5. Targeted Threatened Species Surveys

Targeted surveys for rare or threatened species were undertaken in October to December 2019 within the Upper Gunbower Forest and Middle Gunbower Forest (upstream of Deep Creek) area of investigation, where potential habitat was identified. These areas contained intact native vegetation and it was considered possible that they supported suitable habitat of varying qualities for rare or threatened species.

Threatened species for Middle Gunbower (downstream of Deep Creek) have been assessed at a desktop level only, with targeted field surveys to occur in spring 2020. Results of these surveys will be provided in an updated version of this report.

5.1 Threatened Flora Assessment

5.1.1 Desktop Assessment and Likelihood of Occurrence

VBA and PMST searches as well as previous studies in the project area (Bennetts et al. 2012, Bennetts 2014b, Bennetts 2014a, Biosis 2014a, GHD 2017, Seran BL&A 2018) identified fifteen (16) threatened flora species previously recorded or with Occurrence Possible within the study area that are EPBC Act listed (13) and/or FFG Act listed (13). A further ten (10) species listed as rare or threatened on the Advisory list of Rare and Threatened Plants in Victoria (DEPI 2014) were also identified.

Each of these species has been assessed for their likelihood of occurrence and impact within the construction footprint (Appendix D) and inundation area (Appendix E), taking into account factors such as the habitat requirements of each species and comparing those to the habitats encountered within the Gunbower National Park project area, and also the number and frequency of records within the study area.

Species for which habitat was present or that had previously been located within Gunbower National Park were targeted during the threatened flora surveys. This included River Swamp Wallaby-grass (*Amphibromus fluitans*, EPBC Act listed Vulnerable), Winged Pepper-cress (*Lepidium monoplocoides*, EPBC Act listed Endangered), Ridged Water-milfoil (*Myriophyllum porcatum*, EPBC Act listed Vulnerable), Floodplain Rustyhood (*Pterostylis cheraphila*, EPBC Act listed Vulnerable), Stiff Groundsel (*Senecio behrianus,* EPBC Act listed Endangered) and Slender Darling-pea (*Swainsona murrayana*, EPBC Act listed Vulnerable).

Some species have been identified as 'possibly occurring' within the construction footprint but as having a low likelihood of being impacted. This has arisen in situations where even though preferred habitat is present (meaning likelihood of occurrence is possible), an impact on these species has been deemed as unlikely, as the species has not been recorded during targeted surveys at the appropriate time of the year. However, it should be noted that due to the prevailing drought conditions, the response of many ephemeral species has been muted, and absence during the 2019 targeted surveys does not necessarily imply that the species is not present – it may still reside in the soil as underground tubers, rootstock or seed, waiting for appropriate moisture to trigger germination.

Table 5-1 Overview of likelihood of occurrence assessments for rare or threatened flora

Number of rare or threatened flora	Construction Footprint			Inundation Area*		
	Total^	EPBC	FFG	Total^	EPBC	FFG
Present	2		1	1	1	0
Possible	17	6	7	19	6	9
Unlikely	5	5	4	4	4	3
Highly Unlikely	2	2	1	2	2	1
Total	**26**	**13**	**13**	**26**	**13**	**13**

* Determined from previous assessments within the inundation area (Bennetts et al. 2012, Bennetts and Cook 2020, Bennetts and Jolly 2020)

^Includes DELWP Advisory listed rare and threatened flora

Threatened flora species identified as Present or with Possible occurrence in the construction footprint and inundation area are discussed in Section 7.2 and in Table 7-2. Species identified as Unlikely or Highly Unlikely to occur within the construction footprint and inundation are shown only in Appendix D and Appendix E.

5.1.2 Field survey results

One EPBC Act listed species, River Swamp Wallaby-grass (*Amphibromus fluitans*) was recorded in the area of investigation at the very western end of the Baggot's Creek overflow in Middle Gunbower. Two FFG Act listed species, Umbrella Wattle (*Acacia oswaldii*) were identified at three locations and Buloke (*Allocasuarina luehmannii*) was identified at one location in the area of investigation. Two further threatened species, Long Eryngium (*Eryngium paludosum*) and Leek Flax-lily (*Dianella porracea*), listed on the DELWP Advisory list of rare or threatened plants (DEPI 2014) were located in the area of investigation, the former extensively at one location while the latter at a few locations as summarised in Table 5-2.

The location of threatened species identified during the 2019 surveys and in previous assessments are shown in Figure 5-4.

Table 5-2 Summary of threatened flora recorded during 2019 surveys

Species Name	Conservation Status	Location(s)
River Swamp Wallaby-grass (*Amphibromus fluitans*)	EPBC - Vulnerable	Multiple individuals (20-30) recorded along the levee in the area of investigation within the broader Baggots Swamp (semi-permanent wetland) in Upper Gunbower Forest, approximately 1.75 km fron the nearest construction footprint at Dry Creek Outlet.
Umbrella Wattle (*Acacia oswaldii*)	DELWP Advisory list – vulnerable FFG listed	Two individuals recorded near the construction footprint at Cameron's Creek Mid Creek regulator, two individuals in the area of investigation (2019) along an existing levee in Middle Gunbower and one individual along Forster Road outside the National Park.
Buloke (*Allocasuarina luehmannii*)	FFG listed	One individual recorded south of the Torrumbarry Weir in the area of investigation (2019).
Leek Flax-lily (*Dianella porraceae*)	DELWP Advisory list – vulnerable	A few individuals recorded within the area of investigation (2019) in Riverine Chenopod Woodland and Plains Woodland.
Long Eryngium (*Eryngium paludosum*)	DELWP Advisory list – vulnerable	Multiple individuals (~100) recorded in the construction footprint and broader area of investigation at Cameron's Creek Mid Creek regulator.

5.1.3 Presence of EPBC Act listed flora

One EPBC listed flora species, River Swamp Wallaby-grass (*Amphibromus fluitans*, EPBC Act listed Vulnerable) was identified during the most recent field assessment within the area of investigation, and five others, Winged Peppercress (*Lepidium monoplocoides*, EPBC Act listed Endangered), Ridged Water-milfoil (Myriophyllum

porcatum), Floodplain Rustyhood (Pterostylis cheraphila), Stiff Groundsel (*Senecio behrianus,* EPBC Act listed Endangered) and Slender Darling-pea (*Swainsona murrayana*, EPBC Act listed Vulnerable) are either known to occur close to the project area or suitable habitat exists within the project area.

Of the thirteen (13) EPBC Act-listed flora species that were identified by the PMST (10 km radius) and previous assessments in the project area, the likelihood of occurrence for listed flora species in the construction footprint is detailed in Appendix C.

5.1.3.1 River Swamp Wallaby-grass (*Amphibromus fluitans*)

River Swamp Wallaby-grass (EPBC Act listed Vulnerable) is considered to present within the project area, as the species is known to occur in the Gunbower National Park and broader Gunbower region (Bennetts and Cook 2020). Targeted surveys also identified the species within the area of investigation in the far western extent of the Baggot's creek overflow in Upper Gunbower Forest (see Figure 5-4). Individuals recorded during surveys were heavily browsed by herbivores and were challenging to confirm their ID compared to the Common Swamp Wallaby-grass (*Amphibromus nervosus*). However, distinctive characteristics including individuals being stoloniferous and possessing straight awns, not bent, assisted in verifying the species as River Swamp Wallaby-grass.

River Swamp Wallaby-grass is an aquatic perennial grass growing to 1 m high and is considered relatively common in the small area of remaining habitat in the low-lying areas of northern Victoria (DAWE 2020a). The species has been specifically impacted by the damage that hard-hooved animals, particularly cattle, have had on the wetland environments across its relatively large range. The removal of cattle and the restoration of more natural inundation conditions are considered to be beneficial to the species (DAWE 2020a).

Figure 5-1 River Swamp Wallaby-grass (Amphibromus fluitans) recorded at Baggot's Creek overflow in Upper Gunbower in dry Riverine Swamp Forest. All individuals recorded during surveys had been heavily browsed with little reproductive material making it challenging to positively confirm ID.

5.1.3.2 Winged Peppercress (*Lepidium monoplocoides*)

Winged Peppercress (EPBC Act listed Endangered) is considered to 'possibly' occur within the inundation area but has not been previously recorded in the Middle or Upper Gunbower Forest systems. Winged Peppercress is also listed under the FFG Act and on the DELWP Advisory list (endangered). It has been recorded in and is known

to occur in the Lower Gunbower Forest (Bennetts et al. 2012). Targeted surveys by R8 in 2019 did not record the Winged Peppercress within the area of investigation.

Winged Peppercress is a small annual herb growing to 20 cm tall that has suffered a similar, but more severe decline to River Swamp Wallaby-grass, from the loss of exposure to flooding events and the impact of hard-hooved herbivores (Mavromihalis 2010). The species is known from six 'important populations' within Victoria with the closest being Reedy Lagoon Cohuna, 30 km downstream of the project area. Given the species is known from upstream at Barmah National Park, it is likely the species once occurred within the inundation area and could recolonise as suitable flooding conditions are restored. Despite being extensively surveyed, there is still the possibility the species occurs within Gunbower National Park, most likely to be on the upper alluvial terraces where it is exposed to periodic inundation under large flooding events (Mavromihalis 2010). It is associated with Black Box chenopod shrubland (understorey dominated by *Atriplex*, *Maireana* and/or *Nitraria* species) which is relatively widespread throughout the Gunbower National Park.

It is likely the species historically occurred within the Upper and Middle Gunbower Forests, and if a population does exist within Gunbower National Park it is likely to benefit from a restored natural flooding regime.

5.1.3.3 Ridged Water-milfoil (*Myriophyllum porcatum*)

Ridged Water-milfoil (EPBC Act listed Vulnerable) is considered to 'possibly' occur within the inundation area but has not been previously recorded in Gunbower National Park or within 10 km of the project area. Ridged Water-milfoil is also listed under the FFG Act and on the DELWP Advisory list (vulnerable). Targeted surveys by R8 in 2019 did not record the species within the area of investigation.

The Ridged Water-milfoil is an aquatic herb which has both submerged and emergent components. It is endemic to Victoria, where it is widely but patchily distributed across the north and north-west of the state (Murphy, 2006). The majority of known populations occur in central north Victoria on private land, wetlands, parks, swamps, farm dams and temporary waterholes (TSSC, 2016). Habitat for the species range from shallow, ephemeral and seasonal wetlands, including lakes, swamps, rock pools in granite outcrops, waterholes in claypans to highly modified habitats such as farm dams and drainage lines. Key growth occurs following autumn and winter inundation (TSSC, 2016).

If a population does exist within Gunbower National Park it is likely to benefit from a restored natural flooding regime.

5.1.3.4 Floodplain Rustyhood (*Pterostylis cheraphila*)

Floodplain Rustyhood (EPBC Act listed Vulnerable) is considered to 'possibly' occur within the project area as it was recently recorded in 2015 on Spur Island in Middle Gunbower (outside the project area) (Bennetts and Cook 2020). Floodplain Rustyhood is also listed under the FFG Act and on the DELWP Advisory list (vulnerable). Targeted surveys by R8 in 2019 did not record the species within the area of investigation.

The Floodplain Rustyhood is a small, terrestrial deciduous herb that is Summer-dormant and emerges annually from a spherical subterranean tuber (Duncan et. al. 2009). Following Autumn rains the tubers produce stem-encircling, ground-hugging, oval-shaped leaves that grow to 40 mm long (Duncan et. al. 2009). Previous records of the species are from the Wimmera River floodplain region over 200 km away, however the species has been recently recorded in 2016-18 and 2020 on Spur Island in Gunbower Forest (Bennetts and Cook 2020).

At Gunbower Forest, the Floodplain Rustyhood occurs in terrestrial Box Woodland and Semi-arid Woodland vegetation dominated by Grey Box. Despite extensive surveys and suitable Box Woodland habitat within Gunbower National Park and the broader Gunbower region (Bennetts et al. 2012, Bennetts and Jolly 2020), no populations of this species have been recorded in these areas. It is likely the species historically occurred within the Gunbower Forests, and if a population does exist within Gunbower National Park it is likely to benefit from a restored natural flooding regime.

5.1.3.5 Stiff Groundsel (*Senecio behrianus*)

Stiff Groundsel (EPBC Act listed Endangered) is considered to 'possibly' occur within the inundation area but has not been previously recorded in the Middle or Upper Gunbower Forests systems (Bennetts et al. 2012). Stiff

Groundsel is also listed under the FFG Act and on the DELWP Advisory list (endangered). Targeted surveys did not record the Stiff Groundsel within the area of investigation.

The Stiff Groundsel is an erect shrub to 1 m tall endemic to Victoria known from only from six (wild population) locations within the state, with the majority of the population around Corop in Central Victoria (Nevill and Camilleri 2010). Other known locations include Miners Rest near Ballarat, Lake Boga and Gunbower, the latter two within the broader floodplain of the Murray River. All wild populations occupy <0.25 ha in extent (Rakali Ecological Consulting 2015).

The ecology and historical habitat of the species is poorly understood owing to the fact that it was thought extinct until 1991. Remaining populations grow on poorly-drained sedimentary grey clays or sandy clays on or close to floodplains, and on basalt-derived grey cracking clays in periodically flooded depressions (Nevill and Camilleri 2010). Despite extensive surveys and suitable floodplain habitat within Gunbower National Park and the broader Gunbower region (Bennetts et al. 2012), no populations of this species have been recorded in these areas. It is likely the species historically occurred within the Gunbower Forests, and if a population does exist within Gunbower National Park it is likely to benefit from a restored natural flooding regime.

5.1.3.6 Slender Darling-pea (*Swainsona murrayana*)

Slender Darling-pea (EPBC Act listed Vulnerable) is considered to 'possibly' occur within the inundation area but has not been previously recorded in the Middle or Upper Gunbower Forests systems (Bennetts et al. 2012). Slender Darling-pea is also listed under the FFG Act and on the DELWP Advisory list (endangered). Targeted surveys did not record the Slender Darling-pea within the area of investigation.

The Slender Darling-pea is a prostrate, ascending to erect perennial herb growing to 25 cm tall. It is found on heavy soils, especially depressions, and is found on grey and red to brown clay and loamy soils in Black Box (*Eucalyptus largiflorens*) woodlands and grasslands. Known populations of the species occur in grasslands and on lake margins in the Victorian Riverina across the Patho Plains and Terrick Terrick region within the study area.

Despite extensive surveys and suitable floodplain habitat within Gunbower National Park and the broader Gunbower region (Bennetts et al. 2012), no populations of this species have been recorded in these areas. It is likely the species historically occurred within the Gunbower Forests, and if a population does exist within Gunbower National Park it is likely to benefit from a restored natural flooding regime.

Inundation Area

The likelihood of occurrence for threatened flora in the inundation area has been assessed at a desktop level only based on VBA records and previous assessments within the inundation area (Bennetts et al. 2012, Bennetts and Cook 2020, Bennetts and Jolly 2020). Of the 13 EPBC Act listed species, six are considered as possible to occur in the inundation area (see Appendix C and Appendix D).

A conservative approach to EPBC listed species has been taken for this assessment to include species that have been assessed as possibly occurring within the inundation area only. These species have also been considered further to demonstrate that they are unlikely be adversely impacted by the proposed project, see Section 7.2.1

5.1.4 Presence of FFG Act-listed and DELWP Advisory-listed threatened flora

Species listed as threatened under the FFG Act along with species considered rare or threatened under the DELWP Victorian Advisory List for Rare or Threatened Species (DEPI 2014) were recorded within the area of investigation during the current surveys (Section 5.1.2).

Two FFG Act listed species, Umbrella Wattle (*Acacia oswaldii*) and Buloke (*Allocasuarina luehmannii*) were identified during the most recent field assessment (2019) within the area of investigation. One species, Wavy Marshwort (*Nymphoides crenata*) has previously been recorded (Bennetts 2014a, Biosis 2014a), however as an obligate wetland species is unlikely to be present within the construction footprint.

Other species listed under the FFG Act as well as the EPBC Act as discussed above, include Winged Peppercress, Ridged Water-milfoil, Floodplain Rustyhood, Stiff Groundsel and Slender Darling-pea have the potential to occur.

The only FFG Act listed species identified within the construction footprint is Umbrella Wattle, with two individuals recorded along the access track close to the Cameron's Creek Mid Creek regulator.

Eighteen (18) species listed under the DELWP Advisory list of rare or threatened plants identified in searches of the VBA and PMST were considered as Possible to occur within the construction footprint. Two of these species, Umbrella Wattle listed above also under the FFG Act, and Long Eryngium (*Eryngium paludosum*) were identified in the construction footprint during surveys in 2019:

- Umbrella Wattle (*Acacia oswaldii*)
- Long Eryngium (*Eryngium paludosum*)

Inundation Area

The likelihood of occurrence for threatened flora in the inundation area has been assessed at a desktop level only based on VBA records and previous assessments within the inundation area (Ecological Associates 2013, Bennetts 2014c, Biosis 2014b). Of the nineteen FFG Act and DELWP Advisory listed flora species, all are considered to be flood-dependent or flood-tolerant species and area likely to benefit from the restoration of a more natural inundation cycle (see Appendix D and Appendix E).

5.1.5 Presence of FFG Act-protected flora

During R8 surveys in 2019, sixteen flora listed as protected under the FFG Act were recorded within the area for investigation. These species and their approximate abundance within the construction footprint is provided in Table 5-3. These abundances only account for the construction footprint surveyed in 2019 and do not include Middle Gunbower Forest (downstream of Deep Creek) and Camerons Creek pump station and pipeline. These totals will be updated following field survey in spring 2020.

The populations of some of these species will vary from year to year. Some of these species are annuals, and/or may be dormant and unidentifiable during any one season, therefore it is difficult to estimate the exact number of each species that will be directly impacted by the vegetation removal associated with the proposed works when construction commences. However, an estimate of the number of individuals that will likely be impacted based on the construction footprint is provided below, taking in to account the data from the 2019 surveys.

The protected flora outlined below are also likely to be present within the inundation area.

Table 5-3 FFG Act protected flora recorded in the construction footprint 2019

Scientific Name	Common Name	Approximate abundance within the construction footprint
Acacia dealbata	Silver Wattle	10-20
Acacia oswaldii	Umbrella Wattle	2
Azolla rubra	Pacific Azolla	50-100
Calocephalus sonderi	Pale Beauty-heads	100-200
Brachyscome paludicola	Woodland Swamp-daisy	10-20
Cassinia sifton	Drooping Cassinia	50-100
Centipeda cunninghamii	Common Sneezeweed	50-100
Cotula australis	Common Cotula	50-100
Euchiton sphaericus	Annual Cudweed	50-100
Marsilea drummondii	Common Nardoo	100-200

Rhodanthe corymbiflora	Paper Sunray	100-200
Senecio quadridentatus	Cotton Fireweed	50-100
Senecio runcinifolius	Tall Fireweed	10-20
Vittadinia cuneata subsp. cuneata	Fuzzy New Holland Daisy	100-200
Vittadinia gracilis	Woolly New Holland Daisy	50-100
Xerochrysum bracteatum	Golden Everlasting	100-200

5.2 Threatened Fauna Assessment

5.2.1 Desktop assessment and Likelihood of Occurrence

A total of 56 threatened fauna species have been assessed. VBA and PMST searches highlighted 40 threatened fauna species previously recorded or with the potential to occur within the study area, that are EPBC Act listed (21) and/or FFG Act listed (35). A further 16 species are listed as rare or threatened on the Advisory list of Rare and Threatened Fauna in Victoria (DSE 2013).

Each of these species has been assessed for their likelihood of occurrence and impact within the construction footprint (Appendix F) and inundation area (Appendix G), taking into account factors such as the habitat requirements of each species and comparing those to the habitats encountered within the Gunbower National Park project area, and also the number and frequency of records within the study area.

Forty-five (45) of these species are considered possible to occur within the construction footprint or inundation area (see Appendix F and Appendix G for rationale). These species are summarised in Table 7-4 below.

Table 5-4 Overview of likelihood of occurrence assessments for rare or threatened fauna

Number of rare or threatened fauna	**Construction Footprint**			**Inundation Area**		
	Total	**EPBC***	**FFG**	**Total**	**EPBC**	**FFG**
Present	11^	3	7	7	0	4
Possible	22	6	16	38	11	24
Unlikely	17	2	8	3	2	1
Highly Unlikely	6	0	4	8	8	5
Total	**56**	**11**	**35**	56	**21**	**19**

^Includes DELWP Advisory listed rare and threatened flora; * this only include EPBC species listed as threatened, not migratory

Threatened fauna species identified as Present or with Possible occurrence in the construction footprint and inundation area are discussed in Section 7.3 and in Table 7-4. Species identified as Unlikely or Highly Unlikely to occur within the construction footprint and inundation are shown only in Appendix F and Appendix G. Migratory species, that are not listed as threatened under EPBC or FFG are not included here.

5.2.2 Field survey results

During field surveys of the Upper Gunbower Forest and Middle Gunbower Forest (upstream of Deep Creek) area of investigation between 22-25, 31 October and 1 November 2019, R8 Ecologists identified a total of 60 fauna species, including two FFG Act listed threatened species, two listed as endangered and two near threatened on the Advisory list of Rare and Threatened Fauna in Victoria (DSE 2013). No EPBC Act listed threatened fauna species were identified during the field surveys. A summary of all fauna species recorded during the surveys,

including targeted Squirrel Glider and Grey-crowned Babbler surveys is provided in Appendix J and summarised below.

The Grey-crowned Babbler (FFG listed and DELWP listed endangered) was observed once during targeted surveys for the species in the area of investigation along the levee in Upper Gunbower Forest, with one individual recorded which is unusual as the species is known to be found in groups. In addition, a group (4) was recorded in the inundation area near Black Charlie Lagoon. No breeding activity or nests were identified in the construction footprint. Lace Monitors (*Varanus varius*, DELWP Advisory listed endangered) were relatively common with multiple records (6) of the species during these surveys and incidentally observed in the project area. Other threatened species observed include two woodland birds Diamond Firetail (*Stagonopleura guttata*, FFG listed and DELWP listed near threatened), Brown Treecreeper (*Climacteris picumnus*, VicAdv listed near threatened) and the Emu (*Dromaius novaehollandiae*, DELWP Advisory listed near threatened).

Table 5-5 Summary of threatened fauna recorded during 2019 surveys

Species Name	Conservation Status	Location(s)
Brown Treecreeper (*Climacteris picumnus*)	DELWP Advisory list – near threatened	Multiple individuals recorded across the project area including on 4 arboreal cameras.
Diamond Firetail (*Stagonopleura guttata*)	FFG – listed threatened DELWP Advisory list – near threatened	One (1) individual recorded on two occasions at Brereton Pump Station, Middle Gunbower. Three (3) individuals recorded along the levee bank in the area of investigation in Upper Gunbower Forest.
Emu (*Dromaius novaehollandiae*)	DELWP Advisory list – near threatened	A large family group of >10 individuals recorded on multiple days in the area of investigation in Upper Gunbower Forest.
Grey-crowned Babbler (*Pomatostomus temporalis*)	FFG – listed threatened DELWP Advisory list – endangered	A group of four (4) individuals recorded within the inundation area near Black Charlie Lagoon and one (1) individual recorded along the levee bank in the area of investigation in Upper Gunbower Forest.
Lace Monitor (*Varanus varius*)	DELWP Advisory list – endangered	Six individuals recorded incidentally within the project area and on 10 arboreal cameras within Upper and Middle Gunbower Forest (upstream of Deep Creek)

Figure 5-2 One of four Diamond Firetail (FFG Act listed and DELWP Advisory listed near threatened) recorded during field surveys in 2019

Figure 5-3 One of six Lace Monitors (DELWP Advisory listed endangered) identified during field surveys in 2019

5.2.3 Squirrel Glider arboreal remote-sensor camera survey results

Targeted arboreal camera surveys undertaken for the State listed Squirrel Glider did not confirm the presence of the species across the area of investigation. A total of 24 species (15 birds, 6 mammals and 2 reptiles) were recorded across the 30 cameras, including the related Sugar Glider (*Petaurus breviceps*) recorded on eleven cameras (Appendix N). A full list of species recorded during camera surveys is provided in Appendix J and the location of arboreal cameras is shown in Figure 5-4.

The absence of this species during targeted surveys suggests the construction footprint is unlikely to support critical habitat for the Squirrel Glider, however it does not rule out the species from occurring. Camera survey locations were chosen based on what was considered the best available habitat in the area of investigation. Suitable hollow-bearing, habitat trees for the species are present throughout the project area, including areas in the construction footprint that were not subject to targeted surveys. Targeted survey locations were mainly along levee banks on the outer edge of the forest, which due to edge effects for this small-ranging gliding marsupial, is likely to provide less suitable habitat than the majority of the broader project area. Limited wattle (important foraging trees) species and density were recorded across the area of investigation, also indicating the dryer outer forest may not provide suitable habitat, however this may change with a returned flooding regime.

Potential impacts to the species, along with avoidance and mitigation measures are further discussed in Section 7.3 and Section 9.

5.2.4 Grey-crowned Babbler targeted survey results

Targeted surveys for the State listed Grey-crowned Babbler completed across five mornings in October and November 2019 recorded the species at one location within the area of investigation, shown in Figure 5-4. In addition, four (4) Grey-crowned Babblers were observed in the inundation area during vegetation condition assessments, shown in Figure 5-4.

A total of 37 bird species were recorded during the morning surveys across three days, which targeted areas of suitable habitat for the Grey-crowned Babbler. A full list of species recorded is shown in Appendix J.

The Grey-crowned Babbler is a social and highly mobile species that live in territorial groups of up to 15 birds and have a very large home-range. The observation of a single individual is unusual for the species which normally occurs in family groups, however an overhead raptor may have caused the family group to disperse quickly. Grey-crowned Babblers create large conspicuous nests of branches and twigs in areas of dense vegetation, often producing multiple within each group's home range. No nests were recorded during targeted surveys or during vegetation assessments within the entire area of investigation. The area of investigation and construction footprint includes largely disturbed areas with sparser vegetation, less likely to provide areas of suitable nesting habitat. This suggests the construction footprint is unlikely to support critical habitat for the species.

Potential impacts to the species, along with avoidance and mitigation measures are further discussed in Section 7.3 and Section 9.

5.2.5 Likely presence of EPBC Act listed fauna species within the proposed construction footprint

No EPBC Act listed fauna species were recorded during targeted surveys in 2019 or in previous assessments within the project area (Biosis 2014a, GHD 2017).

Nine EPBC Act listed fauna species were identified as possibly occurring within the construction footprint and/or inundation area:

- Painted Honeyeater (*Grantiella picta*)
- Superb Parrot (*Polytelis swainsonii*)
- White-throated Needletail (*Hirundapus caudacutus*)
- South-eastern Long-eared Bat (*Nyctophilus corbeni*)

- Growling Grass Frog (*Litoria raniformis*)
- Sloane's Froglet (*Crinia sloanei*)
- Murray Cod (*Maccullochella peelii*)
- Trout Cod (*Maccullochella macquariensis)*
- Silver Perch (*Bidyanus bidyanus*)

A conservative approach to EPBC listed species has been taken for this assessment and a further two species, have been assessed as possibly occurring within the inundation area only:

- Australasian Bittern (*Botaurus poiciloptilus*)
- Australian Painted Snipe (*Rostratula australis*)

Painted Honeyeater (*Grantiella picta*) (Vulnerable)

The Painted Honeyeater is nomadic and occurs at low densities throughout its range. The species is sparsely distributed from south-eastern Australia to north-western Queensland and eastern Northern Territory. The greatest concentrations and almost all records of breeding come from south of 26°S, on inland slopes of the Great Dividing Range between the Grampians, Victoria and Roma, Queensland (Higgins et al., 2001). During the winter it is more likely to be found in the north of its distribution. This species generally uses the following habitats:

- Inhabits Boree/ Weeping Myall (*Acacia pendula*), Brigalow (*A. harpophylla*) and Box-Gum Woodlands and Box-Ironbark Forests.
- A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus *Amyema*.
- Insects and nectar from mistletoe or eucalypts are occasionally eaten.
- Nest from spring to autumn in a small, delicate nest hanging within the outer canopy of drooping eucalypts, she-oak, paperbark or mistletoe branches.

The species exhibits seasonal north-south movements governed principally by the fruiting of mistletoe, with which its breeding season is closely matched (Barea and Watson, 2007). Many birds move after breeding to semi-arid regions such as north-eastern South Australia, central and western Queensland, and central Northern Territory. Considering its dispersive habits, the species is considered to have a single population (Garnett et al., 2011).

Painted Honeyeater is considered to have potential to utilise habitats within the proposed construction footprint and broader inundation area. This species has not been previously recorded within the study area, and very few records exist across the local landscape. They are known to be highly mobile and have the potential to rarely forage in the Gunbower National Park forests.

Superb Parrot (*Polytelis swainsonii)* (Vulnerable)

The Superb Parrot is found in NSW and northern Victoria, where it occurs on the inland slopes of the Great Divide and on adjacent plains, especially along the major river systems. In Victoria, it is confined to the north of the state with the majority of records and known breeding locations in Barmah State Forest/State Park.

The species inhabits the following forests and woodlands:

- Large, mature River Red Gums (*E. camaldulensis*) or Blakely's Red Gum (*E. blakelyi*) close to watercourses
- Occasionally nesting or foraging in Yellow Box (*E. melliodora*), Grey Box (*E. microcarpa*) or Red Box (*E.* polyanthemos)

Superb Parrot is considered to have potential to utilise habitats within the proposed construction footprint and broader inundation area. Although extensive suitable Red Gum forest habitat exists, this species has not been previously recorded within the study area, with the closest and main population known from Barmah State Forest

50-100 km further east upstream of the Murray River. The Superb Parrot is a well-studied species, which has undergone significant range contractions over the last 100 years due to habitat loss and competition for nesting sites, trapping for the pet industry and road collisions (Baker-Gabb 2011).

South-eastern Long-eared Bat (*Nyctophilus corbeni*) (Vulnerable)

The South-eastern or Corben's Long-eared Bat is considered unlikely to occur within the construction footprint or inundation area of the Gunbower National Park, and has not been recorded previously within the study area. It has however been considered further due to its relatively poorly understood status in Victoria with regards to habitat preferences and use. This species has a scattered distribution, mostly within the Murray-Darling Basin, but with some records outside of this area. It is known to inhabit a variety of vegetation types, but is distinctly known to occur in Box / Ironbark / Cypress-pine vegetation along the western slopes and plains of NSW. It roosts in tree hollows, crevices and under loose bark, and is a slow flying agile bat that hunts for non-flying prey, especially caterpillars and beetles (OEH 2012). Threats to the species include habitat loss and fragmentation, fire and reduction of hollow availability.

The species has not been recorded in the project area and was not recorded during bat surveys in the construction footprint in 2017 (GHD 2017). The closest records in Victoria to the project area are in old growth mallee vegetation around the Hattah township and Hattah-Kulkyne National Park, over 200 km to the north/west. It is considered unlikely that this species utilises Red Gum forests and woodland habitats within the Gunbower National Park project area, and that if it does occur, it is likely to be in extremely low numbers.

Growling Grass Frog (*Litoria raniformis*) (Vulnerable)

The Growling Grass Frog is one of the largest frog species in Australia, and was once distributed across a large area of south-eastern Australia, including Tasmania. The species was previously widespread across Victoria and absent only from the western desert regions and the eastern alpine regions (Littlejohn 1963, 1982; Hero et al. 1991 in Mahony 1999). The species has disappeared from most of its former range across Victoria, and persists in isolated populations in the greater Melbourne area, in the south-west of Victoria and a few sites in central Victoria and Gippsland (Atlas of Victorian Wildlife database cited in Clemann and Gillespie 2004).

Major watercourses such as the Murray River within the species' range have been substantially altered by impoundments, river regulation and irrigation release schemes. Alterations to the timing, frequency and extent of flooding events have resulted in dramatic changes to many natural processes, such as preventing or greatly reducing spring flood events across natural floodplains. Cold water releases from impoundments have had a considerable impact on downstream ecological processes and native fish populations (MDBC 2003), and are likely to adversely affect the development rates and survivorship of eggs and tadpoles. Natural flooding of floodplains probably triggered breeding activity in semi-arid areas in the past (Wassens 2006), and altered hydrological regimes have grossly modified natural processes around extant populations.

The Growling Grass Frog is considered to have potential to utilise habitats within the broader inundation area. The species has been recorded once in the project area but not within the last 30 years. It has been recorded four times previously within the study area, most recently in 2009 on a farm dam 5 km to the south-west of the project area. Despite the long absence of records of this species, the presence of suitable habitat, and the ability of this species to recolonise areas suggest that it has potential to occur in the area, and a reintroduction of more suitable ecological watering regimes may help facilitate this.

A broad analysis of potential Growling Grass Frog habitat (i.e. Ecological Vegetation Classes (EVC) across the Gunbower National Park project area that have potential to support this species) was undertaken, specifically assessing the extent of wetland and associated EVCs within the inundation area. The analysis returned an area of potential habitat of 91 ha (includes wetland-dependent EVCs: EVC 168 Drainage Line Aggregate, EVC 334 Billabong Aggregate Wetland, EVC 819 Spike-sedge wetland , EVC 821 Tall Marsh, EVC 945 Floodway Pond Herbland/Riverine Swamp Forest Complex and EVC 1071 Sedgy Riverine Forest - Tall Marsh Complex) This analysis at least at a broad level demonstrates that there is a very large area of potential habitat that may support this species when the appropriate episodic wetland conditions occur.

Sloane's Froglet (*Crinia sloanei*) (Endangered)

Sloane's Froglet is endemic to the Murray-Darling Basin and is known from scattered locations in north-central Victoria and central western New South Wales. It has disappeared from much of its former range and within

Victoria, recent surveys have only located the species at a few locations in the Albury-Rutherglen area (Knight 2013). The species is found in woodland, grassland and open or disturbed areas, usually associated with inundated areas (Robinson 1993). Males call after rain while afloat in temporary ponds, flooded grassland, ditches and swamp areas (Anstis 2002) and the upper laterals of non-perennial creeks.

Sloane's Froglet is considered to have the potential to utilise habitats within the broader inundation area. The species has been recorded in the project area, with records of the species from 1993, which indicate the species may be present in Gunbower National Park. The species is likely to be under-surveyed as it's peak calling period is during the winter months which differs from the majority of other frog species. The species has additionally only been listed under the EPBC Act in 2019. Despite an absence of records, the presence of suitable habitat, and the ability of this species to recolonise areas suggest that it has potential to occur in the area, and a reintroduction of more suitable ecological watering regimes may help facilitate this.

Similar to Growling Grass Frog above, a broad analysis of potential Sloane's Froglet habitat (i.e. Ecological Vegetation Classes (EVC) across the Gunbower National Park project area that have potential to support this species) was undertaken, specifically assessing the extent of wetland and associated EVCs within the inundation area. The analysis returned an area of potential habitat of 91 ha (includes wetland-dependent EVCs: EVC 168 Drainage Line Aggregate, EVC 334 Billabong Aggregate Wetland, EVC 819 Spike-sedge wetland , EVC 821 Tall Marsh, EVC 945 Floodway Pond Herbland/Riverine Swamp Forest Complex and EVC 1071 Sedgy Riverine Forest - Tall Marsh Complex) This analysis at least at a broad level demonstrates that there is a very large area of potential habitat that may support this species when the appropriate episodic wetland conditions occur.

Murray Cod (*Maccullochella peelii peelii*) (Vulnerable)

Murray Cod (*Maccullochella peelii peelii*; EPBC Act listed Vulnerable) are known to occur in the Murray River alongside the project area and is considered a main channel specialist. Murray Cod occurs naturally in the waterways of the Murray-Darling Basin (ACT, SA, NSW and Vic) and is known to live in a wide range of warm water habitats from clear, rocky streams to slow flowing turbid rivers and billabongs (TSSC, 2003).

The species has been frequently recorded in the Murray River and Gunbower Creek, including the Torrumbarry Weir Pool (Stuart, 2020). The species has been recorded in low abundances during annual monitoring between 2008-2017 of the Murray River in Gunbower Forest (Bloink et al. 2018). The species may enter the forest areas during inundation events, but seasonally inundated semi-permanent forest wetlands do not provide suitable long-term habitat. Regardless of the records, presence within the main channels adjacent the site should be assumed.

Trout Cod (*Maccullochella macquariensis*) (Endangered)

Trout Cod (*Maccullochella macquariensis*, EPBC Act listed Endangered) are known to occur in the Murray River alongside the project area. Trout Cod is a riverine species, inhabiting a variety of flowing waters in the mid to upper reaches of rivers and streams with cover in the form of woody debris or boulders.

Trout Cod have been detected in the Murray River downstream of Yarrawonga Weir in the vicinity of large woody debris, branch piles and steep clay banks, usually in areas of fast flowing current (DSE, 2008). Trout Cod have also been recorded in Gunbower Creek (Mallen-Cooper et. al. 2014) and in the Torrumbarry Weir Pool (Stuart, 2020). The species may enter the forest areas during inundation events, but seasonally inundated semi-permanent forest wetlands do not provide suitable long-term habitat. Regardless of the records, presence within the main channels adjacent the site should be assumed.

Silver Perch (*Bidyanus bidyanus*) (Critically Endangered)

Silver Perch (*Bidyanus bidyanus*; EPBC Act listed Critically Endangered) are known to occur in the Murray River alongside the project area. Silver perch are endemic to the Murray-Darling system, utilising a diversity of habitats but with a preference for faster-flowing water including rapids and races, and more open sections of a river (DoE, 2013a).

Recent surveys have detected Silver Perch in low abundances during annual monitoring of the Murray River adjacent to Gunbower Forest (2008-2017) (Bloink et. al. 2018). Silver Perch have also been detected in low numbers in surveys on the Gunbower Creek (Rehwinkel & Sharpe, 2009). The Murray River upstream and downstream of the project area and the Murray River in vicinity of project area has been mapped as possible habitat by NSW Fisheries. They are a main channel specialist and are expected to be present in the Murray River in the project area from time to time. Although the species has not been recorded within the semi-permanent wetlands of the project area, they may enter the forest areas during natural inundation events, but the seasonally inundated semi-permanent forest wetlands do not provide suitable long-term habitat. As such, the species is considered as a possible occurrence within the construction area and inundation extent.

Australasian Bittern (*Botaurus poiciloptilus*) (Endangered)

The Australasian Bittern occurs in terrestrial freshwater wetlands and, rarely, estuarine habitats (Marchant and Higgins 2004). It favors wetlands with tall, dense vegetation, where it forages in still, shallow water up to 0.3 m deep, often at the edges of pools or waterways, or from platforms or mats of vegetation over deep water (Marchant and Higgins 2004). The species favors permanent freshwater habitats, particularly those dominated by sedges, rushes and/or reeds (e.g. *Phragmites, Cyperus, Eleocharis, Juncus, Typha, Baumea,Bolboschoenus*) or cutting grass (*Gahnia*) growing over muddy or peaty substrate (Marchant & Higgins 1990; within DoE 2016c).

In Victoria the species is recorded mostly in the southern coastal areas and in the Murray River region of central northern Victoria (Jaensch 2005, as cited in DSEWPaC 2011). The species was last recorded in Gunbower National Park in Pig Swamp in 1993. The decline in wetland quality in Guttrum-Benwell Forests with the absence of sedges and rushes is indicative of an absence of this species, and a return of a naturally occurring flooding regime will enhance the future habitat availability for the Australasian Bittern.

Limited data are available about breeding requirements for this species, but available data indicate that the Australasian Bittern breeds in relatively deep, densely vegetated freshwater swamps and pools, building its nests in deep cover over shallow water (Marchant & Higgins 1990; within DOE 2020a). In rush land, it may avoid breeding in the densest areas (Marchant & Higgins 1990; within DOE 2020a); alternatively, this may simply reflect the location of the few nests that have been found in wetlands that are difficult to access (Jaensch 2005, as cited in DoE 2020a).

The likelihood of this species using the project area as more than an occasional visitor is considered low given the bulk of the project area lacks the required habitat features for this species (tall, dense aquatic vegetation) and is comprised predominately of dry Red Gum forest and woodlands.

Australian Painted Snipe (*Rostratula australis*) (Endangered)

The Australian Painted Snipe is a rare, nomadic bird species that may turn up at any suitable wetland across Australia, when conditions are favourable. This species is widespread but rare throughout most of eastern Australia.

The Australian Painted Snipe generally inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans. They also use inundated or waterlogged grassland or saltmarsh, dams, rice crops, sewage farms and bore drains. Typical sites include those with emergent tussocks of grass, sedges, rushes or reeds, or samphire; often with scattered clumps of lignum *Muehlenbeckia* or canegrass or sometimes tea-tree (*Melaleuca*). The Australian Painted Snipe sometimes utilises areas that are lined with trees, or that have some scattered fallen or washed-up timber (Marchant & Higgins 1993 within DOE 2020b).

The species is reported to have been mainly recorded in the Murray-Darling region however in Victoria and NSW, known records (VBA, Atlas of NSW and ebird) indicate this to be more accurate for the region east of Swan Hill (DOE 2020b). Within the study area, there are no records of the species, and similar to the Australasian Bittern, the long absence is characteristic of the decline in wetland habitat within the Gunbower National Park Forests due to the lack of recent natural flooding.

The likelihood of this species using the project area as more than an occasional visitor is considered low given the majority of the project area lacks the required habitat features for this species (tall, dense aquatic vegetation) and is comprised predominately of dry Red Gum forest and woodlands.

5.2.6 Likely presence of EPBC Act Migratory Species

Fourteen species listed as migratory under the EPBC Act are predicted to occur, or were previously recorded from a VBA/PMST search of the study area (10 km buffer of the project area). Of these 14 species, four are also listed as threatened under other acts and were included in 5.2.1 above. None of these species were considered as likely to occur within the construction footprint during the time of the survey, mostly due to the lack of recent records within the construction footprint and/or a lack of suitable habitat present (see Table 5-6 and Appendix E for rational).

It is highly unlikely that the construction footprint supports habitat that will be considered important for migratory species foraging or breeding activity or support an ecologically significant proportion of a population of migratory species.

Similarly, from a desktop assessment, 14 EPBC Act listed Migratory Species were predicted to occur within the inundation extent and the broader study area (Table 5-6). One of these species, Glossy Ibis (*Plegadis falcinellus*) was recorded during field surveys at Reed Bed Swamp within the inundation area during artificial watering in 2019. Several species also have the potential to occasionally occur in the inundation area following the return to a more natural inundation regime (Common Sandpiper, Curlew Sandpiper, Pectoral Sandpiper, Sharp-tailed Sandpiper, Common Greenshank, Satin Flycatcher, Rufous Fantail, Osprey, Latham' Snipe).

Table 5-6 Summary of EPBC listed migratory species known or with the potential to occur in the study area based on the PMST and VBA search and their associated likelihood of occurring in the project area

Scientific Name	Functional Group	FFG[1]	DEWLP Advisory[2]	Source	Construction Footprint	Inundation Area
Fork-tailed Swift (*Apus pacificus)*	Aerial		-	PMST	Above / aerial	Above / aerial
White-throated Needtail *(Hirundapus caudacutus)*	Aerial		vu	PMST / VBA	Above / aerial	Above / aerial
Yellow Wagtail *(Motacilla flava)*	Terrestrial		vagrant	PMST		
Satin Flycatcher *(Myiagra cyanoleuca)*	Terrestrial		-	PMST		X
Common Sandpiper (*Actitis hypoleucos)*	Shorebird		vu	PMST		X
Sharp-tailed Sandpiper (*Calidris acuminate)*	Shorebird		-	PMST		X
Curlew Sandpiper (*Calidris ferruginea)*	Shorebird		en	PMST		X
Pectoral Sandpiper (*Calidris melanotos)*	Shorebird		nt	PMST		X
Eastern Curlew *(Numenius madagascariensis)*	Shorebird		vu	PMST		
Common Greenshank *(Tringa nebularia)*	Shorebird		vu	PMST		X
Latham's Snipe (*Gallinago hardwickii)*	Wetland	N	nt	PMST		X
Osprey *(Pandion haliaetus)*	Wetland		-	PMST		X

Rufous Fantail (*Rhipidura rufifrons*)	Terrestrial		-	PMST		X
Glossy Ibis (*Plegadis falcinellus*)	Wetland		nt	VBA		X

[1]*Flora and Fauna Guarantee Act 1988* categories: L = Listed, N = Nominated; [2] Conservation Status in Victoria DEWLP Advisory List; cr = critically endangered, en = endangered, vu = vulnerable, nt = near threatened

Figure 5-4: Threatened species targeted survey locations and records within area of investigation, Page 1 of 8

VMFRP

GCB1

Bawden Track
Red Rise Track
Deep Creek
River Track
GUNBOWER NATIONAL PARK
Regulator Deep Creek Return
Bells Bend Road
Headworks Track
Dye Road
The Flume
North Road
Island School Road
Fence Track
Hancock Track
Mcgillivray Track
Middle Track
Murray River

Legend

R8 Threatened Flora Records 2019
- Native Peppercress
- Umbrella Wattle

Survey Locations
- Grey-crowned Babbler surveys
- Grey-crowned Babbler survey points
- Squirrel Glider arboreal camera locations
- Inundation Area
- Area of Investigation
- Construction Footprint
- Development Footprint
- Area of Investigation 2019
- Minor Road
- Waterbody
- Cadastre

Public Land Management
- NATIONAL PARK

*Targeted flora and fauna surveys not completed for Middle Gunbower (downstream of Deep Creek) and Cameron's Creek Pipeline. To be completed in Spring 2020

0 200 400
Metres

IS297705

DATA SOURCES
© Commonwealth of Australia (Geoscience Australia) 2006 Geodata Topo 250k Series 3; Vicmap Data, DELWP © State of Victoria 2019; Jacobs & GHD 2019-2020.

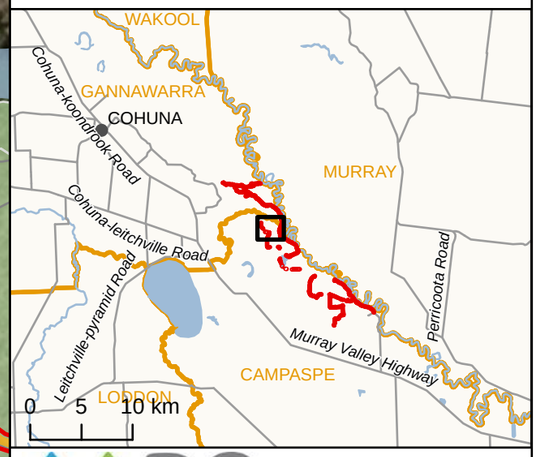

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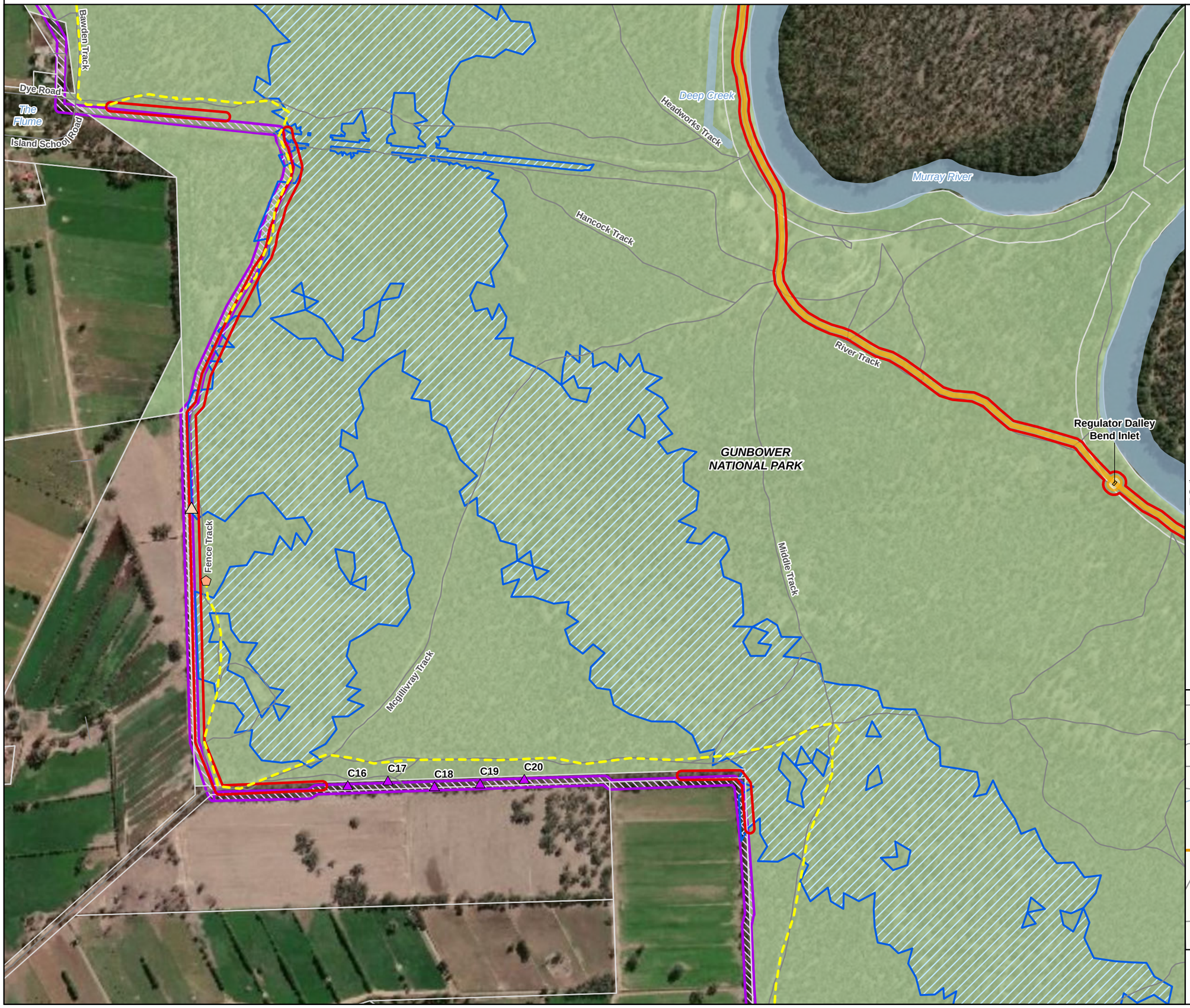
Figure 5-4: Threatened species targeted survey locations and records within area of investigation, Page 2 of 8

VMFRP



Legend

R8 Threatened Fauna Records 2019

- Lace Monitor

Survey Locations

- Grey-crowned Babbler surveys
- Grey-crowned Babbler survey points
- Squirrel Glider arboreal camera locations
- Inundation Area
- Area of Investigation
- Construction Footprint
- Development Footprint
- Area of Investigation 2019
- Minor Road
- Waterbody
- Cadastre

Public Land Management

- NATIONAL PARK

*Targeted flora and fauna surveys not completed for Middle Gunbower (downstream of Deep Creek) and Cameron's Creek Pipeline. To be completed in Spring 2020

0 200 400

Metres

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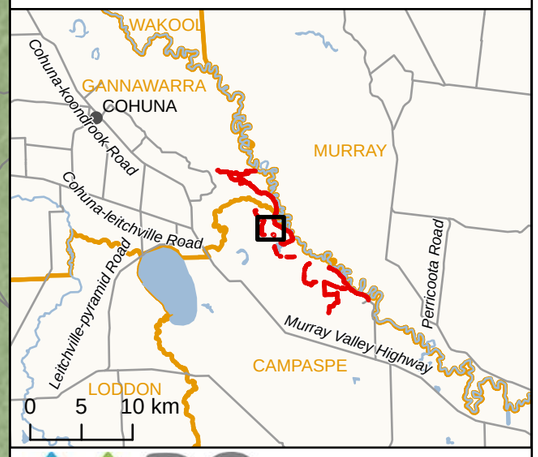

R8

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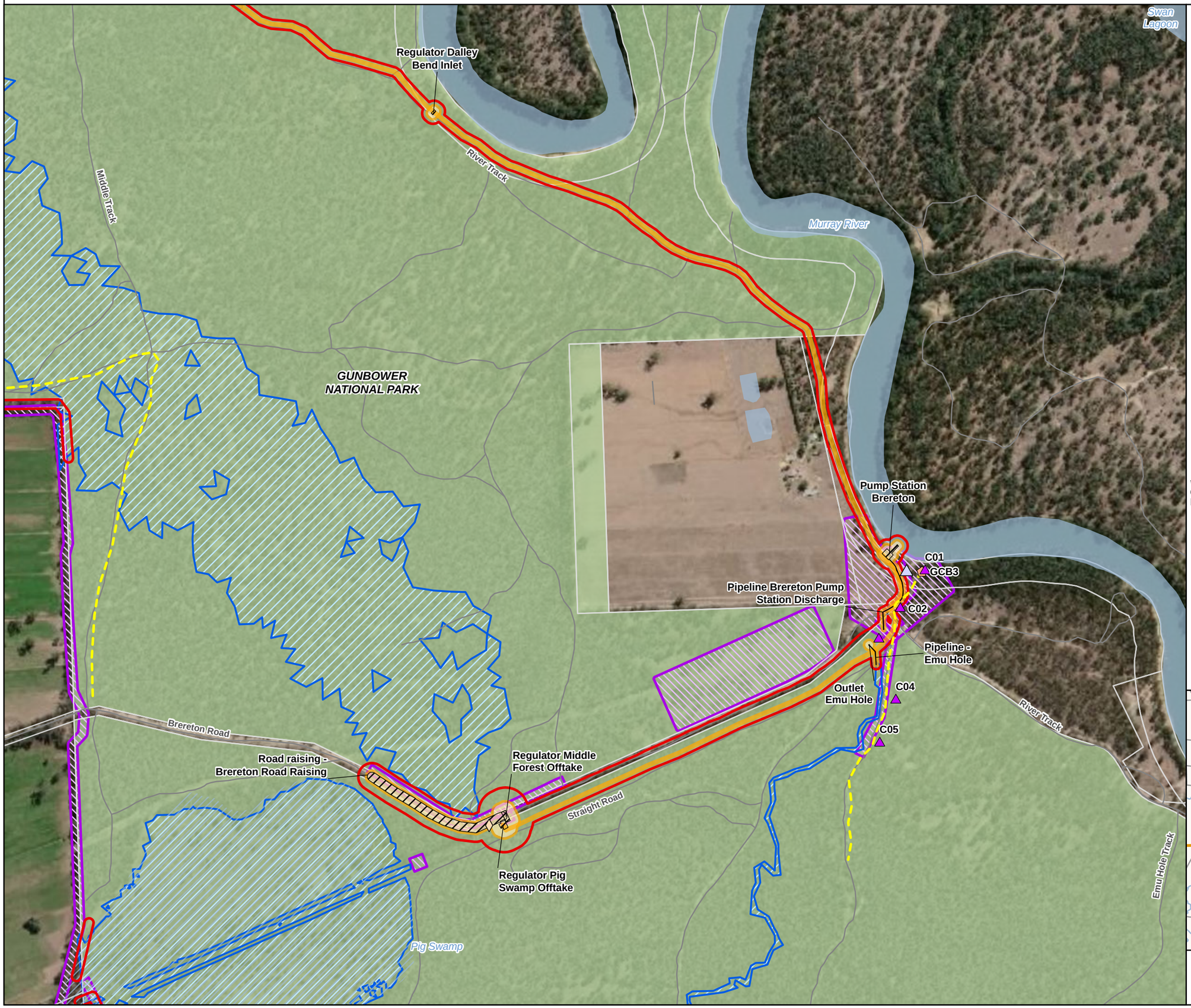
Figure 5-4: Threatened species targeted survey locations and records within area of investigation, Page 3 of 8



Legend

R8 Threatened Fauna Records 2019
- Diamond Firetail

GHD Threatened Species Records 2017
- Lace Monitor

Survey Locations
- Grey-crowned Babbler surveys
- Grey-crowned Babbler survey points
- Squirrel Glider arboreal camera locations
- Inundation Area
- Area of Investigation
- Construction Footprint
- Development Footprint
- Area of Investigation 2019
- Minor Road
- Waterbody
- Wetland Swamp
- Cadastre

Public Land Management
- NATIONAL PARK

*Targeted flora and fauna surveys not completed for Middle Gunbower (downstream of Deep Creek) and Cameron's Creek Pipeline. To be completed in Spring 2020

0 200 400
Metres

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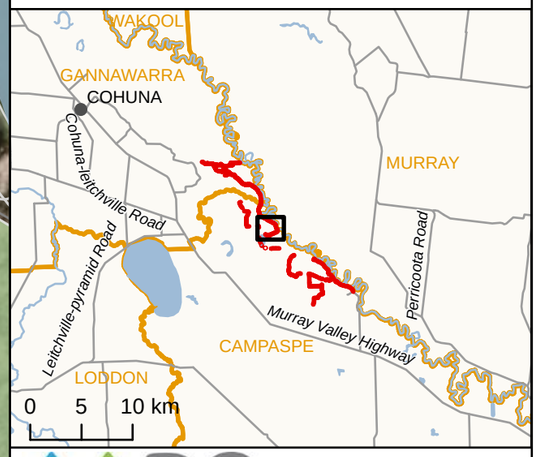

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Figure 5-4: Threatened species targeted survey locations and records within area of investigation, Page 4 of 8

VMFRP

Brereton Road
Road raising - Brereton Road Raising
Brereton Road
C05
Regulator Pig Swamp Offtake
Regulator Middle Forest Offtake
Straight Road
GUNBOWER NATIONAL PARK
GCB4
Emu Hole Track
Bramley Track
Pig Swamp
C06
C08
C09
C10
Mcgillivray Road
Gunbower Island Road
Bramley Road
Baggots Creek

Legend

R8 Threatened Fauna Records 2019
- Lace Monitor

GHD Threatened Species Records 2017
- Lace Monitor

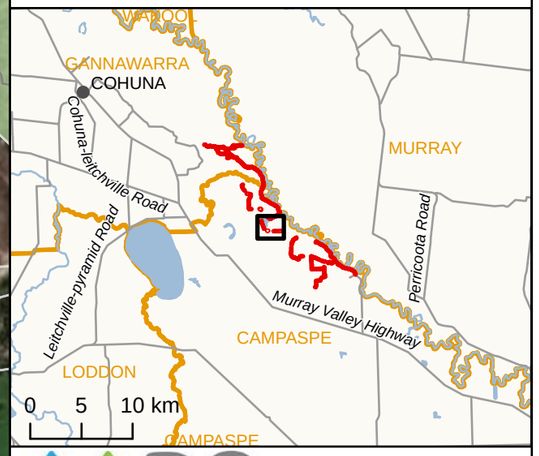
Survey Locations
- Grey-crowned Babbler surveys
- Grey-crowned Babbler survey points
- Squirrel Glider arboreal camera locations
- Inundation Area
- Area of Investigation
- Construction Footprint
- Development Footprint
- Area of Investigation 2019
- Minor Road
- Waterbody
- Wetland Swamp
- Cadastre

Public Land Management
- NATIONAL PARK

*Targeted flora and fauna surveys not completed for Middle Gunbower (downstream of Deep Creek) and Cameron's Creek Pipeline. To be completed in Spring 2020

0 200 400
Metres

IS297705



R8

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Figure 5-4: Threatened species targeted survey locations and records within area of investigation, Page 5 of 8

VMFRP

GCB5
Regulator Dry Creek Outlet
Spillway Dry Creek Outlet
Baggot Creek Track
GUNBOWER NATIONAL PARK
Murray River
Torrumbarry Weir Road
Dry Tree Lagoon
River Track
Black Charlie Track
Norman Road
Black Charlie Lagoon
C21
C22
C23
C24
C25
C26
C27
C28
C29
Forster Road
Pipeline Camerons Creek
Pipeline Outlet

Legend

R8 Threatened Flora Records 2019
- Buloke
- Leek Flax-lily
- River Swamp Wallaby Grass
- Umbrella Wattle

R8 Threatened Fauna Records 2019
- Grey-crowned Babbler
- Lace Monitor

Survey Locations
- Grey-crowned Babbler surveys
- Grey-crowned Babbler survey points
- Squirrel Glider arboreal camera locations
- Inundation Area
- Area of Investigation
- Construction Footprint
- Development Footprint
- Area of Investigation 2019
- Minor Road
- Waterbody
- Cadastre

Public Land Management
- NATIONAL PARK

*Targeted flora and fauna surveys not completed for Middle Gunbower (downstream of Deep Creek) and Cameron's Creek Pipeline. To be completed in Spring 2020

0 200 400
Metres

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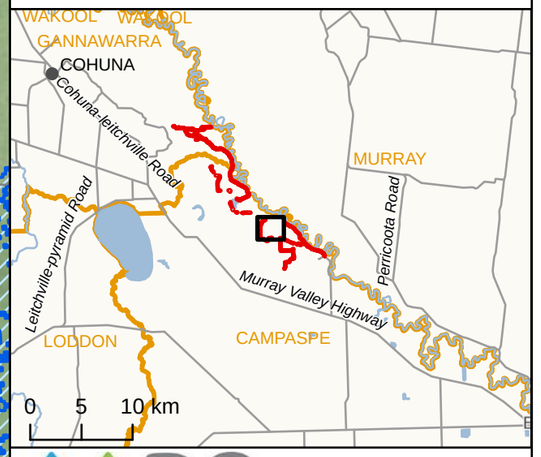

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Figure 5-4: Threatened species targeted survey locations and records within area of investigation, Page 6 of 8

VMFRP

Black Charlie Lagoon
Black Charlie Track
GUNBOWER NATIONAL PARK
Forster Road
Pipeline Outlet
Pipeline Camerons Creek
Mcphail Road
Gamble Road
Forrumbarry Weir Road
Pipeline Outlet
Steel Road

Legend

R8 Threatened Flora Records 2019
- River Swamp Wallaby Grass
- Umbrella Wattle

R8 Threatened Fauna Records 2019
- Emu
- Grey-crowned Babbler

Survey Locations
- Grey-crowned Babbler surveys
- Grey-crowned Babbler survey points
- Squirrel Glider arboreal camera locations
- Inundation Area
- Area of Investigation
- Construction Footprint
- Development Footprint
- Area of Investigation 2019
- Minor Road
- Waterbody
- Cadastre

Public Land Management
- NATIONAL PARK

*Targeted flora and fauna surveys not completed for Middle Gunbower (downstream of Deep Creek) and Cameron's Creek Pipeline. To be completed in Spring 2020

0 200 400
Metres

IS297705

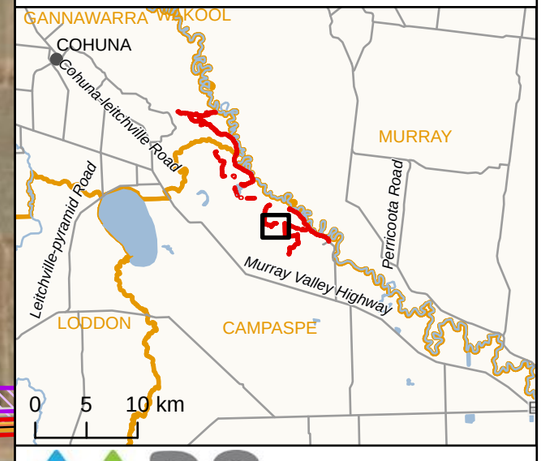

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Figure 5-4: Threatened species targeted survey locations and records within area of investigation, Page 7 of 8

VMFRP

River Track
Black Charlie Track
C21
C22
C23
C24
C25
C26
C27
C28
C29
River Track
Murray River
Black Charlie Lagoon
Torrumbarry Weir Road
Jimmy Williams Track
GUNBOWER NATIONAL PARK
Cameron Creek
Pipeline Camerons Creek
Pipeline Outlet
Forster Road
Mcphail Road
Laydown area
GCB7
Regulator Camerons Mid Creek
Containment Bank - Camerons Mid Creek

Legend

R8 Threatened Flora Records 2019
- Buloke
- Long Eryngium
- Umbrella Wattle

R8 Threatened Fauna Records 2019
- Grey-crowned Babbler
- Lace Monitor

Survey Locations
- Grey-crowned Babbler surveys
- Grey-crowned Babbler survey points
- Squirrel Glider arboreal camera locations
- Inundation Area
- Area of Investigation
- Construction Footprint
- Development Footprint
- Area of Investigation 2019
- Minor Road
- Waterbody
- Cadastre

Public Land Management
- NATIONAL PARK

*Targeted flora and fauna surveys not completed for Middle Gunbower (downstream of Deep Creek) and Cameron's Creek Pipeline. To be completed in Spring 2020

0 200 400
Metres

IS297705

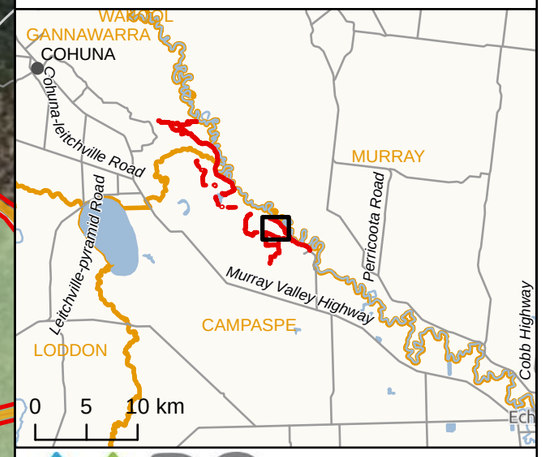

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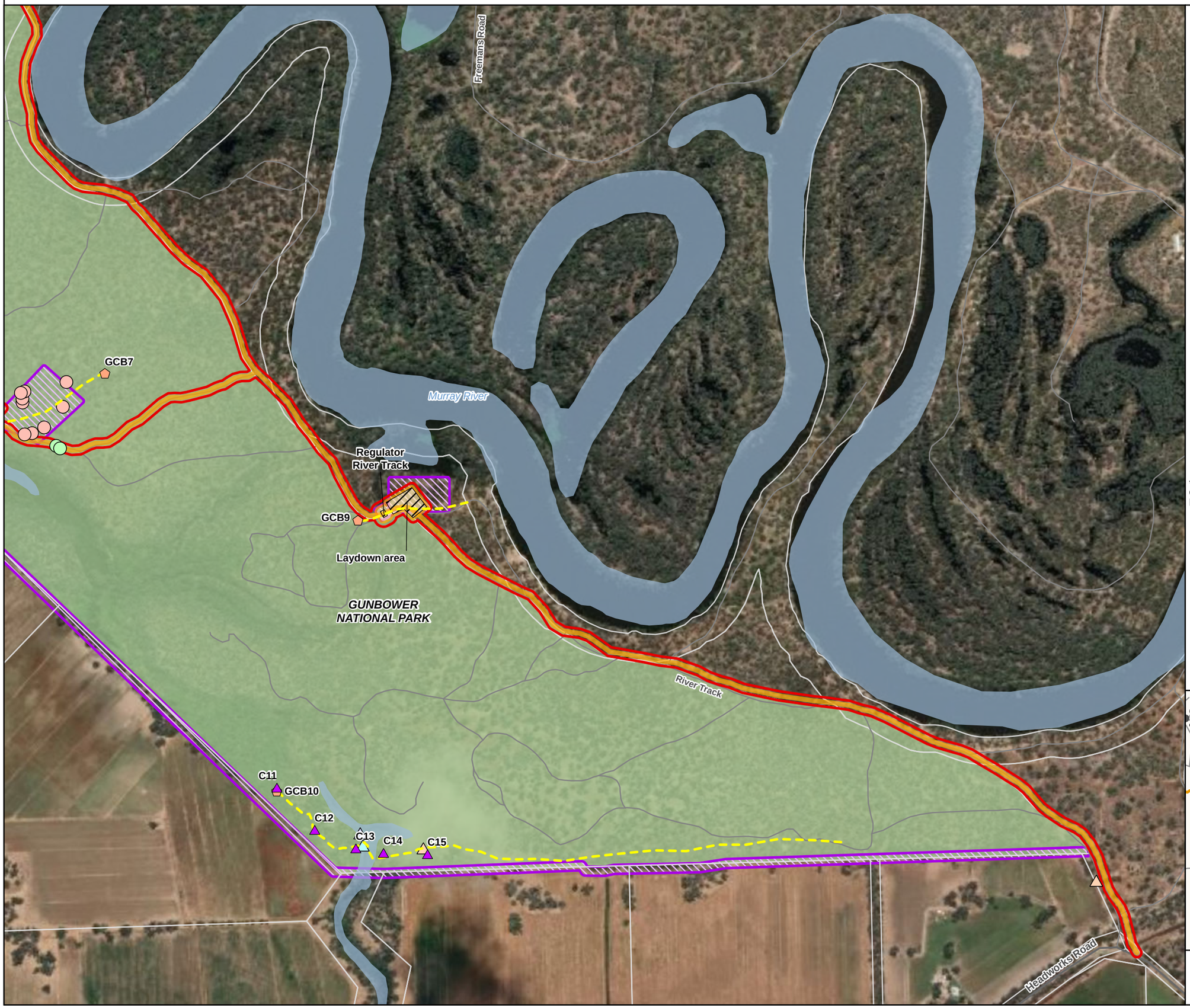
Figure 5-4: Threatened species targeted survey locations and records within area of investigation, Page 8 of 8

VMFRP



Legend

R8 Threatened Flora Records 2019
- Long Eryngium
- Umbrella Wattle

R8 Threatened Fauna Records 2019
- Diamond Firetail
- Grey-crowned Babbler
- Lace Monitor

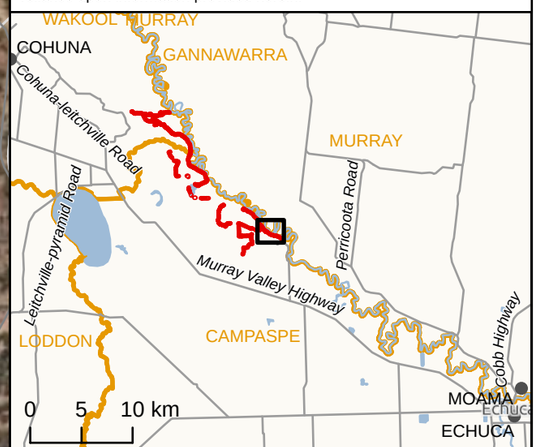
Survey Locations
- Grey-crowned Babbler surveys
- Grey-crowned Babbler survey points
- Squirrel Glider arboreal camera locations
- Area of Investigation
- Construction Footprint
- Development Footprint
- Area of Investigation 2019
- Major Road
- Minor Road
- Waterbody
- Cadastre

Public Land Management
- NATIONAL PARK

*Targeted flora and fauna surveys not completed for Middle Gunbower (downstream of Deep Creek) and Cameron's Creek Pipeline. To be completed in Spring 2020

0 200 400
Metres

IS297705



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6. Overview of potential impacts

This section provides an overview of the proposed project construction and operational activities and an outline of the potential impacts that may be associated with them. The potential for impacts on listed threatened flora and fauna and native vegetation is assessed in Sections 7 and 8. Impact mitigation measures are discussed in Section 9.

6.1 Construction

It will be necessary to construct and/or upgrade a variety of water regulating structures and ancillary infrastructure in order to achieve the proposed environmental watering regimes and objectives (refer Sections 1.3.2, 1.3.3 and 1.3.4). Construction activities would be undertaken in accordance with a CEMP and a variety of sub plans which consider the management of water, soils, flora and fauna.

Construction activities will include:

- Establishment of construction sites, including removal of vegetation, stripping and stockpiling of topsoil, establishing temporary parking and truck turnaround areas, laydown and stockpiling areas
- Removal of existing structures / block banks where required
- Construction / installation of new structures
- Rehabilitation of disturbed areas post-construction.

Construction activities may result in direct and indirect impacts (some permanent and some temporary) associated with:

- Removal, disturbance and lopping of native vegetation
- Borrow, import, excavation and placement of soil, clay, gravel and rock materials
- Movement of machinery, equipment and people
- Works in or adjacent to waterways and wetland areas
- Indirect impacts, e.g. noise, light, dust, etc. associated with construction.

6.2 Operation

Operational activities may also result in a range of positive and negative impacts associated with the managed inundation activities. These activities would be undertaken in accordance with the operating plan. Adaptive management is proposed in order to maximise the benefits and minimise the impacts of environmental watering activities. Direct and indirect impacts are potentially associated with:

- Inundation of vegetation communities
- Changed hydraulic regime with consequent changes to aquatic and terrestrial flora and fauna habitat (including pest species)
- Changes in water quality within the floodplain and associated with return flows to the River and main channels
- Changes to groundwater levels, quality and mobilisation of salt, noting these issues are regarded as being low risk due to the low to moderate salt store in the area and generally fresh to moderately saline groundwater (R8, 2020).

7. Impacts to threatened species and communities

The following chapter outline the impacts to threatened flora, fauna and communities resulting from the construction works proposed to be undertaken as well as the operational phase of the project.

7.1 Potential impacts to threatened vegetation communities

7.1.1 EPBC Act listed Threatened Ecological Communities

One EPBC Act listed TEC, Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia (Endangered) was identified during field assessment within the construction footprint (primarily along access tracks) at Upper Gunbower Forest. Field assessment has not yet been completed at Camerons Creek pump station and pipeline and Middle Gunbower Forest (upstream Deep Creek), and so the extent of the community at these locations has been predicted from EVC mapping.

A total of 2.50 ha of this threatened community was identified during surveys in the construction footprint in Upper Gunbower Forest (excluding Camerons Creek pump station and pipeline) and Middle Gunbower Forest (upstream) and 1.68 ha is predicted to occur in Middle Gunbower Forest (downstream of Deep Creek) based on EVC Plains Woodland mapping (Bennetts 2014a). The latter figure is likely to be a conservative estimate with areas of EVC 803 Plains Woodland potentially not meeting required criteria. This will be assessed during the field survey in spring 2020. The proposed works will result in the permanent loss of 1.71 ha (of which 1.34 ha is required to be confirmed through field assessment) of the TEC in the development footprint. 2.47 ha along access tracks will be avoided by restricting vehicle access to tracks and limiting disturbance to lopping overhanging vegetation to allow access for larger vehicles.

It is anticipated that for the 0.98 ha of the TEC, based on EVC 803 Plains Woodland mapping (Bennetts 2014a), that occurs within the inundation area, there will some benefit to the community as a whole by restoring a more natural flooding regime. A return of a natural flooding regime will benefit the vegetation communities adjacent to the community and lead to positive biodiversity outcomes for the ecotonal areas between the community and the lower-lying, more frequently inundated woodland systems. Over the long-term, the understorey species composition of some of these areas may become more aquatic. However, it is not considered that the level of inundation would result in any detrimental impact to the community that would lead to identified areas of the community no longer meeting the classification criteria for the community.

Previosuly completed reports estimate the extent of Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia within the Gunbower Forest to be approximately 1300 ha (North Central CMA 2012a). This was mapped through a combination of desktop assessment and field verification. The anticipated removal of 1.71 ha of the community accounts for 0.13% of the community extent within the Gunbower Forest. An assessment of the potential impact to the community against the EPBC Act Significant Impact Guidelines 1.1 is provided in Appendix O. Field assessment to be completed in spring of 2020 will map the extent and quality of the community within areas proposed to be impacted that have not yet been field assessed. The proposed works will be refined during the detailed design phase to seek to minimise the impact to the community in the construction footprint where this is feasible. However, given the small percentage of disturbance proposed, compared with the known extent within the wider Gunbower Forest, the predicated impact is not considered significant.

Table 7-1 Location and extent of EPBC Act listed Grey Box Grassy Woodland community in the construction footprint

Location	Construction Footprint		Inundation Area	Location
	Development Footprint	Existing Access Tracks		
Upper Gunbower Forest	0.34 ha	2.08 ha	-	Cameron's Creek Bridge, River Track
Middle Gunbower Forest (upstream of Deep Creek)	0.03 ha	0.05 ha	0.54 ha (Bennetts 2014)	Brereton Pump Station, River Track
Middle Gunbower Forest (downstream of Deep Creek)	1.34 ha (Bennetts 2014)	0.35 ha (Bennetts 2014)	0.43 ha (Bennetts 2014)	River Track, Deep Creek, Broken Axle Creek

7.2 Potential impacts to threatened flora

Modelling and previous assessments, both undertaken for this project and for other endeavours have identified several threatened flora species within the project area. Many of the species are cryptic flood responders by nature and these species were not detected during the 2019 survey, likely due to the dry conditions and elapsed time since inundation. Generally speaking, the flood responding species are rare due to the widespread plight of wetland communities in Australia where land use change, river regulation and increasing influences of climate change are affecting the natural habitat where such species persist. It is also the general conclusion of this assessment that such species will benefit from an artificial flooding program that attempts to mimic the natural conditions such species require and the restoration of the wetland habitat to which they are associated.

The following assessment of likelihood of occurrence and impact to threatened flora considers the potential to occur at the construction footprint and inundation area, based on the VBA and PMST searches, the habitat requirements of the species, and the flora habitat values observed within these areas. This table summarises those species considered possible, likely or present at ONE OR BOTH of the construction footprint and inundation area. An assessment of likelihood of occurrence and impact to all threatened flora is provided in Appendix F for the construction footprint and Appendix G for the inundation area.

The scale and extent of impact to threatened flora as a result of the construction works and operational phase of the project is based on field surveys completed to date which will be updated following additional field survey in 2020 for Middle Gunbower Forest (downstream Deep Creek) and Cameron's Creek pump station and pipeline.

These species are summarised in Table 7-2 below. Impacts to these species are considered further in Section 7.2.1-7.2.2.

Table 7-2 Threatened flora considered possible or present within either the construction footprint or inundation area, as developed from VBA and PMST searches within the study area and the associated likelihood of occurrence and impact

Scientific and Common Name	EPBC Act[1]	FFG Act[2]	DELWP Advisory[3]	Source	Number and Most Recent Record	Likelihood of Occurrence and Impact: Construction footprint	Likelihood of Occurrence and Impact: Inundation area
Acacia oswaldii **Umbrella Wattle**		L	vu	VBA	2 (2002)	**Present.** Individuals recorded during field assessment in high-quality Riverine Chenopod Woodland adjacent to the Cameron's Creek Mid Creek regulator. Occurrence possible in Middle Gunbower Forest (downstream of Deep Creek). **Impact Possible**. Identify any individuals present within construction footprint in Middle Gunbower Forest (downstream of Deep Creek) in spring 2020 and assess whether final design can avoid or minimise impacts.	**Possible.** Suitable habitat of terrestrial or flood-tolerent woodland present within inundation area and recorded in Lower Gunbower Forest (Bennetts et al. 2012) **Impact possible**: EVC mapping indicates that suitable habitat for this species is present within the inundation area. However, it is recommended that areas mapped as suitable habitat within the inundation area are ground truthed to confirm the presence or absence of suitable habitat for this species, and then the likelihood of any impacts to the species that may result from the operational phase of the project can be updated.
Allocasuarina luehmannii **Buloke**		L	en	VBA	1 (1987)	**Possible.** A single individual recorded during field assessment in the area of investigation, but not within the construction footprint. Occurrence possible in Middle Gunbower Forest (downstream of Deep Creek). **Impact Possible**. Identify any individuals present within construction footprint in Middle Gunbower Forest (downstream of Deep Creek) in spring 2020 and assess whether final design can avoid or minimise impacts.	**Possible.** Suitable habitat of terrestrial or flood-tolerent woodland present within inundation area and recorded in Lower Gunbower Forest (Bennetts et al. 2012) **Impact possible**: EVC mapping indicates that suitable habitat for this species is present within the inundation area. However, it is recommended that areas mapped as suitable habitat within the inundation area are ground truthed to confirm the presence or absence of suitable habitat for this species, and then the likelihood of any impacts to the species that may result from the operational phase of the project can be updated.
Amphibromus fluitans **River Swamp Wallaby-grass**	VU			PMST	-	**Possible.** Cryptic species responding to inundation events, occurs in low lying areas. Recorded in dry Riverine Swamp Forest in area of investigation but not close to construction footprint. Occurrence possible in Middle Gunbower Forest (downstream of Deep Creek).	**Present.** Recorded at Baggots Swamp during R8 field assessment and Likely to be present along waterways or dried floodplains within inundation area. **Impact Unlikely.** Species likely to benefit from a return to a more natural flooding regime and increase area of potential occupancy.

						Impact Possible. Unlikely to adversely affect habitat critical for the species or reduce the area of occupancy. Identify any individuals present within construction footprint in Middle Gunbower Forest (downstream of Deep Creek) in spring 2020 and assess whether final design can avoid or minimise impacts.	
Austrostipa trichophylla **Spear-grass**			r	VBA	2 (2010)	**Possible.** Recent records within the study area and suitable woodland habitat present. **Impact Possible**. Identify any individuals present within construction footprint in Middle Gunbower Forest (downstream of Deep Creek) in spring 2020 and assess whether final design can avoid or minimise impacts.	**Possible.** Suitable habitat of terrestrial or flood-tolerent woodland present within inundation area. **Impact possible**: EVC mapping indicates that suitable habitat for this species is present within the inundation area. However, it is recommended that areas mapped as suitable habitat within the inundation area are ground truthed to confirm the presence or absence of suitable habitat for this species, and then the likelihood of any impacts to the species that may result from the operational phase of the project can be updated.
Calotis cuneifolia **Blue Burr-daisy**			r	VBA, Bennetts et al. 2012, Biosis 2014	2 (1987)	**Possible.** Species recorded at Deep Creek (Biosis 2014) and suitable floodplain habitat present in construction footprint. **Impact Possible**. Identify any individuals present within construction footprint in Middle Gunbower Forest (downstream of Deep Creek) in spring 2020 and assess whether final design can avoid or minimise impacts.	**Possible.** Suitable habitat of terrestrial or flood-tolerent woodland present within inundation area. Recorded in Lower Gunbower Forest (Bennetts et al. 2012) **Impact possible**: EVC mapping indicates that suitable habitat for this species is present within the inundation area. However, it is recommended that areas mapped as suitable habitat within the inundation area are ground truthed to confirm the presence or absence of suitable habitat for this species, and then the likelihood of any impacts to the species that may result from the operational phase of the project can be updated.
Dianella porraceae – formally known as *Dianella sp af. longifolia (Riverina)* **Leek Flax-lily**			vu	Bennetts et al. 2012, Biosis 2014, GHD 2017		**Possible.** A few individuals were recorded during field assessment and in previous Biosis (2014) and GHD (2017) surveys in the area of investigation, but not within the construction footprint. Occurrence possible in Middle Gunbower Forest (downstream of Deep Creek). **Impact Possible**. Identify any individuals present within construction footprint in Middle Gunbower Forest (downstream of Deep Creek) in spring 2020 and assess whether final design can avoid or minimise impacts.	**Possible.** Suitable habitat of terrestrial or flood-tolerent woodland present within inundation area. Recorded in Lower and Middle Gunbower Forest (Bennetts et al. 2012) **Impact possible**: EVC mapping indicates that suitable habitat for this species is present within the inundation area. However, it is recommended that areas mapped as suitable habitat within the inundation area are ground truthed to confirm the presence or absence of suitable

							habitat for this species, and then the likelihood of any impacts to the species that may result from the operational phase of the project can be updated.
Digitaria divaricatissima var. divaricatissima **Umbrella Grass**			vu	VBA	1 (2010)	**Possible**. Records of this species occur within the study area and suitable riparian woodland habitat is available in construction footprint. **Impact Possible**. Identify any individuals present within construction footprint in Middle Gunbower Forest (downstream of Deep Creek) in spring 2020 and assess whether final design can avoid or minimise impacts.	**Possible.** Likely to be present along waterways or dried floodplains within inundation area. **Impact Unlikely.** Species likely to benefit from a return to a more natural flooding regime and increase area of potential occupancy.
Enneapogon gracilis **Slender Bottle-washers**			vu	VBA	1 (2010)	**Possible**. Records of this species occur within the study area and suitable riparian woodland habitat available in construction footprint. **Impact Possible**. Identify any individuals present within construction footprint in Middle Gunbower Forest (downstream of Deep Creek) in spring 2020 and assess whether final design can avoid or minimise impacts.	**Possible.** Likely to be present along waterways or dried floodplains within inundation area. **Impact Unlikely.** Species likely to benefit from a return to a more natural flooding regime and increase area of potential occupancy.
Eryngium paludosum **Long Eryngium**			vu	VBA, Bennetts et al. 2012, Biosis 2014	2 (1994)	**Present.** Individuals recorded during field assessment and by Biosis (2014) in high-quality Riverine Chenopod Woodland around the Gunbower Creek Mid Creek regulator. Occurrence possible in Middle Gunbower Forest (downstream of Deep Creek). **Impact Possible**. Identify any individuals present within construction footprint in Middle Gunbower Forest (downstream of Deep Creek) in spring 2020 and assess whether final design can avoid or minimise impacts.	**Possible.** Suitable habitat of terrestrial or flood-tolerent woodland present within inundation area. Recorded in Middle and Upper Gunbower Forest (Bennetts et al. 2012) **Impact possible**: EVC mapping indicates that suitable habitat for this species is present within the inundation area. However, it is recommended that areas mapped as suitable habitat within the inundation area are ground truthed to confirm the presence or absence of suitable habitat for this species, and then the likelihood of any impacts to the species that may result from the operational phase of the project can be updated.
Lepidium monoplocoides **Winged Peppercress**	EN	L	en	VBA, PMST, Bennetts et al. 2012	1 (1983)	**Possible.** Records within the study area and potential habitat present in the outer areas of forest where Black Box chenopod vegetation occurs. **Impact Possible**. Unlikely to adversely affect habitat critical for the species or reduce the area of occupancy. Identify any individuals present within construction footprint in Middle	**Possible.** Likely to be present in outer areas of the forest in Black Box vegetation. Recorded in Lower Gunbower (Bennetts et al. 2012) **Impact Unlikely.** Species likely to benefit from a return to a more natural flooding regime and increase area of potential occupancy.

						Gunbower Forest (downstream of Deep Creek) in spring 2020 and assess whether final design can avoid.	
Minuria integerrima **Smooth Minuria**			r	VBA, Bennetts et al. 2012	1 (1987)	**Possible**. Recorded by Bennetts (2012) in the project area and suitable floodplain habitat present in construction footprint. **Impact Possible**. Identify any individuals present within construction footprint in Middle Gunbower Forest (downstream of Deep Creek) in spring 2020 and assess whether final design can avoid or minimise impacts.	**Possible.** Likely to be present along dried floodplains within inundation area. Recorded in Middle and Upper Gunbower (Bennetts et al. 2012) **Impact Unlikely.** Species likely to benefit from a return to a more natural flooding regime and increase area of potential occupancy.
Myoporum montanum **Waterbush**			r	VBA, Bennetts et al. 2012	2 (1997)	**Possible**. Records of this species occur within the study and suitable riparian woodland habitat is available in construction footprint. **Impact Possible**. Identify any individuals present within construction footprint in Middle Gunbower Forest (downstream of Deep Creek) in spring 2020 and assess whether final design can avoid or minimise impacts.	**Possible.** Likely to be present along waterways or dried floodplains within inundation area. Recorded in Middle and Lower Gunbower (Bennetts et al. 2012) **Impact Unlikely.** Species likely to benefit from a return to a more natural flooding regime and increase area of potential occupancy.
Myriophyllum porcatum **Ridged Water-milfoil**	VU	L	vu	PMST		**Possible.** No records of this species occurs within 10 km, however suitable aquatic habitat present within construction footprint. **Impact Possible**. Identify any individuals present within construction footprint in Middle Gunbower Forest (downstream of Deep Creek) in spring 2020 and assess whether final design can avoid or minimise impacts.	**Possible.** No records of this species occurs within 10 km, however suitable aquatic habitat present within inundation area. **Impact Unlikely.** Species likely to benefit from a return to a more natural flooding regime and increase area of potential occupancy.
Nymphoides crenata **Wavy Marshwort**		L	vu	Bennetts et al. 2012		**Possible:** Previously recorded by Bennetts (2012) in project area and suitable aquatic habitat exists in the construction footprint. **Impact Possible**. Identify any individuals present within construction footprint in Middle Gunbower Forest (downstream of Deep Creek) in spring 2020 and assess whether final design can avoid, or minimise impacts	**Possible.** Likely to be present along waterways or dried floodplains within inundation area. **Impact Unlikely.** Species likely to benefit from a return to a more natural flooding regime and increase area of potential occupancy.
Pterostylis cheraphila	VU	L	vu	Bennetts and	2020	**Possible.** Species only recently recorded in terrestrial box woodland in Lower Gunbower Forest. Suitable habitat present within inundation area.	**Possible.** Species only recently recorded in terrestrial box woodland in Lower Gunbower Forest. Suitable habitat present within inundation area.

Floodplain Rustyhood				Cook 2020		**Impact Possible**. Identify any individuals present within construction footprint in Middle Gunbower Forest (downstream of Deep Creek) in spring 2020 and assess whether final design can avoid, or minimise impacts	**Impact Unlikely.** Species likely to benefit from a return to a more natural flooding regime and increase area of potential occupancy.
Rorippa eustylis **Dwarf Bitter-cress**			r	Bennetts et al. 2012		**Possible.** Recorded by Bennetts (2012) in the project area and suitable floodplain and swamp habitat present in construction footprint. **Impact Possible**. Identify any individuals present within construction footprint in Middle Gunbower Forest (downstream of Deep Creek) in spring 2020 and assess whether final design can avoid, or minimise impacts	**Possible.** Likely to be present along waterways or dried floodplains within inundation area. Recorded in Middle and Lower Gunbower Forest (Bennetts et al. 2012) **Impact Unlikely.** Species likely to benefit from a return to a more natural flooding regime and increase area of potential occupancy.
Senecio behrianus **Stiff Groundsel**	EN	L	en	VBA	3 (2008)	**Possible.** Known from a few locations around Gunbower Forest, including along McGillivray Road (50 m from project area). Occurrence possible in Middle Gunbower Forest (downstream). **Impact Possible**. Unlikely to adversely affect habitat critical for the species or reduce the area of occupancy. Identify any individuals present within construction footprint in Middle Gunbower Forest (downstream of Deep Creek) in spring 2020 and assess whether final design can avoid or minimise impacts.	**Possible.** Likely to be present along waterways or dried floodplains within inundation area. **Impact Unlikely.** Species likely to benefit from a return to a more natural flooding regime and increase area of potential occupancy.
Senecio campylocarpus **Floodplain Fireweed**			vu	Biosis 2014		**Possible.** Species recorded in the project area (Biosis 2014) and suitable floodplain habitat present in construction footprint. **Impact Possible**. Identify any individuals present within construction footprint in Middle Gunbower Forest (downstream of Deep Creek) in spring 2020 and assess whether final design can avoid or minimise impacts.	**Possible.** Likely to be present along waterways or dried floodplains within inundation area. **Impact Unlikely.** Species likely to benefit from a return to a more natural flooding regime and increase area of potential occupancy.
Swainsona murrayana **Slender Darling-pea**	VU	L	en	VBA Seran BL&A 2018	12 (2014)	**Possible.** Limited potential habitat within the already disturbed areas of the construction footprint. **Impact Possible**. Unlikely to adversely affect habitat critical for the species or reduce the area of occupancy. Identify any individuals present within construction footprint in Middle Gunbower Forest (downstream of Deep Creek) in spring 2020	**Possible.** Species hasn't been recorded within the Gunbower National Park, but potential Black Box woodland habitat is present. **Impact Unlikely.** Species likely to benefit from a return to a more natural flooding regime and increase area of potential occupancy.

						and assess whether final design can avoid or minimise impacts.	

[1] Commonwealth *Environment Protection and Biodiversity Convservation Act1999* categories: CR = Critically Endangered, E= Endangered, VU = Vulnerable, [2]*Flora and Fauna Guarantee Act 1988* categories: L = Listed, N = Nominated; [3] Conservation Status in Victoria DEWLP Advisory List; cr = critically endangered, en = endangered, vu = vulnerable, r = rare

7.2.1 Impacts to EPBC Act listed flora

One EPBC listed flora species, River Swamp Wallaby-grass (*Amphibromus fluitans*, EPBC Act listed Vulnerable) was identified during the most recent field assessment within the area of investigation, and five others, Winged Peppercress (*Lepidium monoplocoides*, EPBC Act listed Endangered), Ridged Water-milfoil (*Myriophyllum porcatum*), Floodplain Rustyhood (*Pterostylis cheraphila*), Stiff Groundsel (*Senecio behrianus,* EPBC Act listed Endangered) and Slender Darling-pea (*Swainsona murrayana*, EPBC Act listed Vulnerable) are either known to occur close to the project area or suitable habitat exists within the project area. The species are not considered to be significantly impacted by either the construction works or proposed inundation. As flood responders, these species are likely to benefit from the restoration of a more natural inundation cycle.

An assessment of the EPBC Act significant impact criteria for each EPBC Act listed flora species considered for the Project is provided in Appendix P. A summary of the outcomes of this assessment for the six species with potential to occur within the Project area is provided in Table 7-3.

Table 7-3 Significant impact assessment for EPBC listed flora species with potential of occurring within the project area.

Scientific Name	Status	Habitat	Likelihood of Occurrence/Potential Impact	Assessment of Significance under EPBC Act
Amphibromus fluitans River Swamp Wallaby-grass	VU	Largely confined to permanent swamps, principally along the Murray River between Wodonga and Echuca, uncommon to rare in the south (e.g. Casterton, Moe, Yarram), probably due to historic drainage of wetlands (RBGV 2016).	**Construction footprint** **Possible.** Cryptic species responding to inundation events, occurs in low lying areas. Recorded in dry Riverine Swamp Forest in area of investigation but not close to construction footprint. Occurrence possible in Middle Gunbower Forest (downstream of Deep Creek). **Impact Possible**. Unlikely to adversely affect habitat critical for the species or reduce the area of occupancy. Identify any individuals present within construction footprint in Middle Gunbower Forest (downstream of Deep Creek) in spring 2020 and assess whether final design can avoid or minimise impacts. **Inundation area** **Present.** Recorded at Baggots Swamp during R8 field assessment and Likely to be present along waterways or dried floodplains within inundation area. **Impact Unlikely.** Species likely to benefit from a return to a more natural flooding regime and increase area of potential occupancy.	**It is unlikely that the proposed works will have a significant impact on this species.** ▪ River Swamp Wallaby-grass is known to occur within the broader Gunbower Forest and National Park, particularly in the Lower Forests with populations recorded and being regularly monitored as part of the TLM vegetation condition monitoring (Bennetts and Cook 2020, Bennetts and Jolly 2020). ▪ The species was recorded in the area of investigation in the far western extent of the Baggot's creek overflow in Upper Gunbower Forest, approximately 1.75 km from the nearest construction area. Further surveys are required in spring 2020 for Middle Gunbower (downstream of Deep Creek) and Camerons Creek pump station and pipeline in Upper Gunbower to confirm the presence or absence there. ▪ The species was recorded in a very degraded state due to a lack of recent flooding and browsing by herbivores in dry Riverine Swamp Forest in the area of investigation. Under good conditions, River Swamp Wallaby-grass could be relatively widespread, as it has been recorded more extensively within the Lower Gunbower Forest (Bennetts and Cook 2020). ▪ Listed as Vulnerable under the EPBC Act, impacts are considered at the population level. No important populations are listed in the assessment advice for the species (TSSC 2010), and individuals recorded in the Upper and Middle Gunbower Forests would likely not be considered a key source population, a population necessary for genetic diversity or population at the limit of the species' range. ▪ No individuals were recorded in the construction footprint and limited suitable wetland and semi-permanent wetland habitat is present in the construction footprintn. Given the relative abundance in remaining areas of suitable habitat, no important populations are listed in the assessment advice and no recovery plan has been commenced. It is not considered that the project will have a significant impact on this species. ▪ The operational phase of the project is likely to improve habitat quality in the project area and benefit the population in Gunbower National Park.

Lepidium monoplocoides Winged Peppercress	EN	Uncommon in north western quarter of state, mostly on heavy soils near lakes and watercourses. Flowers mostly spring-summer (Walsh & Entwisle 1996).	**Construction Footprint:** **Possible.** Records within study area (10 km from project area in Lower Gunbower Forest) and potential habitat present in the outer areas of forest where Black Box chenopod vegetation occurs. **Impact Possible** Unlikely to adversely affect habitat critical for the species or reduce the area of occupancy. Identify any individuals present within construction footprint in Middle Gunbower Forest (downstream of Deep Creek) in spring 2020 and assess whether final design can avoid or minimise impacts. **Inundation Area:** **Possible.** Records within study area (10 km from project area in Lower Gunbower Forest) and potential habitat present in the outer areas of forest where Black Box chenopod vegetation occurs. **Impact Unlikely.** Species likely to benefit from a return to a more natural flooding regime and increase area of potential occupancy.	**It is unlikely that the proposed works will have a significant impact on this species.** ▪ The species was not recorded in the construction footprint during targeted surveys in 2019 and the the closest population is 7 km north-west in Lower Gunbower Forest (Bennetts and Cook 2020). Previous surveys within Upper and Middle Gunbower Forest have yet to record the species (Bennetts et al. 2012, Bennetts and Cook 2020, Bennetts and Jolly 2020). ▪ Limited habitat exists within the construction footprint, due to existing disturbance along access tracks. It is therefore unlikely that a population of the species is present or likely to be impacted by the proposed works. ▪ Further surveys are required in spring 2020 for Middle Gunbower (downstream of Deep Creek) and Camerons Creek pump station and pipeline in Upper Gunbower to confirm the presence or absence there. However it is unlikely that a population is present given the construction footprint is centred on existing tracks and degraded areas. ▪ The proposed construction works will not reduce the area of occupancy or affect habitat critical to the survival of the species, particularly as the area of vegetation removal associated with the construction footprint is considered negligible when compared to the broader Gunbower Forest and area that will benefit from a more natural flooding regime. ▪ Given the species can tolerate inundation, the restoration of a natural flooding regime may enhance the quality of suitable habitat available for this species to recolonise and reduce herbivory pressure (Mavromihalis 2010).
Myriophyllum porcatum Ridged Water-milfoil	VU	Rare and restricted to northern and north-western Victoria where it has been recorded growing in temporary waterholes, lagoons, farm dams and rock holes, and on clay pans (Walsh and Entwisle 1996).	**Construction Footprint:** **Possible.** No records of this species occurs within 10 km, however suitable aquatic habitat present within construction footprint. **Impact Possible**. Unlikely to adversely affect habitat critical for the species or reduce the area of occupancy. Identify any individuals present within construction footprint in Middle Gunbower Forest (downstream of Deep Creek) in spring 2020 and assess whether final design can avoid or minimise impacts. **Inundation Area:**	**It is unlikely that the proposed works will have a significant impact on this species.** ▪ Ridged Water-milfoil has not been recorded in Gunbower Forest or the study area, however potential suitable wetland habitat is present. No previous surveys within the Gunbower National Park project area have recorded the species (Bennetts and Cook 2020, Bennetts and Jolly 2020). ▪ The majority of the 15 known widely separated populations occur in central north Victoria on private land, wetlands, parks, swamps, farm dams and temporary waterholes (Murphy 2006). No important populations are known to occur along the Murray River in the Gunbower Forests. ▪ Further surveys are required in spring 2020 for Middle Gunbower (downstream of Deep Creek) and Camerons Creek pump station and pipeline in Upper Gunbower to confirm the presence or absence there. However, it is unlikely that an important population is present given the construction footprint is centred on existing tracks and degraded areas.

			Possible. No records of this species occurs within 10 km, however suitable aquatic habitat present within inundation area. **Impact Unlikely.** Species likely to benefit from a return to a more natural flooding regime and increase area of potential occupancy.	▪ The vegetation removal required for the project is predominantly located on higher ground away from the semi-permanent wetlands and floodways considered potential habitat for this species. The proposed construction works will therefore not lead to a long-term decrease in the size of an important population. ▪ The operational phase of the project is likely to improve habitat quality in the project area and benefit any potential population in Gunbower National Park.
Pterostylis cheraphila Floodplain Rustyhood	VU	Endemic to Victoria where localised and known only from the Little Desert area and near Murtoa in riverine *Eucalyptus largiflorens* woodland, growing amongst ephemerals on sandy loam or cracking silty soils. Recently recorded in Plains Woodland/Semi-arid Woodland in Gunbower Forest (Walsh and Entwisle 1994).	**Construction Footprint:** **Possible.** Species only recently recorded in terrestrial box woodland in Lower Gunbower Forest. Suitable habitat present within inundation area. **Impact Possible**. Identify any individuals present within construction footprint in Middle Gunbower Forest (downstream of Deep Creek) in spring 2020 and assess whether final design can avoid, or minimise impacts **Inundation Area:** **Possible.** No records of this species occurs within 10 km, however suitable aquatic habitat present within inundation area. **Impact Unlikely.** Species likely to benefit from a return to a more natural flooding regime and increase area of potential occupancy.	**It is unlikely that the proposed works will have a significant impact on this species.** ▪ Floodplain Rustyhood has been recently recorded in Lower Gunbower Forest, on Spur Island approximately 2 km north-west of the project area (Bennetts and Cook 2020). Only a sinle population is known, however there is the potential for other nearby populations to exist within the broader Gunbower Forest. ▪ The species has not been recorded during TLM vegetation condition monitoring or other threatened species surveys (Bennetts et al. 2012, Bennetts and Cook 2020, Bennetts and Jolly 2020). ▪ Further surveys are required in spring 2020 for Middle Gunbower (downstream of Deep Creek) and Camerons Creek pump station and pipeline in Upper Gunbower to confirm the presence or absence there. However, it is unlikely that an important population is present given the construction footprint is centred on existing tracks and degraded areas. ▪ Only three populations are listed in the Recovery Plan for the species (Duncan et al. 2010), although the population recorded in Lower Gunbower Forest would be considered an important population as it is a key source population, a population necessary for genetic diversity and a population at the limit of the species' range. ▪ The proposed construction works will not reduce the area of occupancy or affect habitat critical to the survival of the species, particularly as the area of vegetation removal associated with the construction footprint is considered negligible when compared to the broader Gunbower Forest and area that will benefit from a more natural flooding regime. ▪ Given the species can tolerate inundation, the restoration of a natural flooding regime may enhance the quality of suitable habitat available for this species to recolonise and reduce herbivory pressure (Duncan et al. 2010)
Senecio behrianus Stiff Groundsel	EN	Exceedingly rare in Victoria, and thought to be extinct until 1991 when rediscovered	**Construction Footprint:** **Possible.** Known from a few locations around Gunbower Forest, including along McGillivray Road (50 m from project	**It is unlikely that the proposed works will have a significant impact on this species.** ▪ Stiff Groundsel is only known from six locations within Victoria, one of those being just outside the Gunbower National Park within a road reserve on McGillivray Road, Gunbower (50 m from the area of investigation) (Rakali Ecological Consulting 2015)

		between Rochester and Stanhope, and Miners Rest near Ballarat in 2004. Apparently confined to heavy, winter-wet, clayey soils. Formerly known from Casterton, Swan Hill, Barham areas (RBGV 2018).	area). Occurrence possible in Middle Gunbower Forest (downstream). **Impact Possible**. Unlikely to adversely affect habitat critical for the species or reduce the area of occupancy. Identify any individuals present within construction footprint in Middle Gunbower Forest (downstream of Deep Creek) in spring 2020 and assess whether final design can avoid or minimise impacts. **Inundation Area:** **Possible.** Likely to be present along waterways or dried floodplains within inundation area. **Impact Unlikely.** Species likely to benefit from a return to a more natural flooding regime and increase area of potential occupancy.	▪ The species was not recorded in the area of investigation or outside the project area during field survey in 2019. ▪ Previous surveys within Upper and Middle Gunbower Forest have yet to record the species (Bennetts et al. 2012, Bennetts and Cook 2020, Bennetts and Jolly 2020). ▪ Limited habitat exists within the construction footprint, due to existing disturbance along access tracks. It is therefore unlikely that a population of the species is present or likely to be impacted by the proposed works. ▪ Further surveys are required in spring 2020 for Middle Gunbower (downstream of Deep Creek) and Camerons Creek pump station and pipeline in Upper Gunbower to confirm the presence or absence there. However it is unlikely that a population is present given the construction footprint is centred on existing tracks and degraded areas. ▪ The proposed construction works will not reduce the area of occupancy or affect habitat critical to the survival of the species, particularly as the area of vegetation removal associated with the construction footprint is considered negligible when compared to the broader Gunbower Forest and area that will benefit from a more natural flooding regime. ▪ Given the species can tolerate inundation, the restoration of a natural flooding regime may enhance the quality of suitable habitat available for this species to recolonise and reduce herbivory pressure.
Swainsona murrayana Slender Darling-pea	VU	Extremely rare in northern and western Victoria where usually found in seasonally inundated flats and around lakes. Flowers Aug.-Nov. (Walsh and Entwisle 1996)	**Construction Footprint:** **Possible.** Limited potential habitat within the already disturbed areas of the construction footprint. **Impact Possible**. Unlikely to adversely affect habitat critical for the species or reduce the area of occupancy. Identify any individuals present within construction footprint in Middle Gunbower Forest (downstream of Deep Creek) in spring 2020 and assess whether final design can avoid or minimise impacts. **Inundation Area:** **Possible.** Species hasn't been recorded within the Gunbower National Park, but potential Black Box woodland habitat is present.	**It is unlikely that the proposed works will have a significant impact on this species.** ▪ The species was not recorded in the construction footprint during targeted surveys in 2019 and the the closest population is 10 km south in the grasslands of the Terrick Terrick National Park (VBA 2020). Previous surveys within Upper and Middle Gunbower Forest have yet to record the species (Bennetts et al. 2012, Bennetts and Cook 2020, Bennetts and Jolly 2020). ▪ A very cryptic species that responds to flooding, it is known to primarily occur across in heavy grey to red-brown clay soils, primarily known from populations on lake margins and grasslands in the Kerang region, across the Patho Plains and in Terrick Terrick National Park (DEHWA 2008). ▪ Limited habitat exists within the construction footprint, due to existing disturbance along access tracks. It is therefore unlikely that a population of the species is present or likely to be impacted by the proposed works. ▪ Further surveys are required in spring 2020 for Middle Gunbower (downstream of Deep Creek) and Camerons Creek pump station and pipeline in Upper Gunbower to confirm the presence or absence there. However it is unlikely that a population is

			Impact Unlikely. Species likely to benefit from a return to a more natural flooding regime and increase area of potential occupancy.	present given the construction footprint is centred on existing tracks and degraded areas. ▪ The proposed construction works will not reduce the area of occupancy or affect habitat critical to the survival of the species, particularly as the area of vegetation removal associated with the construction footprint is considered negligible when compared to the broader Gunbower Forest and area that will benefit from a more natural flooding regime. ▪ Given the species can tolerate inundation, the restoration of a natural flooding regime may enhance the quality of suitable habitat available for this species to recolonise and reduce herbivory pressure (DEWHA 2008)

[1] Commonwealth *Environment Protection and Biodiversity Convservation Act1999* categories: CR = Critically Endangered, E= Endangered, VU = Vulnerable,

7.2.2 Impacts to FFG Act listed and DELWP Advisory listed threatened flora

Species listed as threatened under the FFG Act along with species considered rare or threatened under the DELWP Victorian Advisory List for Rare or Threatened Species (DEPI 2014) were recorded within the area of investigation during the 2019 field surveys.

Eighteen (18) species listed under the FFG Act and DELWP Advisory list of rare or threatened plants identified in searches of the VBA and PMST were considered as Possible to occur within the construction footprint. Two of these species, Umbrella Wattle and Long Eryngium were identified in the construction footprint.

The location of flora species listed as rare or threatened under the DELWP Advisory list of rare or threatened plants (DEPI 2014) should be taken into consideration when finalising the construction footprint and efforts should be made to avoid listed species where possible (Figure 5-4). Additional avoidance and mitigation measures outlined in this report should be followed where possible to minimise the impacts on these species.

These species are considered rare or threatened, however they are common in suitable habitat under the correct conditions, and it is considered that impacts to these species' would be minor and localised, and that the proposed works would be unlikely to impact a significant population of these species or impact the range/distribution of any of these species.

Further threatened flora surveys are required for spring 2020 for Middle Gunbower (downstream of Deep Creek) and Camerons Creek pump station and pipeline in Upper Gunbower.

7.2.3 Impacts to FFG Act-protected flora

During R8 surveys in 2019, sixteen flora listed as protected under the FFG Act were recorded within the area for investigation. It is anticipated that a number of individuals of each species will require removal to enable the project to proceed. It is not expected that the loss of these individuals will have any long term impact on the species of these protected flora.

However, as the protected flora outlined below are also likely to be present within the inundation area, it is expected that any impacts to these species will be offset by the broader benefits to these species across the inundation area.

7.3 Potential impacts to threatened fauna

The following assessment of likelihood of occurrence and impact to threatened fauna considers the potential to occur at the construction footprint and inundation area, based on the VBA and PMST searches, the habitat requirements of the species, and the fauna habitat values observed within these areas. This table summarises those species considered possible, likely or present at ONE OR BOTH of the construction footprint and inundation area. An assessment of likelihood of occurrence and impact to all threatened fauna is provided in Appendix F for the construction footprint and Appendix G for the inundation area.

These species are summarised in Table 7-4 below. Impacts to these species are considered further in Section 7.3.1-7.3.3.

Table 7-4 Threatened fauna considered possible or present within either the construction footprint or inundation area, as developed from VBA and PMST searches within the study area and the associated likelihood of occurrence and impact

Scientific and Common Name	EPBC Act[1]	FFG Act[2]	DELWP Advisory[3]	Most Recent and Number of Records	Source	Likelihood of Occurrence and Impact: Construction footprint	Likelihood of Occurrence and Impact: Inundation area
Amphibians							
Crinia sloanei **Sloane's Froglet**	EN			1993 (3)	**VBA**	**Possible.** Existing records in project area and suitable habitat present in Cameron's Creek and Deep Creek in construction footprint. **Impact Possible.** A construction specific aquatic fauna management plan should be developed for all works around waterways. Targeted surveys should be undertaken in late winter 2020	**Possible.** Records within the study area and suitable wetland habitat is present in the inundation area. **Impact Unlikely**. Species almost certain to benefit directly from increasing the potential area of occupancy when environmental water is present, and indirectly from improved habitat condition following environmental water.
Litoria raniformis **Growling Grass Frog**	VU	L	en		**PMST**	**Possible.** No recent records exist in project area, and suitable habitat present in Cameron's Creek and Deep Creek in construction footprint. **Impact Possible**. A construction specific aquatic fauna management plan should be developed for all works around waterways. Targeted surveys should be undertaken in early summer in 2020.	**Possible.** No recent records exist in project area, but suitable aquatic habitat is present along waterways. **Impact Unlikely**. Species almost certain to benefit directly from increasing the potential area of occupancy when environmental water is present, and indirectly from improved habitat condition following environmental water.
Birds							
Antigone rubicunda **Brolga**		L	vu	1999 (2)	**VBA**	**Unlikely.** Limited suitable wetland habitat present within the construction footprint.	**Possible.** Records within the study area, and suitable wetland habitat is present in the inundation area. **Impact Unlikely.** Species likely to benefit from environmental watering when present
Ardea alba **Great Egret**		L	vu	2010 (20)	**VBA**	**Unlikely.** Limited suitable wetland habitat present within the construction footprint.	**Possible.** Records within the study area, and suitable wetland habitat is present in the inundation area. **Impact Unlikely.** Species likely to benefit from environmental watering when present
Ardea intermedia plumifera **Plumed Egret**		L	en	2017 (4)	**VBA**	**Unlikely.** Limited suitable wetland habitat present within the construction footprint.	**Possible.** Records within the study area, and suitable wetland habitat is present in the inundation area.

							Impact Unlikely. Species likely to benefit from environmental watering when present
Aythya australis **Hardhead**			vu	2004 (1)	**VBA**	**Unlikely.** Limited suitable wetland habitat present within the construction footprint.	**Possible.** Records within the study area, and suitable wetland habitat is present in the inundation area. **Impact Unlikely.** Species likely to benefit from environmental watering when present
Botaurus poiciloptilus **Australasian Bittern**	EN	L	en	1993 (1)	**VBA, PMST**	**Unlikely.** Limited suitable wetland habitat present within construction footprint. Unlikely to adversely affect habitat critical for the species or reduce the area of occupancy.	**Possible.** Records within the study area, and suitable wetland habitat is present in the inundation area. **Impact Unlikely.** Species likely to benefit from environmental watering when present and increase area of potential occupancy.
Ceyx azureus **Azure Kingfisher**			nt	2017 (23)	**VBA**	**Possible.** Suitable swamp forest habitat present within construction footprint. **Impact Unlikely.** Species mobile and wide-ranging, suitable surrounding habitat widespread. Losses to relatively small area of foraging and potential nesting habitat proposed from the removal of trees.	**Possible.** Many records within the study area and suitable swamp forest habitat is available throughout inundation area. **Impact Unlikely.** Species mobile and wide-ranging, suitable surrounding habitat widespread. Species likely to benefit from improved habitat condition following environmental
Chlidonias hybrida **Whiskered Tern**			nt	2008 (3)	**VBA**	**Unlikely.** Limited suitable wetland habitat present within construction footprint.	**Possible.** Records within the study area, and suitable wetland habitat is present in the inundation area. **Impact Unlikely.** Species likely to benefit from environmental watering when present
Climacteris picumnus **Brown Treecreeper**			nt	2019 (179)	**VBA**	**Present.** Species observed and suitable foraging habitat present within construction footprint **Impact Unlikely.** Species mobile and wide-ranging, suitable surrounding habitat widespread. Losses to relatively small area of foraging and potential nesting habitat proposed from the removal of trees.	**Present.** Species observed during field assessment across the inundation area with suitable habitat widespread. **Impact Unlikely.** Species mobile and wide-ranging, suitable surrounding habitat widespread. Species likely to benefit from improved habitat condition following environmental water.
Dromaius novaehollandiae **Emu**			nt	1999 (3)	**VBA**	**Present.** Species observed and suitable foraging habitat present within construction footprint **Impact Unlikely.** Species mobile and wide-ranging, suitable surrounding habitat widespread. Losses to relatively small area of foraging and potential	**Present.** Species observed during field assessment across the inundation area with suitable habitat widespread. **Impact Unlikely.** Species mobile and wide-ranging, suitable surrounding habitat widespread. Species likely to benefit from improved habitat condition following environmental water.

						nesting habitat proposed from the removal of trees.	
Egretta garzetta **Little Egret**		L	en	1974 (3)	**VBA**	**Unlikely.** Limited suitable wetland habitat present within construction footprint.	**Possible.** Records within the study area, and suitable wetland habitat present in the inundation area. **Impact Unlikely.** Species likely to benefit from environmental watering when present
Falco hypoleucos **Grey Falcon**		L	en	1999 (1)	**VBA**	**Possible.** Suitable foraging habitat present within construction footprint **Impact Unlikely.** Species mobile and wide-ranging, suitable surrounding habitat widespread.	**Possible.** Suitable foraging habitat present within Inundation area **Impact Unlikely.** Species mobile and wide-ranging, suitable surrounding habitat widespread.
Falco subniger **Black Falcon**		L	vu	2019 (2)	**VBA**	**Possible.** Suitable foraging habitat present within construction footprint **Impact Unlikely.** Species mobile and wide-ranging, suitable surrounding habitat widespread.	**Possible.** Suitable foraging habitat present within inundation area **Impact Unlikely.** Species mobile and wide-ranging, suitable surrounding habitat widespread.
Grantiella picta **Painted Honeyeater**	VU	L	vu		**PMST**	**Possible.** No records but suitable foraging habitat present within construction footprint **Impact Unlikely.** Species mobile and wide-ranging, suitable surrounding habitat widespread.	**Possible.** No records but suitable habitat present within inundation area. **Impact Unlikely**. Species likely to benefit from environmental watering when present and increase area of potential occupancy.
Haliaeetus leucogaster **White-bellied Sea-Eagle**		L	vu	2008 (4)	**VBA**	**Possible.** Recent records and suitable foraging habitat present within construction footprint **Impact Unlikely.** Species mobile and wide-ranging, suitable surrounding habitat widespread.	**Possible.** Recent records and suitable foraging habitat present within inundation area **Impact Unlikely.** Species mobile and wide-ranging, suitable surrounding habitat widespread. Species likely to benefit from improved habitat condition following environmental water
Hirundapus caudacutus **White-throated Needletail**	VU, M	L	vu	1980 (1)	**VBA**	**Possible.** Recent records and suitable foraging habitat present within construction footprint **Impact Unlikely.** Species mobile and wide-ranging, suitable surrounding habitat widespread.	**Possible.** Recent records and suitable foraging habitat present within inundation area **Impact Unlikely.** Species mobile and wide-ranging, suitable surrounding habitat widespread. Species likely to benefit from improved habitat condition following environmental water
Lophoictinia isura **Square-tailed Kite**		L	vu	2005 (1)	**VBA**	**Possible.** Suitable foraging habitat present within construction footprint **Impact Unlikely**. Species mobile and wide-ranging, suitable surrounding habitat widespread.	**Possible.** Suitable foraging habitat present within inundation area **Impact Unlikely**. Species mobile and wide-ranging, suitable surrounding habitat widespread.

Melanodryas cucullate **Hooded Robin**		L	nt	2017 (10)	**VBA**	**Possible.** Many recent records and suitable foraging habitat present within construction footprint **Impact Unlikely.** Species mobile and wide-ranging, suitable surrounding habitat widespread. Losses to relatively small area of foraging and potential nesting habitat proposed from the removal of trees.	**Possible.** Many recent records and suitable foraging habitat present within inundation area **Impact Unlikely.** Species mobile and wide-ranging, suitable surrounding habitat widespread. Species likely to benefit from improved habitat condition following environmental water.
Ninox connivens **Barking Owl**		L	en	2008 (3)	**VBA**	**Possible.** Recent records and suitable foraging habitat present within construction footprint **Impact Unlikely.** Species mobile and wide-ranging, suitable surrounding habitat widespread. Losses to relatively small area of foraging and potential nesting habitat proposed from the removal of trees.	**Possible.** Many recent records and suitable foraging habitat present within inundation area **Impact Unlikely.** Species mobile and wide-ranging, suitable surrounding habitat widespread. Species likely to benefit from improved habitat condition following environmental water.
Nycticorax caledonicus **Nankeen Night-Heron**			nt	2003 (7)	**VBA**	**Unlikely.** Limited suitable wetland habitat present within construction footprint.	**Possible.** Records within the study area, and suitable wetland habitat present in the inundation area. **Impact Unlikely.** Species likely to benefit from environmental watering when present
Phalacrocorax varius **Pied Cormorant**			nt	2008 (5)	**VBA**	**Unlikely.** Limited suitable wetland habitat present within construction footprint.	**Possible.** Records within the study area, and suitable wetland habitat present in the inundation area. **Impact Unlikely.** Species likely to benefit from environmental watering when present
Platalea regia **Royal Spoonbill**			nt	2019 (5)	**VBA**	**Unlikely.** Limited suitable wetland habitat present within construction footprint.	**Possible.** Records within the study area, and suitable wetland habitat present in the inundation area. **Impact Unlikely.** Species likely to benefit from environmental watering when present
Plegadis falcinellus **Glossy Ibis**	M		nt	1992 (1)	**VBA**	**Unlikely.** Limited suitable wetland habitat present within construction footprint.	**Possible.** Records within the study area, and suitable wetland habitat present in the inundation area. **Impact Unlikely.** Species likely to benefit from environmental watering when present
Polytelis swainsonii **Superb Parrot**	VU	L	en	1996 (1)	**VBA**	**Possible.** Suitable foraging and nesting habitat present within construction footprint.	**Possible.** Suitable foraging and nesting habitat present within inundation area.

						Impact Unlikely. Species mobile and wide-ranging, suitable surrounding habitat widespread. Losses to relatively small area of foraging and potential nesting habitat proposed from the removal of trees.	**Impact Unlikely.** Species mobile and wide-ranging, suitable surrounding habitat widespread. Species likely to benefit from environmental watering when present and increase area of potential occupancy.
Pomatostomus temporalis **Grey-crowned Babbler**		L	en	2007 (4)	**VBA**	**Possible.** Species recorded during field assessment and suitable foraging habitat present within construction footprint. **Impact Unlikely.** Species mobile and wide-ranging, suitable surrounding habitat widespread. Losses to relatively small area of foraging and potential nesting habitat proposed from the removal of trees.	**Possible.** Species recorded during field assessment and suitable foraging habitat present within inundation area. **Impact Unlikely.** Species mobile and wide-ranging, suitable surrounding habitat widespread. Species likely to benefit from improved habitat condition following environmental water.
Rostratula australis **Australian Painted Snipe**	EN	L	cr		**PMST**	**Unlikely.** Limited suitable wetland habitat present within construction footprint. Unlikely to adversely affect habitat critical for the species or reduce the area of occupancy.	**Possible.** Records within the study area, and suitable wetland habitat present in the inundation area. **Impact Unlikely.** Species likely to benefit from environmental watering when present and increase area of potential occupancy.
Stagonopleura guttata **Diamond Firetail**		L	nt	2010 (36)	**VBA**	**Possible.** Species recorded during field assessment and suitable foraging habitat present within construction footprint. **Impact Unlikely.** Species mobile and wide-ranging, suitable surrounding habitat widespread. Losses to relatively small area of foraging and potential nesting habitat proposed from the removal of trees.	**Possible.** Species recorded during field assessment and suitable foraging habitat present within construction footprint. **Impact Unlikely.** Species mobile and wide-ranging, suitable surrounding habitat widespread. Species likely to benefit from improved habitat condition following environmental water.
Fish							
Bidyanus bidyanus **Silver Perch**	CR	L	vu		**PMST, Bloink et al. 2018**	**Present.** The species is a main-channel specialist (Stuart, 2020) with suitable habitat limited to the Murray River and Gunbower Creek. Recent surveys have detected Silver Perch in low abundances during annual monitoring of the Murray River adjacent to Gunbower Forest (2008-2017) (Bloink et. al. 2018). Silver Perch have also been detected in low numbers in surveys on the Gunbower Creek (Rehwinkel & Sharpe, 2009). The Murray River	**Possible.** May enter waterways and wetlands of Gunbower National Park during inundation events, but seasonally inundated semi-permanent forest wetlands do not provide suitable long term habitat. **Impact Possible.** The operation of the project has been designed to exclude fish from the floodplain wetlands through fish exclusion screens and a pumping only mechanism. It is unlikely that large numbers of fish will enter the floodplain. A

						upstream and downstream of the project area and the Murray River in vicinity of project area has been mapped as possible habitat by NSW Fisheries. Presence in the Murray River and National Channel at the project area should be assumed. **Impact Possible.** Localised impacts possible, consideration of coffer dam construction, dewatering works, and any potential for sediment/ contaminant run-off into wet areas from construction footprint must consider aquatic fauna. A construction specific aquatic fauna management plan should be developed for all works around waterways.	staged and managed drawdown regime will be implemented to monitor water quality of return flows and provide cues for native fish to exit the wetlands to prevent stranding. Release rates of return flows enable suitable mixing to occurs with the Murray River if water quality in return water is low. There is an overall assessment of low likelihood of impact to Silver Perch during the operation phase of the project.
Craterocephalus stercusmuscarum fulvus **Unspecked Hardyhead**		L		2012 (1)	**VBA, Sharp 2014, Sharp 2015**	**Present.** Species recorded during recent surveys of Cameron's Creek and Black Charlie Lagoon (Sharp 2014, 2015) and during annual monitoring across Gunbower Forest between 2008-2017 (Bloink et al. 2018). **Impact Possible.** Localised impacts possible, consideration of coffer dam construction, dewatering works, and any potential for sediment/ contaminant run-off into wet areas from construction footprint must consider aquatic fauna. A construction specific aquatic fauna management plan should be developed for all works around waterways.	**Present.** Species recorded during recent surveys of Cameron's Creek and Black Charlie Lagoon (Sharp 2014, 2015) and during annual monitoring across Gunbower Forest between 2008-2017 (Bloink et al. 2018). **Impact Possible.** The operation of the project has been designed to exclude fish from the floodplain wetlands through fish exclusion screens and a pumping only mechanism. It is unlikely that large numbers of fish will enter the floodplain. A staged and managed drawdown regime will be implemented to monitor water quality of return flows and provide cues for native fish to exit the wetlands to prevent stranding. Release rates of return flows enable suitable mixing to occurs with the Murray River if water quality in return water is low. There is an overall assessment of low likelihood of impact to Unspecked Hardyhead.
Maccullochella peelii **Murray Cod**	VU	L	vu	1970 (1)	**VBA, PMST, Stuart 2020, Bloink et al. 2018**	**Present.** The species is a main-channel specialist with suitable habitat limited to the Murray River and Gunbower Creek where the species has been frequently recorded, including in the Torrumbarry Weir Pool (Stuart, 2020). Species recorded in low abundances during annual monitoring between 2008-2017 of the Murray River in Gunbower Forest (Bloink et al. 2018). Presence in the Murray River at the project area should be assumed.	**Possible.** May enter forest areas during inundation events, but seasonally inundated semi-permanent forest wetlands do not provide suitable long term habitat. **Impact Possible.** The operation of the project has been designed to exclude fish from the floodplain wetlands through fish exclusion screens and a pumping only mechanism. It is unlikely that large numbers of fish will enter the floodplain. A staged and managed drawdown regime will be implemented to

						Impact Possible. Localised impacts possible, consideration of coffer dam construction, dewatering works, and any potential for sediment/ contaminant run-off into wet areas from construction footprint must consider aquatic fauna. A construction specific aquatic fauna management plan should be developed for all works around waterways.	monitor water quality of return flows and provide cues for native fish to exit the wetlands to prevent stranding. Release rates of return flows enable suitable mixing to occurs with the Murray River if water quality in return water is low. There is an overall assessment of low likelihood of impact to Murray Cod during the operation phase of the project.
Maccullochella macquariensis **Trout Cod**	EN	L	cr		**Stuart 2020, R* 2020**	**Present.** The species is a main-channel specialist with suitable habitat limited to the Murray River and Gunbower Creek, where the species has been recorded downstream of Yarrawonga Weir in the vicinity of large woody debris, branch piles and steep clay banks, usually in areas of fast flowing current (DSE, 2008) and in Gunbower Creek (Mallen-Cooper et. al. 2014) and Torrumbarry Weir Pool (Stuart, 2020). Presence in the Murray River and Gunbower Creek/National Channel should be assumed. **Impact Possible.** Localised impacts possible, consideration of coffer dam construction, dewatering works, and any potential for sediment/ contaminant run-off into wet areas from construction footprint must consider aquatic fauna. A construction specific aquatic fauna management plan should be developed for all works around waterways.	**Possible.** May enter forest areas during inundation events, but seasonally inundated semi-permanent forest wetlands do not provide suitable long term habitat. **Impact Possible.** The operation of the project has been designed to exclude fish from the floodplain wetlands through fish exclusion screens and a pumping only mechanism. It is unlikely that large numbers of fish will enter the floodplain. A staged and managed drawdown regime will be implemented to monitor water quality of return flows and provide cues for native fish to exit the wetlands to prevent stranding. Release rates of return flows enable suitable mixing to occurs with the Murray River if water quality in return water is low. There is an overall assessment of low likelihood of impact to Trout Cod during the operation phase of the project.
Macquaria ambigua **Golden Perch**			nt	2012 (1)	**VBA**	**Present**. The species is a main-channel specialist with suitable habitat limited to Gunbower Creek (Mallen-Cooper et al. 2014) and the Murray River, including the Torrumbarry Weir Pool (Stuart, 2020). Has been frequently recorded from the Murray River upstream and downstream of the project area. Presence in the Murray River and Gunbower Creek/National Channel should be assumed.	**Possible.** May enter forest areas during inundation events, but seasonally inundated semi-permanent forest wetlands do not provide suitable long term habitat. **Impact Possible.** The operation of the project has been designed to exclude fish from the floodplain wetlands through fish exclusion screens and a pumping only mechanism. It is unlikely that large numbers of fish will enter the floodplain. A staged and managed drawdown regime will be implemented to monitor water quality of return flows and provide cues for native fish to exit the wetlands to prevent stranding. Release

						Impact Possible. Localised impacts possible, consideration of coffer dam construction, dewatering works, and any potential for sediment/ contaminant run-off into wet areas from construction footprint must consider aquatic fauna. A construction specific aquatic fauna management plan should be developed for all works around waterways.	rates of return flows enable suitable mixing to occurs with the Murray River if water quality in return water is low. There is an overall assessment of low likelihood of impact to Golden Perch during the operation phase of the project.
Melanotaenia fluviatilis **Murray-Darling Rainbowfish**		L			**Sharp 2014, Sharp 2015**	**Present.** Species recorded during recent surveys of Cameron's Creek and Black Charlie Lagoon (Sharp 2014, 2015) and during annual monitoring across Gunbower Forest between 2008 - 2017 (Bloink et al. 2018). **Impact Possible.** Localised impacts possible, consideration of coffer dam construction, dewatering works, and any potential for sediment/ contaminant run-off into wet areas from construction footprint must consider aquatic fauna. A construction specific aquatic fauna management plan should be developed for all works around waterways.	**Present.** Species recorded during recent surveys of Cameron's Creek and Black Charlie Lagoon (Sharp 2014, 2015) and during annual monitoring across Gunbower Forest between 2008 - 2017 (Bloink et al. 2018). **Impact Possible.** The operation of the project has been designed to exclude fish from the floodplain wetlands through fish exclusion screens and a pumping only mechanism. It is unlikely that large numbers of fish will enter the floodplain. A staged and managed drawdown regime will be implemented to monitor water quality of return flows and provide cues for native fish to exit the wetlands to prevent stranding. Release rates of return flows enable suitable mixing to occurs with the Murray River if water quality in return water is low. There is an overall assessment of low likelihood of impact to Murray-Darling Rainbowfish during the operation phase of the project.
Nannoperca australis **Southern Pygmy Perch (Murray-Darling lineage)**			vu	1997 (3)	**VBA**	**Possible.** Has been recorded from Gunbower Creek wetlands in the past 30 years but not since 1997 (Mallen-Cooper et. al., 2014) and is considered locally extinct in the Gunbower region (Sharp 2015). Not recorded during surveys of Cameron's Creek and Black Charlie Lagoon (Sharp 2014, 2015) or during annual monitoring across Gunbower Forest between 2008 - 2017 (Bloink et al., 2018). This species is not currently present in the Murray River adjacent to the project area or in Gunbower Creek (Mallen-Cooper et al., 2014). **Impact Possible.** Localised impacts possible, consideration of coffer dam construction, dewatering works, and any potential for sediment/	**Possible.** Has been recorded from Gunbower Creek wetlands in the past 30 years but not since 1997 (Mallen-Cooper et. al., 2014) and is considered locally extinct in the Gunbower region (Sharp 2015). Not recorded during surveys of Cameron's Creek and Black Charlie Lagoon (Sharp 2014, 2015) or during annual monitoring across Gunbower Forest between 2008 - 2017 (Bloink et al., 2018). This species is not currently present in the Murray River adjacent to the project area or in Gunbower Creek (Mallen-Cooper et al., 2014). **Impact Possible.** The operation of the project has been designed to exclude fish from the floodplain wetlands through fish exclusion screens and a pumping only mechanism. It is unlikely that large numbers of fish will enter the floodplain. A staged and managed drawdown regime will be implemented to

						contaminant run-off into wet areas from construction footprint must consider aquatic fauna. A construction specific aquatic fauna management plan should be developed for all works around waterways.	monitor water quality of return flows and provide cues for native fish to exit the wetlands to prevent stranding. Release rates of return flows enable suitable mixing to occurs with the Murray River if water quality in return water is low. There is an overall assessment of low likelihood of impact to Southern Pygmy Perch during the operation phase of the project.
Tandanus tandanus **Freshwater Catfish**		L	en	2012 (1)	**VBA**	**Present.** Has been recorded from Gunbower Creek wetlands in the past 10 years (Mallen-Cooper et al., 2014). It is possible that individuals are present in the Murray River within the project area and presence should be assumed in the National Channel within the project area. **Impact Possible.** Localised impacts possible, consideration of coffer dam construction, dewatering works, and any potential for sediment/ contaminant run-off into wet areas from construction footprint must consider aquatic fauna. A construction specific aquatic fauna management plan should be developed for all works around waterways.	**Present.** Has been recorded from Gunbower Creek wetlands in the past 10 years (Mallen-Cooper et al., 2014). It is possible that individuals are present in the Murray River within the project area and presence should be assumed in the National Channel within the project area. **Impact Possible.** The operation of the project has been designed to exclude fish from the floodplain wetlands through fish exclusion screens and a pumping only mechanism. It is unlikely that large numbers of fish will enter the floodplain. A staged and managed drawdown regime will be implemented to monitor water quality of return flows and provide cues for native fish to exit the wetlands to prevent stranding. Release rates of return flows enable suitable mixing to occurs with the Murray River if water quality in return water is low. There is an overall assessment of low likelihood of impact to Freshwater Catfish during the operation phase of the project.
Invertebrates							
Murray Crayfish *Euastacus armatus*		L			**R8 2020**	**Possible.** Species seems to be tolerant of a wide variety of habitats, including deep flowing water proximal to clay banks, wood or rock cover, as well as tributary streams and shallow riparian habitats (for smaller individuals) (Fisheries Scientific Committee 2013). The Murray River in vicinity of project area has been mapped as possible habitat by NSW Fisheries (NSW DPI (accessed 2020). It is possible that individuals are present in the Murray River within and adjacent to the Project Area. **Impact Possible.** Localised impacts possible, consideration of coffer dam construction, dewatering works, and any potential for sediment/	**Possible.** Suitable floodplain/wetland habitat in inundation area may become present following natural flooding and the operating phase of the project. **Impact Possible.** A staged and managed drawdown regime will be implemented to monitor water quality of return flows and provide cues for native fish and invertebrates to exit the wetlands to prevent stranding. Release rates of return flows enable suitable mixing to occurs with the Murray River if water quality in return water is low. There is an overall assessment of low likelihood of impact to Murray Crayfish during the operation phase of the project.

						contaminant run-off into wet areas from construction footprint must consider aquatic fauna. A construction specific aquatic fauna management plan should be developed for all works around waterways.	
Mammals							
Nyctophilus corbeni **South-eastern Long-eared Bat**	VU	L	en		**PMST**	**Possible**. Bat surveys undertaken did not record the species (GHD 2017), but species is likely to occur along Murray River with limited survey effort across the landscape for this species. **Impact Possible.** Localised impacts possible during large tree removal in construction footprint. An on-site ecologist with Management Authorisation under the *Wildife Act 1975* must be present during large tree removal and construction works.	**Possible.** Suitable foraging habitat present within the inundation area **Impact Unlikely.** No tree removal is expected within the inundation area. Species likely to benefit from improved habitat condition following environmental water.
Petaurus norfolcensis **Squirrel Glider**		L	en	1996 (2)	**VBA**	**Possible.** Species not recorded during targeted surveys but may still occur in areas not assessed in construction footprint. **Impact Possible.** Localised impacts possible during large tree removal in construction footprint. An on-site ecologist with Management Authorisation under the *Wildife Act 1975* must be present during large tree removal and construction works.	**Possible.** Species not recorded during targeted surveys but may occur across inundation area. **Impact Unlikely.** No tree removal is expected within the inundation area. Species likely to benefit from improved habitat condition following environmental water.
Reptiles							
Anilios proximus **Woodland Blind Snake**			nt	1993 (7)	**VBA**	**Possible.** Records within the study area and suitable Black Box/ Red Gum woodland habitat within the project area. **Impact Possible.** Localised impacts possible during large tree removal and sub-surface impacts in the construction footprint. An on-site ecologist with Management Authorisation under the *Wildife Act 1975* must be present during large tree removal and construction works.	**Possible.** Records within the study area and suitable Black Box/ Red Gum woodland habitat within the project area. **Impact Unlikely.** Species likely to benefit from improved habitat conditions following environmental watering.

Chelodina expansa **Broad-shelled Turtle**		L	en	2012 (4)	**VBA**	**Present.** This species is known to reside in permanent, deep water limited to the Murray River and surrounding Gunbower Lagoons outside the project area (Howard et al. 2013). Species may utilise river banks for nesting. **Impact Possible.** Localised impacts possible, consideration of coffer dam construction, dewatering works, and any potential for sediment/ contaminant run-off into wet areas from construction footprint must consider aquatic fauna. A construction specific aquatic fauna management plan should be developed for all works around waterways. Consider timing of works to avoid breeding season (spring to summer) where turtles may nest along river banks.	**Possible.** This species is known to reside in permanent, deep water limited to the Murray River and surrounding Gunbower Lagoons outside the project area (Howard et al. 2013). Species may utilise river banks for nesting. **Impact Unlikely.** Species likely to benefit from improved habitat conditions following environmental watering.
Emydura macquarii **Murray River Turtle**			vu	2012 (2)	**VBA**	**Present.** This species is known to reside in permanent, deep water limited to the Murray River and surrounding Gunbower Lagoons outside the project area (Howard et al. 2013). Species may utilise river banks for nesting. **Impact Possible.** Localised impacts possible, consideration of coffer dam construction, dewatering works, and any potential for sediment/ contaminant run-off into wet areas from construction footprint must consider aquatic fauna. A construction specific aquatic fauna management plan should be developed for all works around waterways. Consider timing of works to avoid breeding season (spring to summer) where turtles may nest along river banks.	**Possible.** This species is known to reside in permanent, deep water limited to the Murray River and surrounding Gunbower Lagoons outside the project area (Howard et al. 2013). Species may utilise river banks for nesting. **Impact Unlikely.** Species likely to benefit from improved habitat conditions following environmental watering.
Morelia spilota **Carpet Python**		L	en	NA	**Seran BL&A 2018**	**Possible.** No records within study area but suitable floodplain and chenopod woodland present in construction footprint. **Impact Possible.** Localised impacts possible during large tree removal and sub-surface impacts in the construction footprint. An on-site ecologist with	**Possible.** No records within study area but suitable floodplain and chenopod woodland present in inundation area. **Impact Unlikely**. No tree removal is expected within the inundation area. Species likely to benefit from improved habitat condition following environmental water.

						Management Authorisation under the *Wildife Act 1975* must be present during large tree removal and construction works.	
Pogona barbata **Bearded Dragon**			vu	1992 (4)	**VBA**	**Possible.** Records within the study area and suitable woodland habitat within the construction footprint. **Impact Possible.** Localised impacts possible during large tree removal and sub-surface impacts in the construction footprint. An on-site ecologist with Management Authorisation under the *Wildife Act 1975* must be present during large tree removal and construction works.	**Possible.** Records within the study area and suitable woodland habitat within the inundation area. **Impact Unlikely**. No tree removal is expected within the inundation area. Species likely to benefit from improved habitat condition following environmental water.
Varanus varius **Lace Monitor**			en	1998 (12)	**VBA**	**Present.** Species recorded incidentally and on arboreal cameras in the construction footprint. **Impact Possible.** Localised impacts possible during large tree removal and sub-surface impacts in the construction footprint. An on-site ecologist with Management Authorisation under the *Wildife Act 1975* must be present during large tree removal and construction works.	**Present.** Species recorded incidentally and on arboreal cameras in project area. **Impact Unlikely**. No tree removal is expected within the inundation area. Species likely to benefit from improved habitat condition following environmental water.

[1] Commonwealth *Environment Protection and Biodiversity Convservation Act1999* categories: CR = Critically Endangered, E= Endangered, VU = Vulnerable, M = Migratory; [2]*Flora and Fauna Guarantee Act 1988* categories: L = Listed, N = Nominated; [3] Conservation Status in Victoria DEWLP Advisory List; cr = critically endangered, en = endangered, vu = vulnerable, nt = near threatened

7.3.1 Impacts to EPBC Act listed fauna species

Three EPBC Act listed fish species, Murray Cod (*Maccullochella peelii peelii*), Trout Cod (*Maccullochella macquariensis)* and Silver Perch (*Bidyanus bidyanus*) are known to occur within the project area, limited to the Murray River and Gunbower Creek/National Channel. No other EPBC Act listed fauna species were recorded during targeted surveys in 2019 or in previous assessments within the project area (Howard et al. 2013, Biosis 2014a, Sharpe 2014a, Sharpe 2015b, GHD 2017). However, targeted surveys have not yet been completed for the Middle Gunbower (downstream of Deep Creek) and Camerons Creek pump station and pipeline works area.

Six EPBC Act listed threatened fauna species were identified as possibly occurring within the construction footprint and/or inundation area: Painted Honeyeater, Superb Parrot, White-throated Needletail, South-eastern Long-eared Bat, Growling Grass Frog and Sloane's Froglet.

A conservative approach to EPBC listed species has been taken for this assessment and a further two species, Australasian Bittern and Australian Painted Snipe have been assessed as possibly occurring within the construction footprint and inundation area although impacts to these species are unlikely. These species have also been considered further to demonstrate that they are unlikely be adversely impacted by the proposed project.

An assessment of the EPBC Act significant impact criteria for each EPBC Act listed fauna species considered for the Project is provided in Appendix Q. A summary of the outcomes of this assessment for the eight species with potential to occur within the Project area is provided in Table 7-5

Table 7-5 Significant impact assessment for EPBC listed fauna species with potential of occurring within the project area.

Scientific Name	Status	Habitat	Likelihood of Occurrence/Potential Impact	Assessment of Significance under EPBC Act
Silver Perch (*Bidyanus bidyanus*)	CR	Known to occur in the Murray River alongside the project area	**Construction Footprint** **Present.** The species is a main-channel specialist (Stuart, 2020) with suitable habitat limited to the Murray River and Gunbower Creek. Recent surveys have detected Silver Perch in low abundances during annual monitoring of the Murray River adjacent to Gunbower Forest (2008-2017) (Bloink et. al. 2018). Silver Perch have also been detected in low numbers in surveys on the Gunbower Creek (Rehwinkel & Sharpe, 2009). The Murray River upstream and downstream of the project area and the Murray River in vicinity of project area has been mapped as possible habitat by NSW Fisheries. Presence in the Murray River and National Channel at the project area should be assumed. **Potential Impact.** Localised impacts possible, consideration of coffer dam construction, dewatering works, and any potential for sediment/ contaminant run-off into wet areas from construction footprint must consider aquatic fauna. A construction specific aquatic fauna management plan should be developed for all works around waterways. **Inundation Areas** **Possible.** May enter waterways and wetlands of Gunbower National Park during inundation events, but seasonally inundated semi-permanent forest wetlands do not provide suitable long term habitat. **Potential Impact.** The operation of the project has been designed to exclude fish from the floodplain wetlands through fish exclusion screens and a pumping only mechanism. It is unlikely that large numbers of fish will enter the floodplain. A staged and managed drawdown regime will be implemented to monitor water quality of return flows and provide cues for native fish to exit the wetlands to prevent stranding. Release rates of return flows enable suitable	**It is unlikely that the proposed works will have a significant impact on this species.** The proposed works would be undertaken in predominantly dry areas of the floodplain adjacent the River, which will not remove any critical habitat or adversely affect habitat critical to the survival of this species. Some works would occur within the Murray River associated with construction and dewatering of small, temporary coffer dams enabling construction of the drop structures and inlet pipes. A CEMP will be developed and applied to all works around waterways, including strategies that seek to minimise construction footprints and manage potential sediment / contaminant runoff from the site to mitigate possible water quality impacts. A construction specific aquatic fauna management plan will also be developed, containing requirements for monitoring and translocating of any fish trapped in coffer dams prior to dewatering. Any capture, handling or translocation of fish that is required (e.g. during construction works) would be carried out by a qualified aquatic ecologist in accordance with the requirements of the *Fisheries Act 1995*. During operations, the project area will receive water via pumping meaning there is a very low likelihood of large numbers of Silver Perch entering the floodplain. Fine fish screens will be fitted to pipe inlets used to water the floodplain, preventing the introduction of species to the floodplain. A staged and managed drawdown regime will be implemented to monitor water quality of return flows and provide cues for native fish to exit the wetlands to prevent stranding. Outlet regulators will provide for unrestricted fish passage during manged drawdown and natural floodplain inundation events. Low return flows during the maintenance and drawdown periods of environmental watering are planned (1,540 ML total) and will occur at a time of year when flows in the Murray River are high to reduce any potential blackwater impacts to the main Murray River channel. There is an overall assessment of low likelihood of impact to Silver Perch during the operation phase of the project following the above mitigation measures during the operation phase of the project.

			mixing to occurs with the Murray River if water quality in return water is low.	
Murray Cod (*Maccullochella peelii peelii*)	VU	Known to occur in the Murray River alongside the project area	**Construction Footprint** **Present.** The species is a main-channel specialist with suitable habitat limited to the Murray River and Gunbower Creek where the species has been frequently recorded, including in the Torrumbarry Weir Pool (Stuart, 2020). Species recorded in low abundances during annual monitoring between 2008-2017 of the Murray River in Gunbower Forest (Bloink et al. 2018). Presence in the Murray River at the project area should be assumed. **Potential Impact.** Localised impacts possible, consideration of coffer dam construction, dewatering works, and any potential for sediment/ contaminant run-off into wet areas from construction footprint must consider aquatic fauna. A construction specific aquatic fauna management plan should be developed for all works around waterways. **Inundation Areas** **Possible.** May enter forest areas during inundation events, but seasonally inundated semi-permanent forest wetlands do not provide suitable long term habitat. **Potential Impact.** The operation of the project has been designed to exclude fish from the floodplain wetlands through fish exclusion screens and a pumping only mechanism. It is unlikely that large numbers of fish will enter the floodplain. A staged and managed drawdown regime will be implemented to monitor water quality of return flows and provide cues for native fish to exit the wetlands to prevent stranding. Release rates of return flows enable suitable mixing to occurs with the Murray River if water quality in return water is low.	**It is unlikely that the proposed works will have a significant impact on this species.** The proposed works would be undertaken in predominantly dry areas of the floodplain adjacent the River, which will not remove any critical habitat or adversely affect habitat critical to the survival of this species. Some works would occur within the Murray River associated with construction and dewatering of small, temporary coffer dams enabling construction of the drop structures and inlet pipes. A CEMP will be developed and applied to all works around waterways, including strategies that seek to minimise construction footprints and manage potential sediment / contaminant runoff from the site to mitigate possible water quality impacts. A construction specific aquatic fauna management plan will also be developed, containing requirements for monitoring and translocating of any fish trapped in coffer dams prior to dewatering. Any capture, handling or translocation of fish that is required (e.g. during construction works) would be carried out by a qualified aquatic ecologist in accordance with the requirements of the *Fisheries Act 1995*. During operations, the project area will receive water via pumping meaning there is a very low likelihood of large numbers of Murray Cod entering the floodplain. Fine fish screens will be fitted to pipe inlets used to water the floodplain, preventing the introduction of species to the floodplain. A staged and managed drawdown regime will be implemented to monitor water quality of return flows and provide cues for native fish to exit the wetlands to prevent stranding. Outlet regulators will provide for unrestricted fish passage during manged drawdown and natural floodplain inundation events. Low return flows during the maintenance and drawdown periods of environmental watering are planned (1,540 ML total) and will occur at a time of year when flows in the Murray River are high to reduce any potential blackwater impacts to the main Murray River channel. There is an overall assessment of low likelihood of impact to Murray Cod during the operation phase of the project following the above mitigation measures during the operation phase of the project.
Trout Cod (*Maccullochella macquariensis*)	VU	Known to occur in the Murray River alongside the project area	**Construction Footprint** **Present.** The species is a main-channel specialist with suitable habitat limited to the Murray River and Gunbower Creek, where the species has been recorded downstream of	**It is unlikely that the proposed works will have a significant impact on this species.** The proposed works would be undertaken in predominantly dry areas of the floodplain adjacent the River, which will not remove any critical habitat or

			Yarrawonga Weir in the vicinity of large woody debris, branch piles and steep clay banks, usually in areas of fast flowing current (DSE, 2008) and in Gunbower Creek (Mallen-Cooper et. al. 2014) and Torrumbarry Weir Pool (Stuart, 2020). Presence in the Murray River and Gunbower Creek/National Channel should be assumed. **Potential Impact.** Localised impacts possible, consideration of coffer dam construction, dewatering works, and any potential for sediment/ contaminant run-off into wet areas from construction footprint must consider aquatic fauna. A construction specific aquatic fauna management plan should be developed for all works around waterways. **Inundation Areas** **Possible.** May enter forest areas during inundation events, but seasonally inundated semi-permanent forest wetlands do not provide suitable long term habitat. **Potential Impact.** The operation of the project has been designed to exclude fish from the floodplain wetlands through fish exclusion screens and a pumping only mechanism. It is unlikely that large numbers of fish will enter the floodplain. A staged and managed drawdown regime will be implemented to monitor water quality of return flows and provide cues for native fish to exit the wetlands to prevent stranding. Release rates of return flows enable suitable mixing to occurs with the Murray River if water quality in return water is low.	adversely affect habitat critical to the survival of this species. Some works would occur within the Murray River associated with construction and dewatering of small, temporary coffer dams enabling construction of the drop structures and inlet pipes. A CEMP will be developed and applied to all works around waterways, including strategies that seek to minimise construction footprints and manage potential sediment / contaminant runoff from the site to mitigate possible water quality impacts. A construction specific aquatic fauna management plan will also be developed, containing requirements for monitoring and translocating of any fish trapped in coffer dams prior to dewatering. Any capture, handling or translocation of fish that is required (e.g. during construction works) would be carried out by a qualified aquatic ecologist in accordance with the requirements of the *Fisheries Act 1995*. During operations, the project area will receive water via pumping meaning there is a very low likelihood of large numbers of Murray Cod entering the floodplain. Fine fish screens will be fitted to pipe inlets used to water the floodplain, preventing the introduction of species to the floodplain. A staged and managed drawdown regime will be implemented to monitor water quality of return flows and provide cues for native fish to exit the wetlands to prevent stranding. Outlet regulators will provide for unrestricted fish passage during manged drawdown and natural floodplain inundation events. Low return flows during the maintenance and drawdown periods of environmental watering are planned (1,540 ML total) and will occur at a time of year when flows in the Murray River are high to reduce any potential blackwater impacts to the main Murray River channel. There is an overall assessment of low likelihood of impact to Murray Cod during the operation phase of the project following the above mitigation measures during the operation phase of the project.
Painted Honeyeater (*Grantiella picta*)	VU	Inhabits Boree/ Weeping Myall (*Acacia pendula*), Brigalow (*A. harpophylla*) and Box-Gum Woodlands and Box-Ironbark Forests. The species exhibits seasonal north-south movements governed	**Construction footprint** **Possible.** Painted Honeyeater is considered to have potential to utilise habitats within the proposed construction footprint and broader inundation area. This species has not been previously recorded within the study area, and very few records exist across the local landscape **Potential Impact:** Removal of small discrete areas of rarely used habitat	**It is unlikely that the proposed works will have a significant impact on this species.** The Painted Honeyeater is known to be highly mobile and have the potential to rarely forage in the Gunbower National Park. The proposed construction footprints are not likely to significantly impact any areas of important habitat to this extremely mobile nomadic species, which forages widely over large areas in pursuit of mistletoe and flowering eucalypts. The project is highly unlikely to result in the fragmentation of important Painted Honeyeater habitat (large trees supporting abundant mistletoe) as Gunbower National Park consists of 9,330 ha of contiguous habitat, with the proposed

		principally by the fruiting of mistletoe.		construction footprint located on existing tracks and disturbed areas. The proposed construction footprint will not adversely affect habitat critical to the survival of this species, as it represents small, isolated and discrete areas of habitat within an extensive area of rarely used habitats for this highly mobile and infrequently recorded species. Impacts are considered unlikely as the Painted Honeyeater is a highly mobile species that may infrequently utilise the project area and if present, would be expected to benefit from environmental watering.
Superb Parrot (*Polytelis swainsonii*)	VU	In Victoria, species is confined to the north of the state with the majority of records and known breeding locations in Barmah State Forest/State Park. The species inhabits large, mature River Red Gums or Blakely's Red Gum (*E. blakelyi*) close to watercourses	**Construction footprint** **Possible.** Superb Parrot is considered to have potential to utilise habitats within the proposed construction footprint and broader inundation area. Although extensive suitable Red Gum forest habitat exists, this species has only been recorded once within the study area (VBA, 1996), with the closest and main population known from Barmah State Forest 50-100 km further east upstream of the Murray River. **Potential Impact:** Removal of small discrete areas of rarely used habitat	**It is unlikely that the proposed works will have a significant impact on this species.** The proposed construction footprint represents a very small, low quality area of foraging habitat for this highly mobile species, and is considered highly unlikely to lead to a long-term decrease in the size of an important population of this species. The area does not represent core habitat or range for this species. The project is highly unlikely to result in the fragmentation of important Superb Parrot habitat (nesting trees) as the species has not been recorded in the study area. Gunbower National Park consists of 9,330 ha of contiguous habitat, with the proposed construction footprint located on existing tracks and disturbed areas. The proposed construction footprint will not adversely affect habitat critical to the survival of this species, as it represents small, isolated and discrete areas of habitat within an extensive area of rarely used habitats for this highly mobile and infrequently recorded species. Impacts are considered unlikely as the Superb Parrot is a highly mobile species that may infrequently utilise the project area and if present, would be expected to benefit from environmental watering.
White-throated Needletail (*Hirundapus caudacutus)*	VU	Airspace over forests, woodlands, farmlands, plains, lakes, coasts, towns, feeding companies frequency patrol back and forward along favoured hilltops and timbered ranges. (Pizzey and Knight 2012)	**Construction footprint** **Possible.** White-throated Needltail is considered to have potential to utilise habitats within the proposed construction footprint and broader inundation area. This species has only been previously recorded once within the study area (VBA, 1980), and very few records exist across the local landscape. **Potential Impact:** Removal of small discrete areas of rarely used habitat	**It is unlikely that the proposed works will have a significant impact on this species.** The White-throated Needletail is known to be highly mobile and have the potential to rarely forage in the Gunbower National Park. The proposed construction footprints are not likely to significantly impact any areas of important habitat to this primarily aerial species, which forages widely over large areas high in the airspace. The project is highly unlikely to result in the fragmentation of important White-throated Needletail habitat as Gunbower National Park consists of 9,330 ha of contiguous habitat, with the proposed construction footprint located on existing tracks and disturbed areas. The proposed construction footprint will not

				adversely affect habitat critical to the survival of this species, as it represents small, isolated and discrete areas of habitat within an extensive area of rarely used habitats for this highly mobile and infrequently recorded species. Impacts are considered unlikely as the White-throated Needletail is a primarily aerial species that may infrequently utilise the project area and if present, would be expected to benefit from environmental watering.
South-eastern Long-eared Bat (*Nyctophilus corbeni*)	VU	This species has a scattered distribution, mostly within the Murray-Darling Basin, but with some records outside of this area. Inhabits a variety of vegetation types, but is distinctly known to occur in Box / Ironbark / Cypress-pine vegetation along the western slopes and plains of NSW (OEH 2012).	**Construction footprint** **Possible.** The species has not been recorded in the project area and was not recorded during bat surveys in the construction footprint in 2017 (GHD 2017). The closest records in Victoria to the project area are in old growth mallee vegetation around the Hattah township and Hattah-Kulkyne National Park, over 150 km to the north/west. It is considered unlikely that this species utilises Red Gum forests and woodland habitats within the Gunbower National Park project area, and that if it does occur, it is likely to be in extremely low numbers. **Potential Impact:** The species if present is likely to be in extremely low numbers that would not be impacted by the proposed works or could be mitigated by preclearance surveys and hollow-bearing tree management protocols in the highly unlikely event that an *N. corbeni* is encountered during site development.	**It is unlikely that the proposed works will have a significant impact on this species.** It is considered unlikely that South-eastern Long-eared Bat utilises the Box and Red Gum forests and woodland habitats within the Gunbower National Park project area. If the species does occur, it is likely to be in extremely low numbers that would not be impacted by the proposed works or could be mitigated by preclearance surveys and hollow-bearing tree management protocols in the highly unlikely event that an *N. corbeni* is encountered during site development In the unlikely occurrence of this species occurring in the construction footprint, impacts as a result of vegetation removal and potential habitat loss will be localised, and therefore resultant impacts to the species are expected to be very low. However, broader mitigation measures for hollow-dependent species as outlined in Section 9 will also apply to threatened bats including South-eastern Long-eared Bat, including pre-clearance surveys and hollow-bearing tree management. No Significant Impacts are expected for South-eastern Long-eared Bat, as a vulnerable listed species, particularly given the core 'important population' for the species occurs in the western slopes and plains in NSW.
Growling Grass Frog (*Litoria raniformis*)	VU	This species is mostly found amongst emergent vegetation (Robinson 1993), including *Typha* sp. (bullrush), *Phragmites sp*. (reeds) and *Eleocharis sp*.(sedges), in or at the edges of still or slow-flowing water bodies such as lagoons, swamps,	**Construction Footprint** **Possible.** Small areas of potential habitat for the species exist in the construction footprint at Camerons Creek, Baggotts Creek and Deep Creek. **Potential Impact:** Targeted assessments for this species will be completed in Spring/Summer 2020 to determine the presence or absence of this species within the proposed construction footprint. If the species is identified during targeted assessment further consideration will be given to the design to seek to further minimise the impact to the species. Indirect impacts from the proposed works may include the introduction or spread of Chytrid Fungus. Transmission of the	**It is unlikely that the proposed works will have a significant impact on this species.** Due to the fragmentation of habitat for the Growling Grass Frog, any viable population is considered an important population for the persistence and recovery of the species. A viable population is considered one that is not isolated from other populations or waterbodies, such that the opportunity to interact with other nearby populations and has the ability to establish new populations when waterbodies fill and become available (DEWHA, 2009). Previous surveys have failed to identify the species within the Gunbower Forest, The Gunbower Forest Ramsar Site Ecological Character Description determines the following as to the likely presence of the Growling Grass Frog, 'Single record only and despite a number of fish surveys in recent years (Ward 2009) the

		lakes, ponds and farm dams (NSW DEC 2005).	disease from vehicle is unlikely, however, hygiene protocols for Chytrid Fungus will be included in a site specific EMP **Inundation Areas** **Possible.** The Growling Grass Frog is considered to have potential to utilise habitats within the broader inundation area. The species has been recorded once in the project area but not within the last 30 years. Despite the long absence of records of this species, the presence of suitable habitat, and the ability of this species to recolonise areas suggest that it has potential to occur in the area. **Potential Impact:** A return of a naturally occurring flooding regime will greatly enhance the future habitat availability for the species.	species has not been found again. There is a low degree of certainty that the site is important for this species (DSEWPAC, 2011). It is therefore considered unlikely that the project area supports an important population of the Growling Grass Frog. Growling Grass Frog is considered to have potential to utilise habitats within the proposed construction footprint and broader inundation area. Suitable habitat exists near permanent waterways and previous records (1993) of the species indicate the species was once and may still be present in low densities. Recent extensive surveys have only located the species at a few general locations in the Albury-Wodonga region (Knight 2013). Small areas of potential habitat for the species exist in the construction footprint at Camerons Creek, Baggotts Creek and Deep Creek. Targeted surveys for Sloane's Froglet will be completed late winter/early spring 2020 to determine the presence or absence of this species within the proposed construction footprint. It is anticpated that where the species is present within inundation areas, the species will have a positive response to the restoration of a more natural flooding regime. Where the species is not identified within the construction footprint during targeted surveys there will be no requirement for further assessment or specific mitigation measures. Where the species is identified during targeted assessment further consideration will be given to the design to seek to further minimise the impact to the species. In addition, specific mitigation measures will be detailed to ensure that the proposed construction works do not result in a long-term decrease in the size of a population. Impacts are considered unlikely as Growling Grass Frog would only infrequently utilise the inundation area during years or prolonged flooding and is expected to benefit from environmental watering. Potential impacts will be mitigated through the implementation of hygiene measures and sediment and erosion controls. Despite an absence of records of this species, the presence of suitable habitat, and the ability of this species to recolonise areas suggest that it has potential to occur in the area, and a reintroduction of more suitable ecological watering regimes may help facilitate this. Growling Grass Frog is almost set to benefit from the operational phase of the project.

				No Significant Impacts are expected for Growling Grass Frog, however targeted surveys should be undertaken in the construction footprint to confirm this determination.
Sloane's Froglet (*Crinia sloanei*)	EN	Periodically inundated areas of grassland, woodland and disturbed habitats across the Central-western plains of NSW from the Murray River and adjacent areas in Vic (Cogger 2014)	**Construction Footprint** **Possible.** Small areas of potential habitat for the species exist in the construction footprint at Camerons Creek, Baggotts Creek and Deep Creek. **Potential Impact:** Targeted assessments for this species will be completed in Winter/Spring 2020 to determine the presence or absence of this species within the proposed construction footprint. If the species is identified during targeted assessment further consideration will be given to the design to seek to further minimise the impact to the species. Indirect impacts from the proposed works may include the introduction or spread of Chytrid Fungus. Transmission of the disease from vehicle is unlikely, however, hygiene protocols for Chytrid Fungus will be included in a site specific EMP **Inundation Areas** **Possible.** Sloane's Froglet is considered to have potential to utilise habitats within the broader inundation area. The species has been previously recorded in the project area (VBA, 1993), and is unlikely to have been surveyed for extensively as the species has only recentlyl been listed as a threatened species on the EPBC Act. Despite an absence of records of this species, the presence of suitable habitat, and the ability of this species to recolonise areas suggest that it has potential to occur in the area. **Potential Impact:** A return of a naturally occurring flooding regime will enhance the future habitat availability for the Sloane's Froglet	**It is unlikely that the proposed works will have a significant impact on this species.** Sloane's Froglet is considered to have potential to utilise habitats within the proposed construction footprint and broader inundation area. Suitable habitat exists near permanent waterways and previous records (1993) of the species indicate the species was once and may still be present in low densities. Recent extensive surveys have only located the species at a few general locations in the Albury-Wodonga region (Knight 2013). Small areas of potential habitat for the species exist in the construction footprint at Camerons Creek, Baggotts Creek and Deep Creek. Targeted surveys for Sloane's Froglet will be completed late winter/early spring 2020 to determine the presence or absence of this species within the proposed construction footprint. It is anticpated that where the species is present within inundation areas, the species will have a positive response to the restoration of a more natural flooding regime. Where the species is not identified within the construction footprint during targeted surveys there will be no requirement for further assessment or specific mitigation measures. Where the species is identified during targeted assessment further consideration will be given to the design to seek to further minimise the impact to the species. In addition, specific mitigation measures will be detailed to ensure that the proposed construction works do not result in a long-term decrease in the size of a population. Despite an absence of records of this species, the presence of suitable habitat, and the ability of this species to recolonise areas suggest that it has potential to occur in the area, and a reintroduction of more suitable ecological watering regimes may help facilitate this. Sloane's Froglet is almost set to benefit from the operational phase of the project. No Significant Impacts are expected for Sloane's Froglet, however targeted surveys should be undertaken in the construction footprint to confirm this determination.

Australasian Bittern (*Botaurus poiciloptilus*)	EN	Occurs in terrestrial freshwater wetlands and, rarely, estuarine habitats. It favors wetlands with tall, dense vegetation, where it forages in still, shallow water up to 0.3 m deep, often at the edges of pools or waterways, or from platforms or mats of vegetation over deep water (Marchant and Higgins 2004).	**Construction Footprint** **Unlikely.** Limited suitable wetland habitat present within construction footprint. Unlikely to adversely affect habitat critical for the species or reduce the area of occupancy. **Potential Impact:** Removal of small discrete areas of rarely used habitat **Inundation Areas** **Possible.** Records within the study area, and suitable wetland habitat is present in the inundation area. **Potential Impact:** A return of a naturally occurring flooding regime will enhance the future habitat availability for the Australasian Bittern.	**It is unlikely that the proposed works will have a significant impact on this species.** Australasian Bittern is considered to have potential to infrequently utilise habitats within the broader inundation area. The species requires densely vegetated permanent freshwater or brackish swamps and wetlands and is found in southern coastal areas and along the Murray River region of northern Victoria. The species has only been recorded once in the project area, in Pig Swamp (VBA, 1993) although suitable habitat exists along Cameron's Creek and Black Charlie Lagoon. This suggests the species is likely to visit the project infrequently and in response to flooding years when improved habitat availability and condition is recorded. The proposed construction footprint is centred on existing tracks and degraded areas wherever possible. Given vegetation removal for the project will primarily occur in dry, terrestrial vegetation types and only a small area of wetland habitat is within the construction footprint it is unlikely to lead to a decrease in the size of a population. The operational phase of the project is likely to greatly enhance the extent and quality of habitat available.
Australian Painted Snipe (*Rostratula australis*)	EN	Inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans. Typical sites include those with emergent tussocks of grass, sedges, rushes or reeds, or samphire; often with scattered clumps of lignum or canegrass (Marchant & Higgins 1993 within DOE 2020b).	**Construction Footprint** **Unlikely.** Limited suitable wetland habitat present within construction footprint. Unlikely to adversely affect habitat critical for the species or reduce the area of occupancy. **Potential Impact:** Removal of small discrete areas of rarely used habitat **Inundation Areas** **Possible.** Within the study area, there are no records of the species, however suitable wetland habitat is present. **Potential Impact:** A return of a naturally occurring flooding regime will enhance the future habitat availability for the Australian Painted Snipe	**It is unlikely that the proposed works will have a significant impact on this species.** Australian Painted Snipe is considered to have potential to infrequently utilise habitats within the broader inundation area. The species requires vegetated permanent or seasonally inundated freshwater or brackish swamps and wetlands and is found infrequently across eastern Australia. The species has not been recorded in the project area, although suitable habitat exists along Cameron's Creek and Black Charlie Lagoon. This suggests the species may have the potential to visit the project infrequently and in response to flooding years when improved habitat availability and condition is recorded. The proposed construction footprint is centred on existing tracks and degraded areas wherever possible. Given vegetation removal for the project will primarily occur in dry, terrestrial vegetation types and only a small area of wetland habitat is within the construction footprint it is unlikely to lead to a decrease in the size of a population. The operational phase of the project is likely to greatly enhance the extent and quality of habitat available.

7.3.1.1 Impacts to EPBC Act listed fish species during construction phase

Six (6) fish species listed as threatened under the EPBC Act are predicted to occur or were previously recorded from a VBA/PMST search of the study area. Of these species, three were considered as present or likely to occur (Silver Perch, Murray Cod and Trout Cod), given records within the last 30 years and three were considered either highly unlikely (Maquarie Perch) or unlikely to occur (Flat-head Galaxias, Murray Hardyhead) (refer Appendix F and G

The Murray Cod (*Maccullochella peelii peelii*; EPBC Act listed Vulnerable), Silver Perch (*Bidyanus bidyanus*; EPBC Act listed Critically Endangered) and Trout Cod (*Maccullochella macquariensis*) occur in the Murray River alongside the project area. These species are considered as main-channel specialist with suitable habitat limited to the Murray River and National Channel, but they can move onto the floodplain during significant inundation events, however forest habitat does not provide suitable long-term habitat.

An assessment of risks to threatened fish and fish communities as a result of the project's construction activities suggested some impacts to fish may occur. These include impacts associated with activities proposed for the banks of the Murray River and National Channel, including the construction of inlet pipes associated with two pump stations and power supply, and minor works on the levee and flood runners at Dalley Bend. These activities could result in some localised loss of habitat (e.g. removal of snags and other habitat on the banks) and potential for water quality impacts from mobilisation of sediment and accidental spills, interruptions to fish movement and trapping of individual fish within the coffer dam areas. The construction of the new Mid Camerons Creek regulator and cone fishway and removal of the old structure, which will take place within Camerons Creek, a permanently inundated waterbody with a resident native fish population, also represents a potential risk to two FFG Act listed threatened fish species (Unspecked Hardyhead and Murray-Darling rainbowfish).

Impacts to these species are considered unlikely due to the limited construction areas along the Murray River and following mitigation measures. Any in-stream works such as coffer dam construction, dewatering works, and any potential for sediment/ contaminant run-off into wet areas from construction footprint will be managed with consideration of these species. A construction specific Aquatic Fauna Management Plan (as part of a CEMP) should be developed for all works around waterways. Persons undertaking these activities will need to hold the appropriate permit or licence under the *Fisheries Act 1995*. Any capture of fish must be carried out by a qualified aquatic ecologist. The provision of fish passages at the main Upper and Middle Gunbower regulators will allow for fish to exit to the Murray River, provided a suitable drawdown regime is implemented.

7.3.1.2 Impacts to EPBC Act listed fish species during operational phase

All three EPBC Act listed fish species (Silver Perch, Murray Cod and Trout Cod) considered as present or possibly occurring within the project are considered as main-channel specialist with suitable habitat limited to the Murray River and National Channel. They may move onto the floodplain during natural inundation events, however the forest and wetlands do not provide suitable long term habitat and these species tend to return to the mian channel when floodplain inflows drop.

A number of potential impacts to native fish associated with the operation of the project were identified. The operation of pump stations on the National Channel and Murray River has the potential to entrain fish on the floodplain. The risk of this occuring during managed inundation is low given fine fish screens installed on the pump inlets will prevent fish entering the floodplain via the pumps. However, some fish eggs and larvae suspended in the water column may enter the floodplain through the fish screens. Fish may move onto the floodplain from the Murray River and become stranded during natural inundation or hybrid events. Resident fish (e.g. in Upper Gunbower Forest) may be exposed to hypoxic blackwater during managed inundation events. However hypoxic blackwater from the Murray River could be excluded during managed events to prevent impacts to this area and freshening flows provided if hypoxic blackwater developed in the wetlands. There is also a risk of exposure of fish to poor water quality in return flows to the Murray River, but this is considered a low risk given the relative low rate of return flows (estimated at 20 ML/d) relative to Murray River passing flows which have ranged between 1,300 – 59,905 ML/d downstream of the Torrumbarry weir during the period 1974 – 2020 (MDBA 2020) and ability to monitor and manage flows to reduce impacts (e.g. assessing risk of hypoxic blackwater prior to managed inundation, delivering events during cooler conditions, reducing rate of return flows or increasing through flows for dilution).

Active fish passage is proposed to be provided at the Camerons Mid Creek Regulator to maintain connectivity for small bodied fish between the wetland areas separated by this structure (Stuart 2020). The fish passage at Camerons Mid Creek Regulator will be a cone type fishway consisting a simple channel and precast cones. Dedicated fishways are not required at any other structure. Further information on the type of fish passage can be found in the Upper Gunbower Fish Managment Plan (Stuart 2020).

The design of all other regulators and drop structures will allow for passive fish passage. Small regulator structures will be operated either in fully open or fully closed position. When water is released with the regulator gate in fully open position, fish have passage through the regulator both in managed release and natural flood scenarios. Structures have been designed to have flow velocities appropriate for fish passage (based on O'Connor et. al, 2015).

With these mitigation measures in place, risks to threatened fish are considered low and with no significant impacts to populations or the species as a whole.

An assessment of the potential impact to the threatend fish communities for these species, against the EPBC Act Significant Impact Guidelines 1.1 is provided in Appendix Q. Given the construction mitigation measures proposed (partial coffer dams, habitat relocation, sediment management), no significant impacts the EPBC listed threatened fish are expected.

7.3.2 Impacts to EPBC Act Migratory Species

Fourteen (14) species listed as migratory under the EPBC Act are predicted to occur or were previously recorded from a VBA/PMST search of the study area (Table 5-6). Whilst some of these species may occasionally occur in the wider study area or above the forest, or following inundation events, none of these species were considered as likely to occur within the construction footprint, mostly due to the lack of recent records within the construction footprint and/or a lack of suitable preferred habitat present (see Appendix F and G for rational).

The construction footprint is located within the Gunbower Forest Ramsar site. The listing of the site is in part due to the habitat it provides for wetland birds including migratory birds and the use of the site by colonial nesting birds (Hale and Butcher 2011). Potential impacts will be restricted to discrete construction footprints in areas that are not considered to be important for migratory species foraging or breeding activity.

Reinstating historical environmental flows within the Gunbower National Park will almost certainly improve the quality of habitat present for water dependant avifauna, with several species of migratory birds including Glossy Ibis (Plegadis falcinellus) known to respond to environmental watering (Cook et al. 2011 and Wood et al. 2018) and have been observed at other nearby sites (e.g Guttrum Benwell). In addition, a number of migratory shorebirds will occasionally visit inland wetland habitats (e.g. Common Sandpiper, Sharp-tailed Sandpiper, Pectoral Sandpiper, Greenshank), when they are in Australia. Such habitat enhancements include increased productivity of floodplain vegetation communities, increased floral diversity and structure by reducing more dominant drought-tolerant species and increase overall health and integrity of the area to improve breeding, foraging and refuge resources for listed migratory species, and other wetland-dependant bird species.

An assessment of the EPBC Act significant impact criteria to Migratory listed species for impacts from the proposed works is provided in Appendix R and concludes that the project is unlikely to significantly impact on migratory species.

7.3.3 Impacts to FFG Act, NSW BC Act and DELWP Advisory listed fauna and communities

Forty-four (44) FFG Act listed species (26 birds, two mammals, six reptiles, one amphibian, one invertebrate and eight fish species) are considered to have the potential to occur within the construction footprint and/or inundation area (Table 7-4). All species have been recorded within the study area, or have potential habitat within the project area. Two FFG Act listed species, the Diamond Firetail and Grey-crowned Babbler were observed during the field assessment in 2019. However, 26 species listed under the FFG Act are predicted as possible to occur or have been previously recorded within the construction footprint or the broader project area (VBA, PMST, Biosis 2014, GHD 2017).

Most of these FFG Act listed species that may possibly occur in the construction footprint are highly mobile bird species and all have access to large areas of suitable habitat in the immediate surrounding areas in which to disperse. From a landscape perspective the proposed construction footprint represents a small area of around 19.57 ha, centred on existing tracks and degraded areas, within a very large intact area of over 9,330 ha of high quality native vegetation within the Gunbower National Park. All structures are proposed to be centred on and adjacent to existing tracks and degraded areas, within a very large intact area of high quality native vegetation along the Murray River corridor. For these reasons the proposed construction impacts are considered unlikely to significantly impact threatened fauna species.

Direct impacts as a result of habitat removal, e.g. the removal of hollow bearing trees or nesting trees for birds, should be mitigated for acute impacts to species such as the Squirrel Glider, Carpet Python and Lace Monitor (refuges in hollow-bearing trees). Large hollow bearing trees should be prioritised for retention during both the design phase through the implementation of No Go zones and at Construction Phase through the preparation and implementation of a Tree Protection Plan to seek to retain additional trees where works are in close proximity. An on-site ecologist with Management Authorisation under the *Wildife Act 1975* should be present during vegetation removal and sub-surface construction works to readily relocate any fauna found within larger trees or disturbed underground. Additionally, all hollow-bearing trees proposed for removal should be thoroughly inspected prior to removal for refuging wildlife and at risk of harm from felling. A Fauna Management Plan (FMP) or equivalent should be developed and implemented during the works associated with the project to mitigate impacts to all native fauna that may result from removal of vegetation during works. This may be incorporated as a sub-document of a Construction Environmental Management Plan (CEMP) and would contain detailed requirements on the approach to pre-clearance surveys, timing of surveys and clearing, clearing methods, options to enhance surrounding habitat using removed vegetation (e.g. hollow bearing trees/limbs), and other measures to mitigate impacts to fauna. The plan would be required to include particular consideration to the threatened fauna (ie. those listed under the EPBC Act, FFG Act and/or the DELWP Advisory List of Threatened Fauna). All native animals encountered during the pre-clearance and other vegetation clearance activities must be treated humanely, ethically, and in accordance with relevant codes under the Victorian Wildlife Act 1975 and Wildlife Regulations 2002.

Localised impacts as a result of habitat removal and construction works along river banks could occur to turtles, in particular the FFG Act listed Broad-shelled Turtle (*Chelodina expansa*) and DELWP Advisory listed Murray River Turtle (*Emydura macquarii*), which are known to occur throughout the Murray River and surrounding Gunbower Lagoons outside the project area (Howard et al. 2013). A construction specific aquatic fauna management plan should be developed (as part of a CEMP) for all works around waterways, which should consider coffer dam construction, dewatering works and any potential for sediment contaminant run-off. It should also consider the timing of works to where practicable avoid the breeding season of turtles (spring to summer) where turtles may nest along river banks.

The inundation of EVCs that were dry at the time of survey, but are water-dependent may present some landscape impacts to terrestrial dependent species, including the Lace Monitor (*Varanus varius*), Bearded Dragon (*Pogona vitticeps*) and Bush Stone-curlew (*Burhinus grallarius*), all FFG Act listed. The return of a flooding regime to these dry forests will need to be managed (including the rate of flow and inundation extent) so these less-mobile species are able to disperse and avoid potential detrimental impacts of an artificially flooded system.

Two FFG Act listed fish species, Un-speckled Hardyhead and Murray Darling Rainbowfish have been recorded and are considered present within Cameron's Creek (Sharpe 2014a, Sharpe 2015b, Stuart 2020). There is potential for impact to these species, primarily from water quality impacts from a temporary increase in turbidity during construction of the Cameron's Creek Mid Creek regulator and cone fishway and demolition and removal of the existing regulator structure and bridge. Construction will necessitate the use of temporary cofferdams which will block fish passage and potentially trap fish, dewatering of the works area will be required and there is potential for sediment and contaminant runoff into Camerons Creek and connected wetlands including Black Charlie Lagoon. An aquatic fauna management plan should be developed covering this activity and specifying that where practicable the works do not take place in spring/summer, which is the fish migration period (Stuart, 2020), protocols for safely translocating trapped fish and minimising the risks to water quality from dewatering

and erosion. It should be noted that the existing Camerons Mid Creek Regulator is a barrier to fish passage and so fish movement will not be significantly restricted from existing conditions during construction.

There is also potential for mobilisation of sediments that may discharge into wetland habitats during rainfall events at other locations. These works should be planned to be undertaken in dry conditions where possible. Mitigation measures, contingency and emergency response measures should be documented in a CEMP.

Overall the construction related risks associated with the project are considered to be low for Unspeckled Hardyhead and Murray Darling Rainbowfish, provided mitigation measures proposed as part of the project's construction are implemented. Mitigation measures to be undertaken during the construction of the project include the use of partial coffer dams to isolate sections of bank were works will take place. Partial coffer dams on the Murray River and National Channel (Gunbower Creek) will not extend across the channel and hence will not constitute a barrier to fish movement. Any habitat (e.g. large woody debris) within the works area should be relocated with the same reach of the waterway. Standard construction site mitigation measures will be implemented to manage sediment runoff and any accidental spills. Works on the floodplain will occur during dry phases when fish will not be present.

Many threatened species will see improvements of habitat quality and availability during flooding conditions including; Brolga (*Antigone rubicunda*), Great Egret (*Ardea alba*), Little Egret (*Egretta garzetta*) and White-bellied Sea-Eagle (*Haliaeetus leucogaster*), all FFG Act listed. The application of episodic environmental water would be expected to maintain and enhance the conditions of these woodland communities in the face of future water extraction and climate change scenarios rather than a 'do nothing' approach to leaving these habitats in their current ecological state.

FFG Act and NSW BC Act listed threatened fauna communities

Two FFG-listed threatened fauna communities were identified in the project area, Victorian Temperate Woodland Bird Community (VTWBC) and Lowland Riverine Fish Community of the Murray-Darling Basin (LRFC) and one NSW-BC-listed threatened fauna community, Lower Murray River aquatic ecological community (LMRAEC).

The VTWBC was identified as occurring throughout the Gunbower National Park project area, due to the presence of significant River Red Gum Forest and Black Box woodland with an abundance of tree hollows for nesting sites and fallen timber. This determination is consistent with previous assessments within the project area (Biosis 2014a, GHD 2017, Seran BL&A 2018).

Bird species of this FFG-listed fauna community are highly mobile and impacts as a result of the project are expected to be negligible in the short-term to species of these communities, with a long-term improvement in habitat expected from environmental watering. Further information is provided in 8.2.3.

The VTWBC is defined by a suite of 24 bird species mainly associated with drier woodlands on the slopes and plains of the Great Dividing Range that have experienced significant declines in numbers. The community is typically present in drier woodlands dominated by box, stringybark, ironbark, yellow gum or river red gum eucalypts and consists of an open woodland over a light shrubby and grassy understorey. There is typically an abundance of tree hollows for nesting sites and fallen timber.

Seven bird species characteristic to the community were identified in the desktop assessment as being previously recorded or predicted to occur in the inundation area and these are summarised in Table 7-6 (Appendix F and Appendix G). Four of the 24 bird species were recorded during field assessments, Brown Treecreeper (*Climacteris picumnus victoriae*) and Jacky Winter (*Microeca facinans*) were observed in high abundance incidentally and during early-morning Grey-crowned Babbler (*Pomatostomus temporalis*). The Grey-crowned Babbler, Diamond Firetail (*Stagonopleura guttata*) and Red-capped Robin (*Petroica goodenovii*) were observed at lower densities within the project area during targeted surveys and incidentally. Apostlebird (*Struthidea cinerea*), Bush Stone-curlew (*Burhinus grallarius*) and Western Gerygone (*Gerygone fusca*) were not recorded during R8 field assessment but are predicted to occur within the project area.

Hollow-bearing trees and tree with fissures (dead or alive) are essential for some species within the VTWBC, which rely on hollow-bearing trees for nesting. Acute, short term impacts to species of this community as a result of the unavoidable removal of hollow-bearing trees should be mitigated. All hollow-bearing trees proposed for removal should be thoroughly inspected prior to removal for refuging wildlife and at risk of harm from felling. A

Fauna Management Plan (FMP) or equivalent should be developed (as part of a CEMP) and implemented during the works associated with the project to mitigate impacts to all native fauna that may result from removal of vegetation during works. Overall, impacts to the VTWBC are likely to be negligible as the Gunbower project area is comprised of largely intact vegetation and the proposed construction of floodplain infrastructure is unlikely to impact on habitat connectivity or remove habitat important for the VTWBC. The proposed inundation of floodplain and wetland habitats is likely to provide important future benefits to the VTWBC particularly under climate change scenarios of longer, dryer conditions in a semi-arid environment. While the project would remove around 58 large old trees (trees that are likely to contain suitable refuge hollows for native fauna), 1634 large old trees recorded within the area of investigation will remain. Furthermore, numerous hollow bearing trees occur within contiguous habitat within the broader project area.

Table 7-6 Fauna species listed in the VTWBC and previously recorded or predicted to occur (VBA, PMST or previous assessments) within the project area

Common name	Scientific name	Project area (including buffer)
Apostlebird	*Struthidea cinerea*	X
Brown Treecreeper	*Climacteris picumnus victoriae*	X
Bush Stone-curlew	*Burhinus grallarius*	X
Diamond Firetail	*Stagonopleura guttata*	X
Grey-crowned Babbler	*Pomatostomus temporalis*	X
Jacky Winter	*Microeca fascinans*	X
Red-capped Robin	*Petroica goodenovii*	X
Western Gerygone	*Gerygone fusca*	X

The LRFC describes a suite of native fish taxa that is typical of and largely restricted to the geographical area of the lowland river reaches and associated floodplains of the Murray River tributaries. Many of these species have undergone significant reductions in range and abundance since European settlement, particularly due to the introduction of alien fish species. The NSW BC Act listed LMRAEC includes all native fish and aquatic invertebrates within all natural creeks, rivers and associated lagoons, billabongs and lakes of the regulated portions of the Murray, Murrumbidgee and Tumut Rivers, as well as all their tributaries and branches (NSW DPI, 2007). The LRFC and LMRAEC were identified as occurring in the project area.

Construction activities have the potential to impact threatened fish and fish communities from the loss of habitat, barriers to fish movement and degradation of water quality associated with sediment runoff or accidental spills. Operation of the scheme has the potential to entrain fish in pumps, strand fish on floodplains during managed drawdown and expose fish to poor water quality in return flows to the Murray River.

The following mitigation measures are recommended for the project to reduce potential fish impacts:

Construction mitigation measures

- Include the use of only partial coffer dams to isolate small areas of back from construction works, relocation of any habitat within works areas to the same river reach and adoption of sediment control and accidental spill measures. If the capture, handling or translocation of fish is required during construction (e.g. dewatering work sites) or operation of the project, persons undertaking these activities will need to hold the appropriate permit or licence under the Fisheries Act 1995. Any capture of fish must be carried out by a qualified aquatic ecologist.
- Mitigation measures associated with construction of the project need to be documented in an Aquatic Fauna Management Plan as part of the Construction Environmental Management Plan to manage impacts to aquatic values – with emphasis on threatened fish species that may be present in vicinity of construction sites or which access floodplain environments.

Operational mitigation measures

- Include the installation and maintenance of appropriately sized fish screens on inlet pumps, management of inundation and drawdown to minimise the likelihood of fish stranding on the floodplain by ensuring opportunities for fish movement during managed drawdown, management of the timing of inundation and drawdown to minimise blackwater risks and to ensure appropriate dilution of return flows if low dissolved oxygen is evident.
- Mitigation measures associated with operation of the project will develop strategies to implement cues for fish to exit the floodplain to manage risk associated with fish stranding on the floodplain. This will include requirements for pump design to include fish screens to minimise impacts to fish during pumping events. The project's Operating Plan will also need to include measures to reduce the potential for poor water quality of return flows.

Mitigation measures built into the design, construction and operation of the project to manage potential impacts will reduce the risks to fish species of the LRFC and LMRAEC to low during both construction and operation of the project.

7.4 Potential impacts to Wetlands of International Importance

The Gunbower National Park forms a significant part of the Gunbower Forest Ramsar site. While reinstating a wetting and drying regime of appropriate frequency, duration and extent to the broader Gunbower National Park is likely to impart significant ecological benefits for the project area, large infrastructure projects such as this can also have environmental risks, in particular localised, short-term impacts during the construction phase.

Under the Ramsar Convention, contracting parties, including Australia, are expected to manage their Ramsar sites so as to maintain the ecological character of each site. The ecological character is defined as the combination of the ecosystem components, processes, benefits and services that characterise the wetland at a given point in time. The current ecological character description for the Gunbower Forest Ramsar site was prepared in 2011. Change in ecological character is defined as the human-induced adverse alteration of any ecosystem component, process and/or ecosystem benefit or service. Changes to the ecological character of the wetland outside natural variations may signal that uses of the site or externally derived impacts on the site are unsustainable and may lead to the degradation of natural processes, and thus the ultimate breakdown of the ecological, biological and hydrological functioning of the wetland (DEWHA, 2008).

The proposed changes to the water regime in Gunbower Forest as a result of the works delivered through VMFRP will result in a 'human induced' change to the ecological character of the Ramsar site, however this change is intended to be positive resulting in an improvement of the condition of the vegetation and habitats provided by Gunbower Forest by providing more frequent inundation and compensating for some of the negative effects of reduced frequency and duration of natural flooding.

The project is unlikely to destroy or substantially modify areas of the wetlands. Some clearing operations will occur along existing access tracks to facilitate the construction activities. This will largely occur in the terrestrial elements of the Ramsar site and will impact 19.57 ha of terrestrial vegetation of the 20,218 ha Ramsar site (DEPI 2013). Additionally, managed flooding to reinstate a more natural hydrology to 704 ha of wetland within the Ramsar site is the overall aim of the project. 'Modification' is not considered to be the result of the overall project with the return of a hydrological system more closely approximating natural conditions. Flooding events will be managed to restore and improve the overall health of the wetland billabongs and lagoon systems within the Ramsar site. A loss of 19.57 ha of terrestrial vegetation will be required to facilitate the restoration works. The <0.0001 % of the total area of the Ramsar site expected to be impacted through vegetataion removal is not considered to be notable in extent and will result in significant improvements to wetland and floodplain habitats within the Ramsar site.

An Environmental Management Framework will be developed that identifies potential environmental risks and puts in place mitigation strategies to avoid or minimise these risks. Any impacts will be localised and site rehabilitation will occur following completion. The Environmental Management Framework will require development of a CEMP that sets out specific measures that will be employed to minimise impacts during construction.

Overall, the project is likely to significantly benefit the environment, reinstating more natural wetting and drying regimes to over 704 ha of wetlands and floodplain. This will increase the extent and condition of habitat for aquatic and floodplain fauna, and address the aims of the project to increase the overall health of the River Red Gum forest, provide drought refuge habitat for fauna (particularly small-bodied fish) and support healthy wetland bird communities. The overall context of the restoration works to the wetland system will provide a net benefit to the ecology of the wetland system, providing a greater resilience and functionality of the Ramsar site with the changing water allocation issues and impending climate change impacts to general water availability.

A Wetland Assessment of Gunbower National Park (R8 2020) has found that most of the potential impacts from construction of the project will be adequately managed through a construction specific aquatic fauna management plan and that most operational risks can be managed through the development of an Environmental Water Management Plan for the project.

A self-assessment against the Significant Impact guidelines concludes the project was unlikely to represent a significant impact on the Gunbower Forest Ramsar site with the implementation of mitigations for construction and operational phases of the project (R8, 2020). The assessment recognises further work is required to develop a construction specific aquatic fauna management plan and an EWP including monitoring and adaptive management to address the threat of invasive species (Appendix S).

According to a PMST Search, the Ramsar Wetlands Gunbower Forest and NSW Central Murray State Forests are all within the study area. An additional four Ramsar Wetlands were identified 250-500 km downstream of the Gunbower National Park project area (Hattah-kulkyne lakes, Banrock Station Wetland Complex, Riverland and the Coorong, and Lakes Alexandrina and Albert Wetland). It is considered unlikely that the proposed works will impact on any of the other Ramsar sites identified through the PMST search.

7.5 FFG Act threatening processes

Potentially threatening processes are listed in accordance with Section 10 of the *Flora and Fauna Guarantee (FFG) Act 1988*. There are a number of threatening processes that are relevant to the project that have the potential to be exacerbated by either the construction process or proposed inundation of 704 ha of floodplain and wetlands:

Construction Phase:

- Degradation of native riparian vegetation along Victorian rivers and streams.
- Loss of hollow-bearing trees from Victorian native forests.
- Habitat fragmentation as a threatening process for fauna in Victoria.
- Increase in sediment input into Victorian rivers and streams due to human activities.
- Infection of amphibians with Chytrid Fungus, resulting in chytridiomycosis.
- Invasion of native vegetation by 'environmental weeds'.
- Loss of coarse woody debris from Victorian native forests and woodlands (flooded or removed from site – re-purpse)
- Reduction in biodiversity resulting from Noisy Miner (*Manorina melanocephala*) populations in Victoria. - (increased gaps and fragments, leading to increased edge effects and invasion of noisey miner)
- Predation of native wildlife by the introduced Cat, *Felis catus*.
- Predation of native wildlife by the introduced Red Fox *Vulpes vulpes*.
- The spread of *Phytophthora cinnamomi* from infected sites into parks and reserves, including roadsides, under the control of a state or local government authority.

The construction footprint should be refined through the design process to minimise impacts to native vegetation, habitat and hollow bearing trees. A qualified ecologist will need to be on-site to manage the removal of any fauna habitat and capture and relocate fauna observed within the construction area. It is still possible that

hollow-bearing trees will be removed as part of the project, however the broader objective to inundate 704 ha of riverine forest and wetland vegetation is likely to be critical to contribute to the maintenance of hollow-bearing trees into the future.

Any construction activity that requires works within waterways has the potential to temporarily prevent passage of biota and to alter flow regimes. These impacts are likely to be relatively short-term and an aquatic fauna management plan for the project should be prepared to minimise impacts to aquatic fauna. This may incorporated as a sub-document of a CEMP.

An Environmental Management Framework will be prepared as part of the project and require development of a CEMP that includes measures such as vehicle hygiene protocols to mitigate the potential spread of weeds and *Phytophthora cinnamomi* and measures to minimise sedimentation or toxic substance i (e.g. fuel) inputs to waterways.

Operation Phase:

- Predation of native wildlife by the introduced Cat, *Felis catus*.
- Predation of native wildlife by the introduced Red Fox *Vulpes vulpes*.
- Soil degradation and reduction of biodiversity through browsing and competition by Feral Goats (*Capra hircus*).

There is potential for the introduction of environmental water to lead to an increase in abundance of feral predators (Cats, Foxes), herbivores (e.g. Goats) and omnivores (e.g. Pigs) due to the associated increase in productivity. Some of the species such as cats, foxes and pigs could potentially prey on migratory waterbirds, woodland birds, small mammals, reptiles and frogs that may respond to the application of water to floodplains/wetlands. An accompanying pest animal management and control program would need to be implemented within the inundation extent, however this may require Parks Victoria to expand current pest control programs within the park to target these areas during inundation events.

8. Impacts to native vegetation

This section summarises the likely impacts to native vegetation associated with the proposed works within the construction footprint and proposed operational impacts to native vegetation during the operational phase of the project. The impacts described in this section incorporate assessments undertaken at Gunbower National Park by R8 ecologists and previous assessments (Bennetts 2014a, Biosis 2014a, GHD 2017). The combined Vegetation Quality Assessment (Habitat Hectare) results are outlined in Appendix H for all of the native vegetation proposed to be impacted. Further field assessment will be completed to qualify the results in areas where field assessment has not yet been completed. Large Trees have not been mapped within the Middle Gunbower Forest (downstream of Deep Creek) and Camerons Creek pump station and pipeline in Upper Gunbower.

8.1 Objective of the Guidelines

The Guidelines for the removal, destruction or lopping of native vegetation (the Guidelines) were incorporated into the Victorian Planning Provisions and all planning schemes in Victoria in December 2017 (DELWP 2017).

The purpose of the Guidelines is to guide how impacts on biodiversity should be considered when assessing an application for a permit to remove, destroy or lop native vegetation. The Guidelines set out the rules and tools for how the responsible authority (Campaspe Shire Council and Gannawarra Shire Council) and referral authority (DELWP) should consider biodiversity when assessing an application. Adherence to the practices and procedures outlined in the Guidelines will help protect native vegetation. They aim to ensure that the proposed removal of native vegetation is appropriately assessed, that opportunities to avoid and minimise removal are considered, and that appropriate offsets are secured (DELWP 2017) .

When native vegetation removal is permitted, an offset must be secured that achieves a no net loss outcome for biodiversity. To achieve this, the offset needs to make a contribution to Victoria's biodiversity that is equivalent to the contribution made by the native vegetation that was removed. Therefore, the type and amount of offset required depends on the native vegetation being removed and the contribution it makes to Victoria's biodiversity.

8.2 Proposed construction impacts to native vegetation

8.2.1 Ecological Vegetation Classes

The proposed works will involve impacts to 19.57 ha of native vegetation, including 8.23 ha of vegetation classified as endangered, 7.79 ha of vegetation classified as vulnerable, 3.51 ha of vegetation classified as depleted and 0.06 ha of vegetation classified as least concern. However, it is anticipated that any impacts to these Ecological Vegetation Classes (EVCs) associated with the proposed works, will be greatly outweighed by the benefits and improvements that these same EVCs will achieve through environmental watering within the area of inundation. The inundation area is expected to cover 704 ha of Gunbower National Park and will directly benefit 77.29 ha of vegetation classified as endangered, 336.06 ha classified as vulnerable, 212.05 classified as depleted and 9.96 hectares of vegetation classified as least concern.

The proposed direct loss of native vegetation for the project is 19.57 hectares, within an extensive surrounding area of high-quality native vegetation, albeit some areas have experienced decline due to lack of natural flooding, within the 9,330 ha Gunbower National Park. All of the impacts are associated with the installation of infrastructure, and efforts have been made during each iteration of the design, to avoid and minimise impacts to native vegetation and fauna habitat (including large trees where present).

Of the 19.57 ha of native vegetation that is proposed to be removed, 12.83 ha is potentially impacted by the development footprint of proposed structures, containment banks, hardstands and laydown areas, and 6.74 ha is associated with potential maintenance works along existing access tracks Table 8-1.

The scope and requirement for works along access tracks is still to be confirmed and will be designed to avoid and minimise native vegetation removal wherever practicable. The current estimate of potential vegetation removal along tracks is conservative, and assumes a minimum 5 metre buffer where vegetation removal has been accounted for along existing tracks. In some instances these works may be limited to minor maintenance

and upgrades that require minimal if any vegetation clearance. Vegetation is not currently proposed to be cleared within this 5 m buffer, however it is acknowledged that use of the tracks by heavy machinery during the construction phase of the project may require some track maintenance that could impact trees. R8 has recommended that once the construction footprint and required track access has been confirmed, that a qualified arborist is engaged to undertake an assessment along the existing tracks, with a project engineer and construction contractor, to confirm the extent of works required (if any) and any potential losses to trees along the existing tracks either directly (through removal) or indirectly (through encroachment of their TPZs, or the removal of >30% of their canopy). Once this assessment has been undertaken, the extent of impacts to native vegetation for the project will be confirmed. It is anticipated that the actual impacts to native vegetation along the existing access tracks will be significantly lower than the conservative estimate (6.74 ha) that has been currently accounted for.

The total proposed impacts to each individual EVC within the construction areas is outlined in Table 8-1.

Table 8-1 Proposed impacts to each Ecological Vegetation Class (EVC)

EVC	Area (ha) impacted by infrastructure	Area (ha) impacted by tracks*
Upper Gunbower Forest		
56 Floodplain Riparian Woodland		0.03
103 Riverine Chenopod Woodland	1.53	0.71
803 Plains Woodland	0.34	2.08
816 Sedgy Riverine Forest	0.43	0.05
821 Tall Marsh	0.06	
Sub-total	**2.35**	**2.87**
Middle Gunbower Forest (upstream of Deep Creek)		
56 Floodplain Riparian Woodland	0.07	
103 Riverine Chenopod Woodland	0.64	0.41
803 Plains Woodland	0.03	0.05
Sub-total	**0.74**	**0.46**
Middle Gunbower Forest (downstream of Deep Creek)*		
56 Floodplain Riparian Woodland		0.12
103 Riverine Chenopod Woodland		0.75
106 Grassy Riverine Forest	0.08	0.11
295 Riverine Grassy Woodland	0.17	
803 Plains Woodland	1.34	0.35
814 Riverine Swamp Forest		0.73
815 Riverine Swampy Woodland	6.64	0.98
816 Sedgy Riverine Forest	1.52	0.37
Sub-total	**9.74**	**3.41**
Total	**12.83**	**6.74**

* EVC mapping completed by Bennetts (2014) and combined with DELWP modelled EVC mapping. No ground truthing of this data has been completed

8.2.2 Canopy Trees

During the field assessments 1634 trees were recorded within the Upper Gunbower Forest and Middle Gunbower Forest (upstream Deep Creek) area of investigation. The DBH of each stem of each tree has been recorded to determine the size class (as per the guidelines, DELWP 2017). Of these 1634 trees, 58 large trees are located within the construction footprint, either directly or due to their TPZs being impacted >10%. This total does not include Middle Gunbower (downstream of Deep Creek) and Camerons Creek pump station and pipeline in Upper Gunbower. Once field survey has been completed in spring 2020 this number is expected to increase.

A qualified arborist may need to be engaged to determine the full extent of impacts to native trees (both within and immediately adjacent to the proposed construction footprint). This assessment would take in to account direct impacts to trees (tree removal) and indirect impacts to trees (through encroachment of their TPZs). Whilst the size class of a tree is determined by measuring the DBH at 1.3 m under the Guidelines, the TPZs of a tree are calculated by recording the DBH of a tree at 1.4 m (and for multi-stemmed trees such as some eucalypts, the TPZ is determined by combining the DBH measurements of each individual stem). An arborist assessment would also consider the individual tree location and habit, as well as specific characteristics of certain tree where it's possible that individual trees will survive greater than 10% encroachment of their TPZs or the pruning of over 30% of the existing crown (the standard measures for determining indirect tree losses under the guidelines).

It is expected that approximately 58 large trees will be impacted by the current design (Appendix L).

8.2.3 Proposed operational impacts to native vegetation

The proposed works for the Gunbower National Park floodplain and wetlands are designed to deliver water to flood-dependent and flood-tolerant habitats by providing a combination of pumped inflows from the Murray River and the National Channel and gravity flows through the Camerons Creek system into the Forest.

The return of more frequent flooding to Gunbower National Park aims to achieve the following:

1) Healthy River Red Gum forests with flood dependent understorey and temporary wetlands
2) Drought refuge habitat provided for fauna (particularly small-bodied native fish) in Black Charlie Lagoon.
3) Healthy wetland bird community through improved access to food and habitat that promotes breeding and recruitment.

The delivery of water to flood dependent and flood tolerant habitats within the Gunbower National Park during the operational phase of the project is expected to achieve the above aims as indicated by the inundation extents in Table 8-2 below.

An assessment of the potential impacts to vegetation within the inundation area as a result of environmental watering has not been assessed from field assessments undertaken by R8 and instead relies upon previous EVC mapping completed by (Bennetts 2014a) within Gunbower National Park. The project aims to deliver the preferred hydrological regime for native vegetation communities within the inundation area and this is expected to benefit the native vegetation within the inundation areas.

A summary of the EVCs comprising the 704 ha of vegetation within the inundation area is outlined in Table 8-2. The vast majority of these EVCs are seasonal wetlands, Red Gum Forest and Woodland or flood-dependent Box woodland vegetation communities that require or are tolerant of inundation and therefore are expected to positively respond to the proposed inundation. A small area (0.98 ha) of terrestrial box woodland is expected to be inundated during forest floodplain watering. This terrestrial vegetation community occurs on the higher slopes of the forest and can tolerate occasional flooding as it exists within a floodplain environment. However, periodic flooding is not a requirement of this vegetation type.

Table 8-2 Total EVC extents (ha) to be impacted in the construction footprint and to receive inundation as part of the operational phase of the project.

Water Regime Class	Ecological Vegeatation Class	Construction footprint (ha)	Inundation Area (ha)
Scroll Bar and Riparian Billabong	Floodplain Riparian Woodland (EVC 56)	0.22	
	Billabong Wetland Aggregate (EVC 334)		12.84
Seasonal Wetlands	Drainage Line Aggregate (EVC 168)		9.17
	Grassy Riverine Forest - Riverine Swamp Forest (EVC 812)		85.95
	Riverine Swampy Woodland (EVC 815)		10.77
	Tall Marsh (EVC 821)	0.06	12.58
	Riverine Swamp Forest - Floodway Pond Herbland (EVC 954)		1.26
	Sedgy Riverine Forest - Tall Marsh Complex (EVC 1071)		78.10
Red Gum Forest and Woodlands	Grassy Riverine Forest (EVC 106)	0.19	56.75
	Riverine Grassy Woodland (EVC 295)	0.17	
	Riverine Swamp Forest (EVC 814)	0.73	5.95
	Riverine Swampy Woodland (EVC 815)	7.62	316.37
	Sedgy Riverine Forest (EVC 816)	2.37	3.94
Flood-dependent Woodlands	Riverine Chenopod Woodland (EVC 103) *	4.04	92.69
	Lignum Swampy Woodland (EVC 823) ^		8.92
Terrestrial Box Woodlands	Plains Woodland (EVC 803)	4.19	0.98
NA	No EVC Mapping		7.84
	Total	**19.57**	**704.1**

* Categorised as 'Box Woodland' in Bennetts 2014 mapping, this EVC has been assigned to flood-dependent woodlands to fit with the Water Regime Classes provided in Ecological Associates (2014). Though categorised as flood-dependent by Ecological Associates (2014) this EVC is considered 'flood tolerant'

^ Categorised as 'Red Gum Forest and Woodlands' in Bennetts 2014 mapping, this EVC has been assigned to Flood-dependent Woodlands to fit with the Water Regime Classes provided in Ecological Associates (2014).

Numerous long-term monitoring programs have been been established, including The Living Murray (TLM) icon site condition monitoring program, to monitor and track the response of floodplain forests and wetlands over time, and in particular, determine how the ecosystem responds to watering. Results to date indicate that the floodplain systems of the mid-lower Murray respond positively to managed intermittent flooding, whether it be landscape-scale overbank flooding or smaller scale events, e.g. watering of creeks, floodrunners and low-lying wetlands.

The ecological benefits of environmental watering listed above have and continue to be demonstrated through a rigorous monitoring program at the neighbouring TLM program Gunbower Forest icon site, which aligns closely with the ecological character and hydrological requirements of Gunbower National Park. As such, many of the demonstrated outcomes at Gunbower Forest are expected to also result from environmental watering at Gunbower National Park.

Long-term monitoring results at Gunbower Forest for example show that River Red Gum areas that have received the combination of water for the environment and natural floods over the past 10 years, typically have healthier canopies, faster tree growth and supported more native floodplain plants, than areas that only received natural floods and those that remained dry over the same period. At monitoring sites that have received no flooding since 2005, less than half of the River Red Gum trees had at least 50 per cent intact canopy (a measure of tree condition), and these trees continue to suffer from the Millennium Drought and lack of natural flooding. At sites that received only natural flooding since 2005, the trees are in slightly better condition with almost 60 per cent with at least 50 per cent intact canopy. However, the greatest improvement is seen at sites that received both natural floods and water for the environment, where 75 per cent of trees are now considered healthy (Bennetts and Jolly 2019). A range of surveys are also undertaken to monitor the direct response of water-dependent flora and fauna to environmental water delivery, including but not limited to fish monitoring (Bloink et al. 2019), frog monitoring (Durkin and Howard 2020) wetland productivity monitoring including the response of vegetation, micro and macroinvertebrates, fish and birds (Brown 2020), and water quality monitoring of return flows to improve instream productivity for native fish (Baldwin 2019). While there is some variability in ecological responses to environmental water due to the complexity of the systems and multiple contributing factors (e.g. the impact of carp on aquatic vegetation), the results of this monitoring overall show a positive response of water-dependent flora and fauna to the environmental water deliveries.

8.3 Assessment Pathway

Applications to remove native vegetation are categorised into one of three assessment pathways with corresponding application requirements and decision guidelines. The assessment pathway for an application to remove native vegetation reflects its potential impact on biodiversity and it is determined from the location and extent of the native vegetation to be removed (DELWP, 2017). The three assessment pathways recognised by DELWP are:

- *Basic*: limited impacts on biodiversity
- *Intermediate*: could impact on large trees, endangered EVCs, and sensitive wetlands and coastal areas
- *Detailed*: could impact on large trees, endangered EVCs, sensitive wetlands and coastal areas, and could significantly impact on habitat for rare or threatened species

The assessment pathway determines the information that is required to accompany an application to remove, lop or destroy native vegetation. There are three location categories that indicate the potential risk to biodiversity from removing a small amount of native vegetation and play a role in determining the assessment pathway:

- *Location 3*: includes locations where the removal of less than 0.5 hectares of native vegetation could have a significant impact on habitat for a rare or threatened species.
- *Location 2*: includes locations that are mapped as endangered EVCs and/or sensitive wetlands and coastal areas and are not included in Location 3.
- *Location 1*: includes all remaining locations in Victoria.

The higher category is used if native vegetation proposed to be removed includes more than one location category. The process for determining the assessment pathway is summarised in Table 8-3.

The construction footprint is located within a broad area that has mapped as Location 3. Given the scale of the project and both the extent of native vegetation and the number of large trees identified within the Gunbower National Park project area, it is considered likely that the project will follow the Detailed Assessment pathway.

Table 8-3 Risk matrix for determining the assessment pathway that an application to remove native vegetation will take

Extent of Native Vegetation	Location Category		
	Location 1	Location 2	Location 3
< 0.5 hectares (ha) and not including any Large Trees	Basic	Intermediate	Detailed
< 0.5 hectares (ha) and including one or more Large Trees	Intermediate	Intermediate	Detailed
0.5 hectares (ha) or more	Detailed	Detailed	Detailed

8.4 Summary of Vegetation Impacts

Despite the efforts outlined in Section 8 below to avoid and minimise impacts to native vegetation during the design and planning phase of the project, the current construction footprint estimates that 19.57 hectares of native vegetation including Large Trees requires removal for the project. Further efforts will be made during design refinement to further avoid and minimise impacts to native vegetation and fauna habitat.

The total proposed impacts to each individual EVC within the construction footprint is outlined in Table 8-4.

58 Large Trees (i.e. canopy trees within patches with a DBH that meets the threshold to be considered Large for a particular EVC) would be impacted by the current design. No Scattered Trees will be impacted as a part of the project. This total only includes Large Trees mapped within the Upper Gunbower Forest (excluding Camerons Creek pump station and pipeline) and Middle Gunbower Forest (upstream Deep Creek). This total will increase once Large Trees have been mapped within the Middle Gunbower Forest (downstream of Deep Creek) and Camerons Creek pump station and pipeline in Upper Gunbower in spring 2020.

Table 8-4 summarises the proposed impacts to native vegetation, as outlined in the NVR report prepared on 9 June 2020, see Appendix T.

Table 8-4 Summary of impacts to native vegetation for the project

Summary of Impacts	
Assessment Pathway	Detailed Assessment Pathway
Extent of proposed vegetation removal	19.57 ha
Number of Large Trees to be removed	58
Location Category	Location 3 The native vegetation is in an area mapped as an endangered EVC, sensitive wetland or coastal area. Removal of less than 0.5 hectares of vegetation could have a significant impact on any habitat for rare or threatened species.

8.4.1 Offset requirements

The NVR report outlines the offset requirements for the project, including specific species offsets for 33 species of rare and threatened flora and fauna, and 58 Large Trees (Appendix L) (To be confirmed against final design). Offsets will be sought in accordance with the requirements of the Guidelines for removal, destruction or lopping of native vegetation (DELWP 2017) or through an alternate arrangement agreed with the Secretary to DELWP.

The loss of native vegetation due to construction activities is proposed to be offset, at least in part, by the expected improvement in native vegetation quality in the inundation area resulting from environmental watering. The method for confirming this offset would be developed in consultation with DELWP.

9. Avoidance, minimisation and mitigation measures

Efforts have been made throughout the planning and design phases for the proposed construction to avoid and minimise impacts to ecological values including native vegetation and fauna habitat, threatened flora, fauna and communities. All areas of native vegetation that are proposed to be impacted are adjacent to existing vehicle tracks and areas of previous human disturbance, and represent lower quality areas of habitat to those which surround them. From a landscape perspective the proposed construction footprint represent a small area within a very large intact area of high quality native vegetation.

9.1.1 General mitigation measures

The following should be considered during the construction, planning approval phase and implementation of the project:

- Avoid the removal of hollow bearing trees and large old trees (including removal of limbs) within the construction footprint with regards to fauna.
- Avoid areas of native vegetation not approved for removal, areas of high-quality vegetation and areas of vegetation that support rare and threatened flora species (e.g. FFG threatened flora).
- Retain as many large trees as practicable where there are potential impacts to Tree Protection Zones for the construction footprint area.
- Flag areas of native vegetation adjacent to the proposed works that have not been approved for removal as no-go zones. All vegetation clearing extents to be approved by site environmental officer.
- Use existing disturbed areas or areas of non-native vegetation for lay-downs and stockpiling.
- Where practical, avoid areas of high quality vegetation and vegetation that supports rare or threatened flora
- Include the above points to develop and implement mitigation measures for incorporation into an EMP to minimise the potential for ecological impacts within and around the site before, during and after the construction process. These may also include:
  - Minimise and adhere to the approved footprint and supervise construction activities to ensure that activities do not encroach on retained native vegetation.
  - Avoid and minimise disturbance to the National Park.
  - Standard vehicle hygiene measures to prevent the spread and introduction of weed species, particularly the weeds of national significance and noxious weeds listed under the C*atchment and Land Protection Act 1994* (CaLP Act).
  - Strict vehicle hygiene measures to prevent the spread or transmission of Chytrid Fungus as per Murray et al (2011).
  - Management of run-off, spills and sediment to avoid impacts on the Murray River any other waterways.
  - Delineation of areas of remnant native vegetation to be retained from those areas to be removed as no-go zones to avoid encroachment into areas of retained vegetation.
  - EPA construction erosion and sediment control measures to be employed.
- Develop and implement a Flora and Fauna Management Plan as part of the EMP that contains requirements to avoid, mitigate and manage impacts to flora and fauna values and particularly threatened species and describing the habitat preclearance and clearance process. As a minimum the plan must address the requirements described in measures described within this technical report.

9.1.2 Design phase

The following avoidance and mitigation measures have been and should continue to be implemented during the design phase to minimise and mitigate impacts to threatened flora and fauna identified in previous ecological surveys within the construction footprint (Biosis 2014a, GHD 2017):

- Prioritise the avoidance of areas mapped as the EPBC listed threatened ecological community Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia (Appendix M and provided following field assessment of Middle Gunbower Forest (downstream Deep Creek) and and Camerons Creek pump station and pipeline in Upper Gunbower in spring 2020).
- Siting of proposed structures primarily along or immediately adjacent to existing access tracks and other previously disturbed areas.
- Avoid where possible mapped rare and threatened flora species.
- Micro-aligning construction footprint to avoid impacting hollow-bearing trees to reduce impacts to hollow-dependant fauna (such as species within the FFG Act Listed community, VTWBC).
- Refinement of the design and construction methods to minimise the construction footprint (including access track and laydown areas).

9.1.3 Construction phase

The following mitigation measures are recommended to minimise and avoid impacts upon the identified listed ecological values:

- Follow the avoid, minimise protocol in determining the construction works footprint at each site (i.e. make every effort to avoid threatened flora species loss as a high priority).
- Areas of remnant native vegetation to be retained will be delineated from those areas to be removed as 'no-go zones', to avoid encroachment into areas of retained vegetation
- Locations for stockpiles will be within existing cleared or areas of non-native vegetation where practicable
- Manage potential impacts to tree root zones during construction.
- For the protection of threatened flora:
  - Species listed under the FFG Act and EPBC Act that are not permitted to be removed, must be fenced off with temporary one metre high orange barrier mesh medium-heavy weight prior to construction commencing.
  - Fencing must be checked on a weekly basis and the population monitored on a monthly basis.
  - All staff onsite should be made aware through inductions and/ or signage of the presence of threatened species and how to identify the species. Locations for stockpiles should be within existing cleared or areas of non-native vegetation where practicable
- If any threatened flora species additional to those already identified in site plans (i.e. listed as threatened under the EPBC Act, or the FFG Act) are found within the construction area the Project Ecologist will be notified. The number and location of individuals will be recorded and DELWP will be advised
- Manage the removal of hollow-bearing trees within the construction footprint (if required, based on final footprints and potential impacts to tree root zones from track establishment, setdown areas) where construction may impact habitat trees of native fauna, particularly FFG Act listed fauna species and communities and species protected under the Wildlife Act (all wildlife);
  - Avoiding tree removal during the breeding season of hollow-dependant species (spring – summer) is recommended, however where this is not practical, a suitably qualified ecologist must undertake hollow-checks. If juveniles, or eggs, are observed within a hollow a protocol will be devised for removal of the fauna (if possible) by the onsite ecologist on a tree-by-tree basis. In some cases, fauna may not be able to be removed and staged tree removal may follow. In some instances, DELWP will need to be contacted. Where nocturnal wildlife can be removed, they will be kept in cages and released at dusk.
  - Prior to tree removal, complete pre-clearance surveys for any large and hollow-bearing trees to be removed. A hollow-bearing tree is defined as a tree over 40 cm DBH (can adjust within each EVC). Pre-clearance surveys should be conducted prior to (within 24 hours) the hollow-bearing trees being

removed. If fauna are located within hollows, or are nesting in a tree the onsite ecologist will follow the Flora and Fauna Management Plan.

- An initial briefing of construction works crews by a qualified ecologist and subsequent planning of safe work distances and establishment of each site
- Manage the impact of noise and light pollution for fauna during construction. Where night-time works are unavoidable, measures must be implemented to limit the impact to nocturnal fauna. These would include
  - Downward angles or directional lights to avoid unnecessary light spill across a broader area than required
  - Light wavelengths selected (yellow/orange LED) to avoid insect attraction, and therefore reducing indirect impacts to bat and nocturnal bird behaviour
  - Works should be undertaken away from known nesting areas, or done out of season.
  - Avoiding periods of high insect/bird/bat activity so as to minimise disturbance to faunal communication
  - Ensure areas of quiet remain in connected/adjacent habitat that can act as a refuge while other areas are subject to higher temporary noise levels.
  - Avoid where possible equipment which emit noise at known animal communication frequencies (generally higher frequencies above 500Hz)
- Develop and implement a Construction Environmental Management Plan (CEMP) for the construction phase. The CEMP should provide appropriate measures to avoid or minimise indirect impacts such as erosion, sedimentation and the accidental spill of oils or other chemicals. It would also provide a protocol for minimising impacts in ecologically sensitive areas such as creek lines. The EMP should be audited during and following the construction process to check that works have been conducted appropriately, including complying with the Flora and Fauna Management Plan.
- Develop and implement a Flora and Fauna Management Plan as part of the CEMP that contains requirements, including those listed in this section of the referral, to avoid, mitigate and manage impacts to flora and fauna values and particularly threatened species and describing the habitat preclearance and clearance process
- Develop and implement an Aquatic Fauna Management Plan as part of a broader CEMP to manage impacts to aquatic values – with emphasis on threatened fish species that may be present in vicinity of construction sites. Any construction activities that could lead to entrapment of fauna or temporary loss of habitat (e.g. due to the use of coffer dams and dewatering) should be considered. If the capture, handling or translocation of fish is required during construction (e.g. dewatering work sites) or operation of the project, persons undertaking these activities will need to hold the appropriate permit or licence under the *Fisheries Act 1995*. Any capture of fish must be carried out by a qualified aquatic ecologist.
  - Use only partial coffer dams to isolate small areas of back from construction works
  - Relocate any habitat (e.g. large woody debris) within works areas to the same river reach and adoption of sediment control and accidental spill measures
  - Implement sediment control measures according to the CEMP to control the mobilisation of sediments that may discharge into wetland habitats during rainfall events.
- Develop and implement a Weed Management Plan to manage weeds during and after the construction phase within the project area.
- On completion of works, rehabilitate the construction footprint, including:
  - Setting aside topsoil to reinstate when works are complete and compacting to original levels.
  - If native vegetation must be removed, re-spreading of stored topsoil should occur, followed by monitoring to assess germination in the following year.
  - If the site is not naturally recolonised by locally indigenous species, planting of locally indigenous species appropriate to that particular position in the landscape may be undertaken in the following year.

  - Ground debris (logs/litter) that is temporarily removed to allow construction activities, should be reinstated.
- All vehicles and plant must only operate on existing tracks and in areas marked as parking areas or construction zones.
- Minimise the need to create new tracks and use existing tracks as much as possible.

9.1.4 Operation phase

The following mitigation measures are recommended to minimise and avoid impacts upon the identified threatened flora, fauna and community values. These measures are general across the inundation area footprint and are not site specific.

- Mitigation measures associated with operation of the project will develop strategies to implement cues for fish to exit the floodplain to manage risk associated with fish stranding on the floodplain. The project's Operating Plan will also need to include measures to reduce the potential for poor water quality of return flows.
  - Installation and maintenance of appropriately sized fish screens on inlet pumps, management of inundation and drawdown to minimise the likelihood of fish stranding on the floodplain by ensuring opportunities for fish movement during managed drawdown
  - Management of the timing of inundation and drawdown to minimise blackwater risks and to ensure appropriate dilution of return flows if low dissolved oxygen is evident.
- Implement pest animal management and control within the inundation area (and ideally surrounding areas), this may require DELWP and Parks Victoria to expand current pest control programs within the forests to target these areas during inundation events
- Timing water delivery to down seedling, minimise growth, germination and seed set of pest species. Time water delivery to promote native species

10. Legislative and policy requirements

There are a number of ecological values present within the project area as discussed within this report, with the potential to trigger the requirement to obtain permits or approvals if impacted. Table 10-1 below outlines the potential legislative implications for the project that may result from the removal of native vegetation and/or fauna habitat within the construction footprint and in the inundation area during the operational phase.

Table 10-1 Summary of probable legislative requirements

Federal legislation	Relevance to project
Environment Protection and Biodiversity Conservation Act 1999	**EPBC listed threatened communities** One EPBC Act listed threatened community (Endangered), Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia was identified within the construction footprint (primarily along access tracks) within Upper and Middle Gunbower Forest (downstream of Deep Creek). A total of 4.18 ha of this threatened community has been assessed as occurring within the construction footprint consisting of 2.47 ha along access tracks. It is expected that impacts to the threatened community occurring either side of the track can be avoided by restricting vehicle access to existing tracks and ensuring minimal lopping of vegetation is to occur. The anticipated removal of 1.71 ha of the community within the development footprint accounts for 0.13% of the community extent within the Gunbower Forest. This total is not considered notable in extent of the community or will have a long term impact on the survival of the community. **EPBC listed threatened flora** No EPBC Act listed flora have been identified within the construction footprint during the field assessment in 2019 by R8 ecologists and in previous assessments (Bennetts et al. 2012, Bennetts 2014a, Biosis 2014a, GHD 2017, Bennetts and Cook 2020). Six EPBC Act listed flora species, River Swamp Wallaby-grass, Winged Peppercress, Ridged Water-milfoil, Floodplain Rustyhood, Stiff Groundseland Slender Darling-pea are considered as having the potential to occur within the inundation area. All of these species are flood-responders and the restoration of a natural flooding regime is likely to benefit these species. None of these species have been or are likely to be present within the construction footprint, therefore the project is unlikely to have a Significant Impact on any EPBC Act listed threatened flora. **EPBC listed threatened fauna** No EPBC Act listed fauna have been identified within the construction footprint during the field assessment in 2019 by R8 ecologists and in previous assessments (Biosis 2014a, Sharpe 2014a, Sharpe 2015b, GHD 2017). A total of 10 EPBC Act listed fauna species are considered to have the potential to occur within the project area, particularly after the environmental watering operational activities of the project have been undertaken. Two amphibians, the Growling Grass Frog and Sloane's Froglet have not been recorded recently within the project area, however a small area of suitable habitat exists along permanent waterways (<1 ha). Targeted surveys in late winter (Sloane's Froglet) and early summer (Growling Grass Frog) in 2020 are recommended to assess habitat quality and determine presence/absence for the species within areas of the construction footprint. Overall, despite the long absence of records of this species, the presence of seasonally-suitable habitat, and the ability of this species to recolonise areas suggest that it has potential to occur in the area, and a reintroduction of more suitable ecological watering regimes may help facilitate this. Significant impacts to

	Growling Grass Frog and Sloane's Froglet are unlikely, but localised impacts in wet areas may occur. The South-eastern Long-eared Bat (*Nyctophilus corbeni*, EPBC Act listed Vulnerable) has not been recorded in the project area and was not recorded during bat surveys in the construction footprint in 2017 (GHD 2017). However suitable habitat exists within the construction footprint with the species potentially roosting in large, hollow-bearing trees. No significant impacts are expected, as per the significant impact criteria (DEWHA 2010) for South-eastern Long-eared Bat, particularly given the population stronghold occurs within the Piliga Scrub in NSW. Two threatened wetland birds, the Australasian Bittern and Australian Painted Snipe are considered to have the potential to utilise wetland habitats within the Gunbower National Park. The latter has not been recorded within the last 50 years (Hale and Butcher 2011). Both species are likely to benefit from environmental watering and a return to natural flooding within the project area. Impacts to these species are considered unlikely as they are highly mobile species and impacts to aquatic EVCs are expected to be negligible. Three other threatened bird species, Painted Honeyeater, Superb Parrot and White-throated Needletail have rarely been recorded if at all within the Gunbower National Park but are considered to have the potential to use Forest and Woodland habitat within the project area. Impacts to these species are considered unlikely as they are highly mobile species that may infrequently utilise the project area and are expected to benefit from environmental watering. The Murray Cod (*Maccullochella peelii peelii*), Trout Cod (*Maccullochella macquariensis*) and Silver Perch (*Bidyanus bidyanus*) are considered to be present within the Murray River and National Channel alongside the project area. There is an overall assessment of low likelihood of impact to each of these species during the construction and operational phase of the project following mitigation measures are implemented in full as part of the CEMP, aquatic fauna management plan and during the operation phase of the project. **EPBC listed Migratory Species** Thirteen (13) migratory species were identified as having the potential to occur within the construction footprint, and within the proposed inundation area (PMST and VBA). Most of these species are either highly unlikely to occur (e.g. Eastern Curlew, Yellow and Grey Wagtails) or are aerial in nature and whilst they may occur, core habitats of the species will not be impacted (e.g. White-throated Needletail, Fork-tailed Swift). It is highly unlikely that the construction footprint supports habitat that would be considered important for migratory species foraging or breeding activity or support an ecologically significant proportion of a population of migratory species. An assessment of the EPBC Act significant impact criteria to migratory listed species for impacts from the proposed works are provided in Appendix R, which conclude that it is unlikely that a Significant Impact will occur. **EPBC listed Wetlands of International Importance** The Ramsar Wetland Gunbower Forest occurs within the project area and the NSW Central Murray State Forests Ramsar Wetland occurs across the Murray River from the project area. It is anticipated that 19.57 ha of vegetation, primarily consisting of terrestrial vegetation will be removed for the construction of the environmental watering infrastructure. This represents <0.0001% of the total area of the Gunbower Forest Ramsar site and through the operation of the project is expected to deliver substantial improvements to vegetation condition and improve fauna habitats. An Environmental Management Plan (EMP) should be developed that identifies potential environmental risks and puts in place mitigation strategies to avoid or minimise any impacts from construction (e.g. sediment runoff).

	Considering the substantial benefits to wetland health by restoring a natural flooding regime, it was determined that the project is unlikely to have a Significant Impact on the Gunbower Forest Ramsar site.
Victorian State legislation	**Relevance to project**
Environment Effects (EE) Act 1978	A project can trigger an EES referral if over 10 ha of native vegetation is proposed to be impacted. It is currently estimated that up to 19.57 ha of native vegetation will require removal with 58 Large Trees potentially impacted. The project would therefore trigger an EES referral based on the extent of native vegetation identified within the construction footprint. Other relevant EES criteria are for matters under the FFG Act. No threatened flora or fauna listed under the FFG Act are considered to have critical habitat within the Gunbower National Park construction footprint. The FFG Act listed Grey-crowned Babbler and Diamond Firetail, although known to occur in the project area are both highly mobile species with large home ranges, that are unlikely to be significantly impacted from the potential habitat loss and fragmentation from vegetation removal in the construction footprint. Two FFG Act listed fish species, Un-speckled Hardyhead and Murray Darling Rainbowfish have both been recorded within Cameron's Creek (Sharpe 2014a, Sharpe 2015b). The limited construction area at the Cameron's Creek Mid Creek regulator is not considered as supporting critical habitat for these species, but mitigation measures outlined in 7.3.3 are required. The FFG Act listed Broad-shelled Turtle has also been recorded extensively throughout the broader Gunbower region, with habitat limited to deep-pooled water of the Murray River. The limited construction area at the Brereton Pump Station adjacent to the Murray River is not considered as supporting critical habitat for this species, but mitigation measures outlined in 7.3.3 are required. The assessment concludes that the project will not result in the loss of a significant proportion of a population or genetically important population of any FFG listed species. No loss of FFG-listed community. Two FFG-listed fauna communities was identified in the project area, Victorian Temperate Woodland Bird Community (VTWBC) and Lowland Riverine Fish Community of the Southern Murray-Darling Basin (LRFC). The VTWBC was identified as occurring throughout the Guttrum and Benwell Forests project area. Bird species of this FFG-listed fauna community are highly mobile and impacts as a result of the Project are expected to be negligible in the short-term to species of these communities, with a long-term improvement in habitat expected from environmental watering. The LRFC was identified as occurring within the project area as several species included within this community have been confirmed present including Silver Perch, Unspecked Hardyhead, Trout Cod, Murray Cod, Golden Perch, Murray-Darling Rainbowfish and Freshwater Catfish. The potential impacts of construction and operation of the project on these species have been found to be low following mitigation measures outlined in section 9. This assessment concludes that the project will not result in the loss of a significant area of an FFG listed ecological community.
National Parks Act 1975	The proposed inundation area and most of the proposed construction area occurs within the Gunbower National Park. This land is subject to the objects of the Act, which make provision for the preservation and protection of the natural environment including wilderness areas and natural areas in those parks; for the protection and preservation of indigenous flora and fauna and of features of scenic or archaeological, ecological, geological, historic or other scientific interest in those parks; for the study

	of ecology, geology, botany, zoology and other sciences relating to the conservation of the natural environment in those parks, and for the responsible management of the land in those parks. The objects of the Act have been considered during the design phase to minimise the construction footprint and avoid important threatened species habitat (e.g. Threatened Ecological Communities). Furthermore, by aiming to restore a more natural inundation regime to about 704 ha of the Gunbower National Park floodplain, the project is consistent with the priority actions identified in the River Red Gums Management Plan (Parks Victoria) which aim to halt the decline of biodiversity values threatened by river regulation and changing flooding patterns.
Planning and Environment Act 1987 (P&E Act)	The construction footprint indicates that 19.57 ha of native vegetation will require removal with 58 Large Trees potentially impacted for the project. Approval under the P&E Act will be required for the removal of any native vegetation unless exemptions (as specified in Clause 52.17) apply. Given the extent of native vegetation identified within the construction footprint, as well as the presence of scattered native individuals (<25% cover) within areas considered to be non-native vegetation, it is considered that planning permission under the P&E Act will be required for the project.
Guidelines for the removal, destruction or lopping of native vegetation (DELWP 2017) – the Guidelines.	The location mapping for the project area identifies that the construction areas are classified as Location Risk 3. Given the scale of the project and both the extent of native vegetation and the number of trees identified within the project area, it is considered likely that the project would need to follow the Detailed Assessment pathway. For this reason, habitat hectare assessments were undertaken in all areas of construction footprint. The results of this are presented in Appendix H.
Flora and Fauna Guarantee Act 1988	**Fauna species and communities** Two FFG Act listed species were observed during the field assessment in 2019 (Grey-crowned Babbler and Diamond Firetail). Both species have relatively few records within the Gunbower National Park. In total 26 FFG Act species are predicted as possible to occur, or previously recorded within the construction footprint or inundation area (VBA, PMST, Biosis 2014, GHD 2017). All species have been recorded within 10 km of the construction footprint, and utilise habitats such as those found within the construction footprint. None of these species are considered likely to be significantly impacted by the proposed construction, although localised impacts on hollow-dependent species such as the Squirrel Glider are possible. Most are highly mobile bird species and all have access to large areas of suitable habitat in the immediate surrounding areas in which to disperse. General mitigation measures to avoid the removal of hollow bearing trees, and the presence of an on-site ecologist with Management Authorisation under the *Wildife Act 1975* will reduce impacts to any threatened fauna species present. Nine fish species listed under the FFG Act (Silver Perch, Murray Hardyhead, Unspecked Hardyhead, Flat-headed Galaxias, Murray Cod, Trout Cod, Macquarie Perch, Murray-Darling Rainbowfish and Freshwater Catfish) have been identified as potentially occurring in the project area. Of these, only Silver Perch, Unspecked Hardyhead, Murray Cod, Trout Cod, Murray-Darling Rainbowfish and Freshwater Catfish are present or likely to be present in the project area including in the Murray River and National Channel (Gunbower Creek). Of these only Unspecked Hardyhead and Murray-Darling Rainbowfish are present within floodplain wetlands. Impacts to these species are considered likely to be low. Mitigation measures are proposed for construction works that will minimise risks. Operating scenarios for the project include strategies to minimise impacts during managed events including

	timing of inundation to prevent development of hypoxic blackwater and managing drawdown to prevent fish becoming stranded on the floodplain or within semi-permanent wetlands. Screens on pumps on the Murray River and National Channel (Gunbower Creek) will also prevent large-bodied fish from being stranded in unsuitable habitat. Potential exposure to poor water quality will be managed through timing inundation to cooler periods, monitoring of potential blackwater and management of return flows to the Murray River that maximise dilution potential. A construction specific aquatic fauna management plan should be developed for all works around waterways. With these mitigation measures impacts are considered unlikely. Fish passage is planned to to be provide at Cameron's Creek to maintain connectivity for small bodied fish which will improve habitat connectivity (Stuart 2020). The FFG Act listed Broad-shelled Turtle has also been recorded extensively throughout the broader Gunbower region, with habitat limited to deep-pooled water of the Murray River. Again, consideration of any in-stream works such as coffer dam construction, dewatering works, and any potential for sediment/ contaminant run-off into wet areas from construction footprint must consider the Broad-shelled Turtle. A construction specific aquatic fauna management plan should be developed for all works around waterways. With these mitigation measures impacts are considered unlikely. Two FFG Act listed fauna communities are considered to occur within the project area: The VTWBC and LRFC. Impacts to the VTWBC community are likely to be negligible as Gunbower National Park project area is comprised largely of intact vegetation and the proposed construction of floodplain infrastructure is unlikely to impact on habitat connectivity or remove important habitat for the VTWBC. The proposed inundation of floodplain and wetland habitats however, is likely to provide important future benefits to the VTWBC particularly under climate change scenarios of longer, dryer conditions in a semi-arid environment. Other than VTWBC, no other threatened fauna communities listed under the FFG Act are likely to occur within the construction footprint or inundation area. It is recommended that efforts should be made to avoid and minimise impacts to any species and/or communities listed as threatened or protected under the FFG Act during the design and construction phases of the project. General mitigation measures to avoid the removal of hollow bearing trees, and the presence of an on-site ecologist with Management Authorisation under the *Wildife Act 1975* will reduce impacts to any FFG Act listed fauna species. The LRFC was identified as occurring entirely within the Murray River as no semi-permenent wetlands present in the project area would support these fish species. With mitigation measures as outlined in section 9, including use of only partial coffer dams to maintain fish passage and sediment control detailed in a specific Aquatic Fauna Management Plan Consideration, it is unlikely that there will be any significant impacts to the community. **Flora species** Three FFG Act listed threatened flora species were recorded during targeted surveys in the area of investigation in 2019 and in previous assessments (Biosis 2014a, GHD 2017), however two, Umbrella Wattle and Buloke are considered to be possible as occurring in the construction footprint. These species have the potential to be impacted by the proposed works, and an FFG Act Permit would be required for their removal. construction footprint One flora species listed under the FFG Act (Wavy Marshwort) has been previously identified within the study area (Biosis, 2014). Given the size of the site and the extensive areas of native vegetation identified within the construction footprint it is

	anticipated that protected flora species will not be impacted by the proposed works. As an obligate wetland species Wavy Marshwort is likely to benefit from the restoration works. A permit should be sought for the removal of species listed as protected under the FFG Act. It is recommended that efforts should be made to avoid and minimise impacts to threatened and protected flora species listed as threatened or protected under the FFG Act during the design and construction phases of the project. Species that are not permitted to be removed, must be fenced off with temporary one metre high orange barrier mesh medium-heavy weight prior to construction commencing.
Wildlife Act 1975	Any persons engaged to remove, salvage, hold or relocate native fauna during construction must hold a current Management Authorisation under the *Wildlife Act 1975* (e.g. if hollow-bearing trees are removed or fauna are rescued from open trenches during construction). The permit needs to be obtained prior to construction, and the name of the ecologists/ company who are undertaking fauna management for the Project.
Catchment and Land Protection Act 1994	Seven weeds listed under the CaLP Act have been recorded within the construction footprint (refer Appendix K). Mitigation measures to prevent the spread of these species (and any other WONS or CaLP Act listed weed species) will need to be incorporated into a CEMP.
Fisheries Act 1995	The *Fisheries Act 1995* (Fisheries Act) provides a legislative framework for the regulation, management and conservation of Victorian fisheries. A person must not take fish from marine waters or inland waters; or use or possess recreational fishing equipment in or next to Victorian water unless authorised to do so by a licence. Section 119 of the Fisheries Act requires that a person must not create an obstruction across a watercourse or water body that would obstruct the free passage of fish, leave fish stranded, or destroy immature fish without authorisation under the Act. Design, construction and operation of the project should seek to avoid creating obstructions to fish passage, otherwise authorisation may be required under the Fisheries Act. If the capture, handling or translocation of fish is required during construction (e.g. dewatering work sites) or operation of the project, persons undertaking these activities will need to hold the appropriate permit or licence under the Fisheries Act.
Environment Protection Act 1970	The *Environment Protection Act 1970* empowers the Environment Protection Authority Victoria (EPA Victoria) to implement regulations, maintain State Environment Protection Policies (SEPPs) and protect the environment from pollution and the management of wastes. The *Environmental Protection Act* (1970) allowed for the establishment of the *State Environmental Protection Policy (Waters) (SEPP Waters)*, which applies to all surface waters, estuarine and marine waters and groundwaters across the State (Vic. Gov. 2018). Relevant clauses of this policy must be adhered to. The following clauses (with a brief description of relevant aspects) are applicable to the project. Clause 40 – Management of instream works ▪ A person undertaking works in or adjacent to surface waters must minimise risks to beneficial uses. ▪ Minimise unnatural erosion, sediment re-suspension and other risks to aquatic habitat. ▪ Ensure that existing and new in situ structures do not pose a barrier to fish movement. Clause 42 - Construction activities

	▪ Minimise soil erosion, land disturbance and discharge of sediment and other pollutants to surface waters ▪ Where construction activities impinge on surface waters, construction managers need to monitor affected surface waters to assess whether beneficial uses are being protected Clause 45 – Native vegetation protection and rehabilitation ▪ Minimise the removal of and rehabilitate native vegetation within or adjacent to surface waters.
Water Act 1989	The *Water Act 1989* provides legislative framework for the allocation and management of water. A Works-on-Waterways permit is required to construct works on a waterway identified under section 67 of the Water Act. The permit must be approved by North Central CMA.
NSW State legislation	**Relevance to project**
Biodiversity Conservation Act 2016	The Biodiversity Conservation Act 2016 (BC Act) provides for the protection and management of biodiversity in NSW, including the conservation of threatened species, communities and habitats. The BC Act is administered by the Environment, Energy and Science Group (EESG) of the Department of Planning, Industry and Environment, formerly known as the Office of Environment and Heritage (OEH). An assessment under this Act is yet to be complete
Fisheries Management Act 1994	The *Fisheries Management Act 1994* (FM Act) provides for the conservation, protection and management of fisheries, aquatic systems and habitats in NSW. The Murray River in the project area has the potential to support five threatened fish (Silver Perch, Murray Hardyhead, Flat-headed Galaxias, Southern Pygmy Perch and Trout Cod), one threatened population (Murray-Darling Basin population of Freshwater Catfish) and one threatened ecological community (Lower Murray River aquatic ecological community) listed under Schedule 4, 4A and 5 of the FM Act. Impacts to these species are considered likely to be low. Mitigation measures are proposed for construction works that will minimise risks. Operating scenarios for the project include strategies to minimise impacts during managed events including timing of inundation to prevent development of hypoxic blackwater and managing drawdown to prevent fish becoming stranded on the floodplain or within semi-permanent wetlands. Screens on pumps on the Murray River and National Channel (Gunbower Creek) will also prevent large-bodied fish from being stranded in unsuitable habitat. Potential exposure to poor water quality will be managed through timing inundation to cooler periods, monitoring of potential blackwater and management of return flows to the Murray River that maximise dilution potential

11. Recommendations

The proposed Gunbower National Park Restoration project aims to inundate approximately 631 ha of floodplain and wetland habitats that support water dependent vegetation threatened by river regulation, on-going drought and a drying climate.

11.1 Next steps

R8 recommends the following next steps:

- Complete field assessment for Middle Gunbower (downstream of Deep Creek) and Camerons Creek pump station and pipeline in Upper Gunbower, including undertaking a Vegetation Quality Assessment (Habitat Hectare) and Large Tree mapping as well as targeted threatened species surveys in spring 2020. The results of this will update the ecological mapping in Appendix A and Appendix B, and Habitat Hectare data presented in Appendix H.
- Targeted surveys recommended for EPBC Act listed Sloane's Froglet during late winter 2020 and Growling Grass Frog during early summer 2020 in areas where the construction footprint intersects major waterways (Cameron's Creek, Deep Creek).
- Additional targeted surveys for EPBC Act and FFG Act species may be required to support Federal and State approval processes.
- Refine the construction footprint within the bounds of the 19.57 ha footprint utilising the existing ecological values mapping to avoid and minimise impacts to native vegetation and threatened flora/fauna and communities within the construction footprint.
- Engage with DELWP, discussing the proposed construction footprint and the efforts that have been made to avoid and minimise impacts to native vegetation during the preliminary and design phases of the project.
- Depending on the extent of impacts to areas of treed vegetation a qualified arborist may need to be engaged to determine the full extent of impacts to native trees (both within and immediately adjacent to the proposed construction footprint). This assessment would take in to account direct impacts to trees (tree removal) and indirect impacts to trees (through encroachment of their TPZs). An arborist assessment would also consider the individual tree location and habit, as well as specific characteristics of certain tree species where it's possible that individual trees will survive greater than 10% encroachment of their TPZs or the pruning of over 30% of the existing crown (the standard measures for determining indirect tree losses under the guidelines).
- Engage with DELWP, discussing the proposed approach for obtaining offsets for the project and whether the conservation works exemption or an alternative offset approach may apply to the works at Gunbower National Park. This approach may include the establishment of a vegetation condition monitoring regime within the proposed inundation area that would identify changes in condition to the vegetation within these areas that results from the environmental watering regime.
- Prepare an Offset Plan for the project – this will include a plan for obtaining the required offsets. This plan would support any application for planning approval to remove native vegetation under the *Planning and Environment Act 1987*.
- A CEMP should be developed for the project and implemented in full to further avoid and minimise impacts to areas of ecological value. A specific Flora and Fauna Management Plan should be developed as part of the CEMP which includes the avoidance, minimisation and mitigation measures as specified in section 9. The CEMP should be prepared once the footprint and construction methods for the proposed works have been finalised and should include provisions relevant to protecting the ecological values identified within the construction footprint (Appendix A and B).

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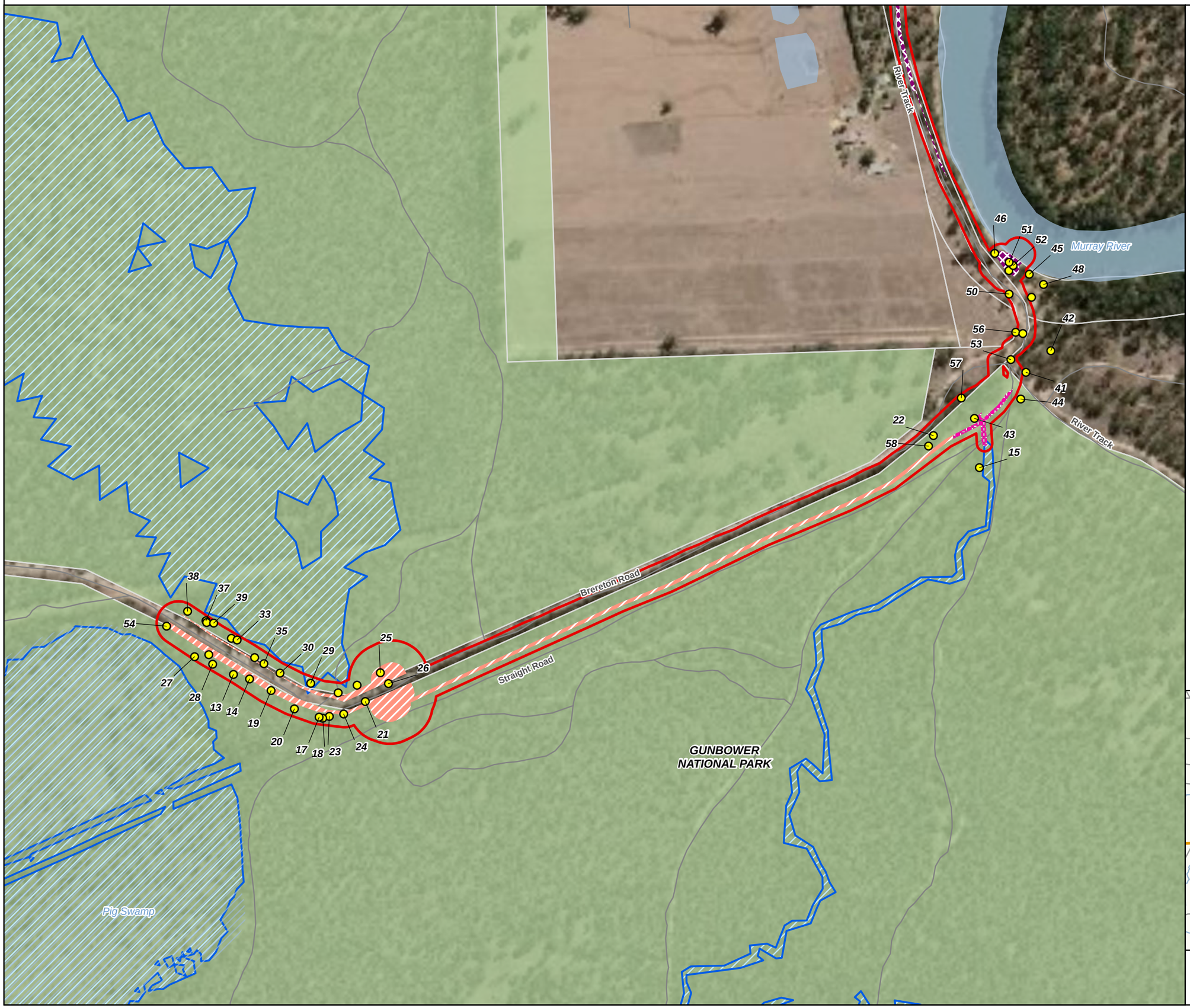
Appendix A. Ecological Vegetation Classes (EVCs) and Large Old Tree mapping in the construction footprint (GHD 2017 and R8 2019 field assessment)

Appendix A EVCs and Large Old Trees in construction footprint at Gunbower National Park (Field Assessment), Page 1 of 19

VMFRP



Legend

- Area of Investigation
- Inundation Area
- Large Old Trees, GHD

Vegetation Sumary - Construction Footprint

- Floodplain Riparian Woodland (EVC 56)
- Plains Woodland (EVC 803)
- Riverine Chenopod Woodland (EVC 103)
- Minor Road
- Waterbody
- Wetland Swamp
- Cadastre

Public Land Management

- NATIONAL PARK

IS297705

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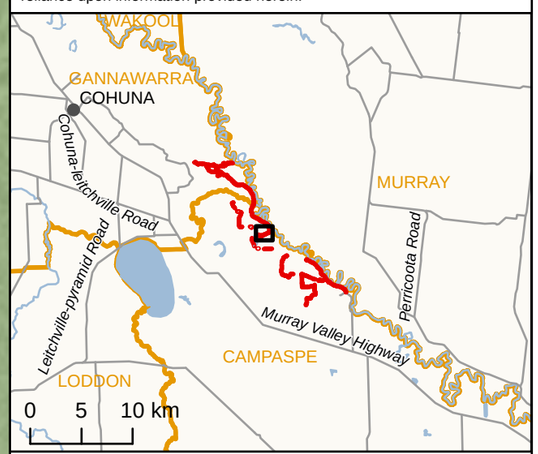
Metres

DATA SOURCES
© Commonwealth of Australia (Geoscience Australia) 2006 Geodata Topo 250k Series 3; Vicmap Data, DELWP © State of Victoria 2019; Jacobs & GHD 2019-2020.



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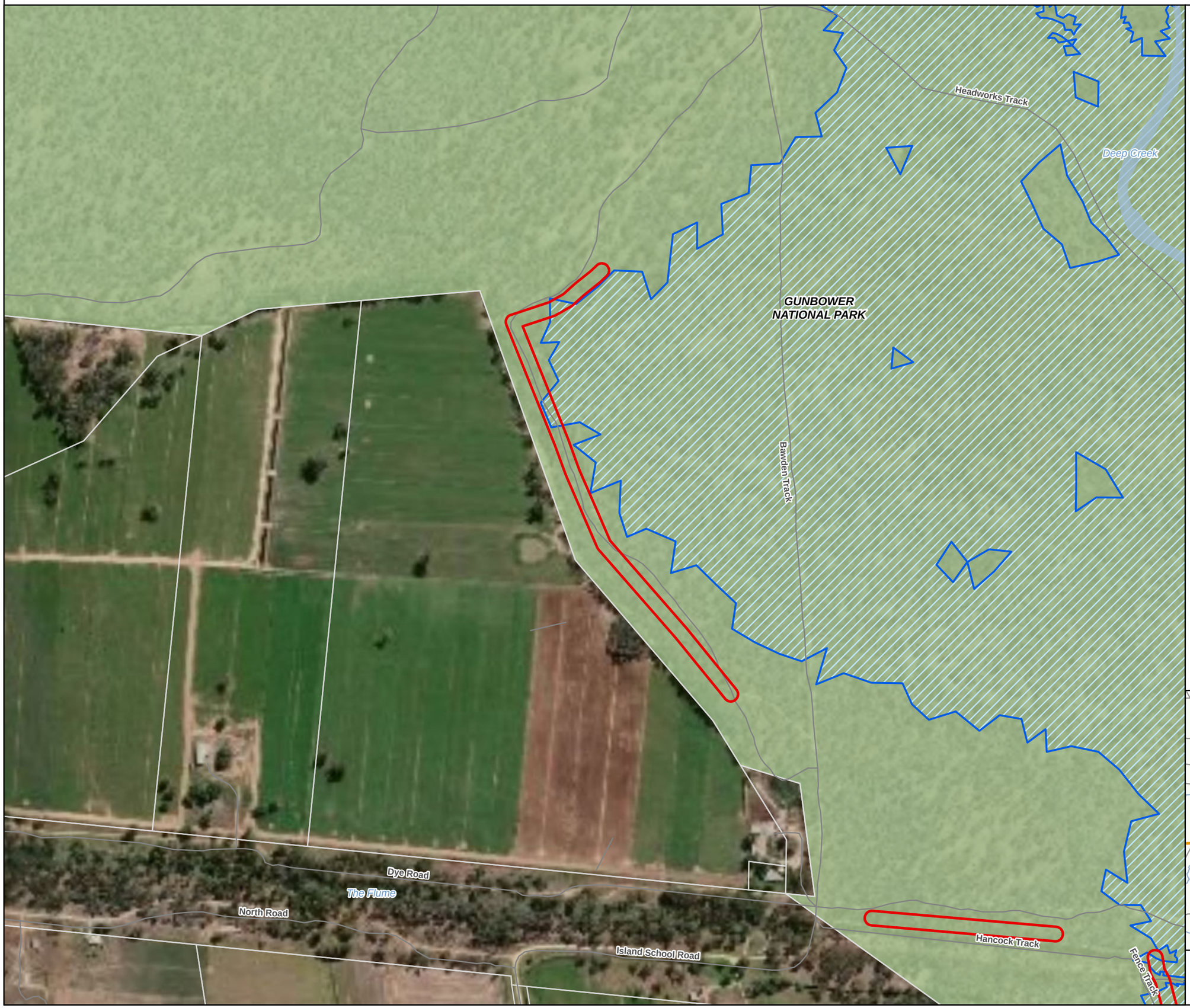
Appendix A EVCs and Large Old Trees in construction footprint at Gunbower National Park (Field Assessment), Page 2 of 19

VMFRP



Legend

- Area of Investigation
- Inundation Area
- Large Old Trees, GHD
- Minor Road
- Waterbody
- Cadastre

Public Land Management

- NATIONAL PARK

IS297705

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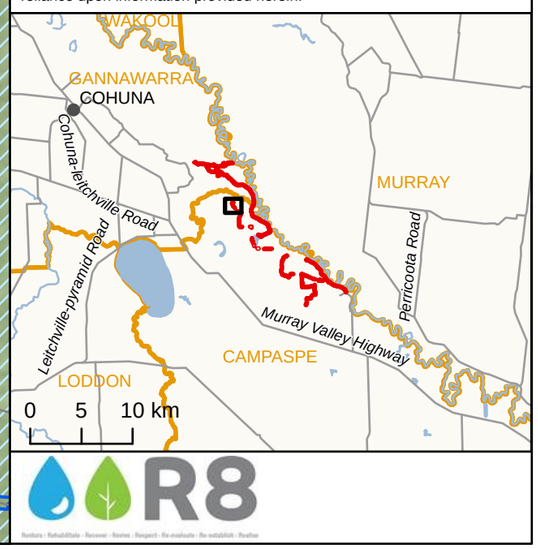
Metres

DATA SOURCES
© Commonwealth of Australia (Geoscience Australia) 2006 Geodata Topo 250k Series 3; Vicmap Data, DELWP © State of Victoria 2019; Jacobs & GHD 2019-2020.



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Appendix A EVCs and Large Old Trees in construction footprint at Gunbower National Park (Field Assessment), Page 3 of 19

VMFRP

Legend

- Area of Investigation
- Inundation Area
- Large Old Trees, GHD
- Minor Road
- Cadastre

Public Land Management

- NATIONAL PARK

IS297705

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Metres

DATA SOURCES

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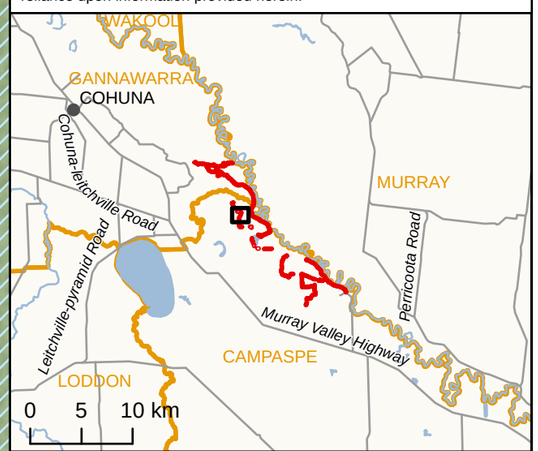

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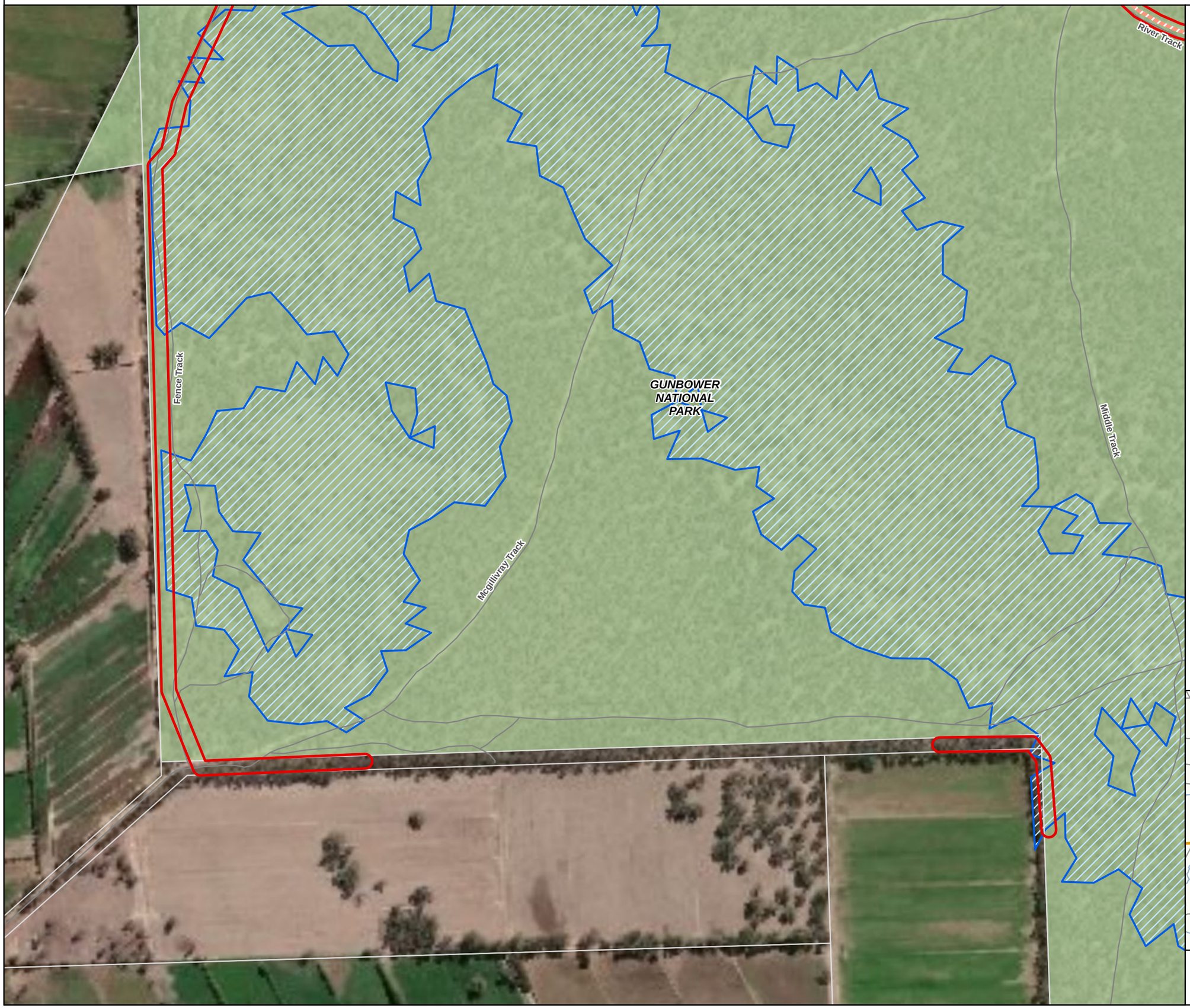

Legend

- Area of Investigation
- Inundation Area
- Large Old Trees, GHD

Vegetation Sumary - Construction Footprint

- Riverine Chenopod Woodland (EVC 103)
- Minor Road
- Cadastre

Public Land Management

- NATIONAL PARK

IS297705

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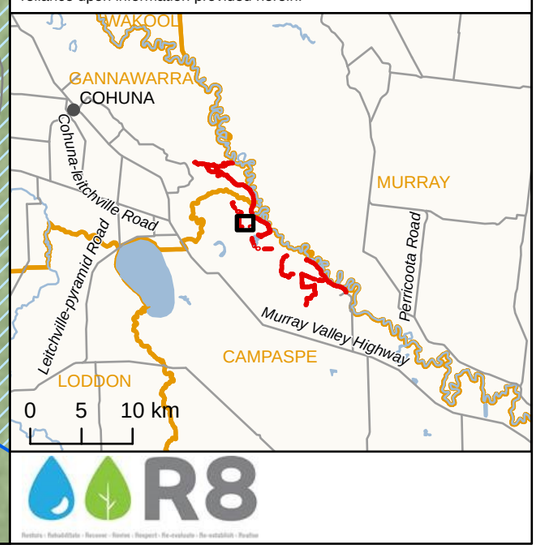

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Appendix A EVCs and Large Old Trees in construction footprint at Gunbower National Park (Field Assessment), Page 5 of 19

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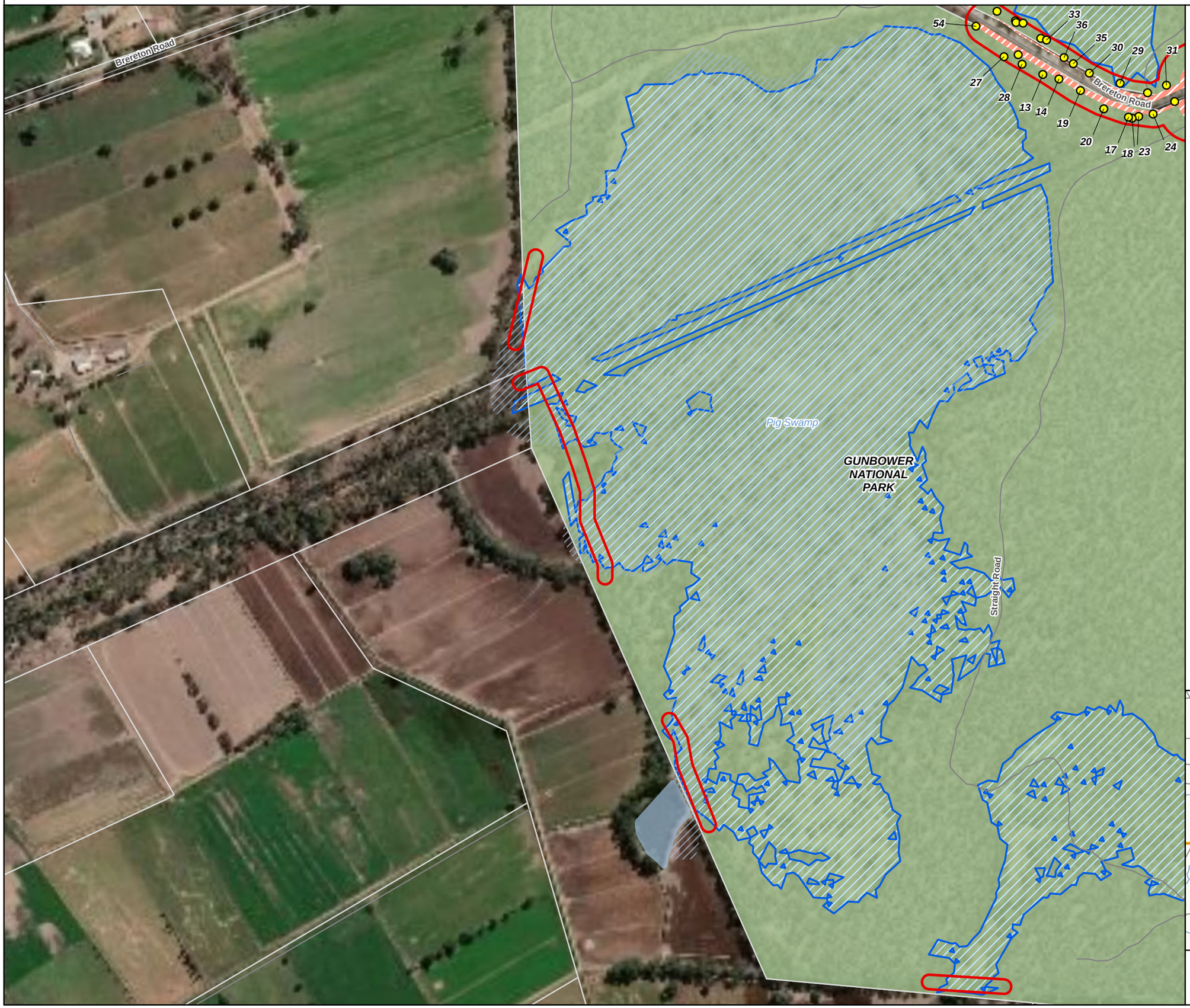

Legend

- Area of Investigation
- Inundation Area
- Large Old Trees, GHD

Vegetation Sumary - Construction Footprint

- Riverine Chenopod Woodland (EVC 103)
- Minor Road
- Waterbody
- Wetland Swamp
- Cadastre

Public Land Management

- NATIONAL PARK

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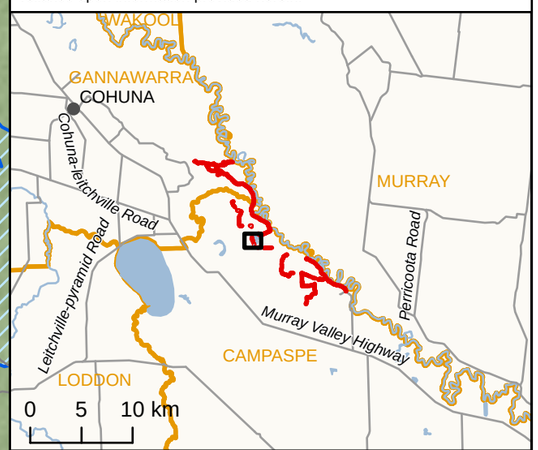

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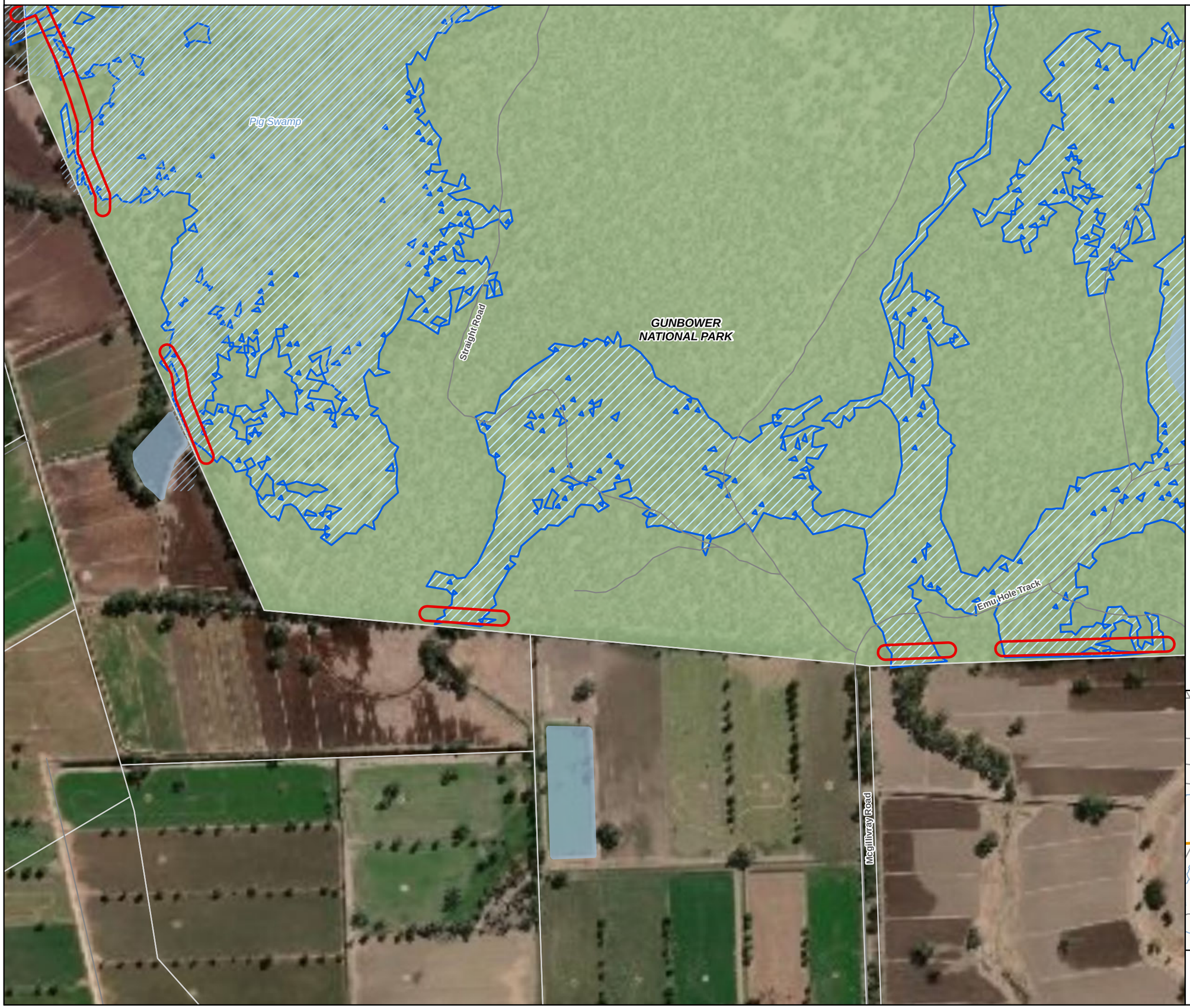

Legend

- Area of Investigation
- Inundation Area
- Large Old Trees, GHD
- Minor Road
- Waterbody
- Wetland Swamp
- Cadastre

Public Land Management

- NATIONAL PARK

IS297705

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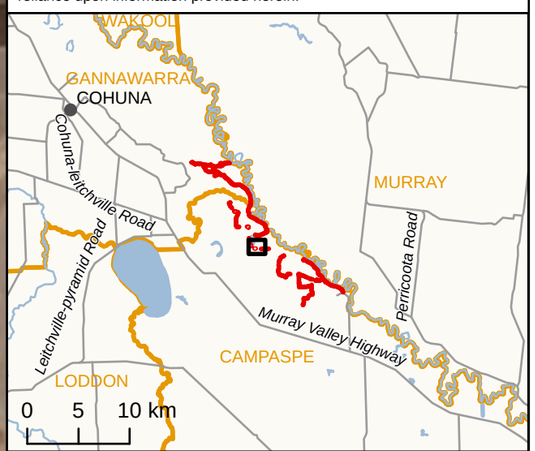

GUNBOWER NATIONAL PARK
Emu Hole Track
Bramley Track
Straight Road
Megillivray Road
Gunbower Island Road
Baggots Creek

Legend
- Area of Investigation
- Inundation Area
- Large Old Trees, GHD
- Minor Road
- Waterbody
- Cadastre

Public Land Management
- NATIONAL PARK

IS297705

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DATA SOURCES
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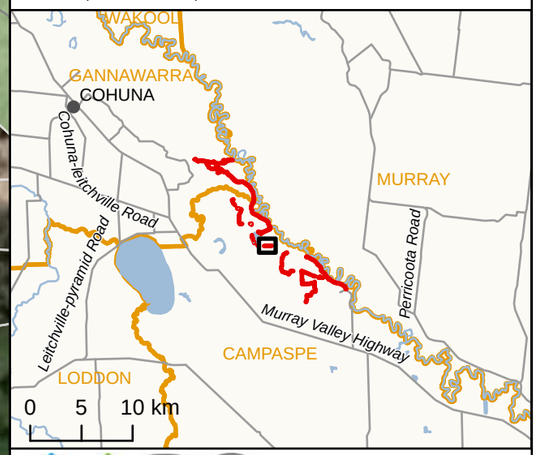

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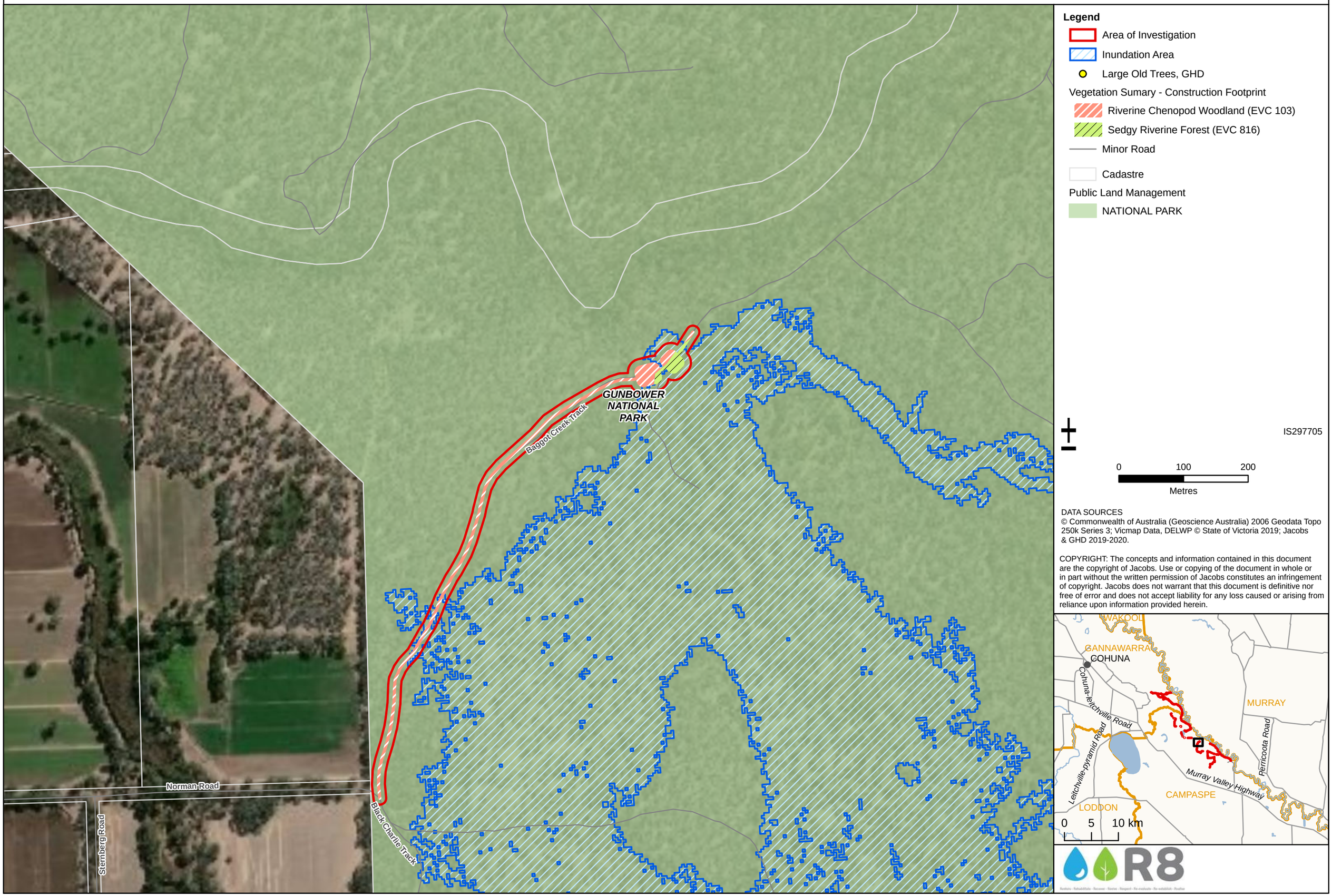

Legend

- Area of Investigation
- Inundation Area
- Large Old Trees, GHD

Vegetation Sumary - Construction Footprint

- Riverine Chenopod Woodland (EVC 103)
- Sedgy Riverine Forest (EVC 816)
- Minor Road
- Cadastre

Public Land Management

- NATIONAL PARK

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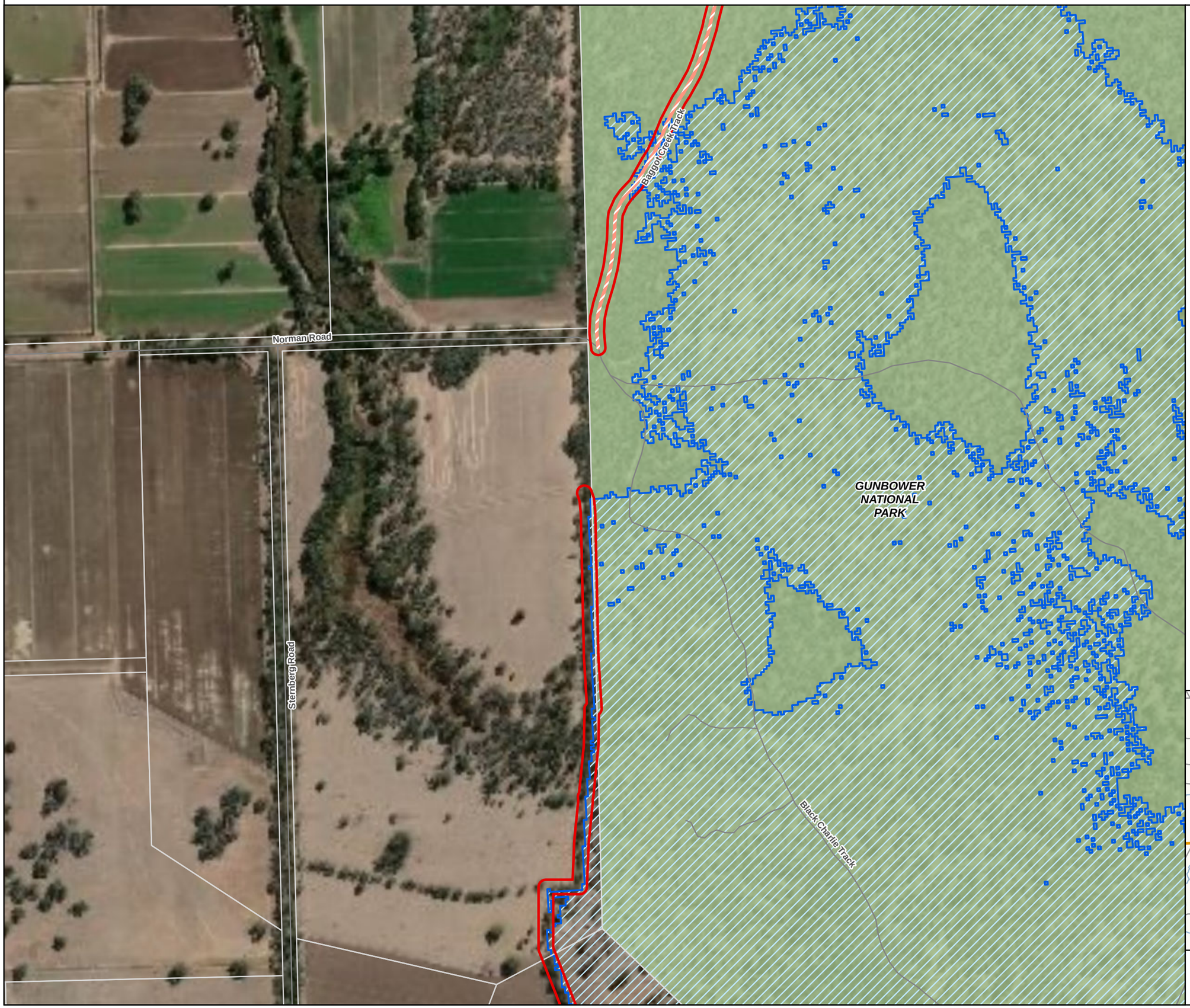

Legend

- Area of Investigation
- Inundation Area
- Large Old Trees, GHD

Vegetation Sumary - Construction Footprint

- Riverine Chenopod Woodland (EVC 103)
- Minor Road
- Cadastre

Public Land Management

- NATIONAL PARK

IS297705

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Metres

DATA SOURCES
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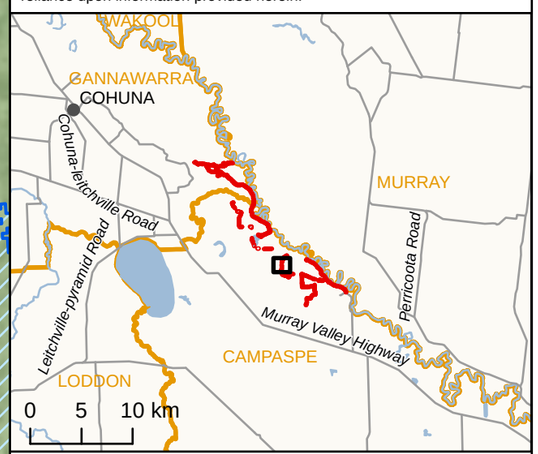
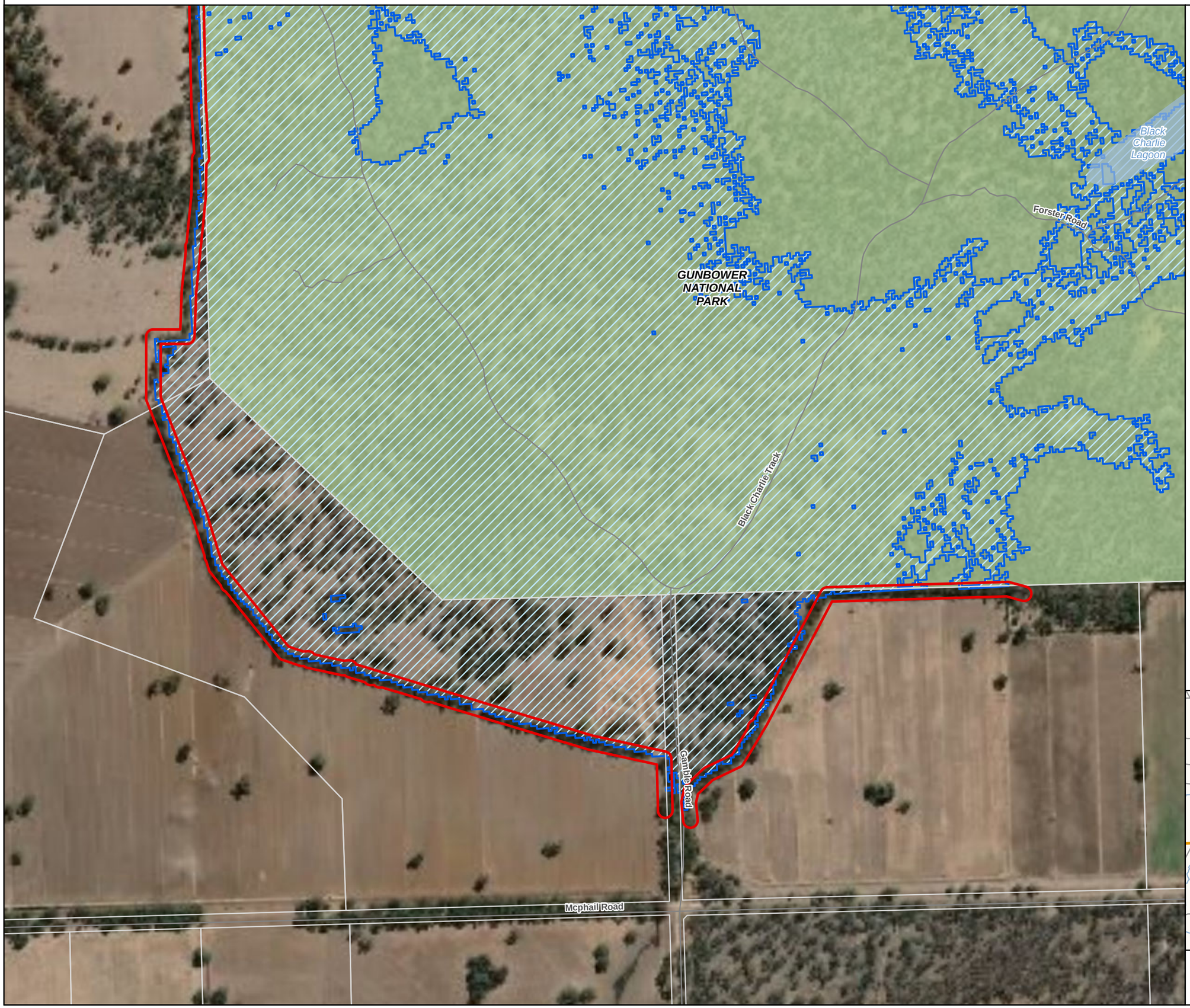


R8

Appendix A EVCs and Large Old Trees in construction footprint at Gunbower National Park (Field Assessment), Page 10 of 19

VMFRP



Legend

- Area of Investigation
- Inundation Area
- Large Old Trees, GHD
- Minor Road
- Waterbody
- Cadastre

Public Land Management

- NATIONAL PARK

IS297705

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Metres

DATA SOURCES
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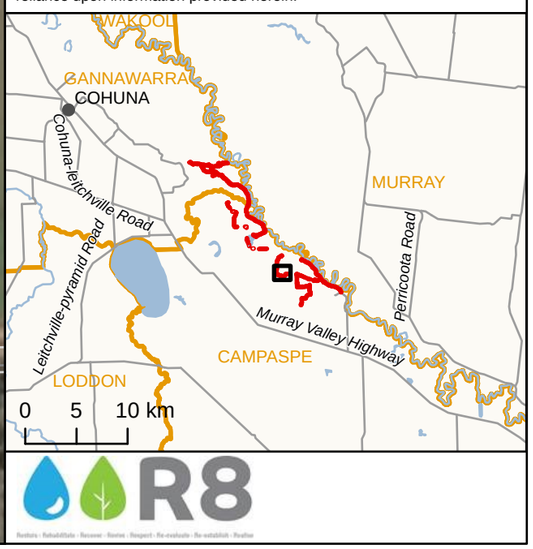

R8

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Lock Road
Lock Road
Murray River
River Track
Torrumbarry Weir Road
River Track
GUNBOWER NATIONAL PARK
Jimmy Williams Track

Legend

- Area of Investigation
- Inundation Area
- Large Old Trees, GHD

Vegetation Sumary - Construction Footprint

- Plains Woodland (EVC 803)
- Minor Road
- Waterbody
- Cadastre

Public Land Management

- NATIONAL PARK

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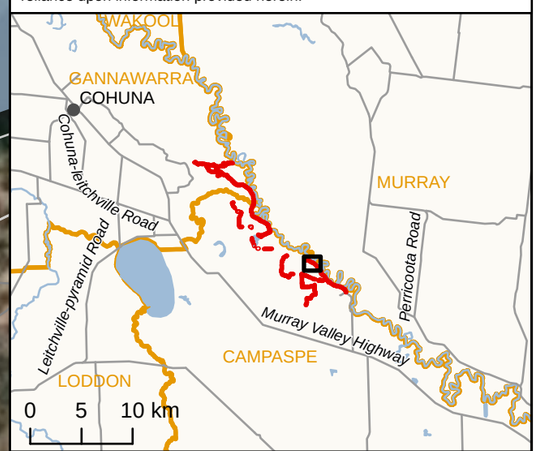
Metres



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Legend

- Area of Investigation
- Inundation Area
- Large Old Trees, GHD

Vegetation Sumary - Construction Footprint

- Floodplain Riparian Woodland (EVC 56)
- Plains Woodland (EVC 803)
- Riverine Chenopod Woodland (EVC 103)
- Minor Road
- Waterbody
- Cadastre

Public Land Management

- NATIONAL PARK

IS297705

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Metres

DATA SOURCES
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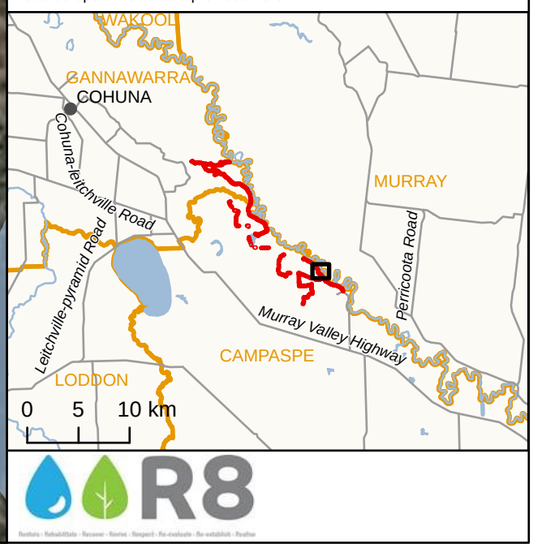

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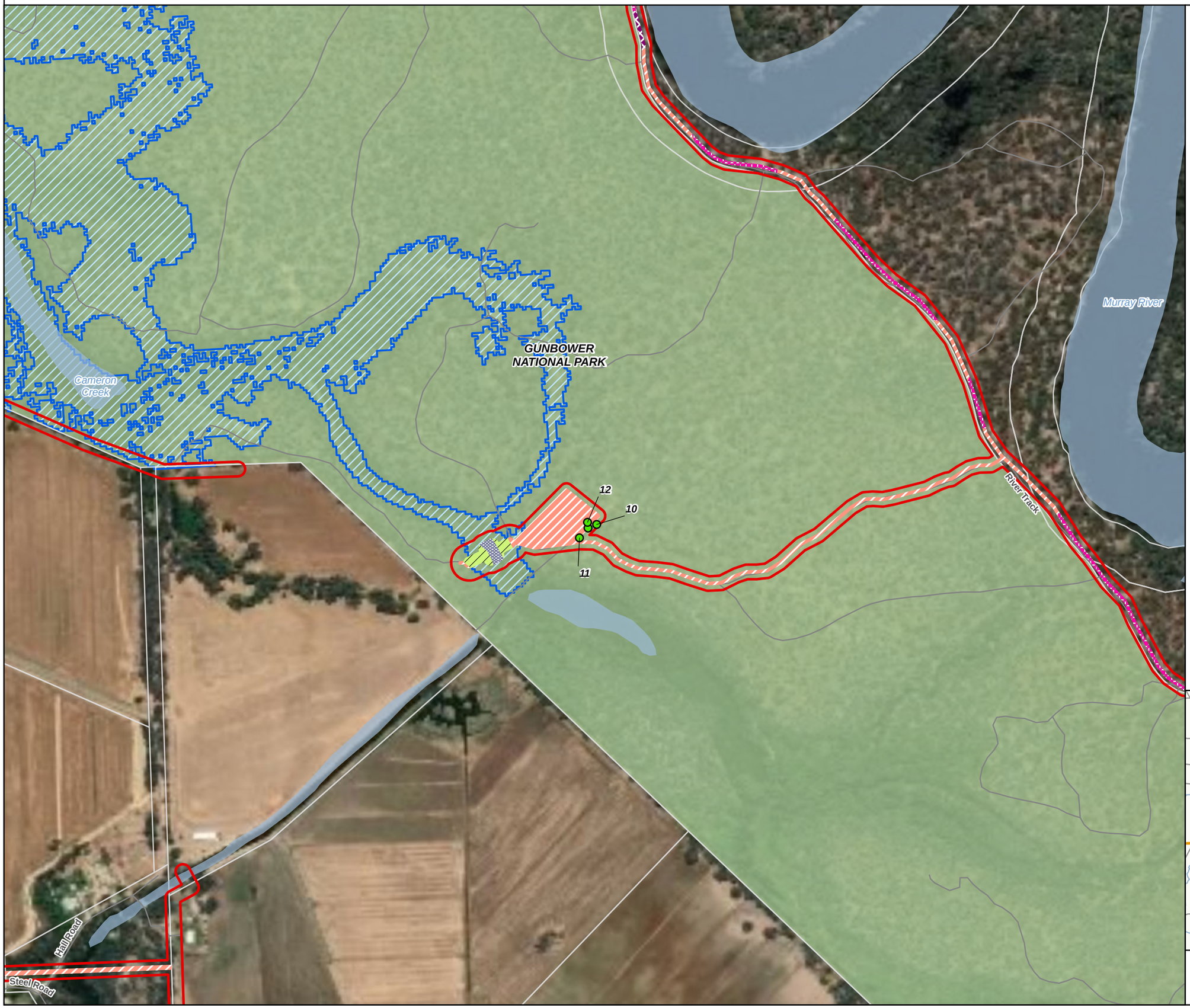

Legend

- Area of Investigation
- Inundation Area
- Large Old Trees, R8 2020
- Large Old Trees, GHD

Vegetation Sumary - Construction Footprint

- Floodplain Riparian Woodland (EVC 56)
- Plains Woodland (EVC 803)
- Riverine Chenopod Woodland (EVC 103)
- Sedgy Riverine Forest (EVC 816)
- Tall Marsh (EVC 821)
- Minor Road
- Waterbody
- Cadastre

Public Land Management

- NATIONAL PARK

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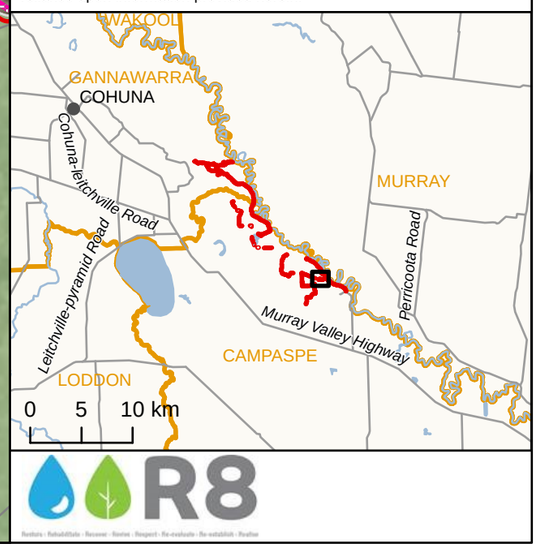

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Legend

- Area of Investigation
- Large Old Trees, R8 2020
- Large Old Trees, GHD

Vegetation Sumary - Construction Footprint

- Plains Woodland (EVC 803)
- Riverine Chenopod Woodland (EVC 103)
- Sedgy Riverine Forest (EVC 816)
- Minor Road
- Waterbody
- Cadastre

Public Land Management

- NATIONAL PARK

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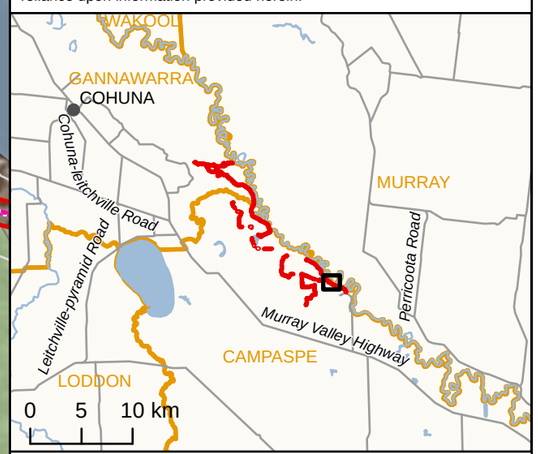

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GUNBOWER NATIONAL PARK
River Track
Murray River
Headworks Road
Headworks Road
Barge Road

Legend

- Area of Investigation
- Large Old Trees, GHD

Vegetation Sumary - Construction Footprint

- Plains Woodland (EVC 803)
- Major Road
- Minor Road
- Waterbody
- Cadastre

Public Land Management

- NATIONAL PARK

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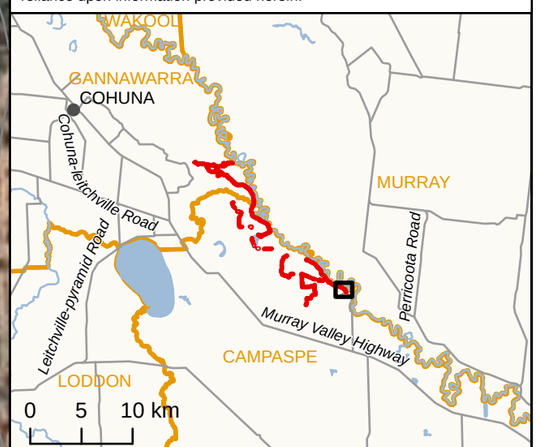

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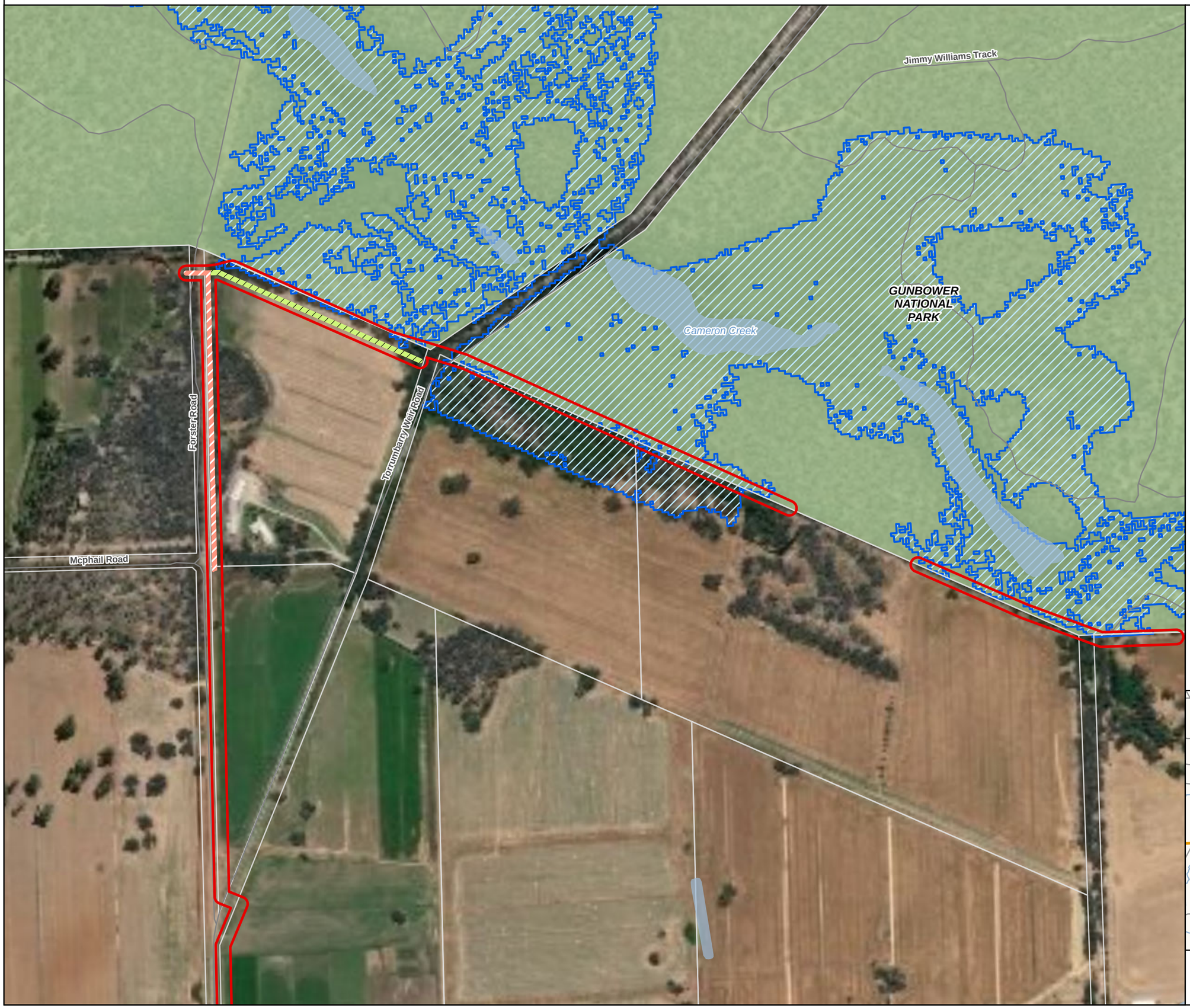


Legend

- Area of Investigation
- Inundation Area
- Large Old Trees, GHD

Vegetation Sumary - Construction Footprint

- Riverine Chenopod Woodland (EVC 103)
- Sedgy Riverine Forest (EVC 816)
- Minor Road
- Waterbody
- Cadastre

Public Land Management

- NATIONAL PARK

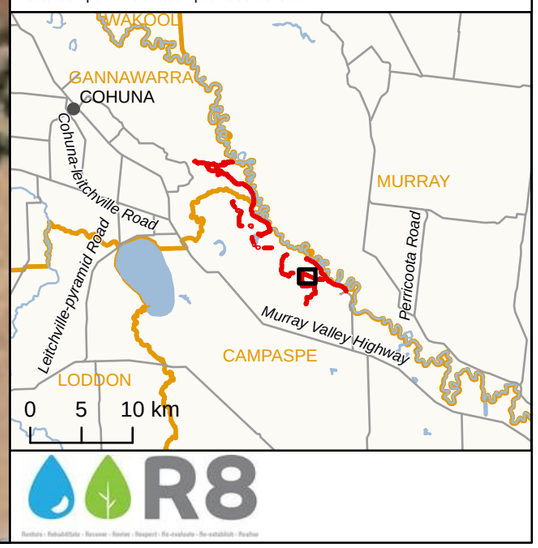
IS297705

0 100 200

Metres

DATA SOURCES

© Commonwealth of Australia (Geoscience Australia) 2006 Geodata Topo 250k Series 3; Vicmap Data, DELWP © State of Victoria 2019; Jacobs & GHD 2019-2020.



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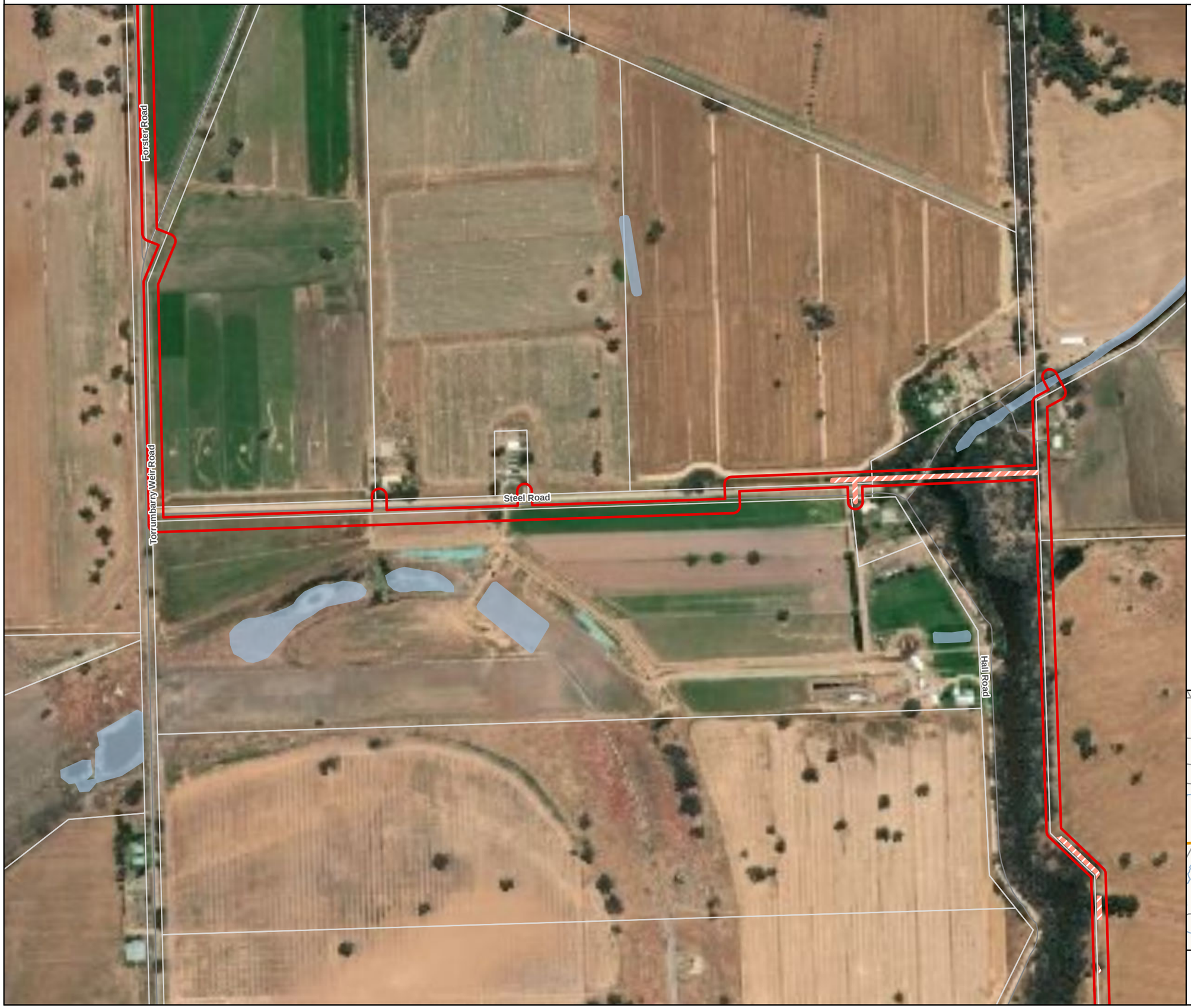


Legend

- Area of Investigation
- Large Old Trees, GHD

Vegetation Sumary - Construction Footprint

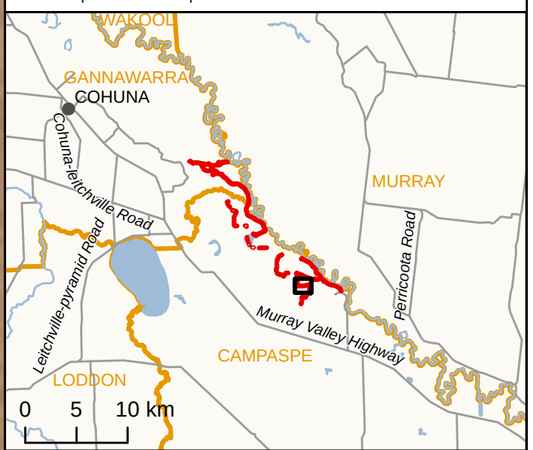
- Riverine Chenopod Woodland (EVC 103)
- Minor Road
- Waterbody
- Cadastre

IS297705

0 100 200

Metres

DATA SOURCES
© Commonwealth of Australia (Geoscience Australia) 2006 Geodata Topo 250k Series 3; Vicmap Data, DELWP © State of Victoria 2019; Jacobs & GHD 2019-2020.



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Steel Road

Hall Road

Headworks Road

Legend

- Area of Investigation
- Large Old Trees, GHD

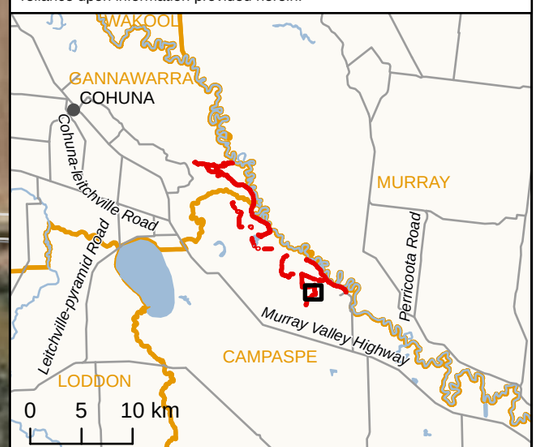
Vegetation Sumary - Construction Footprint

- Riverine Chenopod Woodland (EVC 103)
- Minor Road
- Waterbody
- Cadastre

IS297705

0 100 200

Metres



Appendix A EVCs and Large Old Trees in construction footprint at Gunbower National Park (Field Assessment), Page 19 of 19

VMFRP

Legend

- Area of Investigation
- Large Old Trees, GHD

Vegetation Sumary - Construction Footprint

- Riverine Chenopod Woodland (EVC 103)
- Minor Road
- Waterbody
- Cadastre

IS297705

0 100 200

Metres

DATA SOURCES

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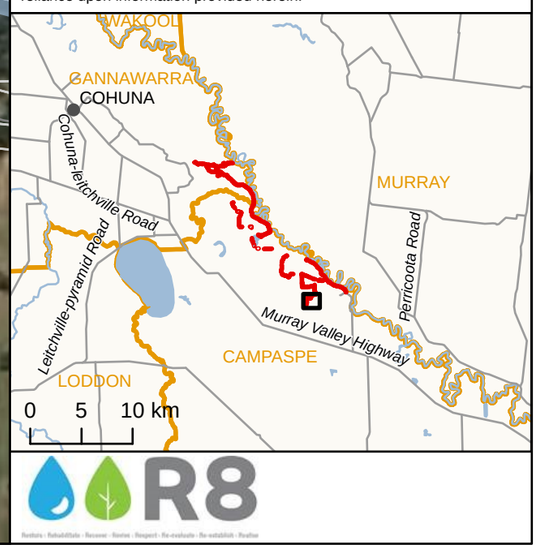

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