GOVERNMENT OF
WESTERN AUSTRALIA

CLEARING PERMIT

Granted under section 51E of the Environmental Protection Act 1986

Purpose Permit number:	CPS 9288/1
Permit Holder:	Shire of Cuballing
Duration of Permit:	From 21 April 2022 to 21 April 2037

The permit holder is authorised to clear *native vegetation* subject to the following conditions of this permit.

PART I – CLEARING AUTHORISED

1. Clearing authorised (purpose)

The permit holder is authorised to clear *native vegetation* for the purpose of road upgrades.

2. Land on which clearing is to be done

Cuballing East Road Reserve (PIN 11471986), Commodine
Cuballing East Road Reserve (PINs 11431009; 11431010; 11471955; 11471958; 11542350; 11523628), Cuballing
3. Cuballing East Road Reserve (PINs 11471957; 11471961; 11471963; 11471966; 11471968; 11471984; 11471985), Wandering

4. Clearing authorised

The permit holder must not clear more than 0.481 hectares of *native vegetation* within the area cross-hatched yellow in Figure 1 to Figure 17 of Schedule 1.

5. Period during which clearing is authorised

The permit holder must not clear any native vegetation after 21 April 2027.

PART II – MANAGEMENT CONDITIONS

6. Avoid, minimise, and reduce impacts and extent of clearing

In determining the *native vegetation* authorised to be cleared under this permit, the permit holder must apply the following principles, set out in descending order of preference:

(a) avoid the clearing of *native vegetation*;

(b) minimise the amount of *native vegetation* to be cleared; and

(c) reduce the impact of clearing on any environmental value.

7. Weed and dieback management

When undertaking any clearing authorised under this permit, the permit holder must take the following measures to minimise the risk of introduction and spread of *weeds* and *dieback*:

(a) clean earth-moving machinery of soil and vegetation prior to entering and leaving the area to be cleared;

(b) ensure that no known *dieback* or *weed*-affected soil, *mulch*, *fill*, or other material is brought into the area to be cleared; and

(c) restrict the movement of machines and other vehicles to the limits of the areas to be cleared.

8. Directional clearing

The permit holder must conduct clearing activities in a slow, progressive manner from the Cuballing East Road centreline towards the areas of closest adjacent *native vegetation* to allow fauna to move into the adjacent *native vegetation* ahead of the clearing activity.

9. Fauna management – black cockatoo habitat trees

(a) Within 48 hours of undertaking any clearing authorised under this permit within the combined areas cross-hatched yellow on Figure 1 to Figure 17 of Schedule 1, the permit holder must engage a *fauna specialist* to conduct a fauna survey to inspect the two trees (wpt025 and wpt032) identified in red in Figure 1 of Schedule 2 for:

  (i) suitability as a *black cockatoo habitat tree* for use as breeding by *black cockatoo species;* and

  (ii) evidence of current or past breeding use by *black cockatoo species.*

(b) For each tree characterised as suitable as a *black cockatoo habitat tree* by a *fauna specialist* in accordance with condition 9(a), the permit holder must install an artificial black cockatoo nest hollow.

(c) For each tree characterised as suitable as a *black cockatoo habitat tree* by a *fauna specialist* in accordance with condition 9(a) with no evidence of current or past use by *black cockatoo species* that tree must only be cleared immediately after the inspection.

(d) Where a *black cockatoo habitat tree* is identified with evidence of current or past breeding use by *black cockatoo species* under condition 9(a), and clearing of that tree cannot be avoided, that tree must be monitored by a fauna specialist to determine when it is no longer in use for that breeding season.

(e) Any *black cockatoo habitat tree* with evidence of current breeding use by *black cockatoo species* must not be cleared whilst it is in use for that breeding season as determined by the *fauna specialist* under condition 9(d).

(f) Any artificial black cockatoo nesting hollow required by condition 9(b) must be installed prior to commencement of the next black cockatoo breeding season following clearing of the related *black cockatoo habitat tree(s)*.

(g) Any artificial black cockatoo nest hollow(s) required by condition 9(b) of this permit must:

(i) be installed within the area cross-hatched blue on Figure 1 of Schedule 3;
(ii) be designed and placed in accordance with the specifications detailed in Schedule 4; and
(iii) be monitored and maintained in accordance with the specifications detailed in Schedule 5, for a period of at least ten years.

(b) Within two months of clearing authorised under this permit within the combined areas cross-hatched yellow on Figure 1 to Figure 17 of Schedule 1, the permit holder must provide the results of the fauna survey in a report to the *CEO*.

(c) The fauna survey report must include the following;

(i) the location of any *black cockatoo habitat tree(s)* recorded using a Global Positioning System (GPS) unit set to Geocentric Datum Australia 1994 (GDA94), expressing the geographical coordinates in Eastings and Northings or decimal degrees;
(ii) whether the *black cockatoo habitat tree/s* identified show current or past use by *black cockatoo species;*
(iii) the methodology, used to survey the permit area;
(iv) a photo of the *black cockatoo habitat tree(s)* identified; and
(v) a description of the *black cockatoo habitat tree(s)* identified, including the:

(A) species of *black cockatoo habitat tree(s)*; and
(B) condition of the *black cockatoo habitat tree(s)*.

10. Offset – Lot 434 on Deposited Plan 84296 (being Crown Reserve 2556)

(a) By 21 April 2023, the permit holder shall provide to the *CEO* a copy of the executed change in purpose of the area hatched red on Figure 1 of Schedule 6 within Lot 434 on Deposited Plan 84296 (Crown Reserve 2556) from 'Gravel' to 'Conservation'.

(b) In the event that the change in purpose of Lot 434 on Deposited Plan 84296 (being Crown Reserve 2556) is not achieved in accordance with condition 10(a):

(i) the permit holder must submit a new offset proposal for the *CEO*'s approval by 21 April 2023; and
(ii) in preparing an offset proposal in accordance with condition 10(b)(i), the permit holder must comply with the principles in the Government of Western Australia's *WA Environmental Offsets Policy* (September 2011) and have regard to the *WA Environmental Offsets Guidelines* (August 2014).

PART III - RECORD KEEPING AND REPORTING

11. Records that must be kept

The permit holder must maintain records relating to the listed relevant matters in accordance with the specifications detailed in Table 1.

Table 1: Records that must be kept

No.	Relevant matter	Specifications
1.	In relation to the authorised clearing activities generally	(a) the species composition, structure, and density of the cleared area; (b) the location where the clearing occurred, recorded using a Global Positioning System (GPS) unit set to Geocentric Datum Australia 1994 (GDA94), expressing the geographical coordinates in Eastings and Northings; (c) the date that the area was cleared; (d) the direction of clearing; (e) the size of the area cleared (in hectares); (f) actions taken to avoid, minimise, and reduce the impacts and extent of clearing in accordance with condition 5; and (g) actions taken to minimise the risk of the introduction and spread of *weeds* and *dieback* in accordance with condition 6.
2.	In relation to black cockatoo fauna management pursuant to condition 9	(a) the time(s) and date of inspection of the potential *black cockatoo habitat trees* by the *fauna specialist*; (b) a description of the inspection methodology employed by the *fauna specialist*; (c) details of any *black cockatoo habitat tree(s)* identified by the *fauna specialist;* (d) the time and date that any *black cockatoo habitat tree(s)* was cleared. (e) details of artificial black cockatoo nest hollows installed; (f) details of any *black cockatoo habitat tree(s)* identified by the *fauna specialist* to be occupied by *black cockatoo species* including: (i) time and date determined to be no longer occupied; and (ii) a description of the evidence by which it was determined to be no longer occupied (g) the time and date that any *black cockatoo habitat tree* was cleared.

12. Reporting

(a) The permit holder must provide to the *CEO,* on or before 31 December of each calendar year, a written report containing:

(i) the records required to be kept under condition 11; and

(ii) records of activities done by the permit holder under this permit between 1 July of the preceding calendar year and 30 June of the current calendar year.

(b) If no clearing authorised under this permit has been undertaken, a written report confirming that no clearing under this permit has been undertaken, must be provided to the *CEO* on or before 31 December of each calendar year.

(c) The permit holder must provide to the *CEO*, no later than 90 calendar days prior to the expiry date of the permit, a written report of records required under condition 11, where these records have not already been provided under condition 12(a).

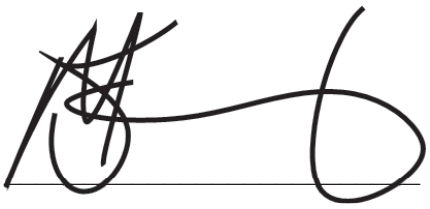
DEFINITIONS

In this permit, the terms in Table have the meanings defined.

Table 2: Definitions

Term	Definition
black cockatoo habitat trees	means trees that have a diameter, measured at 130 centimetres from the base of the tree, of 50 centimetres or greater (or 30 centimetres or greater for *Eucalyptus salmonophloia* or *Eucalyptus wandoo*) that contain hollows suitable for breeding by black cockatoo species.
black cockatoo species	means one or more of the following species: (a) *Calyptorhynchus lateriosis* (Carnaby's cockatoo); (b) *Calyptorhynchus baudinii* (Baudin's cockatoo); and/or (c) *Calyptorhynchus banksii naso* (forest red-tailed black cockatoo).
CEO	Chief Executive Officer of the department responsible for the administration of the clearing provisions under the *Environmental Protection Act 1986*.
clearing	has the meaning given under section 3(1) of the EP Act.
condition	a condition to which this clearing permit is subject under section 51H of the EP Act.
fauna specialist	means a person who holds a tertiary qualification specialising in environmental science or equivalent, and has a minimum of 2 years work experience in fauna identification and surveys of fauna native to the region being inspected or surveyed, or who is approved by the *CEO* as a suitable fauna specialist for the bioregion, and who holds a valid fauna licence issued under the *Biodiversity Conservation Act 2016*.
fill	means material used to increase the ground level, or to fill a depression.
dieback	means the effect of *Phytophthora* species on native vegetation.
department	means the department established under section 35 of the *Public Sector Management Act 1994* (WA) and designated as responsible for the administration of the EP Act, which includes Part V Division 3.
EP Act	*Environmental Protection Act 1986* (WA)
mulch	means the use of organic matter, wood chips or rocks to slow the movement of water across the soil surface and to reduce evaporation.
native vegetation	has the meaning given under section 3(1) and section 51A of the EP Act.
weeds	means any plant – (a) that is a declared pest under section 22 of the *Biosecurity and Agriculture Management Act 2007*; or (b) published in a Department of Biodiversity, Conservation and Attractions species-led ecological impact and invasiveness ranking summary, regardless of ranking; or (c) not indigenous to the area concerned.

END OF CONDITIONS



Mathew Gannaway
MANAGER
NATIVE VEGETATION REGULATION

Officer delegated under Section 20
of the Environmental Protection Act 1986

28 March 2022

Schedule 1 - The boundary of the areas authorised to be cleared is shown in the maps below (Figure 1 to Figure 17).

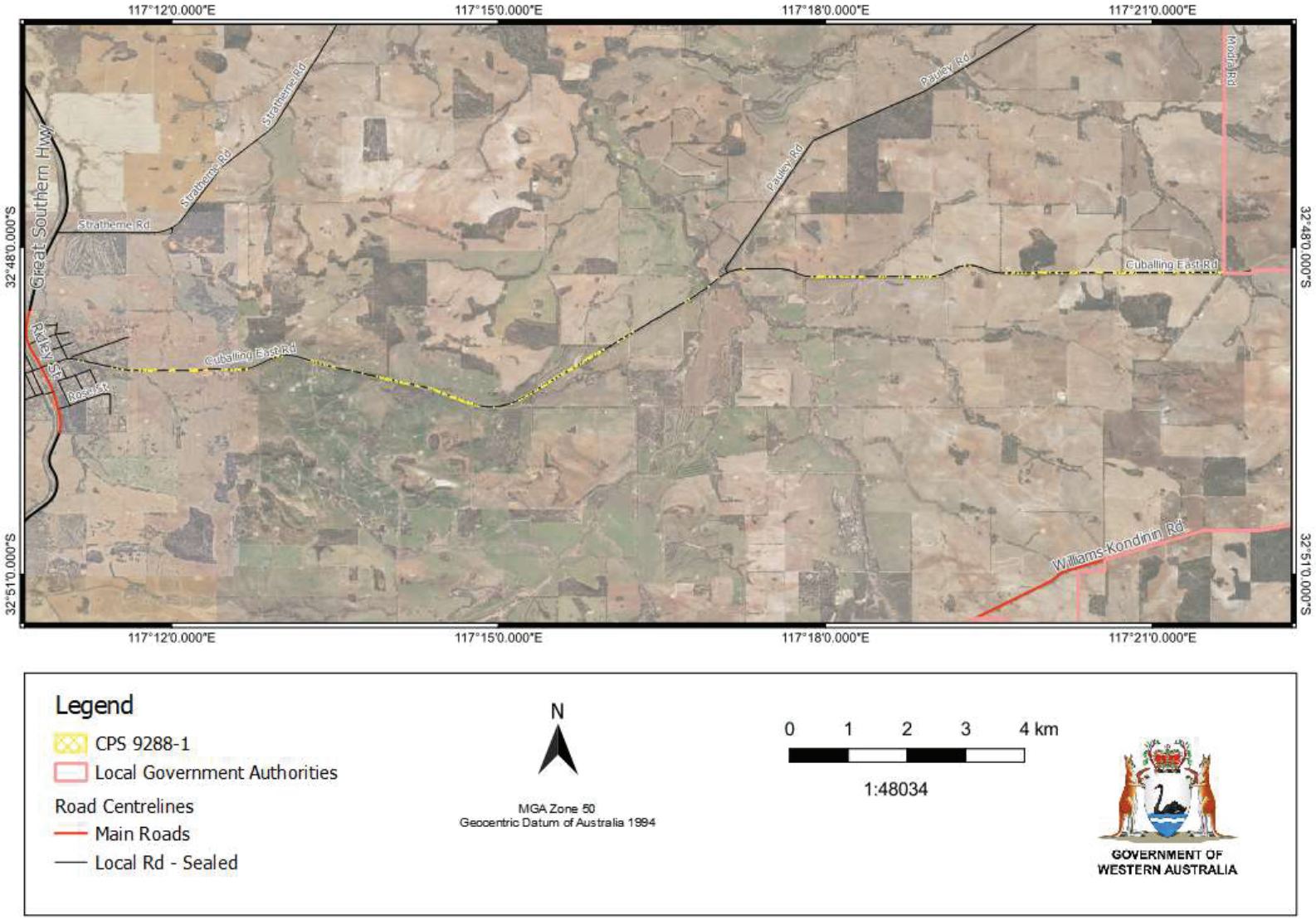


Figure 1: Context map of the application area

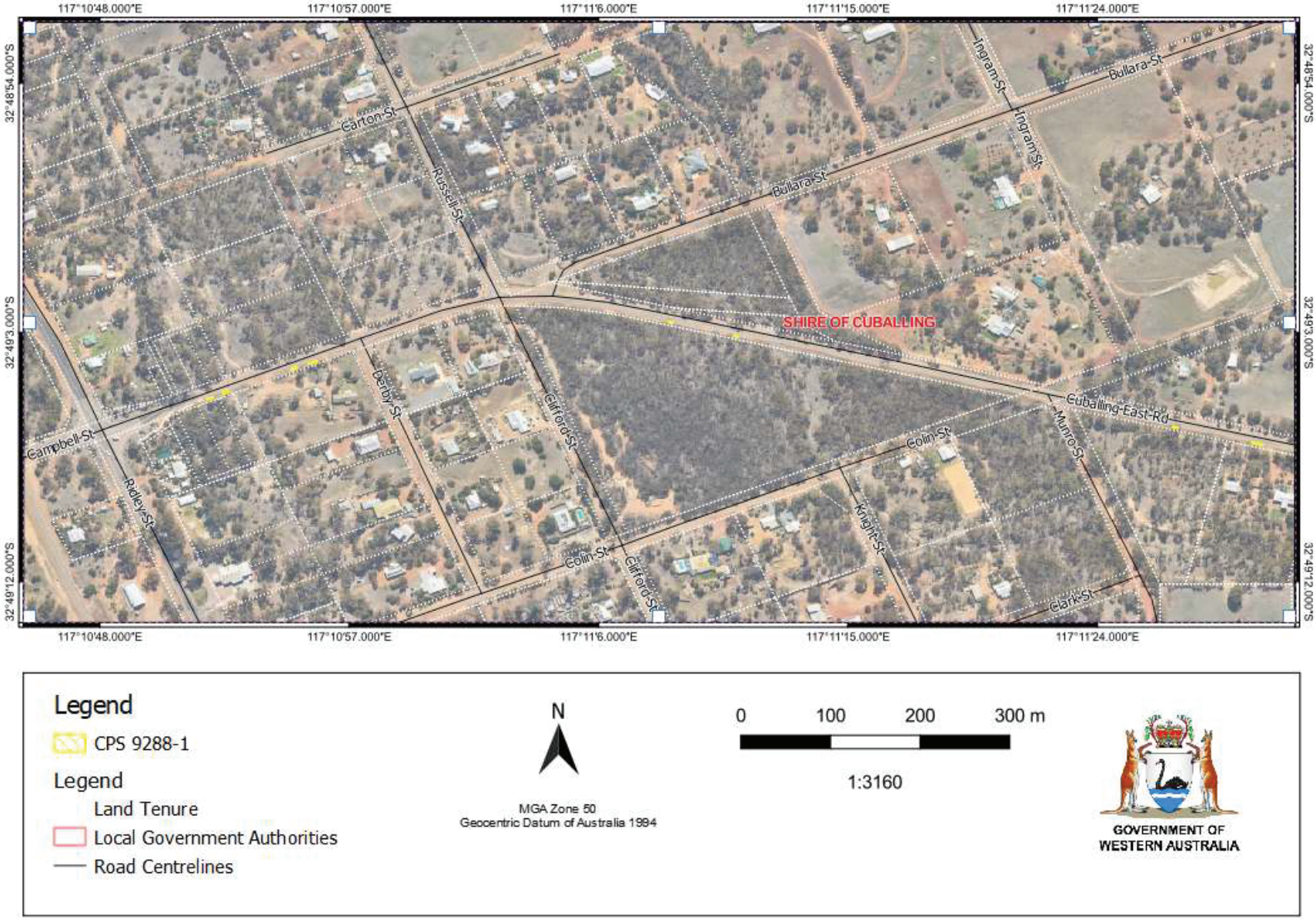


Figure 2: Map of the boundary of the area within which clearing may occur (A)

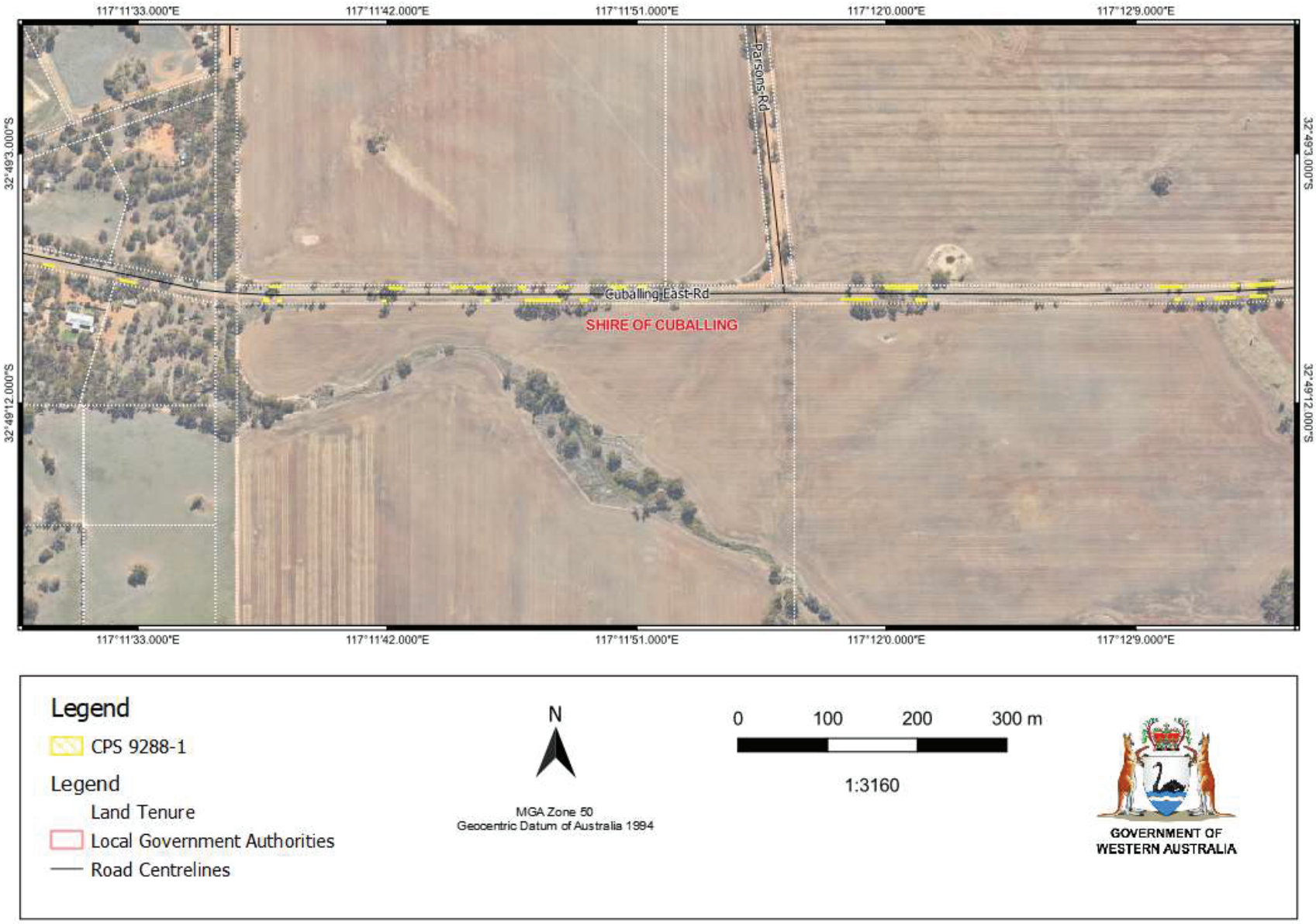


Figure 3: Map of the boundary of the area within which clearing may occur (B)

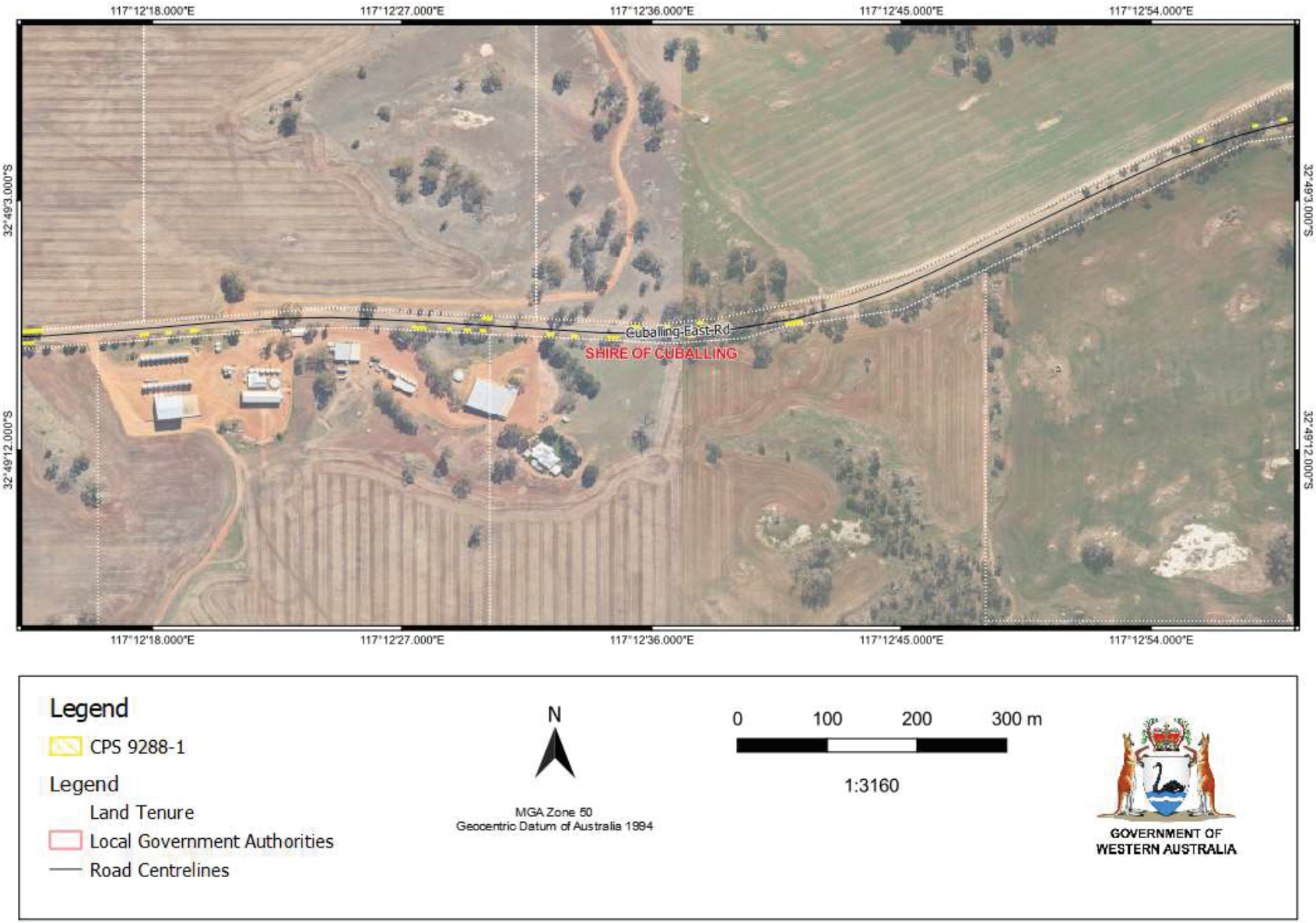


Figure 4: Map of the boundary of the area within which clearing may occur (C)

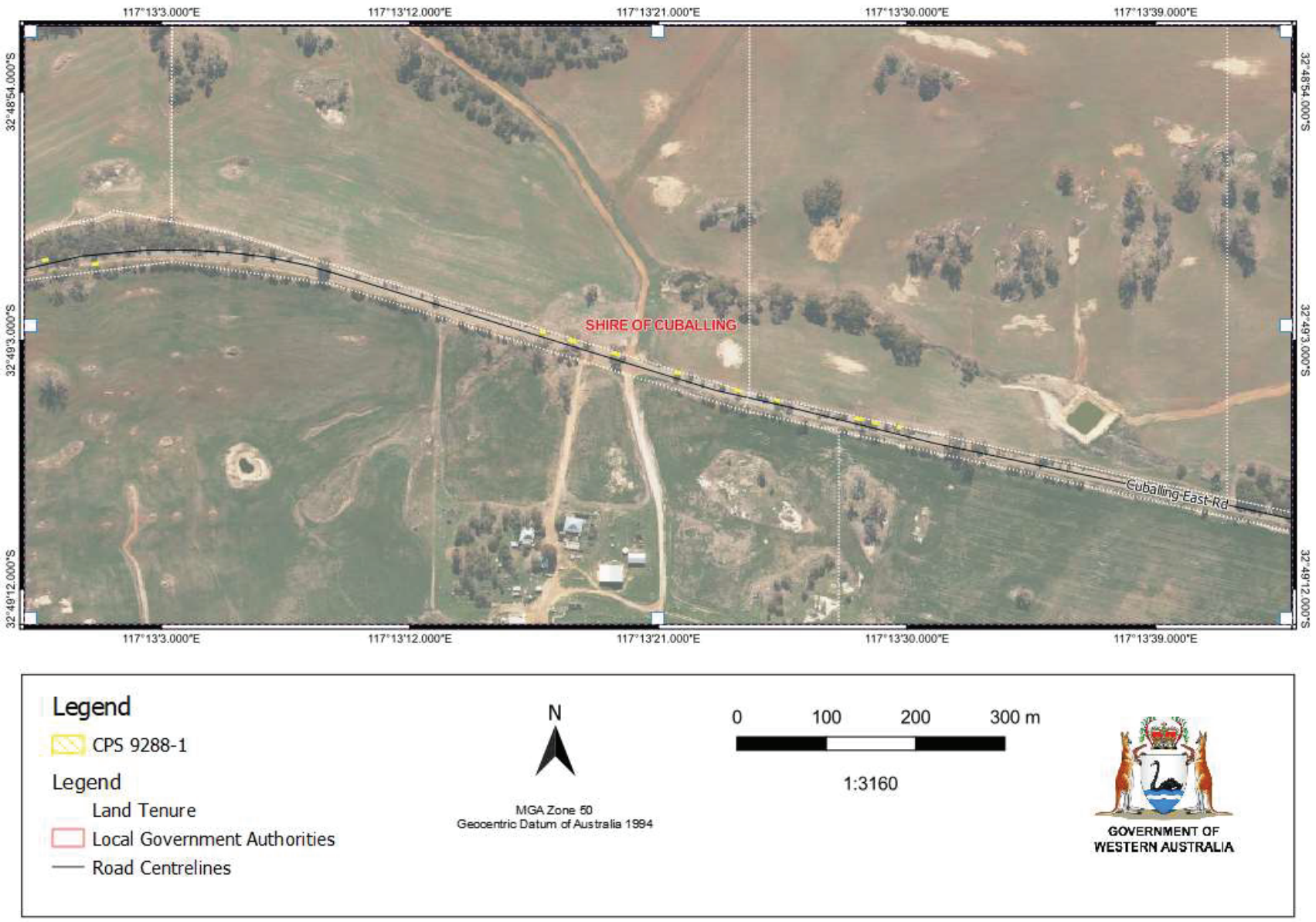


Figure 5: Map of the boundary of the area within which clearing may occur (D)

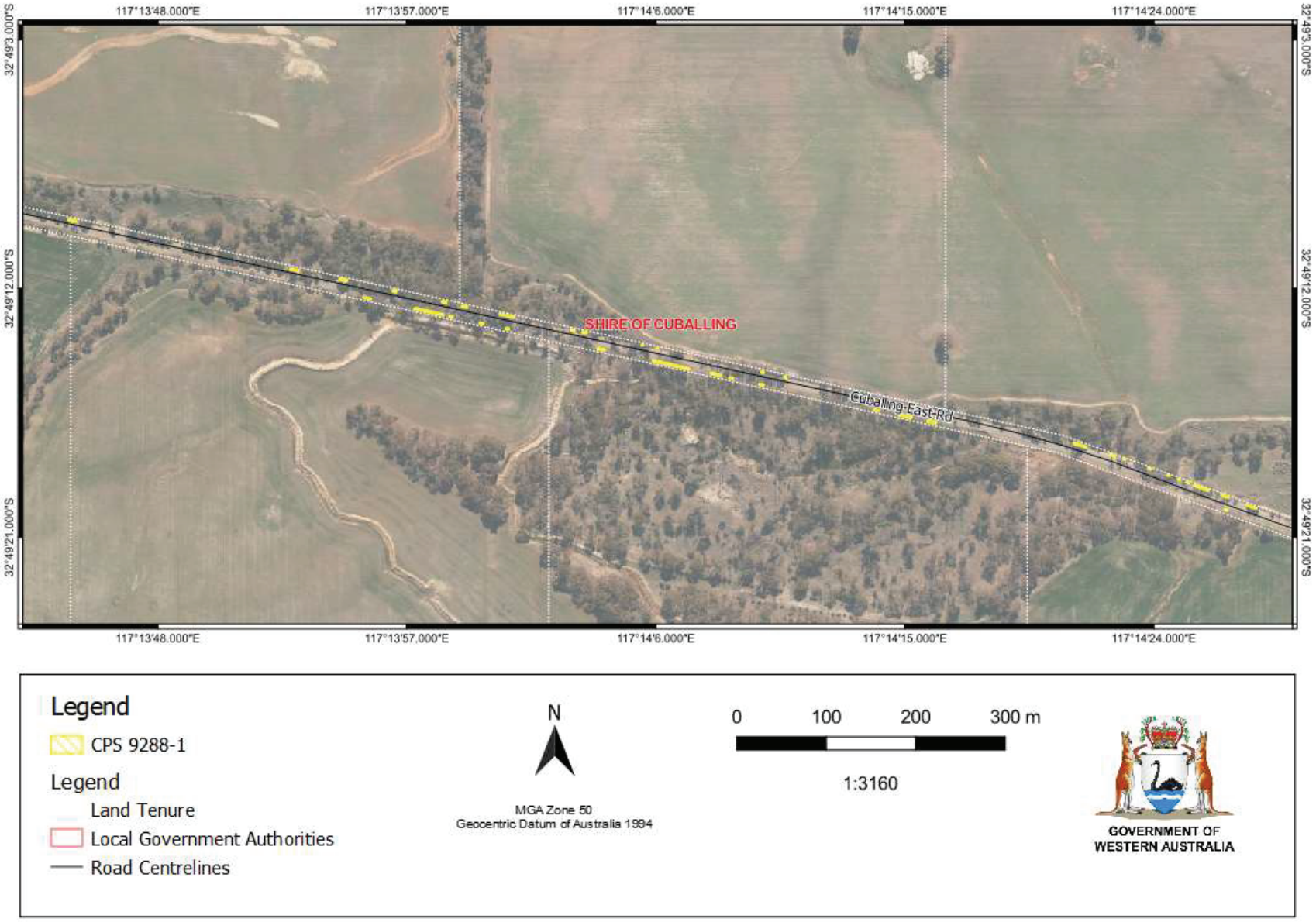


Figure 6: Map of the boundary of the area within which clearing may occur (E)

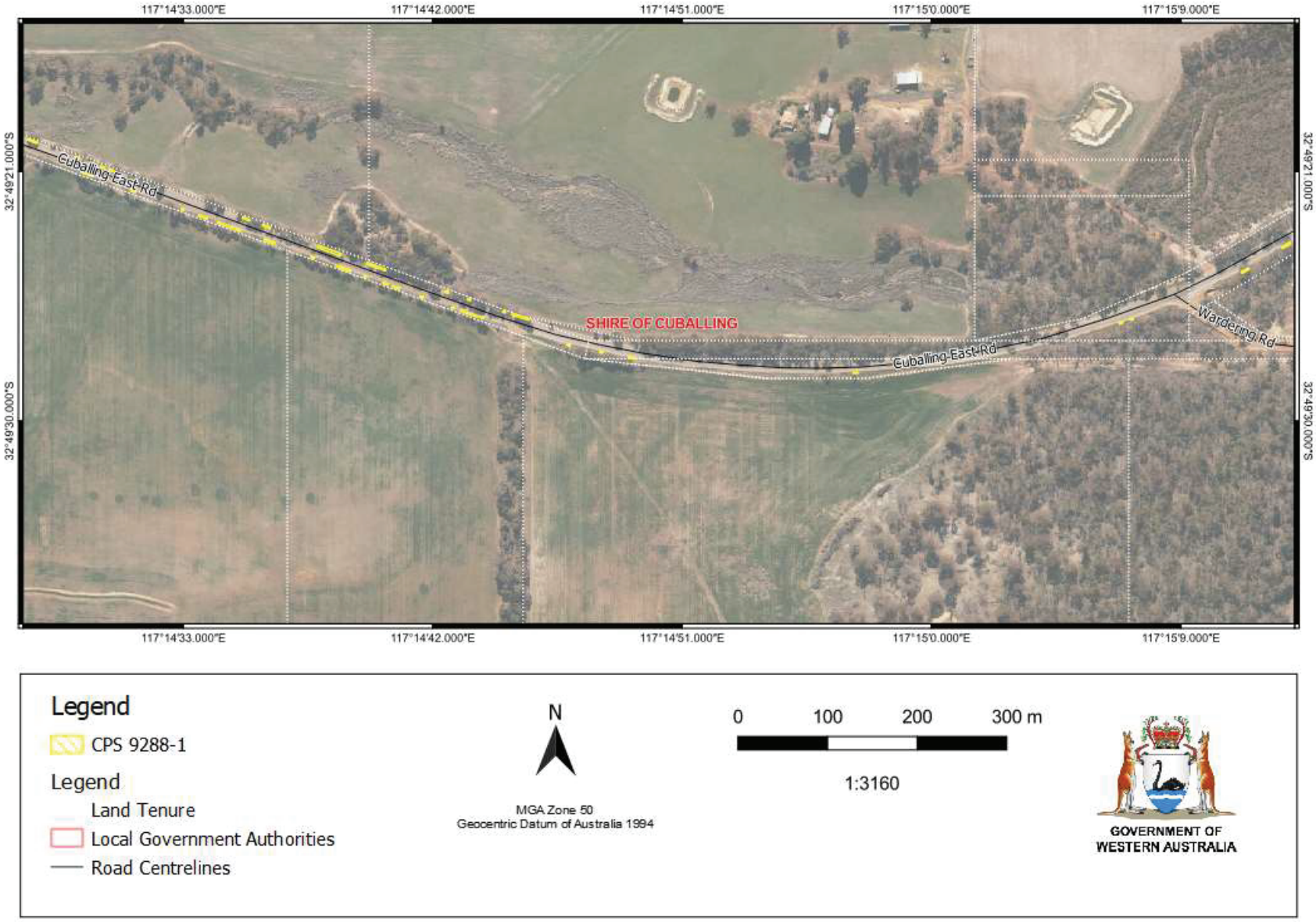


Figure 7: Map of the boundary of the area within which clearing may occur (F)

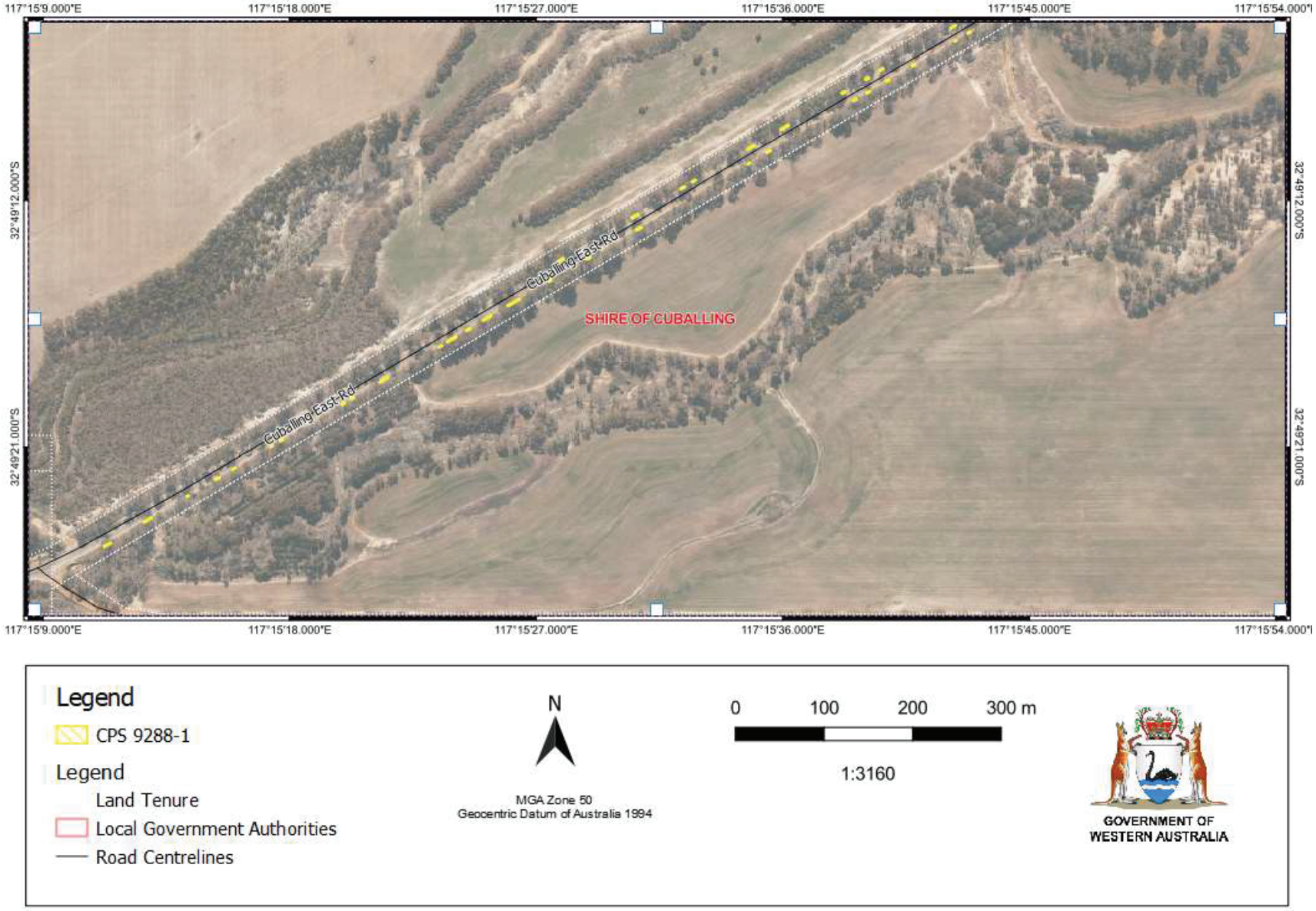


Figure 8: Map of the boundary of the area within which clearing may occur (G)

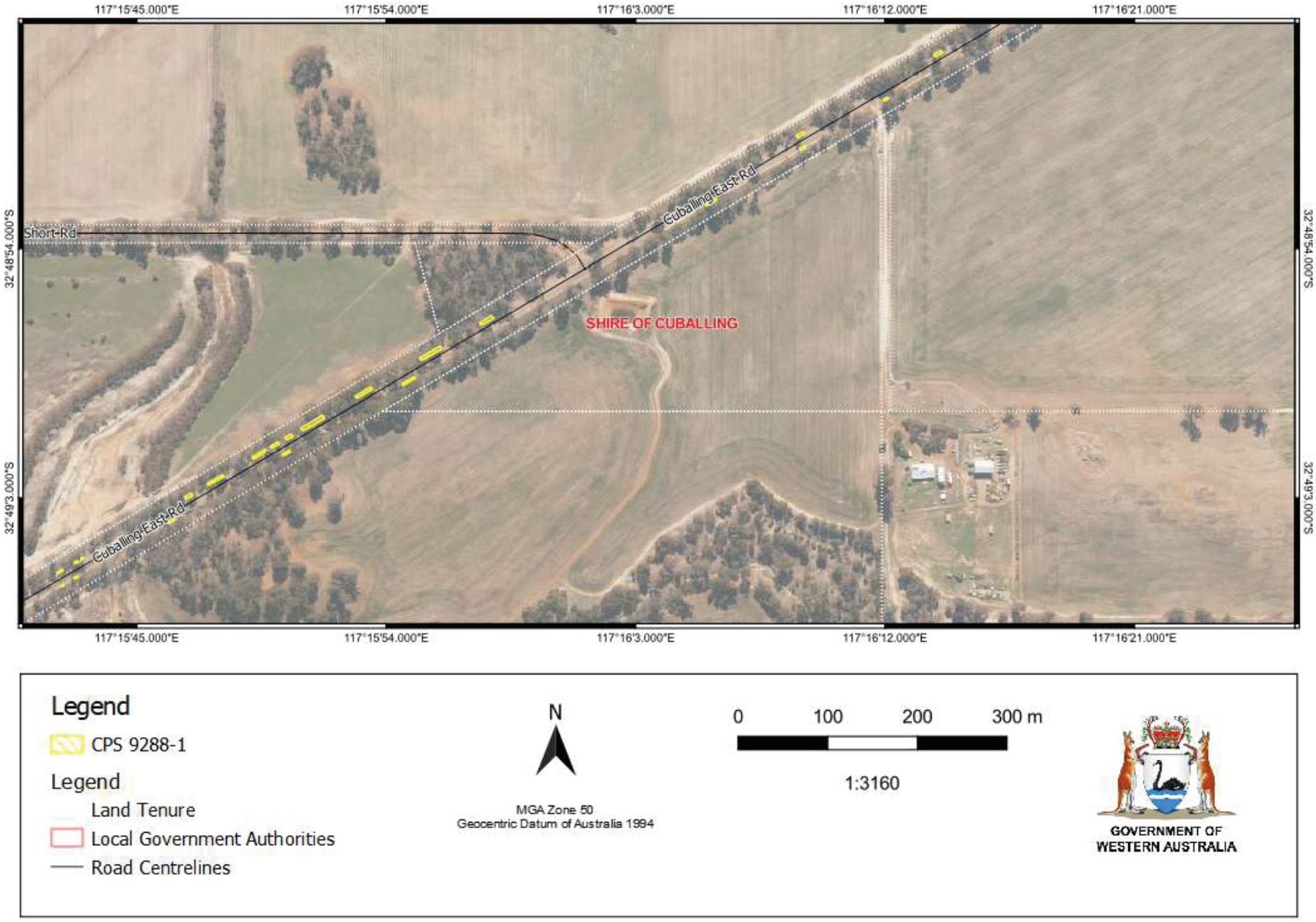


Figure 9: Map of the boundary of the area within which clearing may occur (H)

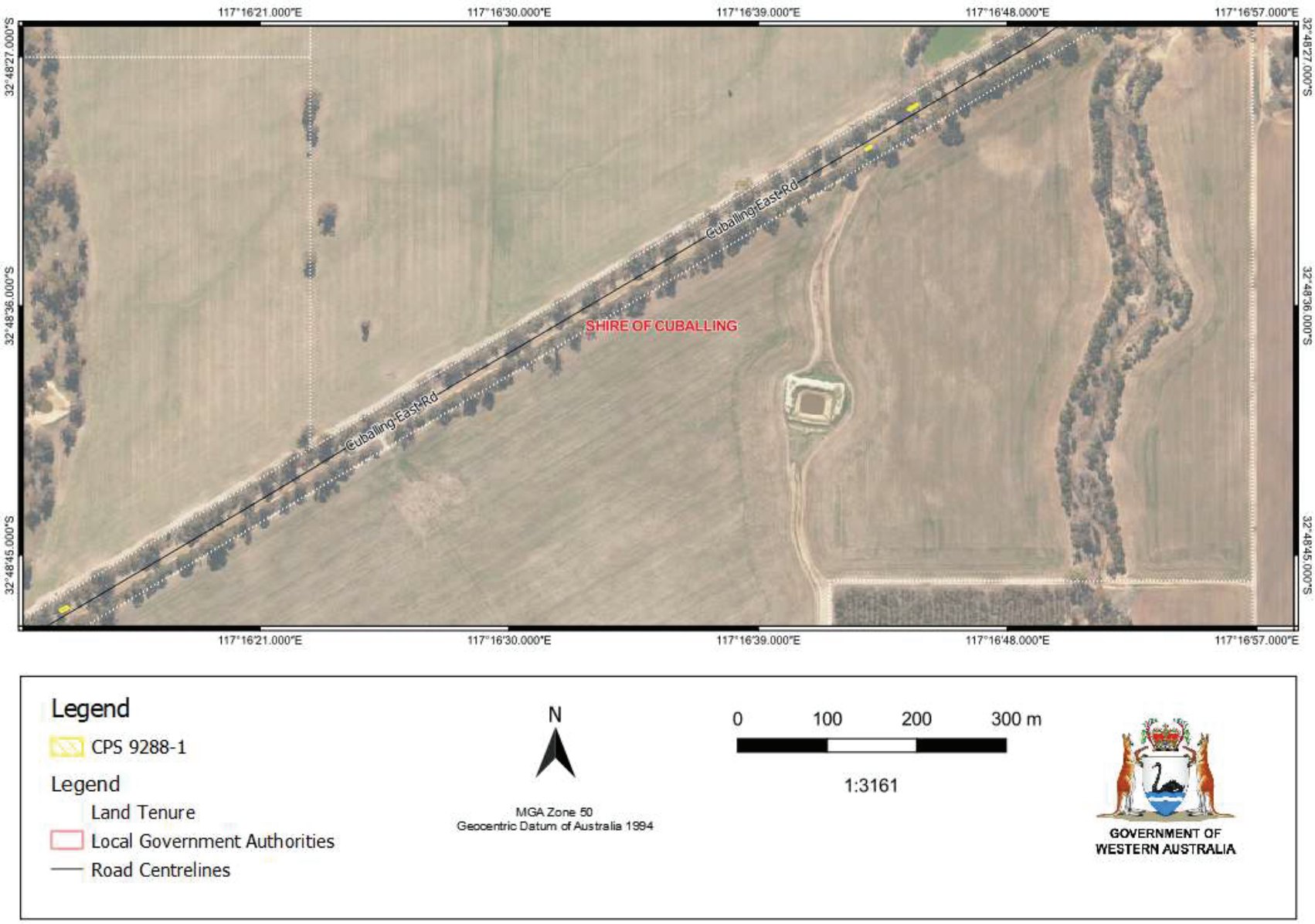


Figure 10: Map of the boundary of the area within which clearing may occur (I)

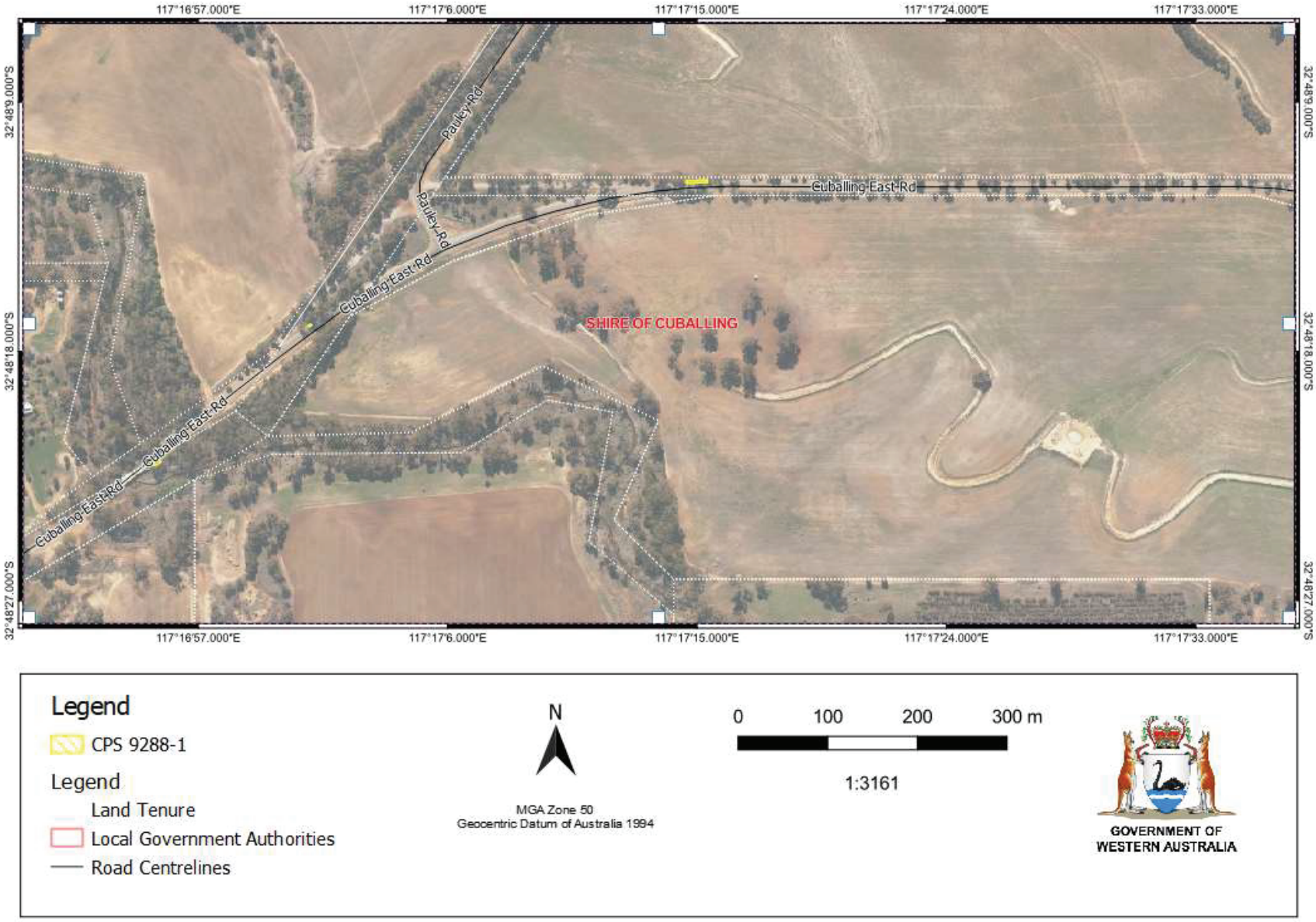


Figure 11: Map of the boundary of the area within which clearing may occur (J)

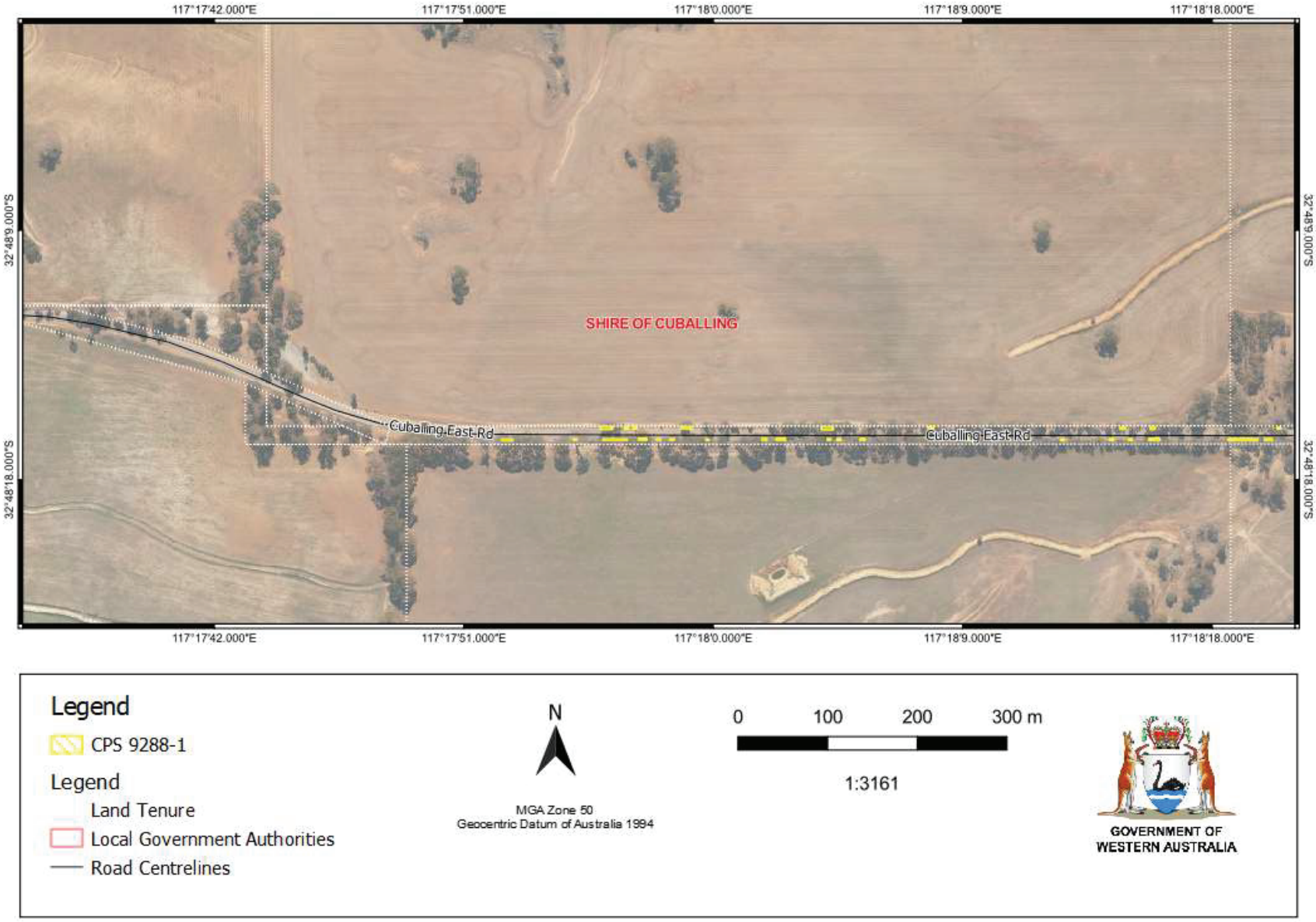


Figure 12: Map of the boundary of the area within which clearing may occur (K)

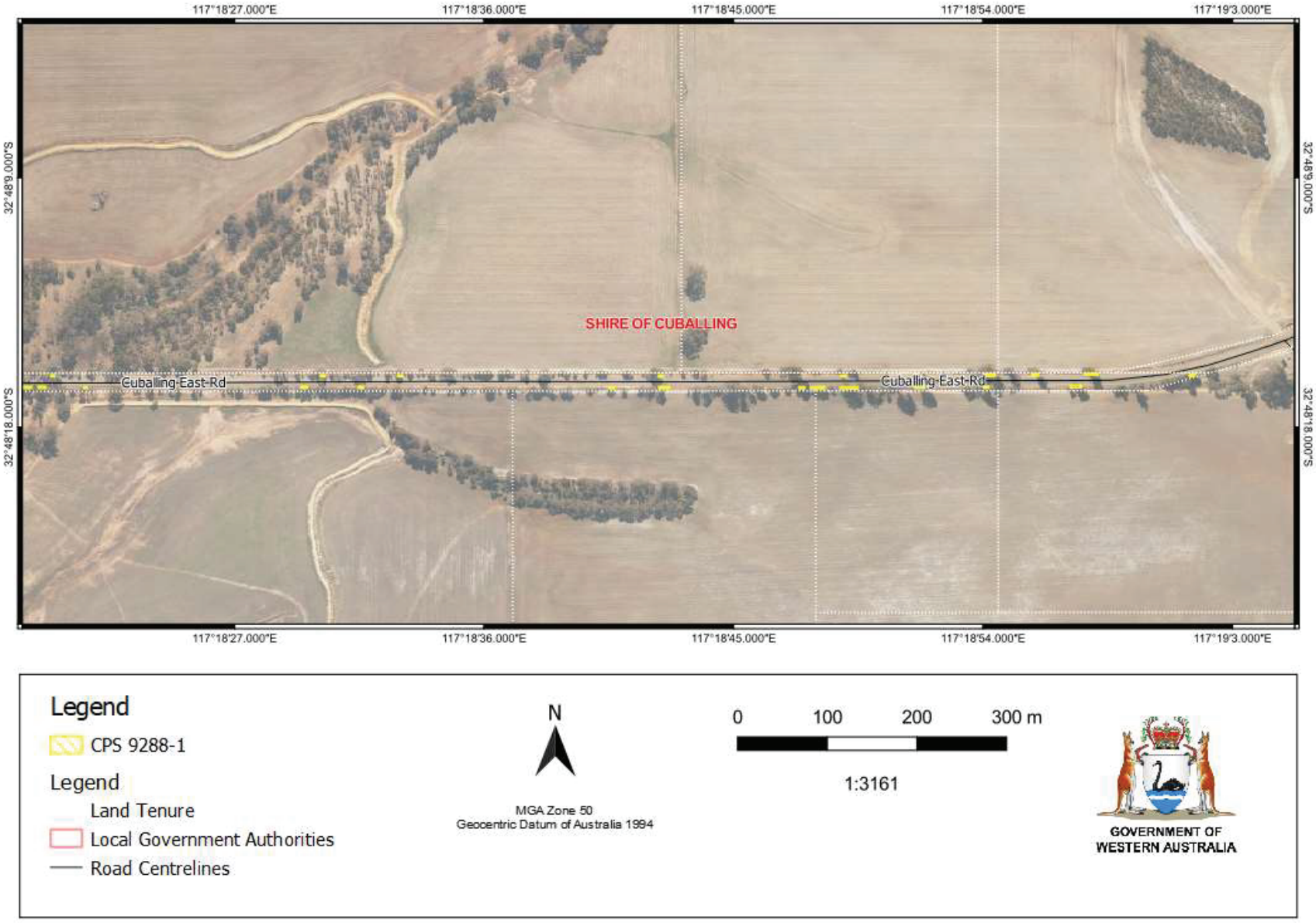


Figure 13: Map of the boundary of the area within which clearing may occur (L)

Figure 14: Map of the boundary of the area within which clearing may occur (M)

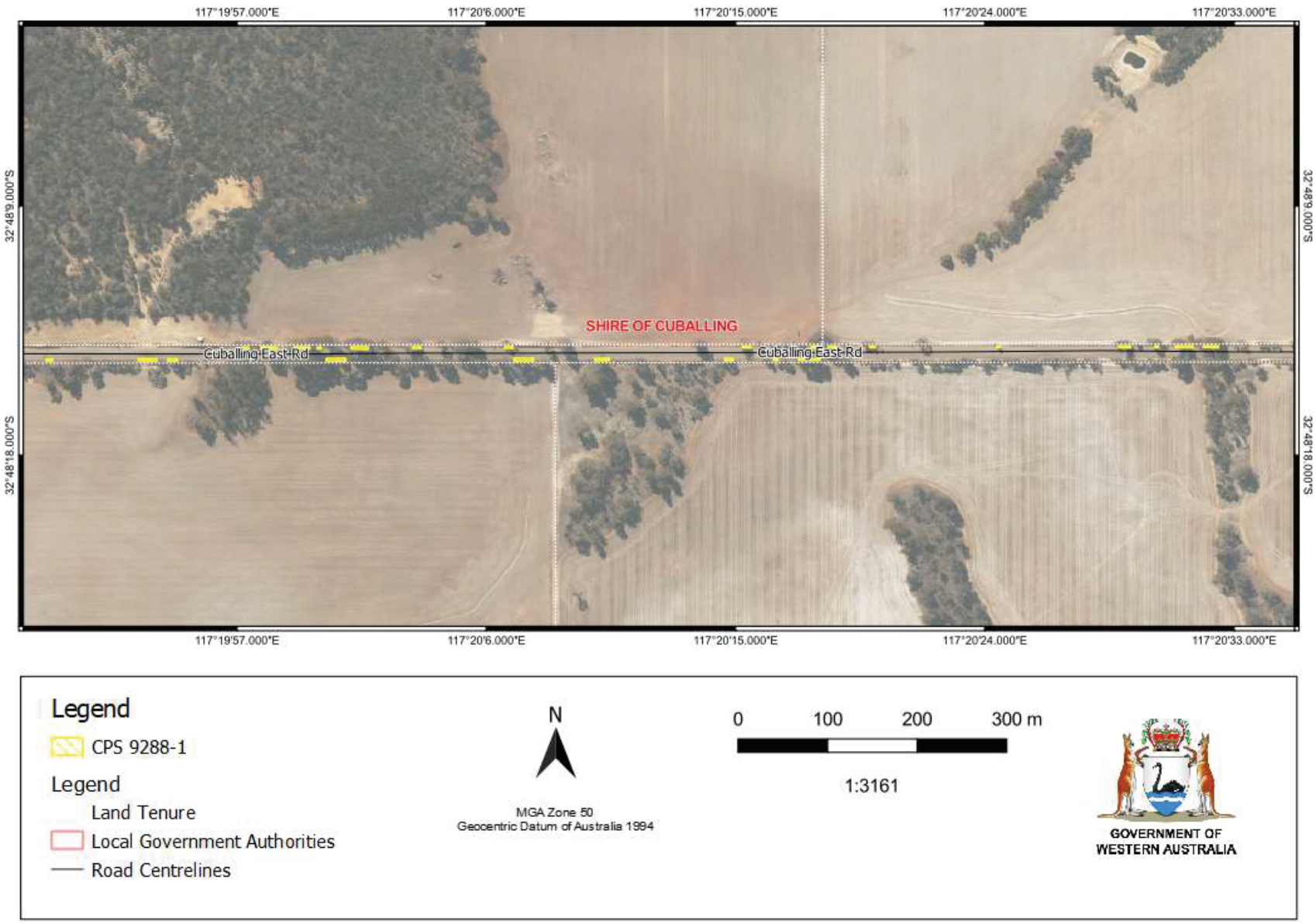


Figure 15: Map of the boundary of the area within which clearing may occur (N)

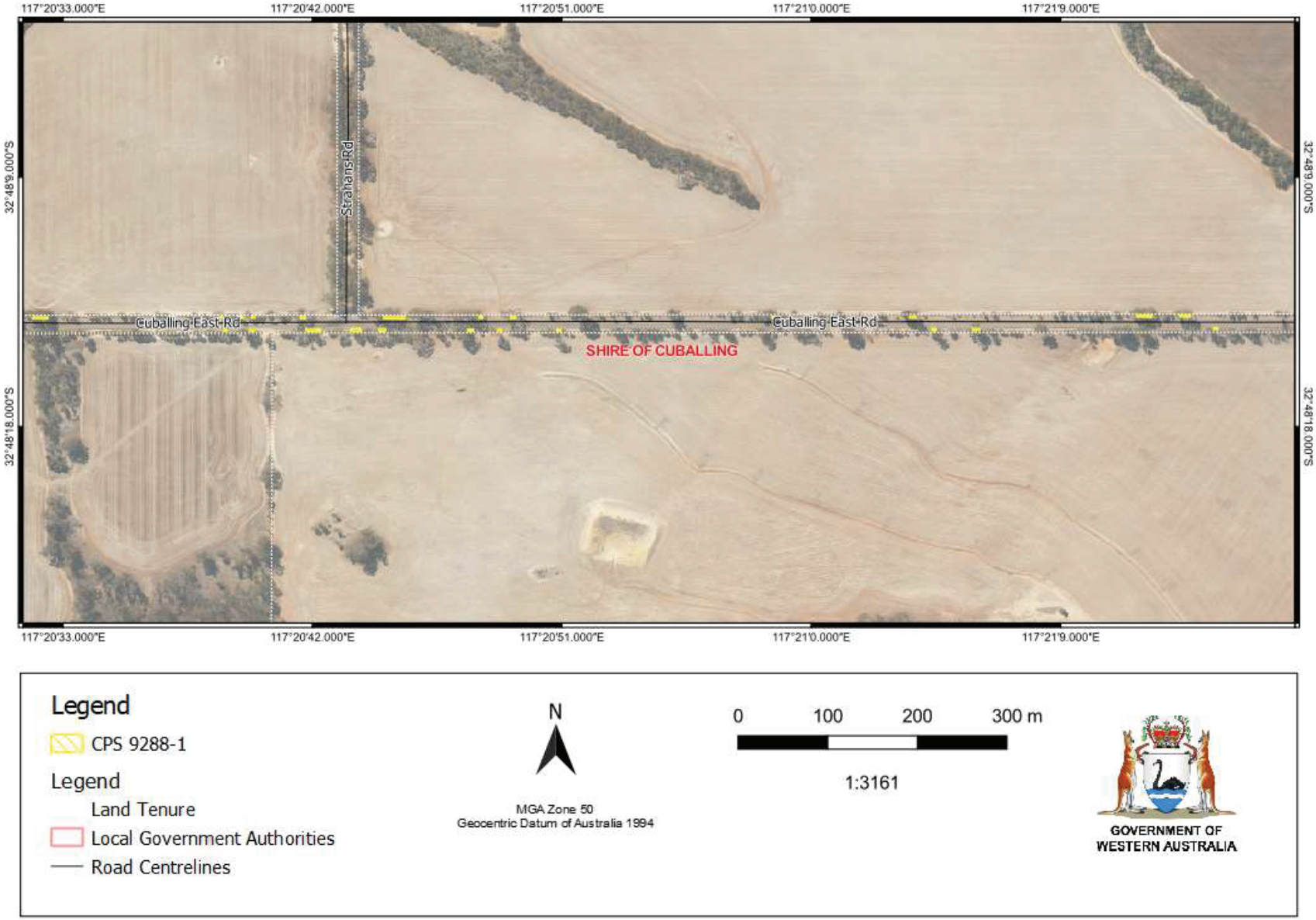


Figure 16: Map of the boundary of the area within which clearing may occur (O)

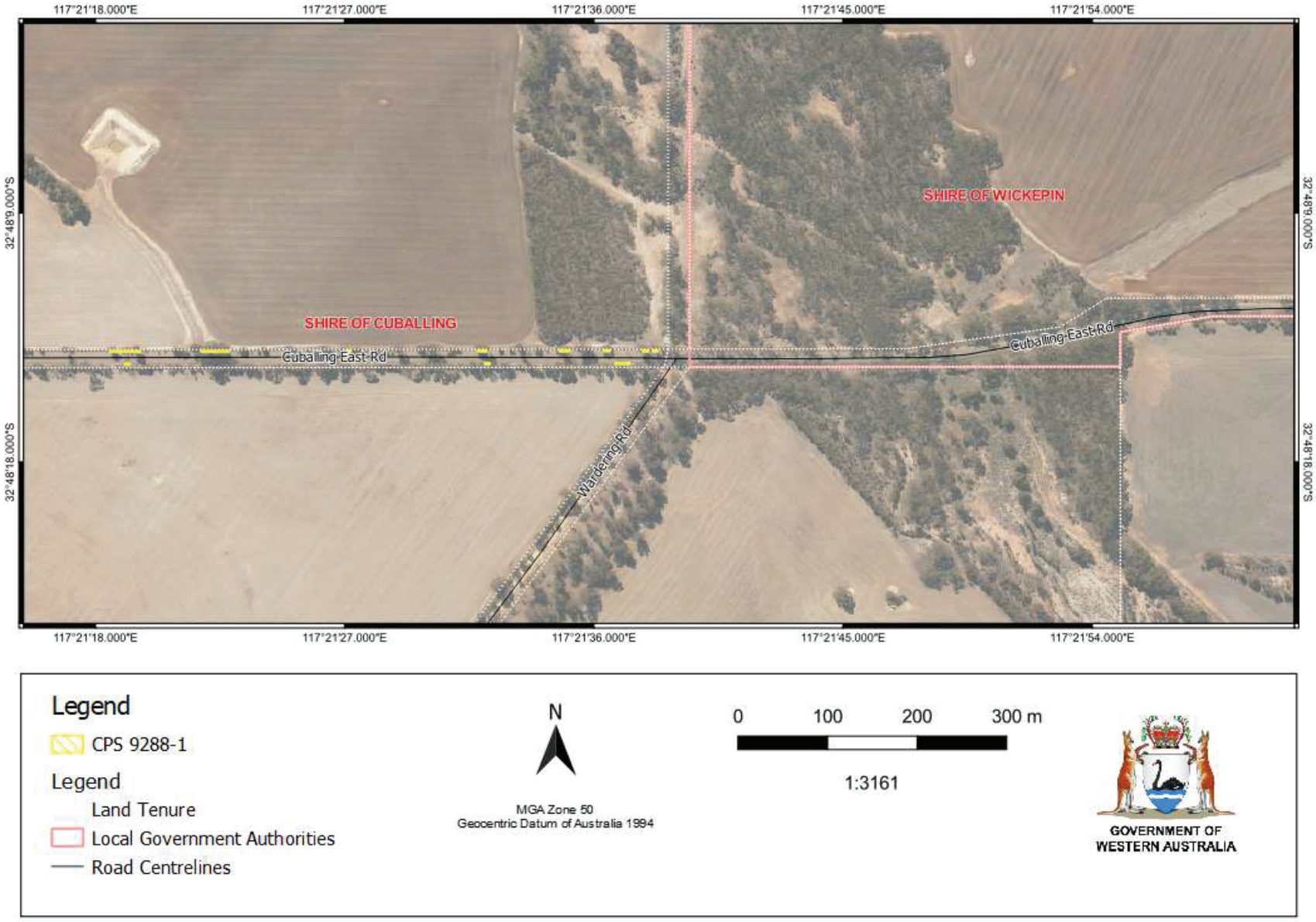


Figure 17: Map of the boundary of the area within which clearing may occur (P)

Schedule 2 - Figure 1: Locations of two trees to be inspected as black cockatoo habitat trees

Schedule 3 - Figure 1: Location of artificial black cockatoo nest hollow installation

Department of Parks and Wildlife

Fauna notes

Artificial hollows for Carnaby's cockatoo

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How to design and place artificial hollows for Carnaby's cockatoo

Artificial hollows can be used to help conserve the threatened Carnaby's cockatoo by enabling the cockatoos to breed in areas where natural hollows are limited.

A wide variety of artificial hollow designs have been used with mixed success. Evidence suggests that, while the hollow must meet some basic requirements, other factors such as proximity to existing breeding areas may be more important in determining the success of artificial hollows. Before using this information sheet to construct or install an artificial hollow, you should refer to the criteria listed in the separate information sheet; *When to use artificial hollows for Carnaby's cockatoo*.

This information sheet contains broad guidelines for the design and placement of artificial hollows for Carnaby's cockatoo.

Below are three examples of successful artificial hollows used by Carnaby's cockatoo for nesting. Artificial hollows made from a natural log with cut side entrance (left), white industrial pipe with top entrance (centre) and natural log with natural side entrance (right).

Photos by Christine Groom (left and right) and Rick Dawson (centre)

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Walls

The walls of the artificial hollow need to be constructed from a material that is;

- Durable enough to withstand exposure to elements for an extended period of time (i.e. 20+ years).
- Able to simulate the thermal properties of a natural tree hollow.
- Not less than 380 mm in internal diameter.
- Preferably 1.2 m deep overall and 1m deep to top of substrate/nesting material.

Successful artificial hollows have been constructed from sections of salvaged natural hollow, black and white industrial pipe. When using non-natural materials care must be taken to ensure there are no toxic residues and that the materials are safe to ingest.

Base

The base of the artificial hollow must be;

- Able to support the adult and nestling(s).
- Durable enough to last the life of the nest.
- Free draining.
- At least 380 mm in diameter.
- Covered with 200 mm of sterile, dry, free draining material such as charcoal, hardwood woodchips or wood debris.

  Do not use:

  - Saw dust or fibre products that will retain moisture.

Example materials that could be used for artificial hollow bases include heavy duty stainless steel, galvanised or treated metal (e.g. Zincalume ®), thick hardwood timber slab or marine ply (not chipboard or MDF). The base material must be cut to size to fit internally with sharp or rough edges ground away or curled inwards and fixed securely to the walls.

Carnaby's cockatoo eggs in an artificial hollow.
Photo by Rick Dawson

Entrance

The entrance of the artificial hollow must;

- Have a diameter of at least 270 mm).
- Preferably be top entry which will minimise use by non-target species.

Top entry hollows are unattractive to nest competitors such as feral bees, galahs and corellas. Side entry hollows have been successful in areas where feral bees are not a problem and where galahs and corellas are deterred.

Ladder

For artificial hollows made of non-natural materials, or of processed boards, it is necessary to provide a ladder to enable the birds to climb in and out of the hollow easily.

The ladder must be;

- Securely mounted to the inside of the hollow.
- Made from an open heavy wire mesh such as WeldMesh™ with mesh size of 30 - 50 mm, or heavy chain.

Do not use:

- A material that the birds can chew.
- Galvanized because the birds may grip or chew the ladder and ingest harmful compounds.

If using mesh for the ladder, the width will depend on the curvature of the nest walls. A minimum width of about 60 - 100 mm is recommended.

Sacrificial chewing posts

For artificial hollows made of non-natural materials, or of processed boards, it is necessary to provide sacrificial chewing posts. The birds chew material to prepare a dry base on which to lay their egg(s).

The sacrificial chewing posts must:

- Be made of untreated hardwood such as jarrah, marri or wandoo
- Be thick enough to satisfy the birds' needs between maintenance visits.
- Extend beyond the top of the hollow as an aid to see whether the nest is being used.
- Be placed on the inside of the hollow.
- Be attached in such a way that they are easy to replace e.g. hook over the top of hollow or can slide in/out of a pair of U bolts fitted to the side of the hollow.

It is recommended that at least two posts are provided. Posts 70 x 50 mm have been used, but require replacing at least every second breeding season when the nest is active. Birds do vary in their chewing habits and therefore the frequency at which the chewing posts require replacement will also vary.

Bottom of an artificial hollow showing ladder that is fixed to the wall and a chewed sacrificial post which is 200 mm from the floor.

Photo by Rick Dawson

Mountings

The artificial hollows must be mounted such that:

- The fixings used will last the duration of the nest e.g. galvanized bracket or chain fixed with galvanized coach screws.
- It is secured by more than one anchor for security and stability.
- It is positioned vertically or near vertically.

Placement

Sites should be chosen within current breeding areas and where they can be monitored, but preferably not conspicuous to the general public. It is important that artificial hollows are placed where they will be accessible for future monitoring and maintenance. For more detail refer to the separate information sheet; *When to use artificial hollows for Carnaby's cockatoo*.

The height at which artificial hollows should be placed is variable. The average height of natural hollows in dominant tree species in the area is a good guide. Natural hollows used by Carnaby's cockatoos have been recorded as low as 2 m above the ground. If located on private property the hollows can be placed lower to the ground so they are accessible by ladder or a rope and pulley system can be used. Where public access is possible artificial hollows should be placed at least 7 m high (i.e. higher than most ladders) and on the side of the tree away from public view to reduce the chance of interference or poaching.

Carnaby's cockatoo show no preference for aspect of natural hollows, however, it may still be beneficial to place artificial hollows facing away from prevailing weather and where they receive the most shade and protection.

Artificial hollows to be placed in trees require:

- Accessibility of the tree for a vehicle, elevated work platform or cherry picker.
- A section of trunk 2-3 m long suitable for attaching the hollow

If necessary, artificial hollows may be placed on poles, but this may result in excessive exposure to sun during very hot weather. When erected on poles there should be*

- A hinge at the bottom of the pole that can be secured when the pole is in the upright position.
- Access for a vehicle to assist raising the pole.

Safety

Care needs to be taken when placing artificial hollows to ensure safety is considered at all times. Artificial hollows are heavy and require lifting and manoeuvring into position up to 7 m above the ground.

Maintenance and monitoring

Once artificial hollows have been placed they require monitoring and maintenance to ensure they continue to be useful for nesting by Carnaby's cockatoo. It is important to monitor artificial hollows to determine use by Carnaby's cockatoo, other native species as well as pest species. By undertaking monitoring the success of the design and placement of artificial hollows can be determined and areas for improvement identified for future placement of artificial hollows.

Monitoring can also assess whether any maintenance is required. Without regular maintenance artificial hollows are unlikely to achieve their objective (that is, they will fail to provide nesting opportunities for threatened cockatoos). Therefore it is important to continue a regime of regular maintenance while the artificial hollow is required. It may be several (to many) decades until a natural replacement hollow is available.

For further advice on monitoring and maintenance of artificial hollows please refer to the separate information sheet; *How to monitor and maintain artificial hollows for Carnaby's cockatoo*.

Carnaby's cockatoo female prospecting an artificial hollow.
Photo by Rick Dawson

Example fixing for artificial hollow
Photo by Christine Groom

Acknowledgements

This information sheet is a joint initiative of Birdlife Australia, the Western Australian Museum and the Department of Parks and Wildlife. Many individuals have contributed to its preparation. Special acknowledgement is made for the contributions of Ron Johnstone from the WA Museum, Alan Elliott from the Serpentine-Jarrahdale Land care Centre and Denis Saunders. This updated version was compiled by Rick Dawson Department of Parks and Wildlife).

Other information sheets in the series: Artificial hollows for Carnaby's cockatoo

- *How to design and place artificial hollows for Carnaby's cockatoo*
- *How to monitor and maintain artificial hollows for Carnaby's cockatoo*

Information sheets available on the *Saving Carnaby's cockatoo* webpage:
http://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/threatened-animals/208-saving-carnaby-s-cockatoo

Further Information **Last updated 28/04/2015**

Contact fauna@dpaw.wa.gov.au or your local office of the Department of Parks and Wildlife

See the department's website for the latest information: www.dpaw.wa.gov.au

Schedule 5 - How to monitor and maintain artificial hollows for Carnaby's cockatoo

Department of Parks and Wildlife

Fauna notes

Artificial hollows for Carnaby's cockatoo

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How to monitor and maintain artificial hollows for Carnaby's cockatoo

It is important to monitor and maintain artificial hollows after they have been erected. Monitoring ensures that the effectiveness of the artificial hollow can be determined. It also means that problems with pest species or any maintenance requirements can be identified and resolved.

Without regular maintenance, artificial hollows are likely to fail to achieve their objective (that is, they will fail to provide nesting opportunities for threatened cockatoos). Therefore it is important to continue a regime of regular maintenance while the artificial hollow is required. It may be several (to many) decades until a natural replacement hollow is available.

Monitoring should be undertaken in order to detect:

- Use by Carnaby's cockatoo
- Maintenance requirements
- Use by other native species
- Use by pest species (e.g. feral bees, galahs, corellas etc.)

Carnaby's cockatoo female prospecting an artificial hollow.
Photo by Rick Dawson

How do I monitor artificial hollows?

Before undertaking monitoring of artificial hollows for Carnaby's cockatoo it is recommended that you seek advice from BirdLife Australia, the WA Museum or the Department of Parks and Wildlife. It is also important to contact Parks and Wildlife, Wildlife Licensing Section, to determine if a scientific licence is required (wildlifelicensing@dpaw.wa.gov.au).

Monitoring artificial hollows requires keen observation and naturalist skills. It is often not possible to observe evidence of breeding directly (i.e. nestlings or eggs) and inferences must be made based on observation. There are many techniques available to monitor artificial hollows. A combination of several is likely to achieve the best results.

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Looking for signs of use

Cobwebs covering the entrance to the hollow will indicate that the hollow has not been used recently. This would also apply to other light debris that may have fallen to cover the opening partially. Signs of recent use or interest in the hollow include evidence of chewing.

Observing parent behaviour around the hollow

The behaviour of parent birds around a hollow will indicate an approximate age of young in the nest.

Parent behaviour	Approximate age/stage of young
Prospecting for hollow	Unborn
Male only seen out of hollow	Egg or very young nestling (< 3 - 4 weeks)
Both parents seen entering/exiting the hollow	Nestling(s) have hatched (> 3 - 4 weeks)

Observing feeding flocks

Flocks of all male birds indicate that the females are incubating eggs. When flocks are mixed it suggests the birds have either not laid yet or that the nestlings have hatched and no longer require brooding (approximately 3 - 4 weeks old).

Tapping

When females are sitting on eggs they will usually respond to tapping at the base of their tree (or pole) by appearing at the entrance or flying from the hollow opening. This is not a guarantee of breeding activity, but an indication that it is possibly occurring in the hollow.

Observing insect activity around nest

The faecal matter produced by nestlings in a nest attracts insects, especially flies and ants. The type and number of these insects will help indicate how old any nestlings present may be. Factors such as temperature and humidity will also affect insect activity and so observations of insect activity should only be used as supporting evidence for other indications of age/use. Blowflies around a nest usually indicate that a death has occurred.

Listening for nestlings

With experience it is possible to determine if one or two nestlings are present and a broad estimate of age based on the type and loudness of noises they make.

Looking inside the nest

This can be achieved either with the aid of a telescopic pole and camera or mirror, or with the use of a ladder or other climbing equipment. This method can obtain the most detailed monitoring information for artificial hollows. However it is also the most time consuming and difficult to organise. Special equipment is likely to be needed depending on the height and positioning of artificial hollows. There are also safety issues associated with ladder or rope climbing options to reach nests to undertake observations.

How often should I monitor artificial hollows?

The minimum frequency of monitoring and the techniques used will be determined by the aims of the monitoring and the resources available. It is important to limit disturbance to breeding birds and this should be considered when determining the techniques used and frequency.

How do I maintain artificial hollows?

Artificial hollows require maintenance to ensure they continue to have the greatest chance of them being used by Carnaby's cockatoos. Periodic maintenance checks should be undertaken at least every two years, preferably annually. These checks should be undertaken prior to the breeding season which is between July and January with breeding occurring later in this period in southern areas. It is important to maintain a regime of regular maintenance as long as the artificial hollow is required. It may take several (to many) decades until a natural replacement hollow is available.

Maintenance checks should assess the following as a minimum:

- Condition of chewing posts (if present)
- Condition of attachment points
- Condition of hollow bases
- Stability of tree or pole used to mount the artificial hollow

Artificial hollow base needing repair.
Photo by Christine Groom

Repairing hollows

Any problems identified during maintenance checks should be addressed, and any repairs required done, as soon as possible. If breeding is currently occurring, maintenance may need to be delayed if it is likely to disturb the parents or nestling. Likely maintenance needs include replacement of chewing posts (frequently) or nest bases (occasionally) and repairing of any cracks (infrequently). Maintenance concerns regarding the security of attachment points or the stability of the tree or pole should be addressed as a priority for safety reasons.

For artificial hollows known to be used, spare chewing posts should be taken into the field when undertaking maintenance checks.

Monitoring of artificial hollows:

Monitoring aim	Frequency of visits	Monitoring techniques
To determine possible use by Carnaby's cockatoo	At least once during peak breeding season (i.e. between September and December)	• Observing behaviour of adults around hollow • Tapping to see if female will flush from hollow (best undertaken between 10am and 3pm when females most likely to be sitting) • Listening for nestlings • Looking for evidence of chewing • Looking inside nest
To confirm use by Carnaby's cockatoo	At least two visits during peak breeding season (i.e. between September and December)	To observe at least two of the following: • Breeding behaviour of adults around hollow or evidence of chewing • Female flushed from hollow • Noises from nestlings in hollow Or to observe: • Nestlings or eggs in nest
To determine nesting success by Carnaby's cockatoo	The more visits, the better. Preferably fortnightly visits between July and December. As a minimum, at least 3 visits spread throughout breeding season.	• Looking inside nest to observe eggs or nestlings.
To determine use by any species	As often as possible.	• Inspection from ground as a minimum. • Looking inside nest for detailed observations.
To determine maintenance requirements	At least every two years and preferably annually if hollow fitted with sacrificial chewing posts, can be longer if without.	• A basic maintenance check can be undertaken from the ground. A ladder or elevated work platform will be required for a comprehensive check and to replace sacrificial chewing posts

Acknowledgements

This information sheet is a joint initiative of Birdlife Australia, the Western Australian Museum and the Department of Parks and Wildlife. Many individuals have contributed to its preparation. The updated version was compiled by Rick Dawson (Department of Parks and Wildlife) with assistance from Denis Saunders.

Other information sheets in the series: Artificial hollows for Carnaby's cockatoo

- *How to design and place artificial hollows for Carnaby's cockatoo*
- *How to monitor and maintain artificial hollows for Carnaby's cockatoo*

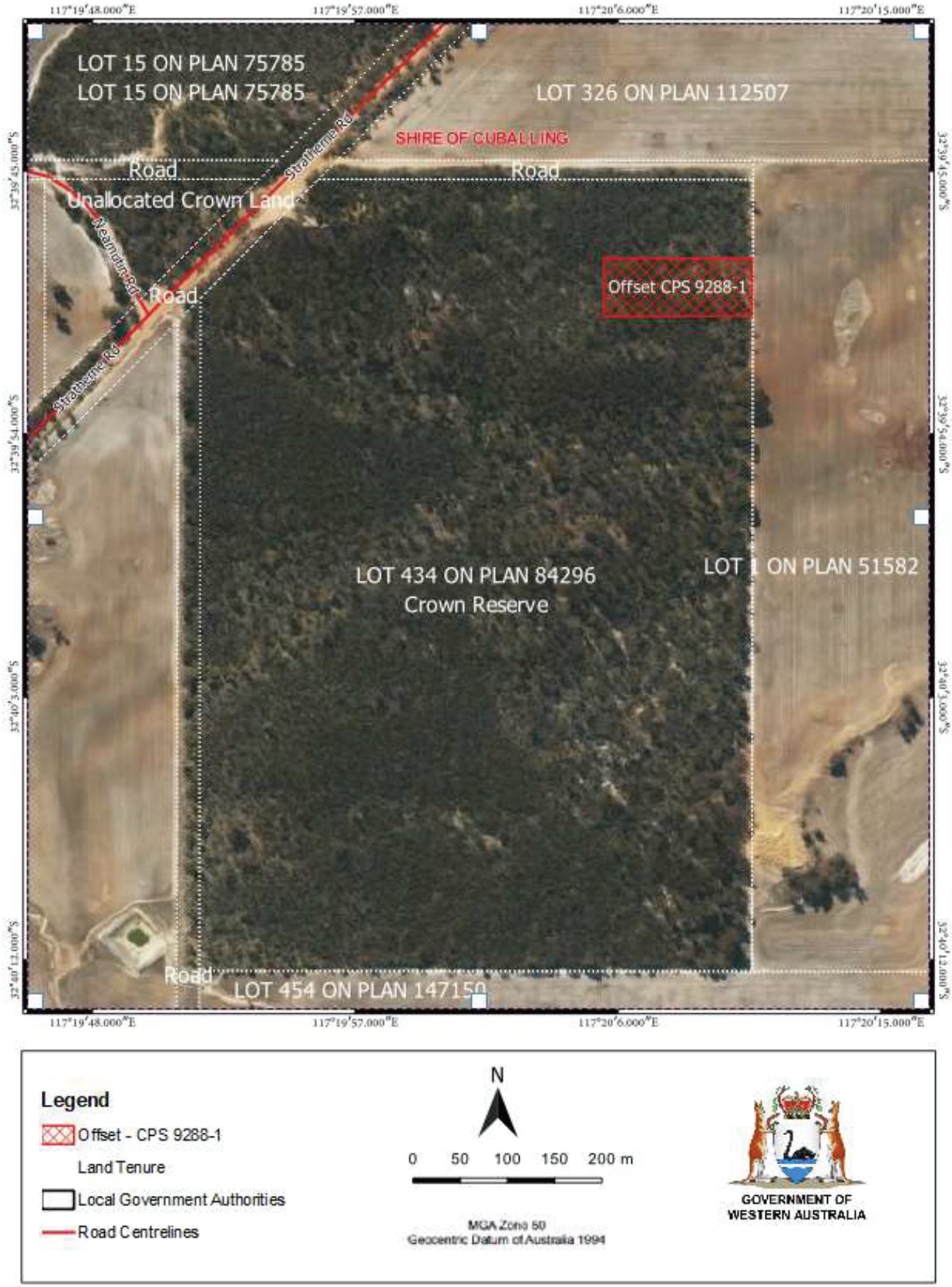
Information sheets available on the *Saving Carnaby's cockatoo* webpage:
http://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/threatened-animals/208-saving-carnaby-s-cockatoo

Further Information **Last updated 28/04/2015**

Contact fauna@dpaw.wa.gov.au or your local office of the Department of Parks and Wildlife

See the department's website for the latest information: www.dpaw.wa.gov.au

Schedule 6 - Figure 1: Location of offset site



Government of Western Australia
Department of Water and Environmental Regulation

Clearing Permit Decision Report

1 Application details and outcome

1.1. Permit application details

Permit number:	CPS 9288/1
Permit type:	Purpose permit
Applicant name:	Shire of Cuballing
Application received:	12 May 2021
Application area:	0.481 hectares of native vegetation incorporating 537 native trees
Purpose of clearing:	Road upgrades
Method of clearing:	Mechanical removal
Properties:	Cuballing East Road Reserve PIN 11471986, Commodine PINs 11431009, 11431010, 11471955, 11471958, 11542350 and 11523628, Cuballing PINs 11471957, 11471961, 11471963, 11471966, 11471968, 11471984 and 11471985, Wandering
Location (LGA area):	Shire of Cuballing
Localities:	Commodine, Cuballing, and Wandering

1.2. Description of clearing activities

The Shire of Cuballing (Shire) is seeking to clear native vegetation to construct a road upgrade to approximately 18.1 kilometres of the Cuballing East Road for road widening and road safety reasons. The application area consists of 0.481 hectares of native vegetation on both sides of the Cuballing East Road, comprising 537 individual trees and shrubs at 216 locations.

1.3. Decision on application

Decision:	Granted
Decision date:	28 March 2022
Decision area:	0.481 hectares of native vegetation as depicted in Section 1.5, below.

1.4. Reasons for decision

This clearing permit application was submitted, accepted and assessed in accordance with sections 51E and 51O of the *Environmental Protection Act 1986* (EP Act). The permit application was received by DWER on 12 May 2021 and advertised on the DWER website for 21 days on 10 June 2021. No submissions were received in relation to the application.

In making this decision, the Delegated Officer had regard for the site characteristics (Appendix B), relevant datasets (Appendix L), the findings of a fauna habitat tree assessment (Appendix H), the clearing principles set out in Schedule 5 of the EP Act (Appendix D), relevant planning instruments and any other matters considered relevant to the assessment (Section 3). The Delegated Officer also took into consideration the purpose of the proposed clearing to upgrade and widen Cuballing East Road for safety reasons as a component of the Wheatbelt South Freight Network.

The assessment identified that the proposed clearing is at variance to clearing Principles (b) and (e) and that significant residual impacts remain after the application of the avoidance and mitigation measures provided by the applicant (Section 3.1). Residual impact consists of the loss of:

- 0.481 hectares of native vegetation representing a significant remnant of native vegetation in an area that has been extensively cleared; and

- 0.481 hectares of native vegetation representing low to moderate foraging habitat for the Endangered Carnaby's Cockatoo.

The assessment also identified that the proposed clearing will result in:

- the loss of two trees (ID wpt032 and ID wpt025) providing potential breeding opportunities for Carnaby's Cockatoo;
- potential impacts to fauna present within the application area at the time of clearing; and
- the potential introduction and spread of weed species or dieback disease *(Phytophthora* sp) currently not present in the application area that have the potential to impact adjacent areas of native vegetation.

After consideration of the available information, as well as the applicant's minimisation and mitigation measures (Section 3.1), the Delegated Officer determined that the proposed clearing is unlikely to lead to long-term adverse impacts on the environmental values above. The applicant has suitably demonstrated avoidance and minimisation measures (Section 3.1), and the offset provided counterbalances the impacts to black cockatoo foraging habitat and a significant remnant of native vegetation in an area that has been extensively cleared (Section 4).

The Delegated Officer decided to grant a clearing permit subject to conditions to:

- avoid, minimise to reduce the impacts and extent of clearing;
- provide an offset to counterbalance the significant residual impacts to 0.481 hectares of low to moderate Carnaby's Cockatoo foraging habitat and 0.481 hectares of native vegetation representing a significant remnant of native vegetation in an area that has been extensively cleared. An offset to conserve 0.81 hectares of native vegetation in at least good condition within Crown Reserve 2556 is considered appropriate to address the residual impacts;
- take hygiene steps to minimise the risk of the introduction and spread of weeds and dieback;
- implement slow directional clearing to allow fauna to move into adjacent vegetation ahead of the clearing activity;
- engage a fauna specialist to inspect two Carnaby's Cockatoo breeding habitat trees (wpt032 and wpt025) for evidence of breeding use prior to clearing, and the suitability of hollows for black cockatoo breeding purposes and
    - any breeding habitat tree with evidence of current breeding use must not be cleared whilst it is in use for that breeding season,
    - for each hollow assessed by the fauna specialist as suitable for black cockatoo breeding purposes the applicant must install and maintain an artificial Carnaby's Cockatoo nest hollow, and
    - any artificial nesting hollow must be installed prior to commencement of the next Carnaby's Cockatoo breeding season following clearing of the related breeding habitat tree(s).

1.5. Site map

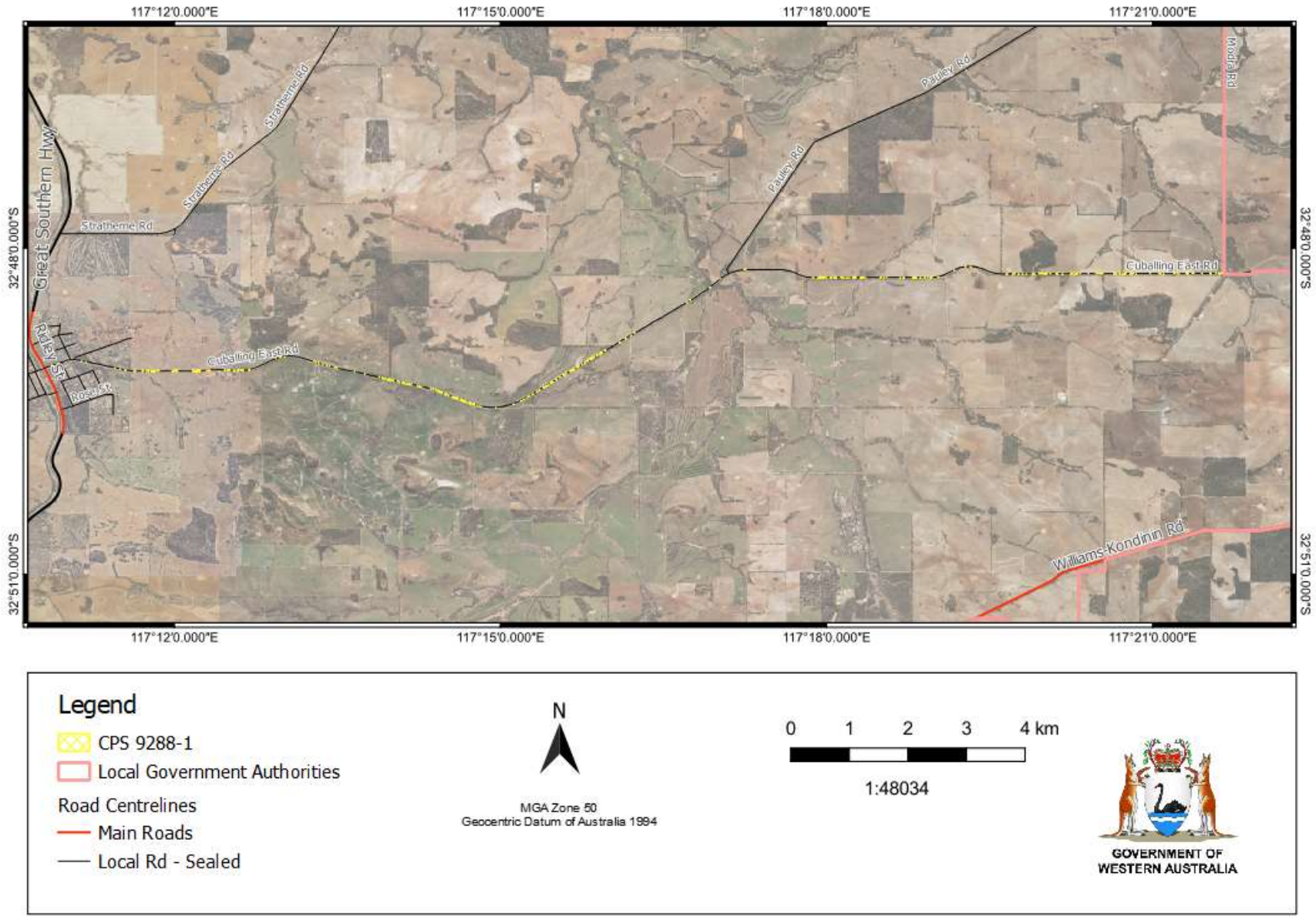


Figure 1: Context Map of the application area

2 Legislative context

The clearing of native vegetation in Western Australia is regulated under the EP Act and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* (Clearing Regulations).

In addition to the matters considered in accordance with section 51O of the EP Act (see Section 1.4), the Delegated Officer has also had regard to the objects and principles under section 4A of the EP Act, particularly:

- the precautionary principle
- the principle of intergenerational equity
- the principle of the conservation of biological diversity and ecological integrity.

Other legislation of relevance for this assessment include:

- *Biodiversity Conservation Act 2016* (WA) (BC Act)
- *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act)
- *Rights in Water and Irrigation Act 1914* (RIWI Act)

Relevant policies considered during the assessment include:

- *Environmental Offsets Policy* (2011)

The key guidance documents which inform this assessment are:

- *A guide to the assessment of applications to clear native vegetation* (DER December 2013)
- *Procedure: Native vegetation clearing permits* (DWER October 2019)
- *Environmental Offsets Guidelines* (August 2014)
- Technical guidance – *Terrestrial Fauna Surveys for Environmental Impact Assessment* (EPA 2016)

3 Detailed assessment of application

3.1. Avoidance and mitigation measures

The Shire is seeking to construct a road upgrade to approximately 18.1 kilometres of the Cuballing East Road for road widening and road safety reasons and is a component of the Wheatbelt South Freight Network funding for 42 Local Government Authorities.

All trees and shrubs over the application area have been described and located using a geographic information system (GIS).

The existing Cuballing East Road maintenance zone is generally well-defined from eight to nine metres from the road centreline in the section of road from Straight Line Kilometre (SLK) 6.5 to SLK 11.2 where the road reserve is 40 metres wide. In the remaining areas the existing road maintenance zone is generally less-defined and varies from 5.4 metres to 9 metres from the road centreline where the road reserve is 20 metres wide. Most of the vegetation clearing will occur in these latter sections, extending the cleared area of the existing road's maintenance zone to the area required for the new road construction.

The Shire has a preference, wherever possible, to construct a 19 metre wide road extending 9.5 metres from the road centreline. This preferred design will be utilised where the current width and maintenance zone is clear of native vegetation within the 19 metre width (Shire of Cuballing 2021c) (Appendix I – Plan 1 of 4).

In other areas the Shire has avoided clearing where possible by modifying the road design to maintain most of the benefits of the road construction improvements, while seeking to reduce the clearing of vegetation. This will be achieved by two strategies by

a. realigning the road centreline to areas with no or minimal vegetation compared to the opposite side, and
b. narrowing the total road width required from 19 metres to either 16 metres or 15 metres (Shire of Cuballing 2021c).

The works undertaken are also aimed at improving roadside drainage to preserve the new road construction and avoid the road failures currently experienced. Within the areas above the alternative design will widen the existing road pavement from the current maximum 7.2 metres wide seal to an 8.0 metre wide seal with two 1.3 metre wide unsealed road shoulders, equating to a 10.6 metre wide carriageway. The works will reduce the clearing widths required by reducing the areas required for the table drains and associated cut batters. The reduction in the clearing width has been made to retain larger potential habitat-sized trees. This has been undertaken where drainage can be installed around the trees identified for retention, or the location of the trees to be retained pose no safety risk to motorists (for example they are not located in run-off areas). Trees identified by the Shire for retention are presented in Appendix F (Table F1). Pink dots have been painted on the trunks of trees to be retained. Additional trees are

located outside of the application area, including individuals identified by Harewood (2021), and will also be retained (Appendix F: Table F2). A summary is provided below (Shire of Cuballing 2021c).

From SLK 0.00 to SLK 10.98 and SLK 15.00 to SLK 18.11 there is no opportunity, or gain, in shifting the road centreline. The alternative design cross section of a reduced 16 metre clearing width (with associated reduced areas for table drains) will be utilised where either the current cleared width and maintenance zone for the existing road is at least 16 metres wide or where the Shire clears vegetation to allow construction of the road to be 16 metres wide (Appendix I – Plan 2 of 4).

From SLK 11.12 to SLK 11.89 the road centre line has been realigned to the right hand side by 1.0 metre as there is no verge vegetation along this section on the right hand side. The realignment tapers from SLK 10.98 to 11.10 at commencement and start and 11.77 to 11.89 at the end. One metre is the maximum possible realignment since any additional shift will compromise the space for suitable table drains on the right hand side verge (Appendix I – Plan 3 of 4).

From SLK 11.89 to SLK 15.00 the Shire will utilise an alternative road design cross section to construct a 15 metre wide road extending 7.5 metres from a new road centreline realigned to the verge with minimal native vegetation where the current cleared width and maintenance zone for the existing road is at least 15 metres wide, or where the Shire clears vegetation to allow construction of the road to be 15 metres wide (Appendix I – Plan 4 of 4).

The strategies identified and initiated to retain native vegetation, and in particular the larger habitat trees, will result in roadside table drains that are designed and constructed smaller to optimal size. The reduced-sized table drains will result in increased costs to the Shire due to the complexity of maintenance with either; grading work being more complex and time-consuming, or drain maintenance requiring more expensive means such as the use of an excavator and associated truck. The reduced-sized table drains may also compromise the integrity and life of the pavement from less efficient drainage saturating of road foundations due to a greater risk of wetter periods causing the saturation of *in situ* soil, and subsequent weakening, resulting in pavement failure and/or reduced pavement life under heavy loading. Any further reduction of the size of the table drains, particularly through lower lying areas, poses an unacceptable risk to the Shire of potential road pavement failure (Shire of Cuballing 2021c).

Two trees within the application area (wpt025 and wpt032) provide potential breeding opportunities for the Endangered Carnaby's Cockatoo *(Calyptorhynchus latirostris).* The Shire have assessed both trees for potential avoidance. Both trees are located in the drainage path, with the former within 5.5 metres of the road centreline, and the latter within 6.35 of the road centreline. Eight metres is required to establish effective drainage. Tree wpt025 is too close to the edge of traffic path, and if the two trees are not removed they will both grow into the table drain and likely result in increased rate of adjacent pavement deterioration. Root systems of the trees will also be impacted by the necessary drainage works, affecting long term viability. The two trees wpt025 and wpt032 cannot be avoided and the Shire have committed to commission a fauna specialist to inspect hollows in these trees prior to commencement to ensure hollows are not occupied and if so delay removal until confirmed by the fauna specialist that it is safe to do so (Shire of Cuballing 2022).

The Delegated Officer was satisfied that the applicant has made a reasonable effort to avoid and minimise potential impacts of the proposed clearing on environmental values (Shire of Cuballing 2021a; Shire of Cuballing 2021b; Shire of Cuballing 2021c).

After consideration of avoidance and mitigation measures, it was determined that an offset is required to counterbalance the significant residual impacts to a significant remnant of native vegetation in an area that has been extensively cleared. Offsets are required to be in accordance with the Government of Western Australia's Environmental Offsets Policy and Environmental Offsets Guidelines. The Shire has proposed to relinquish a portion of Crown Reserve 2556 as an offset for the clearing by amending the reserve purpose from 'Gravel' to 'Conservation'. Further consideration of suitable offsets are discussed in Section 4.

3.2. Assessment of impacts on environmental values

The assessment against the clearing principles (Appendix C) identified that the impacts of the proposed clearing may present a risk to a significant ecological community, fauna habitat, and significant remnant vegetation. The consideration of these impacts, and the extent to which they can be managed through conditions applied in line with sections 51H and 51I of the EP Act, is set out below.

3.2.1. Biological values (significant ecological communities). Clearing Principle (a), Principle (d)

Assessment: The application area consists of ten species of native trees and shrubs in a completely degraded to degraded condition utilising the vegetation condition scale of Keighery (1994) (Appendix D). The structure of the vegetation is no longer intact and is 'parkland cleared' with no native understorey. Due predominantly to the lack of understorey the species richness of the vegetation present is likely to be very low when compared to analogous areas of native vegetation in better condition. A review of available databases determined that eight priority flora taxa

and two threatened flora taxa have been recorded within ten kilometres of the application area (Table B3.1). Due to the lack of understorey, the likelihood of flora of conservation significance occurring over the application area is very low.

The Eucalypt Woodlands of the Western Australian Wheatbelt (Eucalypt Woodlands) is listed as a Threatened Ecological Community under the EPBC Act (CR), and a Priority 3 Priority Ecological Communities (PEC) by the Department of Biodiversity, Conservation, and Attractions (DBCA 2017b). Eucalypt Woodlands have been mapped regionally over the application area (Appendix K: Figure 3). Eucalypt species occurring over the application area align with the species representative of this community (Appendix B: Table B1.2).

The approved conservation advice for the Eucalypt Woodlands community is detailed by DoE (2015), and the Commonwealth of Australia (2016) provide a guide to identify and assess the Eucalypt Woodlands community.

Patch size and vegetation condition are important determinants in assessing the presence of the Eucalypt Woodlands community (Commonwealth of Australia 2016; DoE 2015). The vegetation condition thresholds to confirm the Eucalypt Woodlands community generally exclude degraded patches such as roadside remnants that are too small and narrow, or where the tree canopy has become discontinuous and the understorey has lost considerable elements of its native structure and diversity (DoE 2015). The minimum patch width for roadsides should be over five metres based upon the native understorey component (DoE 2015).

The application area is in completely degraded to degraded condition without a native understorey. The Commonwealth of Australia (2016) recognise that narrow road verges will usually be too small or too degraded to form part of the Eucalypt Woodlands community, however, the presence of mature eucalypts can indicate 'good' condition if the understorey has lower native vegetation cover, and that eucalypt woodlands that are reasonably intact retain native understorey vegetation or important habitat features such as large trees with hollows (Commonwealth of Australia 2016). A minimum patch size of five hectares is stipulated for patches likely to correspond to a condition of degraded to good (Keighery 1994) but that retain important habitat features (DoE 2015). Native vegetation along either side of a sealed road is considered to be a separate patch. Mature trees are particularly important for the provision of hollows where native animals can shelter and nest. Patches that are spatially linked are important as wildlife habitat, and to the viability of the patches themselves, and it is important to consider the environment surrounding potential patches (Commonwealth of Australia 2016).

In terms of mature eucalypts or large trees with hollows, Harewood (2020) undertook an assessment of the application area and identified all suitable trees with a Diameter at Breast Height (DBH) of equal to or over 30 centimetres for Wandoo (*Eucalyptus wandoo)* and Salmon Gum (*Eucalyptus salmonophloia*) and over 50 centimetres DBH for the other eucalypt species present. Thirteen individual trees consisting of 10 Wandoos, two Red Morrel (*Eucalyptus longicornis*) (and one dead tree) were identified from within the application area. Of these trees, ten provided at least the possibility of small hollows (with two providing large hollows) (Appendix H). Considering that 181 Wandoos and 36 Red Morrels occur within the application area (Appendix B: Table B1.2) the vast majority of the application area does not support large trees with hollows.

In terms of patch size the vast majority of the application area consists of narrow road verge isolated by rural lands supporting exotic pasture grasses. However, there are four areas likely to support surrounding eucalypt woodland with patch size greater than five hectares (Appendix K: Figure 4 to Figure 7). From west to east the application area includes two York Gums *(Eucalyptus loxophleba)* in the first potential patch, seven Wandoos and five Rock Sheoaks *(Allocasuarina huegeliana)* in the second potential patch, two York Gums and six Wandoos in the third potential patch, and one Wandoo and one York Gum in the second potential patch (Appendix K: Figure 4 to Figure 7).

The four potential Eucalypt Woodland patches include 0.03 hectares of proposed clearing, or 6.2 per cent of the total application area, consisting of 19 eucalypts, or 5.2 per cent of the total eucalypts within the application area. The components of the application area that intersect the potential Eucalypt Woodland patches do not include any large trees as identified by Harewood (2020). That is, they include Wandoos under 30 centimetres DBH, with other trees under 50 centimetres DBH. The areas of potential Eucalypt Woodland patches within the application area are unlikely to support mature eucalypts indicating 'good' condition inferring the potential presence Eucalypt Woodland significant community (Commonwealth of Australia 2016).

Of the approximately 12,668 hectares of native vegetation remaining within 10 kilometres of the application area approximately 10,508 hectares has been mapped as Eucalypt Woodlands (Appendix B: Table B5.2) (Appendix K: Figure 2 and Figure 3). That is, approximately 82.7 per cent of the remaining remnant vegetation in the local area has been mapped as Eucalypt Woodlands. The application area intersects four potential eucalypt woodland patches (Appendix K: Figure 4 to Figure 7). However, in consideration of the areas required for proposed clearing, the condition of the vegetation present, and the attributes of the eucalypts present, the proposed clearing is unlikely to significantly impact the Eucalypt Woodlands of the Western Australian Wheatbelt ecological community.

Although very degraded or modified patches of Eucalypt Woodlands may not represent the Eucalypt Woodlands of the Western Australian Wheatbelt community, it is recognised that some patches can still retain important natural values that may be crucial for certain species or habitats (DoE 2015), and these patches should not be excluded

from recovery and other management actions (DoE 2015). The introduction of weed species or dieback disease *(Phytophthora* sp) currently not present in the application area, or the spread of existing weeds or dieback disease, may compromise the condition of adjacent woodlands and habitat and the clearing of eucalypts may impact fauna species present at the time of clearing.

Conclusion: For the reasons set out above, it is considered that the impacts of the proposed clearing on significant ecological communities can be managed by implementing the applicant's avoidance and minimisation strategies, minimising the risk of the introduction and spread of weeds and dieback, and implementing slow directional clearing to allow fauna to move into adjacent vegetation.

Conditions: To address the above impacts, the following management measures will be required as conditions on the clearing permit:

- avoid, minimise to reduce the impacts and extent of clearing;
- take hygiene steps to minimise the risk of the introduction and spread of weeds and dieback; and
- implement slow directional clearing to allow fauna to move into adjacent vegetation ahead of the clearing activity.

3.2.2. Biological values (fauna). Clearing Principle (b)

Assessment: According to available databases, two birds, seven mammals and one reptile of conservation significance have been recorded from within ten kilometres of the application area (Appendix B: Table B4.1). Of these, seven species were assessed as very unlikely to occur due to the habitats present, the completely degraded to degraded condition of the vegetation, and the local context of the vast majority of the application area consisting of isolated trees and shrubs along a narrow road verge isolated by rural lands supporting exotic pasture grasses.

Of the remainder, the Endangered Carnaby's Cockatoo *(Calyptorhynchus latirostris)* was assessed as possibly occurring and the Priority 4 Western Rosella (inland) *Platycercus icterotis xanthogenys* and Conservation Dependant Red-tailed Phascogale (*Phascogale calura)* assessed as unlikely to occur.

There are two sub-species of the Western Rosella with the nominate sub-species *(icterotis)* confined to the south-west coast, with the inland sub-species *(xanthogenys),* occurring in the Wheatbelt and east to the Goldfields including the Great Western Woodlands within eucalypt woodlands with a heath understorey. The Western Rosella nests in a hollow in a limb or tree trunk, usually one metre or more deep (DEC 2009). The inland sub-species is thought to be declining in the western wheatbelt, and is now typically found in the outer wheatbelt and Goldfields, from Southern Cross, Hyden, Bruce Rock and east to Norseman (Higgins 1999) with the population thought to be stable in the vegetated western woodlands (Garnett and Crowley 2000; Higgins 1999). Although listed as a Priority species, the Inland Western Rosella was not listed in the 2010 Action Plan for Australian Birds as the population is considered too large and the decline too slow to be designated Near Threatened (Garnett *et al.* 2011).

Just two records of the Western Rosella (inland) have been recorded within ten kilometres of the application area and due to the low number of records, time of records, separation distance, and local context of the application area consisting of isolated trees and shrubs without a native understorey along a narrow road verge, the inland sub-species of the Western Rosella is considered unlikely to occur over the application area.

Seventy records of the Red-tailed Phascogale have been made within the local area within ten kilometres of the application area. The Red-tailed Phascogale inhabits Wandoo and Rock Sheoak woodland associations (DEC 2012). Red-tailed Phascogales are arboreal and show a preference for long-unburnt and dense habitat that contains tree hollows and providing a continuous canopy that facilitates protection from predation by both feral cats and foxes (DEC 2012). Wandoo trees in particular provide nesting sites in the form of hollow logs and limbs and the best habitat has numerous tree hollows for shelter and a continuous or at least semi-continuous canopy (DEC no date).

The vast majority of records of Red-tailed Phascogale from the local area are from the East Yornaning Nature Reserve approximately 5.7 kilometres to the north of the application area, the Yarling Nature Reserve approximately 8.2 kilometres to the east of the application area, and the Ockley Nature Reserve approximately 4.6 kilometres to the south of the application area where large vegetated areas provide the habitat required. One 'moderately certain' opportunistic record from 1996 is located immediately adjacent to the application area, with the next closest record from 1974 in an area adjoining the Rosedale Nature Reserve in Cuballing (Appendix K: Figure 11). Harewood (2021) identified 14 eucalypts containing hollows, or possible hollows, potentially suitable for the Red-tailed Phascogale, of which ten occur within the application area (Appendix H) (Appendix K: Figure 9). No evidence of occupancy was recorded, and the scaterred isolated trees over the application area do not provide a continuous or semi-continuous canopy to provide the appropriate levels of cover to support the species, with Harewood (2021) concluding that It is unlikely that the application area is inhabited by the species given the degraded and fragmented nature of the vegetation in the wider area (Appendix H).

Carnaby's Cockatoo habitat can be considered in terms of breeding habitat, night roosting habitat, and foraging habitat. Carnaby's Cockatoo will generally forage up to 12 kilometres from an active breeding site (DSEWPaC 2012)

(Commonwealth of Australia 2017) (DPaW 2013). Following breeding, they will flock in search of food, usually within six kilometres of a night roost (DSEWPaC 2012; DPaW 2013), but may range up to 20 kilometres (Commonwealth of Australia 2017). Food resources within the range of breeding sites and roost sites are important to sustain populations, and foraging resources are therefore viewed in the context of known breeding and night roosting sites, particularly within 12 kilometres of an impact area (Commonwealth of Australia 2017). Carnaby's Cockatoo night roosts are usually located in the tallest trees of an area, and in close proximity to both a food supply and surface water (DAWE 2020; Le Roux (2017). Flocks will use different night roosts, often for weeks, or until the local food supply is exhausted. Flocks show some fidelity to night roosts with sites used in most years to access high-quality feeding sites. However, not all night roosts are used in every year (DPaW 2013).

The extreme western end of the application area is within the eastern edge of the range of the Vulnerable Forest Red-tailed Black Cockatoo *(Calyptohynchus banksii naso)* (Appendix K: Figure 8). There are no records within ten kilometres of the application area and the sub-species is very unlikely to occur. The application area is within the breeding range of the Endangered Carnaby's Cockatoo (Appendix K: Figure 8) and four records have been made within the local area, the most recent from 2016 adjacent to Yornaning Nature Reserve approximately 9.9 kilometres to the north of the application area (Appendix K: Figure 8).

The application area provides potential foraging habitat (four tree species), breeding habitat (five tree species) and roosting habitat (five tree species) for Carnaby's Cockatoo (Appendix B: Table B4.2). Harewood (2021) identified two eucalypts, one Wandoo (wpt032 / 111Ea) and one Red Morrel (wpt025 / 295EL) that appear to have hollows large enough for Carnaby's Cockatoo (breeding habitat trees) (Appendix K: Figure 9), although no evidence of black cockatoos, or evidence of use of hollows was observed (Appendix H). The Red Morrel had one possible large side entry hollow that could not be examined in detail, and the Wandoo was examined with a pole camera and had one large upward facing spout (Appendix K: Figure 10).

Due to the lack of black cockatoo records in the vicinity of the application area, and the location along a public road, the use of trees in the application area as night-roosts is unlikely. Over 290 trees consisting of Wandoo, York Gum, Marri and Salmon Gum provide potential foraging habitat for Carnaby's Cockatoo (Bamford 2013; Groom 2011) (Appendix B: Table B4.2). Food resources within the range of breeding sites and roost sites are important to sustain populations, and foraging resources are therefore viewed in the context of known breeding and night roosting sites, particularly within 12 kilometres of an impact area (Commonwealth of Australia 2017). No black-cockatoo breeding sites or roosting sites have been recorded within 12 kilometres of the application area (Appendix K: Figure 8).

References that identify food resources and their relative importance in the diet of Carnaby's Cockatoo include: Bamford (2013), Bamford (2020), Cooper *et al.* (2002); Commonwealth of Australia (2017), DSEWPaC (2012), Groom (2011), Johnstone *et al.* (2011), Lee *et al.* (2013), Saunders (1980), Shah (2006), and Valentine and Stock (2008). Of the four foraging species identified Marri is considered a high quality foraging resource as it provides a relatively high energy source of food. The remaining species are considered low to moderate quality.

Marri represents less than 2.5 per cent of the trees within the application area, with the other four species representing approximately 52 per cent of the of the trees within the application area. In consideration of the species make-up and proportion, the scaterred nature of the resource over the application area, and the site context with just four Carnaby's Cockatoo records and no black-cockatoo breeding sites or roosting sites recorded within 12 kilometres, the foraging resource is considered low to moderate quality.

Conclusion: Based on the above assessment, the proposed clearing will result in the removal of two trees providing potential breeding opportunities for Carnaby's Cockatoo, and foraging habitat of low to moderate quality. Impacts of the proposed clearing on fauna species potentially present at the time of clearing can be managed by an inspection of potential black cockatoo hollows prior to clearing and implementing slow directional clearing to allow fauna to move into adjacent vegetation.

Conditions: To address the above impacts, the following management measures will be required as conditions on the clearing permit:

- avoid and minimise to reduce the impacts and extent of clearing;
- implement slow directional clearing to allow fauna to move into adjacent vegetation ahead of the clearing activity;
- a fauna specialist is to inspect the two potential Carnaby's Cockatoo breeding habitat trees (wpt032 and wpt025) for evidence of breeding use prior to clearing, and the suitability of hollows for black cockatoo breeding purposes;
    - any breeding habitat tree with evidence of current breeding use must not be cleared whilst it is in use for that breeding season;
    - for each hollow assessed by the fauna specialist as suitable for black cockatoo breeding purposes the applicant must install and maintain an artificial Carnaby's Cockatoo nest hollow;
    - any artificial nesting hollow must be installed prior to commencement of the next Carnaby's Cockatoo breeding season following clearing of the related breeding tree(s); and

- provide an offset to counterbalance the significant residual impacts to 0.481 hectares of low to moderate Carnaby's Cockatoo foraging habitat.

3.2.3. Biological values (significant remnant vegetation). Clearing Principle (e)

Assessment: The national objectives and targets for biodiversity conservation in Australia has a target to prevent clearance of ecological communities with an extent below 30 per cent of that present prior to 1750, below which species loss appears to accelerate exponentially at an ecosystem level (Commonwealth of Australia 2001). The application area is located within the extensively cleared Avon Wheatbelt IBRA Bioregion which retains approximately 18.5 per cent of its pre-European vegetation extent (Government of Western Australia 2019) (Appendix B: Table B2.1).

Two vegetation associations as described and mapped by Shepherd *et al.* (2001) have been mapped over the application area; vegetation association 1023, and vegetation association 947 (Appendix K: Figure 1).

The major vegetation association occurring over the application area is vegetation association 1023 described as a medium woodland of York Gum *(Eucalyptus loxophleba),* Wandoo *(Eucalyptus wandoo)* and Salmon Gum *(Eucalyptus salmonophloia)* (Shepherd *et al.* 2001). Association 1023 has just 10.8 per cent of it's pre-European vegetation extent remaining (Government of Western Australia 2019), with approximately 10.9 per cent of its current extent protected in lands managed by the DBCA (Appendix B: Table B2.1). York Gum, Wandoo, and Salmon Gum are all present over the application area (Appendix B: Table B1.2) and the vegetation present can be considered a degraded element of vegetation association 1023.

Two very minor occurrences of vegetation association 947 have been mapped over the eastern end of the application area, representing less than four per cent of the proposed clearing. Vegetation association 947 is described as a medium woodland of Powderbark (*Eucalyptus accedens)* and mallet. Association 947 has 34.6 per cent of it's pre-European vegetation extent remaining (Government of Western Australia 2019), with approximately 40.6 per cent of its current extent protected in lands managed by the DBCA (Appendix B: Table B2.1). Powderbark and mallet (*Eucalyptus astringens)* are present over the application area (Appendix B: Table B1.2) and the vegetation present over a minor area of the application area can be considered a degraded element of vegetation association 947.

Approximately 12,668 hectares of native vegetation remains within 10 kilometres of the application area representing 19.1 per cent of its original pre-European extent, of which approximately 10,508 hectares has been mapped as the Eucalypt Woodlands of the Western Australian Wheatbelt significant ecological community, and the application area intersects four potential eucalypt woodland patches (Appendix K: Figure 2 and Figure 3) (Appendix K: Figure 4 to Figure 7).

Noting that the extent of native vegetation remaining within the IBRA bioregion, the extent of the mapped occurrence of vegetation association 1023, and the extent of native vegetation retained in the local area are all below the national objectives and targets for biodiversity conservation in Australia, and the presence of the mapped Eucalypt Woodlands of the Western Australian Wheatbelt community and black cockatoo foraging habitat, the vegetation within the application area is considered significant as a remnant of native vegetation in an area that has been extensively cleared.

Conclusion: For the reasons set out above, it is considered that the impacts of the proposed clearing on a significant remnant of native vegetation in an area that has been extensively cleared cannot be mitigated by the applicant's avoidance and minimisation strategies and an offset is required to counterbalance the significant residual impact remaining consistent with the Government of Western Australia's Environmental Offsets Policy and Environmental Offsets Guidelines.

Conditions: To address the above impacts, the following management measures will be required as conditions on the clearing permit:

- avoid, minimise to reduce the impacts and extent of clearing;
- take hygiene steps to minimise the risk of the introduction and spread of weeds and dieback; and
- provide an offset to counterbalance the significant residual impacts to 0.481 hectares of native vegetation representing a significant remnant of native vegetation in an area that has been extensively cleared.

3.3. Relevant planning instruments and other matters

The CPS 9288/1 clearing permit application was received by DWER on 12 May 2021 and advertised on the DWER website for 21 days on 10 June 2021. No submissions were received in relation to the application.

Proposed clearing is confined to the Cuballing East Road Reserve, zoned a Local Road (Zone number 796) under the Shire of Cuballing Scheme Number 2, and the applicant has access and authorisation to undertake the upgrade works proposed.

The proposed clearing for the road upgrades is located within the Murray River System Surface Water Area proclaimed under the RIWI Act (UFI 30). Advice from DWER was received in respect to the applicant's obligations under the RIWI Act (DWER 2021). Any activities that interfere with the bed or banks of a watercourse may require a permit under the RIWI Act from DWER. The applicant has advised (Shire of Cuballing 2021c) that while the proposed clearing is located within the Murray River System Surface Water Area the project does not include any modification or realignment to any watercourses intersecting the application area. The road structures associated with crossings are structurally sound and will not require upgrades and the applicant is of the view that a permit under the RIWI Act will not be required.

In regard to management of water quality impacts, sites affected by construction or removal activities should be stabilised using the methods outlined in Stream Stabilisation (Report No RR10) and refer to Water Quality Protection Note (WQPN) 44: Roads near sensitive water resources. These publications offer best practice advice and recommendations in regards to onsite wastewater disposal, hazardous materials storage, spill response, stormwater management and rehabilitation (DWER 2021). Both documents are available from the DWER website.

The application area is located within a filed Native Title Claim area: the Single Noongar Claim (Area 1) (WAD6006/2003), and a Native Title Registered Claim area: Gnaala Karla Booja (WAD6274/1998), and the Gnaala Karla Booja Indigenous Land Use Agreement (ILUA) covers the application area.

According to available databases one Aboriginal Heritage Place has been recorded within the local area. That is, the Cuballing Reserve Hill (Place ID: 27274) located approximately 275 metres west of the application area. It is the responsibility of the applicant to comply with the *Aboriginal Heritage Act 1972* and ensure that no unauthorised impacts to Sites of Aboriginal Significance occur through the clearing process.

4 Suitability of offsets

The applicant has provided evidence of avoidance and minimisation (Section 3.1). The applicant has advised that, from a safety perspective, the proposed road works cannot be minimised further (Shire of Cuballing 2021c).

Through the detailed assessment outlined in Section 3.2 above, it has been concluded that significant residual impacts remain after the application of the avoidance and mitigation measures summarised in Section 3.1. Residual impact consists of:

- The loss of 0.481 hectares of native vegetation representing a significant remnant of native vegetation in an area that has been extensively cleared.
- The loss of 0.481 hectares of native vegetation representing low to moderate foraging habitat for the Endangered Carnaby's Cockatoo.

The Shire has proposed an environmental offset consisting of the acquisition and conservation in perpetuity of 0.81 hectares of native vegetation in at least good condition, representing at least moderate foraging habitat for the Endangered Carnaby's Cockatoo within Crown Reserve 2556 (Lot 434 on Deposited Plan 84296) in the Shire of Cuballing (Shire of Cuballing 2022). The Shire is prepared to relinquish a portion of Crown Reserve 2556 as an offset for the proposed clearing by amending the reserve purpose from 'Gravel' to 'Conservation' (Shire of Cuballing 2022).

Crown Reserve 2556 is located approximately 15 kilometres north of the application area within the Shire of Cuballing. The offset site is mapped as the same vegetation association as the application area (vegetation association 1023 medium woodland of York Gum, Wandoo and Salmon Gum) (Shepherd *et al.* (2001), and it is considered that the offset site contains environmental values that relate to those being lost (DWER 2018) including eucalypt woodland. Portions of Crown Reserve 2556 have been used to provide suitable offsets for the Shire of Cuballing in the past including CPS 8731/1, CPS 8151/2, CPS 7870/1 and CPS 7869/1.

The relevant documents required to initiate the change in reserve purpose from gravel to conservation were lodged by the Department of Planning, Lands and Heritage (DPLH) with Landgate on the 11 February 2022 (DPLH Ref. No: 173196), and the issue of a new Management Order to the Shire of Cuballing is imminent (Shire of Cuballing 2022).

To determine the quantum of the impact of proposed clearing, DWER undertook a calculation using the WA Environmental Offsets Metric (Appendix J). The output suggests that an environmental offset consisting of the acquisition and conservation in perpetuity of 0.81 hectares of native vegetation in good condition, representing at least moderate foraging habitat for the Endangered Carnaby's Cockatoo, would be acceptable to counterbalance the residual impacts identified (Appendix J). In summary:

- An offset to conserve 0.81 hectares of native vegetation in at least good condition (Appendix D) within Crown Reserve 2556 is considered appropriate to address the residual impacts to a significant remnant of native vegetation in an area that has been extensively cleared.
- An offset to conserve 0.81 hectares of native vegetation providing moderate Carnaby's Cockatoo foraging habitat within Crown Reserve 2556 is considered appropriate to address the residual impacts to Carnaby's Cockatoo resulting from the proposed clearing.

Given the above, the offset proposed by the applicant adequately counterbalances the significant residual impacts listed above, representing 100 per cent of the offset contribution consistent with the WA Environmental Offsets Policy September 2011. The justification for the values used in the offset calculation is provided in Appendix J.

Figure 2: Proposed offset site Crown Reserve 2556 (Lot 434 on Deposited Plan 84296)

Appendix A. Information received

	Description	Reference
CPS 9288/1 application	Native vegetation clearing permit application provided by the Shire of Cuballing for application CPS 9288/1.	Shire of Cuballing (2021a)
Supporting documentation provided by the applicant	Verge vegetation clearing area minimisation strategy and details	Shire of Cuballing (2021b)
	Cuballing East Road Tree photographs and locations (from west to east)	
	Cuballing East Road photopoint locations (from west to east)	
	Road design cross sections, revised verge clearing area minimisation details, tree locations and photopoints including GIS data	Shire of Cuballing (2021c)
	Western Australian Local Government Association desktop assessment report for native vegetation clearing application	WALGA (2021)
	Habitat tree assessment of proposed clearing areas: Cuballing east road and associated GIS data	Harewood (2020)
Response from the applicant to a request for further information from DWER	Cuballing East Rd - Preferred Road Design Cross Section - Plan 1 of 4 - Rev 2 at 3-11-21	Shire of Cuballing (2021c)
	Cuballing East Rd - Compromised Road Design Cross Section - No CL Shift - Plan 4 of 4 - Rev 0 at 3-11-21	
	Cuballing East Rd - Compromised Road Design Cross Section - No CL Shift - Plan 2 of 4 - Rev 2 at 3-11-21	
	Cuballing East Rd - Compromised Road Design Cross Section - 1M CL Shift - Plan 3 of 4 - Rev 2 at 3-11-21	
	Revised Cuballing East Rd - Verge clearing area minimisation details	
	Cuballing Road East - Right Hand Side Tree count	
	Cuballing Road East - Left Hand Side Tree count	
	Cubaling East Road – southern side (from the Shire boundary to the townsite) Photo IDs consistent with photo-point labels in the shape file Cuballing East RHS Tree Locations_points.shp	
	Cubaling East Road – northern side (from the Shire boundary to the townsite) Photo IDs consistent with photo-point labels in the shape file Cuballing East RHS Tree Locations_points.shp	
	GIS Data associated with the trees present within the application area	
	Assessment of the potential avoidance of two habitat trees, and the provision of an offset proposal	Shire of Cuballing (2022)

Appendix B. Site characteristics

The information provided below describes the key characteristics of the area proposed to be cleared and is based on the best information available to DWER at the time of the assessment. This information was used to inform the assessment of the clearing against the Clearing Principals, contained in Appendix C.

B.1 Site characteristics

Characteristic	Details
Local context	The application area consists of approximately 18.1 kilometres on both sides of the Cuballing East Road within the Shire of Cuballing comprising approximately 0.481 hectares of native vegetation with 537 individual trees and shrubs at 216 separate locations. The application area is located within the Avon Wheatbelt IBRA bioregion of Thackway and Cresswell (1995). Spatial data indicates the local area (10 kilometre radius from the area proposed to be cleared) retains approximately 19 per cent of the original native vegetation cover.
Ecological linkage	Proposed clearing is not located within an Environmentally Sensitive Area (ESA), or any recognised ecological linkage.
Conservation areas	Twelve reserves managed by the Department of Biodiversity, Conservation and Attractions (DBCA) are located within ten kilometres of the application area (Table B1.1).

Table B1.1 – DBCA managed lands within ten kilometres of the application area

DBCA managed lands	Vesting	Proximity (m)	No. of associated lots
Commodine Nature Reserve	WA Conservation and Parks Commission	1,080	1
Rosedale Nature Reserve	WA Conservation and Parks Commission	1,591	1
Un-named reserve	WA Conservation and Parks Commission	3,089	6
North Yilliminning Nature Reserve	WA Conservation and Parks Commission	4,134	3
Montague State Forest	WA Conservation and Parks Commission	4,157	20
Ockley Nature Reserve	WA Conservation and Parks Commission	4,628	5
East Yornaning Nature Reserve	WA Conservation and Parks Commission	5,695	7
Claypit Nature Reserve	WA Conservation and Parks Commission	6,232	1
Mungerungcutting Nature Reserve	WA Conservation and Parks Commission	7,050	1
Yornaning Nature Reserve	WA Conservation and Parks Commission	7,358	2
Fourteen Mile Brook Nature Reserve	WA Conservation and Parks Commission	7,600	1
Yarling Nature Reserve	WA Conservation and Parks Commission	8,199	1

<table>
<tr><th>Characteristic</th><th>Details</th></tr>
<tr><td>Vegetation description</td><td>
Two vegetation associations as described by Shepherd et al. (2001) have been mapped over the application area:
The major occurrence mapped over the application area is:
• Association 1023 described as a medium woodland of York Gum (Eucalyptus loxophleba), Wandoo (Eucalyptus wandoo) and Salmon Gum (Eucalyptus salmonophloia).
A minor occurrence mapped over the application area is:
• Association 947 described as a medium woodland of Powderbark (Eucalyptus accedens) and mallet.
Ten species of native trees and shrubs are present within the application area (Table B1.2) (Appendix G).
Table B1.2 – Summary of native flora species present over the application area
<table>
<tr><th colspan="2">Native species</th><th>Individuals</th><th>Locations</th></tr>
<tr><td>Acacia acuminata</td><td>Jam</td><td>86</td><td>24</td></tr>
<tr><td>Allocasuarina huegeliana</td><td>Rock Sheoak</td><td>86</td><td>36</td></tr>
<tr><td>Corymbia calophylla</td><td>Marri</td><td>13</td><td>5</td></tr>
<tr><td>Eucalyptus accedens</td><td>Powderbark</td><td>22</td><td>14</td></tr>
<tr><td>Eucalyptus astringens</td><td>Brown Mallet</td><td>8</td><td>3</td></tr>
<tr><td>Eucalyptus longicornis</td><td>Red Morrel</td><td>36</td><td>16</td></tr>
<tr><td>Eucalyptus loxophleba</td><td>York Gum</td><td>90</td><td>42</td></tr>
<tr><td>Eucalyptus rudis</td><td>Flooded Gum</td><td>3</td><td>1</td></tr>
<tr><td>Eucalyptus salmonophloia</td><td>Salmon Gum</td><td>12</td><td>2</td></tr>
<tr><td>Eucalyptus wandoo</td><td>Wandoo</td><td>181</td><td>73</td></tr>
</table>
Exotic (non-native) tree and shrub species have also been recorded over the application area (Table B1.3).
Table B1.3 – Summary of exotic trees and shrubs present over the application area
<table>
<tr><th colspan="2">Exotic Species</th><th>Individuals</th><th>Locations</th></tr>
<tr><td>Eucalyptus sp</td><td>‘Gum tree'</td><td>5</td><td>5</td></tr>
<tr><td>Acacia sp</td><td>Wattle</td><td>1</td><td>1</td></tr>
<tr><td>Melaleuca sp</td><td>Melaleuca</td><td>1</td><td>1</td></tr>
<tr><td>Allcasuarina sp</td><td>Sheoak</td><td>1</td><td>1</td></tr>
</table>
</td></tr>
<tr><td>Vegetation condition (Appendix D)</td><td>Comprehensive photography provided of every location of native vegetation over the application area (Shire of Cuballing 2021b) (e.g. Appendix G) indicate native vegetation in a predominantly completely degraded to degraded condition when utilising the vegetation condition scale for the south west and interzone botanical province of Keighery (1994) (Appendix D). That is, the structure of the vegetation is no longer intact and described as ‘parkland cleared’ with the flora comprising predominantly weed or crop species with isolated native trees or shrubs.</td></tr>
<tr><td>Climate and landform</td><td>The climate experienced in the area is a Mediterranean climate, with dry, hot summers and cool, wet winters. Average rainfall is 512.5 millimetres per annum with the majority falling between June and August (BOM 2021).
The application area is mapped predominantly in the Minor Valleys S1 Subsystem (Pimelia) of valleys in granitic terrain with narrow swampy floors, and predominantly the mid to lower slopes, footslopes and poorly drained drainage depressions (DPIRD 2017-).</td></tr>
</table>

<table>
<tr><th>Characteristic</th><th>Details</th></tr>
<tr><td>Soil description</td><td>Six soils sub-systems have been mapped over the application area (Schoknecht et al. 2004) (Table B1.4).
<table>
<tr><th colspan="4">Table B1.4 – Soils sub-systems mapped over the application area</th></tr>
<tr><th>Map unit symbol</th><th>Map unit name</th><th colspan="2">Description</th></tr>
<tr><td>257DyBK</td><td>Biberkine Subsystem (Dryandra)</td><td>Valley floors and footslopes with gently undulating rises and low hills.</td><td>Alluvium and colluvium over granite etc. Yellow brown sandy duplexes, wet and semi-wet soils & brown deep loamy duplexes. Wandoo-Flooded Gum with Jam-Sheoak-Teatree.</td></tr>
<tr><td>257DyNB</td><td>Noombling Subsystem (Dryandra)</td><td>Long gentle and undulating hillslopes and divides. Colluvium / weathered granite, gneiss and some dolerite.</td><td>Yellow/brown and grey deep sandy duplexes, brown deep loamy duplexes, sandy gravels and shallow duplexes. Marri-Wandoo / Jam-Sheoak</td></tr>
<tr><td>257NgNB</td><td>Noombling Subsystem (Narrogin)</td><td>Gently sloping terrain which may extend over local divides.</td><td>Yellow and red duplex soils and associated granite and dolerite outcrops</td></tr>
<tr><td>257DyNO</td><td>Norrine Subsystem (Dryandra)</td><td>A complex of lateritic residuals and associated pediment.</td><td>Gravely sand, sand, duplex yellow soils and duricrust</td></tr>
<tr><td>257PbNO</td><td>Norrine Subsystem (Pumphreys)</td><td>A complex of lateritic residuals and associated pediment.</td><td>Gravely sand, sand, duplex yellow soils and duricrust</td></tr>
<tr><td>257PbPG</td><td>Popanyinning Subsystem (Pumphreys)</td><td>Broad valley floor.</td><td>Yellow duplex soils and a narrow lower sandy terrace, spoadic sand dunes</td></tr>
</table></td></tr>
<tr><td>Land degradation risk</td><td>Mapped land degradation risk for the soil sub-systems mapped over the application area are provided in Table B1.5 below.
<table>
<tr><th colspan="4">Table B1.5 – Land degradation risks</th></tr>
<tr><th rowspan="2">Factor</th><th colspan="3">Area</th></tr>
<tr><th>West</th><th>Central</th><th>East</th></tr>
<tr><td>Wind erosion</td><td>M1</td><td>M1</td><td>M1</td></tr>
<tr><td>Water Erosion</td><td>L1</td><td>L1</td><td>L1</td></tr>
<tr><td>Phosphorus export</td><td>M1</td><td>M1</td><td>M1</td></tr>
<tr><td>Waterlogging</td><td>L1</td><td>M1</td><td>L1</td></tr>
<tr><td>Flooding</td><td>L1</td><td>M1</td><td>L1</td></tr>
<tr><td>Salinity risk</td><td>L2</td><td>M1</td><td>L2</td></tr>
</table>
Key:
<table>
<tr><td>H2</td><td>High</td><td>>70%</td><td>of mapped unit has a high to extreme risk</td></tr>
<tr><td>H1</td><td>High</td><td>50-70%</td><td>of mapped unit has a high to extreme risk</td></tr>
<tr><td>M2</td><td>Meduim</td><td>30-50%</td><td>of mapped unit has a high to extreme risk</td></tr>
<tr><td>M1</td><td>Meduim</td><td>10-30%</td><td>of mapped unit has a high to extreme risk</td></tr>
<tr><td>L2</td><td>Low</td><td>3-10%</td><td>of mapped unit has a high to extreme risk</td></tr>
<tr><td>L1</td><td>Low</td><td><3%</td><td>of mapped unit has a high to extreme risk</td></tr>
</table></td></tr>
</table>

Characteristic	Details
	Land capability tables for the soil sub-systems mapped over the application area are provided in Table B1.6 below.

Table B1.6 - Land capability assessment of the soils mapped over the application area

Map unit	257DyNB	257DyBK	257DyNO	257NgNB	257PbPG	257PbNO
lc_ann_hor	B1	B2	B1	A2	B2	B1
lc_ann_ho3	>70% of the land has moderate to very high capability	50-70% of the land has moderate to very high capability	>70% of the land has moderate to very high capability	50-70% of the land has high to very high capability	50-70% of the land has moderate to very high capability	>70% of the land has moderate to very high capability
lc_dry_cro	B2	B2	B2	B1	B2	B1
lc_dry_cr3	50-70% of the land has moderate to very high capability	50-70% of the land has moderate to very high capability	50-70% of the land has moderate to very high capability	>70% of the land has moderate to very high capability	50-70% of the land has moderate to very high capability	>70% of the land has moderate to very high capability
lc_graz	A2	A2	B2	B1	B2	B2
lc_graz_de	50-70% of the land has high to very high capability	50-70% of the land has high to very high capability	50-70% of the land has moderate to very high capability	>70% of the land has moderate to very high capability	50-70% of the land has moderate to very high capability	50-70% of the land has moderate to very high capability
lc_per_hor	A2	B2	A2	B1	B2	B1
lc_per_ho3	50-70% of the land has high to very high capability	50-70% of the land has moderate to very high capability	50-70% of the land has high to very high capability	>70% of the land has moderate to very high capability	50-70% of the land has moderate to very high capability	>70% of the land has moderate to very high capability
lc_vines	A2	B2	A2	A2	B2	A2
lc_vines_d	50-70% of the land has high to very high capability	50-70% of the land has moderate to very high capability	50-70% of the land has high to very high capability	50-70% of the land has high to very high capability	50-70% of the land has moderate to very high capability	50-70% of the land has high to very high capability

Watercourses

One minor ephemeral watercourse bisects the application area. Numerous watercourses are mapped within ten kilometres of the application area (Table B1.7 below).

Table B1.7 – Waterbodies and inland waters mapped within five kilometres of the application area

Type of inland water	Description	Proximity (m)
Hydrography, linear	Watercourse - minor, non-perennial	0
Rivers	Hotham RIver Mainstream	22
Rivers	Mainstream	23
Rivers	Darring Brook Major Trib	502
Rivers	Major Tributary	1,234
Rivers	Minor River	2,199
Rivers	Fourteen Mile Brook Major River	4,962

Characteristic	Details		
	Geomorphic Wetlands Wheatbelt	Not defined	5,122
	Geomorphic Wetlands Wheatbelt	Blackwood_EA012_a1_a5_a2_a3_a5b - Not defined	5,891
	Geomorphic Wetlands Wheatbelt	Blackwood_EA012_a1_a5_a2_a3_a5a - Not defined	5,985
	Rivers	Major River	6,049
	Geomorphic Wetlands Wheatbelt	Blackwood_EA012_a1_a5_a7b - Not defined	6,080
	Rivers	Cuneenying Brook Minor River	6,243
	Geomorphic Wetlands Wheatbelt	Blackwood_EA012_a1_a5_a2_a3_a4 - Not defined	6,259
	Geomorphic Wetlands Wheatbelt	Blackwood_EA012_a1_a5_a7a - Not defined	6,694
	Rivers	Minor Tributary	6,794
	Geomorphic Wetlands Wheatbelt	Blackwood_EA012_a1_a5_a2_a5 - Not defined	6,887
	Geomorphic Wetlands Wheatbelt	Blackwood_EA012_a1_a5_a6_a1 - Not defined	6,921
	Geomorphic Wetlands Wheatbelt	Blackwood_EA012_a1_a5_a6 - Not defined	6,991
	Rivers	Wurungnulling Creek Major Trib	7,186
	Geomorphic Wetlands Wheatbelt	Blackwood_EA012_a1_a5_a2_a3_a3 - Not defined	7,360
	Rivers	Yarling Brook Significant Stream	7,372
	Geomorphic Wetlands Wheatbelt	Blackwood_EA012_a1_a5_a2_a4 - Not defined	7,430
	Geomorphic Wetlands Wheatbelt	Blackwood_EA012_a1_a5_a2_a3_a3_a1 - Not defined	7,559
	Rivers	Narrogin Brook Major River	7,864
	Geomorphic Wetlands Wheatbelt	Blackwood_EA012_a1_a5_a2_a3_a2 - Not defined	8,202
	Geomorphic Wetlands Wheatbelt	Blackwood_EA012_a1_a5_a6_b1 - Not defined	8,275
	Geomorphic Wetlands Wheatbelt	Blackwood_EA011_b2_a1_c8 - Not defined	8,295
	Geodata, Lakes	lake	8,307
	Hydrography, Lakes (medium scale 250k)	lake	8,307
	Geomorphic Wetlands Wheatbelt	Blackwood_EA012_a1_a5_a6_c1 - Not defined	8,520
	Geomorphic Wetlands Wheatbelt	Blackwood_EA012_a1_a5_a2_a3_a2_a1 - Not defined	8,973
	Geomorphic Wetlands Wheatbelt	Blackwood_EA011_b2_a1_c7_c1 - Not defined	9,025
	Geomorphic Wetlands Wheatbelt	Blackwood_EA012_a1_a5_a5 - Not defined	9,029
	Geomorphic Wetlands Wheatbelt	Blackwood_EA012_a1_a5_a2_a4_a1 - Not defined	9,062
	Geomorphic Wetlands Wheatbelt	Blackwood_EA012_a1_a5_a2_a4_a2 - Not defined	9,103
	Geomorphic Wetlands Wheatbelt	Blackwood_EA012_a1_a5_a2_a3_a2_a3 - Not defined	9,149
	Geomorphic Wetlands Wheatbelt	Blackwood_EA012_a1_a5_a2_a3_a1 - Not defined	9,192

Characteristic	Details		
	Geomorphic Wetlands Wheatbelt	Blackwood_EA012_a1_a5_a2_a3_a2_a2a - Not defined	9,192
	Rivers	Minniging Brook Significant Stream	9,207
	Geomorphic Wetlands Wheatbelt	Blackwood_EA012_a1_a5_a2_a3_a2_a2c - Not defined	9,233
	Geomorphic Wetlands Wheatbelt	Blackwood_EA012_a1_a5_a5_a1 - Not defined	9,261
	Geomorphic Wetlands Wheatbelt	Blackwood_EA012_a1_a5_a2_a3_a2_a2b - Not defined	9,278
	Geomorphic Wetlands Wheatbelt	Blackwood_EA012_a1_a5_a4a - Not defined	9,303
	Rivers	Significant Stream	9,307
	Geomorphic Wetlands Wheatbelt	Blackwood_EA011_b3_a6 - Not defined	9,379
	Geomorphic Wetlands Wheatbelt	Blackwood_EA011_b2_a1_c7 - Not defined	9,387
	Geomorphic Wetlands Wheatbelt	Blackwood_EA012_a1_a5_a2_a3_a2_a4a - Not defined	9,433
Hydrogeography	Hydrological attributes are provided in Table B1.8 below.		

Table B1.8 – Hydrological attributes

Factor	ID
Hydrological Zone	Southern zone of rejuvenated drainage
Basin	Murray River
Hydrographic Catchment	Peel Estuary_Murray River
RIWI Act Surface Water and Irrigation District	Murray River System (UFI 30)
RIWI Act Rivers	None
RIWI Act Groundwater Areas	None
CAWS Act Clearing Control Catchment	None
Public Drinking Water Source Areas	None
Wellhead Protection Zone	None
Resevoir Protection Zone	None
Salinity	7,000 to 14,000 TDS /mg/l
Flooding	
Central section	M1

B.2. Vegetation extent

Table B2.1 - Extent of mapped native vegetation					
	Pre-European (ha)	Current Extent (ha)	Remaining (%)	Current Extent in DBCA Managed Lands	
				(ha)	(%)
IBRA Bioregion					
Avon Wheatbelt	9,517,110	1,761,187	18.5	174,981	9.9
Vegetation association					
Association 1023 (major)	1,601,606	172,875	10.8	18,926	10.9
Association 947 (minor)	33,788	11,703	34.6	4,717	40.3
Remnant vegetation					
10 kilometre radius	66,418	12,668	19.1		

B.3 Flora of significance potentially occurring over the application area

Two threatened flora taxa and eight priority flora taxa have been recorded within ten kilometres of the application area. Due to the completely degraded to degraded condition of the vegetation the likelihood of flora of conservation significance occurring over the application area is very low (WAH 1998-).

Table B3.1 - Flora of significance recorded within ten kilometres of the application area			
Threatened taxon	**Status (WA)**	**Records / locations**	**Likelihood of occurrence**
Acacia insolita subsp. recurva	CR	11	Very low
Pultenaea pauciflora	VU	1	Very low
Priority taxon	**Status (WA)**		
Andersonia carinata	P2	2	Very low
Babingtonia maleyae	P2	5	Very low
Banksia subpinnatifida var. *subpinnatifida*	P2	2	Very low
Acacia deflexa	P3	4	Very low
Thysanotus tenuis	P3	1	Very low
Verticordia huegelii var. tridens	P3	1	Very low
Eucalyptus loxophleba x wandoo	P4	2	Very low
Gastrolobium tomentosum	P4	2	Very low

B.4 Fauna of significance potentially occurring over the application area

Two birds, seven mammals and one reptile of conservation significance have been recorded within ten kilometres of the application area.

Table B4.1 - Fauna of significance recorded within ten kilometres of the application area				
Taxon	**Common Name**	**Status**	**Records/ Locations**	**Likelihood of occurrence**
Birds				
Calyptorhynchus latirostris	Carnaby's Cockatoo	EN	4	Possible
Platycercus icterotis xanthogenys	Western Rosella (inland)	P4	2	Unlikely
Mammals				
Bettongia lesueur graii	Boodie (inland)	EX	3	Extinct
Myrmecobius fasciatus	Numbat	EN	9	Very Unlikely
Macrotis lagotis	Bilby	VU	1	Very Unlikely

Table B4.1 - Fauna of significance recorded within ten kilometres of the application area				
Taxon	**Common Name**	**Status**	**Records/ Locations**	**Likelihood of occurrence**
Isoodon fusciventer	Quenda	P4	1	Very Unlikely
Notamacropus irma	Western Brush Wallaby	P4	1	Very Unlikely
Notamacropus eugenii derbianus	Tammar Wallaby	P4	2	Very Unlikely
Phascogale calura	Red-tailed Phascogale	CD	70	Unlikely
Reptiles				
Acanthophis antarcticus	Southern Death Adder	P3	3	Very Unlikely

The application area provides potential foraging habitat (four tree species), breeding habitat (five tree species) and roosting habitat (five tree species) for the Endangered Carnaby's Cockatoo *(Calyptorhynchus latirostris).*

Table B4.2 – Tree species providing potential habitat for Carnaby's Cockatoo (Bamford 2013)						
Native Species		**Individ.**	**Locations**	**Foraging**	**Breeding**	**Roosting**
Eucalyptus wandoo	Wandoo	181	73	F	B	R
Eucalyptus loxophleba	York Gum	90	42	F	B	R
Allocasuarina huegeliana	Rock Sheoak	86	36			
Acacia acuminata	Jam	86	24			
Eucalyptus longicornis	Red Morrel	36	16		B	
Eucalyptus accedens	Powderbark	22	14			
Corymbia calophylla	Marri	13	5	F	B	R
Eucalyptus salmonophloia	Salmon Gum	12	2	F	B	R
Eucalyptus rudis	Flooded Gum	3	1			R
Eucalyptus astringens	Brown Mallet	8	3			

B.5 Significant ecological communities

No Threatened Ecological Communities (TECs) endorsed by the Western Australian Minister for Environment have been mapped within ten kilometres of the application area. One Threatened Ecological Community (TEC) listed as Critically Endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) and as a Priority 3 Priority Ecological Communities (PEC) by the Department of Biodiversity, Conservation and Attractions (DBCA) has been mapped within ten kilometres of the application area, and over the application area (Table B5.1).

Table B5.1 - Significant ecological communities recorded within ten kilometres of the application area				
Common name	**Common ID**	**Status (WA)**	**Status (Cth)**	**Proximity (m)**
Eucalypt woodlands of the Western Australian Wheatbelt	Wheatbelt Woodlands	P3	CR	Application area

Of the approximately 12,668 hectares of native vegetation remaining within 10 kilometres of the application area (19.1 per cent of its former extent), 10,508 hectares has been mapped as Eucalypt Woodlands (Table B5.2 below). That is, 82.7 per cent of the remaining remnant vegetation in the local area has been mapped as Eucalypt Woodlands.

Table B5.2 – Remnant vegetation mapped within ten kilometres of the application area			
Remnant vegetation	**Pre-European extent (ha)**	**Current extent (ha)**	**Remaining (%)**
Remnant vegetation	66,418	12,668	19.1
Eucalypt Woodlands (P3)		10,508	15.8

Appendix C. Assessment against the clearing principles

Assessment against the clearing principles	Variance level	Is further consideration required?
Environmental value: biological values		
Principle (a): *"Native vegetation should not be cleared if it comprises a high level of biodiversity."* Assessment: The area proposed to be cleared does not contain regionally significant flora. The application area consists of ten native trees and shrubs (Table B1.2) in a completely degraded to degraded condition utilising the vegetation condition scale of Keighery (1994) (Appendix D). The structure of the vegetation is no longer intact and is 'parkland cleared' with no native understorey. Due predominantly to the lack of understorey the species richness of the vegetation present is likely to be very low when compared to analogous areas of native vegetation in better condition. Due to the lack of understorey, the likelihood of flora of conservation significance occurring over the application area is very low. Two potential breeding hollows suitable for black cockatoos are located within the application area. The Eucalypt woodlands of the Western Australian Wheatbelt is TEC has been mapped over the application area.	Not likely to be at variance	Yes Refer to Section 3.2.1
Principle (b): *"Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna."* Assessment: According to available databases, two birds, seven mammals and one reptile of conservation significance have been recorded from within ten kilometres of the application area (Table B4.1). The application area is within the breeding range of the Endangered Carnaby's Cockatoo *(Calyptorhynchus latirostris)* and provides potential foraging habitat (four tree species), breeding habitat (five tree species) and roosting habitat (five tree species) for the species.	At variance	Yes Refer to Section 3.2.2
Principle (c): *"Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, threatened flora."* Assessment: A review of available databases determined that two threatened flora taxa have been recorded within ten kilometres of the application area (Table B3.1). Due to the completely degraded to degraded condition of the vegetation, and in particular the lack of an understorey component, the likelihood of threatened flora taxa occurring over the application area is very low.	Not at variance	No
Principle (d): *"Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a threatened ecological community."* Assessment: A review of available databases determined that no communities listed as a Threatened Ecological Community (TEC) endorsed by the Western Australian Minister for Environment have been mapped within the application area, or within the local area within ten kilometres of the application area. The Eucalypt woodlands of the Western Australian Wheatbelt TEC, listed as Critically Endangered under the EPBC Act has been mapped over the application area.	May be at variance	Yes Refer to Section 3.2.1
Environmental value: significant remnant vegetation and conservation areas		
Principle (e): *"Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared."*	At variance	Yes Refer to Section 3.2.3

Assessment against the clearing principles	Variance level	Is further consideration required?
The national objectives and targets for biodiversity conservation in Australia has a target to prevent clearance of ecological communities with an extent below 30 per cent of that present prior to 1750, below which species loss appears to accelerate exponentially at an ecosystem level (Commonwealth of Australia 2001). The application area is located within the extensively cleared Avon Wheatbelt IBRA Bioregion which retains approximately 18.5 per cent of its pre-European vegetation extent (Government of Western Australia, 2019) (Table B2.1). The major vegetation association occurring, Association 1023, has just 10.8 per cent of it's pre-European vegetation extent (Government of Western Australia, 2019), and the local area retains approximately 19.1 per cent native vegetation cover (Table B2.1). Noting the extent of vegetation remaining within the IBRA bioregion, the mapped vegetation associations, and the local area, the vegetation within the application area is considered significant as a remnant of native vegetation in an area that has been extensively cleared.		
Principle (h): *"Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area."* Assessment: Twelve reserves managed by the Department of Biodiversity, Conservation and Attractions (DBCA) are located within ten kilometres of the application area (Table B1.1). The closest of these is Commodine Nature Reserve at over one kilometre distant from the application area, with Rosedale Nature Reserve located at over 1.5 kilometres. Given the separation distances and the completely degraded to degraded vegetation within the application area, clearing of the vegetation is not likely to have an impact on the environmental values of any adjacent or nearby conservation area.	Not at variance	No
Environmental value: land and water resources		
Principle (f): *"Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland."* Assessment: Numerous watercourses are mapped within ten kilometres of the application area, and one minor ephemeral watercourse bisects the application area (Table B1.7). Of the native vegetation occurring just one location consists of vegetation considered associated with a watercourse. That is location 1Er (SLK 1.38) where a group of three adjacent Flooded Gums *(Eucalyptus rudis)* occur; two medium-sized trees and one sapling (see Appendix E). Noting the minor extent of clearing of riparian vegetation required (just three trees from a total of 537), the completely degraded to degraded condition of the vegetation, and the 30 metres separation distance from the nearest drainage line, proposed clearing is not considered to have a significant impact on native vegetation growing in association with a watercourse.	At variance	No
Principle (g): *"Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation."* Assessment: The landforms occurring over the application area consist of gently sloping terrain, broad valley floors and foot slopes with some gently undulating rises and low hills or long gentle and undulating hillslopes and divides (Table B1.4). No steep slopes, breakaways are encountered. Wind erosion risk is mapped at 'medium' across the application area (Table B1.5), with smaller areas mapped at 'high' risk, and at the local scale the removal of native vegetation may contribute to increased amounts of wind erosion in adjacent areas from proposed roadworks in any of the soil sub-systems (Table B1.4). However, with standard road construction methodologies in place these localised wind erosion impacts can be managed. The proposed end land use is not expected to contribute to phosphorous export or salinity and waterlogging risk can be mitigated by implementing standard road work design. Proposed clearing is not expected to result in an increased risk of changes to pH, salinity, or eutrophication and	Not likely to be at variance	No

Assessment against the clearing principles	Variance level	Is further consideration required?
standard design features and roadwork construction methodologies are likely to mitigate wind and water erosion risk.		
Principle (i): *"Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water."* Assessment: The application area is not situated within any groundwater areas proclaimed under the *Rights in Water and Irrigation Act 1914* (RIWI Act). Groundwater salinity within the application area is mapped between 7,000 to 14,000 milligrams per litre total dissolved solids (That is, 'saline'). Proposed clearing is not likely to contribute to increased salinity. The application area is located within the Murray River System, a proclaimed surface water area under the RIWI Act (UFI 30). The application area intersects a minor ephemeral watercourse (Table B1.7). The applicant has advised that no modifications or realignments to drainage lines are planned and that existing structures associated with drainage crossings are structurally sound and will not require amendment. With standard design features and roadwork construction methodologies implemented, proposed clearing is not likely to cause any deterioration in the quality of surface or underground water.	Not likely to be at variance	No
Principle (j): *"Native vegetation should not be cleared if the clearing of the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding."* Assessment: The application area experiences an annual average rainfall of approximately 512 millimetres per annum with the majority falling between June and August (BOM 2021). The Hotham River bisects the Cuballing East Road within 25 metres of the application area, and a minor ephemeral watercourse intersects the application area. Flood risk has been mapped as 'medium' in the central area of the application area associated with Hotham River, and 'low' elsewhere (Table B1.5). There are no mapped floodplains mapped within ten kilometres of the application area and proposed clearing is therefore located outside of a 1 in 5,000 annual exceedance probability (AEP) event. Noting the end land-use and standard design features and roadwork construction methodologies implemented, the risk of proposed clearing causing, or exacerbating, the incidence or intensity of flooding is low.	Not likely to be at variance	No

Appendix D. Vegetation condition rating scale

Vegetation condition is a rating given to a defined area of vegetation to categorise and rank disturbance related to human activities. The rating refers to the degree of change in the vegetation structure, density and species present in relation to undisturbed vegetation of the same type. The degree of disturbance impacts upon the vegetation's ability to regenerate. Disturbance at a site can be a cumulative effect from a number of interacting disturbance types.

Considering its location, the scale below was used to measure the condition of the vegetation proposed to be cleared. This scale has been extracted from Keighery, B.J. (1994) *Bushland Plant Survey: A Guide to Plant Community Survey for the Community*. Wildflower Society of WA (Inc). Nedlands, Western Australia.

Measuring vegetation condition for the South West and Interzone Botanical Province (Keighery 1994)

Condition	Description
Pristine	Pristine or nearly so, no obvious signs of disturbance.
Excellent	Vegetation structure intact, with disturbance affecting individual species; weeds are non-aggressive species.
Very Good	Vegetation structure altered, with obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and/or grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and/or grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and/or grazing.
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

Appendix E. Locations and flora species present in the application area

Table E1 – Summary of flora species present in the application area

Code	Native Species	LHS	RHS	Locations
		Individ.	Individ.	
Aa	*Acacia acuminata*	55	31	24
Ah	*Allocasuarina huegeliana*	38	48	36
Cc	*Corymbia calophylla*	7	6	5
Ea	*Eucalyptus accedens*	5	17	14
East	*Eucalyptus astringens*	5	3	3
EL	*Eucalyptus longicornis*	18	18	16
Elox	*Eucalyptus loxophleba*	38	52	42
Er	*Eucalyptus rudis*	3	0	1
Es	*Eucalyptus salmonophloia*	9	3	2
Ew	*Eucalyptus wandoo*	79	102	73
TOTAL		257	280	**216**
		537		

Table E2 – Flora species present in the application area

Side	ID/Code	Latitude	Longitude	SLK	Comments
RHS	442Asp	-32.8181	117.1811	0.11	
RHS	441Msp	-32.8181	117.1813	0.13	
RHS	440Elox	-32.8179	117.1819	0.2	
RHS	439Aa	-32.8178	117.1821	0.22	2x
RHS	438Elox	-32.8174	117.1858	0.59	counted as 1
RHS	437Elox	-32.8175	117.1865	0.66	+ dead Ah
RHS	436Elox	-32.8185	117.1909	1.1	counted as 1
RHS	435Elox	-32.8186	117.1916	1.17	as one + dead Aa
RHS	434Elox	-32.8186	117.1917	1.18	counted as 1
RHS	433Elox	-32.8188	117.1923	1.24	
RHS	432Elox	-32.8188	117.1924	1.25	3x
RHS	431Elox	-32.8190	117.1938	1.38	
LHS	1Er	-32.8188	117.1939	1.38	3x *Eucalyptus rudis*
RHS	430Aa	-32.8190	117.1939	1.39	counted as 1
LHS	2El	-32.8189	117.1950	1.49	2x Elox + 1 Aa
RHS	429Elox	-32.8190	117.1952	1.51	
LHS	3Aa	-32.8189	117.1957	1.56	2x
LHS	4Ah	-32.8189	117.1959	1.57	
RHS	428Elox	-32.8190	117.1959	1.58	
LHS	5Aa	-32.8189	117.1961	1.58	+ Elox
LHS	6Ah	-32.8189	117.1963	1.62	
RHS	427Elox	-32.8190	117.1964	1.63	
RHS	425Elox	-32.8189	117.1965	1.64	counted as 1
RHS	426Aa	-32.8190	117.1965	1.64	
RHS	424Elox	-32.8190	117.1965	1.64	
RHS	423Elox	-32.8190	117.1966	1.65	+Ah
LHS	7Elox	-32.8189	117.1968	1.66	
RHS	422Elox	-32.8190	117.1970	1.68	
LHS	8Elox	-32.8189	117.1974	1.71	
LHS	9Aa	-32.8189	117.1976	1.74	

Table E2 – Flora species present in the application area					
Side	**ID/Code**	**Latitude**	**Longitude**	**SLK**	**Comments**
RHS	421Elox	-32.8189	117.1998	1.95	3x
LHS	10Elox	-32.8189	117.2000	1.97	3x
LHS	11Elox	-32.8191	117.2001	1.98	
LHS	12Elox	-32.8189	117.2002	1.99	
RHS	419Elox	-32.8190	117.2004	2	counted as 1
RHS	420Elox	-32.8190	117.2003	2	
LHS	13Ah	-32.8189	117.2028	2.23	
RHS	418Ah	-32.8190	117.2029	2.24	
LHS	14Ah	-32.8189	117.2030	2.24	
RHS	417Ah	-32.8190	117.2031	2.26	
RHS	415Ah	-32.8190	117.2034	2.29	
RHS	416Cc	-32.8189	117.2034	2.29	
LHS	15Cc	-32.8189	117.2035	2.3	Counted as 3
RHS	414Cc	-32.8190	117.2037	2.31	
LHS	16Cc	-32.8188	117.2038	2.32	2x
LHS	17CC	-32.8188	117.2039	2.33	
RHS	413Elox	-32.8189	117.2049	2.43	
RHS	412Aa	-32.8188	117.2051	2.45	
RHS	411Aa	-32.8188	117.2055	2.48	
RHS	406Elox	-32.8188	117.2077	2.69	counted as 1
RHS	405Aa	-32.8188	117.2080	2.72	
RHS	404Elox	-32.8188	117.2082	2.73	counted as 1
RHS	403Elox	-32.8188	117.2083	2.75	counted as 1
LHS	18Elox	-32.8187	117.2083	2.75	Counted as 1
LHS	19Aa	-32.8187	117.2084	2.76	
RHS	402Cc	-32.8188	117.2090	2.81	
RHS	401Aa	-32.8188	117.2092	2.83	
RHS	399Cc	-32.8189	117.2097	2.87	counted as 1
RHS	400Cc	-32.8189	117.2096	2.87	2x
LHS	20Aa	-32.8188	117.2099	2.9	
LHS	21Elox	-32.8188	117.2102	2.92	Counted as 1
RHS	398Elox	-32.8189	117.2104	2.94	
LHS	22Cc	-32.8188	117.2105	2.95	
RHS	397Elox	-32.8187	117.2114	3.04	2x
RHS	396Elox	-32.8187	117.2115	3.05	2x
LHS	23Aa	-32.8169	117.2155	3.47	
LHS	24Aa	-32.8168	117.2161	3.52	
LHS	25Aa	-32.8167	117.2163	3.55	
RHS	395Elox	-32.8167	117.2168	3.6	
LHS	26Elox	-32.8175	117.2213	4.03	
LHS	27Elox	-32.8175	117.2216	4.06	
LHS	28Elox	-32.8177	117.2221	4.11	
LHS	29Aa	-32.8179	117.2227	4.17	
LHS	30Aa	-32.8180	117.2233	4.23	
LHS	31Aa	-32.8181	117.2237	4.26	counted as 1
LHS	32Ew	-32.8183	117.2245	4.35	
LHS	33Aa	-32.8184	117.2247	4.36	
LHS	34Aa	-32.8184	117.2249	4.38	
LHS	35Aa	-32.8190	117.2276	4.65	
LHS	36Aa	-32.8193	117.2291	4.79	
LHS	37Ew	-32.8193	117.2292	4.8	
LHS	38Ew	-32.8198	117.2314	5.01	+ 2xAa

Table E2 – Flora species present in the application area					
Side	**ID/Code**	**Latitude**	**Longitude**	**SLK**	**Comments**
LHS	39Ew	-32.8199	117.2319	5.06	+ Aa
RHS	393Ah	-32.8202	117.2326	5.09	
RHS	394Ah	-32.8200	117.2321	5.09	
LHS	40Elox	-32.8201	117.2324	5.11	
RHS	391Ah	-32.8202	117.2327	5.14	
RHS	392Elox	-32.8202	117.2326	5.14	+ Ah
RHS	390Elox	-32.8202	117.2328	5.14	
RHS	389Elox	-32.8202	117.2330	5.16	
LHS	41Ew	-32.8202	117.2329	5.16	Counted as 1
RHS	388Elox	-32.8203	117.2330	5.17	
LHS	42Elox	-32.8202	117.2330	5.18	Counted as 1
RHS	387Ah	-32.8203	117.2333	5.2	
RHS	386Ah	-32.8204	117.2335	5.22	
LHS	43Ew	-32.8203	117.2334	5.22	3x
LHS	44Ew	-32.8204	117.2342	5.28	
LHS	45Ew	-32.8205	117.2343	5.29	Counted as 1
RHS	385Ew	-32.8206	117.2345	5.32	
LHS	46Ew	-32.8206	117.2349	5.35	
LHS	47Ew	-32.8206	117.2349	5.36	
RHS	384Ah	-32.8207	117.2350	5.37	
RHS	383Ew	-32.8207	117.2351	5.38	+Ah
RHS	381Ew	-32.8207	117.2352	5.39	
RHS	382Ew	-32.8207	117.2352	5.39	2x
RHS	380Ew	-32.8207	117.2353	5.4	counted as 1
RHS	379Ew	-32.8208	117.2357	5.43	
RHS	378Ah	-32.8209	117.2358	5.44	
RHS	377Ah	-32.8209	117.2361	5.47	
LHS	48Ah	-32.8208	117.2361	5.47	
LHS	49Aa	-32.8209	117.2363	5.49	2x
RHS	376Ah	-32.8212	117.2372	5.58	
RHS	375Ew	-32.8212	117.2375	5.61	+Ah
RHS	374Ah	-32.8213	117.2378	5.63	dead
LHS	50Ew	-32.8216	117.2392	5.77	3x
LHS	51Ew	-32.8217	117.2396	5.81	
LHS	52Ah	-32.8217	117.2397	5.82	
LHS	53Ew	-32.8218	117.2400	5.84	
LHS	54Aa	-32.8219	117.2402	5.86	
LHS	55Aa	-32.8219	117.2403	5.87	
LHS	56Aa	-32.8220	117.2403	5.88	
LHS	57Aa	-32.8220	117.2404	5.89	2x
LHS	59Aa	-32.8220	117.2405	5.9	2x
LHS	60Aa	-32.8220	117.2405	5.91	2x
LHS	62Aa	-32.8221	117.2407	5.92	2x
LHS	61Aa	-32.8221	117.2406	5.92	counted as 1
RHS	373Ew	-32.8222	117.2407	5.93	
LHS	64Ew	-32.8222	117.2410	5.94	+Ah
LHS	63Ew	-32.8222	117.2409	5.94	
LHS	65Ew	-32.8222	117.2410	5.95	
LHS	66Elox	-32.8224	117.2414	6	
LHS	67Aa	-32.8225	117.2417	6.01	
RHS	371Ew	-32.8225	117.2416	6.02	2x
RHS	372Ew	-32.8225	117.2416	6.02	

Table E2 – Flora species present in the application area					
Side	**ID/Code**	**Latitude**	**Longitude**	**SLK**	**Comments**
LHS	68Asp	-32.8225	117.2418	6.03	Wattle species
RHS	370Aa	-32.8226	117.2420	6.06	2x
RHS	369Aa	-32.8228	117.2426	6.11	
RHS	367Ew	-32.8229	117.2427	6.14	+Ah
RHS	366Ew	-32.8229	117.2428	6.15	counted as 1
RHS	365Ew	-32.8230	117.2430	6.16	2x
RHS	364Aa	-32.8230	117.2430	6.17	2x +Ew
RHS	362Aa	-32.8231	117.2431	6.17	
RHS	363Aa	-32.8230	117.2431	6.17	
LHS	69Aa	-32.8230	117.2431	6.17	Counted as 1
LHS	70Ah	-32.8230	117.2432	6.18	
LHS	71Ah	-32.8230	117.2433	6.19	
LHS	72Ah	-32.8231	117.2434	6.2	
RHS	361Aa	-32.8232	117.2434	6.21	
RHS	360Aa	-32.8233	117.2437	6.24	
LHS	73Ah	-32.8232	117.2439	6.25	5x
LHS	74Ah	-32.8233	117.2440	6.26	2x
RHS	358Aa	-32.8234	117.2441	6.28	dead
RHS	359Ah	-32.8234	117.2441	6.28	
RHS	357Aa	-32.8235	117.2442	6.29	
LHS	75Ah	-32.8234	117.2444	6.29	
LHS	77Aa	-32.8235	117.2445	6.3	4x
LHS	76Ah	-32.8235	117.2444	6.3	+Aa
RHS	356Aa	-32.8235	117.2444	6.31	
RHS	355Ea	-32.8236	117.2446	6.33	
RHS	353Aa	-32.8237	117.2449	6.36	+Ah
RHS	354Ew	-32.8236	117.2447	6.36	
LHS	78Aa	-32.8237	117.2451	6.37	
RHS	352Aa	-32.8238	117.2453	6.39	
RHS	351Aa	-32.8239	117.2453	6.4	dead
LHS	79Ah	-32.8238	117.2453	6.4	counted as 1 (one part dead)
RHS	350Ah	-32.8239	117.2454	6.41	
RHS	349Ah	-32.8239	117.2455	6.42	2
LHS	80Ah	-32.8239	117.2457	6.43	
LHS	82Aa	-32.8240	117.2459	6.45	
LHS	81Ah	-32.8239	117.2458	6.45	
LHS	83Aa	-32.8240	117.2459	6.46	
RHS	348Ah	-32.8242	117.2463	6.51	
RHS	347Ah	-32.8243	117.2467	6.55	
RHS	346Ah	-32.8243	117.2470	6.57	2x
RHS	345Ah	-32.8245	117.2493	6.78	
RHS	344Elox	-32.8240	117.2519	7.03	
RHS	343Elox	-32.8240	117.2520	7.04	
RHS	342Ew	-32.8235	117.2531	7.16	
RHS	341Ew	-32.8232	117.2535	7.21	2x
RHS	340Ew	-32.8231	117.2537	7.21	first in the row, two more further up are pictured in 341Ew
RHS	339Ew	-32.8230	117.2539	7.24	
RHS	338Ew	-32.8228	117.2543	7.29	2x
RHS	337Ew	-32.8227	117.2544	7.31	

Table E2 – Flora species present in the application area					
Side	**ID/Code**	**Latitude**	**Longitude**	**SLK**	**Comments**
RHS	336Ew	-32.8224	117.2549	7.35	
RHS	335Ew	-32.8224	117.2549	7.36	+Ah
RHS	334Ea	-32.8221	117.2555	7.43	
RHS	333Ew	-32.8220	117.2556	7.44	
RHS	332Ew	-32.8218	117.2559	7.48	3x
RHS	331Ew	-32.8218	117.2560	7.48	2x + Aa
RHS	330Ea	-32.8215	117.2565	7.54	
RHS	329Ew	-32.8214	117.2567	7.56	5x
RHS	328Ew	-32.8214	117.2567	7.56	2x
RHS	327Ea	-32.8213	117.2568	7.58	
RHS	325Ew	-32.8212	117.2570	7.6	
RHS	326Ew	-32.8212	117.2569	7.6	
RHS	324Ew	-32.8210	117.2573	7.63	Recored 3xEw + 1Ah but only 2Ew visible
RHS	323Ew	-32.8210	117.2573	7.64	2x
RHS	322Ah	-32.8208	117.2577	7.68	
LHS	84Ew	-32.8206	117.2578	7.69	
RHS	321Ew	-32.8207	117.2579	7.7	
RHS	320Ew	-32.8206	117.2580	7.72	2x one with hollow
RHS	319Ew	-32.8203	117.2585	7.78	
LHS	85Ew	-32.8201	117.2585	7.79	2x
LHS	86Ew	-32.8199	117.2590	7.83	
LHS	87Ew	-32.8198	117.2591	7.84	
RHS	318Ew	-32.8196	117.2597	7.91	
LHS	88Ew	-32.8195	117.2597	7.91	+Ah
LHS	89Ew	-32.8195	117.2597	7.92	
RHS	317Ew	-32.8195	117.2598	7.93	
RHS	316Ew	-32.8195	117.2599	7.93	dead
LHS	91Ew	-32.8193	117.2601	7.95	
LHS	90Ew	-32.8193	117.2599	7.95	
LHS	92Ew	-32.8189	117.2606	8.02	counted as 1
RHS	315East	-32.8190	117.2607	8.03	
RHS	314East	-32.8189	117.2609	8.05	
LHS	93Ew	-32.8188	117.2609	8.05	
RHS	313Ew	-32.8188	117.2611	8.07	
LHS	94Ew	-32.8187	117.2610	8.07	
RHS	312Ew	-32.8186	117.2613	8.1	2x
RHS	311Ew	-32.8184	117.2617	8.14	
LHS	96Ew	-32.8182	117.2617	8.15	
LHS	95Ah	-32.8182	117.2617	8.15	
RHS	310Ea	-32.8183	117.2619	8.16	
LHS	97Ea	-32.8182	117.2619	8.17	
RHS	309Ew	-32.8179	117.2625	8.23	
RHS	308Ew	-32.8178	117.2627	8.26	
RHS	307Ew	-32.8177	117.2628	8.27	
LHS	99Ew	-32.8175	117.2630	8.3	
LHS	100East	-32.8174	117.2632	8.32	
LHS	101Ew	-32.8173	117.2633	8.33	
LHS	102East	-32.8171	117.2637	8.37	
RHS	306Ew	-32.8171	117.2638	8.39	
RHS	305East	-32.8171	117.2638	8.39	
LHS	103East	-32.8170	117.2639	8.4	

Table E2 – Flora species present in the application area					
Side	**ID/Code**	**Latitude**	**Longitude**	**SLK**	**Comments**
LHS	104Es	-32.8169	117.2640	8.41	
LHS	105Es	-32.8168	117.2642	8.43	3x
LHS	106Es	-32.8167	117.2643	8.44	2X
LHS	107East	-32.8165	117.2647	8.49	
LHS	108East	-32.8164	117.2648	8.5	
RHS	304Es	-32.8163	117.2652	8.54	2x
LHS	109Ew	-32.8161	117.2654	8.57	
LHS	111Ea	-32.8160	117.2655	8.58	with hollow
LHS	110Ew	-32.8161	117.2654	8.58	
LHS	112Ea	-32.8157	117.2660	8.63	Ea with hollow +Ew
RHS	303Ea	-32.8145	117.2682	8.89	
LHS	114Ea	-32.8139	117.2692	8.99	
RHS	302Ew	-32.8140	117.2692	9.09	dead
RHS	301Ew	-32.8135	117.2700	9.09	2x
LHS	115Ew	-32.8131	117.2706	9.15	
LHS	98Ew	-32.8181	117.2620	9.17	
RHS	300Ew	-32.8084	117.2786	10.08	with hollow
LHS	116Es	-32.8080	117.2791	10.13	2x
RHS	299Ew	-32.8061	117.2821	10.49	
LHS	117Elox	-32.8048	117.2836	10.9	counted as 1
LHS	118Es	-32.8033	117.2875	11.09	Counted as 1
LHS	119Ew	-32.8033	117.2876	11.1	
RHS	298EL	-32.8046	117.2979	12.11	
RHS	297EL	-32.8046	117.2980	12.12	
RHS	295EL	-32.8046	117.2987	12.18	with hollow
LHS	137Ew	-32.8045	117.2989	12.19	
LHS	136Ew	-32.8045	117.2989	12.19	
RHS	294EL	-32.8046	117.2990	12.2	
RHS	292EL	-32.8046	117.2991	12.21	
RHS	293Ew	-32.8046	117.2990	12.21	
RHS	291EL	-32.8046	117.2992	12.22	
LHS	138EL	-32.8045	117.2991	12.22	
RHS	290EL	-32.8046	117.2992	12.23	
LHS	139EL	-32.8045	117.2992	12.23	counted as 1
RHS	289Ew	-32.8046	117.2995	12.25	counted as 1
RHS	288EL	-32.8046	117.2996	12.26	
LHS	140El	-32.8045	117.2998	12.28	+Ew
RHS	286Ew	-32.8046	117.2999	12.29	
RHS	284Ew	-32.8046	117.3006	12.35	
RHS	283Ea	-32.8046	117.3007	12.36	
RHS	281EL	-32.8046	117.3012	12.41	2x +1Ew
LHS	142Ah	-32.8046	117.3012	12.41	
LHS	141Elox	-32.8046	117.3011	12.41	+Aa
RHS	280Ew	-32.8046	117.3013	12.42	
RHS	278Elox	-32.8046	117.3015	12.44	counted as 1
RHS	275Ea	-32.8046	117.3020	12.49	2x
LHS	143Elox	-32.8045	117.3022	12.51	
RHS	272Ah	-32.8046	117.3024	12.53	
RHS	271Ew	-32.8046	117.3026	12.55	
RHS	270Ah	-32.8046	117.3029	12.58	
RHS	269Ah	-32.8046	117.3031	12.6	
RHS	268Ah	-32.8046	117.3035	12.63	

Table E2 – Flora species present in the application area					
Side	**ID/Code**	**Latitude**	**Longitude**	**SLK**	**Comments**
RHS	267Ah	-32.8046	117.3040	12.68	
LHS	144Ah	-32.8045	117.3041	12.68	
RHS	266Ah	-32.8046	117.3042	12.69	
LHS	145Ah	-32.8045	117.3044	12.71	
RHS	264Ah	-32.8046	117.3044	12.72	
RHS	265Ah	-32.8046	117.3044	12.72	
RHS	263Ah	-32.8046	117.3044	12.72	
RHS	262EL	-32.8046	117.3052	12.79	
RHS	261EL	-32.8046	117.3053	12.8	
RHS	260Elox	-32.8046	117.3054	12.81	
RHS	259Elox	-32.8046	117.3056	12.83	2x
LHS	146Ew	-32.8045	117.3057	12.84	
RHS	258Aa	-32.8046	117.3060	12.87	
RHS	257Ew	-32.8046	117.3082	13.07	
LHS	147Elox	-32.8045	117.3084	13.09	
RHS	256Aa	-32.8046	117.3088	13.13	
LHS	148Aa	-32.8045	117.3092	13.17	
RHS	255Aa	-32.8046	117.3113	13.36	
RHS	254Ew	-32.8046	117.3118	13.41	2x
LHS	149Aa	-32.8045	117.3118	13.41	
RHS	253Ew	-32.8046	117.3132	13.55	
RHS	252Ah	-32.8046	117.3133	13.56	
RHS	251Ah	-32.8046	117.3134	13.56	2x
RHS	249Ea	-32.8046	117.3137	13.59	3x
RHS	250Ea	-32.8046	117.3136	13.59	
LHS	150Ah	-32.8045	117.3136	13.59	
RHS	247Ew	-32.8046	117.3144	13.6	with hollow
RHS	248Ew	-32.8046	117.3137	13.6	dead
RHS	246Ea	-32.8046	117.3150	13.72	
LHS	151Ew	-32.8045	117.3150	13.72	
LHS	152Ea	-32.8045	117.3156	13.77	
RHS	245Ew	-32.8046	117.3159	13.8	
LHS	153Ew	-32.8045	117.3161	13.82	counted as 1
RHS	244Ah	-32.8045	117.3171	13.92	
RHS	243Ea	-32.8034	117.3195	14.17	
LHS	154Ew	-32.8028	117.3213	14.35	with hollow
RHS	242Ah	-32.8029	117.3221	14.43	
RHS	241Elox	-32.8040	117.3276	14.97	
RHS	239Elox	-32.8040	117.3277	14.98	2x + 1Aa
RHS	240Elox	-32.8041	117.3276	14.98	
RHS	238Ew	-32.8040	117.3286	15.06	
LHS	157Ew	-32.8040	117.3288	15.07	
RHS	237Ea	-32.8040	117.3295	15.14	with hollow
RHS	236Ew	-32.8040	117.3300	15.2	dead with hollow
RHS	235Ew	-32.8040	117.3306	15.25	with hollow
RHS	234EL	-32.8040	117.3316	15.35	counted as 1
RHS	233Es	-32.8040	117.3319	15.37	
LHS	158EL	-32.8039	117.3326	15.44	counted as 1
LHS	159EL	-32.8039	117.3328	15.46	5x
LHS	161EL	-32.8040	117.3332	15.49	
LHS	160Ew	-32.8039	117.3331	15.49	+EL
LHS	162EL	-32.8039	117.3333	15.5	

Table E2 – Flora species present in the application area					
Side	**ID/Code**	**Latitude**	**Longitude**	**SLK**	**Comments**
RHS	232EL	-32.8040	117.3335	15.53	
RHS	231EL	-32.8040	117.3336	15.54	
LHS	163EL	-32.8039	117.3337	15.54	2x + 3xEw
LHS	164EL	-32.8039	117.3338	15.55	
LHS	165EL	-32.8040	117.3342	15.6	+Ew
LHS	166Ah	-32.8039	117.3352	15.68	2x
RHS	230Ew	-32.8040	117.3353	15.7	
RHS	229Ew	-32.8040	117.3354	15.7	counted as 1
RHS	228Ew	-32.8040	117.3361	15.77	3x
RHS	227Ew	-32.8040	117.3374	15.89	
LHS	167Ew	-32.8039	117.3377	15.91	
RHS	226Ea	-32.8040	117.3378	15.94	
LHS	169Ah	-32.8039	117.3382	15.97	
LHS	168Aa	-32.8039	117.3382	15.97	
RHS	224Ew	-32.8040	117.3383	15.98	counted as 1
RHS	225Ew	-32.8040	117.3382	15.98	
LHS	170Ah	-32.8039	117.3383	15.98	
LHS	171Ew	-32.8039	117.3384	15.99	with hollow
LHS	172Ah	-32.8039	117.3388	16.03	
LHS	173Aa	-32.8039	117.3402	16.15	
LHS	174Aa	-32.8039	117.3414	16.27	
LHS	175Ew	-32.8039	117.3414	16.28	
LHS	176Aa	-32.8039	117.3417	16.3	2x
LHS	177Ew	-32.8039	117.3419	16.32	
LHS	178Ew	-32.8039	117.3420	16.33	counted as 1
LHS	179Ew	-32.8039	117.3422	16.34	
LHS	181Ew	-32.8039	117.3423	16.35	2x
LHS	180Ew	-32.8039	117.3423	16.35	2x + Aa
RHS	223Esp	-32.8040	117.3441	16.52	cannot identify the species, does not look like a local species
LHS	182Aa	-32.8039	117.3440	16.52	dead
LHS	183Ah	-32.8039	117.3443	16.54	
RHS	222Ew	-32.8040	117.3444	16.55	
LHS	184Aa	-32.8039	117.3444	16.55	
LHS	185Elox	-32.8039	117.3449	16.6	4x but possibly 1
RHS	221Elox	-32.8040	117.3450	16.61	counted as 1
LHS	186Elox	-32.8039	117.3457	16.61	
RHS	220Aa	-32.8040	117.3454	16.65	2x + 1Elox
RHS	219Elox	-32.8040	117.3456	16.67	dead
LHS	187Elox	-32.8039	117.3458	16.68	2x
LHS	188Elox	-32.8039	117.3459	16.7	
RHS	217Elox	-32.8040	117.3468	16.75	
RHS	218EL	-32.8040	117.3465	16.76	2x one with hollow
LHS	189Elox	-32.8039	117.3467	16.76	
LHS	190Elox	-32.8039	117.3470	16.8	
RHS	216EL	-32.8040	117.3474	16.84	
LHS	191Ew	-32.8039	117.3496	17.04	with hollow
LHS	192Ew	-32.8039	117.3511	17.18	
RHS	215Ew	-32.8040	117.3512	17.2	
RHS	214Ew	-32.8040	117.3517	17.24	2x one with a hollow
LHS	194Elox	-32.8039	117.3534	17.4	2x
LHS	193Elox	-32.8039	117.3534	17.4	

Table E2 – Flora species present in the application area					
Side	**ID/Code**	**Latitude**	**Longitude**	**SLK**	**Comments**
LHS	195Elox	-32.8039	117.3537	17.43	
LHS	196Elox	-32.8039	117.3538	17.44	
RHS	213Ew	-32.8040	117.3540	17.47	
LHS	198Ah	-32.8039	117.3553	17.58	2x
LHS	197Ah	-32.8039	117.3552	17.58	
RHS	212Ah	-32.8040	117.3553	17.59	
LHS	199Ew	-32.8039	117.3554	17.6	
LHS	200EL	-32.8039	117.3562	17.66	+ 2x Ew
LHS	202EL	-32.8039	117.3563	17.67	
LHS	201Ew	-32.8039	117.3562	17.67	with holow, counted as 1
LHS	203Ah	-32.8039	117.3573	17.78	dead
RHS	211Ah	-32.8040	117.3589	17.93	
LHS	204Ew	-32.8039	117.3589	17.93	2x
LHS	205Ew	-32.8039	117.3597	18	2x
LHS	206Ew	-32.8039	117.3598	18.01	
LHS	207Aa	-32.8039	117.3601	18.04	
RHS	210Ew	-32.8040	117.3603	18.06	2x
LHS	208Ew	-32.8039	117.3605	18.08	Counted as 1
LHS	209Elox	-32.8039	117.3606	18.09	

Appendix F. Trees identified for retention

Table F.1

SHIRE OF CUBALLING - WSFN - CUBALLNG EAST RD RECONSTRUCTION PROJECT

VERGE VEGETATION CLEARING AREA MINIMISATION STRATEGY AND DETAILS

SLK	Tree Details					Comment / Tree Saving Strategy
	Verge Side[1]	Tree Type	Qty	Diameter at 1.5m High (mm)	Foliage Area (m2)	
11.12	LHS	Wandoo	1	350	36	Note - Two Strategies have been put in place to save these trees from being cleared. These are: a) Shift CL to RHS from existing CL by 1.0m from SLK 11.10 to 11.77 (CL Shift Tapers from SLK 10.98 to 11.10 at start and 11.77 to 11.89 at end) since there is no verge vegetation along this section on the RHS verge. However, 1.0m is the maximum possible shift since any additional shift will compromise the space for suitable table drain on the RHS verge. b) Reduce the Clearing Width from New CL from 16m to 15m to save larger "Potential Habitat" sized trees - where drainage can be installed around trees to be saved or the location of the trees to be saved poses no safety risk to motorists (ie is not located in run off areas). **Pink dots have been painted on the trunks of these trees to save.** These strategies, whilst instigated to save these trees listed will result in the following ongoing costs to the Shire of Cuballing: 1) Will result in reduced sized table drains, which cannot be effectively and economically maintained of weeds and other vegetative growth by grader, and only by more expensive means with Excavator and Truck. 2) Will result in reduced sized table drains, which will compromise the integrity of the pavement by running greater risk of wetter periods (which Cuballing is at high risk of) causing saturation of insitu soil, subsequently weakening it and resulting in pavement failure (and / or reduced pavement life) under heavy loading.
	LHS	Wandoo	1	200		
11.22	LHS	Wandoo	1			
	LHS	Sheoak	1			
11.25	LHS	Wandoo	1	450	49	
	LHS	Wandoo	3	250		
11.28	LHS	Sheoak	1	400	16	
11.31	LHS	Sheoak	1	600	36	
11.34	LHS	Wandoo	1	550	81	
	LHS	Wandoo (with Hollows)	1	750		
11.37	LHS	Sheoak	1	250	49	
	LHS	Wandoo	1	500		
11.41	LHS	Wandoo	1	800	64	
11.46	LHS	York Gum	1	400	35	
11.48	LHS	York Gum	2	250	30	
11.51	LHS	Wandoo	1	450	36	
11.58	LHS	Wandoo	1			
	LHS	Jam Wattle	1			
11.68	LHS	Wandoo	2	250	25	
11.69	LHS	Jam Wattle	1	200	16	
11.72	LHS	Jam Wattle	1	250	16	
12.13	RHS	Morrell	1	380	64	Note - One Strategy has been put in place to save these trees from being cleared. This is to reduce the Clearing Width from New CL from 16m to 15m to save larger "Potential Habitat" sized trees - where drainage can be installed around trees to be saved or the location of the trees to be saved poses no safety risk to motorists (ie is not located in run off areas). There is no opportunity or gain in shifting the centreline from existing to reduce the clearing impact, since there are similar size and types of vegetation located at similar offsets from the existing centreline. **Pink dots have been painted on the trunks of these trees to save.** This strategy, whilst instigated to save these trees listed will result in the following ongoing costs to the Shire of Cuballing: 1) Will result in reduced sized table drains, which cannot be effectively and economically maintained of weeds and other vegetative growth by grader, and only by more expensive means with Excavator and Truck. 2) Will result in reduced sized table drains, which will compromise the integrity of the pavement by running greater risk of wetter periods (which Cuballing is at high risk of) causing saturation of insitu soil, subsequently weakening it and resulting in pavement failure (and / or reduced pavement life) under heavy loading.
12.29	RHS	Morrell	1	200	64	
	RHS	Morrell	1	450		
12.31	RHS	Morrell	1	750	121	
12.39	RHS	Wandoo	1	270	9	
12.41	RHS	Morrell	1	600	54	
12.43	RHS	York Gum	1	350	48	
12.46	RHS	York Gum	4	300	90	
12.48	RHS	Wandoo	1	250	25	
12.50	RHS	York Gum	1	400	49	
12.51	RHS	York Gum (leaning over	1	400	25	
14.94	LHS	York Gum	1	400	64	
15.00	LHS	Wandoo	1	400	49	
			41			
					1151	

Notes :

1 - LHS is Northern Verge and RHS is Southern Verge

2 - The verges from SLK 4.157 to 4.829 were checked for the existence of any native shrubs and or ground covers, and none were found. There is only some weeds growing us understory to the trees along this section (being Radish, Wild Oats, Deadly Nightshade) and some very small Jam Wattle regrowth suckers. The maintenance zone along the 18.1km section of the Cuballing East Rd is generally from 16 to 18m in width (8.0 to 9.0m from the existing centreline) and the Shire of Cuballing spray these verges each year to reduce the weed burden within this maintenance zone. There are large trees within the designated 16m clearing width within this section that will need to be removed to allow suitable table drains to be constructed and maintained into the future.

Table F.2

Species		Side	SLK	Qty	DBH	Hollows	ID
Eucalyptus loxophleba	York Gum	LHS	4.06	1			27Elox
Eucalyptus wandoo	Wandoo	RHS	7.72	1	>300	Small	EW294 (Harewood 2021)
Eucalyptus wandoo	Wandoo	LHS	8.63	1	>300	Small & Medium	EW94 (Harewood 2021)
Eucalyptus wandoo	Wandoo	RHS	10.08	1	>300	Small	EW274 (Harewood 2021)
Eucalyptus wandoo	Wandoo	LHS	11.12	1	350		
Eucalyptus wandoo	Wandoo	LHS	11.12	1	200		
Allocasuarina huegeliana	Rock Sheoak	LHS	11.22	1	200		
Eucalyptus wandoo	Wandoo	LHS	11.22	1	450		
Eucalyptus wandoo	Wandoo	LHS	11.25	1	450		
Eucalyptus wandoo	Wandoo	LHS	11.25	3	250		
Allocasuarina huegeliana	Rock Sheoak	LHS	11.28	1	400		
Allocasuarina huegeliana	Rock Sheoak	LHS	11.31	1	600		
Eucalyptus wandoo	Wandoo	LHS	11.33	1	>300	Medium	EW108 (Harewood 2021)
Eucalyptus wandoo	Wandoo	LHS	11.34	1	550		
Eucalyptus wandoo	Wandoo	LHS	11.34	1	750		
Allocasuarina huegeliana	Rock Sheoak	LHS	11.37	1	250		
Eucalyptus wandoo	Wandoo	LHS	11.37	1	500		
Eucalyptus wandoo	Wandoo	LHS	11.41	1	800		
Eucalyptus loxophleba	York Gum	LHS	11.46	1	400		
Eucalyptus loxophleba	York Gum	LHS	11.48	2	250		
Eucalyptus wandoo	Wandoo	LHS	11.51	1	450		
Acacia acuminata	Jam	LHS	11.58	1	100		
Eucalyptus wandoo	Wandoo	LHS	11.58	1	550		
Eucalyptus wandoo	Wandoo	LHS	11.68	2	250		
Acacia acuminata	Jam	LHS	11.69	1	200		
Acacia acuminata	Jam	LHS	11.72	1	250		
Eucalyptus longicornis	Red Morrell	RHS	12.13	1	380		
Eucalyptus longicornis	Red Morrell	RHS	12.29	1	200		
Eucalyptus longicornis	Red Morrell	RHS	12.29	1	450		
Eucalyptus longicornis	Red Morrell	RHS	12.31	1	750		
Eucalyptus wandoo	Wandoo	RHS	12.39	1	270	Small	
Eucalyptus longicornis	Red Morrell	RHS	12.41	1	600		
Eucalyptus loxophleba	York Gum	RHS	12.43	1	350		
Eucalyptus loxophleba	York Gum	RHS	12.46	4	300		
Eucalyptus wandoo	Wandoo	RHS	12.48	1	250		
Eucalyptus accedens	Powderbark	RHS	12.49	2			275Ea
Eucalyptus loxophleba	York Gum	RHS	12.50	1	400		
Eucalyptus loxophleba	York Gum	RHS	12.51	1	400		
Eucalyptus loxophleba	York Gum	LHS	14.94	1	400		
Eucalyptus wandoo	Wandoo	LHS	15.00	1	400		

Appendix G. Representative photographs of the flora species present

***Eucalyptus wandoo* (Ew)**

215Ew - SLK 17.20
Date: 2021:03:05 13:59:28
Latitude: -32.803997, Longitude: 117.351233, Direction: 195.1 degrees
Comments: bottom & top

Eucalyptus loxophleba **(Elox)**

221Elox - SLK 16.61
Date: 2021:03:05 14:03:08
Latitude: -32.803986, Longitude: 117.344966, Direction: 185.9 degrees
Comments: counted as 1

***Eucalyptus accedens* (Ea)**

226Ea - SLK 15.94
Date: 2021:03:05 14:07:32
Latitude: -32.803981, Longitude: 117.33784, Direction: 194.1 degrees
Comments:

Eucalyptus rudis (Er)

1Er - SLK 1.38
Date: 2021:03:05 10:42:10
Latitude: -32.818881, Longitude: 117.193823, Direction: 348.6 degrees
Comments: 3x Eucalyptus rudis, photos showing bottom with a young Eucalyptus sapling and top

***Eucalyptus longicornis* (El)**

216EL - SLK16.84
Date: 2021:03:05 14:00:22
Latitude: -32.803986, Longitude: 117.34744, Direction: 195.3 degrees
Comments: bottom and top

***Eucalyptus salmonophloia* (Es)**

233Es - SLK 15.37
Date: 2021:03:05 14:11:40
Latitude: -32.804018, Longitude: 117.331858, Direction: 193.9 degrees
Comments: bottom and top

Eucalyptus astringens **(East)**

305East - SLK 8.39
Date: 2021:03:05 14:48:49
Latitude: -32.817131, Longitude: 117.263805, Direction: 147.6 degrees
Comments:

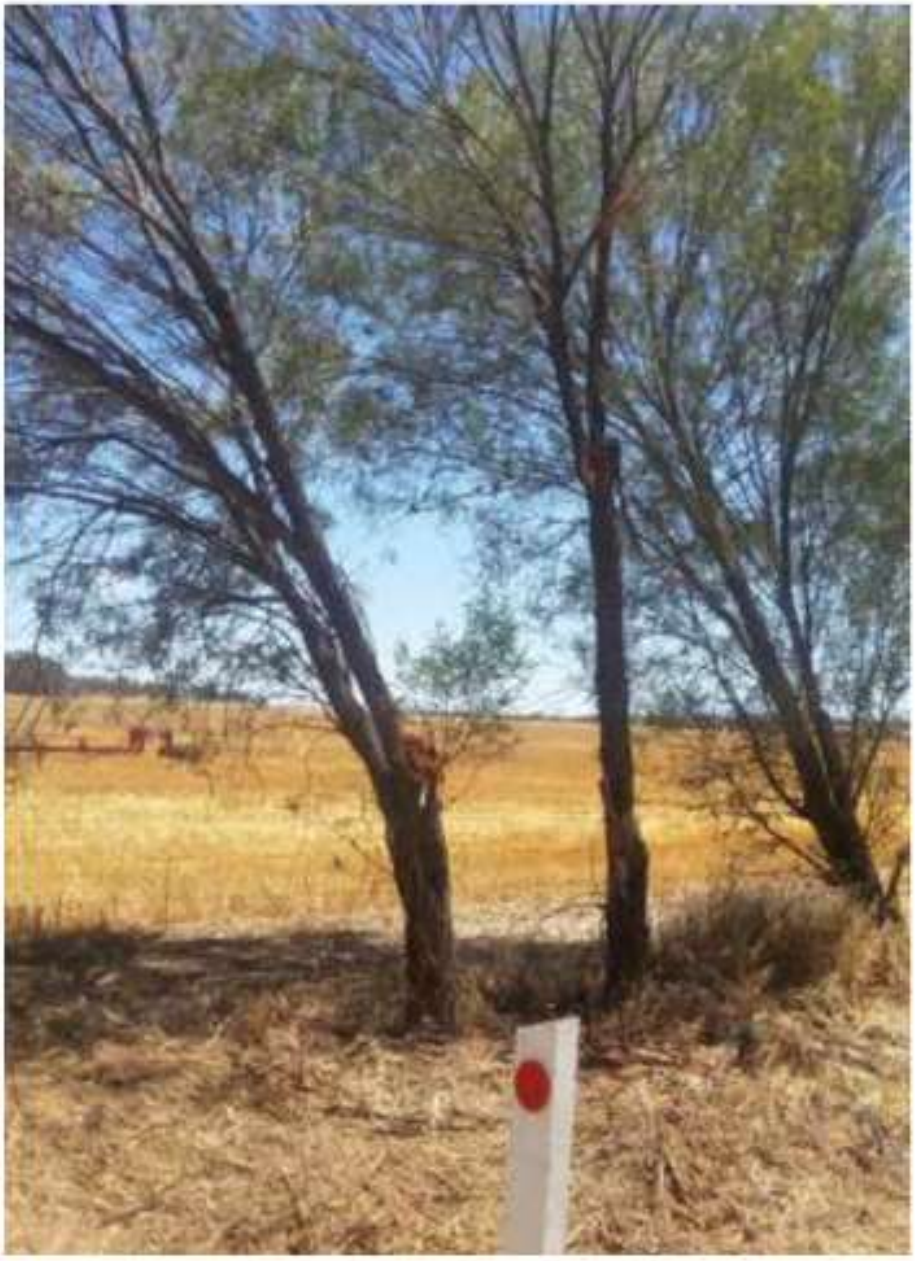
***Corymbia calophylla* (Cc)**

400Cc - SLK 2.87
Date: 2021:03:05 15:26:08
Latitude: -32.818873, Longitude: 117.209625, Direction: 193.4 degrees
Comments: 2x; bottom & top

***Allocasuarina huegeliana* (Ah)**

335Ew - SLK 7.36
Date: 2021:03:05 14:59:40
Latitude: -32.822436, Longitude: 117.254904, Direction: 147.4 degrees
Comments: +Ah

***Acacia acuminata* (Aa)**



353Aa - SLK 6.36
Date: 2021:03:05 15:07:30
Latitude: -32.823717, Longitude: 117.244936, Direction: 217.2 degrees
Comments: +Ah

Appendix H. Fauna survey: Information excerpts (Harewood 2021)

SUMMARY

This report details the results of a habitat tree assessment carried out along a 18-kilometre section of the Cuballing East Road (~SLK 00.00 to ~SLK 18.00) (the survey area) in the Shire of Cuballing (the Shire). The Shire has identified vegetation along the road reserve that may need removal to allow for proposed road works. A subset of the vegetation is represented by hollow bearing trees potentially suitable for use by black cockatoos and other fauna (e.g. red-tailed phascogale).

The Shire will soon be applying for a clearing permit and it is anticipated that the Department of Water and Environmental Regulation (DWER) will require any hollow bearing trees to be specifically identified and inspected prior to clearing being undertaken. This report details the results of an initial inspection of the vegetation with the aim of identifying any significant hollow bearing trees.

An inspection of the survey area was carried out by Greg Harewood (Zoologist - 19 years' experience) on the 8 February 2021.

The assessment has involved the identification of all suitable tree species within the survey area previously identified by the Shire (generally marked with a blue paint dot) that have a Diameter at Breast Height (DBH) of equal to or over 50cm (<30cm for wandoo/salmon gum) and containing hollows or apparent hollows possibly suitable for black cockatoos and/or phascogales.

The initial survey identified 17 "habitat trees" as potentially containing hollows possibly suitable for black cockatoos and/or phascogales. Where possible these potential hollows were examined in more detail using a pole camera.

Of the 17 potential hollow bearing trees 15 were assessed as being unsuitable for black cockatoos. This conclusion was based largely on the fact that most hollows or apparent hollows appeared to only have small (<10cm) entrances into hollows unlikely to accommodate a black cockatoo. The two remaining trees (SLK 8.58 and 12.18) both appeared to have hollows large enough for black cockatoos, though no evidence of use was observed at the time of the survey.

Fourteen trees were assessed as containing hollows or possible hollows potentially suitable for red-tailed phascogales. No evidence of phascogales using hollows was found though this was in most cases based on external examination of hollows with binoculars only, as hollows could not be examined internally. It is however considered unlikely this area would be inhabited by phascogales given the fact that they generally occur at low densities, the degraded and fragmented nature of the vegetation in the wider area.

Additional details of each tree can be found in Appendix A.

Subject to clearing approval being obtained from DWER it is recommended that the trees in question be examined immediately prior to clearing taking place so that appropriate management measures can be employed in the event animals are encountered.

5. RESULTS

A total of 17 "habitat trees" were initially identified as potentially containing hollows possibly suitable for black cockatoos and/or phascogales. A summary of the observations made is provided in Table 1 below. The location of the trees recorded are shown in Figure 1 & 2.

Table 1: Summary of Habitat Trees Recorded within the Survey Area

SLK	Side of Road	Tree Species	Number of Possible Hollows	Estimated Hollow Entrance Size	Comments	Potential Cockatoo Hollow	Potential Phascogale Hollow
7.72	South	Wandoo	2+	Small	Possible small hollows.	No	Yes
8.58	North	Wandoo	2+	Small, Medium & Large (Cockatoo)	Examined with pole camera - large upward facing spout.	Yes	Yes
8.63	North	Wandoo	2+	Small & Medium	Examined with pole camera - small/medium sized hollows.	No	Yes
9.18	South	Wandoo	2+	Small	Possible small hollows.	No	Yes
10.08	South	Wandoo	1	Small	Possible small hollow.	No	Yes
11.33	North	Wandoo	1	Medium	Possible medium sized spout type hollow - no signs of use.	No	Yes
12.18	South	Red Morrel	2+	Small, Medium & Large (Cockatoo)	One possible large side entry hollow - could not examine in detail.	Yes	Yes
12.98	South	Wandoo	1	Small	Possible small hollow.	No	Yes
13.66	South	Wandoo	2+	Small	Possible small hollows.	No	Yes
14.35	North	Wandoo	2+	Small & Medium	Possible small, medium hollows.	No	Yes
15.14	South	Wandoo	2+	Small & Medium	Examined with pole camera - small internal dimensions.	No	Yes
15.2	South	Dead Unknown	2+	Small, Medium & Large	Examined with pole camera - too shallow/exposed - unsuitable BC hollow.	No	No
15.25	South	Wandoo	1	Small	Examined with pole camera - no hollow/too shallow.	No	No
15.99	North	Wandoo	1	Small	Possible small hollow.	No	Yes
16.76	South	Red Morrel	1	Large	Examined with pole camera - too shallow/exposed - unsuitable BC hollow.	No	No
17.04	North	Wandoo	1	Small	Possible small hollow.	No	Yes
17.67	North	Wandoo	1	Small	Possible small hollow.	No	Yes

Note: Wandoo = Wandoo or Powderbark Wandoo

As indicated the initial survey identified 17 "habitat trees" as potentially containing hollows possibly suitable for black cockatoos and/or phascogales. Where possible these potential hollows were examined in more detail using a pole camera.

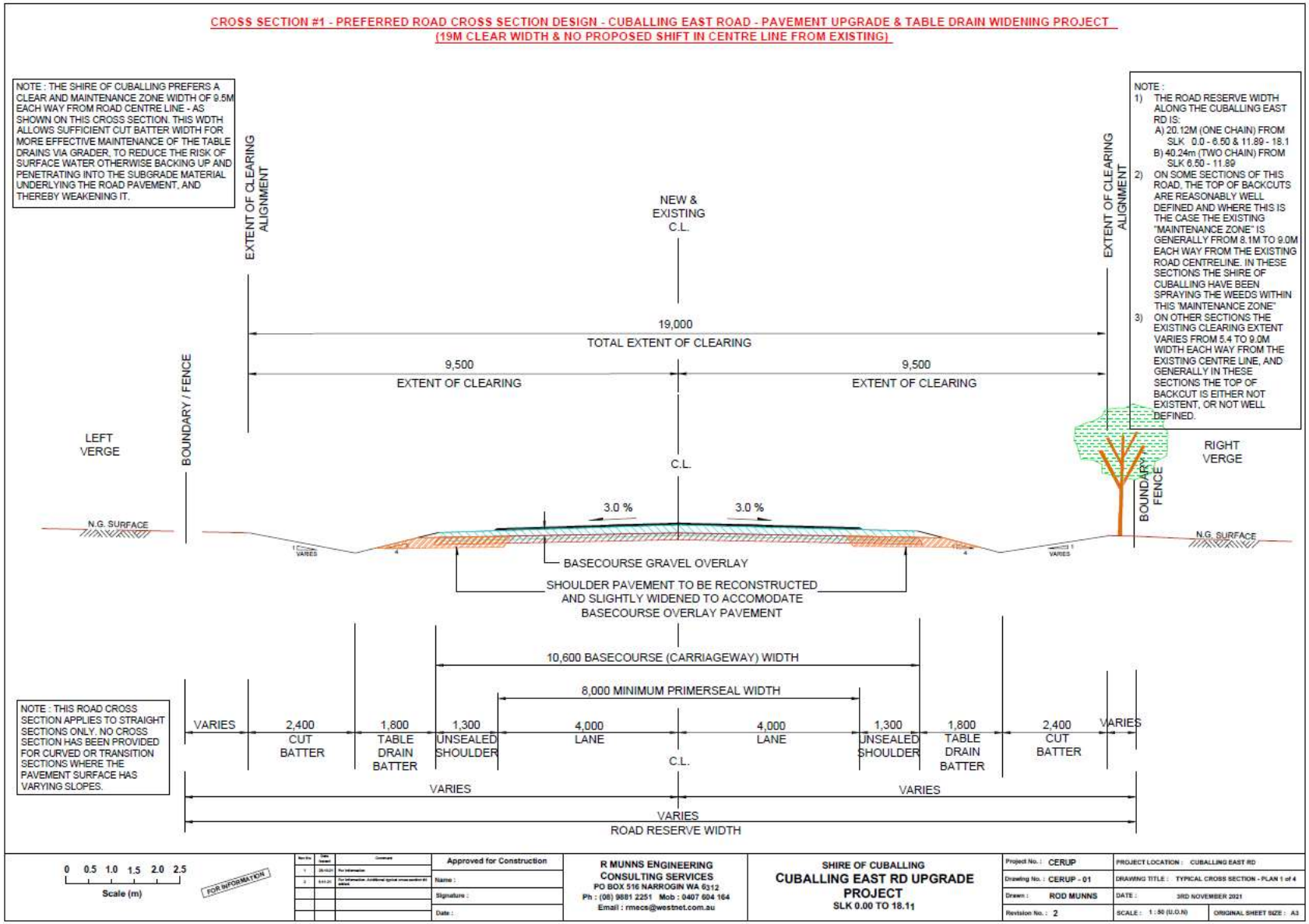
Of the 17 potential hollow bearing trees 15 were assessed as being unsuitable for black cockatoos. This conclusion was based largely on the fact that most hollows or apparent hollows appeared to only have small (<10cm) entrances into hollows unlikely to accommodate a black cockatoo. The two remaining trees (SLK 8.58 and 12.18) both appeared to have hollows large enough for black cockatoos, though no evidence of use was observed at the time of the survey.

Fourteen trees were assessed as containing hollows or possible hollows potentially suitable for red-tailed phascogales. No evidence of phascogales using hollows was found though this was in most cases based on external examination of hollows with binoculars only, as hollows could not be examined internally. It is however considered unlikely this area would be inhabited by phascogales given the fact that they generally occur at low densities, the degraded and fragmented nature of the vegetation in the wider area.

Additional details of each tree can be found in Appendix A.

Summary of Harewood (2021) Appendix A tree hollow data								
ID	**Tree species**	**DBH (cm)**	**No. potential hollows and size**		**Comments**	**Black-cockatoo**	**Phas-cogale**	**Impact?**
Dead214	Dead Unknown	>30	2+	Small, Medium & Large	Too shallow/exposed - unsuitable hollow (examined with pole camera)			Impact
Esp198	Red Morrel	>30	1	Large	Too shallow/exposed - unsuitable hollow (examined with pole camera)			Impact
wpt014	Wandoo	>30	1	Small	No hollow/too shallow (examined with pole camera)			Impact
EW216	Wandoo	>30	2+	Small & Medium	Small internal dimensions (examined with pole camera)		Yes	Impact
wpt003	Wandoo	>30	1	Small	Possible small hollow		Yes	Impact
wpt006	Wandoo	>30	1	Small	Possible small hollow		Yes	Impact
wpt007	Wandoo	>50	1	Small	Possible small hollow		Yes	Impact
wpt017	Wandoo	>30	2+	Small & Medium	Possible small, medium hollows		Yes	Impact
EW225	Wandoo	>30	2+	Small	Possible small hollows		Yes	Impact
wpt022	Wandoo	>30	1	Small	Possible small hollow		Yes	Impact
wpt029	Wandoo	>30	2+	Small	Possible small hollows		Yes	Impact
wpt025	Red Morrel	>30	2+	Small, Medium & Large (Cockatoo)	One possible large side entry hollow - could not examine in detail	Yes	Yes	Impact
wpt032	Wandoo	>30	2+	Small, Medium & Large (Cockatoo)	Examined with pole camera - large upward facing spout	Yes	Yes	Impact
EW274	Wandoo	>30	1	Small	Possible small hollow		Yes	RETAIN
EW294	Wandoo	>30	2+	Small	Possible small hollows		Yes	RETAIN
EW94	Wandoo	>30	2+	Small & Medium	Examined with pole camera - small/medium sized hollows		Yes	RETAIN
EW108	Wandoo	>30	1	Medium	Possible medium sized spout type hollow - no signs of use		Yes	RETAIN

Appendix I. Engineering drawings (Shire of Cuballing 2021c)



CROSS SECTION #2 - COMPROMISED ROAD CROSS SECTION DESIGN - CUBALLING EAST ROAD - PAVEMENT UPGRADE & TABLE DRAIN WIDENING PROJECT
(16M CLEAR WIDTH & NO PROPOSED SHIFT IN ROAD C.L. FROM EXISTING) - FOR SECTIONS FROM SLK 0.00 - 11.12 & 15.00 - 18.11

NOTE : THE SHIRE OF CUBALLING PREFERS A CLEAR AND MAINTENANCE ZONE WIDTH OF 9.5M EACH WAY FROM ROAD CENTRE LINE. THIS WDTH ALLOWS SUFFICIENT CUT BATTER WIDTH FOR MORE EFFECTIVE MAINTENANCE OF THE TABLE DRAINS VIA GRADER, TO REDUCE THE RISK OF SURFACE WATER BACKING UP AND PENETRATING INTO THE SUBGRADE MATERIAL UNDERLYING THE ROAD PAVEMENT, AND THEREBY WEAKENING IT.

A REDUCED AND COMPROMISED CLEARING WIDTH OF:

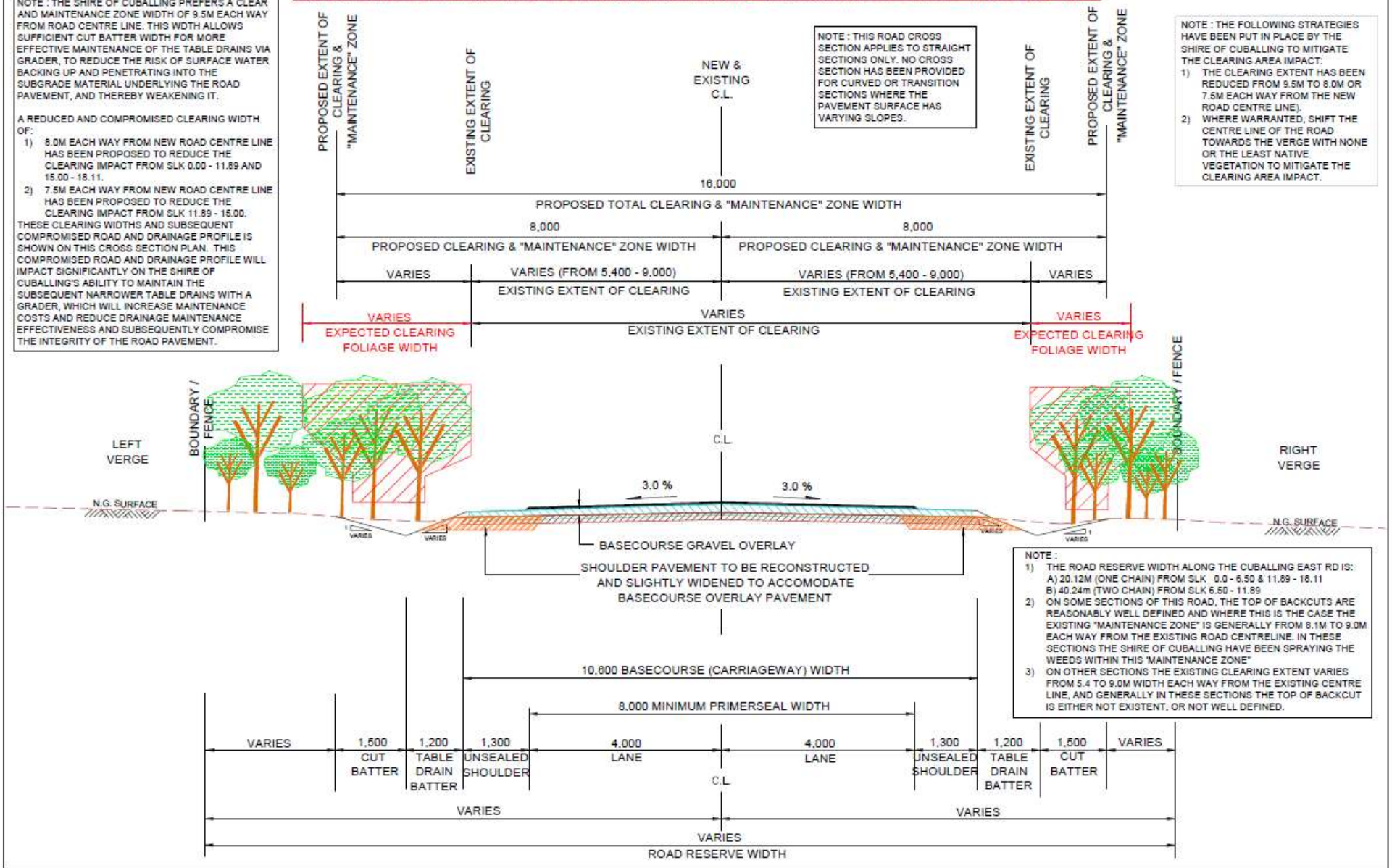
1) 8.0M EACH WAY FROM NEW ROAD CENTRE LINE HAS BEEN PROPOSED TO REDUCE THE CLEARING IMPACT FROM SLK 0.00 - 11.89 AND 15.00 - 18.11.
2) 7.5M EACH WAY FROM NEW ROAD CENTRE LINE HAS BEEN PROPOSED TO REDUCE THE CLEARING IMPACT FROM SLK 11.89 - 15.00.

THESE CLEARING WIDTHS AND SUBSEQUENT COMPROMISED ROAD AND DRAINAGE PROFILE IS SHOWN ON THIS CROSS SECTION PLAN. THIS COMPROMISED ROAD AND DRAINAGE PROFILE WILL IMPACT SIGNIFICANTLY ON THE SHIRE OF CUBALLING'S ABILITY TO MAINTAIN THE SUBSEQUENT NARROWER TABLE DRAINS WITH A GRADER, WHICH WILL INCREASE MAINTENANCE COSTS AND REDUCE DRAINAGE MAINTENANCE EFFECTIVENESS AND SUBSEQUENTLY COMPROMISE THE INTEGRITY OF THE ROAD PAVEMENT.

NOTE : THIS ROAD CROSS SECTION APPLIES TO STRAIGHT SECTIONS ONLY. NO CROSS SECTION HAS BEEN PROVIDED FOR CURVED OR TRANSITION SECTIONS WHERE THE PAVEMENT SURFACE HAS VARYING SLOPES.

NOTE : THE FOLLOWING STRATEGIES HAVE BEEN PUT IN PLACE BY THE SHIRE OF CUBALLING TO MITIGATE THE CLEARING AREA IMPACT:

1) THE CLEARING EXTENT HAS BEEN REDUCED FROM 9.5M TO 8.0M OR 7.5M EACH WAY FROM THE NEW ROAD CENTRE LINE).
2) WHERE WARRANTED, SHIFT THE CENTRE LINE OF THE ROAD TOWARDS THE VERGE WITH NONE OR THE LEAST NATIVE VEGETATION TO MITIGATE THE CLEARING AREA IMPACT.



NOTE :

1) THE ROAD RESERVE WIDTH ALONG THE CUBALLING EAST RD IS:
   A) 20.12M (ONE CHAIN) FROM SLK 0.0 - 6.50 & 11.89 - 18.11
   B) 40.24m (TWO CHAIN) FROM SLK 6.50 - 11.89
2) ON SOME SECTIONS OF THIS ROAD, THE TOP OF BACKCUTS ARE REASONABLY WELL DEFINED AND WHERE THIS IS THE CASE THE EXISTING "MAINTENANCE ZONE" IS GENERALLY FROM 8.1M TO 9.0M EACH WAY FROM THE EXISTING ROAD CENTRELINE. IN THESE SECTIONS THE SHIRE OF CUBALLING HAVE BEEN SPRAYING THE WEEDS WITHIN THIS 'MAINTENANCE ZONE"
3) ON OTHER SECTIONS THE EXISTING CLEARING EXTENT VARIES FROM 5.4 TO 9.0M WIDTH EACH WAY FROM THE EXISTING CENTRE LINE, AND GENERALLY IN THESE SECTIONS THE TOP OF BACKCUT IS EITHER NOT EXISTENT, OR NOT WELL DEFINED.

0 0.5 1.0 1.5 2.0 2.5
Scale (m)

FOR INFORMATION

Rev No.	Date Issued	Comment
1	30.10.21	For Information
2	3.11.21	For Information. Additional typical cross section #2 added.

Approved for Construction
Name :
Signature :
Date :

R MUNNS ENGINEERING CONSULTING SERVICES
PO BOX 516 NARROGIN WA 6312
Ph : (08) 9881 2251 Mob : 0407 604 164
Email : rmecs@westnet.com.au

SHIRE OF CUBALLING
CUBALLING EAST RD UPGRADE PROJECT
SLK 0.00 TO 18.11

Project No. :	CERUP	PROJECT LOCATION :	CUBALLING EAST RD
Drawing No. :	CERUP - 02	DRAWING TITLE :	TYPICAL CROSS SECTION - PLAN 2 of 4
Drawn :	ROD MUNNS	DATE :	3RD NOVEMBER 2021
Revision No. :	2	SCALE :	1 : 50 (U.O.N)
		ORIGINAL SHEET SIZE :	A3

C

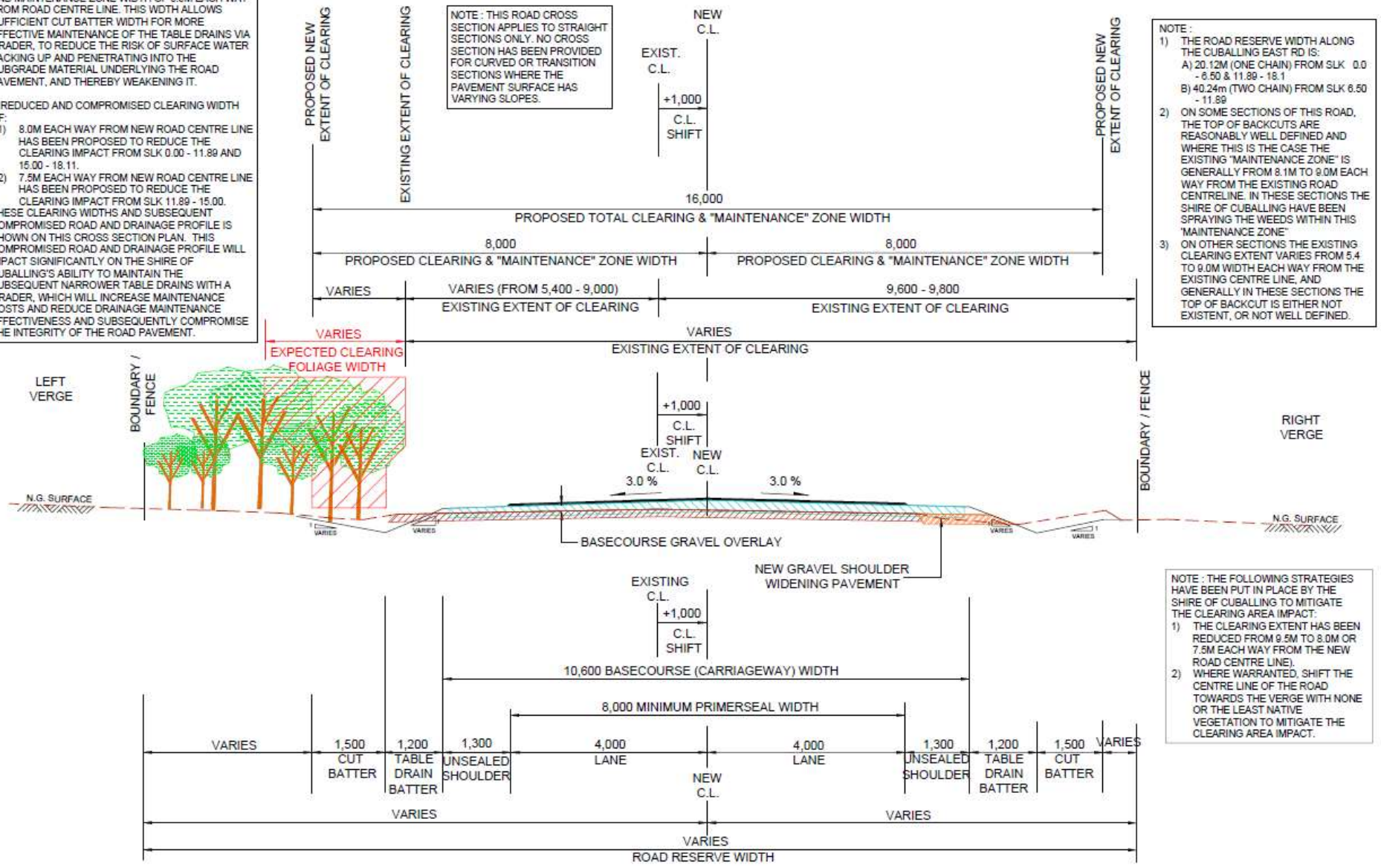
CROSS SECTION #3 - COMPROMISED ROAD CROSS SECTION DESIGN - CUBALLING EAST ROAD - PAVEMENT UPGRADE & TABLE DRAIN WIDENING PROJECT
(16M CLEAR WIDTH & PROPOSED SHIFT IN ROAD C.L. 1.0M TO RHS FROM EXISTING) - FOR SECTION FROM SLK 11.12 - 11.89

NOTE : THE SHIRE OF CUBALLING PREFERS A CLEAR AND MAINTENANCE ZONE WIDTH OF 9.5M EACH WAY FROM ROAD CENTRE LINE. THIS WDTH ALLOWS SUFFICIENT CUT BATTER WIDTH FOR MORE EFFECTIVE MAINTENANCE OF THE TABLE DRAINS VIA GRADER, TO REDUCE THE RISK OF SURFACE WATER BACKING UP AND PENETRATING INTO THE SUBGRADE MATERIAL UNDERLYING THE ROAD PAVEMENT, AND THEREBY WEAKENING IT.

A REDUCED AND COMPROMISED CLEARING WIDTH OF:
1) 8.0M EACH WAY FROM NEW ROAD CENTRE LINE HAS BEEN PROPOSED TO REDUCE THE CLEARING IMPACT FROM SLK 0.00 - 11.89 AND 15.00 - 18.11.
2) 7.5M EACH WAY FROM NEW ROAD CENTRE LINE HAS BEEN PROPOSED TO REDUCE THE CLEARING IMPACT FROM SLK 11.89 - 15.00.

THESE CLEARING WIDTHS AND SUBSEQUENT COMPROMISED ROAD AND DRAINAGE PROFILE IS SHOWN ON THIS CROSS SECTION PLAN. THIS COMPROMISED ROAD AND DRAINAGE PROFILE WILL IMPACT SIGNIFICANTLY ON THE SHIRE OF CUBALLING'S ABILITY TO MAINTAIN THE SUBSEQUENT NARROWER TABLE DRAINS WITH A GRADER, WHICH WILL INCREASE MAINTENANCE COSTS AND REDUCE DRAINAGE MAINTENANCE EFFECTIVENESS AND SUBSEQUENTLY COMPROMISE THE INTEGRITY OF THE ROAD PAVEMENT.

NOTE : THIS ROAD CROSS SECTION APPLIES TO STRAIGHT SECTIONS ONLY. NO CROSS SECTION HAS BEEN PROVIDED FOR CURVED OR TRANSITION SECTIONS WHERE THE PAVEMENT SURFACE HAS VARYING SLOPES.



NOTE :
1) THE ROAD RESERVE WIDTH ALONG THE CUBALLING EAST RD IS:
   A) 20.12M (ONE CHAIN) FROM SLK 0.0 - 6.50 & 11.89 - 18.1
   B) 40.24m (TWO CHAIN) FROM SLK 6.50 - 11.89
2) ON SOME SECTIONS OF THIS ROAD, THE TOP OF BACKCUTS ARE REASONABLY WELL DEFINED AND WHERE THIS IS THE CASE THE EXISTING "MAINTENANCE ZONE" IS GENERALLY FROM 8.1M TO 9.0M EACH WAY FROM THE EXISTING ROAD CENTRELINE. IN THESE SECTIONS THE SHIRE OF CUBALLING HAVE BEEN SPRAYING THE WEEDS WITHIN THIS "MAINTENANCE ZONE"
3) ON OTHER SECTIONS THE EXISTING CLEARING EXTENT VARIES FROM 5.4 TO 9.0M WIDTH EACH WAY FROM THE EXISTING CENTRE LINE, AND GENERALLY IN THESE SECTIONS THE TOP OF BACKCUT IS EITHER NOT EXISTENT, OR NOT WELL DEFINED.

NOTE : THE FOLLOWING STRATEGIES HAVE BEEN PUT IN PLACE BY THE SHIRE OF CUBALLING TO MITIGATE THE CLEARING AREA IMPACT:
1) THE CLEARING EXTENT HAS BEEN REDUCED FROM 9.5M TO 8.0M OR 7.5M EACH WAY FROM THE NEW ROAD CENTRE LINE).
2) WHERE WARRANTED, SHIFT THE CENTRE LINE OF THE ROAD TOWARDS THE VERGE WITH NONE OR THE LEAST NATIVE VEGETATION TO MITIGATE THE CLEARING AREA IMPACT.

0 0.5 1.0 1.5 2.0 2.5
Scale (m)

FOR INFORMATION

Rev No.	Date Issued	Comment
1	29.10.21	For Information
2	3.11.21	For Information - Additional typical cross section #4 added.

Approved for Construction
Name :
Signature :
Date :

R MUNNS ENGINEERING CONSULTING SERVICES
PO BOX 516 NARROGIN WA 6312
Ph : (08) 9881 2251 Mob : 0407 604 164
Email : rmecs@westnet.com.au

SHIRE OF CUBALLING
CUBALLING EAST RD UPGRADE PROJECT
SLK 0.00 TO 18.11

Project No. :	CERUP	PROJECT LOCATION :	CUBALLING EAST RD
Drawing No. :	CERUP - 03	DRAWING TITLE :	TYPICAL CROSS SECTION - PLAN 3 of 4
Drawn :	ROD MUNNS	DATE :	3RD NOVEMBER 2021
Revision No. :	2	SCALE :	1 : 50 (U.O.N)
		ORIGINAL SHEET SIZE :	A3

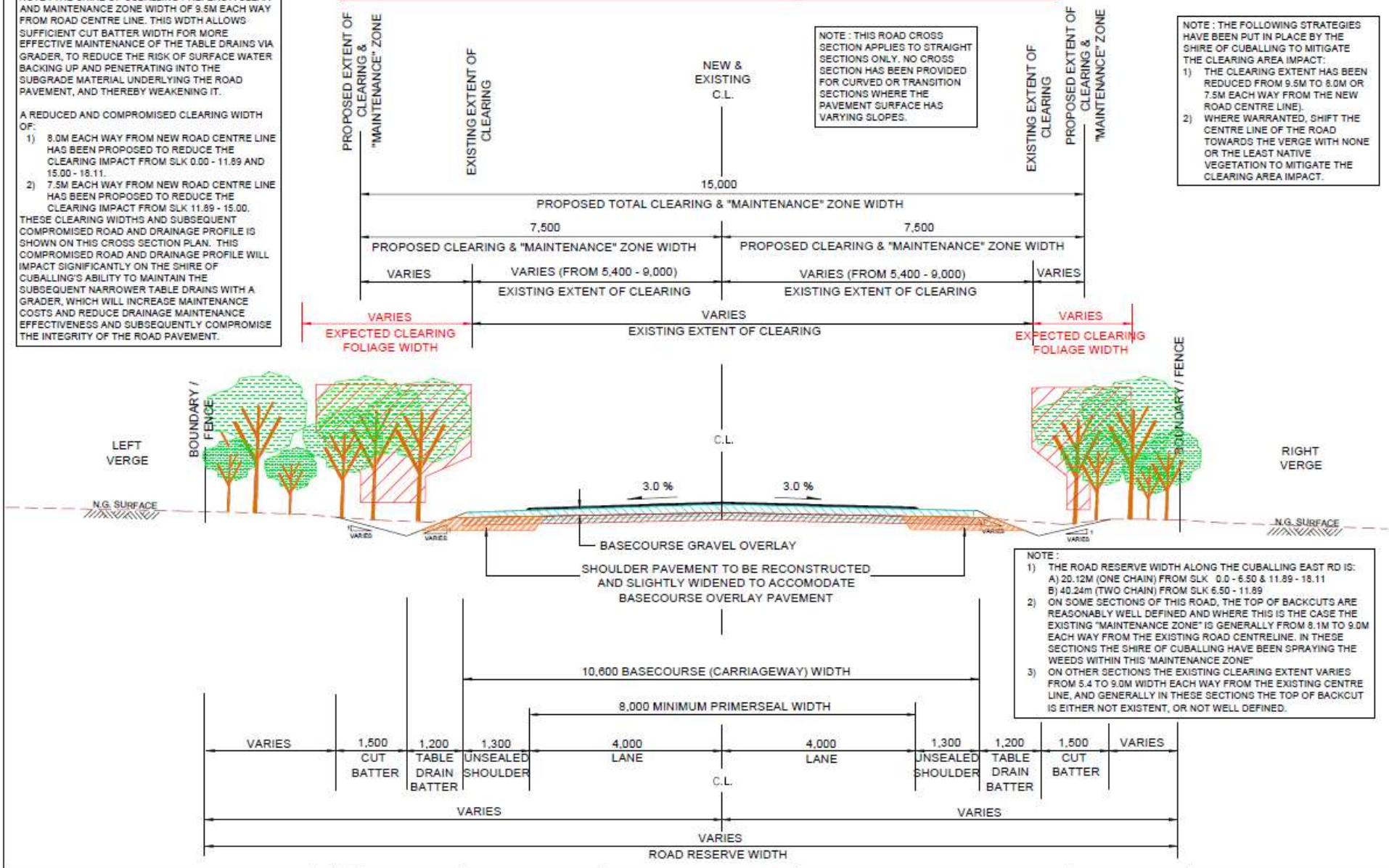
C

CROSS SECTION #4 - COMPROMISED ROAD CROSS SECTION DESIGN - CUBALLING EAST ROAD - PAVEMENT UPGRADE & TABLE DRAIN WIDENING PROJECT
(15M CLEAR WIDTH & NO PROPOSED SHIFT IN ROAD C.L. FROM EXISTING) - FOR SECTION FROM SLK 11.89 - 15.00

NOTE : THE SHIRE OF CUBALLING PREFERS A CLEAR AND MAINTENANCE ZONE WIDTH OF 9.5M EACH WAY FROM ROAD CENTRE LINE. THIS WDTH ALLOWS SUFFICIENT CUT BATTER WIDTH FOR MORE EFFECTIVE MAINTENANCE OF THE TABLE DRAINS VIA GRADER, TO REDUCE THE RISK OF SURFACE WATER BACKING UP AND PENETRATING INTO THE SUBGRADE MATERIAL UNDERLYING THE ROAD PAVEMENT, AND THEREBY WEAKENING IT.

A REDUCED AND COMPROMISED CLEARING WIDTH OF:
1) 8.0M EACH WAY FROM NEW ROAD CENTRE LINE HAS BEEN PROPOSED TO REDUCE THE CLEARING IMPACT FROM SLK 0.00 - 11.89 AND 15.00 - 18.11.
2) 7.5M EACH WAY FROM NEW ROAD CENTRE LINE HAS BEEN PROPOSED TO REDUCE THE CLEARING IMPACT FROM SLK 11.89 - 15.00.

THESE CLEARING WIDTHS AND SUBSEQUENT COMPROMISED ROAD AND DRAINAGE PROFILE IS SHOWN ON THIS CROSS SECTION PLAN. THIS COMPROMISED ROAD AND DRAINAGE PROFILE WILL IMPACT SIGNIFICANTLY ON THE SHIRE OF CUBALLING'S ABILITY TO MAINTAIN THE SUBSEQUENT NARROWER TABLE DRAINS WITH A GRADER, WHICH WILL INCREASE MAINTENANCE COSTS AND REDUCE DRAINAGE MAINTENANCE EFFECTIVENESS AND SUBSEQUENTLY COMPROMISE THE INTEGRITY OF THE ROAD PAVEMENT.



NOTE : THIS ROAD CROSS SECTION APPLIES TO STRAIGHT SECTIONS ONLY. NO CROSS SECTION HAS BEEN PROVIDED FOR CURVED OR TRANSITION SECTIONS WHERE THE PAVEMENT SURFACE HAS VARYING SLOPES.

NOTE : THE FOLLOWING STRATEGIES HAVE BEEN PUT IN PLACE BY THE SHIRE OF CUBALLING TO MITIGATE THE CLEARING AREA IMPACT:
1) THE CLEARING EXTENT HAS BEEN REDUCED FROM 9.5M TO 8.0M OR 7.5M EACH WAY FROM THE NEW ROAD CENTRE LINE).
2) WHERE WARRANTED, SHIFT THE CENTRE LINE OF THE ROAD TOWARDS THE VERGE WITH NONE OR THE LEAST NATIVE VEGETATION TO MITIGATE THE CLEARING AREA IMPACT.

NOTE :
1) THE ROAD RESERVE WIDTH ALONG THE CUBALLING EAST RD IS:
   A) 20.12M (ONE CHAIN) FROM SLK 0.0 - 6.50 & 11.89 - 18.11
   B) 40.24m (TWO CHAIN) FROM SLK 6.50 - 11.89
2) ON SOME SECTIONS OF THIS ROAD, THE TOP OF BACKCUTS ARE REASONABLY WELL DEFINED AND WHERE THIS IS THE CASE THE EXISTING "MAINTENANCE ZONE" IS GENERALLY FROM 8.1M TO 9.0M EACH WAY FROM THE EXISTING ROAD CENTRELINE. IN THESE SECTIONS THE SHIRE OF CUBALLING HAVE BEEN SPRAYING THE WEEDS WITHIN THIS 'MAINTENANCE ZONE"
3) ON OTHER SECTIONS THE EXISTING CLEARING EXTENT VARIES FROM 5.4 TO 9.0M WIDTH EACH WAY FROM THE EXISTING CENTRE LINE, AND GENERALLY IN THESE SECTIONS THE TOP OF BACKCUT IS EITHER NOT EXISTENT, OR NOT WELL DEFINED.

0 0.5 1.0 1.5 2.0 2.5
Scale (m)

FOR INFORMATION

Rev No.	Date Issued	Comment
0	3.11.21	For Information

Approved for Construction
Name :
Signature :
Date :

R MUNNS ENGINEERING CONSULTING SERVICES
PO BOX 516 NARROGIN WA 6312
Ph : (08) 9881 2251 Mob : 0407 604 164
Email : rmecs@westnet.com.au

SHIRE OF CUBALLING
CUBALLING EAST RD UPGRADE PROJECT
SLK 0.00 TO 18.11

Project No. : CERUP		PROJECT LOCATION : CUBALLING EAST RD	
Drawing No. : CERUP - 04		DRAWING TITLE : TYPICAL CROSS SECTION - PLAN 4 of 4	
Drawn : ROD MUNNS		DATE : 3RD NOVEMBER 2021	
Revision No. : 0		SCALE : 1 : 50 (U.O.N)	ORIGINAL SHEET SIZE : A3

C

Appendix J. Offset calculator value justification

Environmental value to be offset		
Calculation/Element	***Score (Area)***	***Rationale***
Conservation significance		
Description	0.481 hectares of native vegetation representing foraging habitat for Carnaby's Cockatoo and a significant remnant in an area that has been extensively cleared	The application area consists of 0.481 hectares of native vegetation that is significant as a remnant in an area that has been extensively cleared. Foraging habitat is present for Carnaby's Cockatoo, with two trees providing potential nesting hollows.
Type of environmental value	Species (Flora/Fauna)	As above
Conservation significance of environmental value	Rare/Threatened Species - Endangered	The Endangered Carnaby's Cockatoo foraging habitat.
Landscape-level value impacted	yes/no	Native vegetation significant as a remnant in an area that has been extensively cleared
Significant impact		
Description	The loss of 0.481 hectares of native vegetation representing foraging habitat for Carnaby's Cockatoo and a significant remnant of native vegetation in an area that has been extensively cleared	The loss of 0.481 hectares of native vegetation that is significant as a remnant in an area that has been extensively cleared with foraging habitat present for Carnaby's Cockatoo, and two trees providing potential nesting hollows.
Significant impact (hectares) / Type of feature	0.48	0.481 hectares of native vegetation that is significant as a remnant in an area that has been extensively cleared providing foraging habitat for Carnaby's Cockatoo, and two trees providing potential nesting hollows.
Quality (scale) / Number	3.00	Quality score derived from vegetation in a completely degraded to degraded condition (Keighery 1994) (1) and providing Carnaby's Cockatoo foraging habitat and mature eucalypts with hollows, two of which provide potential breeding hollows for Carnaby's Cockatoo resulting in an improved quality score of (3).
Rehabilitation credit		
Description	0	None proposed
Offset		
Description	Land Acquisition	Representing 100 per cent of the offset.
Proposed offset (area in hectares)	0.81	Representing 100 per cent of the offset.
Current quality of offset site / Start number (of type of feature)	6.00	Native vegetation within Crown Reserve 2556 located in the Shire of Cuballing is in at least good condition (Keighery 1994) providing moderate Carnaby's Cockatoo foraging habitat (6).
Future quality WITHOUT offset (scale) / Future number WITHOUT offset	6.00	It is assumed that native vegetation within Crown Reserve 2556 located in the Shire of Cuballing would remain in at least good condition (Keighery 1994) providing moderate Carnaby's Cockatoo foraging habitat (6) without the offset.
Future quality WITH offset (scale) / Future number WITH offset	6.00	It is assumed that native vegetation within Crown Reserve 2556 located in the Shire of Cuballing will remain in at least good condition (Keighery 1994) providing moderate Carnaby's Cockatoo foraging habitat (6) with the offset.
Time until ecological benefit (years)	1.00	The process of a change in reserve R 2556 purpose from 'Gravel' to 'Conservation' incorporating an

Environmental value to be offset		
Calculation/Element	***Score (Area)***	***Rationale***
		acquired land parcel of at least 0.81 hectares would be immediate.
Confidence in offset result (%)	0.9	There is a high level of confidence that the change in reserve R 2556 purpose from 'Gravel' to 'Conservation' incorporating an acquired land parcel of at least 0.81 hectares could occur, and that the habitat quality and vegetation condition will not deteriorate with the offset's implementation.
Duration of offset implementation (maximum 20 years)	20.00	The offset site will be protected by a change in reserve R 2556 purpose from 'Gravel' to 'Conservation'.
Time until offset site secured (years)	1.00	The reduction in any risk of loss will occur as soon as the change in reserve R 2556 purpose occurs.
Risk of future loss WITHOUT offset (%)	40.0%	The offset site is located in a reserve zoned for public purposes with the purpose of Gravel. There is a moderate to high risk of loss.
Risk of future loss WITH offset (%)	10.0%	Securing the offset land parcel will reduce the risk of loss to 10%. The risk of catastrophic events (fire, dieback etc.) remain.
Offset ratio (Conservation Area only)	N/A	N/A
Landscape level values of offset?	N/A	N/A

Appendix K. Figures (1 to 11)

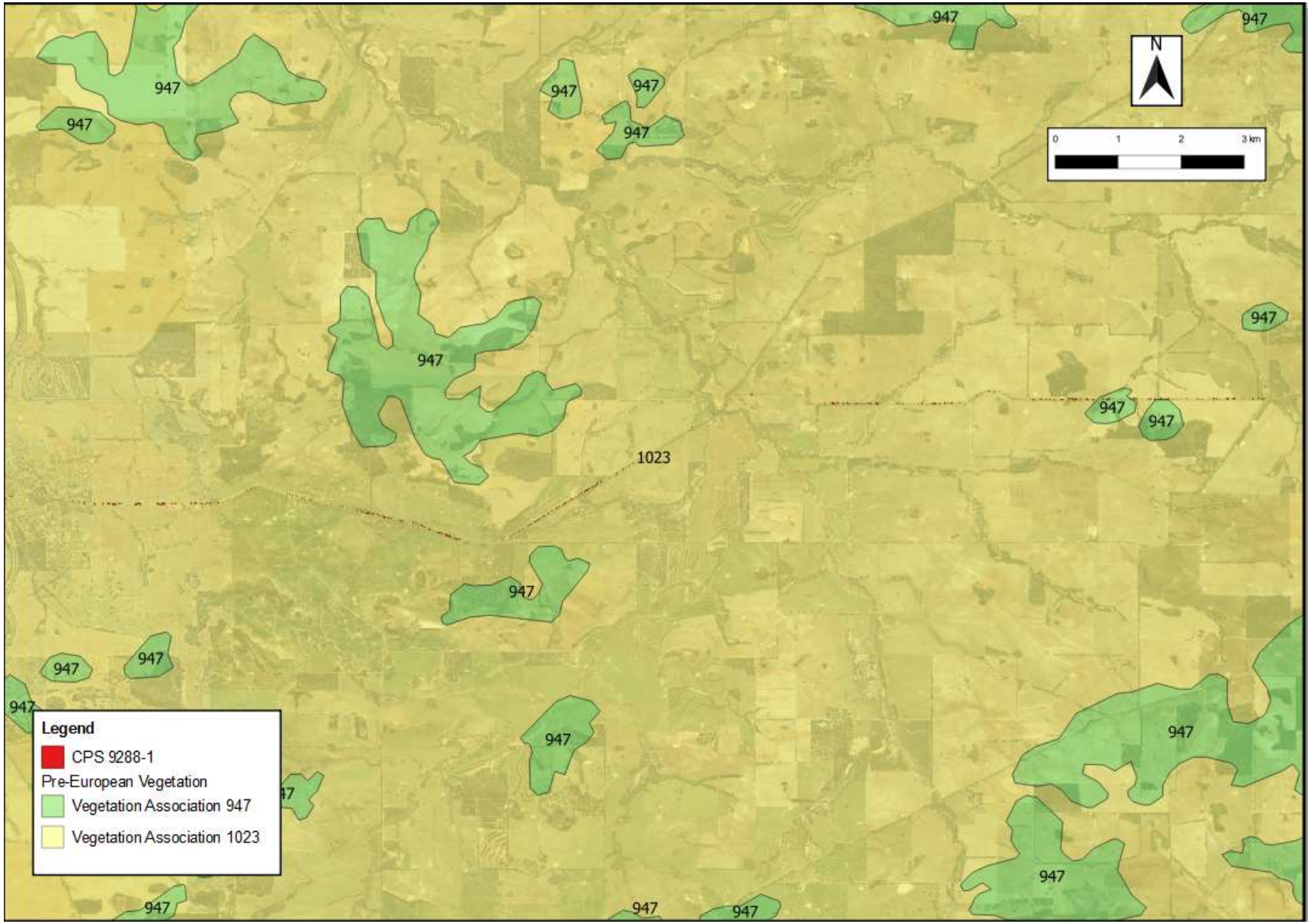


Figure 1: Mapped vegetation associations over the application area (vegetation association 1023, and vegetation association 947)

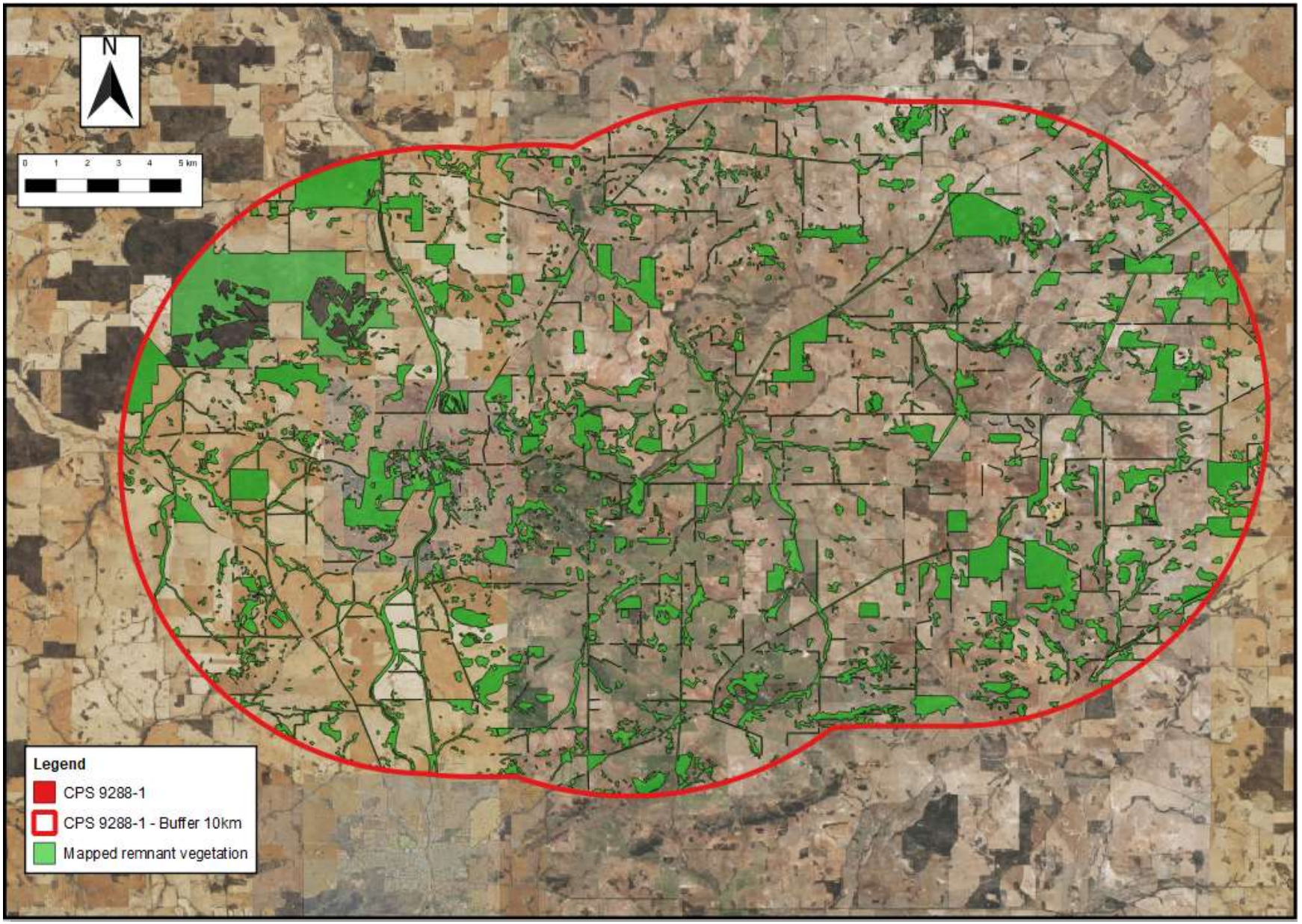


Figure 2: Mapped remnant vegetation within ten kilometres of the application area

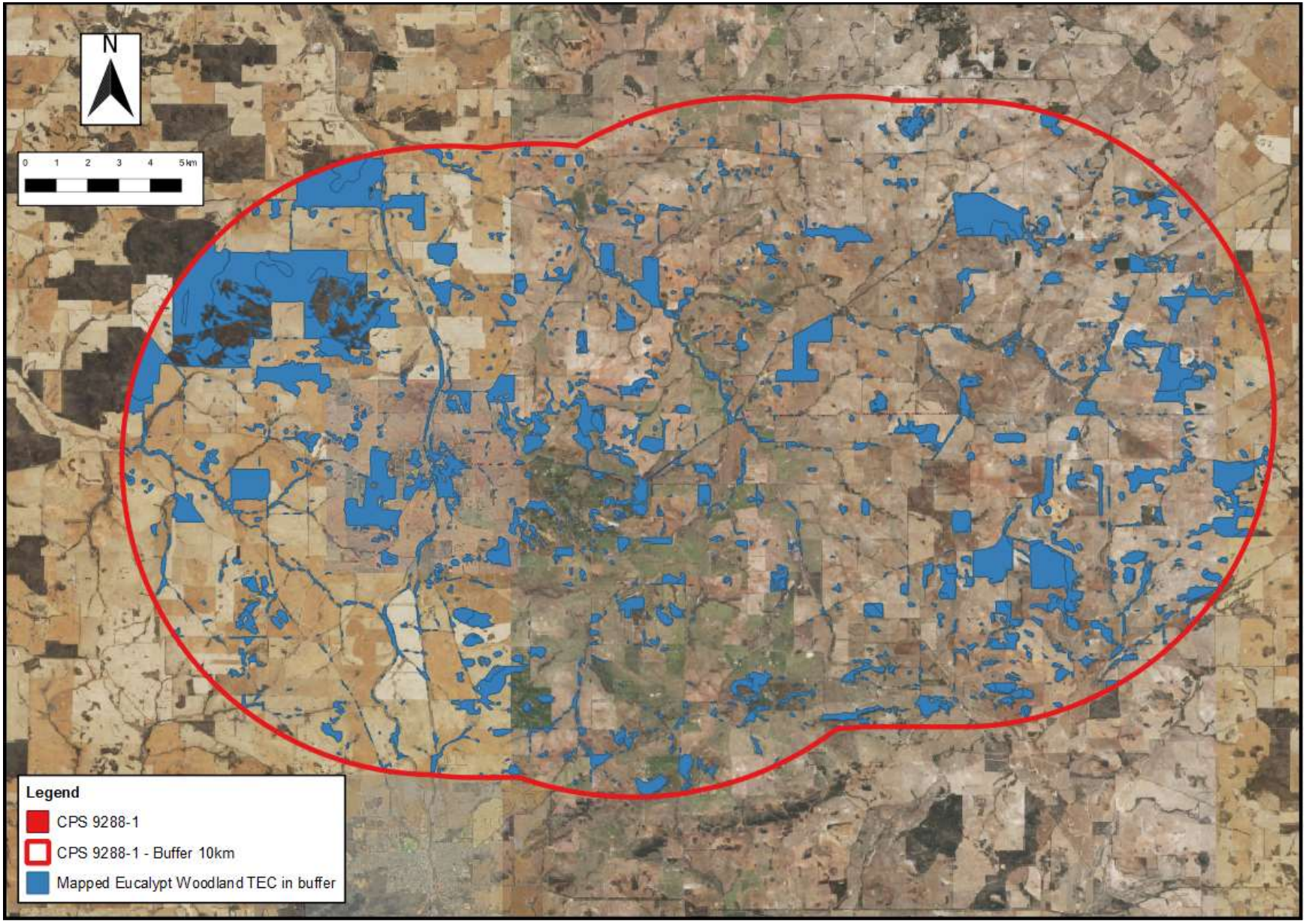


Figure 3: Mapped Eucalypt Woodlands within ten kilometres of the application area

Figure 4: Trees located in potential Eucalypt Woodlands patch A

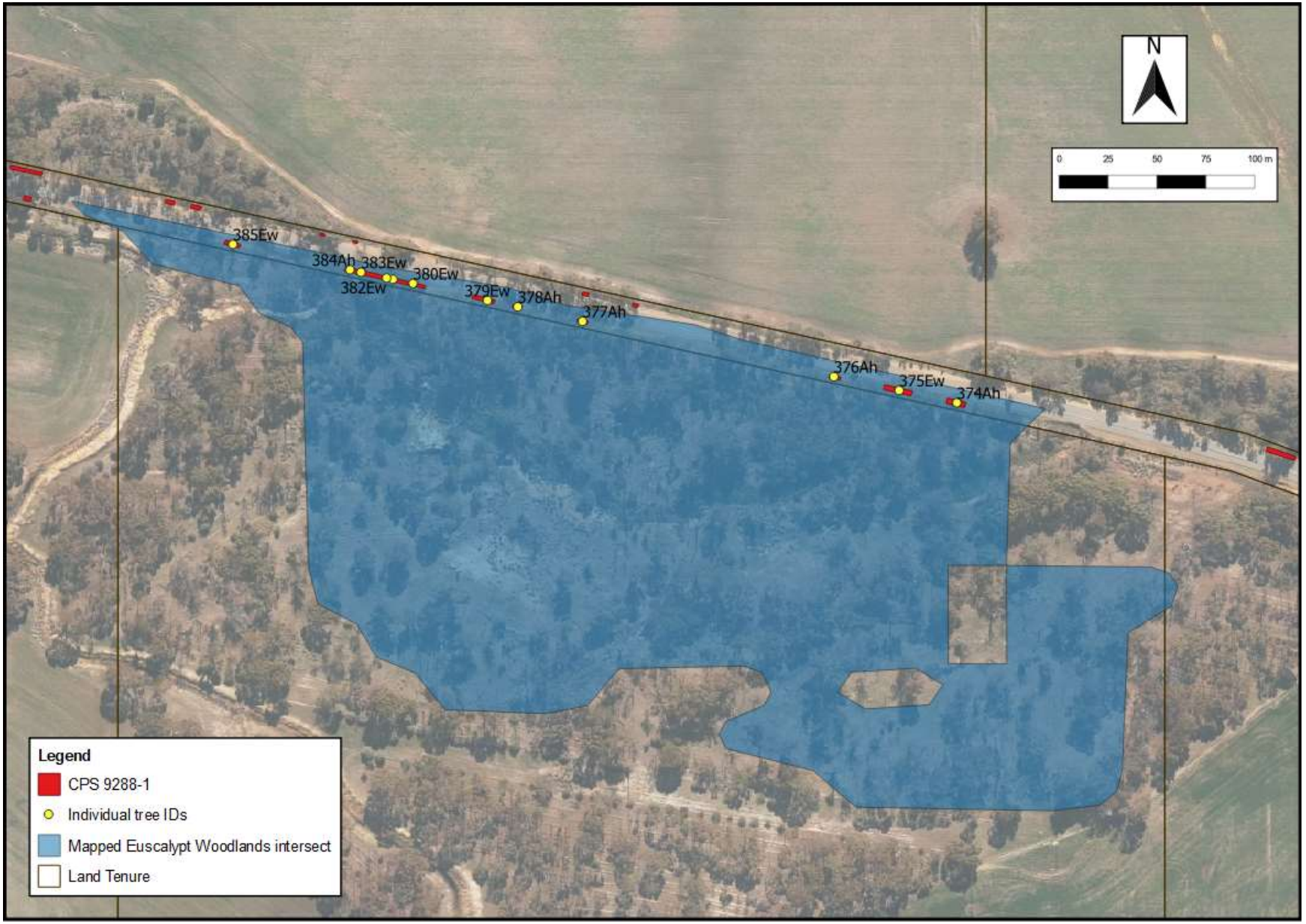


Figure 5: Trees located in potential Eucalypt Woodlands patch B

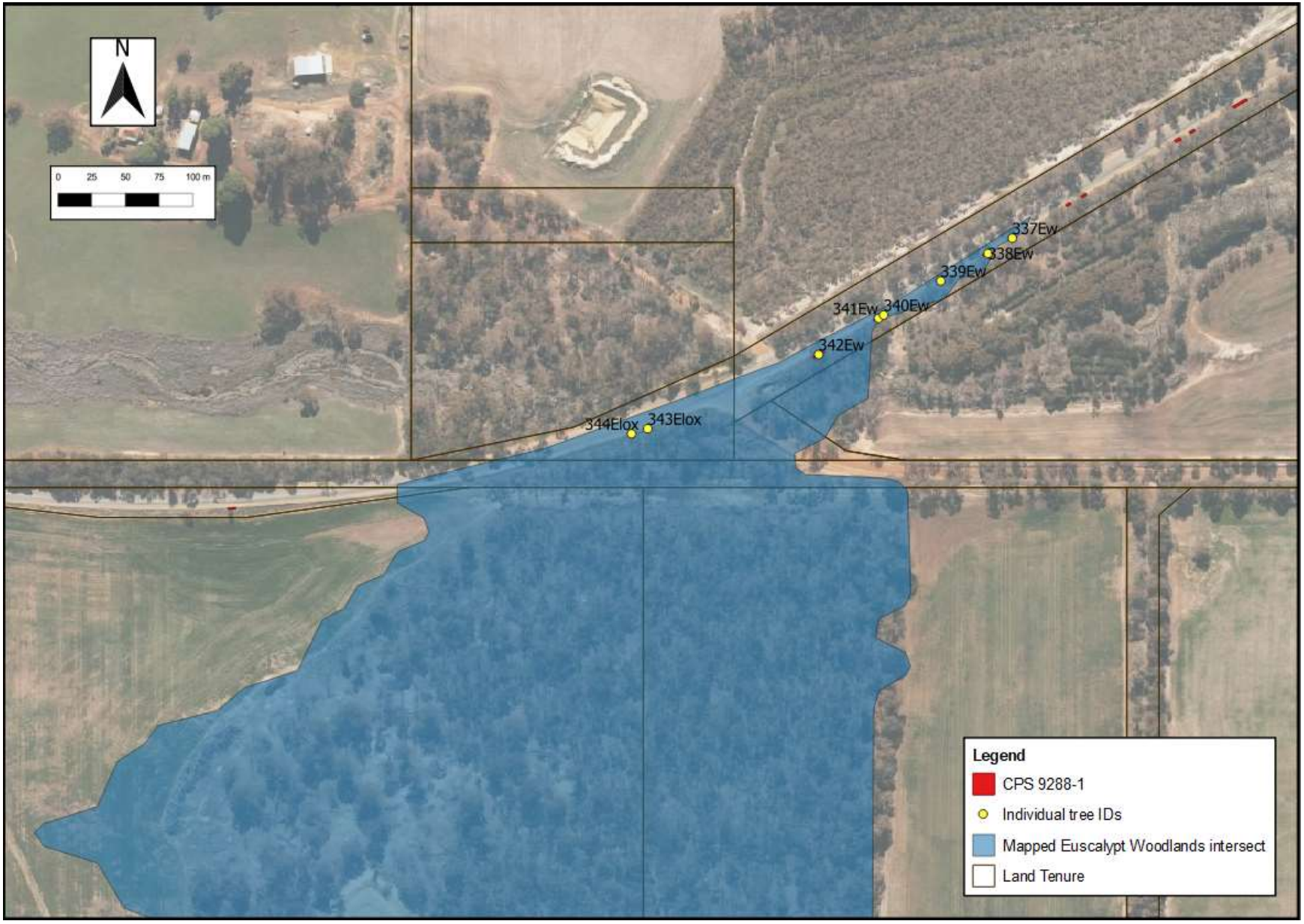


Figure 6: Trees located in potential Eucalypt Woodlands patch C

Figure 7: Trees located in potential Eucalypt Woodlands patch D

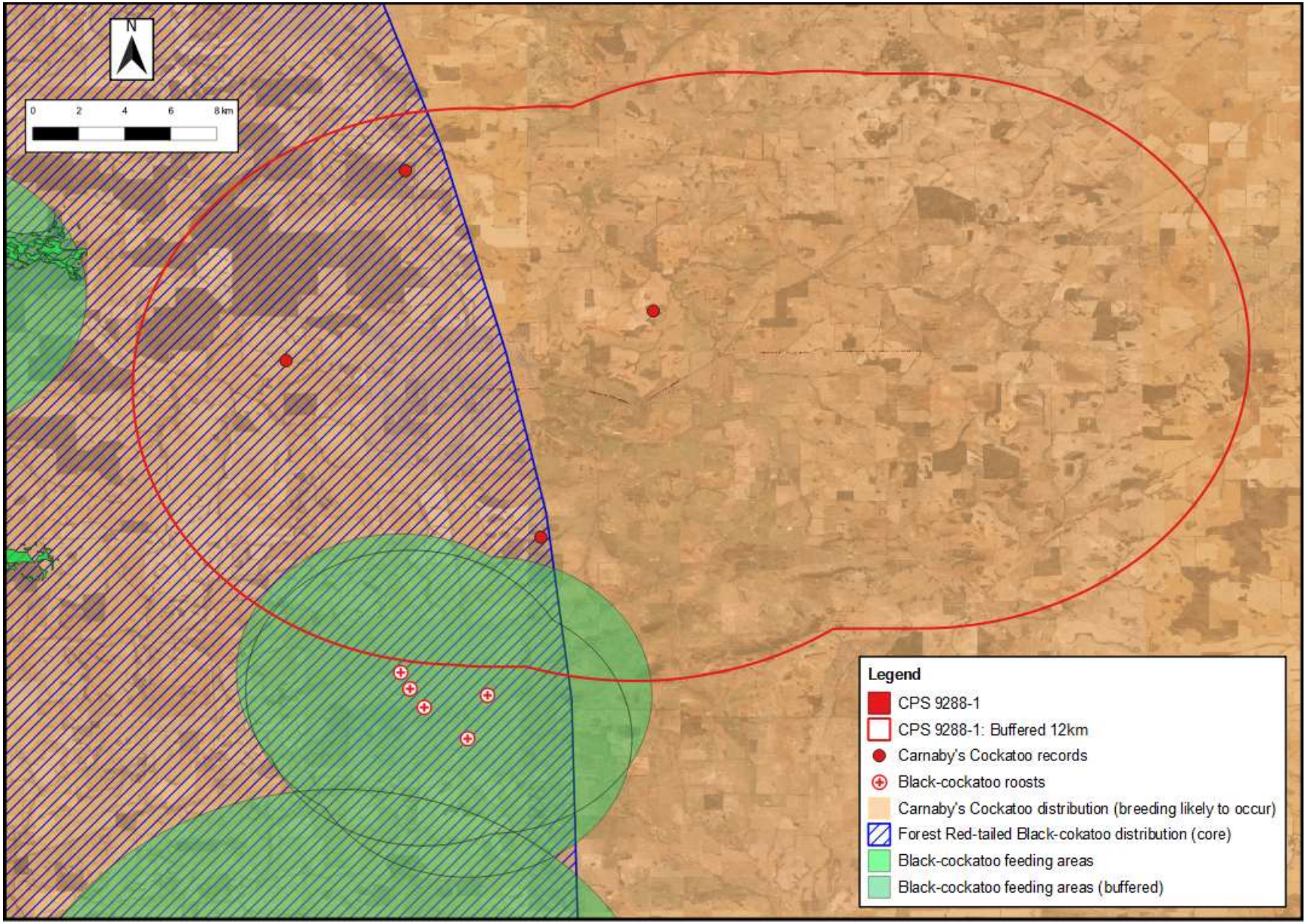


Figure 8: Black cockatoo data

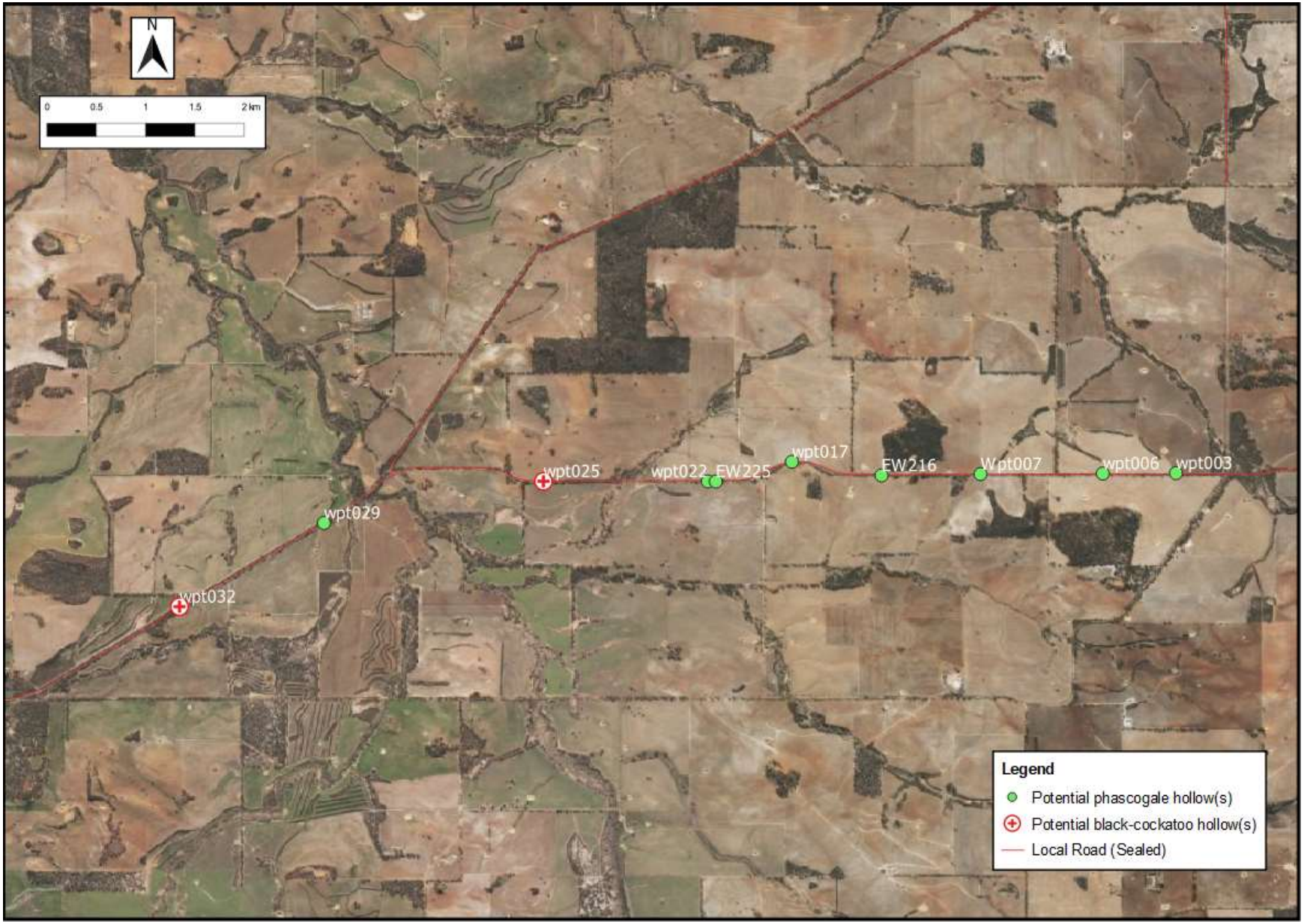


Figure 9: Habitat trees with potential hollows located within the application area

Figure 10: Location of habitat tree wpt 032

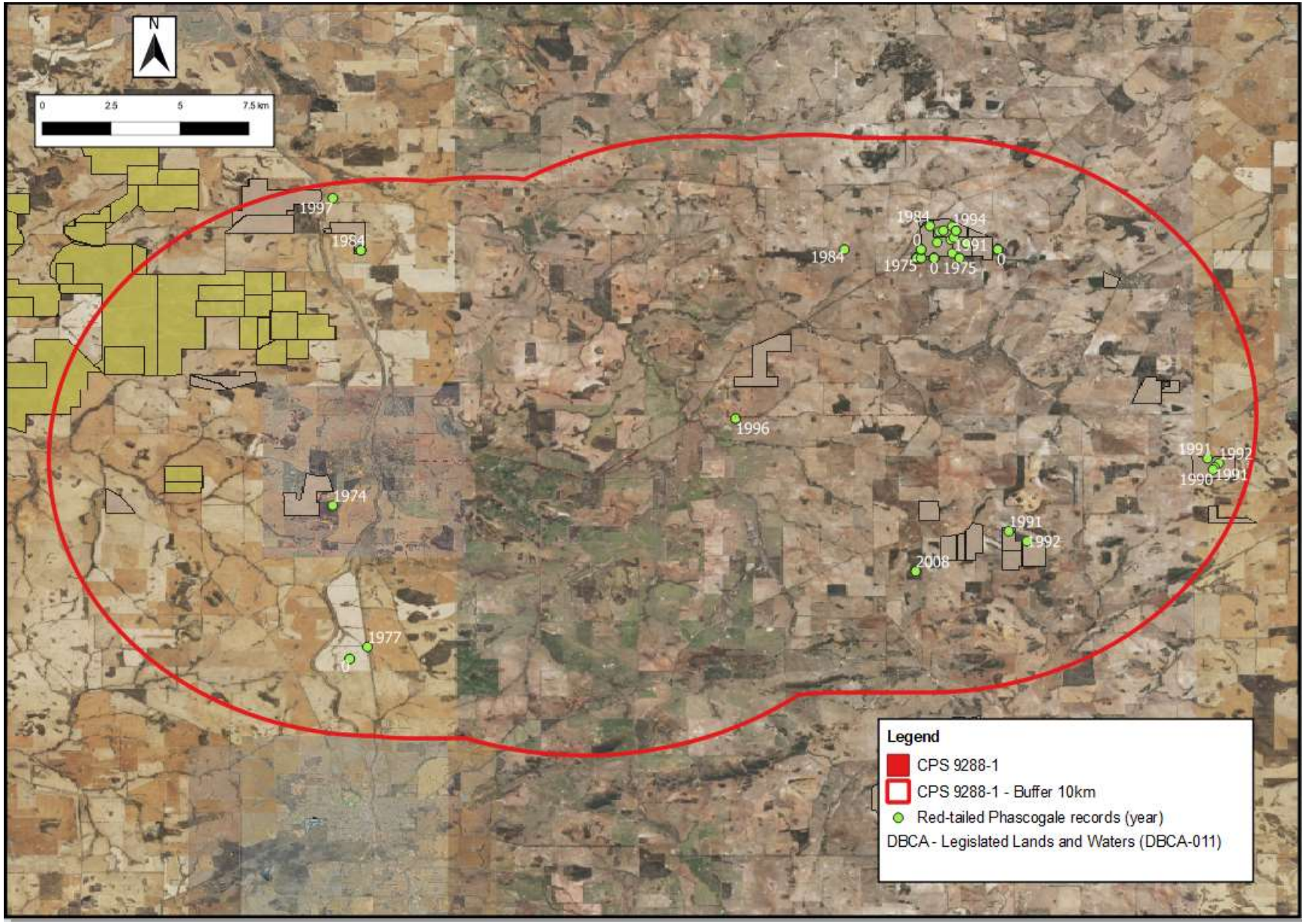


Figure 11: Red-tailed Phascogale records in the local area

Appendix L. Sources of information

L.1. References

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Shire of Cuballing (2021b) Supporting information for native vegetation clearing permit application CPS 9288/1 including minimisation strategy and details, tree photographs and locations, photopoint locations, WALGA

desktop report and a habitat tree assessment (DWER Ref: A2011753; A2007430; A2007448; A2007450; A2007451).

Shire of Cuballing (2021c) Response to a request for further information from DWER including road design cross sections, revised verge clearing area minimisation details, tree locations and photopoints including GIS data (DWER Ref: DWERDT523482; DWERDT523665; DWERDT523672; DWERDT523684).

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L.2. GIS databases

Publicly available GIS Databases used (sourced from www.data.wa.gov.au):

- 10 Metre Contours (DPIRD-073)
- Aboriginal Heritage Places (DPLH-001)
- Aboriginal Heritage Places (DPLH-001)
- Cadastre (LGATE-218)
- Cadastre Address (LGATE-002)
- Contours (DPIRD-073)
- DBCA – Lands of Interest (DBCA-012)
- DBCA Legislated Lands and Waters (DBCA-011)
- Directory of Important Wetlands in Australia – Western Australia (DBCA-045)
- Environmentally Sensitive Areas (DWER-046)
- Flood Risk (DPIRD-007)
- Groundwater Salinity Statewide (DWER-026)
- Hydrography – Inland Waters – Waterlines
- Hydrological Zones of Western Australia (DPIRD-069)
- IBRA Vegetation Statistics
- Imagery
- Local Planning Scheme – Zones and Reserves (DPLH-071)
- Native Title (ILUA) (LGATE-067)
- Offsets Register – Offsets (DWER-078)
- Pre-European Vegetation Statistics
- Public Drinking Water Source Areas (DWER-033)
- Ramsar Sites (DBCA-010)
- Regional Parks (DBCA-026)
- Remnant Vegetation, All Areas
- RIWI Act, Groundwater Areas (DWER-034)
- RIWI Act, Surface Water Areas and Irrigation Districts (DWER-037)
- Soil Landscape Land Quality – Flood Risk (DPIRD-007)
- Soil Landscape Land Quality – Phosphorus Export Risk (DPIRD-010)
- Soil Landscape Land Quality – Subsurface Acidification Risk (DPIRD-011)
- Soil Landscape Land Quality – Water Erosion Risk (DPIRD-013)
- Soil Landscape Land Quality – Water Repellence Risk (DPIRD-014)
- Soil Landscape Land Quality – Waterlogging Risk (DPIRD-015)
- Soil Landscape Land Quality – Wind Erosion Risk (DPIRD-016)
- Soil Landscape Mapping – Best Available

- Soil Landscape Mapping – Systems
- Wheatbelt Wetlands Stage 1 (DBCA-021)

Restricted GIS Databases used:

- ICMS (Incident Complaints Management System) – Points and Polygons
- Threatened Flora (TPFL)
- Threatened Flora (WAHerb)
- Threatened Fauna
- Threatened Ecological Communities and Priority Ecological Communities
- Threatened Ecological Communities and Priority Ecological Communities (Buffers)