cases the stripping of topsoil with windrowing for re-use as part of restoration activities.

If not appropriately managed, vegetation and topsoil clearing has the potential to result in localised impacts to land; most commonly soil erosion or degradation of land suitability classification as a consequence of topsoil loss or compaction and a consequential loss of condition. For the LW500 panel application area, disturbance is superficial and readily able to be restored. To facilitate this, topsoil is removed and windrowed for replacement. Topsoil management is further detailed within Section 7.1.2 and the Kestrel Erosion and Sediment Control Plan.

6.2.3 Land management activities not related to resource activities

Unless lands are actively required for mining, Kestrel Coal Resources preferred land management approach is to maintain agricultural production. Once mining and associated land management activities are complete, the land is returned to the lessee's usual agricultural operations.

7 LW500 application area restoration

Restoration activities have been developed having the objective of returning the mining areas to their pre-disturbance land use and productive capacity.

The general procedure for restoring land to pre-disturbance condition includes:

- infrastructural removal;
- landform reprofiling;
- surface preparation, including topsoil replacement if required;
- revegetation (where required);
- ongoing monitoring (refer Section 7.3); and
- assessment against restoration criteria (refer Section 7.5).

7.1 Management measures

7.1.1 Ground disturbance permit (GDP)

Given that underground mining does not require any vegetation clearing or surface land disturbance to allow the actual mining activity to occur, land disturbance is restricted to surface infrastructure development and operation that is controlled through the Kestrel Mine GDP system (PA-SH-0065). The GDP system is designed to ensure that all statutory compliance and environmental risks are properly assessed, and that targeted management measures are developed and implemented.

Relevant key components assessed by the GDP process include:

- Disturbance location: confirming that any proposed disturbance only occurs within the approved area, and meets any applicable permitting conditions e.g. EA conditions, RIDA conditions, EPBC conditions.
- Communication: ensuring that all relevant parties (including the agricultural lessee) are aware of the proposed disturbance and have been adequately consulted.
- Environmental aspects: ensuring that environmentally sensitive locations (e.g. watercourses) have been identified and appropriate mitigation measures instigated.
- Cultural heritage (CH) aspects: specific focus is given to ensure that appropriate cultural heritage management activities (including CH surveys, salvage of identified artefacts, protection zones around areas of high significance) are undertaken and that Clearance Notices are provided where required by the recognised Native Title applicants, the Western Kangoulu people.
- Permitting: the GDP is provided to all parties involved with the works, with all agreed locations (including maps) and management details to ensure that controls are in place, agreed and communicated to the relevant people undertaking the works.
- Operational aspects, for example:
    - ensuring that topsoil is recovered, stockpiled, and managed in accordance with this RP; and
    - ensuring that all other relevant requirements of Kestrel's Erosion and Sediment Control Plan (KES-0000-PL-OC-0009) are adhered to.

7.1.2 Topsoil management

Topsoil is managed to leading Industry practice, and in accordance with the Environmental Authority (EPML00693413).

Topsoil must be stripped prior to any disturbance that may lead to the loss or destruction of topsoil and stored in stockpiles if not able to be used immediately. Kestrel's topsoil management conforms to the following process:

7.1.2.1 Stripping Topsoil

Topsoil will be stripped to the depth determined by the site Environmental Superintendent and stated on the GDP. The depth of stripping shall be such that no subsoil is stripped.

Machinery movement over soil should be kept to a minimum during stripping operations to avoid compaction and loss of soil structure.

For surface infrastructure associated with the LW500 area, topsoil stripping will be minimised.

7.1.2.2 Stockpiling Topsoil

Topsoil stockpiles for large scale infrastructure projects, likely to be in place for longer than 12 months and greater than 1m in height, are to be located in designated areas and constructed to a shape and depth as specified by the Environmental Superintendent in the GDP.

Soil stockpiles should be located:

- As close as practicable and readily accessible to respreading areas
- Where they will not interfere with present and future mining and ancillary operations
- Out of the flood zone of watercourses (at least 20m from the bank of a watercourse) and not in flood plain areas
- Not on steeply sloping land.

The vertical height of any topsoil stockpiles shall not exceed 2.5m.

For the minor surface infrastructure associated with the LW500 area, and where topsoil stripping is required for drill pads, monitoring or gas flaring bores, topsoil will be windrowed adjacent to the infrastructure area and allowed to revegetate.

7.1.2.3 Topsoil Stockpile Maintenance

Stockpiles from large infrastructure projects - greater than 1m in height and in place for longer than 12 months - will be shaped and revegetated with a cover crop specified by the Environmental Superintendent to provide initial stability, maintain soil viability and minimise erosion.

For the minor infrastructure associated with the LW500 area, windrowed topsoil will be replaced as soon as practicable after the activity has been completed.

7.1.2.4 Topsoil Inventory

For topsoil stockpiles from large infrastructure projects - greater than 1m in height and that will be in place for longer than 12 months - the Mine Surveyor will survey and record the location and volume of each stockpile.

The Environmental Superintendent shall maintain a site topsoil inventory of all surveyed topsoil stockpiles.

For the minor infrastructure associated with the LW500 area, it is considered unlikely that any topsoil stockpiles will be added into the existing site topsoil inventory.

7.1.3 Subsidence management

At Kestrel Mine, subsided areas are considered as 'active mining areas' until exposed to up to three wet seasons, to ensure subsidence has stabilised and soils have been given the opportunity to self-heal from any minor associated impacts.

After this time, any remaining impacts identified as having potential for causing environmental harm or impacting land productivity are then addressed as soon as practicable. It should be noted that restoration activities are contingent on impacts being identified through monitoring activities. If no impacts are able to be identified, then no restoration activities are required.

Historically, subsided panels have required limited, if any, restoration activities, as the soils self-heal and land is returned to pre-disturbance land use with no discernible change in soil properties or productivity. The exception to this is where subsidence occurs close to waterways or within existing floodplains. Monitoring of these areas in particular will determine if any earthworks are required to maintain drainage patterns in the locally impacted area.

As the LW500 panel area is not in proximity to any waterway or floodplain, no significant impact to drainage patterns are expected, however this will be confirmed via the agreed monitoring process.

7.2 Restoration

The objective for any restoration activity is to ensure that the land has been returned to its pre-activity potential productive capacity, and to be able to demonstrate that this has occurred. Criteria able to demonstrate the satisfaction of this objective are outlined in Section 7.5.

7.2.1 Longwall panel subsidence restoration

For the LW500 panel area, by virtue of the existing environmental factors and management measures outlined within Section 7.1.3, longwall panel subsidence is not anticipated to trigger any restoration requirements. The LW500 panel area, however, will be closely monitored to ensure that any unanticipated impacts are mitigated promptly.

Where changes to surface slopes result in localised instances of erosion, one or more of the following controls will be implemented:

- Erosion and sediment controls will be put in place in accordance with the site ESCP and standard erosion management processes(e.g. installation of silt fences or other erosion controls).
- If required, stock controls will be put in place to exclude cattle from the area while restoration activities are undertaken.
- The area may be regraded to mitigate localised surface runoff from entering the area.
- The area may be scarified and revegetated with pasture species currently in use on the property.
- Monitoring of the area will continue until the area is declared as having been restabilised.

Should identified areas of surface cracking not self-heal within the specified three wet seasons:

- The area will be delineated and surveyed.
- Scarifying/ripping of the area to a depth of 0.5 m will be carried out.
- If required, the area will be revegetated.
- Monitoring of the area will continue until the area is declared as having been restabilised.

7.2.2 Supporting surface infrastructure disturbance restoration

Once surface infrastructure is no longer required, the GDP process identifies the restoration requirements specific to that development. The following restoration process will be utilised:

- regrading of the disturbed area to pre-disturbance grades;
- respreading of recovered topsoil, followed by topsoil surface preparation activities and revegetation;
- implementation of any required erosion and sediment control works (e.g. silt fences, sediment traps etc.) as per Kestrel's existing Erosion and Sediment Control Plan (KES-0000-PL-OC-0009); and
- temporary or permanent fencing to enable stock exclusion and manage stock re-introduction during the restoration process.

Where supporting surface infrastructure occurs within mapped SCL areas, restoration monitoring activities will be undertaken to verify that land has been able to be restored to the original condition of the land, including its pre-activity potential productive capacity.

7.3 Monitoring program

7.3.1 Pre-Subsidence monitoring

Prior to the commencement of mining and associated subsidence of LW500 panel, Kestrel will undertake a soil survey in accordance with the requirements of RPI Guideline 09/14 (DSDMIP 2019b). This survey will set the pre-activity baseline of soil characteristics and land productive capacity. This report will be kept by Kestrel and provided on request by the Administering Authority.

7.3.2 Post-Subsidence monitoring

Once mining of LW500 panel and associated subsidence is complete, and following up to three successive wet seasons, Kestrel will undertake a second soil survey in accordance with the requirement of RPI Guideline 09/14 (DSDMIP 2019b). This survey will set the post-activity soil characteristics and land productive capacity. This report will be kept by Kestrel and provided on request by the Administering Authority.

Kestrel will then undertake a comparative assessment between the pre- and post- mining soils surveys to determine if there are any impacts that may require specific restoration activities to be undertaken.

Any areas requiring restoration activities will be identified and a plan for undertaking the restoration works will be developed.

7.3.3 Restoration monitoring

Where active restoration activities are undertaken, relevant monitoring activities will be carried out as follows:

Hillslope erosion

Identification of erosion, and instances of tension cracking, will be identified in the post-subsidence soil survey. Where subsidence-induced erosion is observed to have initiated, the restoration activities detailed at Section 7.2 will be implemented.

Areas undergoing restoration activities will be monitored until stabilisation has been achieved.

Landform change

Landform change will be identified in the post-subsidence soil survey, and through regular LIDAR imagery that is undertaken by Kestrel Mine. In addition, and as required by the site Environmental Authority, LW500 will be inspected prior to mining, during mining and for up to three years following mining, by a suitably qualified and experienced person (EA condition G6).

Slopes will be compared pre- and post- mining, to identify any significant slope changes or areas of potential ponding. Where these impacts are identified as requiring restoration works, the activities identified at Section 7.2 will be implemented.

Areas undergoing restoration activities will be monitored until stabilisation and/or landform outcomes have been achieved.

7.3.4 Land management activities not related to resource activities

Non-mined land management activities will be monitored in accordance with requirements of the current lease agreement and Kestrel land productivity approaches.

7.4 Restoration schedule and costs

Table 3 provides estimates of timeframes and costs that may be incurred where restoration activities are required.

Table 3: Restoration actions, estimated timeframe and costs

Restoration Work Milestones	Actions to be undertaken	Estimated Timeframe	Estimated Cost
Exploration, drill pad restoration	Removal of all infrastructure, deep rip compacted areas, respread topsoil, cultivate, revegetate, installation of temporary fencing.	12 months	$4,000 per installation
Pre-drainage, dewatering infrastructure restoration	Removal of all infrastructure, deep rip compacted areas, respread topsoil, cultivate, revegetate, installation of temporary fencing.	12 months	$10,000 per installation
Access track restoration	Rip area of track, reshape and replace with locally salvaged growth media at thickness 150 mm. Seed with pasture species.	12 months	$0.6/m
Implementation of erosion and sediment control works post-subsidence	Silt fences installation, coir mat installation, cultivate, revegetation.	36-48 months	Contingent on requirements
Ongoing monitoring	Suitably qualified person to conduct assessment of restoration plan area.	From 12 months until restoration has been achieved to agreed standard	$40,000 per annum

7.5 Restoration criteria

As per the definition provided by RPI Act Statutory Guideline 09/14 (DSDMIP 2019b):

> *Restoring the land means that the land is not only returned to its pre-activity use but that it is also returned to its pre-activity productive capacity or potential productive capacity.*

Further, Section 1 of Schedule 2 of the RPI Regulation defines pre-activity condition, for land in the SCA as:

> *the condition of the land's soil as identified and analysed within 1 year before the making of an assessment application for a resource activity or regulated activity to be carried out on the land.*

For the LW500 area, sufficient soils and topographic studies have been undertaken to enable a full physical and chemical characterisation of the resident soils, along with an assessment of the productive capacity of the area.

Within 36 months of completion of the resource activity, a post-disturbance soils characterisation and productive capacity assessment of the area will be undertaken in accordance with relevant RPI Guidelines, to enable a comparison between the pre- and post- activity condition of the soils and the potential productive capacity of the land.

This comparison will provide a determination if any permanent impact has occurred, and if any further restoration activities, and/or mitigation payments, will be required.

Kestrel would propose to enter into an agreed Mitigation Deed with the Administering Authority on this basis.

8 References

DSDMIP 2019a, *RPI Act Statutory Guideline 03/14 Carrying out resource activities in Strategic Cropping Area*, State of Queensland, Department of State Development, Manufacturing, Infrastructure and Planning (DSDMIP), Brisbane.

DSDMIP 2019b, *RPI Act Statutory Guideline 09/14 How to determine if an activity has a permanent impact on Strategic Cropping Land*, State of Queensland, Department of State Development, Manufacturing, Infrastructure and Planning (DSDMIP), Brisbane.

EMM 2012, *Environmental Assessment Report Kestrel Extension #4 November 2012*, report prepared for Rio Tinto Coal Australia by EMGA Mitchell McLennan, Spring Hill, Queensland.

Kestrel Coal Resources 2022, *Regional Interests Development Approval Application: LW500 Supporting Information*, Kestrel coal Resources, Brisbane.

Lu H, Gallant J, Prosser IP, Moran C, and Priestley G 2001, *Prediction of Sheet and Rill Erosion Over the Australian Continent, Incorporating Monthly Soil Loss Distribution*. Technical Report 13/01, CSIRO Land and Water, Canberra, Australia.

MSEC 2022, 500 series longwall layout adjustment, report prepared for Kestrel Coal Resources by Mine Subsidence Engineering Consultants (MSEC), Chatswood, NSW.

MWH 2002, *Kestrel Mine Soil Survey–Final Report*, report prepared for Pacific Coal Pty Ltd by MWH Pty Ltd, Brisbane.

MWH 2011, *Kestrel Mine Extension #4 (Part) Soil Survey,* report prepared for Rio Tinto Coal Australia Pty Ltd, MWH, Brisbane.