

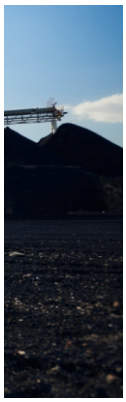


Ashton-Ravensworth Underground Mine Integration

EPBC Act Preliminary Documentation

APPENDIX A

Ecology Assessment

YANCOAL
兖煤澳大利亚有限公司

RAVENSWORTH UNDERGROUND MINE PRELIMINARY DOCUMENTATION (EPBC 2022/09208) ECOLOGY ASSESSMENT

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1 INTRODUCTION

Ashton Coal Operations Pty Ltd (ACOL), a wholly owned subsidiary of Yancoal Australia Limited (Yancoal) is proposing to access and extract State-approved but unmined coal resources at the Ravensworth Underground Mine (RUM) and integrate part of the approved RUM with the Ashton Underground Mine.

1.1 ACTION OVERVIEW

Activities associated with the approved RUM have not previously been referred under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The proposed Action under the EPBC Act would therefore involve the following:

- underground mining of the Pikes Gully and Middle Liddell coal seams using longwall mining methods in the Action area;
- mining operations until approximately 31 December 2032 (i.e. for a period of approximately 8 years);
- establishment and use of gas, ventilation and water management infrastructure including shafts, bores and pipelines (required to ventilate and dewater the longwall operation);
- management of water and gas that accumulates in the underground workings during longwall operations within the proposed Action area;
- transfer of run-of-mine coal from longwall (secondary) extraction of the RUM Pikes Gully and Middle Liddell coal seams in the proposed Action area to the neighbouring Ashton Coal Project via connected underground workings; and
- transfer of water and gas generated during secondary extraction from the Action area to the neighbouring Ashton Coal Project.

The proposed Action does not include non-subsiding first workings development, which would be used to access and undertake secondary extraction of the longwall panels as part of the Action.

The proposed Action is located within an existing mining precinct, which includes historic and ongoing open cut operations including the Ravensworth Operations Project, located above and immediately to the west, and Ravensworth South Open Cut, located above and immediately to the north, Hunter Valley Operations North, located approximately 4 kilometres (km) further west, Glendell Open Cut, located to the north-east, and the Ashton Mine Complex located adjacent to and east of the RUM.

The proposed Action area is located within the Hunter River catchment and the Bowmans Creek sub-catchment. The Hunter River is located south of the proposed Action area and flows to the east. Bowmans Creek is located east of the proposed Action area and was realigned by ACOL in two locations prior to it being undermined by the Ashton Underground Mine operations. Bowmans Creek flows southwards into the Hunter River.

ACOL lodged a referral for the proposed Action under the EPBC Act on 24 March 2022. All new surface infrastructure proposed by the proposed Action would be located within cleared areas and therefore the potential impacts associated with the proposed Action are limited to mine-induced subsidence (the Study Area).

The referral application relied upon survey results from an ecological assessment prepared by Umwelt in 2010 and also considered subsidence effects as reported in SCT (2021) and water impacts as reported in AGE (2023).

The Department of Climate Change, Energy, the Environment and Water (DCCEEW) determined the proposed Action to be a "controlled action" (EPBC Referral 2022/09208), with the following controlling provisions:

- listed threatened species and communities; and
- a water resource, in relation to coal seam gas development and large coal mining development.

In November 2022, DCCEEW requested further assessment of potential impacts on the following threatened ecological communities (TECs):

- *Central Hunter Valley eucalypt forest and woodland* – Critically Endangered; and
- *Hunter Valley Weeping Myall* (Acacia pendula) *Woodland* – Critically Endangered.

In November 2022, DCCEEW requested the Independent Expert Scientific Committee (IESC) to provide advice on the proposed Action with a response received on 14 December 2022.

This report addresses matters raised by both DCCEEW and IESC with regard to TECs and groundwater dependent ecosystems (GDEs) associated with Bowmans Creek.

1.2 PREVIOUS STUDIES

There have been three projects that have included mapping and classification of the vegetation across the proposed Action area: The Hunter Remnant Vegetation Project (Peake, 2006); the report by Umwelt (2010); and the State Vegetation Type Map: Upper Hunter (SVTM, 2021). Table 1 provides details of the results of these projects.

Table 1: Native vegetation mapping projects within the subsidence area.

Hunter Remnant Vegetation Project (Peake, 2006)		
Veg MU Code	**Common Name**	**Area (ha)**
32	Central Hunter Bulloak Forest Regeneration	0.6
10	Central Hunter Box - Ironbark Woodland	9.3
	Total	**9.9**
Umwelt (2010)		
Code	**Community**	**Area (ha)**
Not coded	Central Hunter Box - Ironbark Woodland	30.2
Not coded	Derive native grassland	21.7
	Total	**51.9**
Upper Hunter State Vegetation Type Mapping (SVTM, 2021)		
Plant Community Type ID	**Plant Community Type Name**	**Area (ha)**
796	Derived grassland of the New South Wales (NSW) South Western Slopes	0.5
1603	Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter	35.8
	Total	**36.3**

Umwelt (2010) also mapped patches of rehabilitated woodland throughout the proposed Action area.

In addition, historic aerial imagery was examined to assist with understanding past land use. Figure 1 shows a 1993 aerial image overlaid with the generic habitat types as of 2022. Figure 1 indicates that the majority of rehabilitated woodland areas have been established on backfill overburden or on fringing cleared grassland. It also indicates that a large portion of the remnant woodland has regrown naturally over the ensuing 29 years.

1.3 EPBC PROTECTED MATTERS SEARCH

A protected matters search[1] was conducted for a 10 km rectangle centred on the Action area. Appendix 1 provides the search results for threatened species.

Table 2 provides the threatened species records in BioNet from within the Protected Matters search area and an assessment of the likelihood of occurrence within the Action area.

Table 3 provides the TECs records in BioNet from within the Protected Matters search area and an assessment of the likelihood of occurrence within the Action area.

The likelihood of occurrence presented in Tables 2 and 3 considers the recent survey conducted by Hunter Eco, as described in Section 2.

Table 2: Likelihood of occurrence in the Study Area of threatened species recorded within the Protected Matters Search Area.

Scientific Name	Common Name	Status	Likelihood of Occurrence
Amphibians			
Litoria aurea	Green and Golden Bell Frog	V	May occur in Narama Dam.
Birds			
Lathamus discolor	Swift Parrot	CE	Unlikely. The Study Area is not within Swift Parrot important area maps.
Anthochaera phrygia	Regent Honeyeater	CE	Unlikely. The Study Area is not within Regent Honeyeater important area maps.
Hirundapus caudacutus	White-throated Needletail	V	Possible itinerant overflying the Study Area.
Erythrotriorchis radiatus	Red Goshawk	V	Possible itinerant forager. Insufficient large mature trees for nesting.
Callocephalon fimbriatum	Gang-gang Cockatoo	E	Possible forager but no trees with habitat hollows for breeding were observed.
Mammals			
Dasyurus maculatus maculatus (SE mainland population)	Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population)	E	Possible but unlikely due to poor connectivity of the natural woodland area with similar habitat.
Phascolarctos cinereus (combined populations of Queensland [QLD], NSW and the Australian Capital Territory [ACT])	Koala (combined populations of QLD, NSW and the ACT)	E	The natural woodland contains Grey Box (*Eucalyptus moluccana)* and Narrow-leaved Ironbark (*Eucalyptus crebra*) both listed as Koala use trees for the Central Coast Koala management area in the *State Environmental Planning Policy (Biodiversity and Conservation) 2021.* However, the lack of connectivity means it is unlikely that Koalas would use the habitat.
Pseudomys novaehollandiae	New Holland Mouse, Pookila	V	Unlikely due to the poor connectivity with the species unlikely to disperse across open spaces.
Chalinolobus dwyeri	Large-eared Pied Bat, Large Pied Bat	V	Possible. Within 2 km of old mines or tunnels.

[1] https://www.awe.gov.au/environment/epbc/protected-matters-search-tool

Scientific Name	Common Name	Status	Likelihood of Occurrence
Pteropus poliocephalus	Grey-headed Flying-fox	V	Possible itinerant forager on eucalypt blossom. No camps were present.
Petrogale penicillata	Brush-tailed Rock-wallaby	V	Absent. Occupies rocky escarpments not present in the Action area.
Plants			
Eucalyptus glaucina	Slaty Red Gum	V	Absent.
Asperula asthenes	Trailing Woodruff	V	Possible. The species is associated with Plant Community Type (PCT) 1603 in the Threatened Biodiversity Data Collection (TBDC[2]).
Reptiles			
Delma impar	Striped Legless Lizard, Striped Snake-lizard	V	Possible. The species is associated with PCT 1603 in the TBDC.

[1] Threatened Biodiversity Data Collection (DPE, 2022a).

Table 3: Likelihood of occurrence in the Study Area of TECs predicted within the Protected Matters Search Area.

Community Name	Status	Likelihood of Occurrence
Central Hunter Valley eucalypt forest and woodland	CE	Present.
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (DNG)	CE	Absent. None of the key canopy species White Box, Yellow Box or Blakely's Red Gum were present.
Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland	E	Absent. The remnant vegetated area was dry woodland.
Lowland Rainforest of Subtropical Australia	CE	Absent. The remnant vegetated area was dry woodland.
River-flat eucalypt forest on coastal floodplains of southern NSW and eastern Victoria	CE	Absent. The remnant vegetated area was dry woodland, not on a coastal floodplain.
Warkworth Sands Woodland of the Hunter Valley	CE	Absent. Geology of the remnant vegetated area is of sedimentary (eroded by water) sandstone whereas Warkworth Sands vegetation overlies fluvial (windblown) sand deposits (DMR 1999).
Hunter Valley Weeping Myall (*Acacia pendula)* Woodland	CE	Absent. Several[3] Weeping Myall trees were present in a rehabilitated mine area adjoining the remnant woodland but were planted and thus do not represent the threatened ecological community.
Coastal Swamp Oak (*Casuarina glauca)* Forest of New South Wales and South East Queensland ecological community	E	Absent. A small patch of invasive Swamp Oak was present next to Narama Dam. The location is not coastal.

[2] Threatened Biodiversity Data Collection (DPE 2022).
[3] A count of the distinctive grey canopies in a Nearmap aerial image indicates approximately 20 mature trees and as many again small suckers or saplings.

2 VEGETATION WITHIN THE STUDY AREA

A desktop review of the Action area was conducted that included the report by Umwelt (2010) and historic aerial imagery. The remnant woodland and derived native grassland (DNG) areas along with a rehabilitated mine area containing several Weeping Myall trees as reported by Umwelt (2010) were the targets of a field inspection conducted by Dr Colin Driscoll on 30 May 2022. Land use history clearly showed that other areas of woodland were established on backfilled overburden as part of mine rehabilitation and were thus not naturally occurring remnants.

The field methodology was to access as many locations as possible and record the dominant canopy species; this was completed in 46 locations. With regard to the Weeping Myall planted within mine rehabilitation areas, the trees were inspected for indications of dispersal by seed or suckering, with other planted species also identified.

Figure 2 shows the mapped habitat across the Action area. The mapped habitat is generally consistent with that mapped by Umwelt (2010). Table 4 provides a summary of the mapped and classified plant communities in the Action area.

Table 4 Classified and mapped plant communities and other conditions in the study area.

PCT	PCT Name	Condition	Generic Name	Area (ha)	BC Act TEC	EPBC Act TEC
-	-	Not vegetated	Mine working	289.8	-	-
1603	Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter	Derived Native Grassland	Narrow-leaved Ironbark - Bull Oak - Grey Box DNG	12.7	Not a TEC	-
1603	Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter	Derived Native Grassland	Narrow-leaved Ironbark - Bull Oak - Grey Box DNG	2.2	-	Central Hunter Valley eucalypt forest and woodland
1603	Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter	Dominated by Bull Oak along with Narrow-leaved Ironbark and Grey Box	Narrow-leaved Ironbark - Bull Oak - Grey Box woodland	42.8	Central Hunter Grey Box—Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions	Central Hunter Valley eucalypt forest and woodland
-	-	Non-native	Overburden rehabilitation grass - shrub	89.1	Not a TEC	Not a TEC
-	-	Rehabilitation woodland with Weeping Myall	Overburden rehabilitation Weeping Myall woodland	3.0	Not a TEC	Not a TEC
-	-	Rehabilitation woodland	Overburden rehabilitation woodland	29.4	Not a TEC	Not a TEC
-	-	Not vegetated	Road	3.1	-	-
-	-	Swamp Oak	Invasive Swamp Oak	0.1	Not a TEC	Not a TEC
-	-	Not vegetated	Waterbody	25.5	-	-

The remnant woodland was dominated by Bull Oak (*Allocasuarina luehmannii*) along with a majority of Narrow-leaved Ironbark and fewer Grey Box on a predominantly grassy ground cover. Cleared areas around the remnant woodland were a mix of native grasses and herbs along with exotic species all designated as DNG. There was also a small patch of invasive Swamp Oak at the edge of the Narama Dam (Figure 2).

2.1 REMNANT WOODLAND

The remnant woodland content matches the NSW PCT 1603 *Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter* and is mapped over an area of approximately 42.8 hectares (ha) (Figure 2). This PCT is assigned to the NSW TEC *Central Hunter Grey Box-Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions.* The floristic content, particularly the dominant canopy species, align with the EPBC Act TEC *Central Hunter Valley eucalypt forest and woodland* (Department of the Environment, 2015). The DNG areas are excluded from the NSW TEC but are included in the EPBC Act TEC to the extent of a 30 m or less gap between woodland patches, totalling approximately 2.2 ha. An impact assessment for this community is provided in Section 5.2.

2.2 WEEPING MYALL

An area of mixed plantation includes Weeping Myall trees and has been mapped over an area of approximately 3.0 ha (Figure 2). Weeping Myall in the mixed species mine rehabilitation area consisted of approximately 20 widely spaced mature trees approximately 3 to 5 metres (m) tall with distinct weeping foliage, along with a similar number of scattered younger plants. The scattered distribution of the younger plants suggests recruitment from seed dispersal with no indication of the dense vegetative suckering characteristic of what is considered naturally occurring Weeping Myall remnants in the Hunter Valley. A variety of eucalyptus species were also present including species such as Sydney Blue Gum (*Eucalyptus saligna)* and Swamp Mahogany (*Eucalyptus robusta)* not recognised as associated with Weeping Myall.

Umwelt (2010) noted that "Planted weeping myall are currently not considered to form part of the listed endangered population unless there is evidence of natural regeneration." Notwithstanding, Umwelt (2010) still designated the presence of Weeping Myall as conforming with the NSW endangered population *Weeping Myall* (Acacia pendula) *in the Hunter Catchment*. The reasoning for this designation was that "Since natural recruitment may be occurring within the planted area, the stand is cautiously considered to conform to the description of the Weeping Myall (Acacia pendula) in the Hunter Catchment Endangered Population".

Nowhere in past or current NSW or Commonwealth Scientific Committee determinations regarding Weeping Myall in the Hunter Catchment does this condition apply. In fact, the reverse condition prevails in that none of the recognised remnant Weeping Myall occurrences produce seed (Bell et al 2007), only spreading by vegetative suckering. Furthermore, the Commonwealth listing advice for the critically endangered community *Hunter Valley Weeping Myall* (Acacia pendula) *Woodland* (Department of the Environment, 2014) specifically excludes planted Weeping Myall, the presence of which is considered to confuse identification of what are considered to be genuine remnant occurrences.

The Weeping Myall were undoubtedly part of an original plantation on previously cleared land, as shown on the 1993 aerial photo (Figure 3). Weeping Myall is widespread west of the Great Divide from Victoria through to NSW and QLD with apparently disjunct occurrences in the Hunter Valley catchment.

Reference was made by the DCCEEW (2022) to Section 2.1.1 of the *National Recovery Plan Weeping Myall – Coobah – Scrub Wilga Shrubland of the Hunter Valley* (Office of Environment and Heritage [OEH], 2013), which states (emphasis added):

> In accordance with IUCN guidelines (IUCN Standards and Petitions Subcommittee 2013), sub-populations or individual trees of either form[4] of Weeping Myall **that have been planted and show evidence of natural recruitment** (i.e. are self-sustaining) should also be considered part of the threatened Hunter Valley Weeping Myall population.

[4] This refers to the classical weeping form characteristic of natural populations outside of the Hunter Valley (and recent introductions), and the less than weeping more erect form characteristic of long-established Hunter occurrences.

It should be noted that the above OEH (2013) statement is an interpretation of a paragraph in Section 2.1.3 Introduced taxa, of the International Union for Conservation of Nature (IUCN) (2013) guidelines which does not specifically mention Weeping Myall or any other taxa. Furthermore, IUCN (2013) section 2.1.3 states (emphasis added):

> In addition to taxa within their natural range and subpopulations resulting from benign introductions (outside the taxon's natural range), the criteria should also be applied to self-sustaining translocated or re-introduced subpopulations (within the taxon's natural range), regardless of the original goal of such translocations or re-introductions. ***In such cases, the listing should indicate whether all or part of the assessed population has been introduced.***

The Commonwealth conservation and listing advice for the critically endangered community *Hunter Valley Weeping Myall* (Acacia pendula) *Woodland* (Department of the Environment, 2014) provides no indication that any introduced populations of Weeping Myall are included. In fact, Section 1.9 describes the existence of deliberately planted stands adding difficulty in establishing the past distribution of the threatened community.

OEH (2013) discusses life history and recruitment in Section 2.5 noting that seed production in non-planted Weeping Myall within the Hunter Valley has not been recorded despite targeted studies. This implies that planted Weeping Myall shown to propagate by seed production and germination must have been more recently introduced into the Hunter Valley.

While Weeping Myall plants from outside the Hunter Valley, and those recently introduced, flower and fruit, the original longer-aged Hunter Valley populations may sporadically flower but do not produce fruit. Section 2.1.1 of OEH (2013) notes that pod and seed characteristics are required to confidently differentiate Weeping Myall from co-occurring Acacia species in the Hunter Valley. Therefore, it is as likely as not that the Hunter Valley populations are Weeping Myall, different taxa or hybrids.

The IUCN (2013) guideline referred to in OEH (2013) is conditional on naturally occurring and introduced (i.e., planted) threatened plants being the same taxon. In the case of Weeping Myall the two forms in the Hunter Valley have not been confirmed to be the same taxon.

The Commonwealth listing advice for the critically endangered community *Hunter Valley Weeping Myall* (Acacia pendula) *Woodland* (Department of the Environment, 2014) Section 1.2 states that:

> It is thought that Hunter Valley stands are a relic from the last glaciation when the Hunter Valley is likely to have been dominated by 'western semi-arid' flora.

There is nothing relictual about a group of recently planted individuals that could not have been sourced from any of the potentially relic Hunter Valley populations that cannot be propagated.

Irrespective of the above, an impact assessment for the Weeping Myall is provided in Section 5.3.

3 BOWMANS CREEK

Bowmans Creek is approximately 60 km in length and flows from the north into the Hunter River just south of the Action area. From its source in the foothills of the Mount Royal Range the first approximately 10 km of the creek is designated non-perennial with the remainder being perennial. A small non-perennial creek approximately 16 km long (Bettys Creek) joins Bowmans Creek immediately to the north-east of the Study Area. Thus, the section of Bowmans Creek that flows past the Action area is fed by nearly 50 km of perennial stream.

The combined catchment of Bowmans Creek and Bettys Creek is over 20,000 ha. The Action area catchment feeding into Bowmans Creek to the east is approximately 180 ha, or 0.9 percent of the total Bowmans Creek catchment. The extent of the Bowmans Creek catchment is shown on Figure 4.

A stream water level and flow rate monitoring station (Site 210130) is located on Bowmans Creek approximately mid-way between the New England Highway and the Hunter River (Figure 4). Figure 5 shows a plot of daily water levels from 27 October 1993 to 11 January 2023. Station data indicate that there are approximately equal numbers of flow days as no-flow days for the period.

AGE (2023) describes that the Bowmans Creek Alluvium is typically between 7 to 15 m thick in the vicinity of the proposed Action. The depth to water through the Bowmans Creek alluvium is variable, but in the range of 4 to 10 m directly east of the proposed Action (representing a saturated thickness of up 10 m in the deepest parts of the alluvium).

Historical mining in the area has resulted in the deeper Permian formation being depressurised, reducing the flow of water from the Permian formation to the alluvial sediments relative to pre-mining conditions. Despite this reduction in water flowing to the alluvial systems, they have maintained their levels through diffuse rainfall recharge and have largely not demonstrated any impacts from the surrounding mining (AGE, 2023).

The trends in groundwater levels recorded within the Bowmans Creek alluvium generally show a correlation with rainfall (AGE, 2023).

4 GROUNDWATER DEPENDENT ECOSYSTEMS

Initially the *Groundwater Dependent Ecosystem Atlas – Terrestrial GDE* (Bureau of Meteorology, 2022 [Figure 6]), which provides a model of potential GDEs across Australia was consulted along with *Probable Vegetation Groundwater Dependent Ecosystems – Hunter / Central Rivers* (Department of Planning and Environment [DPE], 2022b [Figure 7]). Figures 6 and 7 both indicate that the vegetation within the Study Area is a primarily low potential GDE and along Bowmans Creek is high potential GDE.

The *Central Hunter Valley eucalypt forest and woodland* TEC and Weeping Myall trees within the Action area are not considered to be GDEs given these communities occur more widely across the region and are not restricted to areas where they could potentially access groundwater. Further, parts of the *Central Hunter Valley eucalypt forest and woodland* TEC are located immediately adjacent to the Narama Pit where groundwater levels would be drawn down below potential rooting depths and show no decline in condition.

A survey of the vegetation along the section of Bowmans Creek below the Action area runoff entry point was conducted on 24 January 2023. The creek upstream from this point has been highly modified with the creek permanently diverted in two locations (eastern and western diversion channels) over a total length of approximately 2 km to relocate those parts of the original creek away from Ashton Underground Mine subsidence impacts.

Bowmans Creek is incised up to a depth of approximately 5 m in places in relation to the surrounding land with broader alluvial flats in other areas and over 50 m wide between the tops of the banks. The trees along the creek follow a typical riparian gallery pattern generally confined to creek bed level and steep sides. The canopy is dominated by River Oak (*Casuarina cunninghamiana*) on both sides of the creek, along with an approximately 200 m patch of 19 River Red Gums (*Eucalyptus camaldulensis*) again on both sides (Plates 1 and 2); there were also four scattered River Red Gums downstream to the Hunter River (Figures 11 and 12). The River Red Gums are located more than 500 m from the proposed Action. It is noted that some of the River Red Gums are less than 150 m from the completed Ashton Underground Mine longwall panels.

The patch of River Red Gums contained a mix of ages from small saplings, through to large and very old trees up to over 1 m diameter at breast height. Overall, these trees were in healthy condition with no evidence of dieback, notwithstanding the proximity of longwall mining at the Ashton Underground Mine; similarly for the River Oak. At the water edge there were patches of native Common Reed (*Phragmites australis*).

Typical of Hunter Valley waterways, there were a number of exotic species scattered throughout such as Balloon Vine (*Cardiospermum grandiflorum*), Giant Reed (*Arundo donax*), Pepper Tree (*Schinus molle var. areira*) and Weeping Willow (*Salix spp*.). Groundcover consisted of exotic grasses (Plate 3).

5 IMPACT ASSESSMENT

5.1 HYDROLOGY

5.1.1 Pre-subsidence Hydrology

The topography of the naturally vegetated area consists of a central low ridge lying north-west to south-east with elevation falling to the south east from approximately 90 m Australian Height Datum (AHD) to 70 m AHD. The natural vegetation area is effectively hydrologically isolated having negligible outside catchment inflow due to the surrounding mine activities (it is only subject to direct rainfall). Runoff from south of the central ridgeline flows into Narama Dam and from the north into a sediment trap. Lemington Road forms a barrier to overland flow which is catered for by two culverts directing runoff to Bowmans Creek. The northern culvert allows for overflow from the sediment trap and the southern culvert passes controlled release water from Narama Dam. Overland channels from these two culverts ultimately merge and the combined flow enters Bowmans Creek at a single location; the location of the entry point was confirmed by field inspection on 24 January 2023 (Plate 4). Figure 8 shows the pre-subsidence drainage over the Action area.

5.1.2 Post-subsidence Hydrology

A subsidence review was conducted (SCT, 2021) where it is stated that "multi-seam mining below the small areas of natural ground is expected to cause maximum vertical subsidence of approximately 4.2 m". Comparison of drainage across the pre-subsidence digital elevation model (DEM) and post-subsidence DEM shows very similar flow patterns with post-subsidence flow exiting the area and entering Bowmans Creek at the same points as for pre-subsidence (Figure 9).

Based on the likely new drainage across the post-subsidence landform, there is expected to be limited ponding resulting from the proposed Action.

5.2 CENTRAL HUNTER VALLEY EUCALYPT FOREST AND WOODLAND

Multi-seam longwall mining of three coal seams at the approved Ashton Underground Mine has been completed under forested land with no apparent impact.

Predicted levels of subsidence, tilt and strain for the proposed Action in the area of the TEC *Central Hunter Valley eucalypt forest and woodland* are lower than those typically predicted for the area of woodland forest at the Ashton Underground Mine. With the reduced vertical subsidence at the greater depth at the proposed Action, tilt and strain and the subsidence impacts from these parameters are expected to be less. There is expected to be limited changes to hydrology across the natural ground above the Action resulting from subsidence effects.

An assessment of potential impacts to the TEC *Central Hunter Valley eucalypt forest and woodland* against the criteria in *Matters of National Environmental Significance – Significant impact guidelines 1.1* (significant impact assessment guideline) (Department of the Environment, 2013) is provided in Table 5.

Table 5: *Central Hunter Valley eucalypt forest and woodland* – assessment against significant impact assessment guideline.

Requirement	Potential Impact
An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:	
• *reduce the extent of an ecological community*	All new surface infrastructure proposed by the Action would be located within cleared areas and therefore there would be no direct impacts on this ecological community. Potential indirect impacts associated with the proposed Action would be limited to the effects of mine-induced subsidence. As such, there will be no clearing that could otherwise reduce the extent of the community.
• *fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines*	All new surface infrastructure proposed by the Action would be located within cleared areas and therefore there would be no direct impacts on this ecological community. Potential indirect impacts associated with the proposed Action would be limited to effects of mine-induced subsidence. As such, there will be no clearing that could otherwise fragment the community.
• *adversely affect habitat critical to the survival of an ecological community*	There would be no alteration of the existing habitat as a result of the proposed Action.
• *modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns*	Figure 9 shows that drainage across the post-subsidence landform will be essentially the same as that across the pre-subsidence landform (Figure 8). There will be no altered inflow that might change nutrients or create erosion.
• *cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting*	Given the essentially unchanged surface hydrology it is unlikely that species composition will be changed over time.
• *cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:* - *assisting invasive species, that are harmful to the listed ecological community, to become established, or* - *causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community,* • *or interfere with the recovery of an ecological community.*	Subsidence would not result in greater exposure to invasive exotic plants, fertiliser drift or herbicides than already exists. Historic aerial imagery shows that this woodland has been recovering from past aggressive clearing and this recovery will not be interrupted by subsidence. ACOL would implement weed management measures at the Action area in accordance with the Ashton Coal Project Biodiversity Management Plan, which would be updated to incorporate the Action.

The proposed Action would not result in any direct clearance of the *Central Hunter Valley eucalypt forest and woodland* TEC and the effects of mine-induced subsidence from the proposed Action is not expected to impact vegetation above the longwall panels. Therefore, the proposed Action is not considered to have a significant impact on the *Central Hunter Valley eucalypt forest and woodland* TEC.

5.3 HUNTER VALLEY WEEPING MYALL (ACACIA PENDULA) WOODLAND

An assessment of potential impacts to the planted Weeping Myall (Acacia pendula) has been conservatively undertaken against the criteria in *Matters of National Environmental Significance – Significant impact guidelines 1.1* (Department of the Environment, 2013) is provided in Table 5.

Table 5: *Weeping Myall* (Acacia pendula)– assessment against significant impact assessment guideline.

Requirement	Potential Impact
An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:	
• *reduce the extent of an ecological community*	All new surface infrastructure proposed by the Action would be located within cleared areas and therefore there would be no direct impacts on this ecological community. Potential indirect impacts associated with the proposed Action would be limited to the effects of mine-induced subsidence. As such, there will be no clearing that could otherwise reduce the extent of the community. Further, monitoring of *Acacia pendula* above underground mining areas elsewhere in the Hunter Valley showed no observable impacts on the health of the Acacia pendula stand, with respect to age classes, recruitment, health, infestations and senescence (Wambo Coal Pty Limited, 2011).
• *fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines*	All new surface infrastructure proposed by the Action would be located within cleared areas and therefore there would be no direct impacts on this ecological community. Potential indirect impacts associated with the proposed Action would be limited to effects of mine-induced subsidence. As such, there will be no clearing that could otherwise fragment the community.
• *adversely affect habitat critical to the survival of an ecological community*	There would be no alteration of the existing habitat.
• *modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns*	Figure 9 shows that drainage across the post-subsidence landform will be essentially the same as that across the pre-subsidence landform (Figure 8). There will be no altered inflow that might change nutrients or create erosion.
• *cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting*	Given the essentially unchanged surface hydrology it is unlikely that species composition will be changed over time.
• *cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:* - *assisting invasive species, that are harmful to the listed ecological community, to become established, or* - *causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or* • *interfere with the recovery of an ecological community.*	Subsidence would not result in greater exposure to invasive exotic plants, fertiliser drift or herbicides than already exists. This is a developing community having been planted on previously cleared land. The effects of subsidence would not impede continued development.

As discussed earlier, the mixed plantation of several Weeping Myall trees does not conform to the *Hunter Valley Weeping Myall* (Acacia pendula) *Woodland* TEC listed under the EPBC Act. Notwithstanding, an impact assessment has been conservatively prepared for this community.

The proposed Action would not result in any direct clearance of the Weeping Myall (Acacia pendula) and the effects of mine-induced subsidence from the proposed Action is not expected to impact vegetation above the longwall panels. Therefore, the proposed Action is not considered to have a significant impact.

5.4 BOWMANS CREEK GROUNDWATER DEPENDENT ECOSYSTEMS AND ASSOCIATED RIVER RED GUMS

The gallery forest structure along Bowmans Creek is indicative of an aquatic GDE with vegetation primarily dependent on creek baseflow. As previously noted, stream-flow through the section of Bowmans Creek below the inflow point from the Action area is almost entirely from the 20,000 ha catchment.

AGE (2023) assessed potential impacts of the proposed Action on Bowmans Creek using a numerical groundwater model. In summary (AGE, 2023):

- historical mining has not impacted water levels in the alluvium;
- the proposed Action would result in less than 0.2 m of drawdown in the Bowmans Creek alluvium; and
- reduction in baseflow to Bowmans Creek due to proposed Action would be negligible.

These findings are supported by the absence of dieback and ongoing succession in the community despite previous mining in the area, including mining of the Ashton Underground Mine longwalls immediately to the east (Figure 10). The proposed Action longwalls are located further away from Bowmans Creek, its alluvium and the associated GDEs in comparison to the completed longwalls panels for the Ashton Underground Mine. Further, the predicted levels of subsidence, tilt and strain for the proposed Action are lower than those typically predicted for the Ashton Underground Mine.

Figure 5 shows that the lowest water levels in Bowmans Creek occurred from September to December 2019 during a period of drought, with water levels returning to historical pre-mining levels since. Inspection of nearmap® aerial imagery for August 2019 shows ponded areas remaining above and through the patch of River Red Gums (Figures 11 and 12).

6 SUMMARY OF MANAGEMENT AND MONITORING PROGRAMS

Development Consent DA 104/96 includes subsidence performance measures which prescribe that (among other things) underground mining has "negligible environmental consequences" on "threatened species, threatened populations, or endangered ecological communities".

The conditions of Development Consent DA 104/96 also require an Extraction Plan to be prepared for approval by the NSW Planning Secretary prior to commencing longwall extraction within the Proposed Action area.

The Extraction Plan is required to include a Biodiversity Management Plan, which must be prepared in consultation with the NSW Biodiversity Conservation Division (BCD) and NSW Resources Regulator. The Biodiversity Management Plan must:

- include a program of works to ensure that overall terrestrial and aquatic biodiversity values are the same or better than existed in the locality prior to longwall mining; and
- provide for the management of the potential impacts and/or environmental consequences of the proposed second workings on aquatic and terrestrial flora and fauna

ACOL is required to comply with the subsidence performance measures in Development Consent DA 104/96 for the RUM. Further, Condition 2, Schedule 3 requires ACOL to provide a suitable offset to compensate for the impact or environmental consequence where the performance measure is exceeded and the NSW Planning Secretary determines that:

- it is not reasonable or feasible to remediate the impact or environmental consequence; or
- remediation measures implemented by the Applicant have failed to satisfactorily remediate the impact or environmental consequence.

In addition, ACOL operates the existing Ashton Underground Mine in accordance with an approved Biodiversity Management Plan prepared under Condition 28, Schedule 3 of Development Consent DA No. 309-11-2001-i. The existing Ashton Biodiversity Management Plan would be reviewed and updated to incorporate the proposed Action area such that the biodiversity management practices used at the Ashton Underground Mine would be implemented at the proposed Action. The existing Ashton Biodiversity Management Plan includes:

- detailed performance indicators for subsidence impacts to threatened flora and fauna and biodiversity values;
- bi-annual fauna monitoring and annual vegetation monitoring, including within remnant woodland areas and land overlying underground mining operations;
- annual riparian vegetation monitoring (including of potential GDEs on Bowmans Creek);
- bi-annual (spring and autumn) aquatic ecology monitoring; and
- trigger action response plans in the event that a performance indicator is exceeded, such as a decline in tree health/condition being observed through monitoring.

If monitoring determines that a performance measure in the RUM Development Consent has been exceeded (or is likely to be exceeded), ACOL will undertake the following in accordance with the Biodiversity Management Plan:

- report the likely exceedance of the performance indicator to the relevant agencies as soon as practicable after becoming aware of the exceedance;
- identify an appropriate course of action with respect to the identified impact in consultation with appropriate specialists and relevant agencies; and
- review the effectiveness of the Biodiversity Management Plan and performance measures to adequately manage potential impacts within the approval limits.

ACOL operates the existing Ashton Underground Mine in accordance with an approved Water Management Plan prepared under Condition 26, Schedule 3 of Development Consent DA No. 309-11-2001-i. The existing Ashton Water Management Plan would be reviewed and updated to incorporate the proposed Action. The existing Ashton Water Management Plan includes:

- an Erosion and Sediment Control Plan;
- surface water monitoring at several locations on Bowmans Creek and the Hunter River;
- surface water quality trigger levels;
- groundwater monitoring at several locations in the Bowmans Creek and Hunter River alluvium;
- groundwater level and quality trigger levels (groundwater level triggers are also used to observe any potential baseflow impacts); and
- a surface water and groundwater response plan that is implemented if a trigger level is exceeded.

7 CONCLUSION

Past reports have all concluded that there is a small patch of natural woodland to the south of the Action area comprising Bull Oak, Narrow-leaved Ironbark and Grey Box. A field inspection conducted for this report confirms this and concludes that the canopy combination matches NSW PCT 1603 *Narrow-leaved Ironbark – Bull Oak – Grey Box shrub – grass open forest of the central and lower Hunter*. The floristic content, particularly the dominant canopy species, also aligns with the EPBC Act TEC *Central Hunter Valley eucalypt forest and woodland*.

A previously rehabilitated mine area containing Weeping Myall trees was inspected and confirmed to be of planted origin thus excluding the possibility that it is part of any Weeping Myall threatened community or population.

An assessment of potential impacts has been undertaken for the *Central Hunter Valley eucalypt forest and woodland* and also conservatively for the Weeping Myall trees (*Acacia pendula).* All new surface infrastructure proposed by the proposed Action would be located within cleared areas and therefore there would be no direct impact on the remnant woodland associated with the proposed Action. Potential indirect impacts would be limited to the effects of mine-induced subsidence.

The impact of longwall subsidence on the overlying threatened ecological community was concluded to be negligible with the corollary being no impact on any threatened species using the habitat. Accordingly, it is unlikely that there will be a significant impact on EPBC Act listed threatened species and communities as a result of the proposed Action.

A survey of Bowmans Creek identified River Red Gums near to the completed Ashton Underground Mine longwall panels. Based on the findings of AGE (2023) and the lack of apparent impact from previous mining at the Ashton Underground Mine, the proposed Action is unlikely to impact GDEs.

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FIGURES

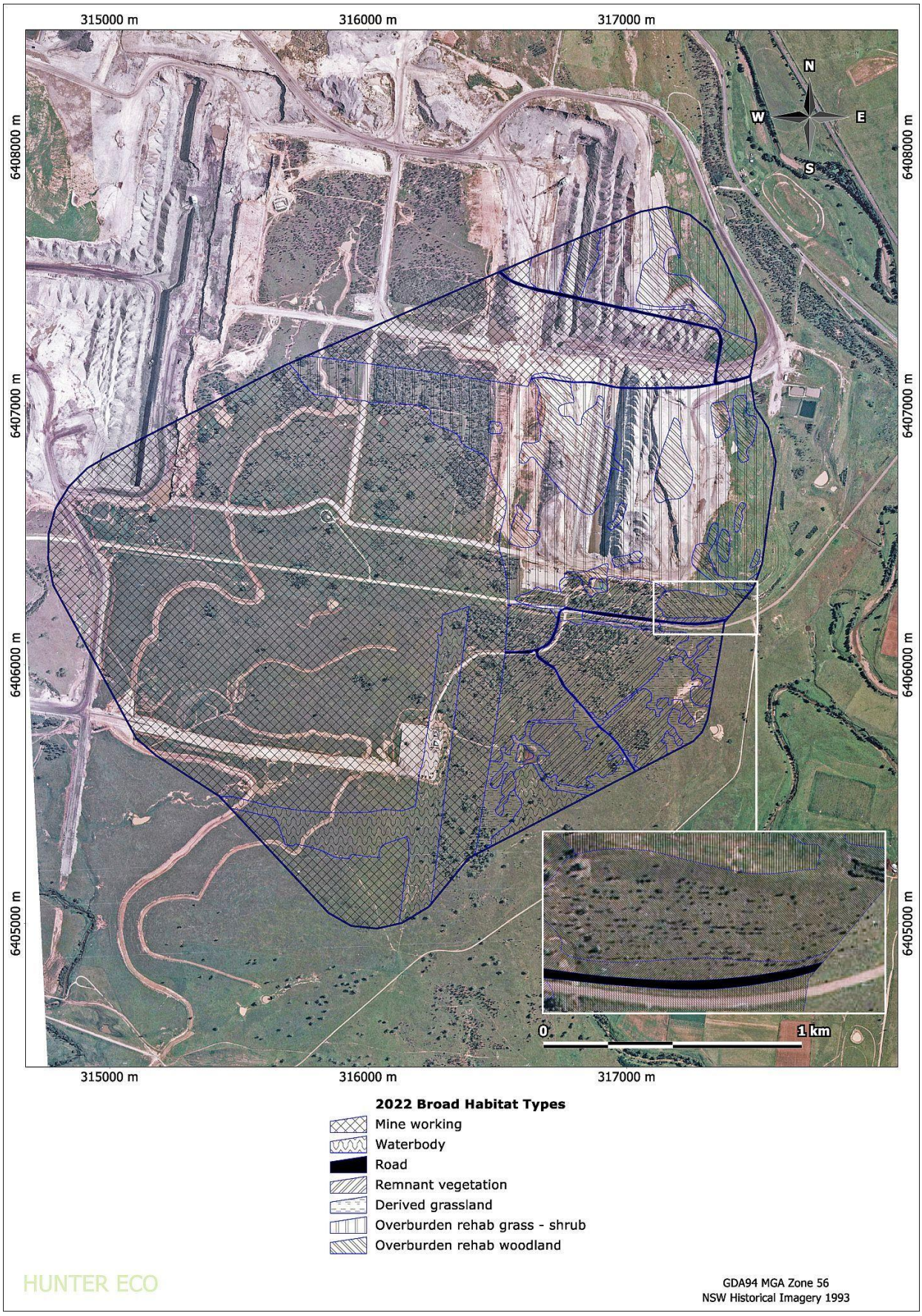

Figure 1 Generic habitat types overlaid on a 1993 aerial image

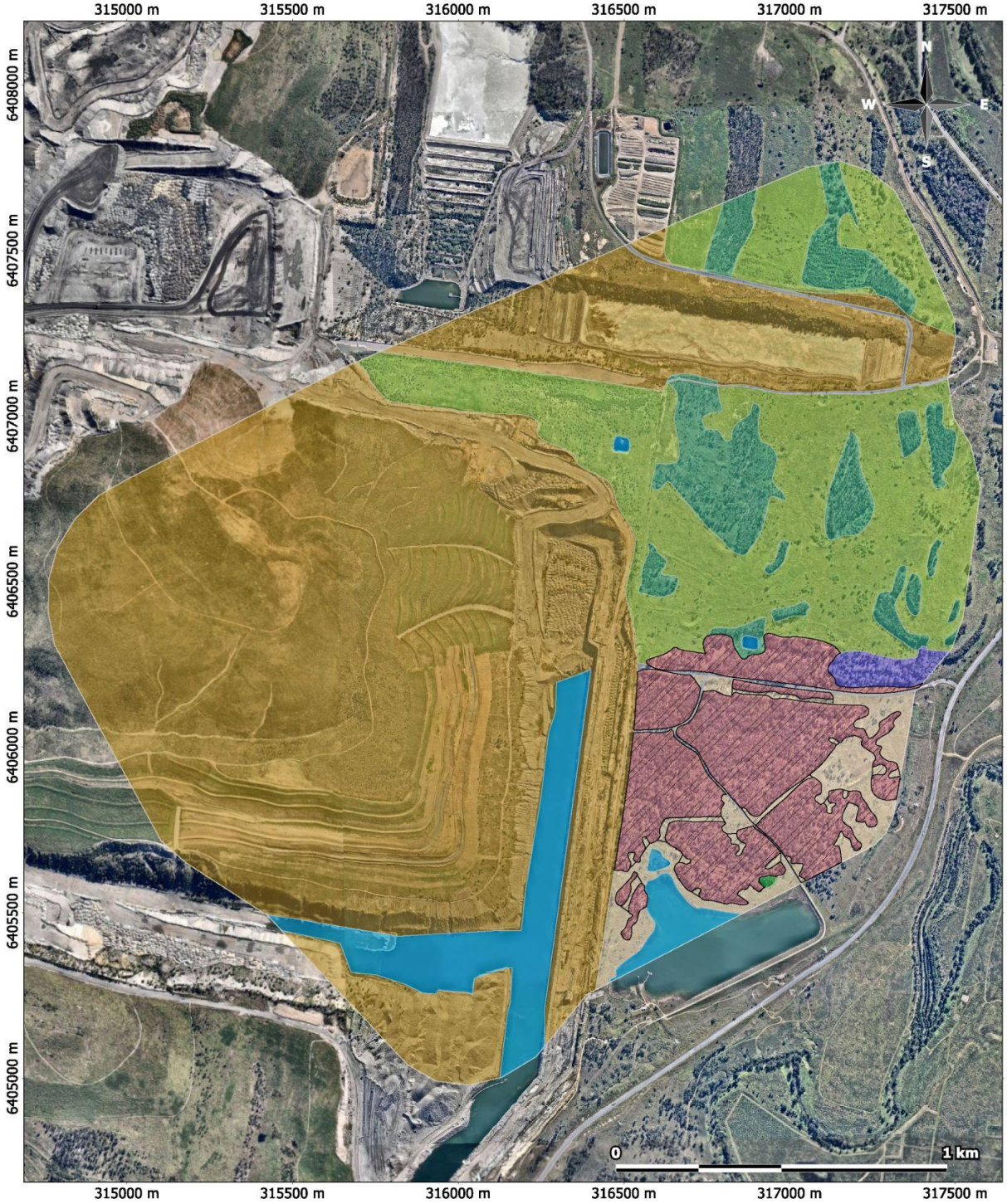

Figure 2 Vegetation map of the Study Area

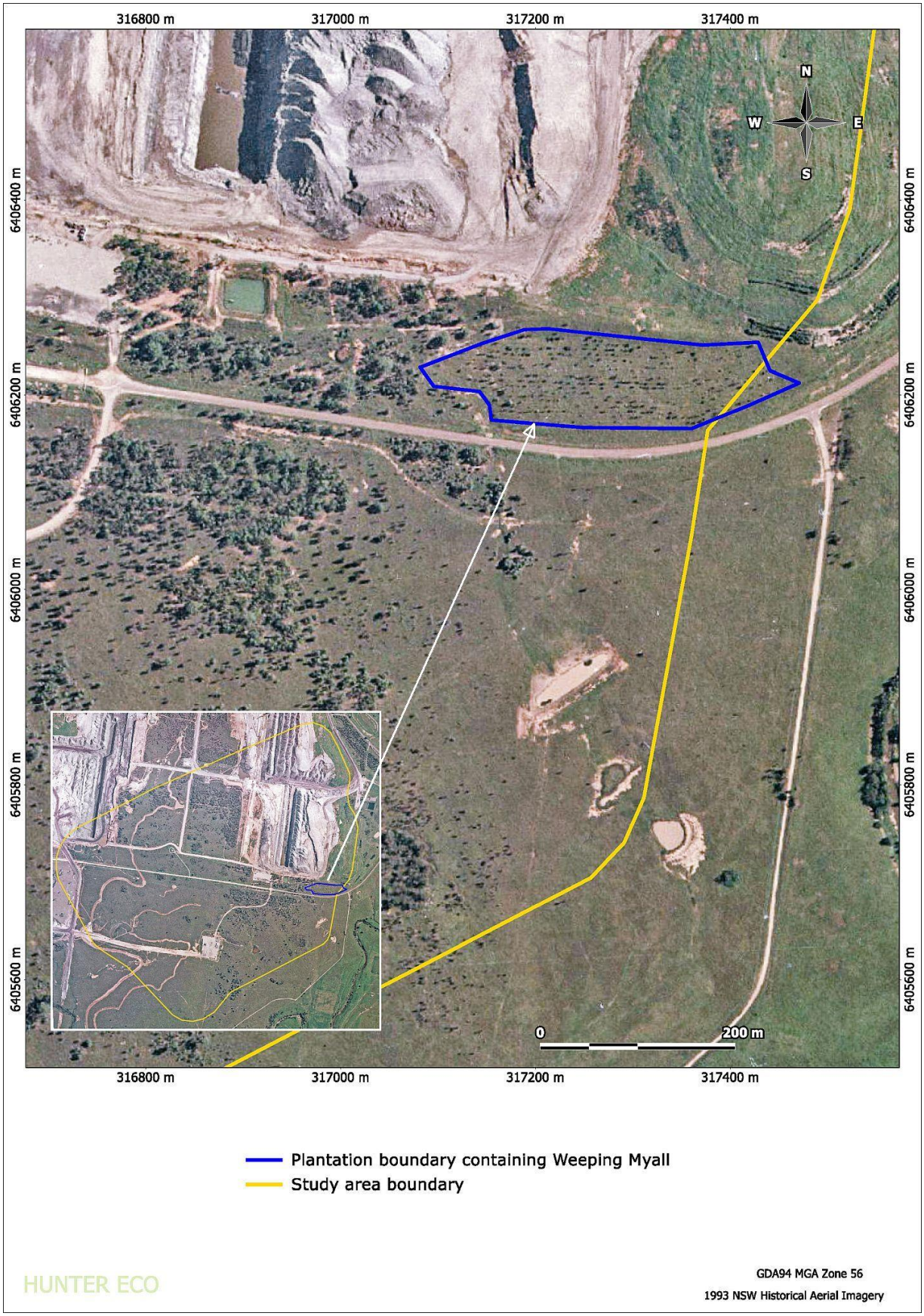

Figure 3 Historic aerial image (1993) showing the regeneration area containing Weeping Myall

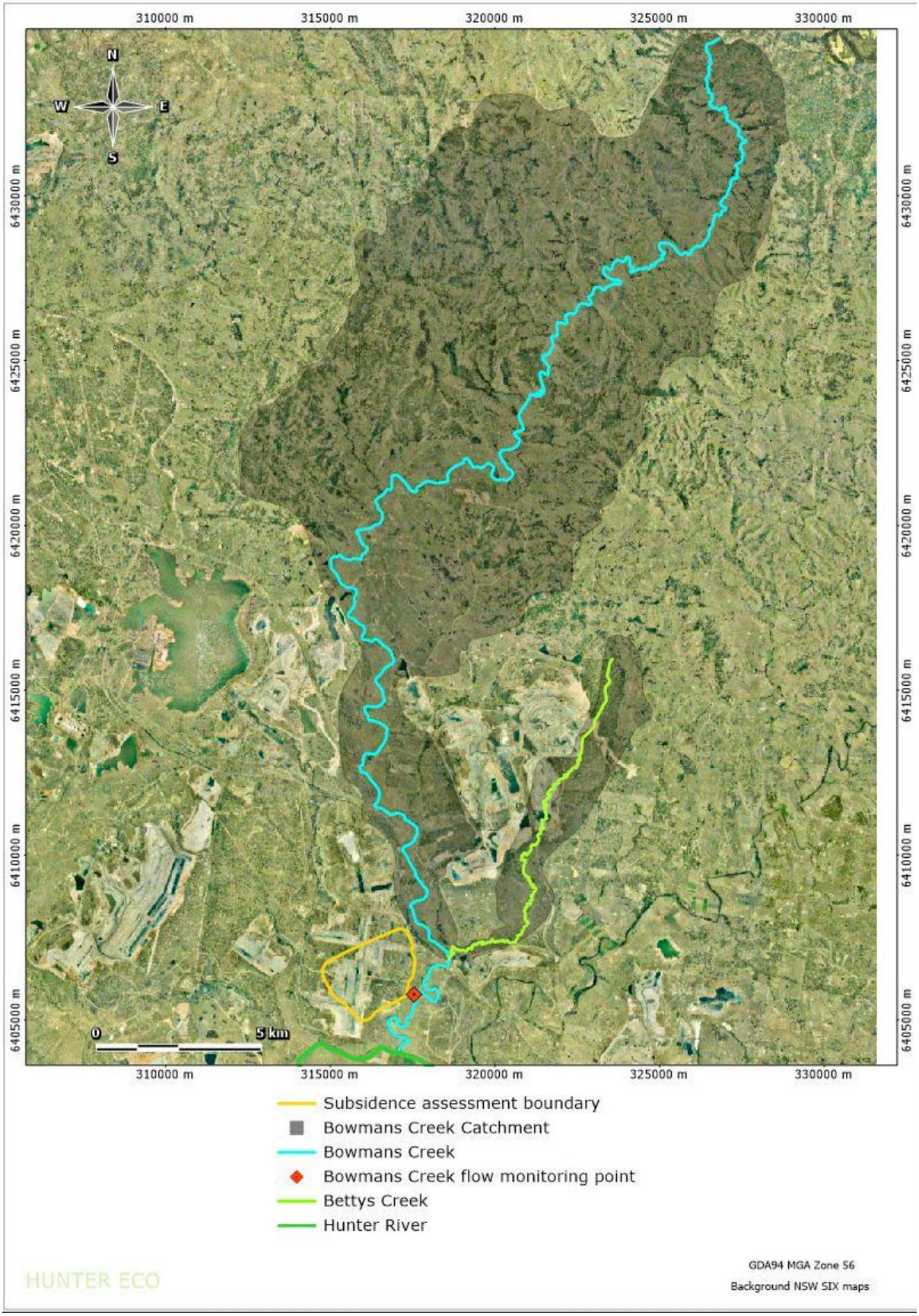

Figure 4 Bowmans Creek catchment

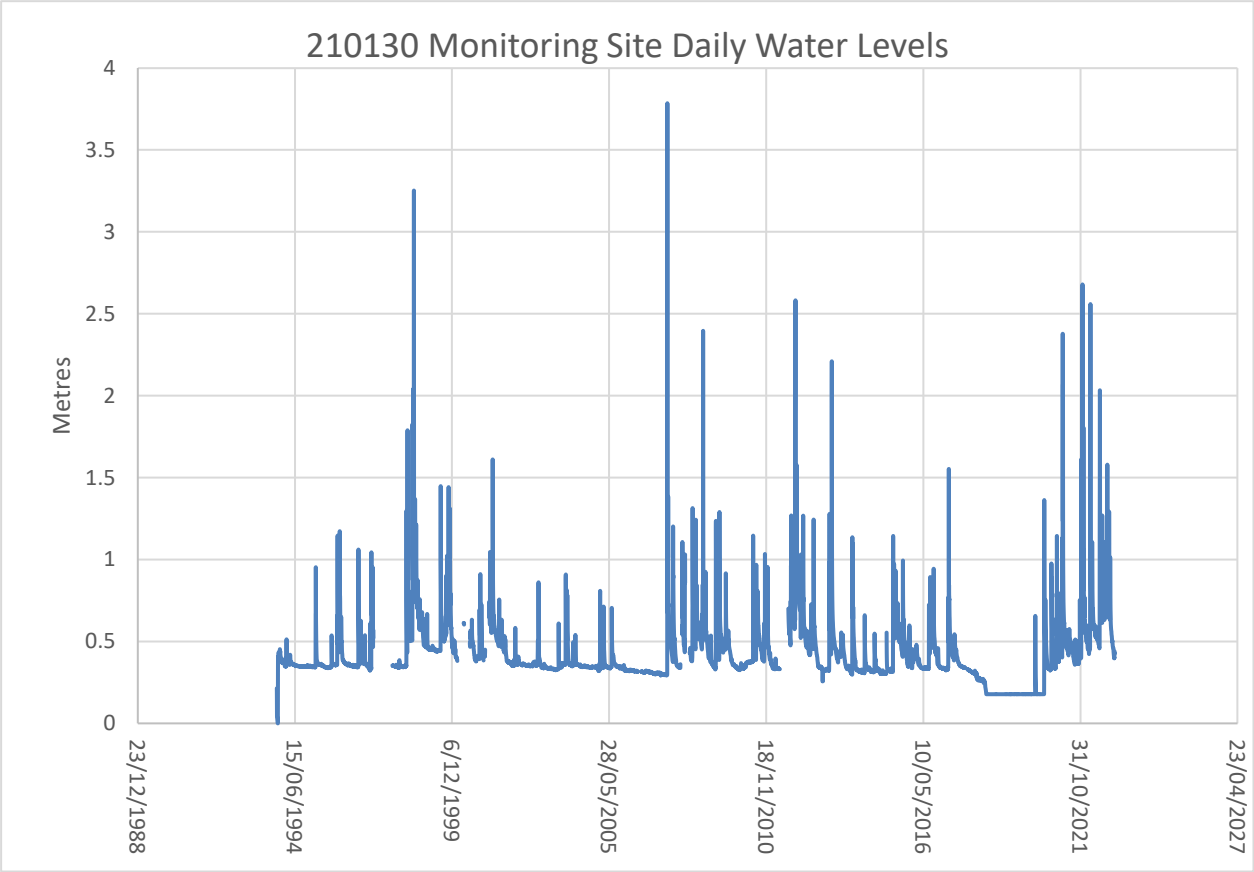

Figure 5 Bowmans Creek daily water levels (WaterNSW Gauging Station GS 210130)

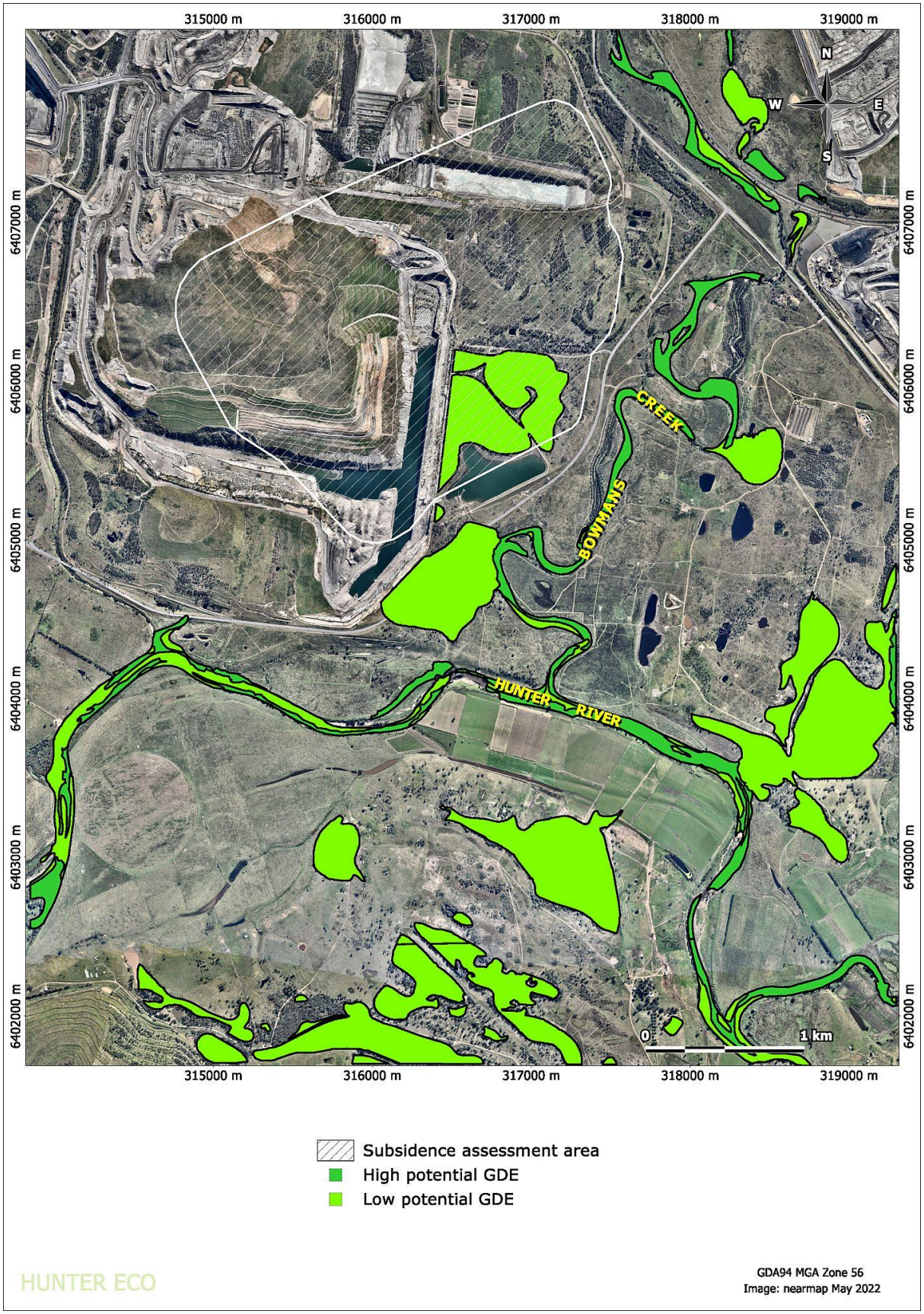

Figure 6 Potential Groundwater Dependent Ecosystems (Bureau of Meteorology, 2022)

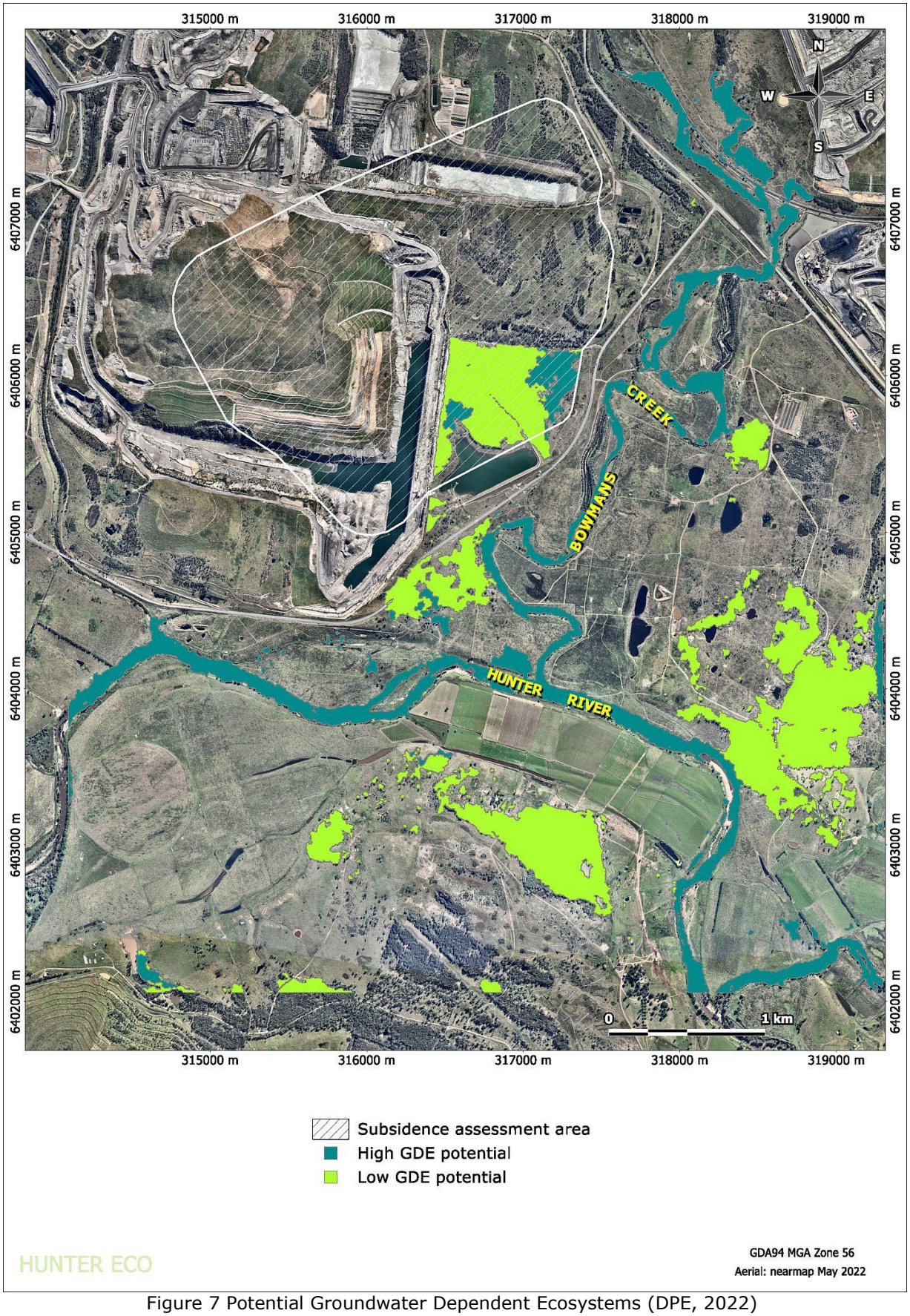

Figure 7 Potential Groundwater Dependent Ecosystems (DPE, 2022)

Figure 8 Pre-subsidence drainage over the Action area

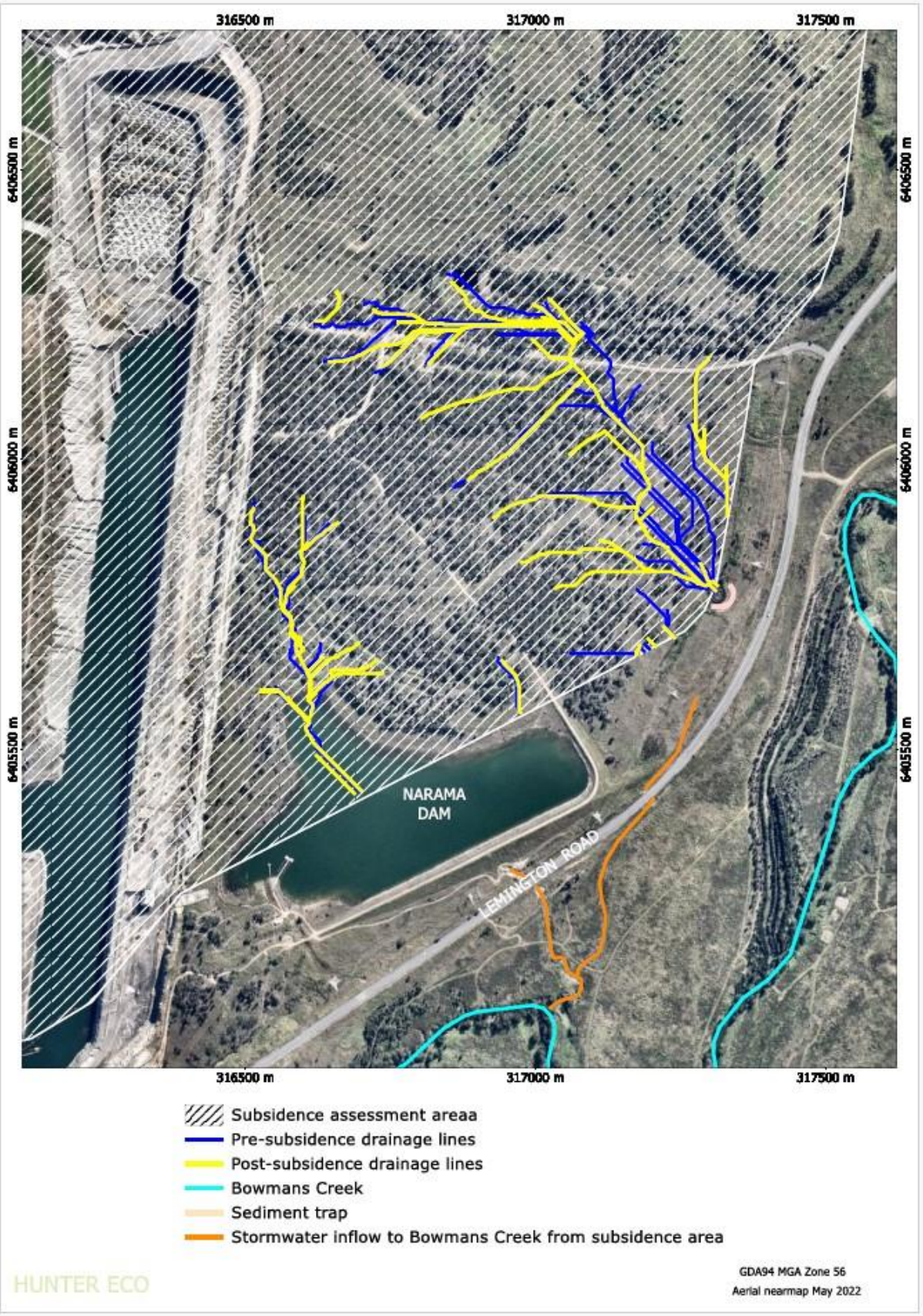

Figure 9 Post-subsidence drainage over the Action area

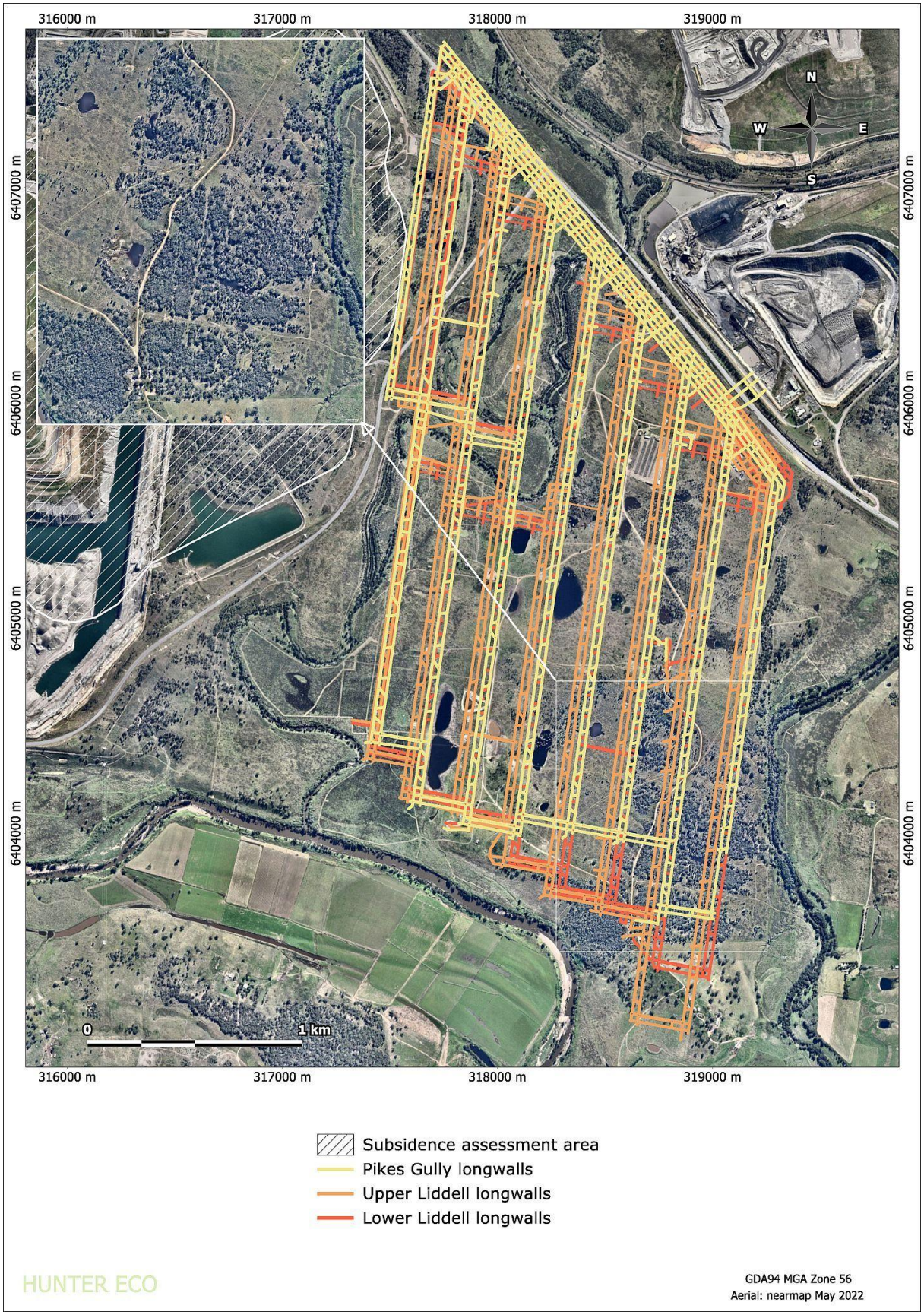

Figure 10 Ashton Underground Mine longwalls over remnant woodland

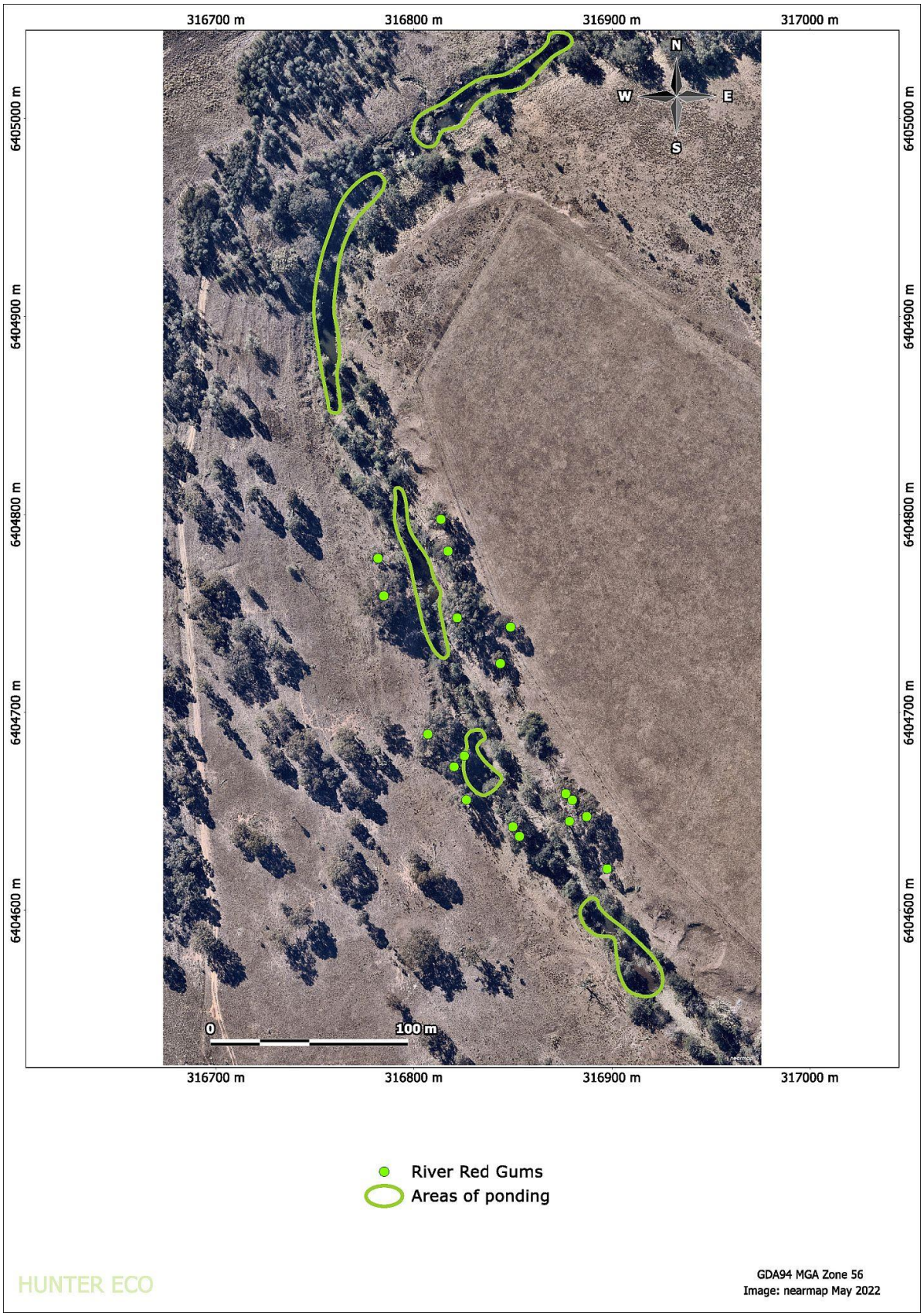

Figure 11 Areas of ponding in Bowmans Creek and surveyed River Red Gums

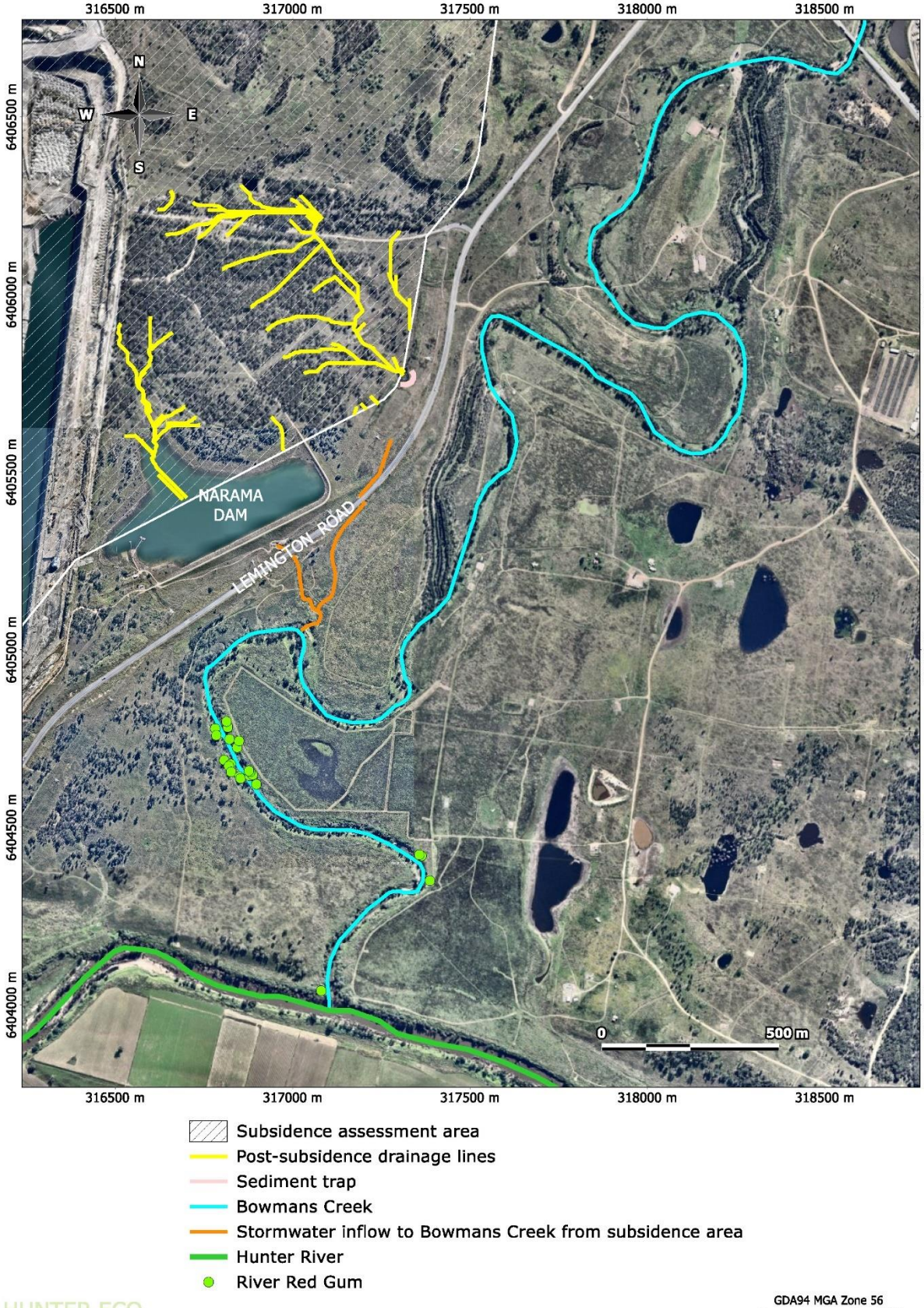

Figure 12 River Red Gums on Bowmans Creek

PLATES

Plate 1 River Red Gum on Bowmans Creek

Plate 2 A typical ponding area on Bowmans Creek showing River Oak and River Red Gum (centre left at water edge)

Plate 3 A typical riffle section on Bowmans creek showing River Oak, Giant Reed and Balloon Vine

Plate 4 Stormwater entry from the Action area into Bowmans Creek

APPENDIX 1 EPBC PROTECTED MATTERS THREATENED SPECIES REPORT

Scientific Name	Common Name	Presence	Status	Recorded[1]
Amphibians				
Litoria aurea	Green and Golden Bell Frog	Known	V	**P**
Litoria booroolongensis	Booroolong Frog	May	E	
Birds				
Lathamus discolor	Swift Parrot	Known	CE	**P**
Anthochaera phrygia	Regent Honeyeater	Known	CE	**P**
Hirundapus caudacutus	White-throated Needletail	Known	V	**P**
Erythrotriorchis radiatus	Red Goshawk	Known	V	**P**
Callocephalon fimbriatum	Gang-gang Cockatoo	Likely	E	**P**
Botaurus poiciloptilus	Australasian Bittern	Likely	E	
Rostratula australis	Australian Painted Snipe	Likely	E	
Grantiella picta	Painted Honeyeater	Likely	V	
Falco hypoleucos	Grey Falcon	Likely	V	
Calidris ferruginea	Curlew Sandpiper	May	CE	
Numenius madagascariensis	Eastern Curlew, Far Eastern Curlew	May	CE	
Pycnoptilus floccosus	Pilotbird	May	V	
Mammals				
Dasyurus maculatus maculatus (SE mainland population)	Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population)	Known	E	**P**
Phascolarctos cinereus (combined populations of QLD, NSW and the ACT)	Koala (combined populations of QLD, NSW and the ACT)	Known	E	**P**
Pseudomys novaehollandiae	New Holland Mouse, Pookila	Known	V	**P**
Chalinolobus dwyeri	Large-eared Pied Bat, Large Pied Bat	Known	V	**P**
Pteropus poliocephalus	Grey-headed Flying-fox	Known	V	**P**
Nyctophilus corbeni	Corben's Long-eared Bat, South-eastern Long-eared Bat	Likely	V	
Petaurus australis australis	Yellow-bellied Glider (south-eastern)	Likely	V	
Petauroides volans	Greater Glider	Likely	V	
Petrogale penicillata	Brush-tailed Rock-wallaby	Likely	V	**P**
Potorous tridactylus tridactylus	Long-nosed Potoroo (northern)	May	V	

Plants				
Eucalyptus glaucina	Slaty Red Gum	Known	V	**P**
Asperula asthenes	Trailing Woodruff	Known	V	**P**
Wollemia nobilis	Wollemi Pine	Likely	CE	
Cynanchum elegans	White-flowered Wax Plant	Likely	E	
Homoranthus darwinioides	null	Likely	V	
Thesium australe	Austral Toadflax, Toadflax	Likely	V	
Dichanthium setosum	bluegrass	Likely	V	
Euphrasia arguta	null	May	CE	
Prasophyllum sp. Wybong (C.Phelps ORG 5269)	a leek-orchid	May	CE	
Rhodamnia rubescens	Scrub Turpentine, Brown Malletwood	May	CE	
Pterostylis gibbosa	Illawarra Greenhood, Rufa Greenhood, Pouched Greenhood	May	E	
Rhizanthella slateri	Eastern Underground Orchid	May	E	
Olearia cordata	null	May	V	
Prostanthera cineolifera	null	May	V	
Androcalva procumbens	null	May	V	
Lepidium aschersonii	Spiny Pepper-cress	May	V	
Ozothamnus tesselatus	null	May	V	
Pomaderris brunnea	Rufous Pomaderris, Brown Pomaderris	May	V	
Reptiles				
Delma impar	Striped Legless Lizard, Striped Snake-lizard	Known	V	**P**
Aprasia parapulchella	Pink-tailed Worm-lizard, Pink-tailed Legless Lizard	Likely	V	

[1] Indicates species recorded in the BioNet Atlas within the Protected Matters search area.