

4. Existing environment

4.1 Physical environment

Parts of the Project Area are heavily disturbed due to mining activities occurring in the area for the last 40 years. Newlands Coal Mine has been transitioning to closure and rehabilitation since 2023, with over 5,000 ha of land already being rehabilitated, representing about over half of all land disturbed (total approximately 9,000 ha). To date, over 210 ha of rehabilitation has been certified by the Queensland Government.

Sections of the existing Cerito Creek diversion system have been historically modified for the original diversion works with Cerito Dam, engineered sections of channels and some concrete structures present creating vertical drops. Existing access tracks are present across the Project Area, with culverts or bed level creek crossings present.

Some parts of the Project Area have been subject to rehabilitation activities. Other historical land uses include clearing and cattle grazing with introduced pasture grasses dominant in many areas.

Remnant and regrowth vegetation also occur throughout the eastern areas of the Project Area, where clearing has not occurred within at least 15 years and predominantly woodland communities are present.

Cerito Creek flows in the valleys of multiple elevations ranging from 330 to 380 m AHD. The terrain to the east of Newlands Coal Mine and around Cerito Creek is gently undulating, typical of the region.

The geology of the area includes a Triassic age Rewan Group, an arenite-mudrock dominant rock. It is summarised by lithic to lithic pebbly sandstone, green to reddish brown mudstone and minor volcanolithic conglomerate base (QLD Globe, 2025). Additional detail on geology is provided in Section 4.5.

The Project Area contains a mosaic of soils including dermosols, sodosols, vertosols, chromosols and rudosols. Vertosols are the most common soil in Queensland and are known for their high soil fertility and high water holding capacity (Queensland Government 2025). Chromosols and sodosols are texture contrast soils, with sodosol containing a high sodium concentration in the subsoil (Queensland Government 2025). Rudosols are known for low fertility and low water holding capacity (Queensland Government 2025).

Newlands Nature Refuge, established in November 2007, is located directly east of Newlands Coal Mine Main Deposit, containing upstream reaches of Cerito Creek (shown on Figure 1.2 and Figure 1.3 of this report). The Newlands Nature Refuge was established to contain offset areas, including offsets for significant impacts of the Newlands Coal Extension Project (EPBC No. 2011/5968) and Wollombi Open Cut Coal Mine - Suttor Creek ML4761 Extension (EPBC No. 2005/2015).

4.2 Flora and fauna

4.2.1 Vegetation communities

4.2.1.1 Regional Ecosystems

Within the study area, the Queensland Government regulated vegetation management map identified areas of:

- Category B: Remnant vegetation
- Category C: High-value regrowth vegetation
- Category X: Non-remnant vegetation or cleared land.

Areas of field verified vegetation communities within the survey area that were classified as endangered, of concern or least concern REs under the VM Act (Qld) are listed in Table 4.1. Field-verified REs are shown on Figure 4.1.

Table 4.1 VM Act (Qld) regional ecosystems field verified within the survey area

RE code	Vegetation description	VM Act (Qld) status	EPBC Act (Cth) status	Location
11.3.3a	<i>Melaleuca bracteata</i> (black tea-tree) woodland on alluvial plains (remnant)	Of concern	–	One area on western side of Lake Austin channel
11.3.4	<i>Eucalyptus tereticornis</i> (blue gum) woodland with <i>Blakella</i> and <i>Eucalyptus spp.</i> on alluvial plains (remnant)	Of concern	–	Small areas in central and northern Project Area
11.3.4a	<i>Blakella tessellaris</i> (Moreton Bay ash) woodland on alluvial sandridges to elevated levees (remnant)	Of concern	–	One area on northern side of mine access road
11.3.11	Semi-evergreen vine thicket on alluvial plains (remnant)	Endangered	Endangered	One area in northern Project Area
11.3.25	Blue gum woodland fringing drainage lines on sandy soils (remnant and regrowth)	Least concern	–	Areas at Cerito Dam and northern Project Area
11.3.30	<i>Eucalyptus crebra</i> (narrow-leaved ironbark) woodland on Cainozoic alluvial plains (remnant)	Least concern	–	One area along eastern diversion channel
11.8.5	<i>Eucalyptus orgadophila</i> (Mountain coolibah) open woodland on Cainozoic igneous rocks (remnant)	Least concern	–	Areas in central and southern Project Area
11.9.1	<i>Acacia harpophylla</i> (brigalow) woodland to open forest on fine-grained sedimentary rocks (regrowth)	Endangered	Endangered	Small areas in northern and southern Project Area
11.9.5	Brigalow open forest on fine-grained sedimentary rocks (remnant and regrowth)	Endangered	Endangered	Areas across the Project Area
11.9.9	Narrow-leaved ironbark woodland on fine-grained sedimentary rocks (remnant and regrowth)	Least concern	–	Areas across the Project Area
11.12.7	Narrow-leaved ironbark woodland with patches of semi-evergreen vine thicket on boulder-strewn hillsides	Least concern	–	One area in central Project Area

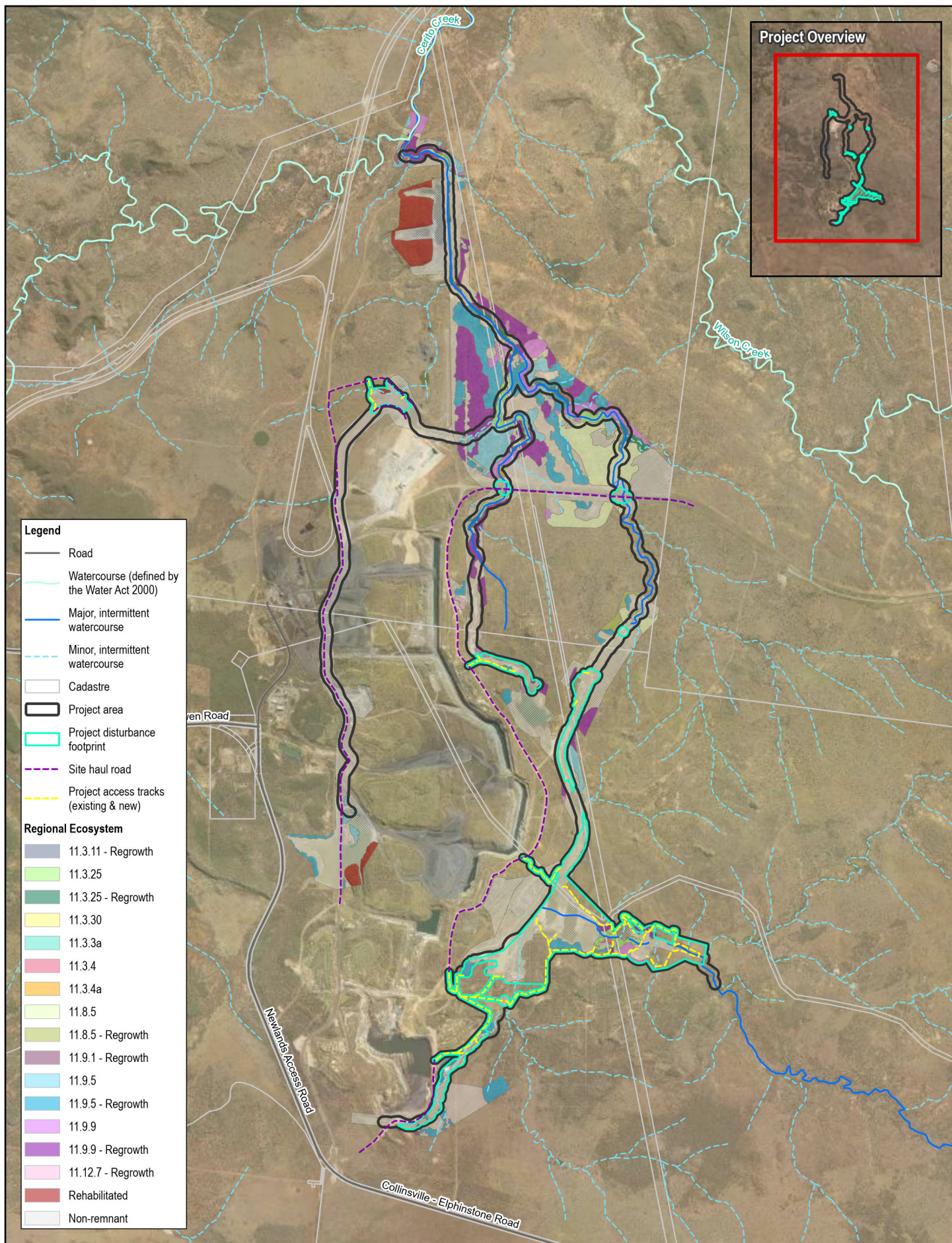
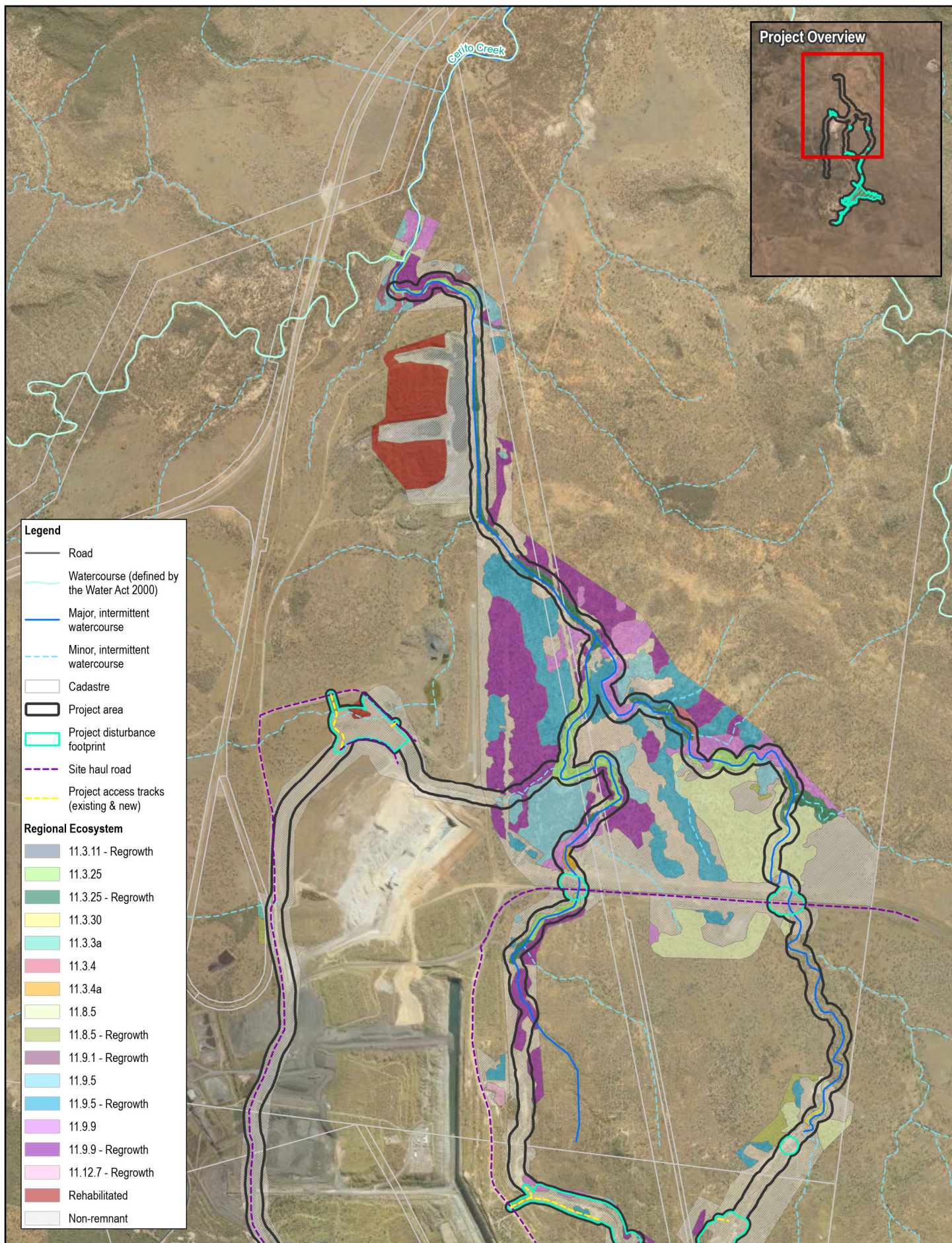
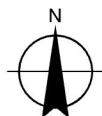


FIGURE 4.1



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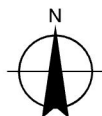
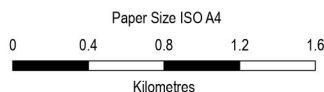
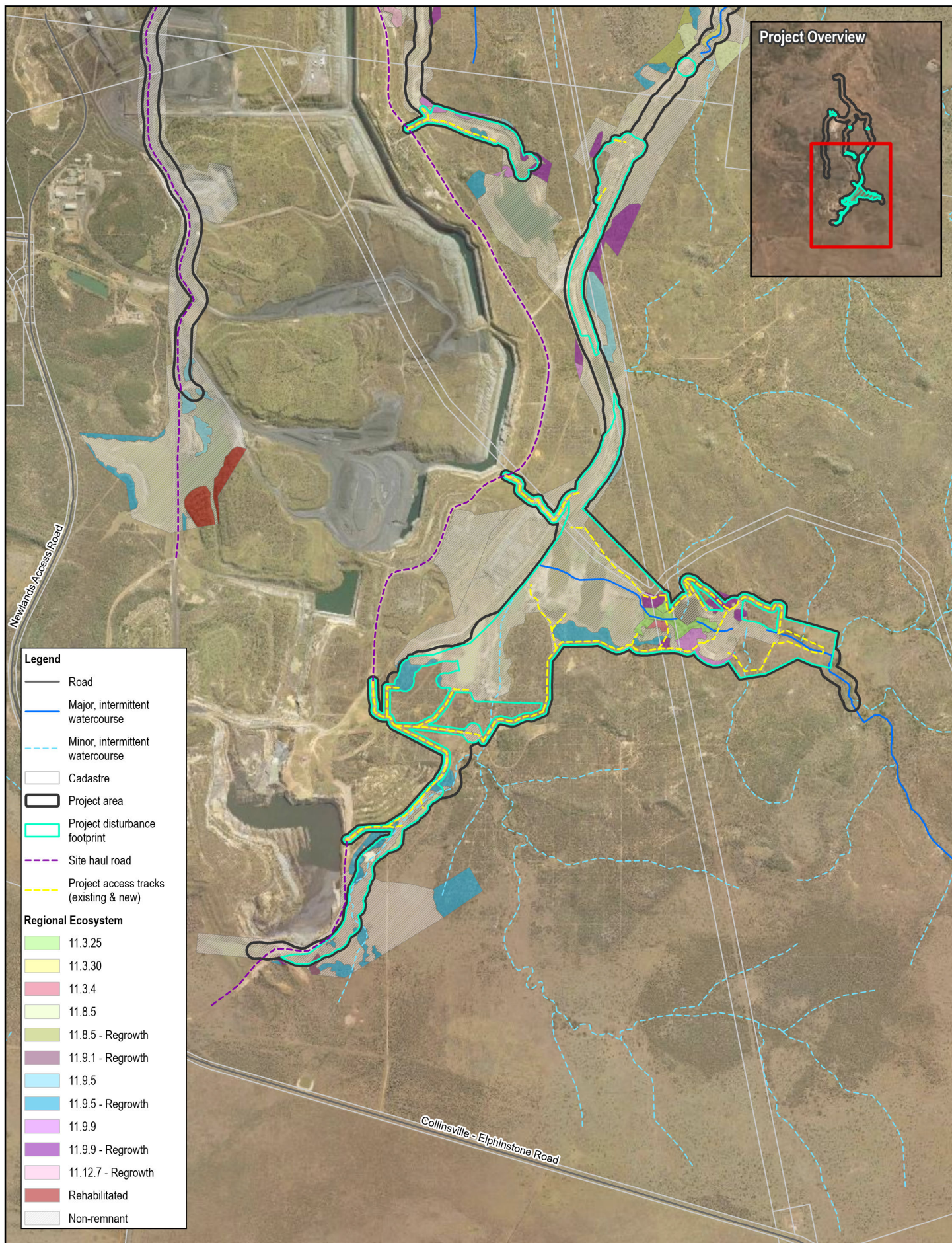


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Field-verified Regional Ecosystem
mapping

Project No. 12611481
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FIGURE 4.1a



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Field-verified Regional Ecosystem
mapping

FIGURE 4.1b

4.2.2 Threatened ecological communities

TECs are listed under the EPBC Act (Cth) as critically endangered, endangered or vulnerable.

The PMST search (Appendix C) identified the potential presence of the following TECs within the study area:

- Poplar Box Grassy Woodland on Alluvial Plains – endangered
- Natural Grasslands of the Queensland Central Highlands and Northern Fitzroy Basin (Natural Grasslands TEC) – endangered
- Brigalow (*Acacia harpophylla* dominant and co-dominant) ecological community (Brigalow TEC) – endangered
- Semi-Evergreen Vine Thickets of the Brigalow Belt (North and South) and Nandewar Bioregions (Semi-Evergreen Vine Thicket TEC) – endangered.

The Poplar Box Grassy Woodland on Alluvial Plains is associated with REs 11.3.2, 11.3.17, 11.4.7, 11.4.12, 12.3.10. None of these REs or associated vegetation communities are mapped within the study area, therefore the Poplar Box Grassy Woodland on Alluvial Plains TEC was assessed as being unlikely to occur.

The Natural Grasslands TEC is associated with REs 11.3.21, 11.4.11, 11.4.4, 11.8.11, 11.9.3, 11.9.12 and 11.11.17. One patch of RE 11.8.11 was recorded in association with locations of the threatened flora species king blue-grass (*Dichanthium queenslandicum*) in the southern extent of the Project Area. However, due to its small size (0.4 ha), it falls below the minimum patch threshold requirement to be considered the Natural Grasslands TEC. Another patch of pasture grassland included some scattered tussocks of native grasses; however, their abundance was insufficient to be classified as native grassland (or the RE 11.8.11). The Natural Grasslands TEC was therefore assessed as being unlikely to occur in the Project Area.

The Brigalow TEC is associated with REs 11.3.1, 11.4.3, 11.4.7, 11.4.8, 11.4.9, 11.4.10, 11.5.16, 11.9.1, 11.9.5, 11.9.6, 11.11.14 and 11.12.21 (relevant to the Brigalow Belt Bioregion). Areas of RE 11.9.5 are mapped within the study area. Regrowth areas of RE 11.9.1 have also been recorded during field surveys. The Brigalow TEC was assessed as known to occur in the Project Area.

The Semi-Evergreen Vine Thicket TEC is associated with REs 11.2.3, 11.3.11, 11.4.1, 11.5.15, 11.8.3, 11.8.6, 11.8.13, 11.9.4, 11.9.8, and 11.11.18. A patch of RE 11.3.11 was confirmed present during field surveys, which comprised the Semi-Evergreen Vine Thicket TEC, resulting in this TEC being assessed as known to occur for the Project Area.

The two TECs assessed as known to occur within the Project Area (being Brigalow TEC and Semi-Evergreen Vine Thicket TEC) are discussed further in Section 6.1.

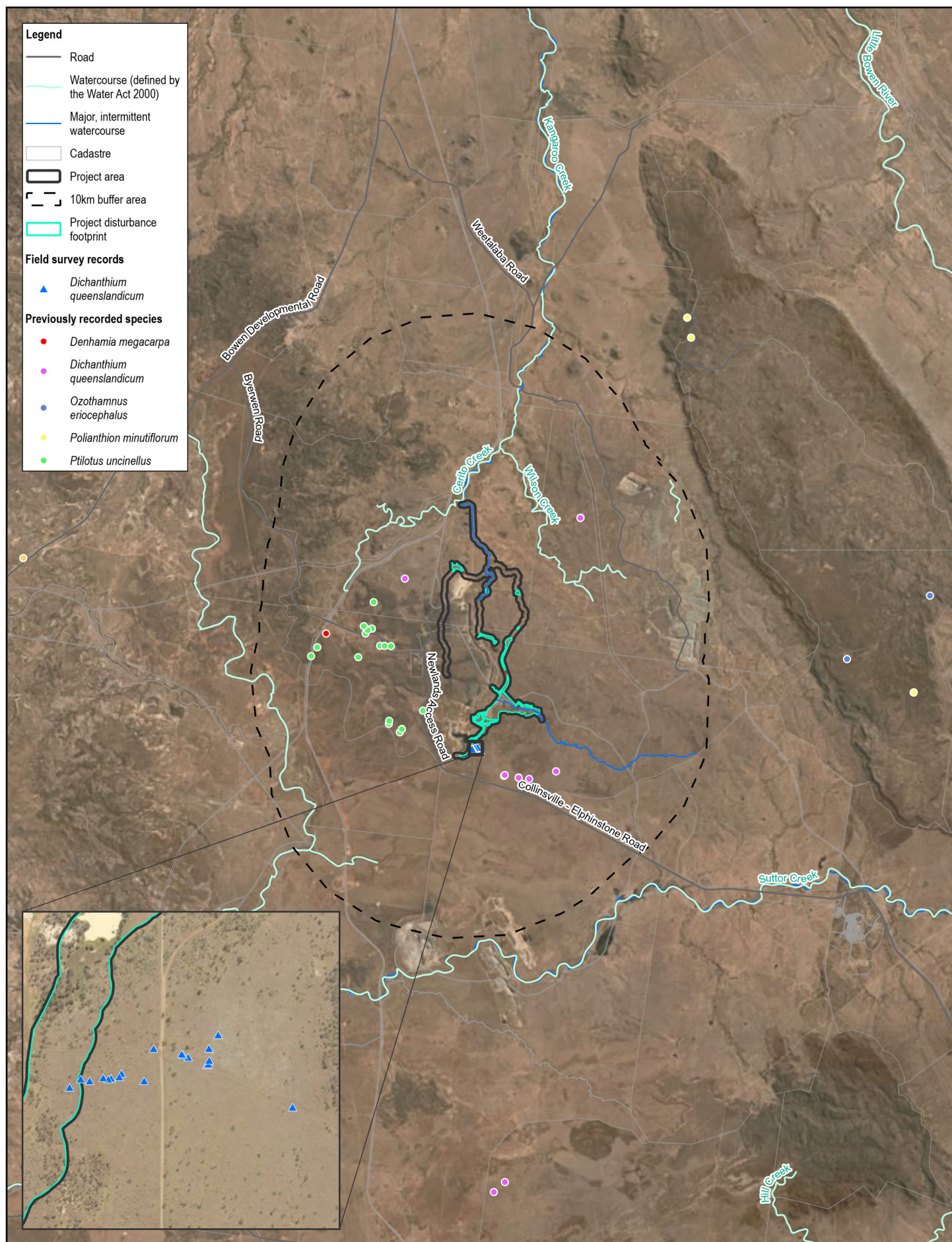
4.2.3 Threatened flora

The PMST search (dated September 2025 and provided in Appendix C) identified seven conservation significant flora species that have the potential to occur within 10 km of the Project Area based on bioclimatic modelling, knowledge of species' distributions and habitat preferences, as listed in Table 4.2. Threatened flora species records are shown on Figure 4.2.

Table 4.2 Threatened flora potentially occurring with the Project Area

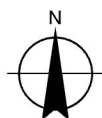
Species name	Common name	EPBC Act* status	PMST presence	Historical records within 10 km of the Project Area
<i>Denhamia megacarpa</i>	Large-fruited denhamia	E	Species or species habitat known to occur within study area	2005: 4.7 km west of the Project disturbance footprint
<i>Dichanthium queenslandicum</i>	King blue-grass	E	Species or species habitat known to occur within study area	– 2025: Within the Project Area, adjacent to the Project disturbance footprint, during Project field surveys – 2015: 1.6 km south of the Project disturbance footprint (Wildnet)

Species name	Common name	EPBC Act* status	PMST presence	Historical records within 10 km of the Project Area
				– 2012: 3.3 km east of the Project disturbance footprint (Wildnet) – 2012: 1.7 km south of the Project disturbance footprint (Wildnet) – 2008: 400 m west of the Project disturbance footprint (Wildnet)
<i>Dichanthium setosum</i>	Bluegrass	V	Species or species habitat likely to occur within study area	No historical records within 10 km.
<i>Eucalyptus raveretiana</i>	Black ironbox	V	Species or species habitat likely to occur within study area	No historical records within 10 km.
<i>Polianthion minutiflorum</i>	–	V	Species or species habitat likely to occur within study area	No historical records within 10 km.
<i>Ptilotus uncinellus</i>	–	E	Species or species habitat known to occur within study area	– 2009: 1.2 km west of the Project disturbance footprint (Wildnet) – 2009: 500 m west of the Project disturbance footprint (Wildnet) (2 records) – 2009: 2.4 km west of the Project disturbance footprint (Wildnet) (2 records) – 2011: 2.1 km west of the Project disturbance footprint (Wildnet) – 2011: Within the south-west portion of the Project disturbance footprint (Wildnet) – 2011: 3 km west of the Project disturbance footprint (Wildnet) – 2011: 2.6 km west of the Project disturbance footprint (Wildnet) – 2011: 1.7 km west of the Project disturbance footprint (Wildnet) – 2011: 1.5 km west of the Project disturbance footprint (Wildnet) – 2011: 1.1 km west of the Project disturbance footprint (Wildnet) – 2012: 5.2 km west of the Project disturbance footprint (Wildnet) – 2019: 5.5 km west of the Project disturbance footprint (Wildnet)
<i>Samadera bidwillii</i>	Quassia	V	Species or species habitat may occur within study area	No historical records within 10 km.
*Key: V – Vulnerable, E – Endangered				



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Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
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Threatened flora species records

FIGURE 4.2

4.2.4 Fauna habitats

The following six major habitat types have been identified within the survey area during field surveys:

- Eucalypt woodlands along main creeks
- Eucalypt dry woodlands
- Acacia woodland to open forest
- Melaleuca woodlands on alluvial plains
- Semi-evergreen vine thicket
- Pasture grassland.

A description of each major habitat is provided in Table 4.3 and the habitat mapping is shown on Figure 4.3.

Table 4.3 *Description of major habitat types*

Habitat type	Description	Representative photograph
Eucalypt woodlands along main creeks	– Regrowth and remnant woodlands of Queensland blue gum along creek edges and/or floodplains. Other canopy and sub-canopy species included Moreton Bay ash, <i>Casuarina cunninghamiana</i> (river sheoak), swamp box and black tea tree. – The shrub layer within this habitat type is generally sparse but, where present, included black tea tree, <i>Cassia brewsteri</i> (Leichhardt bean) and <i>Ficus coronata</i> (sandpaper fig). The ground layer is typically dominated by <i>Megathyrsus maximus</i> (Guinea grass). – Associated with RE 11.3.4, 11.3.4a and 11.3.25. – Shelter habitat in the form of large hollow-bearing trees containing small and large hollows, leaf litter and logs, creek banks, dense grass cover. The hollows provide roosting and breeding habitat for a diverse range of bird and arboreal mammals as well as micro-bat species. – Large hollow-bearing trees appeared to be most prevalent within this habitat through the northern Project Area (RE 11.3.4 and 11.3.25). – Refuge habitat and riparian corridors that provide connectivity within the landscape for arboreal mammals, such as koala, which has potential to utilise these areas, and greater glider, which was observed. – Logs, leaf litter and grass cover provide refuge and foraging habitat for amphibians, reptiles and ground-dwelling mammals. – Moderate to high levels of erosion were observed in some sections along the streams. Several invasive species were observed within this habitat type, including introduced parthenium (<i>Parthenium hysterophorus</i>) and rubber vine (<i>Cryptostegia grandiflora</i>).	

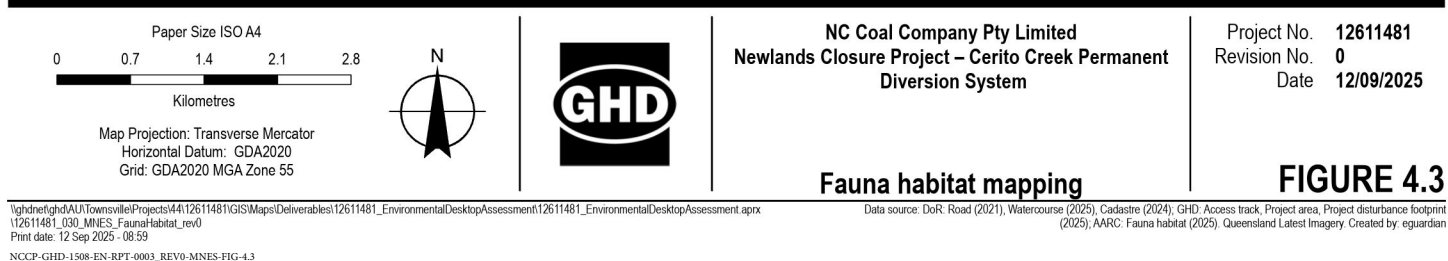
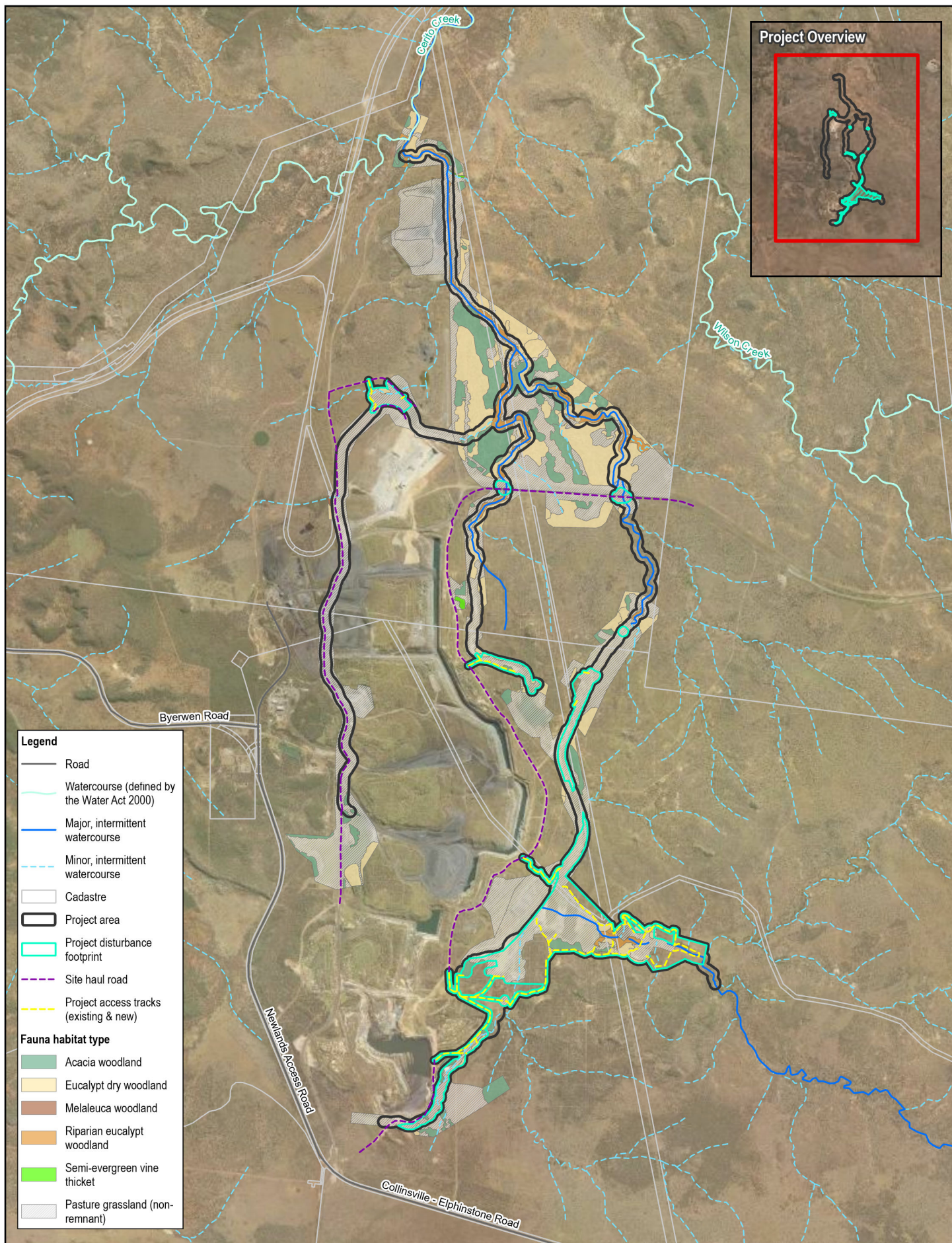
Habitat type	Description	Representative photograph
Eucalypt dry woodlands	– Regrowth and remnant woodlands generally dominated by narrow-leaved ironbark or mountain coolibah with <i>Corymbia erythrophloia</i> (red bloodwood) and/or <i>Blakella dallachiana</i> (Dallachy's gum) as a sub-canopy or associated canopy species. – The shrub layer within this habitat was generally sparse, but often included <i>Santalum lanceolatum</i> (native olive), <i>Lysiphyllum carronii</i> (ebony tree), Leichhardt bean and <i>Carissa ovata</i> (currant bush). The groundcover was generally dense and included a mix of native and exotic pasture grasses but was often dominated by <i>Bothriochloa pertusa</i> (Indian bluegrass). – Associated with RE 11.8.5 and 11.9.9. – Variety of shelter, including tree hollows, logs, leaf litter and dense grass cover, providing different degrees of habitat for the koala and the greater glider, containing a wide variety of food and shelter tree species. – Suitable shelter and foraging habitat for a range of amphibians, reptiles, woodland bird species, ground-dwelling mammals, and arboreal mammals.	

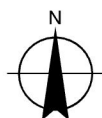
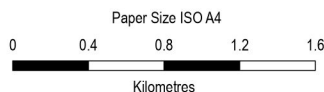
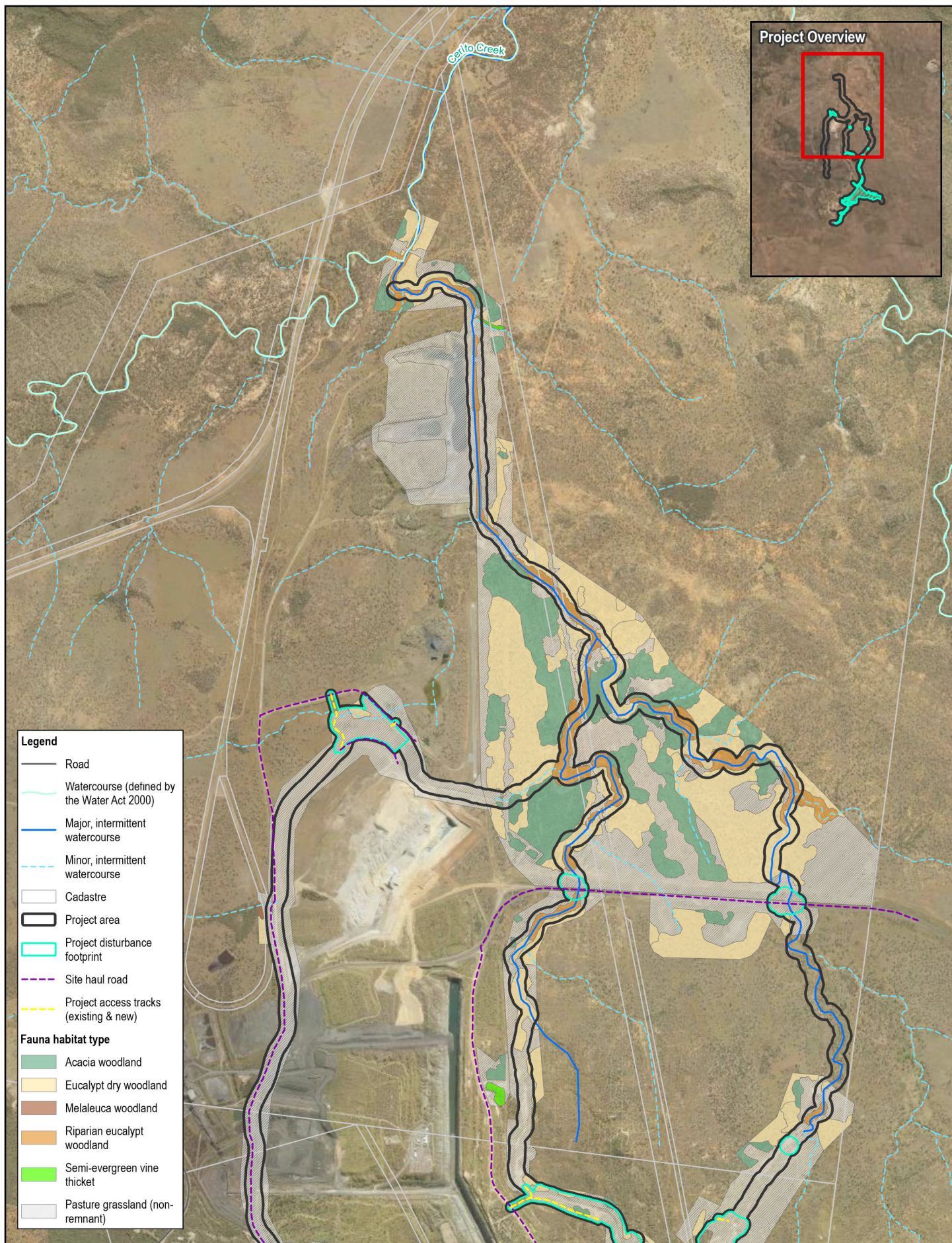
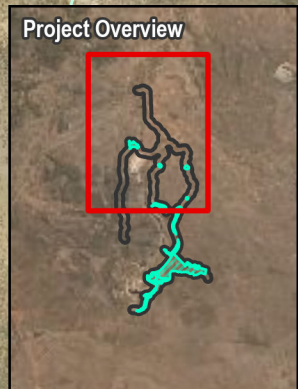
Habitat type	Description	Representative photograph
Acacia woodland to open forest	– Brigalow woodland. – <i>Terminalia oblongata</i> (yellowwood), <i>Geijera parviflora</i> (wilga) and <i>Eremophila mitchellii</i> (false sandalwood) were sometimes present as low tree layer or tall shrub layer. Currant bush was common as a short shrub. Live groundcover ranged from being dense, often dominated by <i>Cenchrus ciliaris</i> (buffel grass), to very open in patches. – Associated with RE 11.9.1 and 11.9.5. – Large amounts of coarse woody debris from fallen trees, providing shelter for amphibians, small reptiles and ground-dwelling mammals. – Suitable foraging and nesting habitat for a range of woodland birds but generally lack hollow-bearing trees and koala foraging trees. – Occasional gilgai and cracking clay soil was observed during surveys (limited to two areas, of which one is shown in the below photo, including some with standing water at the time of survey), indicating that some habitat would be favourable for the threatened species ornamental snake. These areas generally provide shelter habitat as woody debris, however, the presence of the ornamental snake depends on the availability of its diet, which is comprised almost exclusively of frogs, indicating that majority of this habitat type is less likely to be of high quality habitat for this species. – Contains open areas that are potential foraging and/or breeding habitat for squatter pigeon.	

Habitat type	Description	Representative photograph
Melaleuca woodlands on alluvial plains	– Associated with RE 11.3.3a – restricted to one area west of the Project Area. – Low, dense canopy of black tea-tree, as well as a dense groundcover of <i>Alternanthera denticulata</i> (joyweed). – Lacked habitat features such as woody debris, hollows and decorticated bark. – The dense canopy and groundcover provide a high degree of shade and shelter that is likely to be utilised by a variety of small mammals, reptiles and amphibians for shelter, as well as large mammals such as eastern grey kangaroo during warm periods. – No suitable habitat for any of the threatened species with potential to occur.	

Habitat type	Description	Representative photograph
Semi-evergreen vine thicket	– Restricted to the edge of one creek in northern Project Area and one hillside in central Project Area: • Dense canopy and subcanopy along the creek with a variety of species consistent with RE 11.3.11 (top photograph). • Dense continuous shrub cover on a hillside with a variety of canopy and shrub species consistent with RE 11.12.7 (below photograph). – Diverse range of flora provided a variety of potential food sources for birds and other wildlife. – The creek line escarpments and large rocks on the hill provided small crevices that can be utilised as potential shelter and open sunning positions for small mammals and reptiles. – Patches of dense low shrub cover as well as open groundcover with more leaf litter along the creek compared to most areas of other major habitat types. Dense low shrubs, such as currant bush, provided shelter habitat for small mammals, reptiles and amphibians. – The dense canopy and shelter from the escarpments also created a potential cooler microclimate effect that may be utilised by fauna in the area during warm periods.	 

Habitat type	Description	Representative photograph
Pasture grassland	– Non-remnant vegetation characterised by pastureland, either cleared or containing returning vegetation which generally borders patches of remnant vegetation. – Trees were typically absent or sparse within this habitat type, with only isolated <i>Acacia</i> spp. or <i>Eucalyptus</i> spp. saplings occurring throughout the cleared areas. – Habitat value is limited compared to the other major habitat types. – Open areas provide hunting habitat for birds of prey and foraging habitat for ground-dwelling mammals. – Dense grasses provide shelter habitat for small mammals, reptiles and amphibians.	





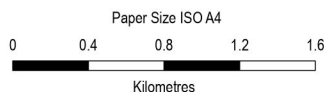
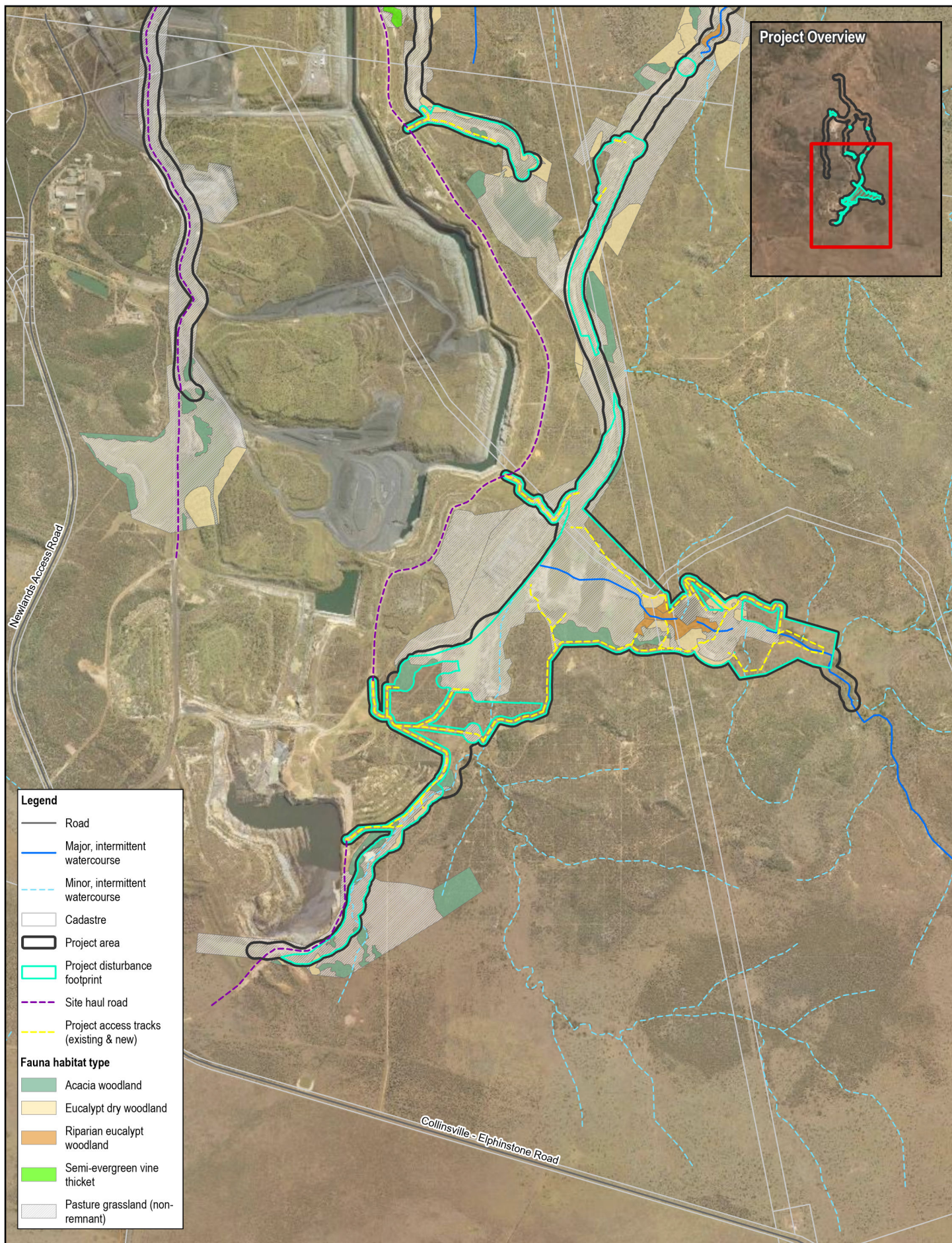
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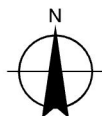
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Fauna habitat mapping

FIGURE 4.3a



Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 55



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Fauna habitat mapping

FIGURE 4.3b

4.2.5 Threatened fauna

The field surveys identified two threatened fauna species within the survey area, as described in Table 4.4 and shown on Figure 4.4.

Table 4.4 Threatened fauna species recorded during surveys

Species	EPBC Act* status	Number of individuals	Method	Location
March 2024 survey				
Greater glider (southern and central) <i>Petauroides volans</i>	E	One	Spotlight sighting	Central Project Area
Squatter pigeon (southern) <i>Geophaps scripta scripta</i>	V	Five (at three locations)	Incidental sightings	Central Project Area
May 2024 survey				
Greater glider (southern and central) <i>Petauroides volans</i>	E	Seven (at seven locations)	Spotlight and spotlight transect sightings	Northern and central Project Area
Squatter pigeon (southern) <i>Geophaps scripta scripta</i>	V	28 (at six locations)	Incidental sightings	Western, central and southern Project Area
June 2024 survey				
Squatter pigeon (southern) <i>Geophaps scripta scripta</i>	V	Eight (at five locations)	Incidental sightings	Northern, central and southern Project Area
March 2025 survey				
Squatter pigeon (southern) <i>Geophaps scripta scripta</i>	V	Eight (at four locations)	Bird survey and incidental sightings	Central Project Area

*Key: V – Vulnerable, E – Endangered

The PMST search (dated September 2025 and provided in Appendix C) identified 20 threatened fauna species that have the potential to occur within 10 km of the Project Area based on bioclimatic modelling, knowledge of species' distributions and habitat preferences, as listed in Table 4.5. One additional species was also recorded on the WildNet database. Threatened fauna species records within 10 to 20 km of the Project Area are shown on Figure 4.4.

Table 4.5 Threatened fauna species potentially occurring within the Project Area

Species name	Common name	EPBC Act* status	PMST presence	Historical records within 10 km of the Project Area
Birds				
<i>Calidris acuminata</i>	Sharp-tailed sandpiper	V, Mi	Species or species habitat may occur within study area	No historical records within 10 km.
<i>Calidris ferruginea</i>	Curlew sandpiper	CE, Mi	Species or species habitat may occur within study area	No historical records within 10 km.
<i>Erythrotriorchis radiatus</i>	Red goshawk	E	Species or species habitat may occur within study area	– No historical records within 10 km. – One historical record approximately 20 km southeast of the Project disturbance footprint.
<i>Falco hypoleucos</i>	Grey falcon	V	Species or species habitat may occur within study area	No historical records within 10 km.

Species name	Common name	EPBC Act* status	PMST presence	Historical records within 10 km of the Project Area
<i>Gallinago hardwickii</i>	Latham's snipe	V, Mi	Species or species habitat may occur within study area	No historical records within 10 km.
<i>Geophaps scripta scripta</i>	Squatter pigeon (southern)	V	Species or species habitat known to occur within study area	– 2010: 2 recorded 5.7 km west of the Project disturbance footprint (Wildnet) – 2010: 2 recorded 3.9 km north of the Project disturbance footprint (Wildnet) – 1999–2008: Multiple sightings within 5 km of Newlands Coal Mine. – 2016–2024: Multiple records during regular offset monitoring at Newlands Coal Mine
<i>Grantiella picta</i>	Painted honeyeater	V	Species or species habitat may occur within study area	No historical records within 10 km.
<i>Hirundapus caudacutus</i>	White-throated needletail	V	NA Species recorded in WildNet database	No historical records within 10 km.
<i>Neochmia ruficauda ruficauda</i>	Star finch (eastern), star finch (southern)	E	Species or species habitat likely to occur within study area	No historical records within 10 km.
<i>Poephila cincta cincta</i>	Southern black-throated finch	E	Species or species habitat may occur within study area	No historical records within 10 km.
<i>Rostratula australis</i>	Australian painted snipe	E	Species or species habitat may occur within study area	No historical records within 10 km.
<i>Tyto novaehollandiae kimberli</i>	Masked owl (northern)	V	Species or species habitat may occur within study area	No historical records within 10 km.
Mammals				
<i>Dasyurus hallucatus</i>	Northern quoll	E	Species or species habitat likely to occur within study area	No historical records within 10 km.
<i>Macroderma gigas</i>	Ghost bat	V	Species or species habitat likely to occur within study area	No historical records within 10 km.
<i>Petauroides minor</i>	Greater glider (northern), Greater glider (north-eastern Queensland)	V	Species or species habitat may occur within study area	No historical records within 10 km.
<i>Petauroides volans</i>	Greater glider (southern and central)	E	Species or species habitat likely to occur within study area	– No historical records within 10 km. – Observed during offset monitoring in February 2021 approximately 2.5 km east of Project disturbance footprint – Recently observed in March 2024 surveys, one individual via spotlight survey. – Recently observed in May 2024 surveys, seven individuals.
<i>Phascolarctos cinereus</i>	Koala	E	Species or species habitat likely to occur within study area	– No historical records within 10 km. – Anecdotally observed in proximity to the Project Area

Species name	Common name	EPBC Act* status	PMST presence	Historical records within 10 km of the Project Area
Reptiles				
<i>Denisonia maculata</i>	Ornamental snake	V	Species or species habitat known to occur within study area	– 2006: 2 recorded 6.1 km west of the Project disturbance footprint (Wildnet) – 2004: 2 recorded 6.2 km west of the Project disturbance footprint (Wildnet) – 2008-2010: 6 recordings 8.5–8.8 km south-west of the Project disturbance footprint (Wildnet) – Records during Newlands offset monitoring in February 2021 in Wollombi – Records during offset monitoring in Newlands Nature Refuge in March 2024 approximately 3.2 kms southeast of Ramp 4 TSF drain
<i>Egernia rugosa</i>	Yakka skink	V	Species or species habitat may occur within study area	No historical records within 10 km.
<i>Elseya irwini</i>	Irwin's turtle	V	Species or species habitat may occur within study area	No historical records within 10 km.
<i>Lerista vittata</i>	Mount Cooper striped skink	V	Species or species habitat may occur within study area	No historical records within 10 km.

*Key: V – Vulnerable, E – Endangered, CE – Critically Endangered, Mi – Migratory

4.2.6 Migratory species

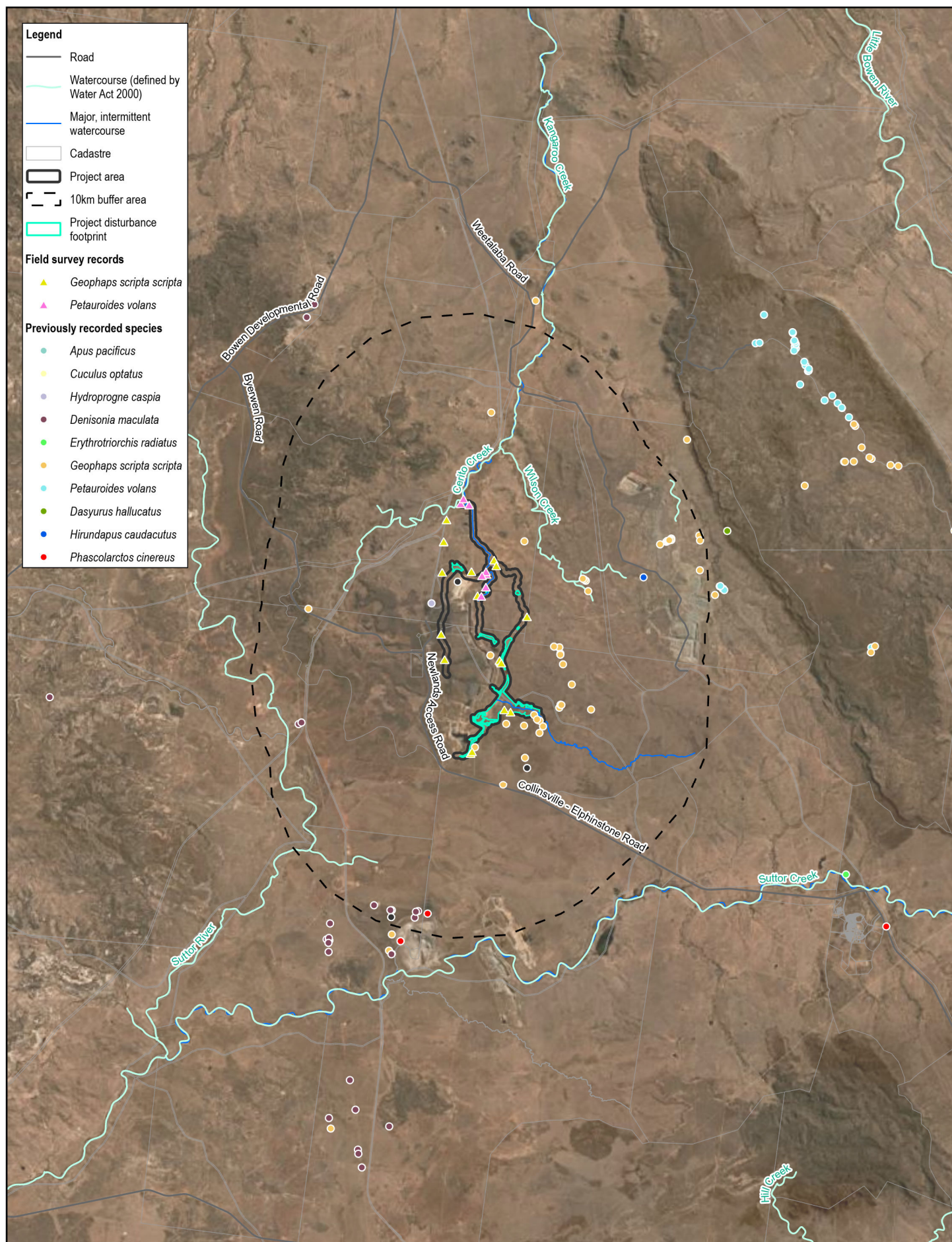
The PMST search (dated September 2025 and provided in Appendix C) identified nine migratory bird species that have the potential to occur within 10 km of the Project Area based on bioclimatic modelling, knowledge of species' distributions and habitat preferences, as listed in Table 4.6. One additional species, Caspian tern, was recorded on the WildNet search results. Migratory species records within 10 to 20 km of the Project Area are shown on Figure 4.4.

Table 4.6 Listed migratory species potentially occurring within the Project Area

Species name	Common name	EPBC Act* status	PMST presence	Historical records within 10 km of the Project Area
Migratory marine species				
<i>Apus pacificus</i>	Fork-tailed swift	Mi, Ma	Species or species habitat likely to occur within study area	– 2001: Within 1 km of the Project disturbance footprint (Birdata)
<i>Hydroprogne caspia</i>	Caspian tern	Mi, Ma	NA Recorded on WildNet search results	– 2001–2003: 3 records within 1 km of the Project disturbance footprint (Birdata)
Migratory terrestrial species				
<i>Cuculus optatus</i>	Oriental cuckoo	Mi	Species or species habitat known to occur within study area	– 2007: Within 1 km of the Project disturbance footprint (Birdata)
<i>Actitis hypoleucos</i>	Common sandpiper	Mi	Species or species habitat may occur within study area	No historical records within 10 km.

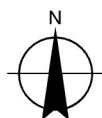
Species name	Common name	EPBC Act* status	PMST presence	Historical records within 10 km of the Project Area
<i>Calidris acuminata</i>	Sharp-tailed sandpiper	V, Mi	Species or species habitat may occur within study area	No historical records within 10 km.
<i>Calidris ferruginea</i>	Curlew sandpiper	CE, Mi	Species or species habitat may occur within study area	No historical records within 10 km.
<i>Calidris melanotos</i>	Pectoral sandpiper	Mi	Species or species habitat may occur within study area	No historical records within 10 km.
<i>Gallinago hardwickii</i>	Latham's snipe	V, Mi	Species or species habitat may occur within study area	No historical records within 10 km.
<i>Motacilla flava</i>	Yellow wagtail	Mi	Species or species habitat may occur within study area	No historical records within 10 km.
<i>Pandion haliaetus</i>	Osprey	Mi	Species or species habitat likely to occur within study area	No historical records within 10 km.

*Key: V – Vulnerable, CE – Critically Endangered, Mi – Migratory; Ma – Marine



Paper Size ISO A4
0 2.5 5 7.5 10
Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 55



NC Coal Company Pty Limited
Newlands Closure Project - Cerito Creek Permanent
Diversion System

**Threatened fauna and
migratory species records**

Project No. 12611481
Revision No. 0
Date 12/09/2025

FIGURE 4.4

4.2.7 Likelihood of occurrence assessment results

The species that are considered as known, likely or have potential to occur are listed in Table 4.7, based on the results of desktop reviews and field surveys. These species are the subject of SIAs in Section 6 of this report. Complete likelihood of occurrence assessments are provided in Appendix E.

Table 4.7 MNES species that are known, likely or have potential to occur

Scientific name	Common name	Likelihood rating
TEC		
Brigalow (<i>Acacia harpophylla</i> dominant and co-dominant)	Brigalow TEC	Known
Semi-Evergreen Vine Thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Semi-Evergreen Vine Thicket TEC	Known
Flora species		
<i>Dichanthium queenslandicum</i>	King blue-grass	Known
Fauna species		
<i>Denisonia maculata</i>	Ornamental snake	Likely
<i>Geophaps scripta scripta</i>	Squatter pigeon (southern)	Known
<i>Hirundapus caudacutus</i>	White-throated needletail	Likely*
<i>Petauroides volans</i>	Greater glider (southern and central)	Known
<i>Phascolarctos cinereus</i>	Koala	Potential
Migratory species		
<i>Apus pacificus</i>	Fork-tailed swift	Likely
<i>Cuculus optatus</i>	Oriental cuckoo	Likely
<i>Hirundapus caudacutus</i>	White-throated needletail	Likely*
<i>Hydroprogne caspia</i>	Caspian tern	Likely
* Species is threatened and migratory		

4.3 Cultural Heritage and Native Title

There are two traditional owner groups for the Project Area, being:

- Birriah People:
 - Determined as the Native Title Holders by the Federal Court of Australia on 23 March 2016.
- Jangga People:
 - Determined as the Native Title Holders by the Federal Court of Australia on 9 October 2012.

NCC has executed separate Cultural Heritage Management Plans that provide guidelines and processes that must be strictly followed when engaging with the Birriah or Jangga.

A number of cultural heritage sites within a 10 km radius of the Project Area have been recorded from previous clearance surveys undertaken in 1978, 2002, 2003, 2005, 2010, 2014, 2018, 2019 and 2021.

4.4 Surface water resources

4.4.1 Catchment overview

The Project Area is within the Burdekin catchment, in the Bowen River sub-basin area, which drains north into the Burdekin River and discharges into the sea near Ayr on the Queensland coast (refer Figure 4.5). Cerito Creek and its tributaries flow into and through the Project Area as stream orders 1 to 4, being historically diverted and impounded in some areas by the Newlands Coal Mine.

Cerito Creek then flows into Kangaroo Creek north of the Project Area as a stream order 5 watercourse. Kangaroo Creek then flows into Rosella Creek (at the confluence of Kangaroo Creek and Eastern Creek), then to the Bowen River and then to the Burdekin River (downstream of the Burdekin Dam).

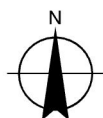
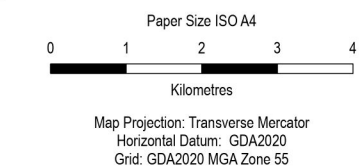
Watercourses and drainage lines in this upper catchment area are ephemeral and flow only after sustained or intense rainfall (typically during the wetter summer months), with low to no flow for the remainder of the year. Cerito Creek is designated as a watercourse under the *Water Act 2000* (Qld), however is ephemeral and does not hold permanent water, although seasonal waterholes (as well as artificial waterbodies) exist. Currently the flow regime is modified by past mining and associated land uses to include existing water storages (Cerito Dam and other artificial waterbodies made through levee structures), a large area of subsidence from historical underground mining panels that has formed artificial wetland values, and diversions and changes to the channel profile in other sections of Cerito Creek and its tributaries.

No Ramsar wetlands of international importance or nationally important wetlands occur in close proximity to, or immediately downstream of, the Project Area. The Queensland Wetlands Mapping layer shows existing disturbed areas adjacent to the Project disturbance footprint as hydrologically modified or artificial lacustrine wetlands (or non-vegetated and non-riverine waterbodies dominated by open water). Riverine wetland areas are mapped along the Cerito Creek riparian corridor immediately downstream at the northern extent of the Project Area (refer Figure 4.5). These riverine wetland areas are mapped in the Qld Wetlands Mapping database due to having a percentage of REs being wetland or riparian type REs. They are characterised as having intermittent water and feature a sparse cover of *Corymbia*, *Eucalyptus* and *Melaleuca* species trees.

The existing modified alignment of Cerito Creek to the east of the existing mining disturbance area of the Main Deposit is mapped as a State significant biodiversity corridor for riparian values, including along diverted sections and containing existing water storages of Cerito Creek. Riparian areas outside the existing mining disturbance area remain relatively intact but consist of ephemeral systems in the upper catchment and are therefore less defined as riparian corridors in areas further downstream. The ability for terrestrial wildlife to move through these riparian corridors is largely unrestricted, with the exception of existing culvert crossings, Cerito Dam wall and the drop structure, all of which are proposed to be removed as part of this Project.

Downstream, along the Bowen River, there are current water entitlements including a license to take water for rural purposes of 360 ML per year and a licence to interfere by impounding water. There are also a number of water entitlements along the Burdekin River further downstream, which are largely for grazing and agricultural purposes.

As part of the Newlands Closure Project, NCC is progressively rehabilitating the existing mine complex to comply with the closure requirements of the EA EPML00817713, and in accordance with the PRCP currently under assessment by the Queensland DETSI. The Cerito Creek permanent diversion system will be authorised by the Queensland Government through the grant of a Water Licence under the *Water Act 2000* (Qld). A number of the existing water storages contain clean water runoff, including the Ramp 1 Pond, Lake Austin, Levee 3 Pond, Levee 5 Pond, Levee 7 Pond, and Upper Cerito Dam.



Catchment, waterbody and wetlands mapping

FIGURE 4.5

4.4.2 Climate and rainfall

The Project Area experiences highly variable seasonal rainfall, with majority occurring in the wet season from November to March. Figure 4.6 depicts the average monthly rainfall recorded at nearby regional BoM weather stations:

- Gatton Vale station (BOM station no. 33176) is located approximately 40 km northeast of the mine
- Strathmore station (BOM station no. 33082) is located approximately 75 km northwest of the mine.

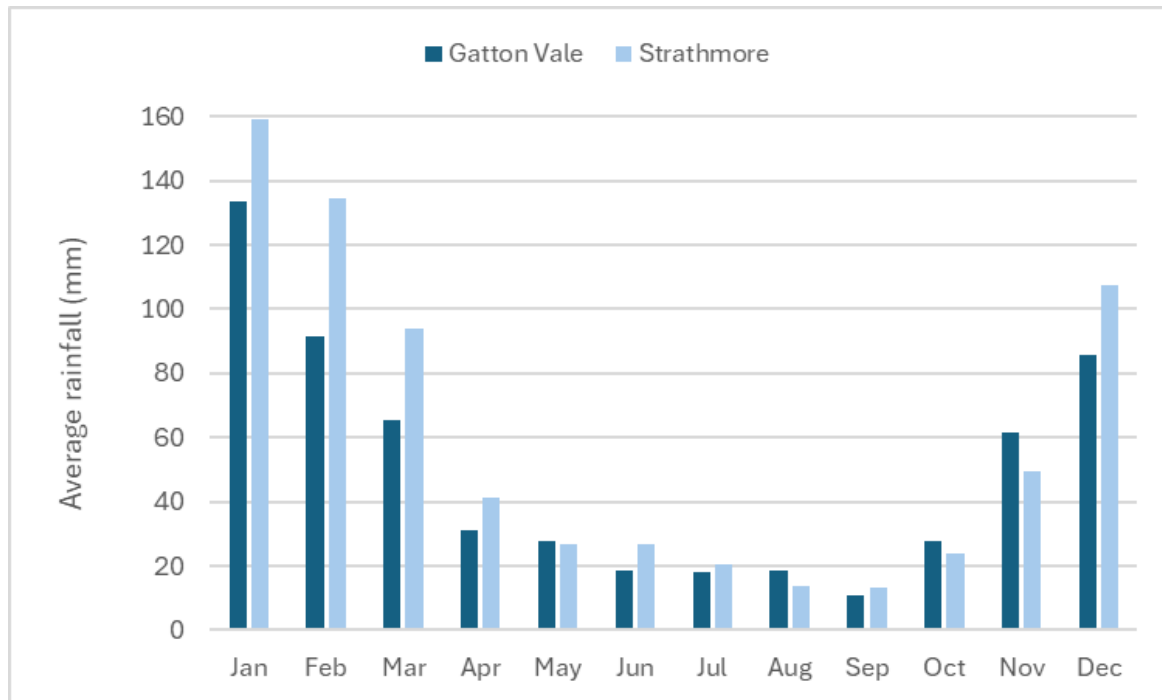


Figure 4.6 Monthly rainfall average from Gatton Vale and Strathmore BOM weather stations

The upper Suttor River catchment experiences similarly variable flow volumes in response to seasonal rainfall. Figure 4.7 depicts the average monthly flow volume recorded at the nearest, open DRDMW stream gauging station. Suttor Creek gauging station at Eaglefield (stream gauging station 120304A) is located approximately 27 km southwest of the mine in the Suttor River sub-catchment, and is within a similarly upper catchment location as the Cerito Creek and Kangaroo Creek catchments. Figure 4.7 indicates that the Suttor River experiences very low flow volumes outside of the wet season, from June to October. Given that Cerito Creek and Kangaroo Creek are in similarly upper creek catchment locations and similar climate and land use settings, it has been assumed that they would experience similar periods of very low to no flow.

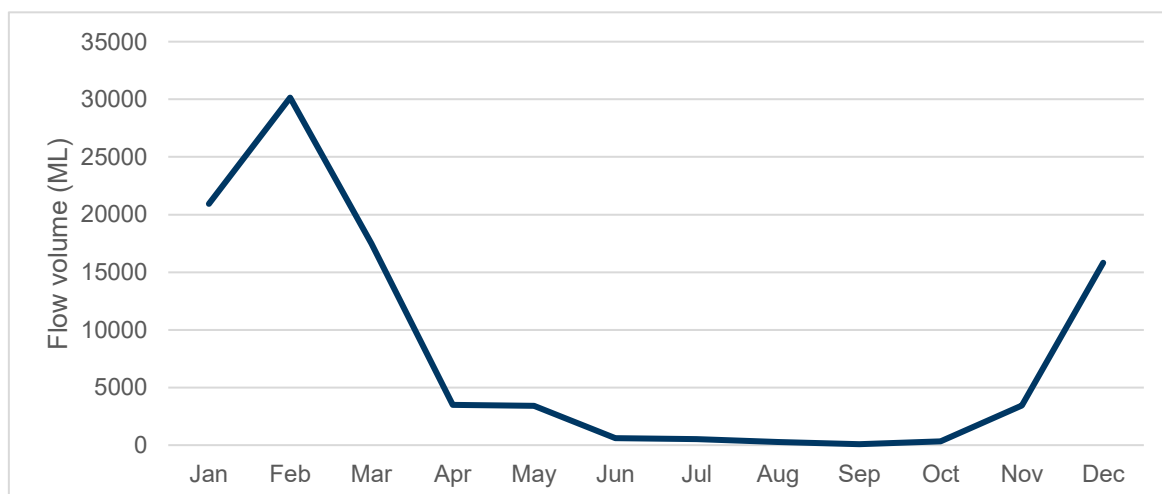


Figure 4.7 Monthly average flow volume from Suttor River gauging station

4.4.3 Aquatic habitat

Aquatic ecology field assessments were conducted from 26 February to 2 March 2025 at 17 survey sites within the Project Area, including nine along Cerito Creek spaced at intervals up to 2 km apart. An additional eight survey sites were analysed within the Project Area, nearby to Cerito Creek that have connectivity to the aquatic ecology of Cerito Creek.

Across the survey extent the availability of aquatic habitat varied, ranging from completely dry channels to intermittent and relatively permanent deep (>0.5 m) pools.

As there was little to no flow observed at most sites, no aquatic fauna passage was available between sites and connectivity was limited. There are multiple man-made barriers to aquatic fauna movement in the form of existing culvert crossings that would restrict flow and movement in a limited rainfall event. The drop structure consisting of a large cement structure in Cerito Creek with an approximate 10 m drop in the channel bed level between the upstream and downstream channels would also limit flow and movement during significant rainfall events. Nonetheless, flow is ephemeral in this region, and pools would become connected during high flow events. Fish and other aquatic fauna would be expected to move along the watercourse extent during such flow events and utilise the existing pools as dry season refuges, which is evident by the presence of fish at sites further upstream.

In-stream habitat, where present, comprised some detritus, woody debris, overhanging vegetation and trailing bank vegetation. Bed substrate was dominated by silt/clay at 12 sites. Other sites displayed a relatively equal balance of bed substrate between cobble, boulder, gravel, pebble and silt/clay, or mostly silt/clay and sand as a bottom substrate, with some gravel present, and one site was dominated by boulder, at 60% of the bottom substrate.

Flow types were predominantly deep pool or shallow isolated pool habitats with no riffles or runs present at any sites, except for one site.

Overall, aquatic habitat was minimal at each site providing limited resources for aquatic fauna. Surveys assessed the potential for Irwin's turtle (*Elseya irwini*) and eight *Euastacus species* of freshwater crayfish, which are listed as threatened fauna under the EPBC Act (Cth) (refer to Appendix E). However, habitat for these species is not considered to be present in the Project Area and they have not been recorded previously in the region.

In-situ water quality results from each site generally fell outside the recommended WQO from the EPP guidelines (DEHP 2019). Results included:

- Dissolved oxygen was below the WQO range in a number of sites. Low dissolved oxygen levels may lead to hypoxia in fish (low oxygen availability), which can restrict aerobic ATP production and ultimately threaten species survival (McArley et al. 2020). Dissolved oxygen was above the WQO range in some sites. High dissolved oxygen levels can cause gas bubble disease, which can involve the blocking of arteries, causing fish mortality (Ali et al. 2022).
- The pH was above the WQO range at some sites, which were all spread across Cerito Creek, therefore not indicating a pattern. All other sites were within the guideline values.
- Turbidity was above the WQO at some sites. Turbidity varied from 3.52 to 923 NTU. The variation in turbidity was likely due to the different sizes of the isolated pools at each survey site and sediment-laden runoff from upslope or upstream of sites. There was no clear relationship identified between the locations of the sites with low and high turbidity results recorded both upstream and downstream of previously disturbed areas.
- Electrical conductivity was above the guideline values for six sites; however, it was particularly high (>2000 µS/cm) at two sites. High conductivity levels varied around the site including sites that have influences from areas upstream of the mining disturbance areas (e.g. Cerito Dam). Elevated conductivity has been found to negatively impact benthic macroinvertebrates, which are commonly used as aquatic health indicators (Kemak et al. 2018).

Although not measured in situ, there was a dense algal bloom at one site, which was present first thing in the morning but had dissipated throughout the water column by the afternoon. The algal bloom was likely related to the high water temperature, lack of shading of the watercourse, and lack of instream aquatic plants.

Sampling of macroinvertebrates undertaken in watercourses between 2006 and 2011 for the Newlands Coal Mine during periods of flow found that the community composition in the environment surrounding the mining activity is consistent with ephemeral streams, with insects being the dominant taxa (according to the Newlands Receiving

Environment Management Program dated March 2012). Long term data analysis suggested that there were no consistent differences between upstream, downstream and recovery sites (situated >15 km downstream). Recovery sites situated >15 km downstream were analysed as having the most degraded macroinvertebrate assemblages. There was also no evidence of any consistent long-term decline in taxa richness at any of the downstream sites.

4.4.4 Environmental values and water quality objectives

The Project Area is contained within the Burdekin River (Lower) and Bowen River sub-basin (WQ1205), within the Rosella Creek environmental value zone, mapped by the *Environmental Protection (Water and Wetland Biodiversity) Policy 2019* (Qld) (DES 2022). The purpose of this policy is to achieve the environment protection objectives of the EP Act (Qld) while allowing for development that is ecologically sustainable. Schedule 1 of the policy outlines environmental values (being the uses of the water by aquatic ecosystems and for human activities) and WQOs (being objectives for the physical, chemical and biological characteristics of the water) for the catchment.

The Rosella Creek environmental values are for freshwater streams, apart from some artificial waterbodies mapped as freshwater lakes/reservoirs. The Project Area is mapped on Queensland Globe (accessed March 2024) as comprising:

- Moderately disturbed values, which are also mapped across the majority of the Rosella Creek environmental values zone
- Slightly disturbed in the upper Cerito Creek extents that occur within the Newlands Nature Refuge.

The environmental values for the Burdekin River (Lower) and Bowen River sub-basin for Rosella Creek are:

- Aquatic ecosystems
- Stock water
- Visual recreation
- Industrial use
- Cultural and spiritual values.

The mine site has long-term water quality monitoring data for sites within the mine disturbance area and upstream and downstream of the mine disturbance area; however, in the absence of any known suitable background water quality monitoring prior to the commencement of mining operations and activities onsite, the default WQOs from the EPP guidelines (DEHP 2019) have been used to establish whether changes in water quality are significant for the moderate and slightly disturbed systems mapped within the Project Area. The WQOs are values that, if achieved, will ensure water quality for the protection of aquatic ecosystems and human use.

No specific WQOs are listed for slightly disturbed systems due to insufficient information available to establish effectively unmodified WQOs for these waters; therefore the default WQOs for moderately disturbed systems and freshwater lakes / reservoirs are provided in Table 4.8.

Table 4.8 Default water quality objectives (State of Queensland 2022)

Parameter	Moderately disturbed – low flow	Moderately disturbed – high flow	Lakes/reservoir
Ammonia nitrogen (µg/L)	10	10	10
Oxidised nitrogen (µg/L)	10	90	10
Total nitrogen (µg/L)	530	960	350
Filterable reactive phosphorus (µg/L)	10	50	5
Total phosphorus (µg/L)	60	180	10
Chlorophyll-a (µg/L)	5	ID	5
Dissolved oxygen (% saturation)	85-110	85-110	90-110
Turbidity (NTU)	8	75	1-20

Parameter	Moderately disturbed – low flow	Moderately disturbed – high flow	Lakes/reservoir
Total suspended solids (mg/L)	10	120	ID
pH	6.5-8.5	6.5-8.5	6.5-8.0
Electrical conductivity (EC) (µS/cm)	340	200	270
Sulfate (mg/L as SO ₄ ²⁻)	8	9	ID

ID = Insufficient data

Receiving water trigger levels

Receiving Environment Management Program monitoring undertaken for the Newlands Coal Mine provides water quality monitoring data from 2003 to 2011 for Rosella Creek catchment that indicates that:

- Rosella Creek catchment typically demonstrates highly variable pH, ranging from a minimum of 6.20 to a maximum of 9.69, with a general trend toward more alkaline values. This is stated as being consistent with the nature of the soils within the catchment.
- EC ranges between fresh (66 µS/cm) to brackish (9,894 µS/cm); however, the 80th percentile is consistently below 2,500 µS/cm. This EC range is stated to be consistent with the existing downstream use of water within the Rosella Creek catchment (i.e. stock watering/irrigation). Typically, elevated EC concentrations are observed following 'first flush' events, as the accumulated salts within catchment soils are liberated. Then as flows recede and become isolated pools, which is typical of the ephemeral creeks on site, evapo-concentration results in locally elevated EC concentrations.
- As expected within a disturbed catchment with a history of cattle grazing, land clearing and pasture improvement practices, turbidity is highly variable and highly dependent on flow. The analysis of a dataset from 2010 and 2011 only found a maximum turbidity of 2,529 NTU coinciding with a 120 mm rainfall event, and an 80th percentile of 134 NTU, reflective of a slightly to moderately disturbed catchment.

Newlands water management systems include discharge criteria for receiving environment monitoring. For Kangaroo Creek, which is located downstream of Cerito Creek and the Cerito Creek permanent diversion system, the discharge criteria are shown on Figure 4.8. The mine operations are permitted to discharge water to the receiving environment in accordance with the EA conditions (listed in Figure 4.9). The allowable release depends on the flow conditions in the receiving environment and the end of pipe water quality.

Table F3 – Mine affected water release during flow events

Kangaroo Creek Discharge Criteria

SCENARIO	FLOW RATES		END OF PIPE (For All Kangaroo Creek Receiving Point Flow Scenarios)					RECEIVING WATER QUALITY LIMITS					
	RECEIVING WATER FLOW RATE AT WQS5	END OF PIPE MAX. RELEASE RATE (Combined)	END OF PIPE WATER QUALITY (WQ) RELEASE LIMITS: (DP1, DP2, DP3, DP6, DP8, DP9, DP10, DP11, DP14A, DP14B, DP30, DP35, DP37, DP38, DP40)				RELEASE TRIGGER LIMITS (End of Pipe)	Receiving Water Contaminant Trigger Levels					ASSIMILATION TRIGGER LIMIT - At Bowen River (FSS18)
	m³/s	m³/s	EC (µS/cm)	pH	Turbidity (NTU)	Sulphate (mg/l)		EC (µS/cm)	pH	Turbidity (NTU)	Sulphate (mg/l)	Sodium (mg/l)	
	Sample Frequency		DAILY²	DAILY²	DAILY²	DAILY²	Weekly During Release	Daily During Release		Weekly During Release		Weekly During Release	
Low Flow	For a period of 28 days after natural flow event that exceeds 1.0 m³/s	0.5	2500	Min. - 6.5 Max. - 9.2	600	500	Not Applicable	2900	Min. - 6.5 Max. - 9.0	400	500	N/A	EC - FSS17 + 200uS/cm at FSS18
Medium Flow	0.5 - 2m³/s	0.75	3000	Min. - 6.5 Max. - 9.2	600	500	Table F2²	2400	Min.- 6.5 Max.- 9.0	400	500	180	Not Required
	0.5 - 2m³/s	0.45	4000		600	750		2400					
High Flow	2-6m³/s	0.9	4000	Min. - 6.5 Max. - 9.2	600	750	Table F2²	2000	Min.- 6.5 Max.- 9.0	400	500	180	Not Required
	2-6m³/s	0.6	5500		600	1000		2000					
Very High Flow	6-12m³/s	1.4	4500	Min. - 6.5 Max. - 9.2	600	750	Table F2²	1850	Min.- 6.5 Max.- 9.0	400	250	180	Not Required
	6-12m³/s	1	6500		600	1000		1850					
Flood Event	12-30m³/s	3	4500	Min. - 6.5 Max. - 9.2	600	750	Table F2²	1850	Min.- 6.5 Max.- 9.0	400	250	180	Not Required
	12-30m³/s	2	6500		600	1000		1850					
Extreme Flood	>30m³/s	7	4500	Min. - 6.5 Max. - 9.2	600	750	Table F2²	1850	Min.- 6.5 Max.- 9.0	400	250	180	Not Required
	>30m³/s	5	6500		600	1000		1850					

Figure 4.8 Kangaroo Creek receiving point of discharge criteria

Table F2 – Release contaminant trigger investigation levels, potential contaminants

Quality Characteristic	Trigger Levels (µg/L)	Comment on Trigger Level	Monitoring Frequency
Aluminium	138	80% upstream background levels	Commencement of release and thereafter weekly during release
Cadmium	0.2	For aquatic ecosystem protection, based on SMD guideline	
Chromium	1	For aquatic ecosystem protection, based on SMD guideline	
Copper	3	For aquatic ecosystem protection, based on LOR for ICPMS	
Iron	280	80% established background levels	
Lead	4	For aquatic ecosystem protection, based on SMD guideline	
Nickel	11	For aquatic ecosystem protection, based on SMD guideline	
Zinc	8	80% established background levels	
Boron	370	For aquatic ecosystem protection, based on SMD guideline	
Manganese	1900	For aquatic ecosystem protection, based on SMD guideline	
Molybdenum	34	For aquatic ecosystem protection, based on low reliability guideline	
Uranium	2	80% established background levels	
Vanadium	10	For aquatic ecosystem protection, based on LOR for ICPMS	
Ammonia	900	For aquatic ecosystem protection, based on SMD guideline	
Nitrate	1100	For aquatic ecosystem protection, based on ambient Qld WQ Guidelines (2006) for TN	
Petroleum hydrocarbons (C6-C9)	20	For aquatic ecosystem protection, based on LOR for Lab Analysis	
Petroleum hydrocarbons (C10-C36)	100	For aquatic ecosystem protection, based on LOR for Lab Analysis	
Sodium (mg/L)	210	80% established background levels	

(a) All metals and metalloids must be measured as total (unfiltered) and dissolved (filtered). Trigger levels for metal/metalloids apply if dissolved results exceed trigger.

(b) The quality characteristics required to be monitored as per **Table F2 – Release contaminant trigger investigation levels, potential contaminants** can be reviewed once the results of **two (2) years** monitoring data is available, or if sufficient data is available to adequately demonstrate negligible environmental risk, and it may be determined that a reduced monitoring frequency is appropriate or that certain quality characteristics can be removed from **Table F2 – Release contaminant trigger investigation levels, potential contaminants** by amendment.

(c) SMD – slightly moderately disturbed level of protection, guideline refers ANZECC & ARMCANZ (2000).

(d) LOR – typical reporting for method stated. ICPMS/CV FIMS – analytical method required to achieve LOR.

Figure 4.9 Release contaminant trigger investigation levels

The default WQOs for moderately disturbed systems and the Kangaroo Creek discharge criteria were used to evaluate whether the water quality values recorded exceeded these threshold levels for a number of representative sample sites and parameters. The analysed water quality parameters and relevant thresholds are as follows:

- pH:
 - Default WQO: 6.5 – 8.5 (both low flow and high flow)
 - Discharge criteria: 6.5 – 9.0 (both low flow and high flow)
- EC:
 - Default WQO: 200 – 340 µS/cm (high flow to low flow)
 - Discharge criteria: 1850 – 2900 µS/cm (high flow to low flow)

- Turbidity:
 - Default WQO: 8 – 75 NTU (low flow to high flow)
 - Discharge criteria: 400 NTU
- Ammonia:
 - Default WQO: 0.01 mg/L (both low flow and high flow) (DES 2022)
 - Discharge criteria: 0.90 mg/L.

Where the recorded values fall outside of the range specified by the default WQOs, the value has been highlighted in **red**. Where the recorded values fall outside both the default WQOs and the Kangaroo Creek discharge criteria for the receiving waters (according to the EA), the value is shown in **bold**.

We note that the application of water quality monitoring data depends on whether the sampling period, frequency and suitability of reference sites complies with the Guideline: Deciding aquatic ecosystem indicators and local water quality guideline values (March 2022) and the Queensland Water Quality Guidelines 2009 (including a minimum of 18 data values collected over two years to derive guideline values). As evident by the tables in the following sections, some sampling locations provide long term monitoring values (either in-situ field values, or laboratory measured, or both), however others have been sampled more sporadically.

The sampling locations analysed for water quality include:

- Levee 3 (located within the central Project Area)
- Kangaroo Creek (located downstream (north) of the Project Area)
- Cerito Creek (located upstream (southeast of the Project Area)
- Cerito Dam (located within the central eastern Project Area).

Immediate receiving environment

The field monitoring point located at Levee 3 (site code PP15) was selected to provide a representation of the immediate receiving environment along a disturbed section of Cerito Creek within the Project Area. The parameters of pH (Table 4.9), EC (Table 4.10), and turbidity (Table 4.11) are provided for this site over the previous 11 years of data.

Table 4.9 *Levee 3 pH*

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	All Years
Field pH													
Median	NR	NR	8.57	8.30	9.11	8.65	9.69	8.50	8.35	8.94	8.15	8.00	8.62
80th percentile	NR	NR	8.71	9.67	10.00	8.84	9.69	9.48	8.95	9.14	8.35	8.41	9.12
Mean	NR	NR	8.56	8.97	8.86	8.65	9.69	9.03	8.49	8.88	8.15	8.00	8.73
Lab pH													
Median	8.10	8.48	8.43	8.37	9.11	8.46	9.65	8.15	8.28	8.46	8.28	7.70	8.45
80th percentile	8.10	8.53	8.51	9.21	9.95	8.51	9.65	9.38	8.83	8.78	8.38	8.03	8.82
Mean	8.10	8.48	8.43	8.82	8.98	8.44	9.65	8.73	8.50	8.45	8.28	7.70	8.54

NR = Not recorded; **red** = exceeds default WQO only; **bold and red** = exceeds default WQO and receiving water limits; shaded = one sample only

Table 4.10 Levee 3 electrical conductivity

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	All Years
Field EC (µS/cm)													
Median	NR	NR	4,057	326	259	362.3	356.1	223	248.8	338.25	213.75	667.6	705.18
80th percentile	NR	NR	6967.6	332	349.2	446.18	356.1	253.96	276.58	1713.28	232.14	904.84	1183.19
Mean	NR	NR	4363.13	312.6	280.95	408.9	356.1	221.03	235.53	1137.8	213.75	667.6	819.74
Lab EC (µS/cm)													
Median	2270	554.5	521	269	246.5	372	338	221	238.5	258.0	217	172	473.13
80th percentile	2270	611.8	575	306.8	322.6	466.8	338	234.2	264.2	301.6	237.4	231.4	513.32
Mean	2270	554.5	521	290	267.75	415.33	338	203.67	225.75	240	217	172	476.25

NR = Not recorded; red = exceeds default WQO only; **bold and red** = exceeds default WQO and receiving water limits; shaded = one sample only

Table 4.11 Levee 3 turbidity

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	All Years
Field Turbidity (NTU)													
Median	NR	NR	NR	25	19.5	127	508	33.2	16.3	133	65.3	86.65	112.66
80th percentile	NR	NR	NR	37.18	118.2	167.8	508	35.12	26.44	151.2	65.3	128.26	137.5
Mean	NR	NR	NR	25	71.67	142.33	508	29.77	20.67	110.45	65.3	86.65	117.76
Lab Turbidity (NTU)													
Median	8.6	7.6	NR	39.6	61.7	NR	NR	NR	12.5	NR	NR	NR	26
80th percentile	8.6	7.6	NR	39.6	61.7	NR	NR	NR	12.5	NR	NR	NR	26
Mean	8.6	7.6	NR	39.6	61.7	NR	NR	NR	12.5	NR	NR	NR	26

NR = Not recorded; red = exceeds default WQO only; **bold and red** = exceeds default WQO and receiving water limits; shaded = one sample only

Downstream receiving environment

The field monitoring point located downstream in Kangaroo Creek (site code FSS4 / WQS5) was selected to provide a representation of the downstream receiving environment of Kangaroo Creek (downstream of the confluence with Cerito Creek and downstream of the Project Area). The parameters of pH (Table 4.12), EC (Table 4.13), turbidity (Table 4.14) and ammonia (Table 4.15) are provided for this site over the previous 10 years of data.

Table 4.12 Kangaroo Creek downstream pH

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	All Years
Field pH													
Median	NR	NR	8.78	8.06	8.24	7.78	7.32	8.23	8.01	7.91	NR	NR	8.04
80th percentile	NR	NR	8.78	8.11	8.27	8.20	7.97	8.42	8.01	7.91	NR	NR	8.21
Mean	NR	NR	8.78	8.07	8.18	8	7.53	8.29	8.01	7.91	NR	NR	8.1
Lab pH													
Median	8.56	8.45	8.19	7.89	8.06	7.59	7.87	8.15	7.96	8.11	8.16	8.21	8.1
80th percentile	8.61	8.68	8.19	8.04	8.15	7.63	8.49	8.28	7.96	8.11	8.18	8.32	8.22
Mean	8.53	8.55	8.19	7.89	8.09	7.59	7.86	8.04	7.96	8.11	8.16	8.21	8.1

NR = Not recorded; red = exceeds default WQO only; bold and red = exceeds default WQO and receiving water limits; shaded = one sample only

Table 4.13 Kangaroo Creek downstream electrical conductivity

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	All Years
Field EC (µS/cm)													
Median	NR	NR	518.7	7.89	339.7	328.0	612.45	366.45	135.7	155.6	NR	NR	308.06
80th percentile	NR	NR	518.7	8.04	555	333.4	947.4	403.12	135.7	155.6	NR	NR	382.12
Mean	NR	NR	518.7	7.89	392.95	264.87	628.08	311.4	135.7	155.6	NR	NR	301.90
Lab EC (µS/cm)													
Median	3210.0	610	604	196.5	370	320	344	352	129	150	180.5	288	562.83
80th percentile	3500.0	1,036	604	201.4	575.2	328.4	397.8	400.8	129.0	150	215.0	349.2	657.23
Mean	2920.67	719	604	197.25	410.3	267.33	347	345.75	129.0	150	180.5	288	546.57

NR = Not recorded; red = exceeds default WQO only; bold and red = exceeds default WQO and receiving water limits; shaded = one sample only

Table 4.14 Kangaroo Creek downstream turbidity

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	All Years
Field Turbidity (NTU)													
Median	NR	NR	NR	252.35	137.64	1431.4	133	19.15	NR	546	NR	NR	419.92
80th percentile	NR	NR	NR	321.7	220.06	2093.56	989.8	23.14	NR	546	NR	NR	699.04
Mean	NR	NR	NR	229.73	137.64	1431.4	577.77	19.15	NR	546	NR	NR	490.28
Lab Turbidity (NTU)													
Median	13.00	322	628.0	619.5	475	9080	234.9	16.45	2,240	475	947.75	90.5	1261.84
80th percentile	56.00	1556.8	628.0	1094	1126	11312	1308.28	8880.0	2,240	475	1,459.1	141.2	2523.03
Mean	106.08	903.8	628.0	598.53	706.19	8993.33	808.93	3,526.3	2,240	475	947.75	90.5	1668.70

NR = Not recorded; red = exceeds default WQO only; bold and red = exceeds default WQO and receiving water limits; shaded = one sample only

Table 4.15 Kangaroo Creek downstream concentrations of ammonia

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	All Years
Ammonia (mg/L)													
Median	NR	NR	NR	NR	0.11	0.15	0.12	0.19	NR	NR	0.01	NR	0.11
80th percentile	NR	NR	NR	NR	0.2	0.17	0.16	0.79	NR	NR	0.01	NR	0.26
Mean	NR	NR	NR	NR	0.14	0.15	0.12	0.34	NR	NR	0.01	NR	0.15

NR = Not recorded; **red** = exceeds default WQO only; **bold and red** = exceeds default WQO and receiving water limits; shaded = one sample only

Upstream waters

The field monitoring point located upstream in Cerito Creek (FSS2 / WQS7) was selected to provide a representation of the upstream waters of Cerito Creek. The field monitoring point located in Cerito Dam (PP46) was selected to provide a representation of upstream waters prior to being released downstream; however, this will change once the dam is removed as part of the Project and flows return to pre-mining conditions.

In Cerito Creek (FSS2 / WQS7), the parameters of pH (Table 4.16), EC (Table 4.17), and turbidity (Table 4.18) are provided for this site over the previous 10 years (with some years missing records). In Cerito Dam, the parameters of pH (Table 4.19), electrical conductivity (Table 4.20), and turbidity (Table 4.21) are provided for this site over the previous 10 years (with some years missing records).

Table 4.16 Cerito Creek upstream pH

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	All Years
Field pH													
Median	NR	NR	NR	7.18	7.48	NR	NR	NR	NR	6.43	NR	NR	7.03
80th percentile	NR	NR	NR	7.25	7.78	NR	NR	NR	NR	6.43	NR	NR	7.15
Mean	NR	NR	NR	7.19	7.52	NR	NR	NR	NR	6.43	NR	NR	7.05
Lab pH													
Median	8.58	8.29	NR	7.69	7.63	NR	NR	NR	NR	7.73	NR	7.34	7.88
80th percentile	8.9	8.29	NR	7.75	7.77	NR	NR	NR	NR	7.73	NR	7.34	7.97
Mean	8.54	8.29	NR	7.71	7.63	NR	NR	NR	NR	7.73	NR	7.34	7.87

NR = Not recorded; **red** = exceeds default WQO only; **bold and red** = exceeds default WQO and receiving water limits; shaded = one sample only

Table 4.17 Cerito Creek upstream electrical conductivity

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	All Years
Field EC (µS/cm)													
Median	NR	NR	NR	150	143.05	NR	NR	NR	NR	24.19	NR	NR	105.75
80th percentile	NR	NR	NR	151.6	147.9	NR	NR	NR	NR	24.19	NR	NR	107.9
Mean	NR	NR	NR	147.8	141.63	NR	NR	NR	NR	24.19	NR	NR	104.54
Lab EC (µS/cm)													
Median	356.5	338	NR	152	143	NR	NR	NR	NR	120	NR	130	206.58
80th percentile	442.8	338	NR	154	144.6	NR	NR	NR	NR	120	NR	130	221.57
Mean	392.24	338	NR	147.6	137.3	NR	NR	NR	NR	120	NR	130	210.86

NR = Not recorded; red = exceeds default WQO only; **bold and red** = exceeds default WQO and receiving water limits; shaded = one sample only

Table 4.18 Cerito Creek upstream turbidity

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	All Years
Field Turbidity (NTU)													
Median	NR	NR	NR	171.9	164	NR	NR	NR	NR	201	NR	NR	178.97
80th percentile	NR	NR	NR	174.38	164	NR	NR	NR	NR	201	NR	NR	179.79
Mean	NR	NR	NR	148.88	164	NR	NR	NR	NR	201	NR	NR	171.29
Lab Turbidity (NTU)													
Median	19.5	32	NR	256	186	NR	NR	NR	NR	180	NR	103	129.42
80th percentile	38.8	32	NR	382.2	513.6	NR	NR	NR	NR	180	NR	103	208.27
Mean	44.28	32	NR	285	299.93	NR	NR	NR	NR	180	NR	103	157.37

NR = Not recorded; red = exceeds default WQO only; **bold and red** = exceeds default WQO and receiving water limits; shaded = one sample only

Table 4.19 Cerito Dam pH

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	All Years
Field pH													
Median	NR	NR	NR	8.14	7.63	8.06	8.55	8.48	8.60	8.08	7.65	8.28	8.16
80th percentile	NR	NR	NR	8.15	8.10	8.42	8.83	8.94	9.04	8.51	7.65	8.28	8.44
Mean	NR	NR	NR	7.98	7.77	8.17	8.59	8.48	8.52	8.28	7.65	8.28	8.19
Lab pH													
Median	8.82	NR	NR	8.40	8.13	8.54	8.68	8.73	9.11	8.43	8.21	8.56	8.56
80th percentile	8.99	NR	NR	8.44	8.43	8.72	8.99	9.13	9.29	8.81	8.21	8.56	8.76
Mean	8.82	NR	NR	8.37	8.22	8.54	8.67	8.70	8.97	8.64	8.21	8.56	8.57

NR = Not recorded; red = exceeds default WQO only; **bold and red** = exceeds default WQO and receiving water limits; shaded = one sample only

Table 4.20 Cerito Dam electrical conductivity

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	All Years
Field EC (µS/cm)													
Median	NR	NR	NR	1124	691.5	1203.5	2351.5	1718.5	1710.5	1049	291.5	1390	1281.11
80th percentile	NR	NR	NR	1297.4	897.52	1485.4	3932.8	3060	1873.8	1115	291.5	1390	1704.82
Mean	NR	NR	NR	992.9	745.4	1268.4 ₃	3001.5	2339.5 ₃	1592.3 ₅	990.8	291.5	1390	1401.38
Lab EC (µS/cm)													
Median	2410	NR	NR	1030	694.5	1225	2240	1675	1780	990.5	284.0	1449	1377.8
80th percentile	2932	NR	NR	1222	900.4	1484	2706	3010	1834	1042	284.0	1449	1686.34
Mean	2410	NR	NR	941	738.25	1247.5	2247.5	2301	1530	944	284.0	1449	1409.23

NR = Not recorded; red = exceeds default WQO only; **bold and red** = exceeds default WQO and receiving water limits; shaded = one sample only

Table 4.21 Cerito Dam turbidity

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	All Years
Field Turbidity (NTU)													
Median	NR	NR	NR	12	8.74	21.82	52.8	13.15	15.35	24.45	NR	21	21.16
80th percentile	NR	NR	NR	13.14	9.39	63.88	66.84	193.34	25.32	64.94	NR	21	57.23
Mean	NR	NR	NR	12	7.32	38.76	52.57	123.43	18.96	43.25	NR	21	39.66
Lab Turbidity (NTU)													
Median	NR	NR	NR	183	19.5	NR	NR	NR	9.12	NR	NR	NR	70.54
80th percentile	NR	NR	NR	183	19.5	NR	NR	NR	9.12	NR	NR	NR	70.54
Mean	NR	NR	NR	183	19.5	NR	NR	NR	9.12	NR	NR	NR	70.54

NR = Not recorded; red = exceeds default WQO only; **bold and red** = exceeds default WQO and receiving water limits; shaded = one sample only

4.4.5 Current and future utility of the watercourse

An analysis of the likely values and current and future utility of the local water resources relevant to the Project are outlined in Table 4.22.

Table 4.22 Current and future values of the water resource

Values for third party uses	Current utility	Future utility
Provisioning services (use by other industries; use as drinking water)	There are several water entitlements licensed downstream of the Project Area.	It is likely that this use will continue in the future, with potential for additional water entitlements to be established.
Regulating services (climate regulation; stabilisation of coastal systems)	Being ephemeral flow watercourses, they are unlikely to contribute substantially to climate regulation or to influencing other systems.	Future use with regard to regulating climate or influencing other systems will be similar to current use.
Cultural services (recreation and tourism; science and education)	Two native title determinations and various Indigenous cultural heritage sites (Birriah People and Jangga People). There are currently numerous cultural heritage sites and items of significance along the natural watercourse sections. There is limited local use of the watercourses for traditional owner groups, recreation and tourism due to inaccessibility in proximity to the mine site. There has been ongoing water quality monitoring and species surveys as part of the mine operation, which has contributed to knowledge of the local systems and site conditions.	Future use is likely to continue as per current private landholder access, with no changes proposed in terms of cultural and recreational uses.
Supporting services (maintenance of ecosystem function)	The current ecosystem function of the local watercourses has been modified by the historical diverted watercourse channels and existing water storages.	Future ecosystem function is likely to remain the same, if no changes to the local catchment are made.

4.5 Groundwater resources

4.5.1 Regional geology

Newlands Coal Mine is located within the northern Bowen Basin which comprises a sequence of Permian and Triassic age sandstone, siltstone, mudstone, conglomeratic and carbonaceous deposits. The Permian coal measures typically comprise labile sandstone, siltstone, mudstone and thick sequences of interbedded coal and carbonaceous shale (ERM, 2023). The two major coal seams mined across most of the open cut areas are the Upper and Lower Newlands Seams of the Rangal Coal Measures. The Upper Newlands Seam (UNS) ranges between 6-8 m in thickness and the Lower Newlands Seam (LNS) ranges between 1-4 m near Main Deposit and thins to the east (SLR, 2018). The Permian-age strata are conformably overlain by up to 300 m of alternating green-grey siltstone and lithic sandstone of the Triassic-age Rewan Group (ERM, 2023).

During the Tertiary, widespread volcanism produced extensive basalt flows which in-filled topographic flows known as paleochannels. The basalts are up to 60 m thick and vary from fresh to completely weathered (ERM, 2023). Tertiary age alluvial deposits underly the basalt within the paleochannels and comprise medium to coarse grained unconsolidated sand referred to as the basal sands (ERM, 2023).

Tertiary sediments (including the Suttor Formation) up to 60 m thick unconformably overly the Triassic and Permian-age strata and comprise mudstone, siltstone, lithic sandstone, quartz sand and minor peaty horizons (ERM, 2023). Quaternary aged alluvial sediments are mapped along many of the creek lines and generally consist of sand and gravel. Soils at the site are generally either cracking clay or texture contrast soils (ERM, 2023).

4.5.2 Topography

Main Deposit is located on undulating terrain, which overall slopes towards the low-lying floodplain of the Bowen River to the north, within the southern Bowen River catchment of the greater Burdekin Basin. Cerito Creek, the existing diversion system and associated natural channels feature overall flow from south to north. The topography of the area is variable, with basalt outcrops forming elevated areas and deeply incised drainage lines forming within weathered bedrock. The former open cut pits within Newlands Coal Mine have been partially backfilled with spoil and graded to limit surface water ingress to the residual pit voids (and associated ponded water, where present).

4.5.3 Groundwater quality

The Project Area is contained within the Burdekin River (Lower) and Bowen River sub-basin (WQ1205), within the Rosella Creek environmental value zone, mapped by the *Environmental Protection (Water and Wetland Biodiversity) Policy 2019* (Qld) (DES 2022). The purpose of this policy is to achieve the environment protection objectives of the EP Act (Qld) while allowing for development that is ecologically sustainable. Schedule 1 of the policy outlines environmental values (being the uses of the water by aquatic ecosystems and for human activities) and WQOs (being objectives for the physical, chemical and biological characteristics of the water) for the catchment.

The environmental values of the Alluvium Zones for the Lower Burdekin with Bowen groundwaters are:

- Aquatic ecosystems
- Irrigation
- Farm supply/use
- Stock water
- Drinking water
- Industrial use
- Cultural and spiritual values.

The WQOs for moderately disturbed groundwaters within the alluvium aquifer class of the Burdekin-Don Haughton River Basins are provided in Table 4.23.

Table 4.23 Water quality objectives for groundwater

Parameter	Moderately disturbed – Lower Burdekin with Bowen	Moderately disturbed – Lower Burdekin with Bowen near stream
Sodium (Na) (mg/L)	80–415	69–129
Calcium (Ca) (mg/L)	20–107	24–45
Magnesium (Mg) (µg/L)	13–70	15–26
Bicarbonate (HCO ₃) (mg/L)	222–386	260–377
Chloride (Cl) (mg/L)	41–447	25–151
Sulfate (SO ₄) (mg/L)	4.7–24.7	2.4–14.1
Nitrate (NO ₃) (mg/L)	1.1–10.6	2.42–10.6
Electrical conductivity (EC) (µS/cm)	583–2250	554–886
Hardness (mg/L)	118–562	132–231
pH	7.6–8.5	7.3–8.3
Alkalinity (mg/L)	189.3–340.8	216–313.5
Silica (SiO ₂) (mg/L)	45–65	52.5–72.5

Water quality objectives shown as a range of 20th to 80th percentiles.

There are several groundwater bores along Cerito Creek and its tributaries registered by the Department of Natural Resources and Mines, Manufacturing and Regional and Rural Development. Strata logs in these locations included sand or sandstone over siltstone, and clay over sandstone.

The Groundwater Database - Queensland holds limited groundwater quality information for the registered bores within the assessment area, however some values are summarised below:

- Data (two records) for the Tertiary (undefined) strata indicates near neutral pH (pH of 7.9) and slightly brackish groundwater (EC of 2,755 and 2,930 $\mu\text{S}/\text{cm}$).
- Six records for groundwater within the Permian coal measures indicates near neutral pH (7.6 to 8.2) and slightly brackish to saline quality (EC range from 1,870 to 11,600 $\mu\text{S}/\text{cm}$).

Groundwater in the alluvium is fresh to slightly brackish, with calculated total dissolved solids (TDS) concentrations for site monitoring data (major ions) in the order of 500 to 1,400 mg/L. Review of available monitoring data reported for Newlands Coal Mine indicates groundwater in the Tertiary basalt is typically fresh to brackish, with an average TDS of 2,139 mg/L and range of 370 mg/L to 4,760 mg/L (SLR, 2018). Groundwater salinity in the Rewan Group is variable, ranging from brackish to highly saline and an average TDS of 5,865 mg/L, while the Rangal Coal Measures is generally brackish to moderately saline, with an average TDS of 1,754 mg/L and range of 912 mg/L to 4,520 mg/L (SLR, 2018).

4.5.4 Groundwater ecosystems

The BoM's GDEs Atlas has mapped:

- Aquatic GDEs along the channels of Cerito Creek and its tributaries and existing water storages (aquatic ecosystems that rely on the surface expression of groundwater, including rivers, wetlands and springs).
- Low to high potential terrestrial GDEs in some riparian zones along the watercourses, particularly in the northern extent of the Project Area (terrestrial ecosystems that rely on the subsurface presence of groundwater).
- No subterranean GDEs (subterranean ecosystems, including caves and aquifer ecosystems).

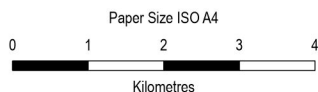
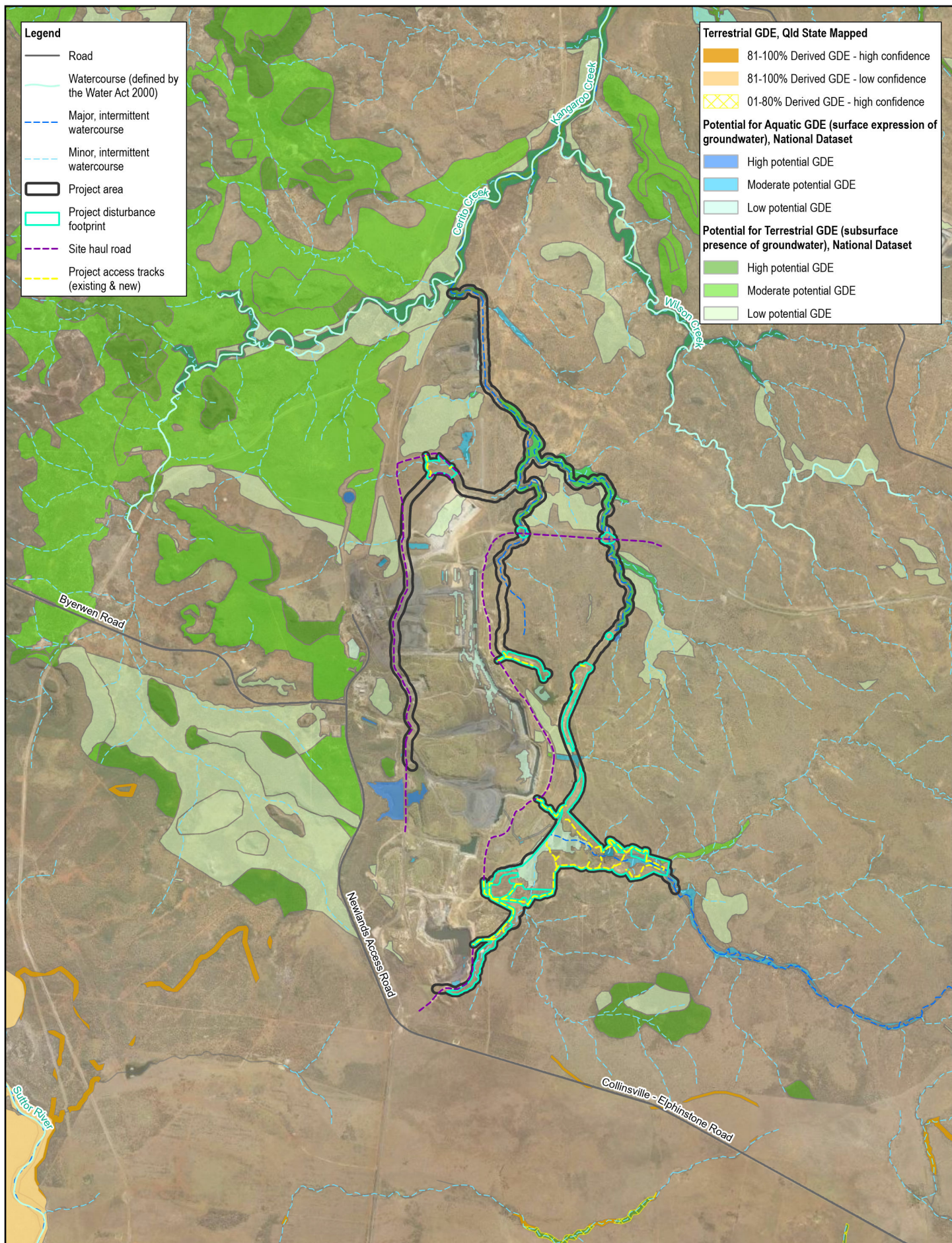
No aquatic GDEs, terrestrial GDEs, or potential subterranean GDEs are mapped within the Bowen River sub-basin area on Queensland Globe (accessed April 2025).

The GDE mapping is shown on Figure 4.10.

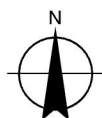
GDEs rely on either permanent, intermittent or opportunistic groundwater access to sustain themselves. The potential for terrestrial GDE existence tends to decrease as distance from watercourses increases.

Terrestrial surveys undertaken for the Project have identified Eucalypt woodlands habitat along main creeks (riparian vegetation) including blue gum woodland, river oak, Moreton Bay ash, black tea tree, Leichhardt bean and sandpaper fig with exotic grasses dominating the ground layer. Riparian communities were verified downstream of Cerito Dam, and downstream and upstream of Cerito Creek northern diversion area. These communities may constitute terrestrial GDEs (however the reliance of riparian vegetation on groundwater and sensitivity and resilience to groundwater level changes has not been verified).

The Project Area is not within the Great Artesian Basin catchment. No springs are mapped in the region and there are no State mapped spring vents, spring complexes or watercourse springs within a 10 km radius of Main Deposit.



Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 55



NC Coal Company Pty Limited
Newlands Closure Project – Cerito Creek Permanent
Diversion System

Project No. 12611481
Revision No. 0
Date 12/09/2025

GDEs mapping

FIGURE 4.10

4.5.5 Cerito Creek diversion hydrogeology

The mapped geology indicates that the majority of the existing channels (naturalised and existing diversion system) at Main Deposit traverse the Rewan Group at outcrop. Short sections of the existing and proposed diversion system are shown to traverse Quaternary alluvium, including upstream and downstream of the existing Cerito Creek South Diversion reach, west of Ramp 6 North, Ramp 8 South and Ramp 8 North and short sections along the Lake Austin Channel (part of the proposed diversion system). The channel beyond the northern end of the existing Cerito Creek South Diversion, and much of the proposed and existing channels along the line of Lake Austin Channel traverse Tertiary basalt at outcrop and sub-crop (beneath alluvium).

Boreholes from geotechnical investigations along the existing diversion indicate the near-surface Rewan Group is a sequence of interbedded sandstones, mudstones and siltstones, with sandstone being the predominant rock type. Depth to groundwater levels recorded in registered bores is summarised as follows:

- Alluvium – 7-14 metres below top of casing (mbtoc) (northern end of Main Deposit. Shallow groundwater in alluvium was observed at a test pit 2.6 m below ground level upstream of the existing diversion within the channel.
- Tertiary basalt – 8-21 mbtoc, reflecting variability in topography across a distance of a few hundred metres.
- Tertiary starta (undefined) – 17-44 m in the surrounding area, with site-specific data indicating depth to groundwater of approximately 26 mbtoc.
- Rewan Group – 20-30 m, with shallow groundwater observed at a test pit at 2.9 m below ground level with the existing diversion channel, potentially perched within weathered bedrock beneath the channel. Two recently installed monitoring bores near the drop structure on the diversion channel indicate depth to groundwater between 22-26 m below ground level.
- Permian coal measures – 9-20 mbtoc, with overall fall in groundwater elevation from south to north.

Available data indicate typical seasonal groundwater level fluctuations in the order of 1 to 4 m across the basalt, 2 to 8 m for the Rewan Group, 2 to 10 m for Rangal Coal Measures and 1 to 2 m for Fort Cooper Coal Measures (ERM, 2023).

Aquifers and water-bearing strata within the assessment area are often limited in extent. The three groundwater bearing units within the assessment area are Quaternary alluvium, Tertiary basalt and associated basal sands, and the Permian coal measures.

Recharge from direct rainfall is expected to be relatively minor. The mean daily evaporation far exceeds the mean monthly and mean annual rainfall totals in the area (data for Collinsville Post Office, site 033013, BoM) and the permeability of the ground surface in the area at and around the site is anticipated to be low given the underlying geology of the Rewan Group and coal measures (low permeability geological units), and Tertiary basalt (typically weathers to clay at and near to the surface) over much of the area.

Hydrogeological conceptual model

The existing, ephemeral, creek diversion system is underlain by the low-permeability Triassic Rewan Group that functions as a regional aquitard (as it restricts the flow of groundwater). The Rewan Group is locally overlain by Quaternary alluvium, which supports the localised presence of groundwater, or Tertiary basalt which is a local groundwater source (indicated to be predominantly used for stock watering).

The alluvium and basalts occur along relatively short sections of the diversion. Groundwater presence in the alluvium is anticipated to be perched on the underlying Rewan Group aquitard. Similarly, groundwater in Tertiary basalt is anticipated to form localised aquifers and be perched on the underlying Rewan Group.

Groundwater flow within the unconfined aquifers, including alluvium, is understood to follow the fall in topography, with a general northerly flow (with localised variability). The inferred overall groundwater flow direction is towards the north and northeast, with localised flow towards the former backfilled open cut voids and former northern and southern underground mining panels.

Aquifer recharge from direct rainfall is anticipated to be minor, as evaporation rates are significantly higher than rainfall rates (refer to Figure 4.12 and Figure 4.13). Recharge occurs from the following mechanisms:

- Direct rainfall and runoff infiltration

- Seepage from water stored within watercourses and ponds
- Seepage from overlying units, e.g., seepage from alluvial perched aquifers into Tertiary basalt and Permian coal seams.

When the watercourses are flowing (following rainfall), infiltration of surface water through the creek bed into alluvium and basalt recharges the groundwater system. Infiltration into the Rewan Group sedimentary sequences is only anticipated in highly fractured or highly weathered areas. The desktop assessment has identified that the shallow aquifers do not appear to provide baseflow for the Cerito Creek system, and watercourse and diversion channels do not intercept groundwater. Therefore, the surface and groundwater systems appear to be hydraulically disconnected.

However, alluvial groundwater is anticipated to be present temporarily within creek bed sediments (where present) and the underlying strata (where fractured or weathered) following periods of flow. On this basis, the riparian eucalypt woodland vegetation may opportunistically access shallow groundwater.

The channels of the existing diversion can be deeply incised into the interbedded sandstone, mudstone and siltstone of the Rewan Group and the Tertiary basalt; however, the channels do not appear to intersect the groundwater table and are considered hydraulically disconnected from surface water (i.e. losing streams). Surface water channels and groundwater in the alluvium and basalt are anticipated to be hydraulically disconnected from the underlying Permian-age strata and associated coal seam aquifers by the Rewan Group.

Underground mining was completed using longwall methods. Following mining, the overburden collapses into the void created by the removal of coal, creating fracturing in the rock layers above and can create subsidence at ground surface (ERM, 2023). Affected subsidence areas have formed a series of rectangular surface depressions above the SUG towards the east of Ramp 2 and west of Cerito Dam. Subsidence induced fracturing is anticipated to be present above both the SUG and NUG, and potentially provide preferential pathways for infiltration from ground surface where the overburden thickness is less than the height of interconnected fracturing. Ground subsidence occurs relatively quickly following longwall mining, and given that all underground mining ceased by 2015, no further ground subsidence is expected at either the SUG or NUG (ERM, 2023).

Post-mining hydrogeological conditions and surface water-groundwater interactions along and near to the Cerito Creek permanent diversion system are anticipated to be similar to existing conditions, with the groundwater table hydraulically disconnected from surface water. The predicted post-mining (recovered) groundwater table indicates a local hydraulic gradient towards the final pit voids and an overall hydraulic gradient towards the north and water in the former open cut pits is predicted to remain disconnected from surface water once in-pit water levels have equilibrated and groundwater levels recovered.

The ephemeral nature of surface water, the absence of baseflow from shallow groundwater, and the hydraulic disconnection of shallow groundwater in the alluvium and Tertiary basalt from the underlying Triassic and Permian strata is anticipated to continue under predicted post-mining groundwater levels. The predicted post-mining groundwater table is indicated to be in the order of 10 to 20 m lower than ground surface along the southern half of the proposed diversion system (to around Ramp 6 North) and in the order of 5 to 10 m lower than ground surface at the northern end of the proposed diversion system.

Conceptual hydrogeological cross-sections have been created for the two locations shown on Figure 4.11, and are provided in Figure 4.12 and Figure 4.13. Potential GDE datasets from regional or national studies (not verified by field surveys) categorising 'potential of ecosystem to be a GDE' for terrestrial and aquatic GDEs, sourced from the Groundwater Dependent Ecosystem Atlas (BoM, 2019), are also shown on these figures. Low and moderate 'potential of ecosystem to be a GDE' is shown along short sections of Cerito Creek and its tributaries and pre-Cerito Creek, primarily coincident with mapped alluvium.

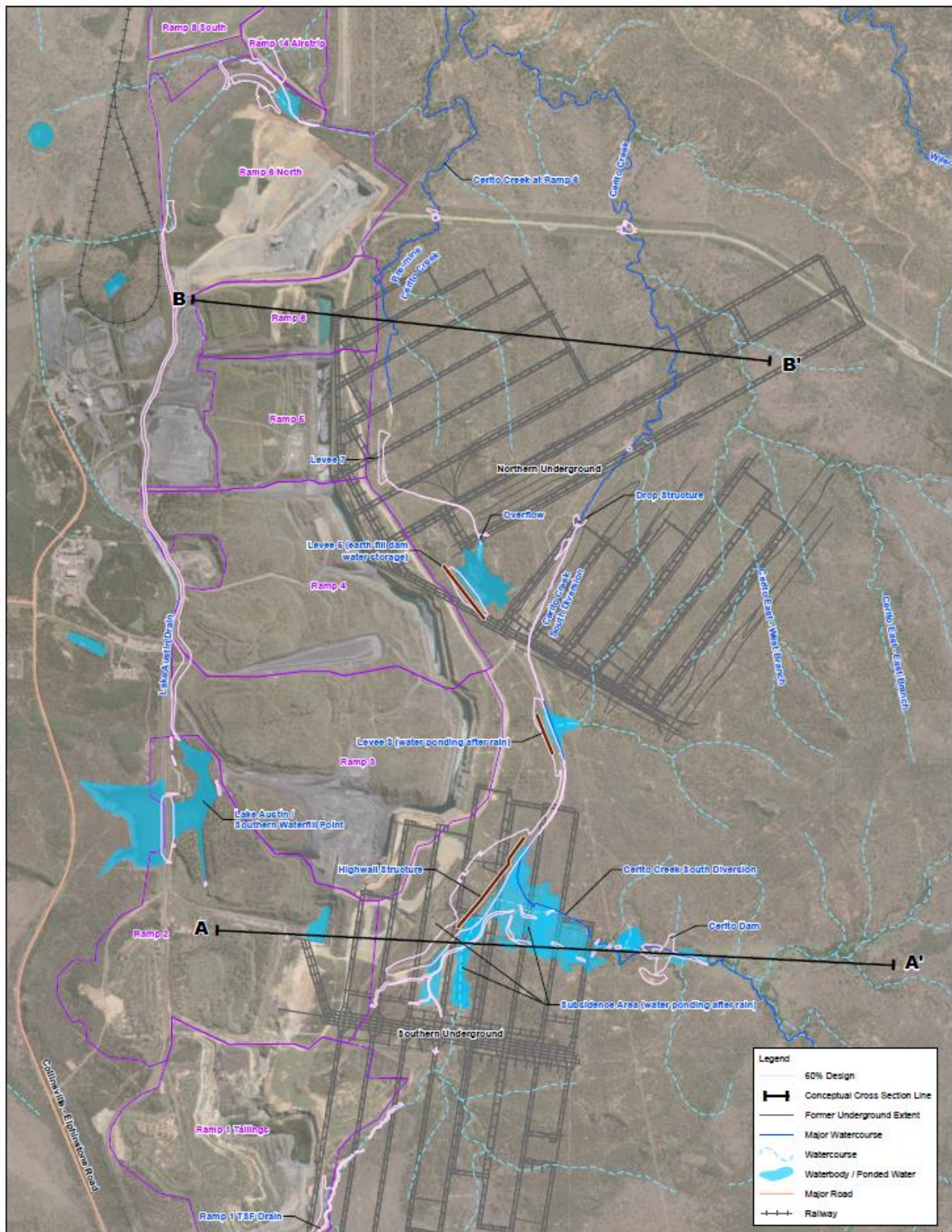


Figure 4.11 Locations of concept hydrogeological cross-sections

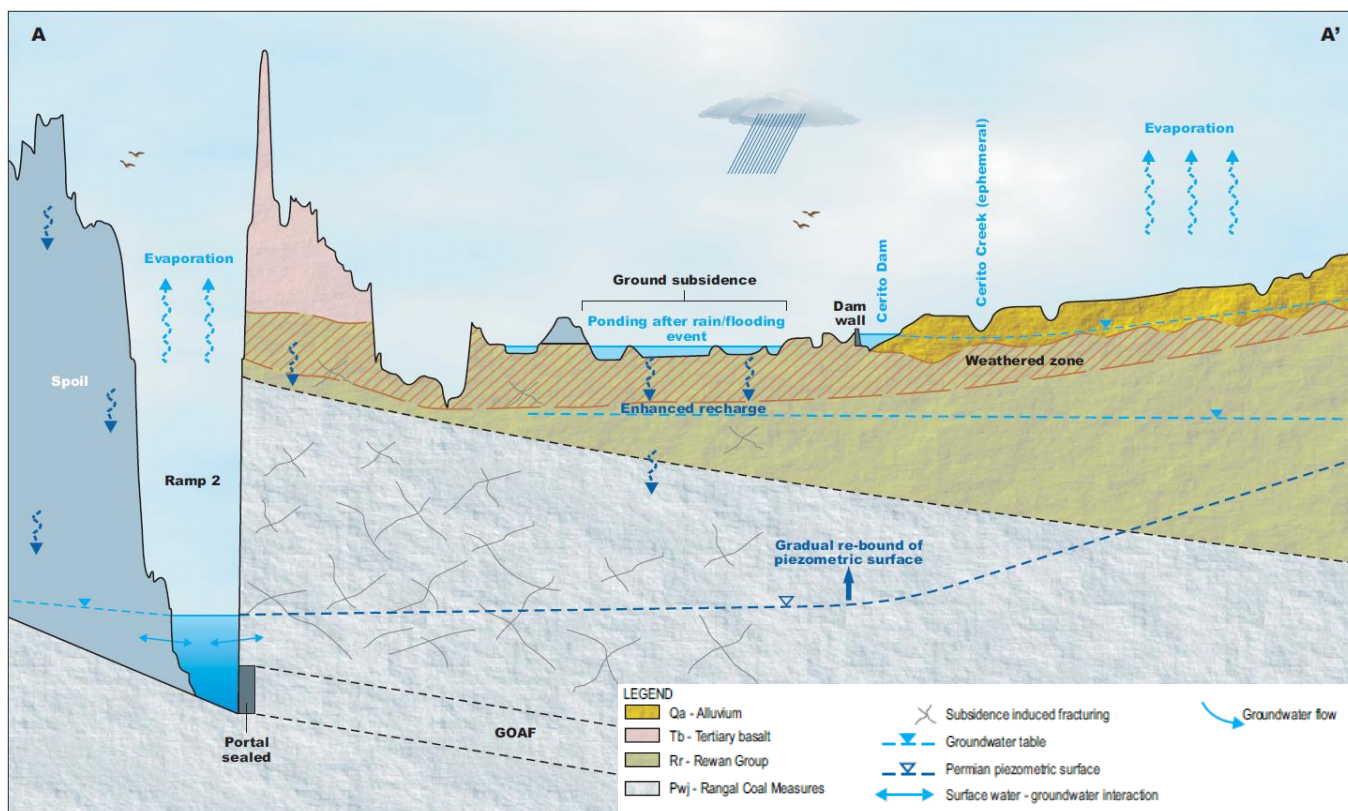


Figure 4.12 Conceptual hydrogeological cross-section (Cerito Dam and subsidence area)

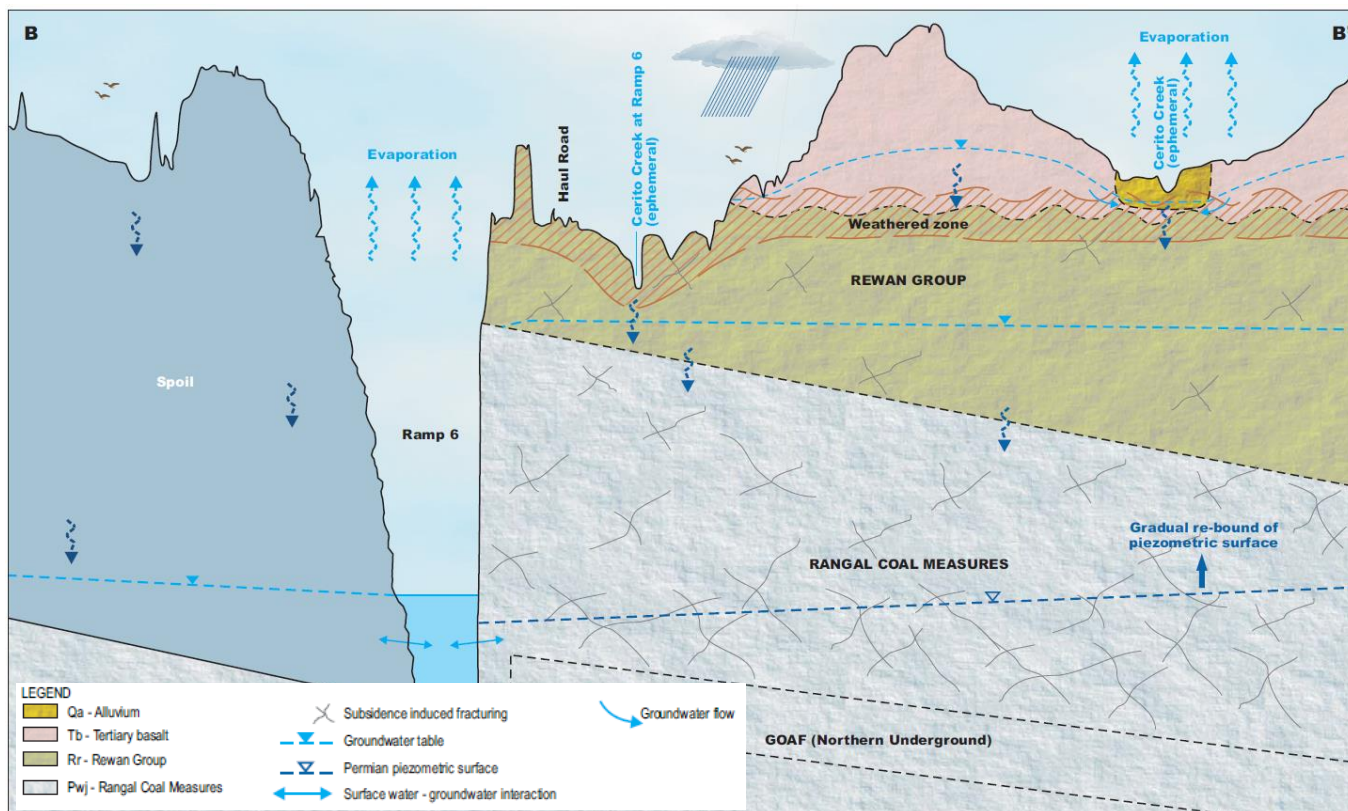


Figure 4.13 Conceptual hydrogeological cross-section (Cerito Creek further downstream from engineered channels)

4.5.6 Groundwater use

The EVs for groundwater have been reviewed in the context of the conceptual model, to identify groundwater users and identify the most sensitive of likely EVs for protection:

- **Aquatic ecosystems** – minimal State mapped GDEs within the immediate area and no State mapped GDEs along Cerito Creek or existing diversion system; Low and moderate 'potential of ecosystem to be a GDE' (BoM, 2019) are shown along parts of Cerito Creek and existing diversion system; Field-verified riparian habitat (Eucalypt woodland) along Cerito Creek and existing diversion system (noting the reliance of this riparian vegetation on groundwater has not been verified).
- **Irrigation** – groundwater from the alluvium and basalt is potentially suitable for irrigation (TDS indicates fresh to brackish groundwater), and groundwater in the coal measures may be suitable for irrigation of salinity tolerant crops (TDS indicates brackish to saline groundwater); the yield and, or volume of available groundwater may be a limiting factor for use of groundwater for irrigation from alluvium.
- **Industrial use** – groundwater from the alluvium and basalt is potentially suitable for industrial use (TDS indicates fresh to brackish groundwater), and the salinity of the coal measures may be suitable for irrigation of salt tolerant crops or very salt tolerant crops (TDS indicates brackish to saline groundwater); the yield and, or, volume of groundwater would likely be a limiting factor for industrial use of groundwater in the alluvium and coal measures; records for nearby registered bores indicate that groundwater from basalt is, or has been, used for 'water supply'.
- **Visual recreation** – creeks and surface water drainage channels are ephemeral and therefore anticipated to be of limited use for visual recreation.
- **Stock water** - groundwater from the alluvium and basalt (TDS indicates fresh to brackish groundwater) and coal measures (TDS indicates brackish to saline groundwater) is potentially suitable for stock water; records for nearby registered bores and site-specific groundwater monitoring records indicate that groundwater is, or has been, used for stock water (and for 'water supply').
- **Cultural and spiritual values** – creeks and surface water drainage channels of the existing diversion and in the surrounding area are ephemeral, however whether dry or flowing the natural channels (and naturalised parts of the existing diversion) have the potential to hold cultural and spiritual values.

For current identified and reasonably foreseeable future use of groundwater resources the aquatic ecosystem EV and the stock water EV are considered the most sensitive for protection.

A groundwater use survey identified 72 private landholder bores around Newlands Coal Mine. The survey found that groundwater was primarily sourced from the Tertiary basalt and Permian coal measures with water use predominantly used for stock water supply (SLR, 2018).

Within a 10 km radius of Main Deposit, 67 existing registered groundwater bores were identified, of which seven have a facility role of water supply and eight have a facility role of 'not described'. The remainder of the bores are indicated to be for mine monitoring, or exploration or investigation for petroleum, gas or other purposes.

5. Potential impacts and mitigation measures

5.1 Overview

This section outlines the potential impacts and associated mitigation measures for ecological and hydrological values associated with construction and maintenance of the Cerito Creek permanent diversion system.

Avoidance and minimisation measures developed through the design progression are discussed in Section 5.2. Specific mitigation measures related to construction and maintenance impacts are detailed in Section 5.3 and Section 5.4, respectively.

A significant impact assessment for each species potentially impacted by the Project is included in Section 6.

5.2 Avoidance and minimisation of impacts

Through progression of design stages of the Project, substantial avoidance and minimisation of impacts has been achieved. The Project aims to improve the ecological functioning of the previously impacted area by preserving mature, stabilising vegetation and rehabilitating disturbed areas with location-appropriate vegetation species, and incorporating natural and existing geomorphological features (low-flow channels, benches, sediment bars and pool/riffle sequences).

Minimise disturbance within the Newlands Nature Refuge area, where practicable, in accordance with authorised disturbance purposes under the Newlands Open Cut (Glencore): PLN Biodiversity Management Plan. The Newlands Nature Refuge area covers part of the existing southern diversion and Cerito Dam area. The Project design includes work within this area aimed to improve the ecological functioning of already impacted areas. Construction works will be confined to the diversion and fragmented areas of the western Newlands Nature Refuge, rather than disturbing the broader area to the east.

5.3 Construction phase impacts

The Project will involve linking of channels, removal of engineered structures, creation of low-flow channels, remediation of erosion, and rehabilitation of an area of past subsidence, amongst other activities, where necessary to reinstate natural flow and sediment transport in Cerito Creek and its tributaries. Project activities will be undertaken in previously mined and disturbed areas, rehabilitated areas, and to a lesser extent, undisturbed areas (due to linking into and integrating with natural ephemeral flow paths).

The Project design prioritises the re-establishment of natural ephemeral watercourse characteristics and the retention of mature, stabilising vegetation and seeks to avoid and minimise disturbance in areas that comprise or contain habitat for conservation significant species. Disturbance in the Newlands Nature Refuge area is authorised under the Newlands Open Cut (Glencore): PLN Biodiversity Management Plan and will be minimised.

To achieve the above, the following Project activities are proposed:

- Vegetation clearing for diversion earthworks (consisting largely of in-channel works and disturbance of riparian vegetation and will therefore have more of a direct and indirect impact to aquatic species, habitats and functions) and construction and maintenance access (establishment of new Project access tracks to gain entry at key locations where in-channel earthworks are proposed to occur and for widening of existing Project access tracks).
- In-channel earthworks, including blasting of areas of strong competent basalt and sandstone layers within the diversion system although a design objective is to minimise blasting through avoidance of strong, competent rock, typically Rewan Group sandstone layers and Tertiary basalt flows. However, areas envisaged to require blasting are as follows:
 - At the drop structure due to challenging access and some medium to high strength sandstone and rock layers within the target excavation depth.
 - Along Lake Austin channel due to strong basalt layers in the upstream reaches of the proposed new channel and deep gravely fill expected to be encountered adjacent to Pub Hill cutting.

- Permanent access track construction for post-construction monitoring and to accommodate post-mine landholder access, including replacing existing culvert crossings with bed level causeways.
- Temporary and permanent erosion and sedimentation controls both during and post-construction.
- Temporary and permanent spoil stockpiles during and post-construction (which will be located in previously mined and/or disturbed areas).
- Temporary and permanent fences to prevent livestock from accessing rehabilitated areas until such time that adequate ground cover and riparian vegetation has established around areas that require additional protection from grazing pressures.
- Temporary laydown areas (which will be located in previously mined and/or disturbed areas).
- Revegetation of riparian areas and rehabilitation of temporary construction areas.

Construction phase activities are expected to result in the loss and disturbance of riparian vegetation and habitat for conservation significant species (refer Section 6.3) and ecological communities. Impacts most likely to adversely affect conservation significant species or communities that were confirmed present or likely or have potential to occur in the Project Area, include:

- Loss of habitat
- Injury and mortality
- Temporary disturbance to wildlife due to noise, light and vibration
- Habitat fragmentation or barrier effects
- Habitat degradation by increased dust, erosion and sedimentation
- Introduction and spread of weeds and pest fauna species
- Modification of hydrological regimes
- Alteration of aquatic habitats.

5.3.1 Loss of habitat

Construction of the Project will result in the loss of vegetation and subsequently habitat for flora and fauna species.

Vegetation clearing during construction will result in the direct loss of MNES fauna habitat. Vegetation clearing includes the removal of structural features that provide habitat and resources for fauna, leading to a reduction in species due to competition for the remaining resources. The habitat resources include mature vegetation, hollow-bearing logs and hollow logs that provide perching, foraging and nesting resources for fauna species.

The following habitat types were identified in the survey area and have potential to be impacted by construction of the Project (with areas of impact within the Project disturbance footprint included):

- Eucalypt woodlands along main creeks (7.25 ha)
- Eucalypt dry woodlands (13.97 ha)
- Acacia woodland to open forest (14.26 ha)
- Melaleuca woodlands on alluvial plains (0 ha)
- Semi-evergreen vine thicket (0 ha)
- Pasture grassland (202.33 ha).

The field-verified REs that are present within the Project disturbance footprint are described in Table 5.1.

Table 5.1 Field-verified REs within Project disturbance footprint

RE code	Condition	Description	Area of impact (ha)
11.3.4	Remnant	<i>Eucalyptus tereticornis</i> (blue gum) woodland with <i>Corymbia</i> and <i>Eucalyptus spp.</i> on alluvial plains	0.94
11.3.25	Remnant	Blue gum woodland fringing drainage lines on sandy soils	7.25

RE code	Condition	Description	Area of impact (ha)
11.8.5	Remnant	<i>Eucalyptus orgadophila</i> (Mountain coolibah) open woodland on Cainozoic igneous rocks	1.69
11.9.1	Regrowth	<i>Acacia harpophylla</i> (brigalow) woodland to open forest on fine-grained sedimentary rocks	0.23
11.9.5	Remnant	Brigalow open forest on fine-grained sedimentary rocks	0.44
	Regrowth		13.75
11.9.9	Remnant	Narrow-leaved ironbark woodland on fine-grained sedimentary rocks	4.78
	Regrowth		5.21
–	Non-remnant	Pasture grassland and other cleared/developed areas	202.88
–	Rehabilitated	Previously cleared areas that have been rehabilitated	1.12

The Project has the potential to result in direct or indirect impacts to 11 MNES species/communities assessed as known to occur, likely to occur or with the potential to occur within the Project disturbance footprint. The estimated loss of predicted habitat for these species is summarised in Table 5.2.

Table 5.2 Predicted habitat loss for MNES species confirmed present or with potential to occur

Species	EPBC Act (Cth) status	Habitat types	Area of predicted habitat loss (ha)
TEC			
Brigalow TEC	E	Confirmed TEC	13.42
Semi-Evergreen Vine Thicket TEC	E	Confirmed TEC	0
Flora			
King blue-grass	E	50 m buffer around records	0.70
Birds			
Squatter pigeon	V	Breeding	10.61
		Foraging	0.034
		Dispersal	29.46
Caspian tern	Mig	Foraging (15 m buffer around waterbodies)	75.33
White-throated needletail	V Mig	Fly-over foraging	35.24
Fork-tailed swift	Mig	Fly-over foraging	35.24
Oriental cuckoo	Mig	General	35.24
Mammals			
Koala	E	Foraging	20.17
		Shelter	17.20
		Dispersal	69.24
Greater glider (southern and central)	E	Denning	7.25
		Foraging	9.65

Species	EPBC Act (Cth) status	Habitat types	Area of predicted habitat loss (ha)
Reptiles			
Ornamental snake	V	Suitable	2.47
		Marginal	7.87

5.3.1.1 Mitigation measures

Acknowledging the avoidance and minimisation of impacts in Section 5.2, vegetation clearing associated with the Project is an unavoidable impact. The following measures will be undertaken to further minimise and mitigate the impacts of vegetation and habitat loss:

- Restrict clearing to the smallest area required for construction of the Project and all ancillary activities.
- Locate spoil and borrow areas in previously disturbed areas wherever possible.
- Schedule construction to minimise the active works area required at any time.
- Locate and mark no-go areas of environmental sensitivity on site and in construction plans, including all vegetation not to be cleared.
- Hollow logs and large woody debris will be salvaged for the use of habitat creation/enhancement outside of the extent of works and within in-channel works to create aquatic habitat features.
- Rehabilitate temporary construction areas as soon as possible after the completion of local construction works.

5.3.2 Injury and mortality

5.3.2.1 Potential impacts

Construction activities have the potential to directly impact fauna through collision with construction vehicles, direct injury or mortality during site clearing, and entanglement in site fencing.

Vegetation clearing has potential to cause injury or mortality to fauna species sheltering in hollows, nests, trees or ground habitat. Species most at risk include nocturnal species that shelter during the day when clearing activities occur (koala, gliders, bat), and slow-moving species that are less able to flee the clearing zone (reptiles, koala, squatter pigeon).

Increased vehicle movement around the Project Area during the construction phase may increase the potential for fauna injury or mortality through vehicle strike and collision. Entrapment in fencing has potential to occur to ground-dwelling reptiles such as snakes.

5.3.2.2 Mitigation measures

The following measures will be instigated to minimise wildlife injury and mortality during construction:

- Enforce on-site speed limits to minimise vehicle strike incidents.
- Clearly locate and mark no-go areas of sensitive vegetation and habitat, including all vegetation not to be cleared.
- Engage suitably qualified and experienced fauna spotter-catchers to supervise all clearing activities within areas of high ecological value (i.e. areas of predicted habitat for conservation significant species, areas with high densities of hollow-bearing trees, rocky outcrops, riparian vegetation associated with watercourses).
- Employ of sequential clearing practices and use of suitably qualified koala spotters.
- Allow fauna individuals to move out of the clearing footprint of their own accord wherever possible.
- Educate all onsite personnel on areas of ecological sensitivity and wildlife breeding areas prior to pre-construction and construction activities, with emphasis on species with increased risk of injury or mortality such as the greater glider and squatter pigeon.
- Inspect trenches, excavations and machinery daily for the presence to trapped fauna.

5.3.3 Temporary disturbance to wildlife from light, noise and vibration

5.3.3.1 Potential impacts

Construction activities may cause indirect degradation of adjacent habitats due to an increase in the exposure to light, noise and vibration. Consequentially, this has the potential to adversely impact native wildlife through the disruption of foraging, breeding and nesting behaviours (Longcore and Rich, 2004).

The earthworks will result in a substantial, localised increase in vehicle movements in the short-term. This will increase light, noise and vibration disturbance to local wildlife. Increased light, noise and vibration can alter individual species' behaviours and disrupt the balance of inter-species interactions. Such disruptions typically favour feral predators and generalist species that owe their success to broad ecological tolerances and possess the ability to tolerate or actively exploit disturbed environments (Hero et al. 2004).

5.3.3.2 Mitigation measures

The following mitigation measures will be undertaken to minimise the impact that noise, light and vibration have on local wildlife populations:

- Service and maintain all plant and equipment to minimise machinery noise as much as possible.
- Develop and implement traffic management requirements for the construction site to control vehicle movements and speeds and reduce the unnecessary generation of vehicular noise.
- Restrict large scale operations such as vegetation clearing and blasting to daylight hours wherever possible to reduce the need for lighting, and reduce noise and vibration impacts on nocturnal fauna species.
- Comply with construction vehicle maintenance schedules and operational restrictions designed to limit noise impacts during construction.

5.3.4 Habitat fragmentation or barrier effects

5.3.4.1 Potential impacts

Habitat fragmentation occurs when large, continuous habitats are broken into smaller, isolated patches. Fragmentation can hinder the movement of animals, isolating populations and lead to habitat degradation. Fragmentation increases edge habitat, where the edge of a habitat patch becomes degraded due to increased exposure to noise, light, erosion and invasive species. The greater glider is reluctant to cross large gaps between vegetation and is therefore susceptible to the adverse effects of habitat fragmentation (McCarthy and Lindenmayer 1999).

Due to the Project being in a previously disturbed area, the majority of existing habitat is fragmented. Where further clearing is required in construction, the Project has potential to result in further localised fragmentation adjacent to construction activities.

5.3.4.2 Mitigation measures

The following mitigation measures will be undertaken to minimise the impact of habitat fragmentation or barrier effects on flora and fauna:

- Limit construction or temporary fencing or utilise wildlife permeable fencing where risk of injury is low.
- Demarcate areas of native vegetation requiring removal to equipment operators and supervisors before any clearance to ensure disturbance is minimised.
- Maintain areas of existing vegetation to assist in providing a source of seed for local rehabilitation works.
- Co-locate or upgrade existing Project access tracks in areas that are already disturbed, wherever possible.
- Use native species for rehabilitation wherever possible. If native species are unsuccessful introduced stoloniferous grasses may be suitable to achieve rapid surface coverage.
- Limit construction laydown areas and stockpiles to areas that have already been cleared to minimise unnecessary clearing wherever possible.

5.3.5 Habitat degradation by increased dust, erosion and sedimentation

5.3.5.1 Potential impacts

Construction activities have the potential to generate localised dust, erosion, run-off and sedimentation through increased vehicle movements, clearance of vegetation, blasting and earthworks. This can reduce the abundance and diversity of adjacent terrestrial and aquatic habitats by physically smothering vegetation, changing nutrient levels, impeding the growth and germination of plant species, encouraging weed incursions and altering the movement and behaviour of fauna species.

The temporary construction works required to modify and rehabilitate the existing diversions include the following potential impacts:

- Alteration of surface water flows due to the modification of the current channel and formation of new channels.
- Temporary impacts on water quality due to increased sediment from earthworks increasing turbidity, lowering dissolved oxygen and releasing of contaminants trapped in the sediment (e.g. nutrients, metals, etc.).
- Modification of aquatic habitats due to changes to channel dimensions, habitat features and conditions.

Most construction impacts are likely to be temporary, with the rehabilitation of riparian corridors proposed where works have occurred, and the watercourse expected to return to natural conditions once completed, with no long-term impacts from the Project anticipated.

Dust generated during construction has the potential to accumulate on vegetation, potentially rendering some food sources unpalatable, particularly for folivorous species like the central greater glider. Indirect impacts on habitat quality will vary in their spatial extent, with dust and sedimentation impacts caused by vehicle movements generally limited to within 40 m of a road edge. Edge effects associated with runoff and sedimentation may extend further in circumstances where local topography increases the potential for run-off or where sediment has entered watercourses. The Project has the potential to generate an increase in dust within the Project Area due to clearing activities, increased traffic and increased ground exposure. These impacts will be heightened during periods of low rainfall and high wind.

5.3.5.2 Mitigation measures

The following mitigation measures will be implemented to minimise habitat degradation by increased dust, erosion and sedimentation:

- Erosion and sediment control measures employed during construction will be consistent with the practices described in the International Erosion Control Association, Best Practice Erosion and Sediment Control Guideline and/or Queensland Division of the Australian Institute of Engineers' Erosion and Sediment Control: Engineering Guidelines for Queensland Construction Sites.
- A Construction Environmental Management Plan will be developed and implemented, which will include a Dust Management Plan.
- Restrict speed limits and other traffic control mechanisms to minimise dust generation.
- Undertake routine dust suppression and monitoring where required to minimise dust dispersal during construction.
- Rehabilitate disturbed areas as soon as is practicable to minimise exposed surface periods.
- Appropriate design of soil stockpiles, and rubbish and waste materials disposal will be undertaken.
- Monitor weather conditions during construction and establish extreme weather stand-down and temporary control protocols to minimise adverse outcomes resulting from extreme weather events.
- Fuel and chemical storage protocols and spill responses will be implemented.
- Waste and hazardous materials management procedures will be implemented.

5.3.6 Introduction and spread of weeds and pest fauna species

5.3.6.1 Potential impacts

Construction activities have the potential to introduce and spread weeds and pest fauna species. Introduced species have the potential to disrupt ecosystems by altering inter-species competition and predation. Vegetation clearing creates increased bare ground, encouraging weed species to grow.

Introduced predators such as foxes, cats and dogs have been known to predate on native species. However the Project is unlikely to adversely impact on the access or spread of feral predators.

5.3.6.2 Mitigation measures

The following mitigation measures will be implemented to minimise the introduction and spread of weeds and pest fauna species:

- Develop and implement a Weed and Pest Management Plan, as part of the Construction Environmental Management Plan, that outlines protocols to prevent the introduction of weed and pest species into the area and minimise the spread of declared weeds and pests within the site.
- Establish appropriate on-site waste-storage and disposal protocols, with designated waste-storage areas and appropriate (i.e. closed) waste receptacles and frequent waste disposal schedules to minimise attracting feral animals (e.g. dogs and pigs).
- Include weed and pest management protocols in all worker inductions.
- Enforce strict weed hygiene protocols including weed-washdowns of all vehicles, machinery and plant prior to entering the construction site. Wash-downs and inspections should also be undertaken regularly for vehicles travelling to different parts of the site to minimise internal spread of weeds within the works area.
- Establish a designated access track network and restrict all vehicle movements to designated access tracks located within the Project Area (or otherwise established access roads).
- Enforce no off-road driving.
- Undertake pre-construction inventory and mapping of all weed-affected areas, as required by local or Queensland Government requirements, and identify areas of high risk that should be designated as no-go areas or areas requiring active weed management during and after construction.
- Undertake regular post-construction monitoring of rehabilitation areas and high-risk weed areas.
- Identify and control all declared weed infestations on the construction site throughout construction.
- Monitor treated areas to assess the success of declared pest/weed eradication.
- Rehabilitate and revegetate temporary works areas as soon as possible to minimise the potential for weed establishment.
- Utilise stockpiled topsoil and chipped vegetation during landscaping and revegetation.
- Utilise native species endemic to the region in revegetation to minimise importation of plants.
- Undertake regular post-construction monitoring of rehabilitation areas and high-risk weed areas.

5.3.7 Modification of hydrological regimes

5.3.7.1 Potential impacts

Construction of the Project will result in a modification of hydrological regimes within the Cerito Creek system. Where Cerito Creek was originally diverted in numerous sections around the Main Deposit of Newlands Coal Mine, it will be refined and adjusted, as well as adding new sections of channels to create a long-term environmentally sympathetic landform.

During construction, a temporarily altered hydrological regime will result in changes to flow characteristics, which can lead to poor water quality (e.g. from increased sediment and turbidity) and potential decreased health of downstream watercourses (e.g. reduction of water flow or levels). Indirectly, modifications of hydrological regimes have potential to impact fauna movements; however, there are numerous existing barriers to fauna movement along the watercourse already limiting fauna movement.

5.3.7.2 Mitigation measures

The following mitigation measures will be implemented to avoid and minimise impacts from the modification of hydrological regimes:

- Environmental flows will be maintained during construction to maintain connectivity and health of downstream habitats and, if required, water will be diverted around construction work areas.
- Construction to occur in the dry season, where possible, to minimise the impacts to flows and aquatic fauna movement.
- Bed level causeways will be designed and constructed in accordance with WWBW acceptable development requirements for constructing a waterway barrier in fish habitat.
- A Flood Management Plan will be developed, as part of Construction Environmental Management Plan, to detail management of high rainfall and flooding events. Actions will include keeping the construction footprints clear of unnecessary debris, drainage within the footprint, and post high flow surveys for stranded fauna.
- Water quality conditions will be monitored to confirm conditions downstream are maintained in accordance with guidelines and allow for adaptive management in the event that impacts are detected. Actions will include pre, during and post-construction monitoring in accordance with the Australian & New Zealand Guidelines for Fresh & Marine Water Quality (AWQG 2018) against criteria set out in the recommended WQO from the EPP guidelines (DEHP 2019).

5.3.8 Alteration of aquatic habitats

5.3.8.1 Potential impacts

Watercourses comprise ephemeral creeks that only flow after periods of heavy rainfall and are generally reduced to isolated pools throughout most of the year. Nonetheless, these isolated pools provide refugial habitat in periods of no flow or drought and support a community of freshwater fish, turtles, macroinvertebrates and aquatic plants that are adapted to the ephemeral conditions. All species recorded during aquatic surveys were native and these species are adapted to ephemeral conditions by either lying dormant until flows resume or having physiological adaptations to withstand a variety of water quality conditions including high electrical conductivity. However, there are numerous barriers instream throughout the project area that prevent fish from migrating upstream.

There may be temporary disturbance to aquatic habitats during construction works where they occur during seasonal flow conditions or following a heavy rainfall event, such as through changes to flow conditions (and therefore connectivity between aquatic habitats) where diversion or bunding is needed to be used, or reduced water quality (through increased erosion and sedimentation due to exposed soils and earthworks on bed and banks). Direct disturbance to aquatic habitat features is likely to occur during construction activities, however this would be temporary as the Project aims to restore and improve the occurrence of habitat features along the watercourse bed and banks.

5.3.8.2 Mitigation measures

While the overall Project is anticipated to have a positive impact on aquatic ecological values, temporary impacts may be experienced during the construction phase. The following mitigation measures will be implemented to avoid and minimise construction impacts to aquatic habitats:

- Environmental flows will be maintained during construction to maintain connectivity and health of downstream habitats and, if required, water will be diverted around construction work areas.
- Construction to occur in the dry season, where possible, to minimise the impacts to flows and aquatic fauna movement.
- Bed level causeways will be designed and constructed in accordance with WWBW acceptable development requirements for constructing a waterway barrier in fish habitat.
- Restrict clearing to the smallest area required for construction of the Project and all ancillary activities.
- Stage construction to minimise the active works area required at any time.
- Rehabilitate temporary construction areas as soon as possible after the completion of construction works.

- A Drainage, Erosion and Sediment Control Plan will be developed and implemented. Management actions will be in accordance with the Best Practice Erosion and Sediment Control Guidelines (IECA) 2008 to minimise excess sediment entering watercourses.
- A Waste and Hazardous Materials Management Plan will be developed and implemented as part of the Construction Environmental Management Plan. Management actions will be in accordance with Australian Standards (Hazardous Material Management Program), which includes reducing the likelihood of chemical spills or leaks through:
 - Storing fuels, oils and other chemicals in bunded areas in accordance with Australian Standard 1940 (2004) – The storage and handling of flammable and combustible liquids.
 - Making spill kits available to enable a rapid response to a spill if one was to occur.
- Laydown areas, site offices and other temporary work areas will be positioned away from watercourses and measures implemented to prevent run off. These will preferably be located above the 1% AEP flood inundation level.
- Water quality conditions will be monitored to confirm conditions downstream are maintained in accordance with guidelines and allow for adaptive management in the event that impacts are detected. Actions will include pre, during and post-construction monitoring in accordance with the Australian & New Zealand Guidelines for Fresh & Marine Water Quality (AWQG 2018) against criteria set out in the recommended WQO from the EPP guidelines (DEHP 2019).

5.4 Post-construction phase impacts

The post-construction or maintenance phase of the Project will consist of Cerito Creek flowing in a self-sustaining matter. This will include permanent modification of hydrological regimes and alteration of aquatic habitats.

5.4.1 Modification of hydrological regimes

5.4.1.1 Potential impacts

Permanent alteration of Cerito Creek will lead to a modified hydrological regime. Over time this has potential to indirectly impact vegetation adjacent to the creek, and subsequently fauna habitat due to water availability. However, the aim of the Project is to restore the creek back to pre-mining condition and original hydrological regimes. Once construction is complete, flows are anticipated to resume as per standard ephemeral watercourses of the region. Culvert crossings established during mining operations will also be removed and replaced with bed level causeways. Therefore, more throughput of flow is expected to occur in the Cerito Creek permanent diversion system.

5.4.1.2 Mitigation measures

Mitigation measures during of the diversion will include post-construction monitoring to confirm the Cerito Creek permanent diversion system is functioning as intended.

A Monitoring Plan will be developed and implemented, to demonstrate that the watercourse diversion is developing and functioning as designed and any issues can be identified before major instabilities occur that require significant rehabilitation.

5.4.2 Alteration of aquatic habitats

5.4.2.1 Potential impacts

The Project is likely to have a long-term positive impact on aquatic habitats by restoring flow and creating long-term stability, with consideration of the currently modified condition of the local watercourses. The Project design is aimed to provide a final landform that will be self-sustaining and positively contribute to watercourse health throughout the system. To achieve this the design includes:

- Incorporating natural features present in the landscape and local watercourses.
- Maintaining existing hydrological characteristics of surface water and groundwater systems.

- Reinstating hydraulic characteristics similar to local watercourses.
- Maintaining sediment transport regime that allows the watercourse to be self-sustaining, while minimising impacts to upstream and downstream reaches.
- Watercourses that maintain equilibrium and functionality and are appropriate for all substrate conditions.

The design includes elements to support improving or enhancing aquatic habitats along the banks and instream. This includes riparian vegetation planting, pool/riffle sequences, meanders and natural bends throughout the channel, and instream habitat features (i.e. large woody debris, boulder piles, etc.). Several culverts are also planned to be decommissioned, which would improve aquatic habitat connectivity throughout the catchment.

The ephemeral nature of the local watercourses means that aquatic habitat is temporary and seasonal, and by restoring flow and habitat features, the design will enhance the functionality and connectivity for use by aquatic species. The removal of unnatural barriers to watercourse flow will be highly beneficial for the flow of water throughout the creek, allowing increased opportunities for aquatic fauna movement during periods of flow and additional habitat creation. It is expected that with the improvement in riparian and creek habitats and restoration of connectivity as a result of this project, the waters will become more interconnected, resulting in an increase in biodiversity.

5.4.2.2 Mitigation measures

Mitigation measures during maintenance of the diversion will include post-construction monitoring to confirm the Cerito Creek permanent diversion system is functioning as intended.

An aquatic ecosystem monitoring program will be implemented to assess aquatic ecological value condition and recovery following construction. Parameters to be included in the program include aquatic habitat assessments, aquatic flora, water quality, sediment quality and fish communities. The monitoring program should be bi-annual at a minimum to help identify where further rehabilitation may be required.

5.4.3 Overgrazing of riparian areas

5.4.3.1 Potential impacts

Overgrazing by livestock as part of the post-mine land use has the potential to impact on the establishment of revegetated areas and natural regeneration, result in the degradation of riparian habitat and increased soil erosion.

5.4.3.2 Mitigation measures

Temporary and permanent fences are proposed to be installed to prevent livestock from accessing rehabilitated areas until such time that adequate ground cover and riparian vegetation has established around areas that require additional protection from grazing pressures. Consideration will be given to the potential risk for entanglement of native wildlife and surrounding habitat values when selecting areas to be fenced, the type of fencing to be installed and in deciding to install temporary or permanent fencing.

Other long-term strategies that the post-mine landholder will be responsible for include reviewing stock levels and implementing rotational grazing, where practicable.