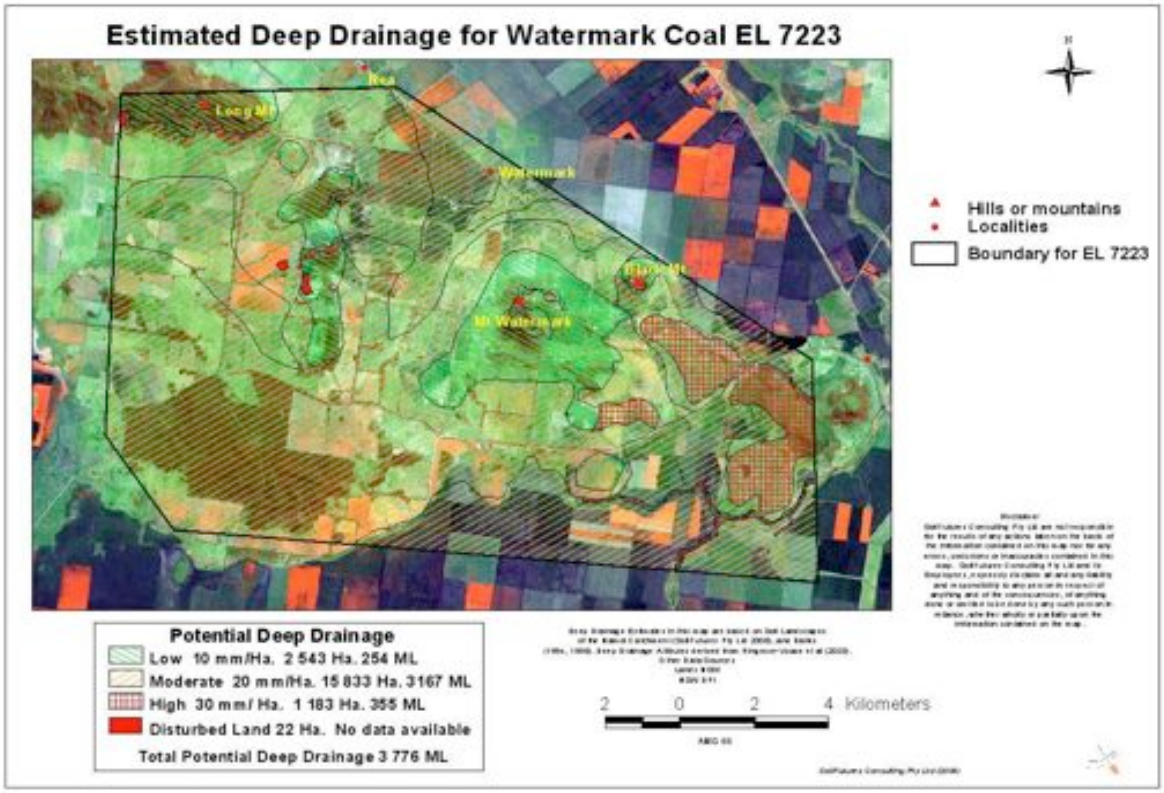
SoilFutures Consulting Pty Ltd

Deep Drainage and Runoff Estimates for Coal Exploration Leases EL6505 and EL 7223



Prepared for the Caroona Coal Action Group

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The findings and opinions in this report are based on research undertaken by Mr Robert Banks (BSc (Hons), CPSS, Dip Bus) of SoilFutures Consulting Pty Ltd as independent consultants, and do not purport to be those of the client.

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1.0 Introduction

1.1 Background

This report has been prepared in response to a request from the Caroona Coal Action Group to provide slope information and estimate potential deep drainage and runoff for the areas included within BHP-Billiton's Caroona Coal Exploration Lease 6505 (EL6505) and the Shenhua Watermark Exploration Lease 7223 (EL7223). The extent of these mining leases is given in Appendices 1 and 2.

This report gives an estimate of the status quo for localised runoff and groundwater recharge within the exploration lease areas. Mining as an activity in a biodiverse and productive agricultural landscape with high yielding groundwater supplies, could cause disruptions to agriculture through dewatering of the landscape. This report provides simple estimates of potential recharge to groundwater systems through deep drainage and runoff generated within the EL6505 and EL 7223. Deep drainage and runoff from one landscape to another may be considered ultimately as sideslope recharge for potable irrigation aquifers within the coal exploration lease areas.

The methodology used in this report also allows for further estimates of potential losses to both groundwater and runoff thorough mining activities if coal mining commences within EL6505 and EL 7223

1.2 Objectives

The main objectives of this report are:

1 To provide maps to showing existing NSW Department of Infrastructure, Planning and Natural Resources (DIPNR) data which defines areas of EL6505 and EL7223 which have a slope of <2%. Slopes of <2% are used to define areas of floodplain which extend between Blackville and Caroona under Part 8 of the NSW Water Act (DIPNR, 2003).

2 Using published environmental data from the Namoi Catchment Management Authority (Namoi CMA), NSW Department of Environment, Conservation and Climate Change (DECC), CSIRO, and NSW Department of Primary Industries (NSW DPI) to calculate estimates of deep drainage and runoff for EL6505 and EL7223.

3 To calculate total potential recharge and runoff values for EL6505 and EL7223 and present these spatially as maps, showing how deep drainage and runoff potential varies across the landscape.

4 To provide the community with recommendations so precautionary actions can be taken to maintain groundwater resources in these important agricultural areas.

2.0 Methods

2.1 Delineation of Areas Less than 2% in EL6505 and EL7223

The areas of slope both greater and less than 2% have been defined and mapped by the DIPNR (2003), as a means of defining floodplains. The 2% slope map for the

Liverpool Plains Catchment was clipped to EL6505 and EL7223 (DIPNR, 2003). Slopes <2% are considered to be floodplain. The maps are presented in Appendices 3 and 4.

2.2 Use of Soil Landscape Maps

Published Soil Landscapes for the area from Banks (1995), Banks (1998) and SoilFutures (2008) exist for the whole of the Namoi Catchment. Soil Landscapes were clipped to the boundaries of the EL6505 and EL7223 (NSW DPI, 2006, 2008). The Soil Landscape information provides a practical way to group different soils and landscapes by their recharge, runoff and land use characteristics according to the methods used in Ringrose-Voase *et al* (2003).

EL6505 contains 13 individual Soil Landscapes, whilst EL7223 has 17 Soil Landscapes. Soil landscapes within the EL6505 and EL7223 are presented in Appendices 5 and 6.

2.3 Grouping of Soil Landscapes by into Land Management Units

Soil Landscapes have been grouped into Land Management Units (LMU's) in SoilFutures (2008) using the method developed by URS (2001). LMU's are lands which have similar characteristics in terms of slope, drainage, and land use potential. The LMU map was clipped to the boundaries of the EL6505 and EL7223. Each LMU was assessed and given rankings of Low, Moderate and High both deep drainage and runoff, based on individual LMU soil properties, using the data found in Ringrose-Voase et al (2003) and URS (2001).

2.4 Estimation of Total Potential Recharge within EL 6505 and EL7223

Total potential recharge values for both EL6505 and EL7223 were estimated using the most conservative values for catchment recharge available based on modeling and measurements of deep drainage provided in Ringrose-Voase et al (2003). It should be stressed that these values are not absolute; these are best estimates based on available data and simple modeling based on measurements performed on dominant soil types within a Land Management Unit. The modeling in Ringrose-Voase et al (2003) was done using long term climate records and represent long term average potential values for different soil types.

The calculation made in this exercise do not take any account of water entering groundwater via inflow from within the aquifers upstream of the Exploration Lease areas. It also does not adequately address in-stream recharge, which according to Coram (1998) are very variable.

2.5 Estimation of Total Potential Runoff within EL 6505 and EL7223

Total potential runoff which potentially feed groundwater in the exploration lease areas was calculated using the most conservative values available for catchment runoff based on modeling and measurements provided in Ringrose-Voase et al (2003).

3.0 Results

3.1 Total Potential Recharge Values within EL 6505 and EL7223

Figures used to estimate potential recharge are summarised below.

Table 3.1: Estimation of Deep Drainage for EL6505 (Caroona)			
Ranking	Value (mm/yr)	Area of Contribution (Ha)	Potential Contribution to Recharge through Deep Drainage (ML)
Low	10	395	40
Moderate	20	16 235	3 247
High	30	17 864	5 359
Disturbed Land	No value ascribed	15	No Value
	Total	34 510	8 646 ML

Table 3.2: Estimation of Deep Drainage for EL7223 (Watermark)			
Ranking	Value (mm/yr)	Area of Contribution (Ha)	Potential Contribution to Recharge through Deep Drainage (ML)
Low	10	2543	254
Moderate	20	15833	3167
High	30	1183	355
Disturbed Land	No value ascribed	22	No Value
	Total	19580 Ha	3776 ML

The above calculations have been projected spatially as maps showing Low, moderate and high recharge areas. The maps show areas which contribute relatively to potential sideslope recharge through deep drainage. Note that no attempt has been made to estimate potential in-flows of groundwater from areas adjacent to the Exploration Leases and concentrate purely on that amount of potential recharge generated within the lease areas. These maps are presented in Appendices 7and 8.

3.2 Total Potential Runoff Values within EL 6505 and EL7223

Figures used for runoff are summarised below.

Table 3.3: Estimation of Runoff for EL6505 (Caroona)			
Ranking	Value (mm/yr)	Area of Contribution (Ha)	Potential Runoff (ML)
Low	15	24 971	3 746
Moderate	45	9 079	4 086
High	80	445	356
Disturbed Land	No value ascribed	15	0
	Total	34 510	8 187 ML

Table 3.4: Estimation of Runoff for EL7223 (Watermark)			
Ranking	Value (mm/yr)	Area of Contribution (Ha)	Potential Runoff (ML)
Low	15	5044	757
Moderate	45	14019	6309
High	80	495	396
Disturbed Land	No value ascribed	22	0
	Total	19580	7 461 ML

The above calculations have been projected spatially as maps showing Low, moderate and high runoff areas. The maps show areas which contribute relatively to potential sideslope recharge and surface waters through runoff. Note that no attempt has been made to estimate potential run-on from areas adjacent to the Exploration Leases and concentrate purely on that amount of potential runoff within the Exploration Lease areas. These maps are presented in Appendices 9 and 10.

4.0 Discussion of Results

The total estimated recharge and runoff for EL6505 is 8.6 GL and 8.2GL respectively, a total of 16.8 GL. Total estimated recharge and runoff for EL7223 is 3.8 GL and 7.5 GL respectively, a total of 11.3 GL.

The above method of calculation used to estimate potential deep drainage and runoff values for EL6505 and EL7223, could be used to calculate impacts of proposed mining within EL6505 and EL7223. For example a reduction in the area of land with moderate deep drainage potential, through open cut mining, in either EL6505 or EL7223 by 1000 Ha could reduce input to aquifers by 200 ML; and a 1000 Ha reduction within the area of moderate runoff would see a reduction in run off to the catchment of 453 ML.

EL6505 and EL7223, potentially feed groundwater zones which are used for irrigated agriculture. Namoi Groundwater Zones 3, 7 and 8 are adjacent or partially included within the coal exploration leases EL6505 and EL7223 (Appendix 11).. The sustainable yield for these zones is as follows: Zone 3, 17.3 GL, Zone 7, 3.7 GL and Zone 8, 16 GL DNR (2006). The combined sustainable yield of groundwater zones 3, 7 and 8 is 37 GL. The combined contribution directly to aquifer recharge through EL6505 and EL 7223 through deep drainage is 12.4 GL. This represents 33.5% of total sustainable groundwater yield.

The estimated annual flow of the Mooki River based on the median flow is 3.6 GL per year, measured at Gunnedah (DIPNR, 2004). The combined estimated runoff from coal explorations leases EL6505 and EL7223 is 15.7 GL. It is probable that a substantial portion of this runoff is entering groundwater systems further down-slope from the points where it has been estimated, rather than entering the Mooki River. Runoff generated within EL6505 and EL7223, represents 436% of the median flow of the Mooki River.

5.0 Conclusions

Given the magnitude of the above estimates, it is strongly recommended that any significant proposed land use changes in within either exploration lease area be seriously weighed up and concomitant losses to surface and groundwater be taken into account. It is apparent that the land within the exploration leases has significant input to both surface and groundwater flows in the region. Significant changes of land use within the areas of the exploration leases could cause very highly significant reductions in both surface and groundwater flows without consideration of damage to the irrigation aquifers themselves.

6.0. References

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NSW DPI 2006 Diagram of Exploration Licence No 6505. NSW Department of Primary Industries, Maitland

NSW DPI 2008 Diagram of Exploration Licence No 7223. NSW Department of Primary Industries, Maitland

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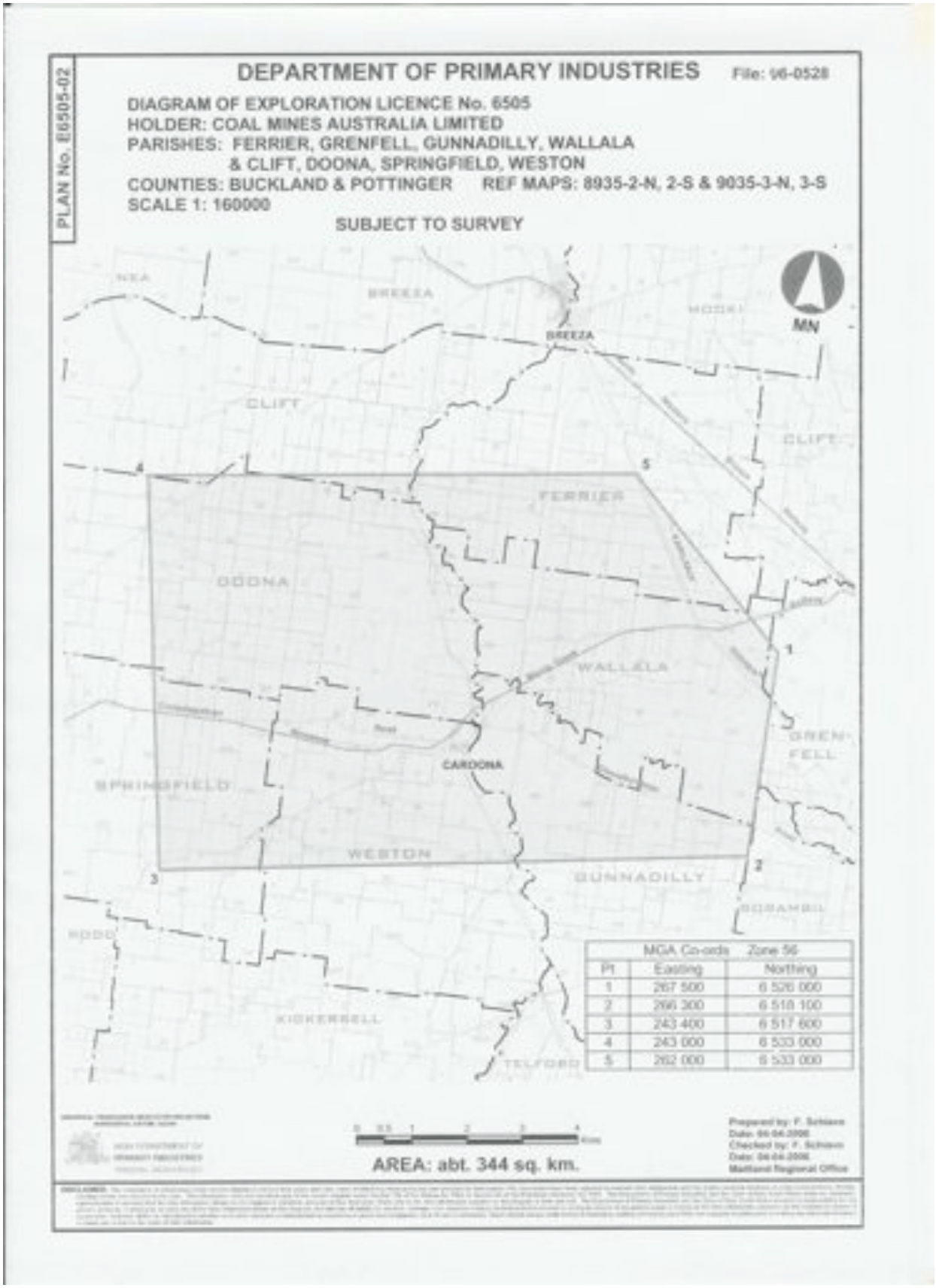
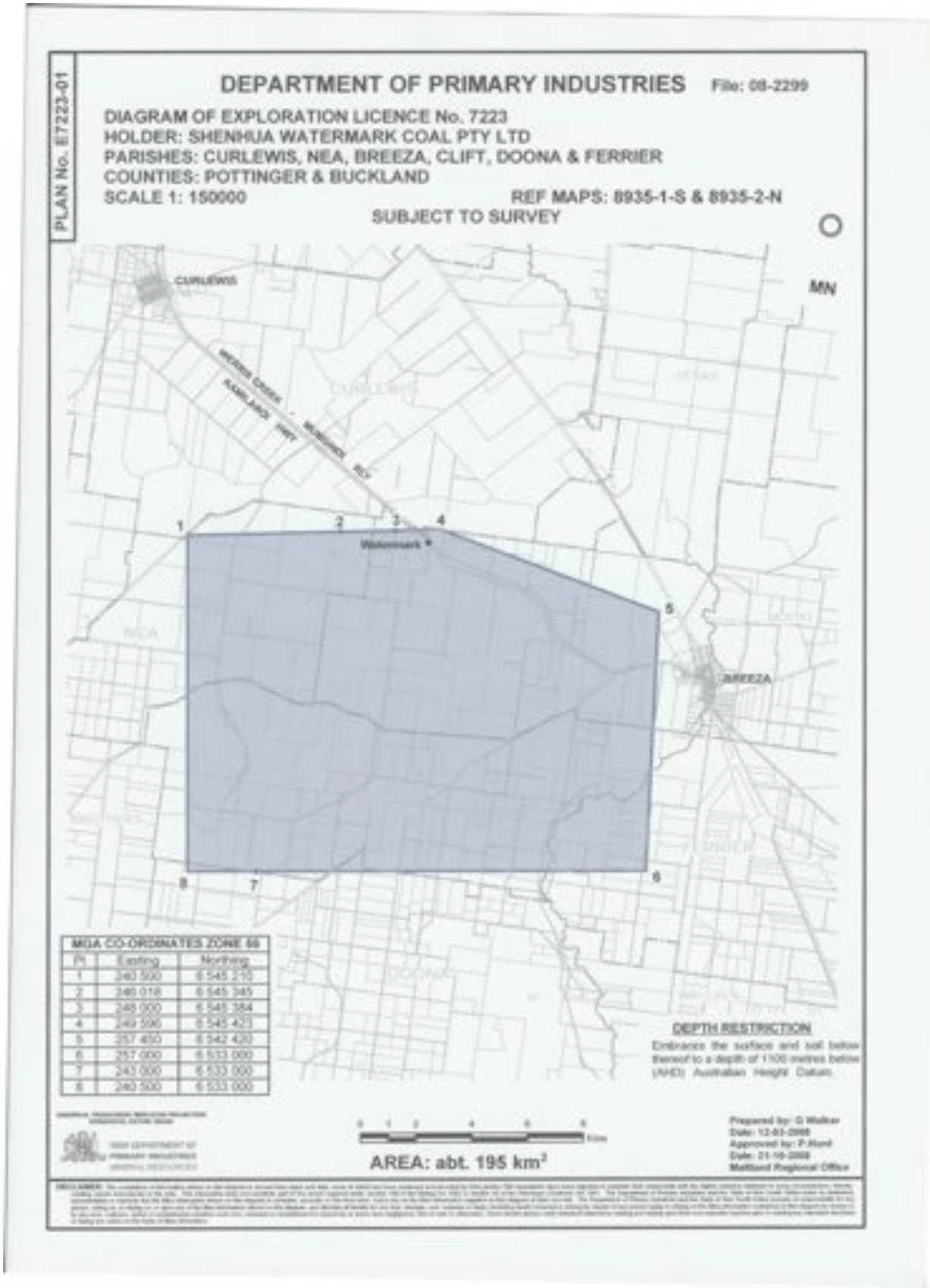
Appendix 1: Location of EL6505

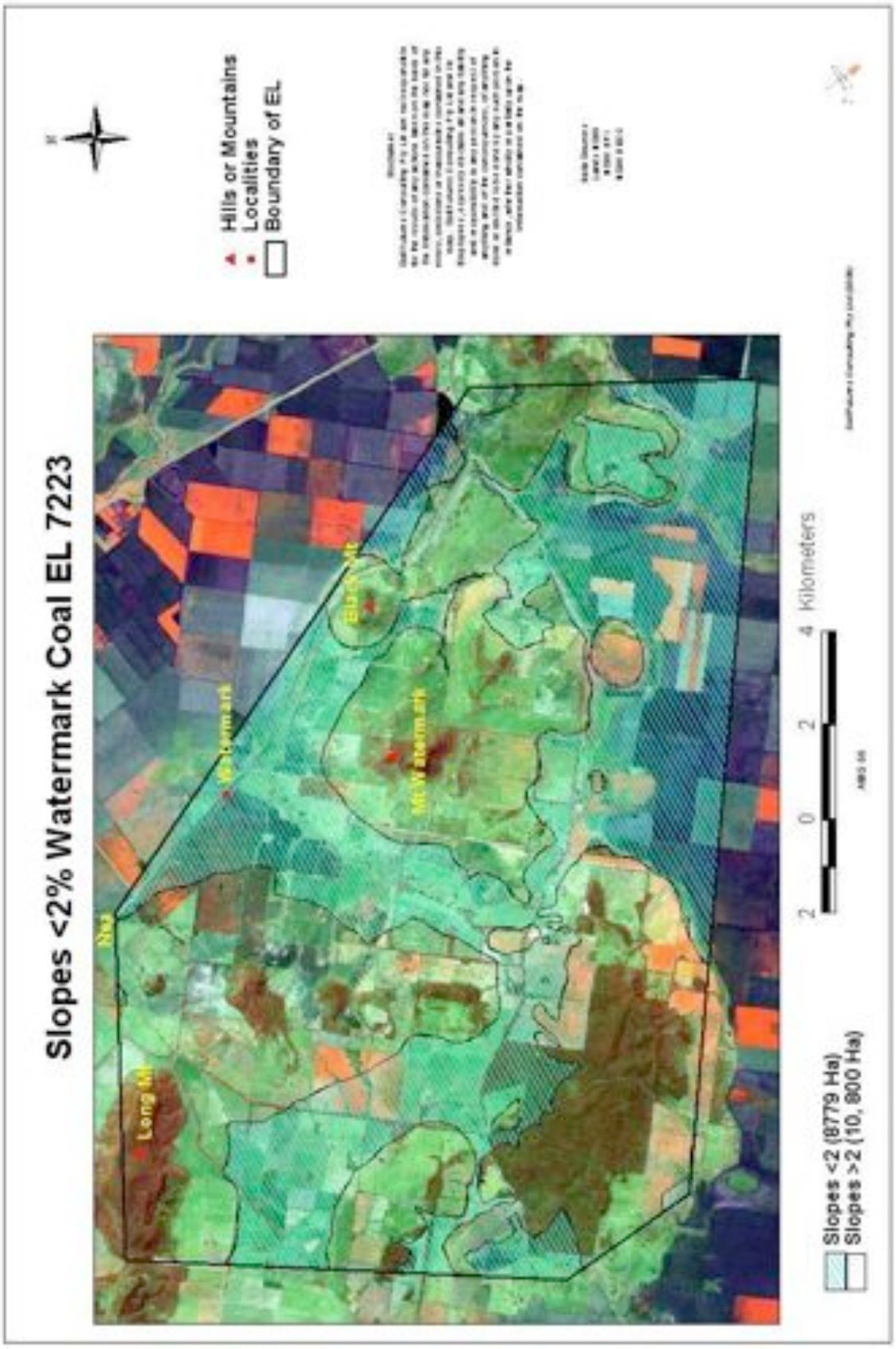


Appendix 2: Location of EL7223

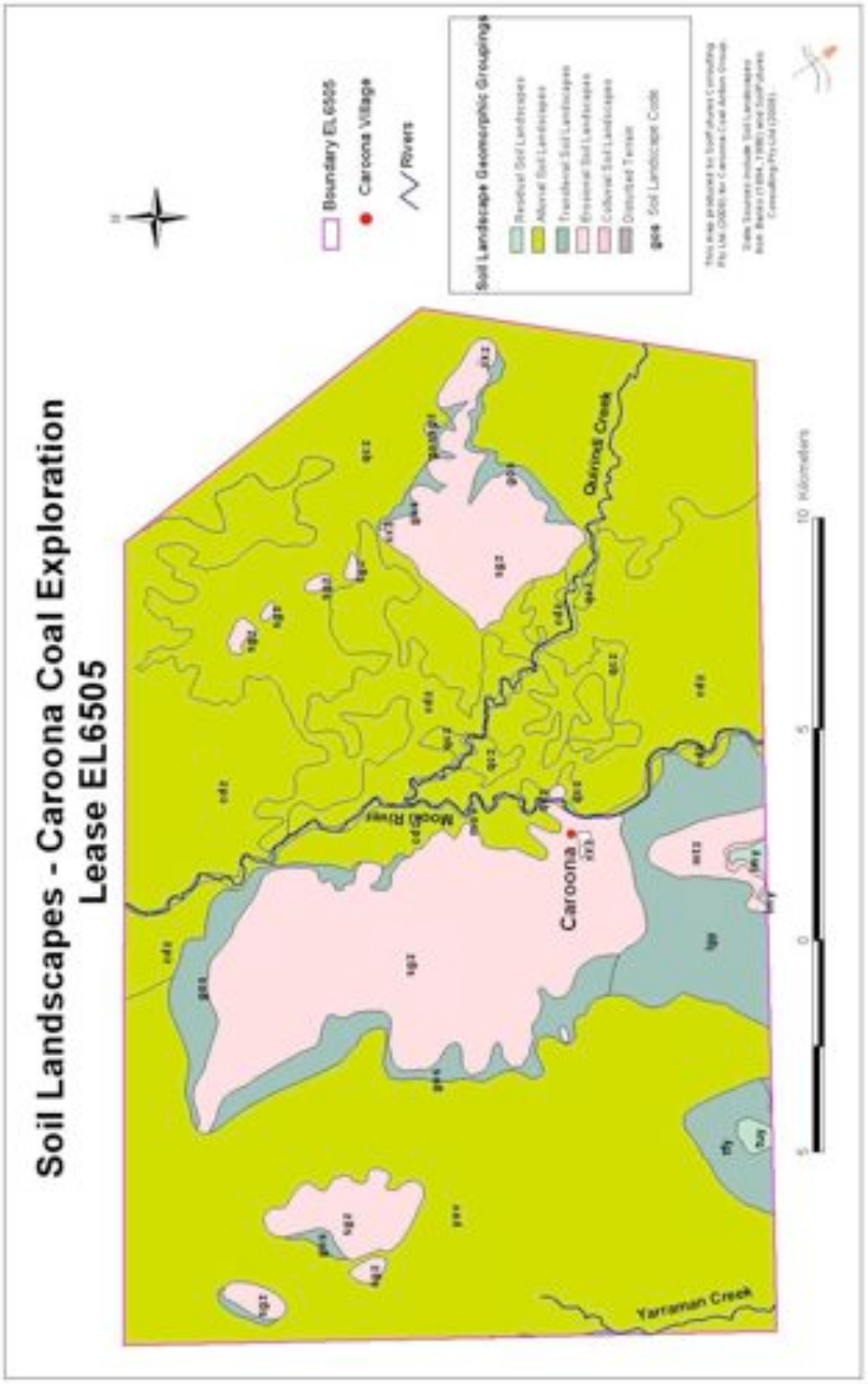


Appendix 3: Slope< 2% EL6505

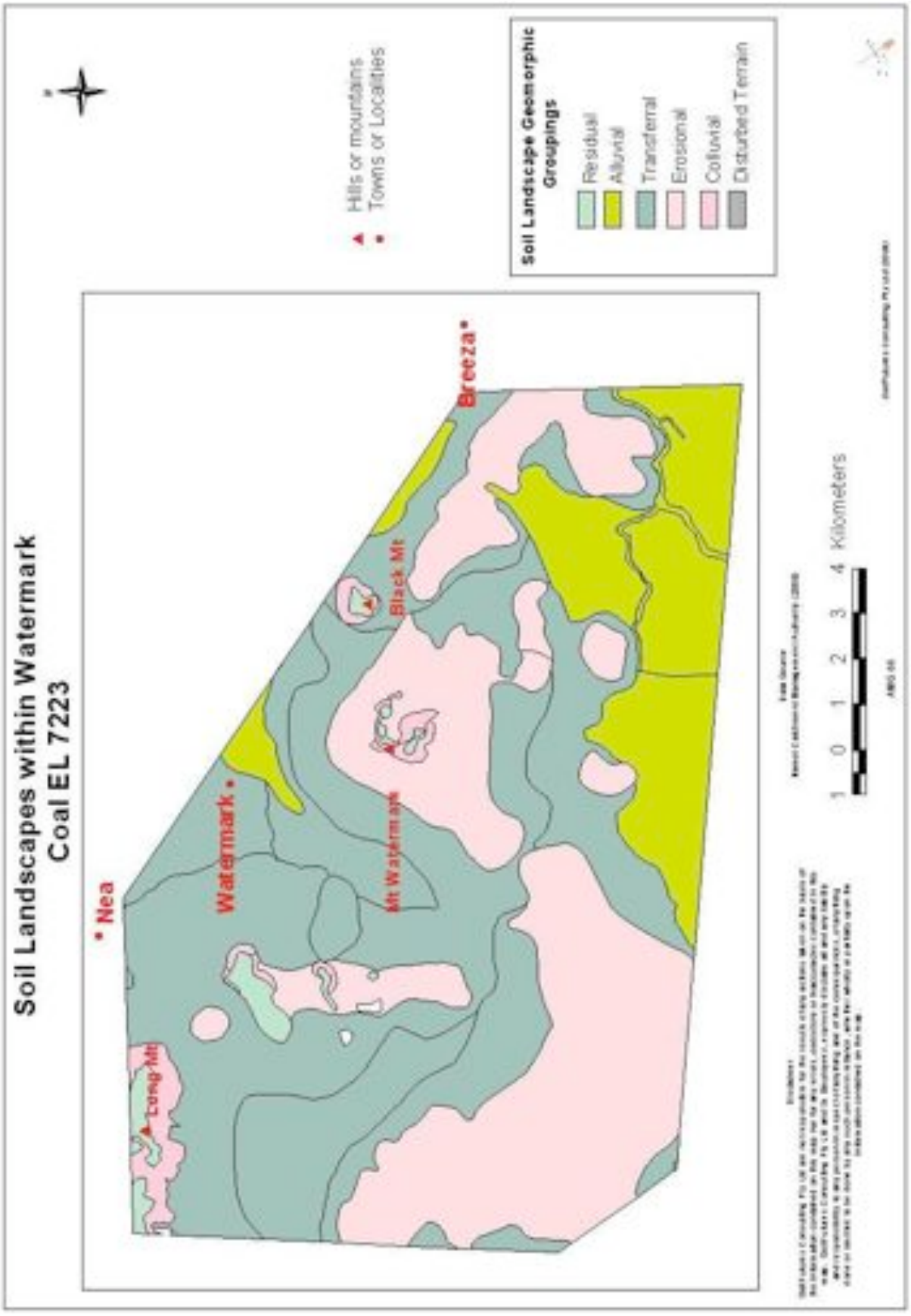
Appendix 4: Slope <2% EL7223



Appendix 5: Soil Landscapes of EL 6505

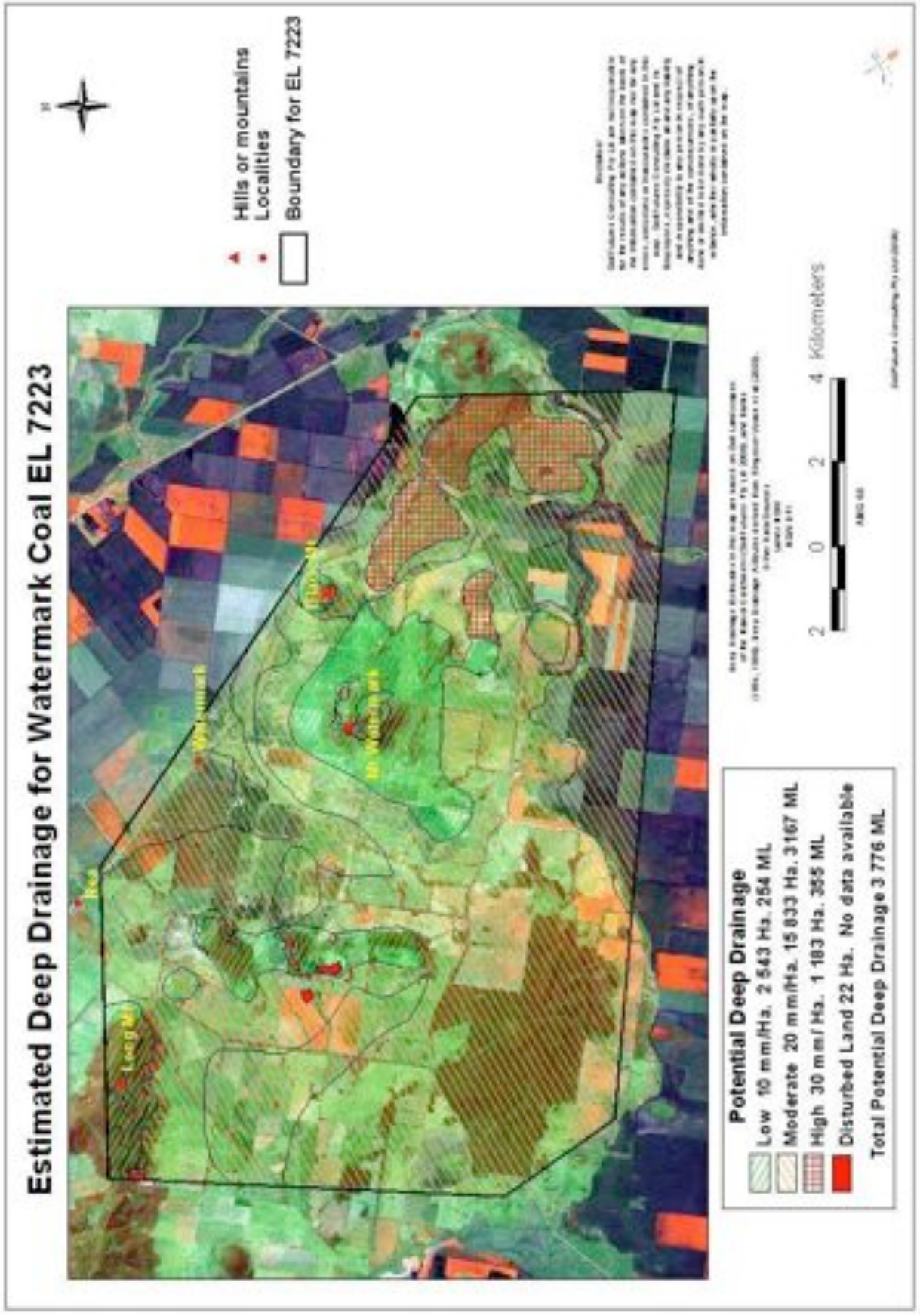


Appendix 6: Soil Landscapes of EL7223



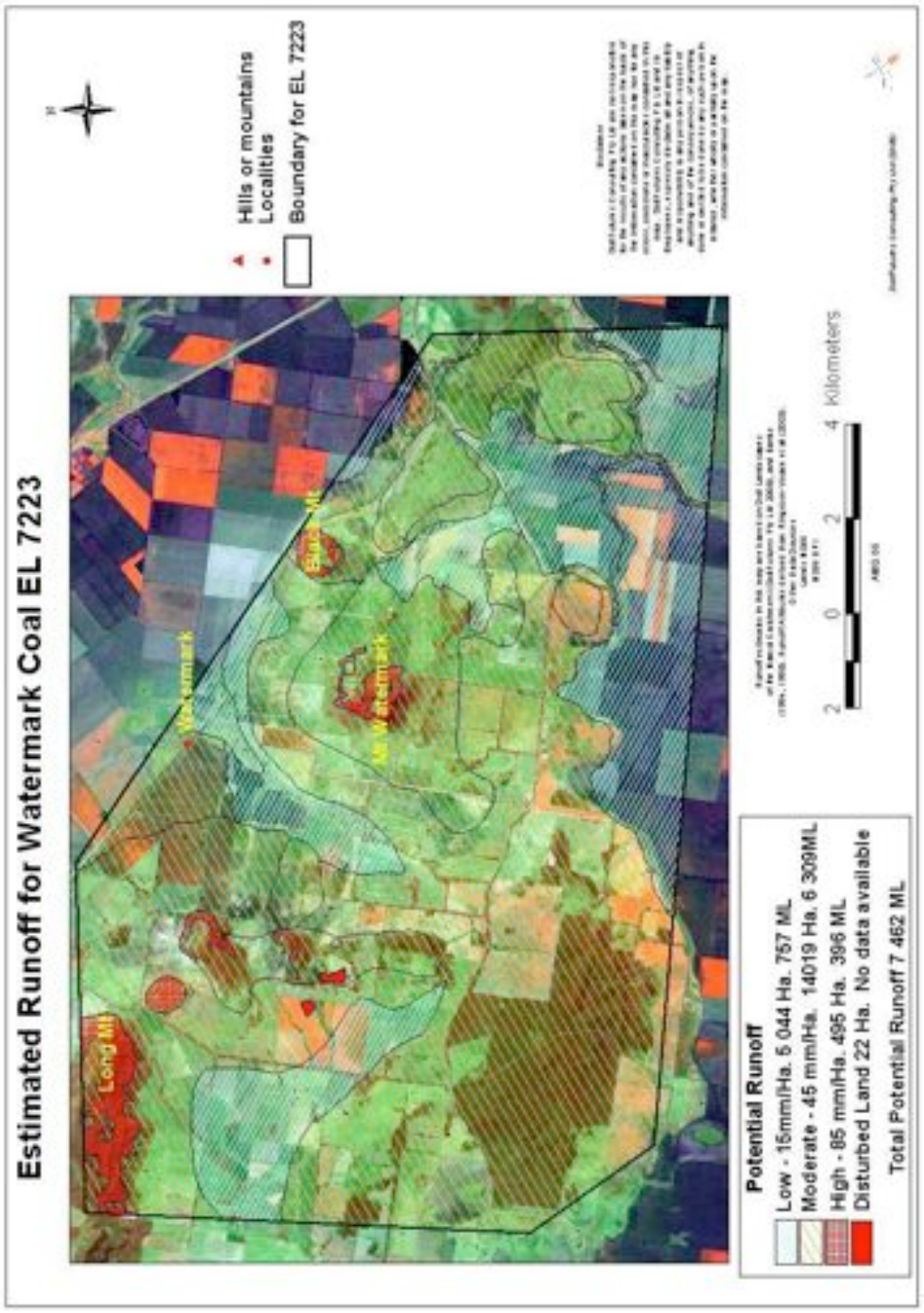
Appendix 7: Deep Drainage Estimates EL6505

Appendix 8: Deep Drainage Estimates EL7223



Appendix 9: Runoff Estimates EL6505

Appendix 10: Runoff Estimates EL7223



Appendix 11: Groundwater Zones near EL6505 and EL7223