



CLEARING PERMIT

Granted under section 51E of the Environmental Protection Act 1986

Purpose Permit number:	CPS 9105/1
Permit Holder:	BHP Nickel West Pty Ltd
Duration of Permit:	From 19 June 2022 to 19 June 2042

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 facilitating processing, maintenance, providing access to and associated facilities development within Kwinana and associated pipelines and maintenance for access and bores within the Baldivis areas.

2. Land on which clearing is to be done

Lot 819 On Deposited Plan 77252, Baldivis
Lot 820 On Deposited Plan 77252, Baldivis
Lot 913 On Deposited Plan 77252, Baldivis
Lot 914 On Deposited Plan 77252, Baldivis
Lot 915 On Deposited Plan 77252, Baldivis
Lot 4639 On Deposited Plan 27786, Baldivis
Charles Street Road Reserve (Pin 1193189), East Rockingham
Lot 1 On Diagram 62220, East Rockingham
Lot 30 On Deposited Plan 68599, East Rockingham
Lot 50 On Plan 8163, East Rockingham
Lot 51 On Diagram 57664, East Rockingham
Lot 51 On Plan 8163, East Rockingham
Lot 52 On Plan 8163, East Rockingham
Lot 54 On Plan 8163, East Rockingham
Lot 55 On Plan 8163, East Rockingham
Lot 89 On Deposited Plan 411084

Lot 105 On Deposited Plan 48637
Lot 149 On Deposited Plan 68599
Lot 153 On Deposited Plan 245392
Lot 622 On Deposited Plan 117585
Lot 1634 On Deposited Plan 27291
Lot 1728 On Deposited Plan 166742, East Rockingham
Lot 4220 On Deposited Plan 192602, East Rockingham
Lot 4332 On Plan 10534, East Rockingham
Lot 4333 On Plan 10534, East Rockingham
Lot 4641 On Deposited Plan 27775, East Rockingham
Lot 4662 On Deposited Plan 95174, East Rockingham
Lot 123 On Deposited Plan 69112, Leda
Lot 310 On Deposited Plan 244038, Leda
Lot 396 On Deposited Plan 219858, Leda
Lot 479 On Deposited Plan 27773, Leda
Lot 502 On Deposited Plan 56798, Leda
Lot 504 On Deposited Plan 56798, Leda
Lot 777 On Plan 3893, Leda
Lot 4335 On Plan 11170, Leda
Unallocated Crown Land (Pin 1192771), Leda
Unallocated Crown Land (Pin 1192772), Leda
Unallocated Crown Land (Pin 11433799), Leda

3. Clearing authorised

The permit holder must not clear more than 10 hectares of *native vegetation* within the area cross-hatched yellow in Figures 1-5 of Schedule 1.

4. Period during which clearing is authorised

The permit holder must not clear any *native vegetation* after 19 June 2032

PART II – MANAGEMENT CONDITIONS

5. 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.

6. 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.

7. Revegetation and rehabilitation (temporary works)

The permit holder must:

- (a) retain the vegetative material and topsoil removed by clearing authorised under this permit and stockpile the vegetative material and topsoil in an area that has already been cleared;
- (b) *revegetate* and *rehabilitate* areas cleared for *temporary works* within six months of the area no longer being required for the purpose for which it was cleared by:
 - (i) ripping the ground on the contour to remove soil compaction;
 - (ii) laying the vegetative material and topsoil retained under condition 7(a) on the cleared area(s); and
 - (iii) undertake additional planting as required, ensuring only *local provenance* propagating materials are used to revegetate the area.

8. Trees not authorised to clear

- (a) Prior to undertaking any clearing authorised under this Permit, the permit holder must identify, record, and photograph all Tuart trees (*Eucalypts gomphocephala*) trees with a diameter at breast height of 15 centimetres or greater within the area cross-hatched red in Figures 6-9 of Schedule 1.
- (b) The permit holder must retain all Tuart trees (*Eucalypts gomphocephala*) trees with a diameter at breast height of 15 centimetres or greater as identified in condition 8(a).
- (c) On completion of clearing authorised under this Permit, the permit holder must identify, record, and photograph all Tuart trees (*Eucalypts gomphocephala*) trees retained in accordance with condition 8(b).

9. Clearing area limited (areas and activities within TEC patches)

The permit holder is limited to the following restricted activities and amounts of clearing within patches of Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain Community:

- (a) Within the areas crossed-hatched red in Figures 6-8 of Schedule 1, restricting activities to those required for the maintenance of existing infrastructure
- (b) Within the areas crossed-hatched red in Figure 9 of Schedule 1, restricting activities to those required for the maintenance of existing infrastructure (groundwater monitoring bores and access tracks)
- (c) Within the areas crossed-hatched red in Figure 6 of Schedule 1, the permit holder

must not clear an area greater than 0.6 hectares; and

- (d) Within the areas crossed-hatched red in Figure 9 of Schedule 1, the permit holder must not clear an area greater than 0.53 hectares

10. Fauna management – south-western brush-tail phascogale

- (a) In relation to the area cross-hatched yellow in Figures 10-16 of Schedule 1, the permit holder must engage a *fauna specialist* to inspect that area within 24 hours prior to, and for the duration of clearing activities, for the presence of south-western brush-tail phascogale (*Phascogale tapoatafa wambenger*).
- (b) Clearing activities must cease in any area where fauna referred to in condition 10(a) are identified until either:
- (i) the south-western brush-tail phascogale (s) individual has moved on from that area to adjoining *suitable habitat*; or
 - (ii) the south-western brush-tail phascogale (s) individual has been removed by a *fauna specialist*.
- (c) Any south-western brush-tail phascogale(s) individual removed in accordance with condition 10(b)(ii) must be relocated by a *fauna specialist* to an area of *suitable habitat*.
- (d) Where fauna is identified under condition 10(a), the permit holder must within 14 calendar days provide the following records to the *CEO*:
- (i) the number of individuals identified;
 - (ii) the date each individual was identified;
 - (iii) the location where each individual was identified recorded using a Global Positioning System (GPS) unit set to Geocentric Datum Australia 1994/2020, expressing the geographical coordinates in Eastings and Northings or decimal degrees;
 - (iv) the number of individuals removed and relocated;
 - (v) the relevant qualifications of the *fauna specialist* undertaking removal and relocation;
 - (vi) the date each individual was removed;
 - (vii) the method of removal;
 - (viii) the date each individual was relocated;
 - (ix) the location where each individual was relocated to, recorded using a GPS unit set to GDA94, expressing the geographical coordinates in Eastings and Northings or decimal degrees; and
 - (x) details pertaining to the circumstances of any death of, or injury sustained by, an individual.

11. Fauna management – black cockatoo habitat

- (a) Within 72 hours prior to undertaking any clearing authorised under this permit within the combined areas cross-hatched red in Figures 10-16 of Schedule 1, the permit holder must engage a *fauna specialist* to inspect all *black cockatoo habitat tree/s* identified in the report ‘Kwinana Nickel Refinery, Targeted Flora Survey and Black Cockatoo Assessment (Biologic, January 2022)’ for *evidence* of current or past breeding use by *black cockatoo species* listed below:
- (i) *Calyptorhynchus lateriosis* (Carnaby’s cockatoo);
 - (ii) *Calyptorhynchus banksii naso* (forest red-tailed black cockatoo); and
 - (iii) *Calyptorhynchus baudinii* (Baudin’s cockatoo).

- (b) Where a *black cockatoo habitat tree* with no *evidence* of current or past use by *black cockatoo species* is identified in accordance with condition 11(a), that tree must only be cleared within 72 hours after the inspection.
- (c) Where a *black cockatoo habitat tree* is identified within the combined areas cross-hatched red in Figures 10-16 of Schedule 1 and that tree shows *evidence* of current or past breeding use by *black cockatoo species* under condition 11(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.
- (d) Any *black cockatoo breeding 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 11(c).
- (e) For each *black cockatoo breeding tree* with *evidence* of current or past breeding use by *black cockatoo species* identified that cannot be avoided, the permit holder must install an artificial black cockatoo nest hollow.
- (f) Each artificial black cockatoo nesting hollow required by condition 11(e) must be installed prior to commencement of any clearing activities otherwise authorised under this permit.
- (g) The artificial black cockatoo nest hollow(s) required by condition 11(e) of this permit must:
 - (i) be installed at a location identified by the Department of Biodiversity, Conservation and Attractions within 10 kilometres of the application area;
 - (ii) be designed and placed in accordance with the specifications detailed in Schedule 2; and
 - (iii) be monitored and maintained in accordance with the specifications detailed in Schedule 3, for a period of at least ten years.
- (h) Within two months of completing the clearing authorised under this permit within the combined areas cross-hatched red on Figures 10-16 of Schedule 1, the permit holder must provide the results of the *fauna specialist's* inspection findings in a report to the *CEO*.

12. Priority flora management

- (a) Prior to undertaking any clearing authorised under this Permit, the permit holder must demarcate the priority flora (*Pimelea calcicola*) identified within the report 'Kwinana Nickel Refinery, Targeted Flora Survey and Black Cockatoo Assessment (Biologic, January 2022)' at the locations in Table 1 below:

Table 1: Priority flora locations

Species name	Conservation status	No. of individual plants	Latitude	Longitude
<i>Pimelea calcicola</i>	P3	1	-32.267871939	115.7840582
<i>Pimelea calcicola</i>	P3	1	-32.268019920	115.7840427
<i>Pimelea calcicola</i>	P3	1	-32.268076059	115.7840572

- (b) The permit holder shall not cause or allow the clearing of all *Pimelea calcicola* individuals identified at the locations specified in Table 1 of condition 12(a).

PART III - RECORD KEEPING AND REPORTING

13. 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 2.

Table 2: Records that must be kept

No.	Relevant matter	Specifications
1.	In relation to the authorised clearing activities generally	<ul style="list-style-type: none"> (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 1994/2020, expressing the geographical coordinates in Eastings and Northings; (c) the date that the area was cleared; (d) the size of the area cleared (in hectares); (e) actions taken to avoid, minimise, and reduce the impacts and extent of clearing in accordance with condition 5; and (f) actions taken to minimise the risk of the introduction and spread of <i>weeds</i> and <i>dieback</i> in accordance with condition 6; (g) actions taken to manage and mitigate impacts to south-west brush-tail phascogales in accordance with condition 10.
2.	In relation to the revegetation and rehabilitation of areas pursuant to condition 7	<ul style="list-style-type: none"> (a) the size of the area revegetated and rehabilitated; (b) the date(s) on which the area revegetation and rehabilitation was undertaken; and (c) the boundaries of the area revegetated and rehabilitated (recorded digitally as a shapefile). (d) a description of the revegetation and rehabilitation activities undertaken;
3.	In relation to condition 8	<ul style="list-style-type: none"> (a) the location of all Tuart tree (<i>Eucalyptus gomphocephala</i>) trees with a diameter at breast height of 15 centimeters or greater identified and retained, recorded using a Global Positioning System (GPS) unit set to Geocentric Datum Australia 1994/2020, expressing the geographical coordinates in Eastings and Northings; (b) photographs of all Tuart trees identified, taken prior to clearing; and (c) photographs of all Tuart trees retained, taken after clearing.

No.	Relevant matter	Specifications
4.	In relation to condition 9	<p>(a) the size of the area cleared (in hectares) specific to the requirements of condition 9 (c) and (d)</p> <p>(b) A record of the activities carried out in accordance with condition 9 (a) and (b)</p>
5.	In relation to black cockatoo fauna management pursuant to conditions 11	<p>(c) the time(s) and date(s) of inspection(s) of the suitable <i>black cockatoo habitat tree</i> by the <i>fauna specialist</i>;</p> <p>(d) a description of the inspection methodology employed by the <i>fauna specialist</i>;</p> <p>(e) the species name of any fauna determined by the <i>fauna specialist</i> to be occupying the suitable <i>black cockatoo habitat tree</i>;</p> <p>(f) where the suitable <i>black cockatoo habitat tree</i> is determined by the <i>fauna specialist</i> to be occupied by <i>black cockatoo species</i>:</p> <p>(i) the time and date that it was determined to be no longer occupied; and</p> <p>(ii) a description of the evidence by which it was determined to be no longer occupied; and</p> <p>(a) the time and date that the suitable <i>black cockatoo habitat tree</i> was cleared.</p>
6.	In relation to flora management pursuant to condition 12	<p>(b) actions taken to demarcate each <i>priority flora</i> species recorded and their relevant buffers; and</p> <p>(c) actions taken to avoid the clearing of <i>priority flora</i> species.</p>

14. 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 13; 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 13, where these records have not already been provided under condition 14(a).

DEFINITIONS

In this permit, the terms in Table 3 have the meanings defined.

Table 3: 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 <i>Eucalyptus salmonophloia</i> or <i>Eucalyptus wandoo</i>) that contain hollows suitable for breeding by black cockatoo species.
black cockatoo species	means one or more of the following species: (a) <i>Calyptorhynchus latirostris</i> (Carnaby's cockatoo); (b) <i>Calyptorhynchus baudinii</i> (Baudin's cockatoo); and/or (c) <i>Calyptorhynchus banksii naso</i> (forest red-tailed black cockatoo).
CEO	Chief Executive Officer of the department responsible for the administration of the clearing provisions under the <i>Environmental Protection Act 1986</i> .
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.
department	means the department established under section 35 of the <i>Public Sector Management Act 1994</i> (WA) and designated as responsible for the administration of the EP Act, which includes Part V Division 3.
dieback	means the effect of <i>Phytophthora</i> species on native vegetation.
EP Act	<i>Environmental Protection Act 1986</i> (WA)
evidence	means showing chew marks or scratchings on the habitat tree representative of the species being surveyed, the presence of the species entering or leaving the habitat tree, and/or the presence of chicks/young.
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 <i>Biodiversity Conservation Act 2016</i> .
fill	means material used to increase the ground level, or to fill a depression.
Local provenance	means native vegetation seeds and propagating material from natural sources within 50 kilometres and the same IBRA subregion of the area cleared.
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.
priority flora	means those plant taxa described as priority flora classes 1, 2, 3, or 4 in the Department of Biodiversity, Conservation and Attractions <i>Threatened and Priority Flora List for Western Australia</i> (as amended from time to time).
rehabilitate/ rehabilitated/ rehabilitation	means actively managing an area containing native vegetation in order to improve the ecological function of that area.
suitable habitat (<i>Phascogale tapoatafa wambenger</i>)	means habitat known to support south-western brush-tail phascogale within the known current distribution of the species. This often includes

Term	Definition
	open woodlands that contain hollow-bearing trees but a sparse ground cover.
temporary works	means access tracks, spoil areas, side tracks, site offices, storage areas, laydown areas, extraction sites, camps, project surveys, pre-construction activities, and similar works associated with a project activity that are temporary in nature.
weeds	means any plant – (a) that is a declared pest under section 22 of the <i>Biosecurity and Agriculture Management Act 2007</i> ; 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



Meenu Vitarana
A/MANAGER
 NATIVE VEGETATION REGULATION

*Officer delegated under Section 20
of the Environmental Protection Act 1986*

26 May 2022

Schedule 1

The boundary of the area authorised to be cleared is shown in Figures 1 to 5 and areas subject to conditions are show in Figures 6-16.

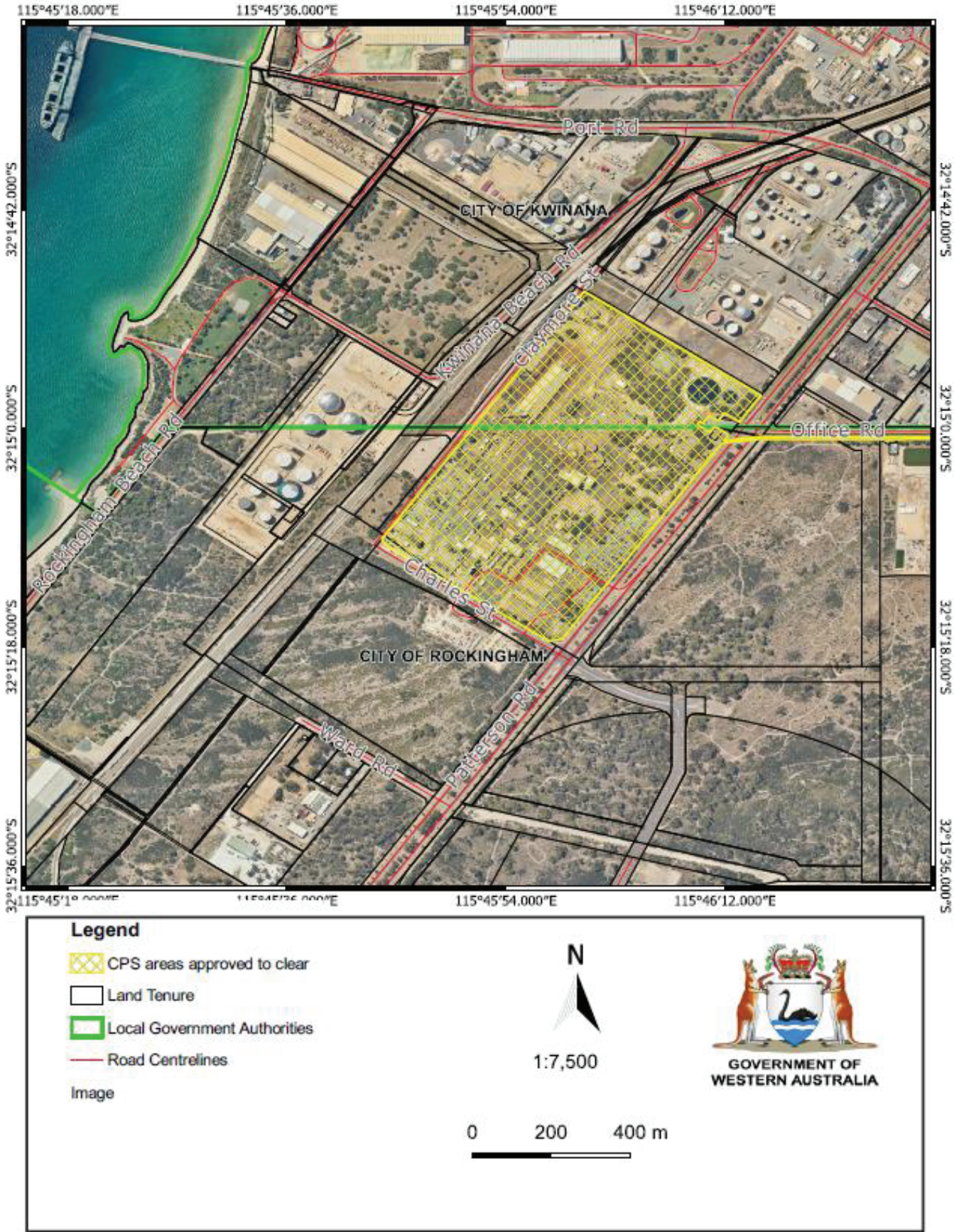


Figure 1: Map of the boundary of the area within which clearing may occur

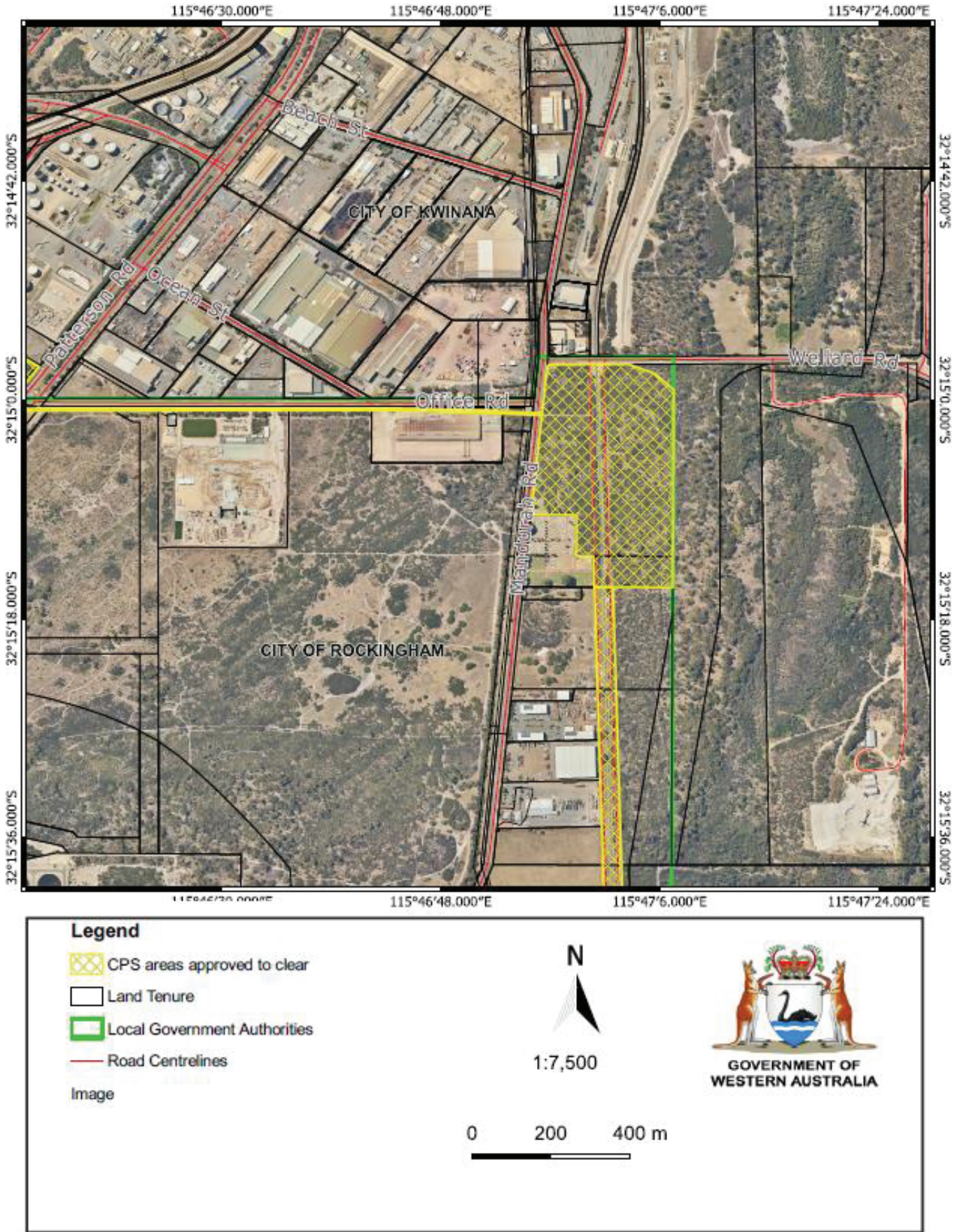


Figure 2: Map of the boundary of the area within which clearing may occur

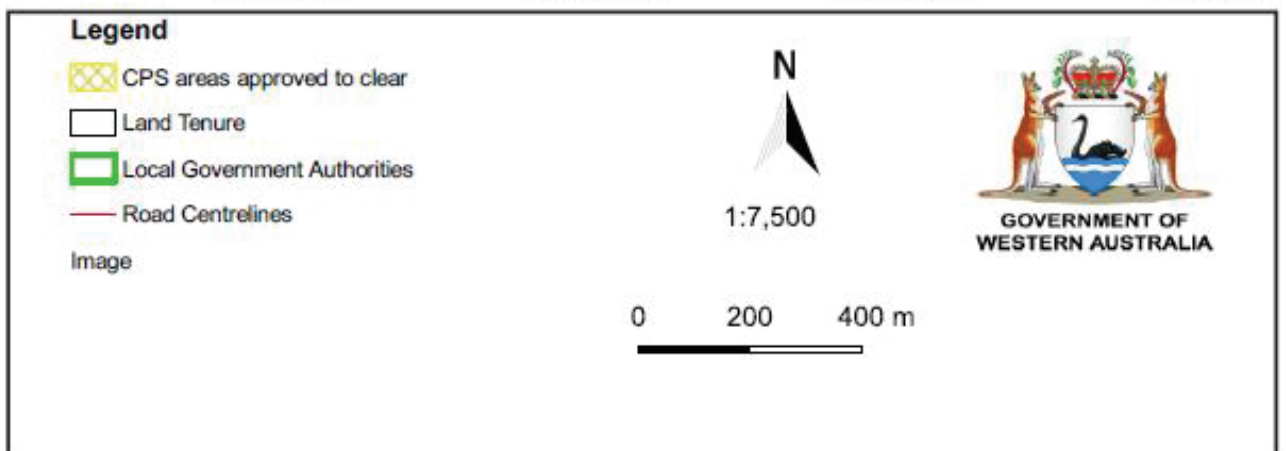
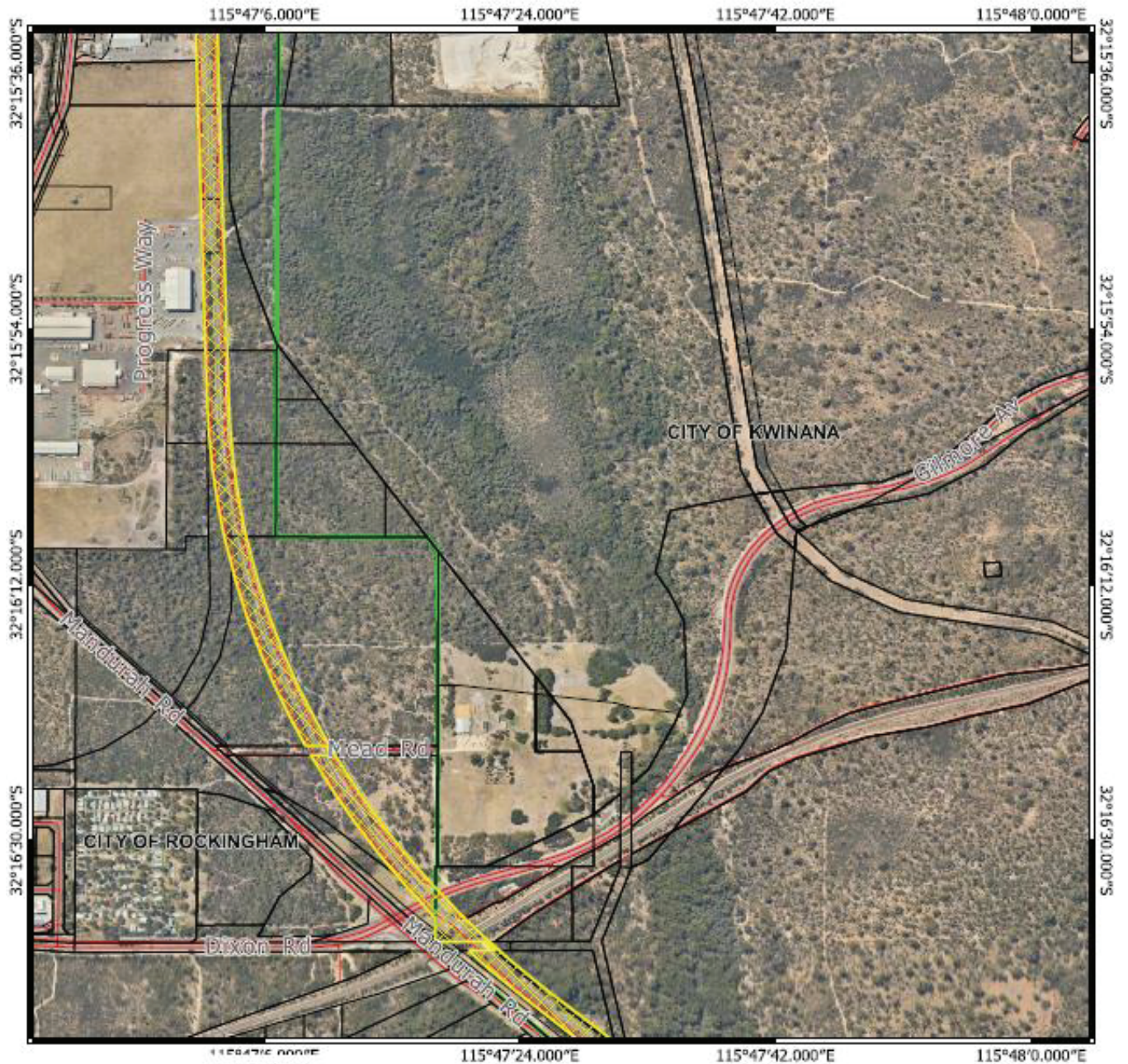


Figure 3 : Map of the boundary of the area within which clearing may occur

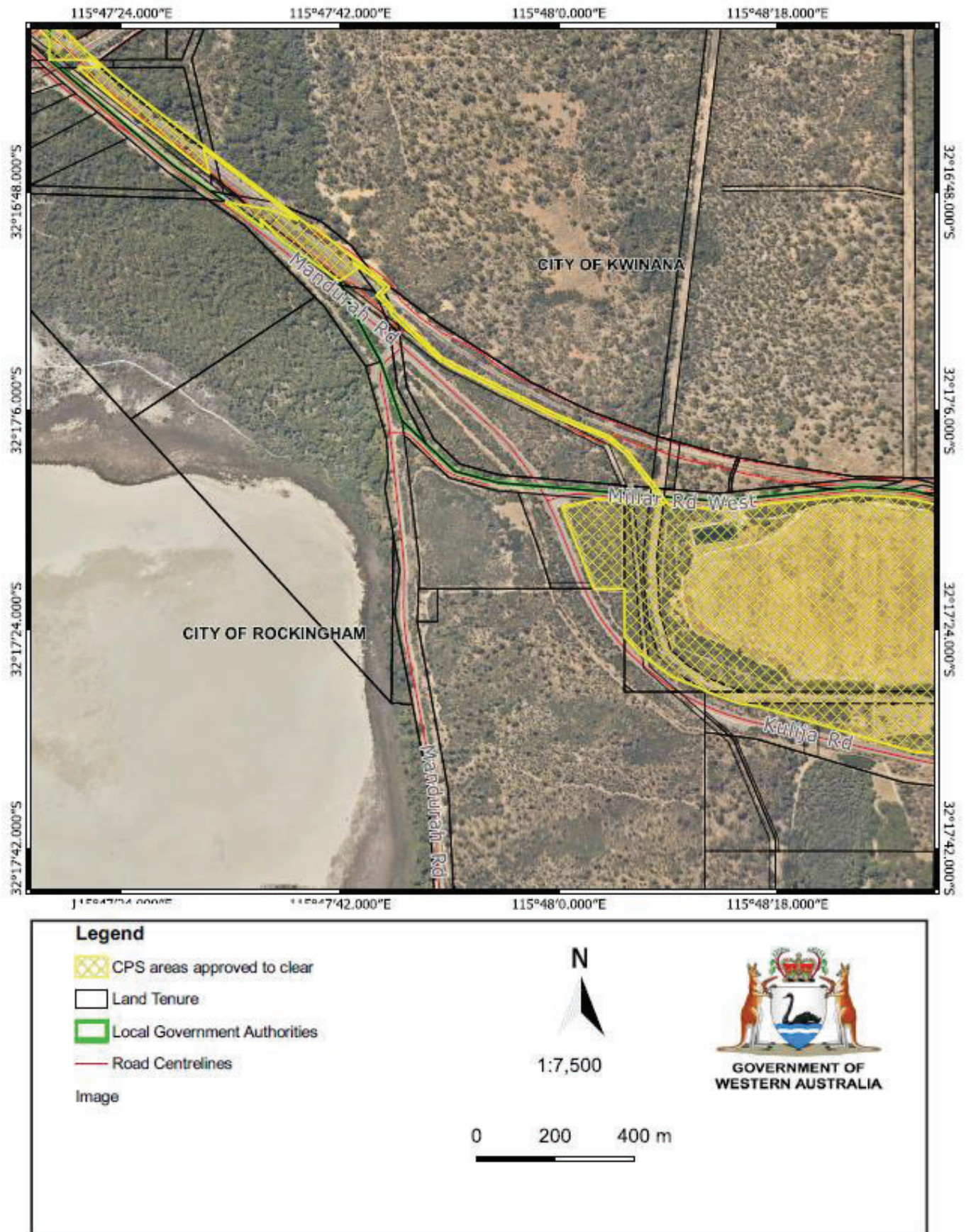


Figure 4: Map of the boundary of the area within which clearing may occur

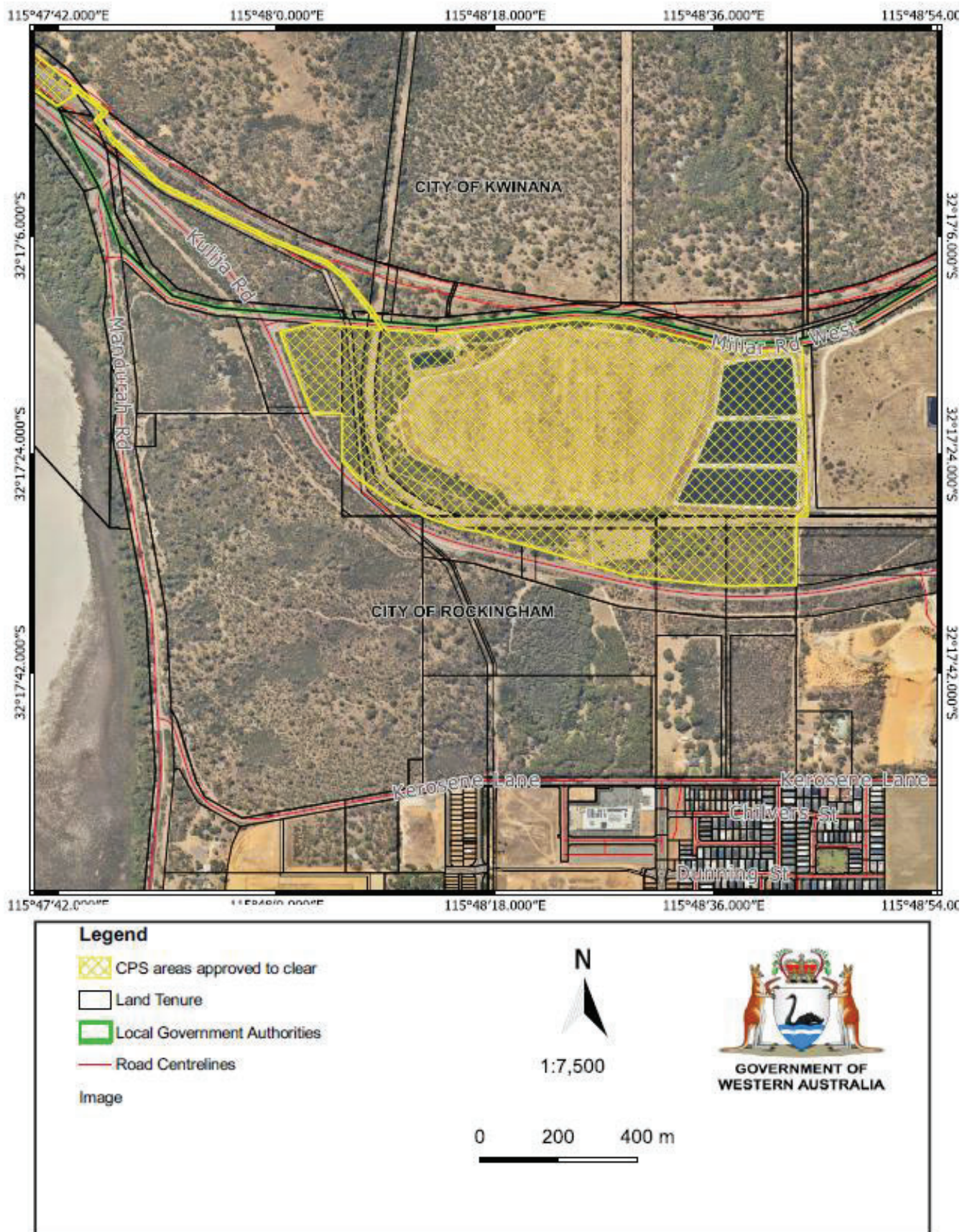


Figure 5: Map of the boundary of the area within which clearing may occur



Figure 7: Area of intersection with Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain subject to conditions

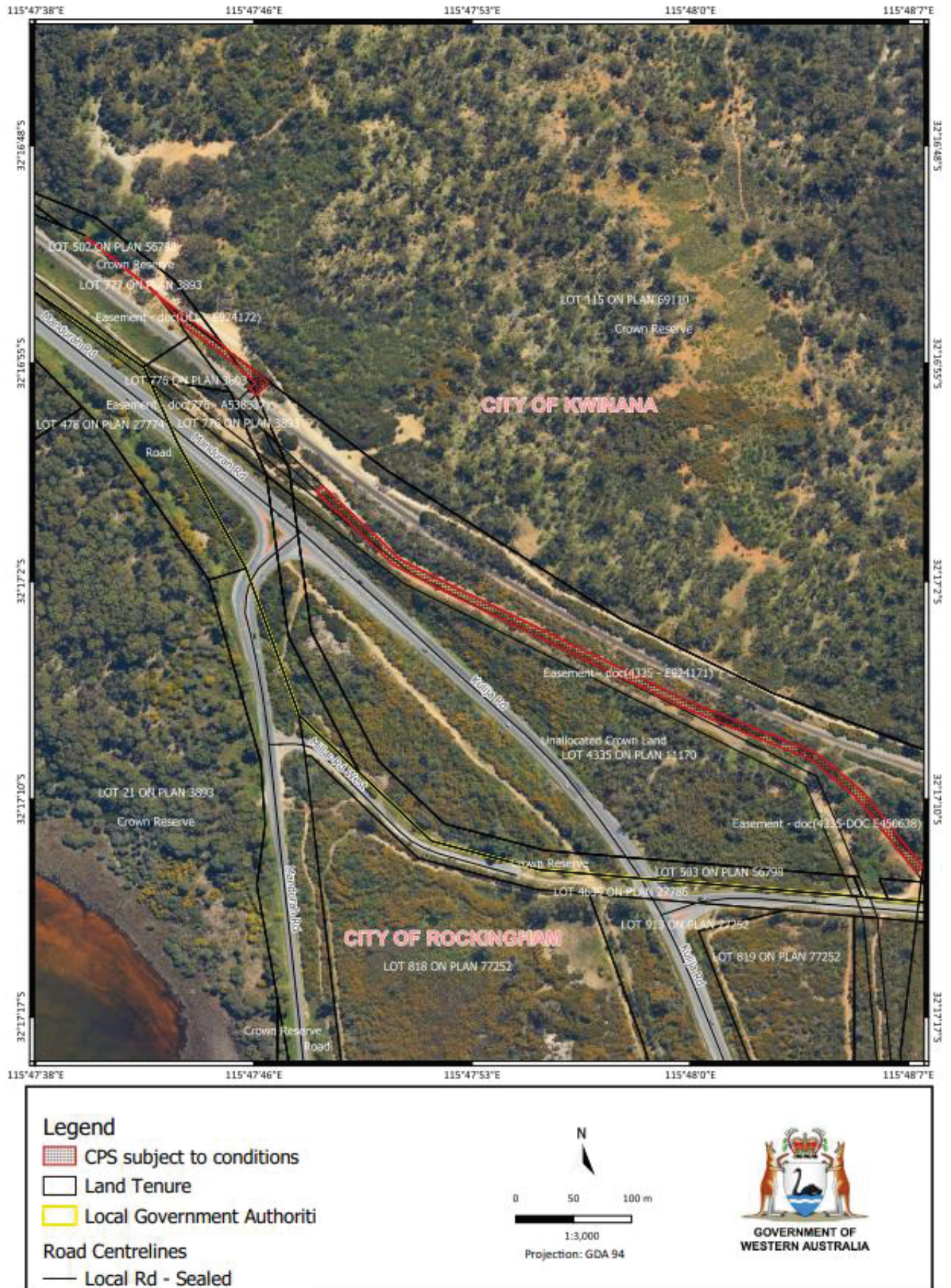


Figure 8: Area of intersection with Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain subject to conditions

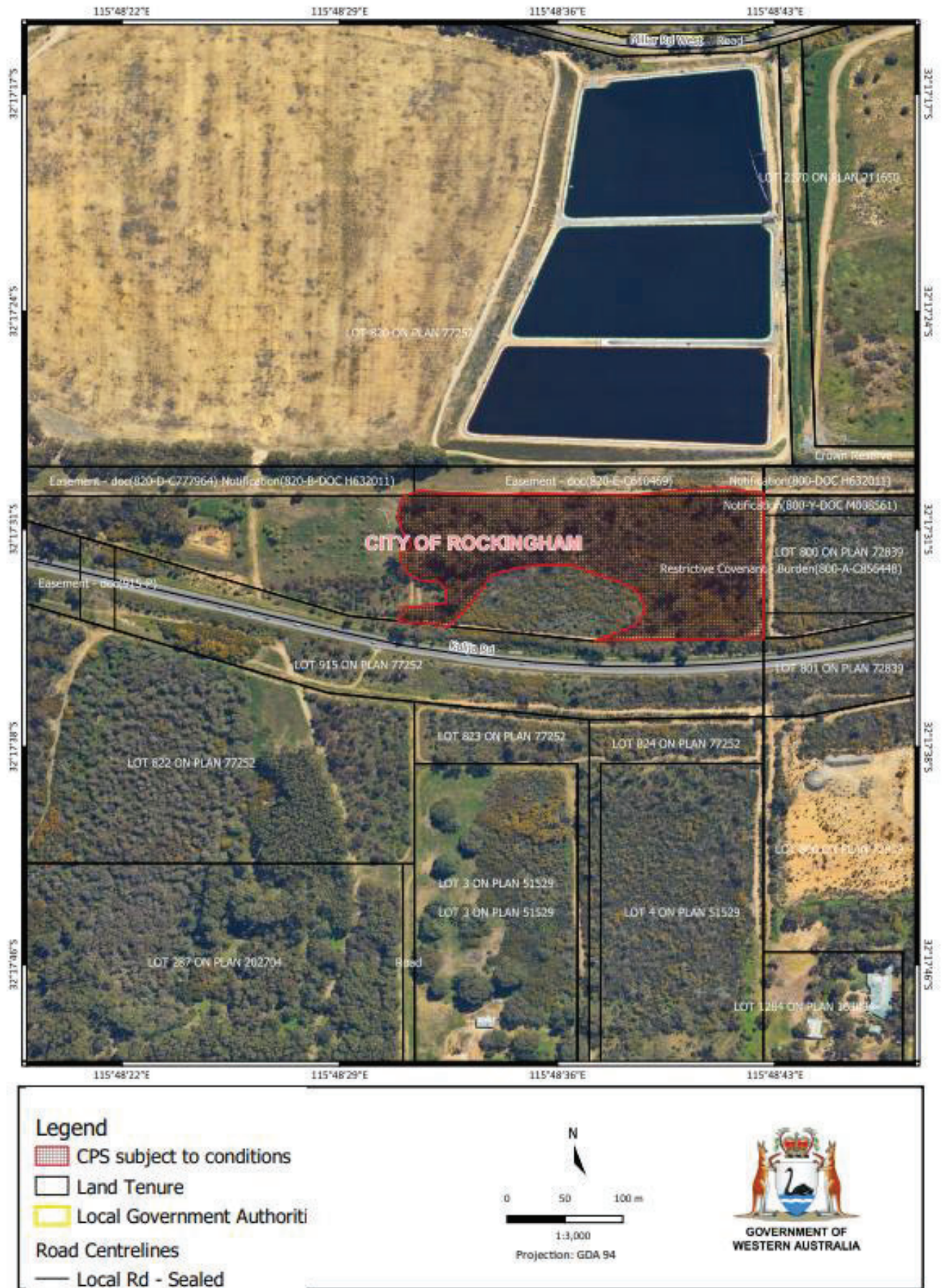


Figure 9: Area of intersection with Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain subject to conditions



Figure 10: Area subject to fauna management conditions



Figure 11: Area subject to fauna management conditions

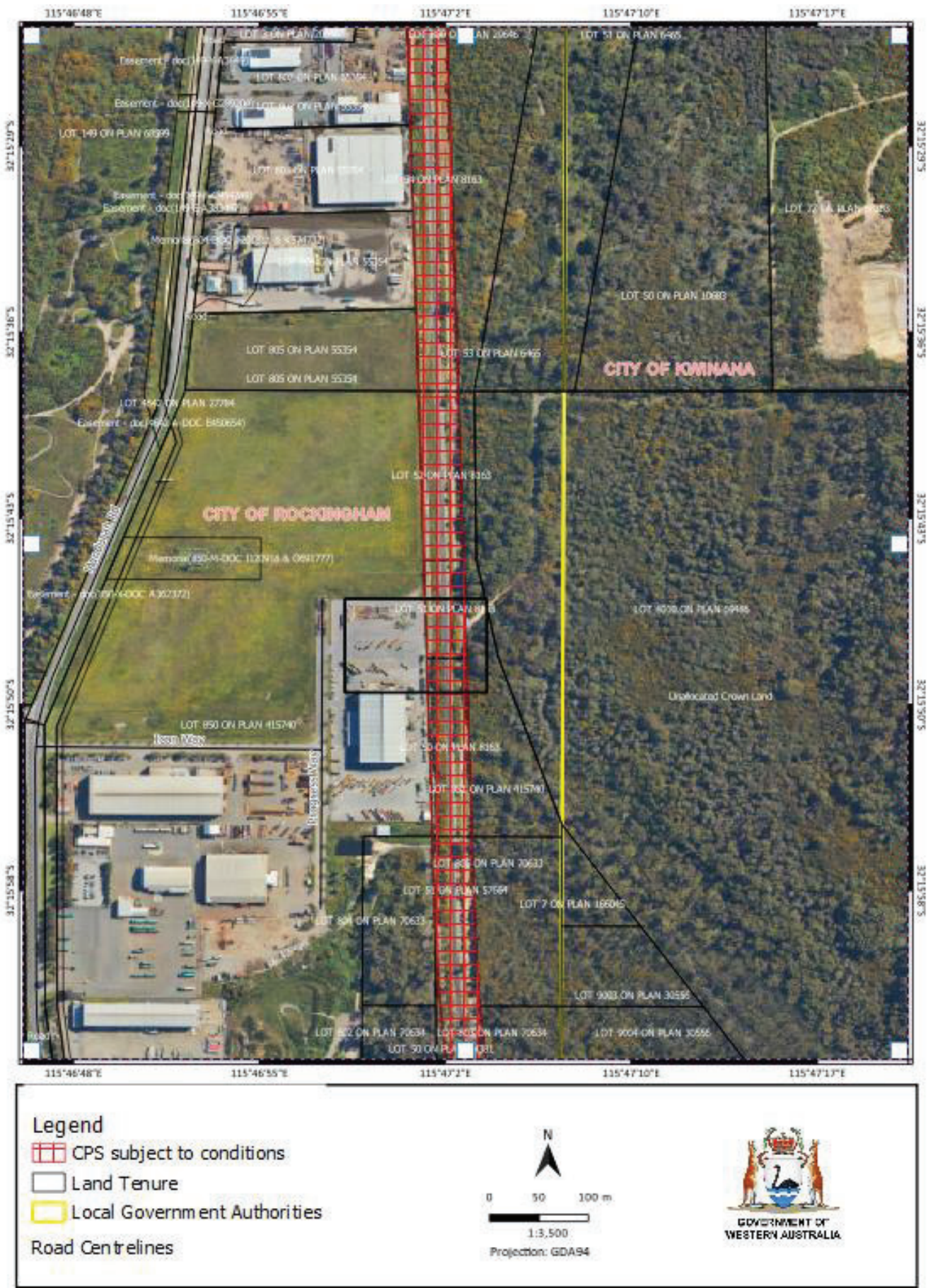


Figure 12: Area subject to fauna management conditions

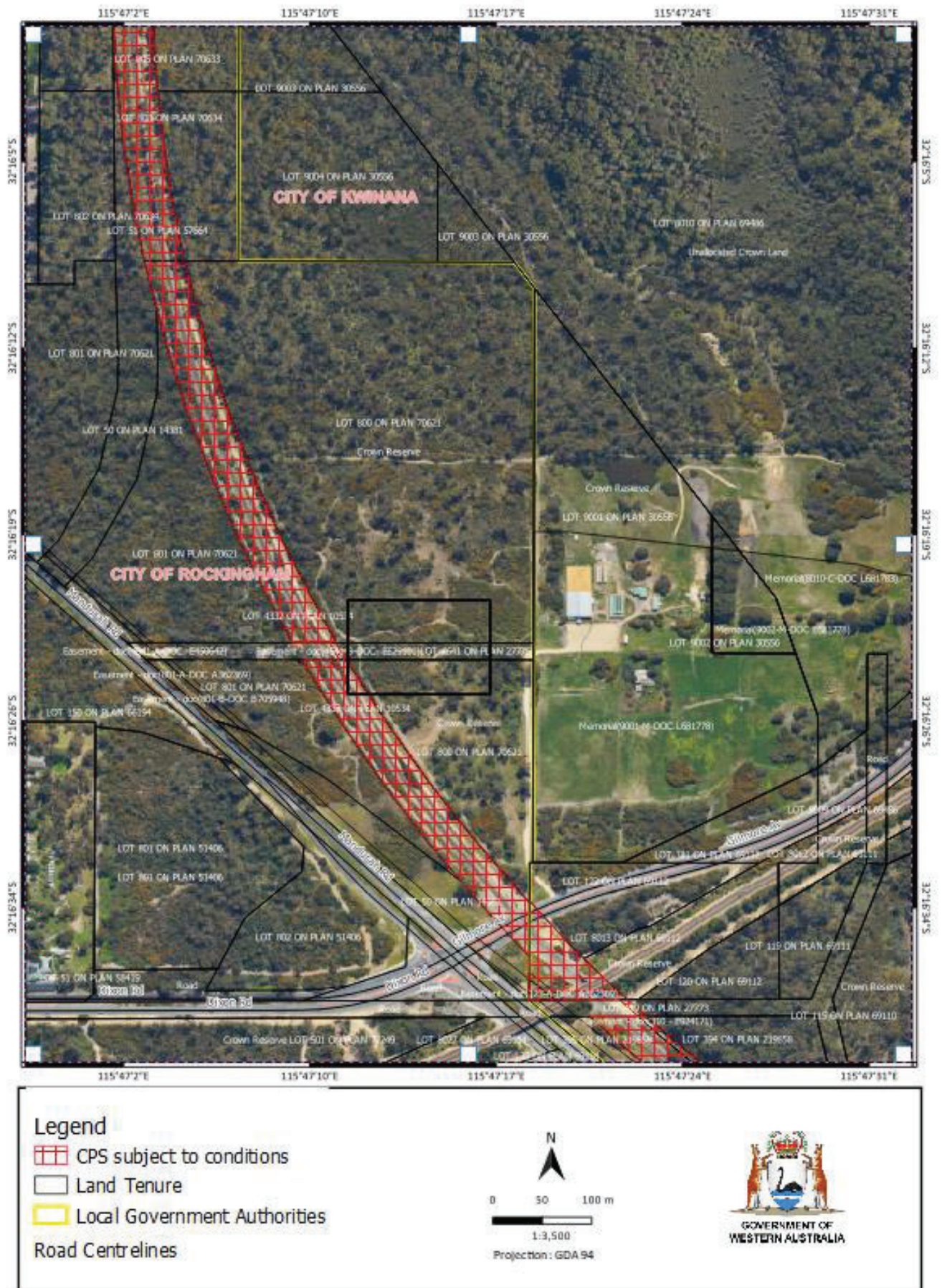


Figure 13: Area subject to fauna management conditions



Figure 15: Area subject to fauna management conditions

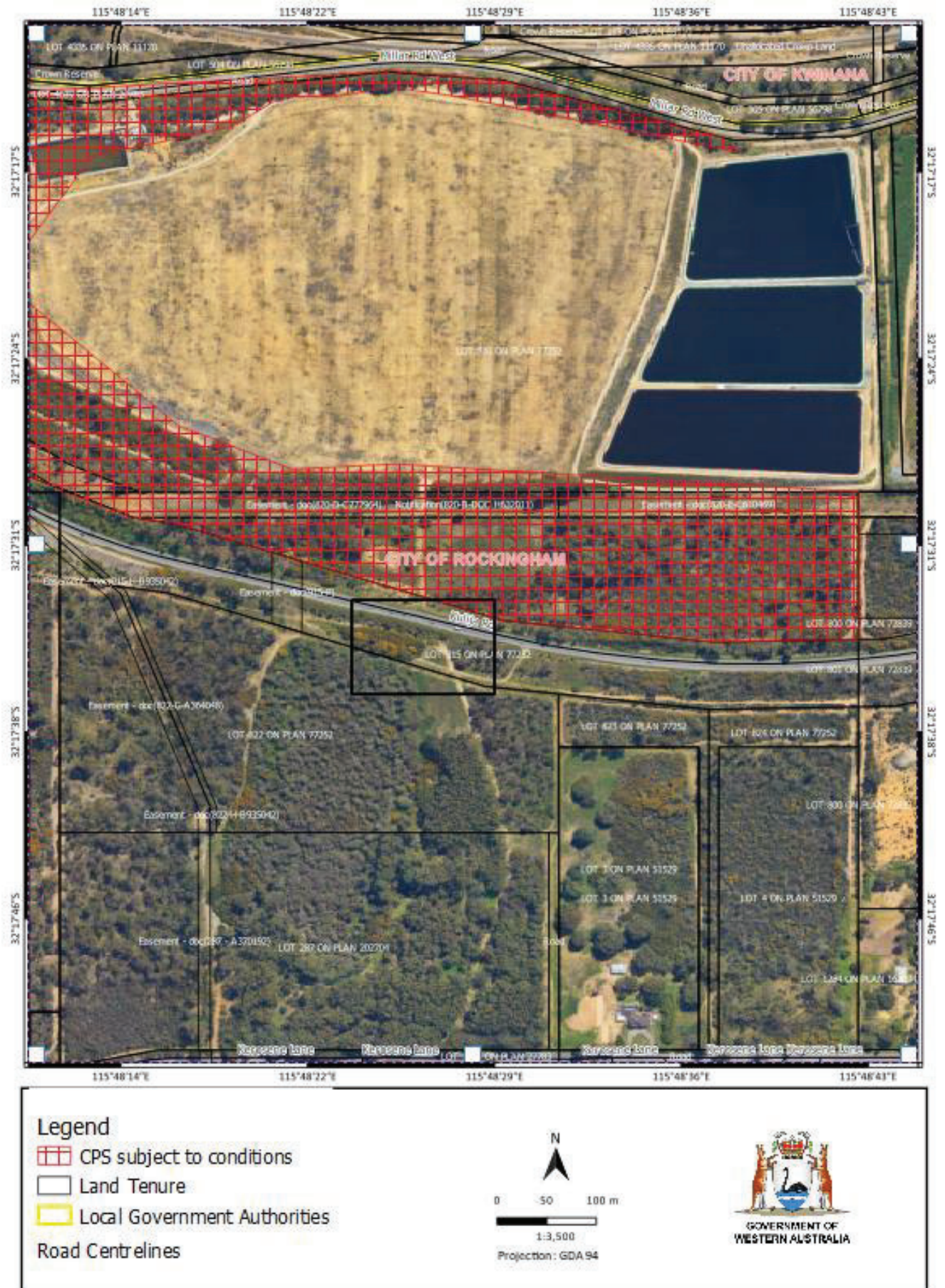


Figure 16: Area subject to fauna management conditions

Schedule 2
How to design and place artificial hollows for Carnaby's black cockatoo



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)

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. Zinalume ®), 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

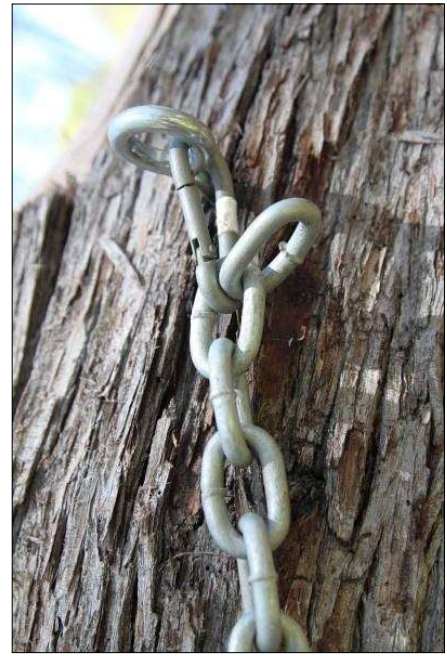
Once artificial hollows have been placed they require monitoring and maintenance to ensure they continue to be useful for nesting by Carnaby's cockatoo. It is important to monitor artificial hollows to determine use by Carnaby's cockatoo, other native species as well as pest species. By undertaking monitoring 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

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Schedule 3

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



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 (wildlifelicencing@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.

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)	<ul style="list-style-type: none"> • 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)	<p>To observe at least two of the following:</p> <ul style="list-style-type: none"> • Breeding behaviour of adults around hollow or evidence of chewing • Female flushed from hollow • Noises from nestlings in hollow <p>Or to observe:</p> <ul style="list-style-type: none"> • 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.	<ul style="list-style-type: none"> • Looking inside nest to observe eggs or nestlings.
To determine use by any species	As often as possible.	<ul style="list-style-type: none"> • 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.	<ul style="list-style-type: none"> • 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

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Clearing Permit Decision Report

1 Application details and outcome

1.1. Permit application details

Permit number:	CPS 9105/1
Permit type:	Purpose permit
Applicant name:	BHP Nickel West Pty Ltd
Application received:	11 November 2020
Application area:	10 hectares within a footprint of 122 hectares
Purpose of clearing:	To facilitate processing, maintenance, access and associated facilities development within Kwinana and associated pipelines, and maintenance for access and bores within Baldivis lots.
Method of clearing:	Mechanical
Property:	Lot 819 On Deposited Plan 77252, Baldivis Lot 820 On Deposited Plan 77252, Baldivis Lot 913 On Deposited Plan 77252, Baldivis Lot 914 On Deposited Plan 77252, Baldivis Lot 915 On Deposited Plan 77252, Baldivis Lot 4639 On Deposited Plan 27786, Baldivis Charles Street Road Reserve (Pin 1193189), East Rockingham Lot 1 On Diagram 62220, East Rockingham Lot 30 On Deposited Plan 68599, East Rockingham Lot 50 On Plan 8163, East Rockingham Lot 51 On Diagram 57664, East Rockingham Lot 51 On Plan 8163, East Rockingham Lot 52 On Plan 8163, East Rockingham Lot 54 On Plan 8163, East Rockingham Lot 55 On Plan 8163, East Rockingham Lot 89 On Deposited Plan 411084 Lot 105 On Deposited Plan 48637 Lot 149 On Deposited Plan 68599 Lot 153 On Deposited Plan 245392 Lot 622 On Deposited Plan 117585 Lot 1634 On Deposited Plan 27291 Lot 1728 On Deposited Plan 166742, East Rockingham Lot 4220 On Deposited Plan 192602, East Rockingham

Lot 4332 On Plan 10534, East Rockingham
Lot 4333 On Plan 10534, East Rockingham
Lot 4641 On Deposited Plan 27775, East Rockingham
Lot 4662 On Deposited Plan 95174, East Rockingham
Lot 123 On Deposited Plan 69112, Leda
Lot 310 On Deposited Plan 244038, Leda
Lot 396 On Deposited Plan 219858, Leda
Lot 479 On Deposited Plan 27773, Leda
Lot 502 On Deposited Plan 56798, Leda
Lot 504 On Deposited Plan 56798, Leda
Lot 777 On Plan 3893, Leda
Lot 4335 On Plan 11170, Leda
Unallocated Crown Land (Pin 1192771), Leda
Unallocated Crown Land (Pin 1192772), Leda
Unallocated Crown Land (Pin 11433799), Leda

Location (LGA area/s): City of Kwinana
City of Rockingham

Localities (suburb/s): Baldivis, East Rockingham, and Leda

1.2. Description of clearing activities

The vegetation proposed to be cleared is up to 10 hectares within a 122-hectare footprint and is distributed across multiple land parcels over approximately eight kilometres (see Figures 1 to 5, Section 1.5). The footprint comprises of both vegetated and non-vegetated areas in varying condition.

1.3. Decision on application

Decision: Granted
Decision date: 26 May 2022
Decision area: 10 hectares of native vegetation, as depicted in Section 1.5, below.

1.4. Reasons for decision

This clearing permit application was submitted, accepted, assessed, and determined in accordance with sections 51E and 51O of the *Environmental Protection Act 1986* (EP Act). The Department of Water and Environmental Regulation (DWER) advertised the application for 21 days and no submissions were received.

The Delegated Officer had regard for the site characteristics (see Appendix B), relevant datasets (see Appendix F.1) and the findings of the biological surveys (see Appendix E), the clearing principles set out in Schedule 5 of the EP Act (see Appendix C), relevant planning instruments and any other matters considered relevant to the assessment (see Section 3). The Delegated Officer also took into consideration that the application is part of a 20-year strategic plan to facilitate processing, maintenance, access and associated facilities development within Kwinana and associated pipelines, and to provide maintenance for access and bores within Baldivis lots.

The assessment identified that the proposed clearing will result in:

- the loss of native vegetation that is suitable habitat for Carnaby's cockatoo (*Calyptorhynchus latirostris*) and forest red-tail black cockatoo (*Calyptorhynchus banksii naso*) and Baudin's cockatoo (*Calyptorhynchus baudinii*)

- the potential introduction and spread of weeds into adjacent vegetation, which could impact on the quality of the adjacent vegetation and its habitat values
- potential impacts on priority flora
- impacts to the Tuart woodland of the Swan Coastal Plain Threatened Ecological Community (TEC)

After consideration of the available information, as well as the applicant's minimisation and mitigation measures (see Section 3.1), the Delegated Officer determined the proposed clearing is unlikely to have long-term adverse impacts on the identified environmental values and can be minimised and managed to be unlikely to lead to an unacceptable risk to environmental values. The applicant has suitably demonstrated avoidance and minimisation measures.

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

- avoid, minimise to reduce the impacts and extent of clearing
- take hygiene steps to minimise the risk of the introduction and spread of weeds
- undertake black cockatoo and phascogale inspections prior to clearing within nominated areas of suitable habitat and carry out actions to avoid impacts to species should they be present within the proposed clearing area
- avoid a population of a Priority 3 species located within the clearing footprint
- avoid mature Tuart trees within areas of mapped TEC
- restrict activities within areas of mapped TEC.

1.5. Site map

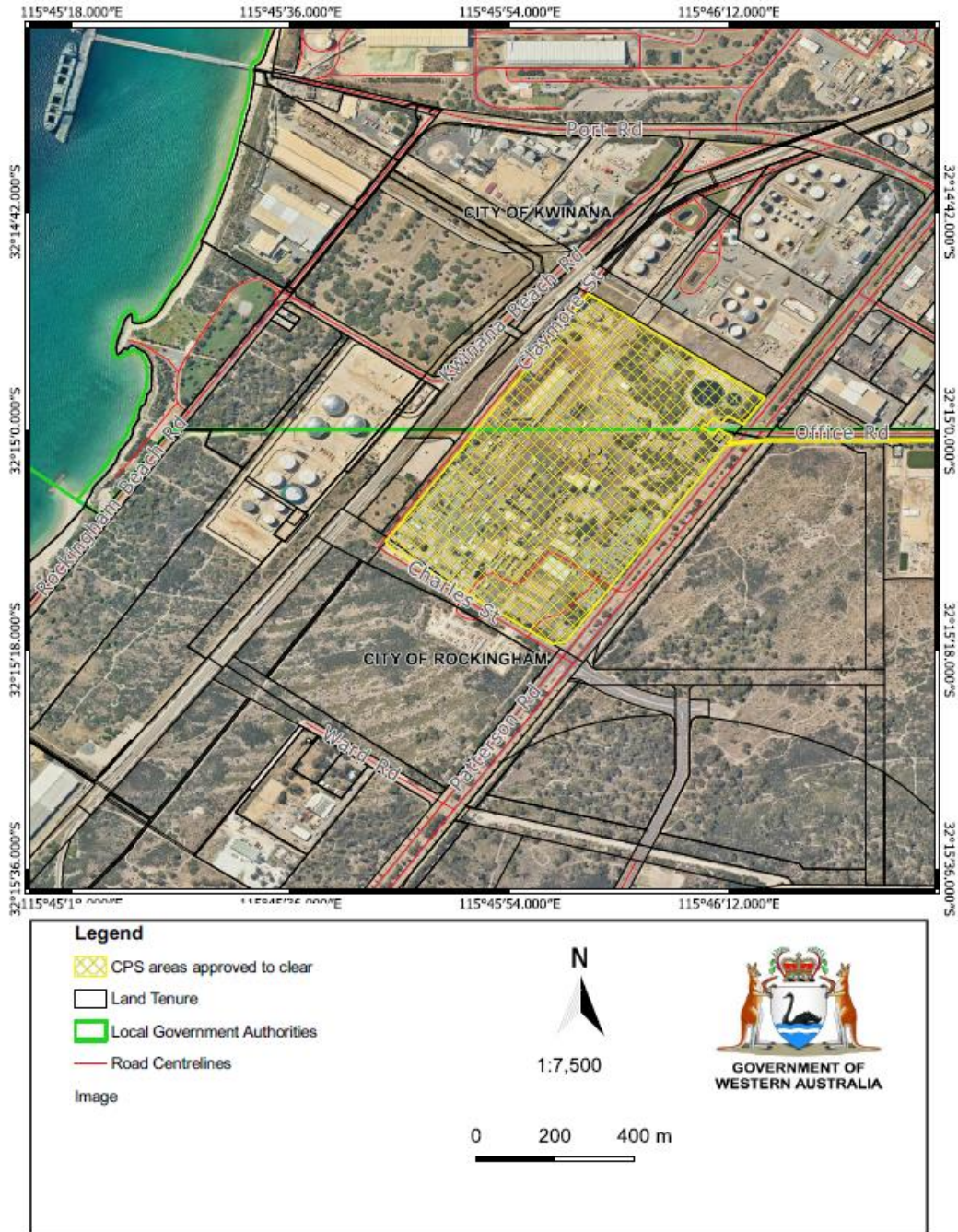


Figure 1 Map of the application area

The area crosshatched yellow indicates the area authorised to be cleared under the granted clearing permit

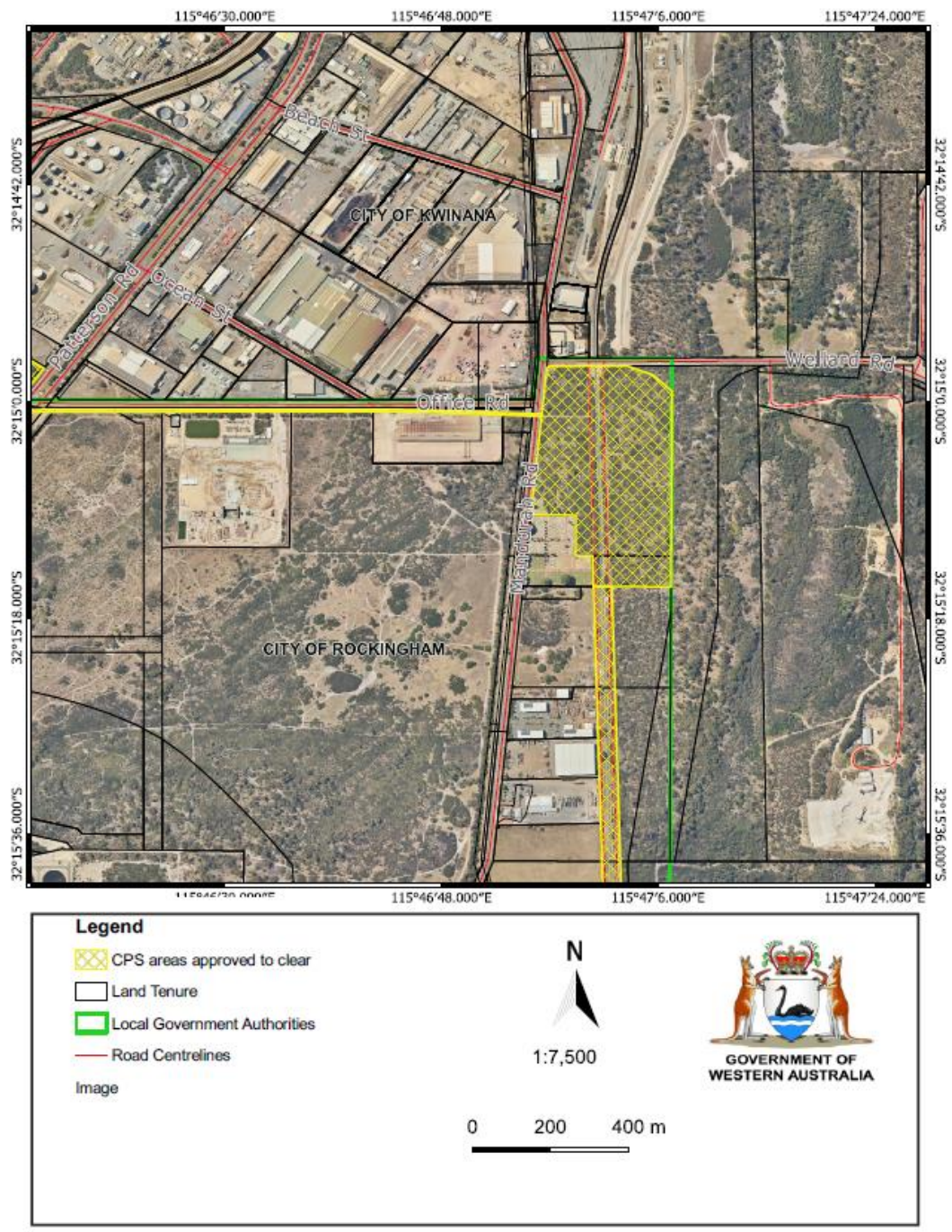


Figure 2 Map of the application area

The area crosshatched yellow indicates the area authorised to be cleared under the granted clearing permit.

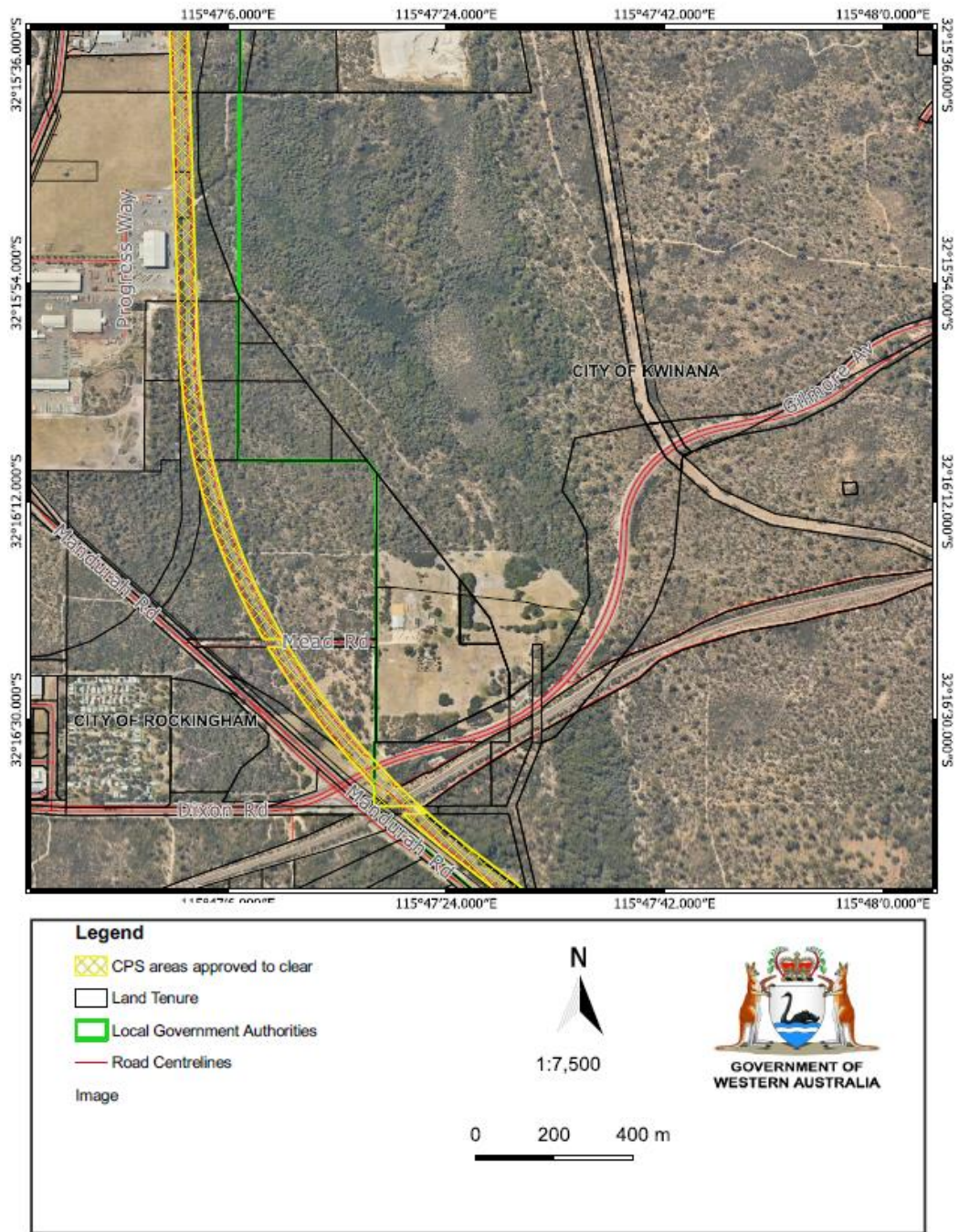


Figure 3 Map of the application area

The area crosshatched yellow indicates the area authorised to be cleared under the granted clearing permit.

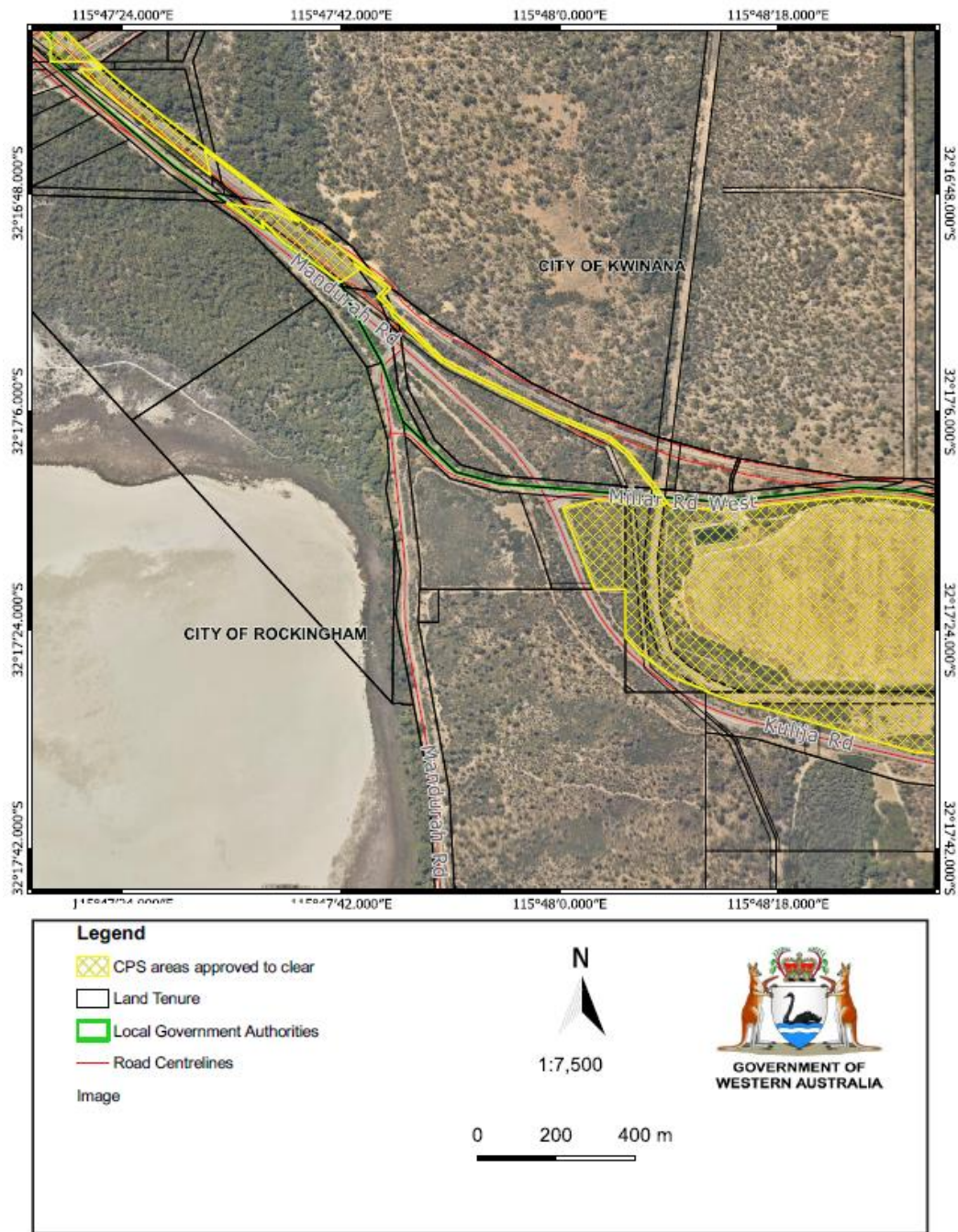


Figure 4 Map of the application area

The area crosshatched yellow indicates the area authorised to be cleared under the granted clearing permit.

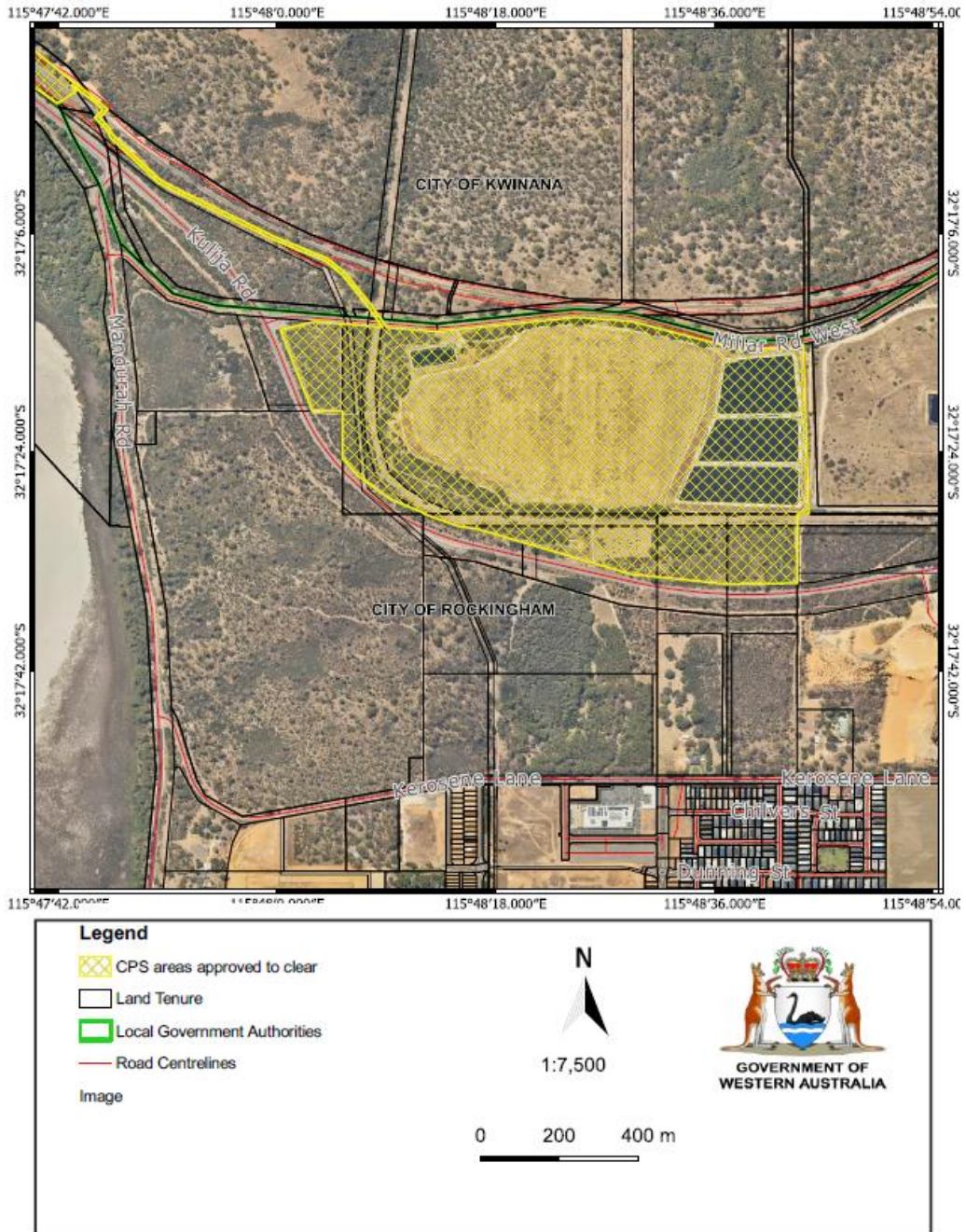


Figure 5 Map of the application area

The area crosshatched yellow indicates the area authorised to be cleared under the granted clearing permit.

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 polluter pays principle
- 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)
- *Conservation and Land Management Act 1984* (WA) (CALM Act)
- *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act)
- *Planning and Development Act 2005* (WA) (P&D Act)

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)
- Technical guidance – *Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA, 2016)

3 Detailed assessment of application

3.1. Avoidance and mitigation measures

Evidence was submitted by the applicant, noting that “The Kwinana site is wholly within an industrial area and over the coming decade future development of the site will continue. Trees will be retained wherever possible” and “The Baldivis lots are not currently proposed for any development but may require additional groundwater bores and associated access tracks, along with maintenance clearing for access. No new project associated clearing is proposed.”

Discussions during a preliminary assessment and request for information noted the original application included a conservation category wetland within the footprint at the southern extent. The applicant provided a response to this and omitted the area, (as seen in Figures 6 and 7 below). The change in the resulting footprint was a decrease from 156 hectares to 122 hectares.

In addition to this, the applicant was required to survey selected areas of vegetation against criteria for ‘Tuart woodlands and forests of the Swan Coastal Plain threatened ecological community’ (Tuart TEC). Findings of the survey are included within Appendix E within figures 16, 17 and 18 and discussed within this assessment (Section 3). The applicant has made commitments to reduce impacts to the mapped occurrences of the Tuart TEC which include:

- avoiding the clearing of mature Tuart trees within areas of TEC
- limiting clearing activities within the areas of TEC
- restricting the total clearing within areas of TEC to a designated amount or width.

These measures are discussed within the assessment below.

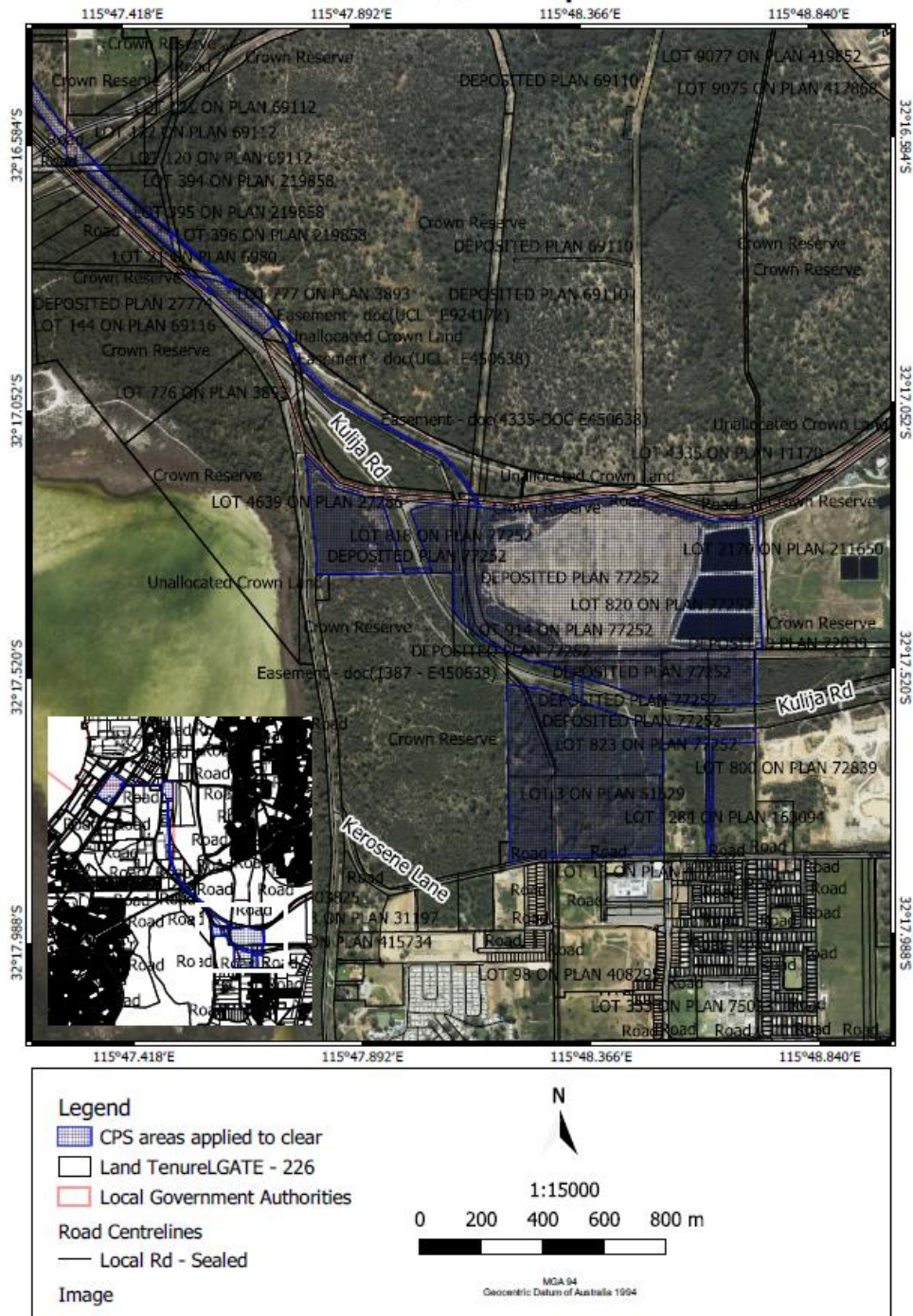


Figure 6: Map of the southern extent of the original application area. This area was reduced during the assessment period by the applicant to reduce impacts on wetlands with the revised area shown in Figure 7 below.

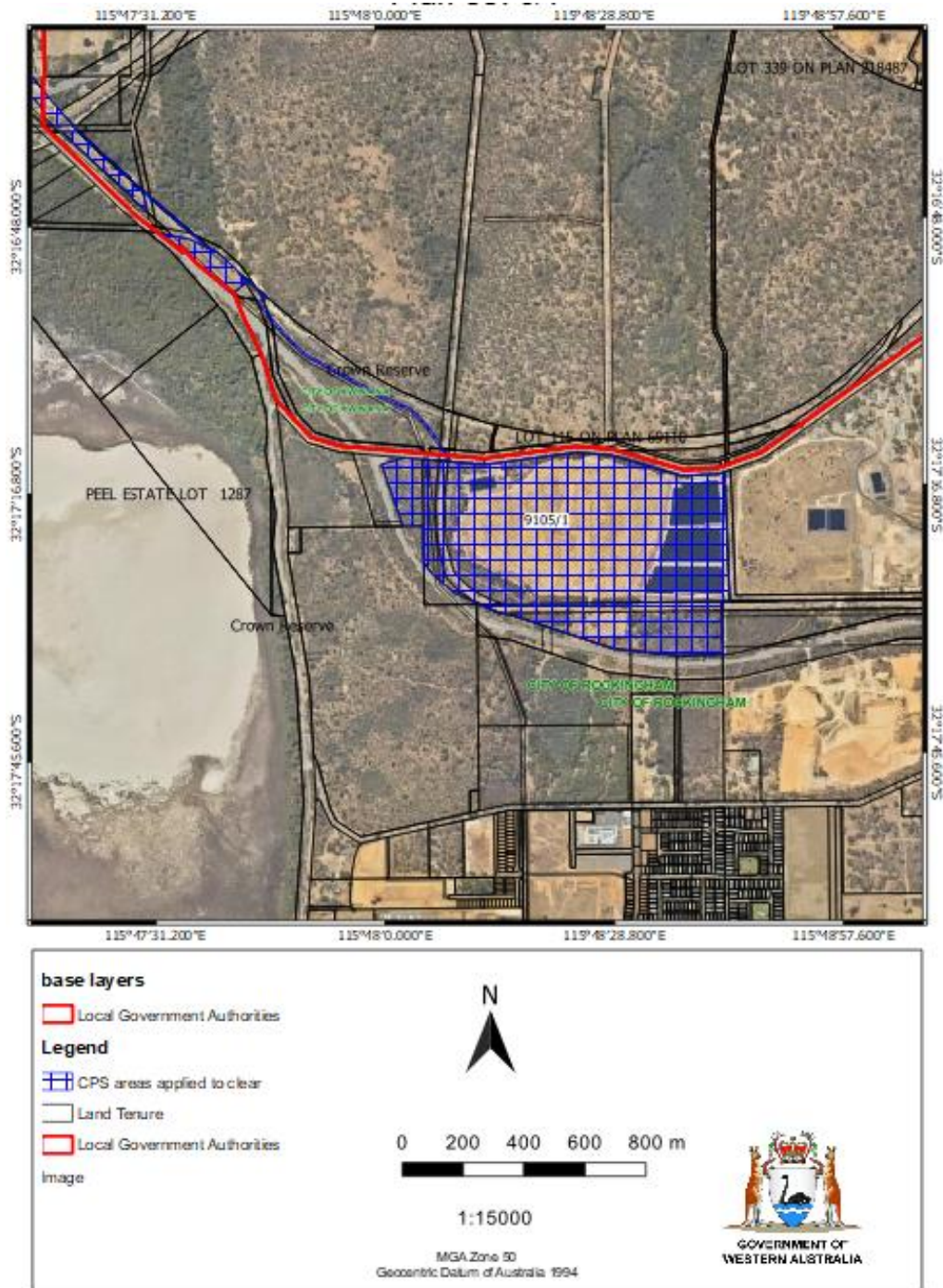


Figure 7: Map of the southern extent of the revised application area.

3.2. Assessment of impacts on environmental values

In assessing the application, the Delegated Officer has had regard for the site characteristics (see Appendix B) and the extent to which the impacts of the proposed clearing present a risk to biological, conservation, or land and water resource values.

The assessment against the clearing principles (see Appendix C) identified that the impacts of the proposed clearing present a risk to biological values of; fauna, priority and threatened ecological communities and conservation areas. 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 (biodiversity) - Clearing Principles (a, b, and c)

Assessment

Available data sources indicate several avian fauna species located within the local area which have habitat preferences likely to be represented within the application area. It is considered the following species may occur:

- *Calyptorhynchus latirostris* (Carnaby's cockatoo)
- *Calyptorhynchus banksii naso* (forest red-tailed black cockatoo)
- *Calyptorhynchus baudinii* (Baudin's cockatoo)

Black cockatoos

The application area is within the outskirts of the Baudin's cockatoo distribution but is within the core habitat for forest red-tailed black cockatoo (FRTBC) and the known breeding distribution of Carnaby's cockatoo. The application area contains vegetation types that support some of the preferred foraging material for these species to some extent and may also contain hollow bearing trees (breeding habitat) and night roosting habitat for these species (Commonwealth of Australia, 2012).

Foraging habitat for black cockatoo species includes foraging material that is within an approximate 6–12-kilometre radius of nesting site and within 6 kilometres of a night roosting site. The preferred foraging habitat for each of the species is described below:

- Carnaby's cockatoo – Native shrubland, kwongan heathland and woodland dominated by proteaceous plant species such as *Banksia* spp, *Hakea* spp. and *Grevillea* spp. The species also forages in pine plantations and eucalypt woodland.
- FRTBC – jarrah and marri woodlands and forest, edges of karri forests including wandoo and blackbutt within the range of the species
- Baudin's cockatoo – Eucalypt woodlands and forest, proteaceous woodland, and heath. Primarily feeding on marri during the breeding season and non-native species outside of the breeding season.

The application area is not likely to present significant foraging habitat for Carnaby's cockatoo due to the absence of proteaceous plant species within most of the mapped and surveyed vegetation types. Foraging value of the application area is considered low due to the absence of marri species from most of the application area. The majority application area has been assessed for foraging habitat for black cockatoo species within two surveys conducted (Biologic, 2019 and Biologic 2022)

The refinery area was surveyed in March 2019 and covered an approximate 38-hectare area. The foraging habitat for black cockatoos was assessed as part of this survey with the findings summarised below in Table 1.

Table 1: Summary of foraging habitat from the Kwinana refinery site (Biologic, 2019)

Summary of foraging habitat in refinery area	Foraging score for Carnaby's cockatoo	Foraging score for Baudin's cockatoo	Foraging score for Forest red-tailed black cockatoo
Total score	4	1	1

A survey was completed within an approximate 54-hectare portion of the application area footprint which assessed the habitat types found present, against a habitat scoring tool for foraging value (Biologic, 2022). This survey identified six habitat types with varying scores for foraging. The results are summarised below in Table 2.

Table 2 Summary of foraging habitat from the Kwinana refinery site (Biologic, 2022)

Habitat type	Foraging score for Carnaby's cockatoo	Foraging score for Baudin's cockatoo	Foraging score for Forest red-tailed black cockatoo
Tuart woodland (10.8 hectares/20.1 % of survey area)	13	0	3
Tuart over Acacia shrubland (12.7 hectares/23.6 % of survey area)	13	0	3
Tuart and Marri woodland (4.4 hectares/8.2% of survey area)	13	6	12

Banksia Shrubland (0.4 hectares/0.7 % survey area)	8	0	0
Acacia shrubland (14.2 hectares/26.4 % of survey area)	2	0	0
Disturbed (11.3 hectares/21.0 % of survey area)	No foraging habitat	No foraging habitat	No foraging habitat
Total surveyed= 53.8 hectares			

'Breeding habitat' for species of black cockatoos is defined within the referral guidelines (Commonwealth of Australia, 2012) as trees of a species known to support breeding within the range of the species which either have a suitable nest hollow or have suitable diameter at breast height (DBH) to develop a nest hollow. For the tree species present within the application area, the suitable DBH is 500 millimetres.

A survey conducted within the refinery site noted that 48 potential breeding trees were observed within the refinery site, five of which contained hollows, however none of the hollows were considered suitable for breeding by black cockatoos (Biologic, 2019).

An additional survey was completed within an approximate 54-hectare area which comprises most of the remaining footprint of the application area (excluding the 29 hectares which does not contain vegetation) (Biologic, 2022). The survey noted 295 native trees with a DBH of ≥ 500 millimetres. Of the 295 trees recorded, 44 had hollows with some of the trees containing multiple hollows. In total, 81 hollows were observed from 44 trees, the findings are summarised below in Table 3.

Table 3 Summary of breeding trees (Biologic, 2022)

Tree species	Number of trees	Number of hollows
Tuart (<i>Eucalyptus gomphocephala</i>)	223	23
Unknown (Dead)	48	56
Marri (<i>Corymbia calophylla</i>)	14	1
Jarrah (<i>Eucalyptus marginata</i>)	7	1
River Red Gum (<i>Eucalyptus camaldulensis</i>)	3	0

The survey further assessed the 81 hollows for suitability for breeding by black cockatoo species considering the diameter of the entry of the hollows, the angle of the hollows, tree species, presence of competitors and the potential depth of the hollows. From the 81 hollows present, 53 of the hollows were determined to have potential to support black cockatoo breeding and were classified as 'suitable' or 'possible'. The survey noted that no hollows were observed to have chew marks around the perimeter of the hollow from 'prospecting' or breeding cockatoos (Biologic, 2022).

Night roosting habitat is common between the three species with flocks of cockatoos using multiple sites during the year as they move across the landscape for foraging. Night roost sites are normally associated with a water source and in the tallest trees within an area.

The 2019 survey of the refinery area (Biologic, 2019) noted that a suite of trees recorded within the refinery site that provide suitable roosting habitat, however no evidence of roosting was observed during the survey. The 2022 survey noted no evidence of night roosts was observed within the survey area, but potential night roost habitat was observed within the woodland habitat types.

In summary of the findings of the two surveys conducted, the application area provides some foraging and night roosting habitat for species of black cockatoos and provides breeding habitat for Carnaby's cockatoo, forest red-tail black cockatoo and Baudin's Cockatoo.

Other fauna

According to available databases, there is one record of western ringtail possum (*Pseudocheirus occidentalis*) within the local area. A further review of this record indicates that the record is inaccurate.

Other arboreal fauna species that may occur within the application area is the south-western brush-tailed phascogale (*Phascogale tapoatafa wambenger*). This is based on the mapped values of application area containing tree species which may support hollows suitable for this species. Surveys completed have not identified the presence of individuals of this species but recent records within the local area indicate the species could be present.

Noting the vegetation types within the application area and that some of the vegetation may provide suitable density, the application area may provide habitat for the following terrestrial species:

- Quenda (*Isoodon fusciventer*) (P4)
- Perth slider (*Lerista lineata*) (P3)
- Black-striped snake (*Neelaps calonotos*) (P3)
- Graceful sunmoth (*Synemon gratiosa*) (P4)
- Jewelled southwest Ctenotus (Swan Coastal Plain population) (*Ctenotus gemmula*) (P3)
- Swan Coastal Plain shield-backed trapdoor spider (*Idiosoma sigillatum*) (P3)
- Western brush wallaby (*Notamacropus irma*) (P4)

The Quenda are widely distributed near the south coast from Guilderton north of Perth to east of Esperance. On the Swan Coastal Plain, Quenda are often associated with wetlands (DEC, 2012). The application area is close to numerous wetlands and contains areas of vegetation density which may provide habitat for the species. A survey conducted in 2021 across a large portion of the application area observed 12 diggings attributed to the species within woodland habitats (Biologic, 2022). The survey report also commented that the woodland habitat within the application area would likely provide foraging and dispersal events for the species in the absence of low Xanthorrhoea species under which diurnal nests for quenda are made.

The Perth slider is restricted to mainland habitat occupied by this species is pale sands (calcareous and siliceous) on coastal plains with Banksia and/or Eucalyptus, and coastal and low fixed dunes, supporting heathlands and shrublands, providing a well-developed patchy litter on the ground (Maryan, G et al, 2015). The application area may provide habitat for this species.

The Graceful sunmoth is known from two general vegetation types; Banksia woodland/woolly bush on deep sands, in the northern suburbs of Perth on the Swan Coastal Plain and open areas of herbland, heathland and shrubland on Quindalup soils (sand and limestone) close to the coast where it breeds on *Lomandra maritima*, which is often present in reasonable numbers and may even be a dominant understorey herb (DEC, 2010). The application area provides limited habitat for this species.

Jewelled southwest Ctenotus (Swan Coastal Plain population) is a little documented species and is known from four records in WA, one of which is recorded within the local area. The species has been recorded within Banksia woodland and sandy soils which does not appear to be present within the application area but given the small amount of records of this species, their habitat preferences aren't well known and may occur within the application area.

Swan Coastal Plain shield-backed trapdoor spider has a substrate-specific distribution along the Swan Coastal Plain of south-western Western Australia, from Dalyellup north to at least Ledge Point (including Rottnest Island and Garden Island)). The eastern limit of its range along the sandy foothills of the Darling Escarpment, from Boyanup north to at least Gingin, abuts the western limits of the ranges of *I. jarrah* and *I. mcclementsorum*. Burrows of this species usually occur in Banksia woodland and heathland on sandy soils. (Rix et.al, 2018). Habitat preferences for this species is not likely to occur within the application area given the absence of Banksia woodland in majority of the application area.

The western brush wallaby's optimum habitat is open forest or woodland, particularly favouring open, seasonally wet flats with low grasses and open scrubby thickets. It is also found in some areas of mallee and heathland and is uncommon in karri forest. Noting the habitat preferences of this species, it is not likely to be present within the application area.

The application area has potential to provide habitat for some of the species listed above. Directional clearing may mitigate impacts to individuals of some of these species which have increased mobility (the larger species, mammals) but would not likely mitigate impacts to the smaller species such as the small reptiles and spiders should they be

present within the application area. However, noting the application area is degraded in parts and is adjacent to busy roads in some parts and vegetation in better condition in other parts, the proposed clearing is not likely to impact the conservation status of the seven priority species listed above, however individuals may be impacted if present during clearing activities. It is also considered that as the purpose of clearing is for maintenance activities and does not propose to clear vast patches of vegetation, impacts to priority fauna are considered minimal.

Priority flora

Available datasets indicate the vegetation and soil types mapped within parts of the application area may provide habitat for the following flora species:

- *Acacia* sp. Binningup (G. Cockerton et al. WB 37784) (P1)
- *Beyeria cinerea* subsp. *cinerea* (P3)
- *Dodonaea hackettiana* (P4)
- *Jacksonia gracillima* (P3)
- *Jacksonia sericea* (P4)
- *Pimelea calcicola* (P3)

Acacia sp. Binningup (G. Cockerton et al. WB 37784) (P1) is known from 11 records within the Swan Coastal Plain IBRA region within sandy soils and in association with woodlands of Tuart and Agonis. It is considered that the application area provides suitable habitat for this species based on the mapped soil and vegetation types within the application area.

Beyeria cinerea subsp. *cinerea* (P3) is known from 53 records within the Swan Coastal Plain IBRA region and the Geraldton Sandplains IBRA region. Records note the species has been recorded within sands over limestone and within numerous vegetation associations both of which are likely to be present within the application area based on mapped values. *Dodonaea hackettiana* (P4) has similar habitat preferences and is known from 31 records.

Jacksonia gracillima (P3) has been recorded within the Swan Coastal Plain and is known from 32 records within sandy soil and winter wet areas and in association with numerous other vegetation types.

Jacksonia sericea (P4) is known from 61 records within the Swan Coastal Plain and grows in association with calcareous and sandy soils within multiple types of woodlands.

Pimelea calcicola (P3) is known from 30 records within the Swan Coastal Plain within sandy soil, clay soil and in association with limestone. Vegetation this species has been recorded in includes heaths and woodlands.

Table 4: Summary of findings from flora surveys

Survey name	Area surveyed	Summary
Kwinana Nickel Refinery, Flora, Vegetation and Fauna Assessment (Biologic, 2019)	Approximate 38-hectare refinery area	No threatened or priority flora species observed
BHP Nickel West Kwinana Pre-clearing Survey Targeted Flora Survey and Black Cockatoo Habitat Assessment (Biologic, 2022)	Approximate 54-hectare pipeline and tailings area	<i>Pimelea calcicola</i> (P3) recorded as three individuals from three locations
BHP Billiton Nickel West Pipelines Biological survey (GHD, 2010)	Approximately 7 hectares along the pipeline corridor	<i>Grevillea olivaceae</i> (P4). The survey notes this occurrence is likely planted given the known distribution of the species and its habitat preferences.

Noting the findings above, there is potential for three individuals of *Pimelea calcicola* to be lost by the proposed clearing. It is considered that as the species is listed as Priority 3 and there is suitable habitat for the species within the adjacent vegetation, the loss of three individuals will not impact the species at a local or regional level and is not likely to impact the conservation status of the species. However, a permit to clear requires the demarcation and avoidance of these individuals.

A priority ecological community 'Northern Spearwood shrublands and woodlands' is mapped within approximately 40 meters of the southern extent of the application area. This vegetation community is a priority listed community by DBCA and has association with the Australian Government listed threatened ecological community as it can be a

component of the Endangered Banksia Woodlands of the Swan Coastal Plain EPBC listed TEC. The complex is a priority three (P3) complex with the listing described as being a poorly known ecological community known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation (DEC, 2013). The complex is described as 'Heaths with scattered *Eucalyptus gomphocephala* occurring on deeper soils north from Woodman Point. Most sites occur on the Cottesloe unit of the Spearwood system. The heathlands in this group typically include *Dryandra sessilis*, *Calothamnus quadrifidus*, and *Schoenus grandiflorus*' (DBCA, 2021). While a portion of the application area may be representative of this community, this portion has been assessed within the criteria for the Tuart Woodlands TEC. The applicant has provided commitments for the preservation and minimisation for the TEC, so should the PEC also be represented within the area, the impacts are also considered minimal.

Conclusion:

Based on the above assessment, the proposed clearing will result in impacts to black cockatoo habitat (breeding, foraging and night roosting) for Carnaby's cockatoo and FRTBC and may also impact priority fauna if individuals are present during clearing. It is considered that the impacts of the proposed clearing on fauna species can be managed by conducting inspections for black cockatoo species and phascogales and undertake further mitigation actions if breeding habitat is confirmed.

Based on the findings of the flora surveys completed, it is considered the impacts to priority flora species identified is minimal at local, regional and species level but can be managed by avoiding the clearing of all known individuals.

Conditions:

To address the above impacts, the following management measures are required as conditions on a clearing permit:

- Fauna management (black cockatoo habitat) and inspection of hollows for phascogales
- Weed and dieback conditions
- Flora management conditions

3.2.2. Biological values (ecological communities) - Clearing Principle (d)

The application area is intersected by four mapped occurrences of the Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain, an ecological community listed as Threatened by the Australian Government and protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The initial surveys of the application area (pipeline) indicate the presence of Tuart trees, but this survey was completed prior to the listing of this community.

During the assessment of this application, additional surveys were undertaken within the application area for occurrences of the Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain. The findings of the survey and maps can be viewed within Appendix E.

In summary of the survey, six patches were assessed against the key diagnostic characteristics and thresholds for the Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain Community considering:

- The location and physical environment
- Soils and landform
- Composition
- Structure
- Condition and thresholds
- Relationships with other communities
- Buffer zones
- Revegetated areas and gardens

On consideration of the key criteria, it was determined that only four of the six patches met the key diagnostic criteria for this TEC (Patch 1, 3, 4 and 6). The patches that did not meet the criteria were determined as such due to the patch size being below the minimum size criteria or quality criteria (Biologic, 2021).

Of the areas that met the diagnostic criteria for the Tuart TEC, analysis of the area notes the following:

Patch 1 is 46.1 hectares in total, of this the application area intersects an area of 2.2 hectares which is less than five per cent of the patch. The applicant has committed to restricting activities within this area of intersection to the following:

- clearing of only 0.6 hectares within this patch, this is the equivalent to a corridor width of 10 meters, being 1.2% of patch 1
- Restricting activities to those required for the maintenance of existing infrastructure
- No mature Tuarts (as identified by a suitably qualified environmental specialist) will be cleared

Patch 3 is 7.5 hectares in total, of this total, the application area intersects and area of 0.28 hectares which is approximately 2 per cent of the patch. The applicant has committed to restricting activities within this area of intersection to the following:

- Restricting activities to those required for the maintenance of existing infrastructure
- No mature Tuarts (as identified by a suitably qualified environmental specialist) will be cleared

Patch 4 is 10.8 hectares in total, the application area intersects this patch to the extent of 0.53 hectares which is approximately five per cent of the patch. The applicant has restricted activities within this area of intersection to the following:

- Restricting activities to those required for the maintenance of existing infrastructure
- No mature Tuarts (as identified by a suitably qualified environmental specialist) will be cleared

Patch 6 is nine hectares in total, the application area intersects 3.5 hectares of this which is approximately 39 per cent of the patch. The applicant has restricted activities within this area of intersection to the following:

- clearing of only 0.53 hectares within this patch, this is the equivalent to 6% of patch 6
- Restricting activities to those required for the maintenance of existing infrastructure (groundwater monitoring bores and access tracks)
- No mature Tuarts (as identified by a suitably qualified environmental specialist) will be cleared

Noting the identification of the Tuart TEC and the proposed clearing activities identified by the applicant, the proposed clearing is likely to impact on a combined area of 1.94 hectares of Tuart TEC. While it is known that clearing of the Tuart TEC is a key threat to the community, the proposed clearing is taken in context of the following.

- The applicant has committed to not clearing any mature Tuart trees within the areas of identified TEC. It is noted within the criteria that patches of >5 hectares meet diagnostic criteria regardless of their understory condition.
- Patches of the TEC can include small areas without understory vegetation, such as bare ground as well as hardscapes that do not significantly alter the overall function of the ecological community

The mapped occurrences of this TEC amount to approximately 35537 hectares with an additional 48.7 hectares as surveyed during this assessment (Biologic, 2021). Noting the combined area of intersection where the application area is within surveyed occurrences of TEC and the applicant has noted the limit of works to occur, the area of impact of the TEC is 1.94 hectares. The area of impact is estimated to be 0.005 per cent of the occurrence of the TEC.

Conclusion:

The application area is within surveyed patches of the Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain Threatened Ecological Community and the proposed clearing is likely to impact the patches through disturbances and some loss of understory. The proposed clearing also has the potential to introduce weeds and dieback into patches of the TEC.

Noting the applicant's commitments and the consideration of the assessment above, impacts to the Tuart TEC can be managed by limiting activities and the extents of area in which activities can occur within patches of TEC.

Conditions:

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

- Weed and dieback conditions
- Limiting the type of activity and the area within the TEC that clearing can occur
- Restricting proposed clearing to not include mature Tuart trees
- Reporting conditions to ensure compliance with the conditions above

3.2.3. Significant remnant vegetation and conservation areas - Clearing Principles (e and h)

Assessment

The site characteristics (Appendix B) note the application area is adjacent to numerous conservation areas. Consideration is given to the presence of larger roads, a rail corridor and previous clearing associated with the pipelines and infrastructure, and it is considered the proposed clearing is not likely to have significant impact on the conservation areas given the existing land use and the alignment of the proposed clearing, however the proposed clearing does have potential to introduce weeds and dieback.

The application area intersects a mapped linkage the 'Perth Regional Ecological Linkages' (Figure 8) The area of intersection is within a meeting point of four linkages that run east-west and north-south. While the importance of such linkages is recognised, consideration is given to the presence of a major road and railway line within the same alignment as the proposed clearing and that the area of intersection contains sparse vegetation (Figure 9). Further to note is the proposed clearing is for maintenance/access of existing infrastructure within this area and not for new permanent infrastructure. It is considered that the proposed clearing is not likely to impact the linkage values.

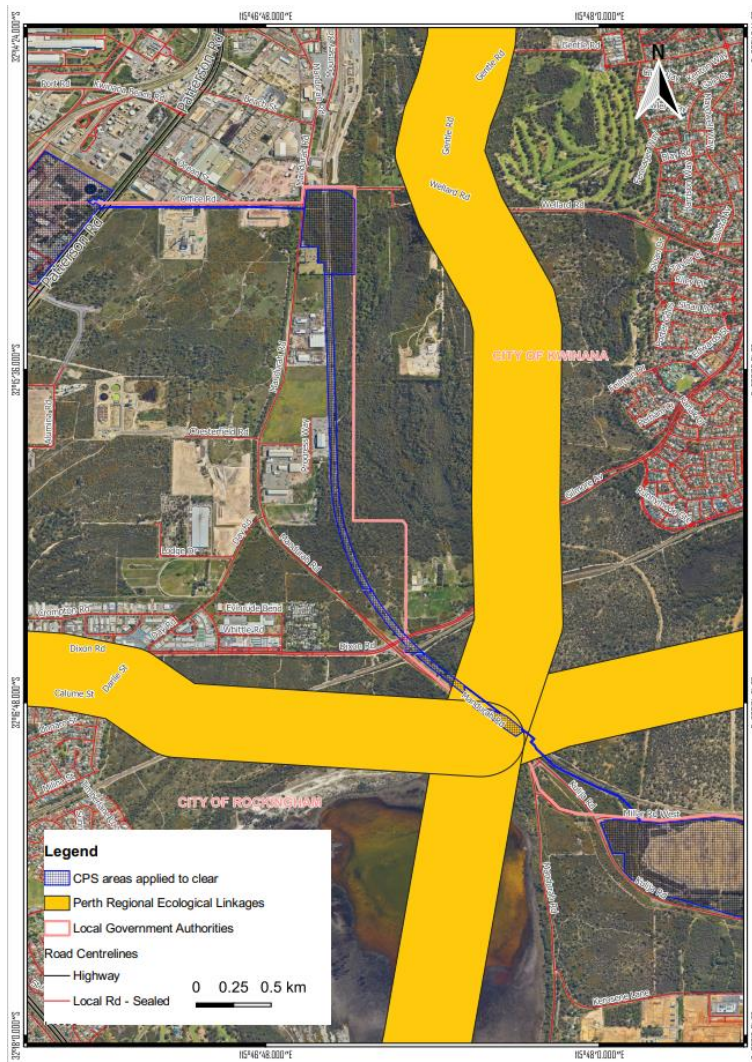


Figure 8: Showing the application area and the mapped Perth Regional Ecological Linkages

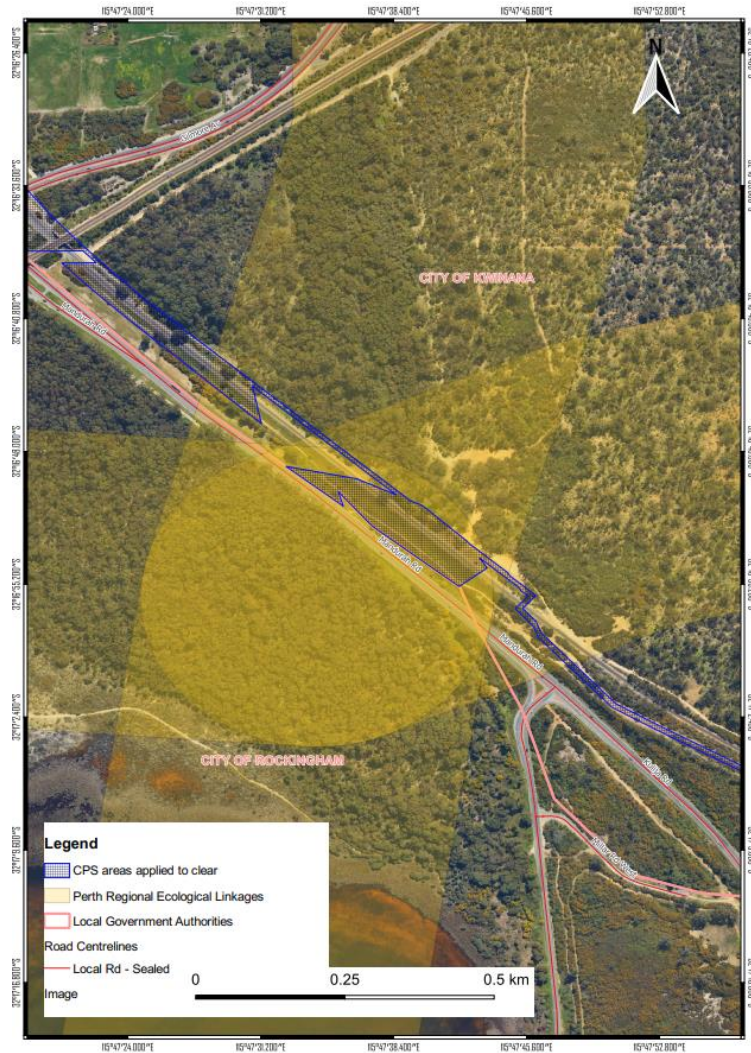


Figure 9: Showing the extent of the application area within the mapped linkages is located between a major road and rail corridor

The mapped vegetation complexes retain over 30 per cent of their pre-European extent. The local area retains approximately 28 per cent of its pre-European extent. Noting the application area is within a constrained area where retention objectives for vegetation within the local area at least 10 per cent and considering the area contains native, and non-native vegetation in varying condition, the vegetation proposed to be cleared is not a significant remnant in an extensively cleared area.

Conclusion:

Noting the proximity of the proposed clearing to conservation areas and considering the assessment above, there is potential for weed and dieback introduction to these areas.

Conditions:

To address the above impacts a weed and dieback condition is required as a condition on a clearing permit.

3.3. Relevant planning instruments and other matters

Other relevant authorisations required for the proposed land use include:

- Development approval under the *Planning and Development Act 2005* (issued by the City of Rockingham) is required for some areas if certain activities are planned. This is discussed in detail below.

The City's initial comments from the original application raised the following concerns to be addressed with the applicant:

- Reduce the clearing area proposed for Clearing Area 2 (the area near Office Road, Mandurah Road) to only include the pipeline with a five-metre buffer either side. Other existing and planned infrastructure (access ways etc.) should also be included in the application.
- Address whether the two Aboriginal Heritage Sites located within the vicinity of Clearing Area 2 (the area near Office Road, Mandurah Road) fall under the *Aboriginal Heritage Act 1972*.
- Reduce the clearing area proposed for Clearing Area 3 (the area in Baldivis) to only include existing and future bores, access ways or other infrastructure, noting that they must be located outside the mapped boundary of the Conservation Category Wetland 'Kerosene Lane Swamp'.

Through the assessment process, the City's concerns were expressed to the applicant and were largely resolved through consultation between the City and the applicant. The application area was reduced to avoid impacts to the conservation category wetlands and TEC at the request of the Delegated Officer, this is discussed in the assessment above.

Following discussions between the City and the applicant, the City of Rockingham advised DWER that in reviewing the information provided by the applicant that generally, the proposed clearing appears to be aligned with 'maintenance and repair work' which is exempt from requiring a Development Approval under clause 61 of the Planning and Development (Local Planning Schemes).

The City also noted that works within Lot 622 (90) Office Road, East Rockingham is a heritage site listed in the City's *Municipal Heritage Inventory*. The City noted that a Development Approval is required from the City if the works should affect this land.

The City's final comments for minimising the environmental impacts from the proposed clearing include:

- Mature trees adjacent to Patterson Road must be retained.
- Mature trees must be avoided as far as practicable.
- Clearing is to be restricted to the Kwinana-Baldivis pipeline corridor and is to be the minimum required for maintenance.
- Clearing must not be undertaken more than 10 meters away from the pipeline alignment; and
- Pre-clearing surveys must be undertaken to identify any significant species or habitat.

Where practicable, the clearing permit accommodates the above.

Advice was received from the Contaminated Sites branch of DWER. The advice contained information from the Department of Health including the following quote: "Due to the potential of asbestos-impacted soils to be present beneath the Kwinana Nickel Refinery (Lot 89 on Deposited Plan 411084 East Rockingham) and Baldivis pipeline easement (multiple lots within Leda and East Rockingham), a site management plan is recommended to be developed to mitigate any potential risk to the health of any workers undertaking intrusive works and should include management measures for any asbestos encountered. The site management plan should be prepared in accordance with the 'Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia'.

Two Aboriginal sites of significance have been mapped within the application area. The sites are identified as #3690 and #3689 from the dataset 'Aboriginal Heritage Places' (DPLH, 001). It is the permit holder's responsibility to comply with the *Aboriginal Heritage Act 1972* (WA) and ensure that no Aboriginal Sites of Significance are damaged through the clearing process.

End

Appendix A. Additional information provided by applicant

During the assessment process, the applicant provided the following additional information:

- A reduction in the application area footprint. The reduction avoided wetland areas at the southern extent of the application area. This is discussed under Section 3.1 above.
- Surveys for Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain ecological community for the likely occurrences within the application area above with some extracts included within Appendix E
- Commitments to reducing impacts to the Tuart TEC
- Flora and fauna surveys were completed during the assessment and considered within Section 3 above with some extracts included within Appendix E

The additional information is considered within areas of this decision report where applicable.

Appendix B. Site characteristics

B.1. Site characteristics

Characteristic	Details
Local context	<p>The area proposed to be cleared stretches across multiple land uses including being aligned with main roads, being part of an industrial area and a portion is adjacent to conservation areas. The area proposed to be cleared is within the intensive land use zone of Western Australia.</p> <p>Spatial data indicates the local area (10-kilometre radius from the centre of the area proposed to be cleared) retains approximately 28 per cent of the original native vegetation cover.</p>
Ecological linkage	The application area intersects 'Perth Regional Ecological Linkages' (a mapped linkage)
Conservation areas	<p>The application area is adjacent to two conservation areas, an unnamed reserve (R51658), the Leda Nature reserve and one unmanaged reserve, all of which are Bush Forever sites. These reserves are at the southern extent of the proposed clearing.</p> <p>The southern extent is also near to the Rockingham Lakes Regional Park.</p>
Vegetation description	<p>Vegetation surveys within the application area (GHD, 2010 and Biologic, 2019) indicate the vegetation within the proposed clearing area consists of both native and non-native species. The full survey descriptions and maps are available in Appendix E.</p> <p>GHD surveyed the pipeline area (Refer to Appendix E) and described vegetation as</p> <ul style="list-style-type: none"> • V1: Planted native species over weed species. • V2: <i>Eucalyptus gomphocephalus</i> over weed species. • V3: Open Woodland of <i>Eucalyptus gomphocephalus</i> over tall scrub of <i>Spyridium globulosum</i> and/or <i>Acacia rostelifera</i> over weed species. • V4: Tall Closed Scrub of <i>Acacia saligna</i> over closed sedges of <i>Gahnia trifida</i> and <i>Tetraria capillaries</i> over open herbland of <i>Muehlenbeckia adpressa</i> over weed species. • V5: Closed Forest of <i>Eucalyptus gomphocephalus</i> over open woodland of <i>Melaleuca preissiana</i> and <i>M. raphiophylla</i> over open sedgeland of <i>Gahnia trifida</i> and weed species. • V6: Open Woodland of <i>Eucalyptus gomphocephalus</i> over tall scrub of <i>Banksia sessilis</i> over shrubland of <i>Acacia saligna</i> and <i>Templetonia retusa</i> over weed species. <p>An additional area surveyed by Biologic in 2019 over the Nickel Refinery area noted the following vegetation types:</p> <ul style="list-style-type: none"> • Eg - <i>Eucalyptus gomphocephala</i> low to mid trees over disturbed understorey consisting of introduced grasses, herbs, and managed lawns/ gardens

Characteristic	Details
	<ul style="list-style-type: none"> • EgAf - <i>Eucalyptus gomphocephala</i> mid trees over <i>Agonis flexuosa</i> low trees over introduced grasses and herbs • EgR - <i>Eucalyptus gomphocephala</i> mid open woodland over <i>Acacia cyclops</i>, <i>Acacia xanthina</i> and <i>Spyridium globulosum</i> scattered tall over <i>Rhagodia baccata</i> low open chenopod shrubland with introduced grasses and herbs • Esp - <i>Eucalyptus gomphocephala</i>, <i>Eucalyptus camaldulensis</i> and other naturalised low to mid trees over varying understorey consisting of native (<i>Melaleuca lanceolata</i>, <i>Callitris preissii</i>) and non-native (<i>Schinus terebinthifolius</i>) shrubs and introduced grasses and herbs • *Ta - <i>Tamarix aphylla</i> low trees over disturbed understorey dominated by introduced grasses and herbs <p>The mapped vegetation types and descriptions are consistent with the mapped vegetation types:</p> <ul style="list-style-type: none"> • Quindalup complex which is described as Coastal dune complex consisting mainly of two alliances - the strand and fore-dune alliance and the mobile and stable dune alliance. Local variations include the low closed forest of <i>Melaleuca lanceolata</i> (Rottnest Teatree) - <i>Callitris preissii</i> (Rottnest Island Pine), the closed scrub of <i>Acacia rostellifera</i> (Summer-scented Wattle) and the low closed <i>Agonis flexuosa</i> (Peppermint) forest of Geographe Bay. • Cottesloe Complex – Central and south, which is described as: Mosaic of woodland of <i>Eucalyptus gomphocephala</i> (Tuart) and open forest of <i>Eucalyptus gomphocephala</i> (Tuart) - <i>Eucalyptus marginata</i> (Jarrah) - <i>Corymbia calophylla</i> (Marri); closed heath on the Limestone outcrops. <p>The mapped vegetation types retain approximately 60 per cent and 32 per cent respectively, of their pre-European extent (Government of Western Australia, 2019).</p>
Vegetation condition	<p>Vegetation survey (GHD 2010, Biologic 2019) indicates the vegetation within part of the proposed clearing area is in good to completely degraded (Keighery, 1994) condition, described as:</p> <ul style="list-style-type: none"> • Good: Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. • Degraded: Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. • Completely degraded: The structure of the vegetation is no longer intact, and the area is completely or almost completely without native species. <p>The full Keighery (1994) condition rating scale is provided in Appendix D. The full survey descriptions and mapping are available in Appendix E.</p>
Climate and landform	<p>Most of the application area is mapped within a flat landscape with elevation of five meters. The southern portion of the application area (east of Lake Coo loongup) is within an area of changing elevations with a rise between Lake Coo loongup and Kerosene Swamp wetland.</p> <p>The annual average rainfall is estimated to be 868 millimetres assuming the value for the Perth region (BOM, 2021)</p>
Soil description	<p>The application area intersects multiple mapped soil types:</p> <ul style="list-style-type: none"> • EnvGeol S13 Phase Calcareous sand - white, medium-grained, rounded quartz and shell debris, well sorted, of eolian origin. This intersection is only marginal (within 1 meter so is not considered within this assessment) • Spearwood S1b Phase Dune ridges with moderately deep to very deep siliceous yellow-brown sands, rare limestone outcrop and slopes 3-20% occurring on the eastern slipface.

Characteristic	Details
	<ul style="list-style-type: none"> • Spearwood S2a Phase Lower slopes (1-5%) of dune ridge with moderately deep to deep siliceous yellow-brown sands or pale sands with yellow-brown subsoils and minor limestone outcrop. • Spearwood disturbed land, mine Phase Mine. Disturbed land. • Quindalup South Qf3 Phase Relict foredunes forming a plain which is topographically lower than Qf2 with prominent ridges and swales. Swamps frequently occupy the swales. Deep calcareous sands with variable organic matter. • Spearwood S4a Phase Flat to gently undulating sandplain with deep, pale, and sometimes bleached, sands with yellow-brown subsoils. • Spearwood wet, swamp Phase Swamp. • Vasse wet, swamp Phase Swamp. • Spearwood S1b Phase Dune ridges with deep siliceous yellow brown sands or pale sands with yellow-brown subsoil and slopes up to 15%. • Quindalup South Qf2 Phase. Relict foredunes and gently undulating beach ridge plain with deep uniform calcareous sands.
Land degradation risk	<p>Some of the soil types within the application area have a high risk of wind erosion. Particularly within the southern extent of the application area.</p> <p>There are areas of mapped soil type having a high risk of phosphorus export risk and other areas with a high risk of subsurface acidification, however it is noted that these areas intersect the application area marginally only.</p>
Waterbodies	<p>The desktop assessment and aerial imagery indicated that the application area is within the boundary of Cooloongup Lake and very close to a sumplands. Both lakes are conservation category wetlands. The proposed clearing runs between the two wetlands but is not considered to break the linkage given that Mandurah Road is also between the two wetlands.</p> <p>The southern extent of the application area is within 60 meters of Kerosene Lane Swap, a conservation category wetland.</p>
Hydrogeography	<p>The application area is within the Rockingham Groundwater Area, the Stakehill Groundwater Area and the Cockburn Groundwater Area proclaimed under the <i>Rights in Water and Irrigation Act 1914</i>.</p>
Flora	<p>There are 10 records of conservation significant flora in local area, with the nearest record being a Priority 3 species <i>Pimelea calcicola</i>. Of the 10 conservation significant species within the local area, three are Threatened species and the remaining seven are priority species.</p>
Ecological communities	<p>The application area intersects the five mapped occurrences of Tuart (<i>Eucalyptus gomphocephala</i>) woodlands and forests of the Swan Coastal Plain and a mapped occurrence of Northern Spearwood shrublands and woodlands, a Priority Ecological Community (PEC) as described and categorised by DBCA. This PEC can also be a component of the Threatened Ecological Community 'Banksia Woodlands of the Swan Coastal Plain'.</p>
Fauna	<p>Within the local area, 51 species of conservation significant fauna have been recorded. Majority of the species recorded within the local area are bird species associated with lake, wetland, and coastal environments.</p> <p>The closest recording of conservation significant fauna is a Carnaby's Cockatoo (Endangered species) which is within the application area. The most frequent occurring species is <i>Isoodon fusciventer</i> (a Priority 4 species)</p>

B.2. Vegetation extent

	Pre-European extent (ha)	Current extent (ha)	Extent remaining (%)	Current extent in all DBCA managed land (ha)	Current proportion (%) of pre-European extent in all DBCA managed land
IBRA bioregion*					
Swan Coastal Plain	1,501,221.93	579,813.47	38.62	222,916.97	14.85
Vegetation complex					
Quindalup Complex *	54,573.87	33,011.64	60.49	5,994.64	10.98
Cottesloe Complex- Central and South	45,299.61	14,567.87	32.16	6,606.12	14.58
Local area					
-	-	-	28.34	-	-

*Government of Western Australia (2019a)

**Government of Western Australia (2019b)

B.3. Flora analysis table

With consideration for the site characteristics set out above, relevant datasets (see Appendix F.1), and biological survey information, impacts to the following conservation significant flora required further consideration.

Species name	Conservation status	Suitable habitat features? [Y/N]	Suitable vegetation type? [Y/N]	Suitable soil type? [Y/N]	Distance of closest record to application area (km)	Number of known records (total)	Are surveys adequate to identify? [Y, N, N/A]
<i>Acacia benthamii</i>	2	N	N	N	9.5	36	N/A
<i>Acacia lasiocarpa</i> var. <i>bracteolata</i> long peduncle variant (G.J. Keighery 5026)	1	N	N	N	10	6	N/A
<i>Acacia</i> sp. Binningup (G. Cockerton et al. WB 37784)	1	Y	Y	Y	2.2	11	Y
<i>Aponogeton hexatepalus</i>	4	N	Y	Y	8.3	30	N/A
<i>Austrostipa mundula</i>	3	N	N	N	7.4	15	N/A
<i>Beyeria cinerea</i> subsp. <i>cinerea</i>	3	Y	Y	Y	8.3	48	Y
<i>Boronia juncea</i> subsp. <i>juncea</i>	1	N	Y	Y	7.3	12	N/A
<i>Cyathochaeta teretifolia</i>	3	N	Y	Y	6.2	39	N/A
<i>Diuris micrantha</i>	T	N	y	Y	3.3	8	N/A
<i>Dodonaea hackettiana</i>	4	Y	Y	Y	2.4	30	Y
<i>Drakaea elastica</i>	T	N	Y	Y	10	19	N/A
<i>Jacksonia gracillima</i>	3	Y	Y	Y	6.8	29	Y
<i>Jacksonia sericea</i>	4	Y	Y	Y	7.0	58	Y
<i>Lachnagrostis nesomytica</i> subsp. <i>paralia</i>	1	N	N	N	6.8	3	N/A
<i>Pimelea calcicola</i>	3	Y	Y	Y	0.5	29	Y
<i>Sphaerolobium calcicola</i>	3	N	Y	Y	6	21	N/A
<i>Stylidium ireneae</i>	4	N	Y	Y	4.7	25	Y
<i>Stylidium longitubum</i>	4	N	Y	Y	8.6	46	Y
<i>Synaphea</i> sp. Serpentine (G.R. Brand 103)	T	N	N	N	7.9	36	N/A
<i>Tetraria</i> sp. Chandala (G.J. Keighery 17055) more recently known as <i>Netrostylis</i> sp. Chandala (G.J. Keighery 17055)	2	Y	Y	Y	6.3	5	Y

T: threatened, CR: critically endangered, EN: endangered, VU: vulnerable, P: priority

B.4. Fauna analysis table

Species name	Conservation status	Suitable habitat features? [Y/N]	Suitable vegetation type? [Y/N]	Distance of closest record to application area (km)	Are surveys adequate to identify? [Y, N, N/A]
Curlew Sandpiper (<i>Calidris ferruginea</i>)	CR	N	N	0.1	N/A
Blue-billed duck (<i>Oxyura australis</i>)	P4	N	N	2.9	N/A
Red knot (<i>Calidris canutus</i>)	EN	N	N	8.5	N/A
Great knot (<i>Calidris tenuirostris</i>)	CR	N	N	8.5	N/A
Carnaby's cockatoo (<i>Calyptorhynchus latirostris</i>)	EN	Y	Y	0	Y
Peregrine falcon (<i>Falco peregrinus</i>)	OS	Y	Y	.0.9	Y
Forest red-tailed black cockatoo (<i>Calyptorhynchus banksii naso</i>)	VU	Y	Y	1.6	Y
Chuditch (<i>Dasyurus geoffroii</i>)	VU	Y	Y	9.1	Y
Quenda (<i>Isoodon fusciventer</i>)	P4	Y	Y	0.5	Y
Perth slider (<i>Lerista lineata</i>)	P3	Y	Y	1.3	Y
Black-striped snake (<i>Neelaps calonotos</i>)	P3	Y	Y	0.9	Y
Tammar wallaby (<i>Notamacropus eugenii derbianus</i>)	P4	N	N	7.4	N/A
Graceful sunmoth (<i>Synemon gratiosa</i>)	P4	Y	Y	9.2	N
Carter's freshwater mussel (<i>Westralunio carteri</i>)	VU	N	N	1	N/A
Fairy Tern (<i>Sternula nereis nereis</i>)	VU	N	N	8.9	N/A
Baudin's cockatoo (<i>Calyptorhynchus baudinii</i>)	EN	y	y	4.1	Y
jewelled southwest Ctenotus (Swan Coastal Plain population) (<i>Ctenotus gemmula</i>)	P3	Y	Y	6.2	Y
water-rat (<i>Hydromys chrysogaster</i>)	P4	N	Y	1.9	N/A
Swan Coastal Plain shield-backed trapdoor spider (<i>Idiosoma sigillatum</i>)	P3	Y	Y	0.9	Y
Australian little bitten (<i>Ixobrychus dubius</i>)	P4	N	Y	1	N/A
Western brush wallaby (<i>Notamacropus irma</i>)	P4	Y	Y	0.3	Y
Eastern curlew (<i>Numenius madagascariensis</i>)	CR	Y	Y	1	N/A
south-western brush-tailed phascogale (<i>Phascogale tapoatafa wambenger</i>)	CD	Y	Y	4.5	Y
western ringtail possum (<i>Pseudocheirus occidentalis</i>)	CR	Y	Y	9.7	Y
Atlantic, yellow-nosed albatross (<i>Thalassarche chlororhynchos</i>)	VU	N	N	8.3	N/A
Hooded plover (<i>Thinornis rubricollis</i>)	P4	N	N	0.7	N/A
Australian lesser noddy (<i>Anous tenuirostris melanops</i>)	EN	N	N	6.5	N/A
Grey-headed albatross (<i>Thalassarche chrysostoma</i>)	VU	N	N	1.4	N/A

T: threatened, CR: critically endangered, EN: endangered, VU: vulnerable, P: priority

B.5. Ecological community analysis table

Community name	Conservation status	Suitable habitat features? [Y/N]	Suitable vegetation type? [Y/N]	Suitable soil type? [Y/N]	Distance of closest record to application area (km)	Are surveys adequate to identify? [Y, N, N/A]
Tuart Woodlands of the Swan Coastal Plain	T	Y	Y	Y	0	Y

Community name	Conservation status	Suitable habitat features? [Y/N]	Suitable vegetation type? [Y/N]	Suitable soil type? [Y/N]	Distance of closest record to application area (km)	Are surveys adequate to identify? [Y, N, N/A]
Northern Spearwood shrublands and woodlands	P3	Y	Y	Y	0.04	Y

B.6. Land degradation risk table

Risk categories	<i>Spearwood S1b Phase</i>
Wind erosion	>70% of map unit has a high to extreme wind erosion risk
Water erosion	10-30% of map unit has a high to extreme water erosion risk
Salinity	<3% of map unit has a moderate to high salinity risk or is presently saline
Subsurface Acidification	<3% of map unit has a high subsurface acidification risk or is presently acid
Flood risk	<3% of the map unit has a moderate to high flood risk
Water logging	<3% of map unit has a moderate to very high waterlogging risk
Phosphorus export risk	>70% of map unit has a high to extreme phosphorus export risk

Risk categories	<i>Spearwood S2a Phase</i>
Wind erosion	>70% of map unit has a high to extreme wind erosion risk
Water erosion	<3% of map unit has a high to extreme water erosion risk
Salinity	<3% of map unit has a moderate to high salinity risk or is presently saline
Subsurface Acidification	3-10% of map unit has a high subsurface acidification risk or is presently acid
Flood risk	<3% of the map unit has a moderate to high flood risk
Water logging	<3% of map unit has a moderate to very high waterlogging risk
Phosphorus export risk	10-30% of map unit has a high to extreme phosphorus export risk

Risk categories	<i>Spearwood disturbed land, mine Phase</i>
Wind erosion	<3% of map unit has a high to extreme wind erosion risk
Water erosion	<3% of map unit has a high to extreme water erosion risk
Salinity	<3% of map unit has a moderate to high salinity risk or is presently saline
Subsurface Acidification	<3% of map unit has a high subsurface acidification risk or is presently acid
Flood risk	<3% of the map unit has a moderate to high flood risk
Water logging	<3% of map unit has a moderate to very high waterlogging risk
Phosphorus export risk	<3% of map unit has a high to extreme phosphorus export risk

Risk categories	Quindalup South Qf3 Phase
Wind erosion	10-30% of map unit has a high to extreme wind erosion risk
Water erosion	<3% of map unit has a high to extreme water erosion risk
Salinity	<3% of map unit has a moderate to high salinity risk or is presently saline
Subsurface Acidification	<3% of map unit has a high subsurface acidification risk or is presently acid
Flood risk	<3% of the map unit has a moderate to high flood risk
Water logging	3-10% of map unit has a moderate to very high waterlogging risk
Phosphorus export risk	3-10% of map unit has a high to extreme phosphorus export risk

Risk categories	Spearwood S4a Phase
Wind erosion	>70% of map unit has a high to extreme wind erosion risk
Water erosion	<3% of map unit has a high to extreme water erosion risk
Salinity	<3% of map unit has a moderate to high salinity risk or is presently saline
Subsurface Acidification	10-30% of map unit has a high subsurface acidification risk or is presently acid
Flood risk	<3% of the map unit has a moderate to high flood risk
Water logging	<3% of map unit has a moderate to very high waterlogging risk
Phosphorus export risk	10-30% of map unit has a high to extreme phosphorus export risk

Risk categories	Spearwood wet, swamp Phase
Wind erosion	<3% of map unit has a high to extreme wind erosion risk
Water erosion	<3% of map unit has a high to extreme water erosion risk
Salinity	<3% of map unit has a moderate to high salinity risk or is presently saline
Subsurface Acidification	>70% of map unit has a high subsurface acidification risk or is presently acid
Flood risk	<3% of the map unit has a moderate to high flood risk
Water logging	>70% of map unit has a moderate to very high waterlogging risk
Phosphorus export risk	>70% of map unit has a high to extreme phosphorus export risk

Risk categories	Vasse wet, swamp Phase
Wind erosion	<3% of map unit has a high to extreme wind erosion risk
Water erosion	<3% of map unit has a high to extreme water erosion risk
Salinity	>70% of map unit has a moderate to high salinity risk or is presently saline
Subsurface Acidification	<3% of map unit has a high subsurface acidification risk or is presently acid
Flood risk	<3% of the map unit has a moderate to high flood risk
Water logging	>70% of map unit has a moderate to very high waterlogging risk
Phosphorus export risk	>70% of map unit has a high to extreme phosphorus export risk

Risk categories	Spearwood S1b Phase
Wind erosion	<3% of map unit has a high to extreme wind erosion risk
Water erosion	<3% of map unit has a high to extreme wind erosion risk
Salinity	>70% of map unit has a moderate to high salinity risk or is presently saline
Subsurface Acidification	<3% of map unit has a high subsurface acidification risk or is presently acid
Flood risk	<3% of the map unit has a moderate to high flood risk
Water logging	>70% of map unit has a moderate to very high waterlogging risk
Phosphorus export risk	>70% of map unit has a high to extreme phosphorus export risk

Risk categories	Quindalup South Qf2 Phase
Wind erosion	30-50% of map unit has a high to extreme wind erosion risk
Water erosion	<3% of map unit has a high to extreme water erosion risk
Salinity	<3% of map unit has a moderate to high salinity risk or is presently saline
Subsurface Acidification	<3% of map unit has a high subsurface acidification risk or is presently acid
Flood risk	<3% of the map unit has a moderate to high flood risk
Water logging	<3% of map unit has a moderate to very high waterlogging risk
Phosphorus export risk	<3% of map unit has a high to extreme phosphorus export risk

Appendix C. Assessment against the clearing principles

Assessment against the clearing principles	Variance level	Is further consideration required?
Environmental value: biological values		
<p><u>Principle (a):</u> "Native vegetation should not be cleared if it comprises a high level of biodiversity."</p> <p><u>Assessment:</u></p> <p>The area proposed to be cleared may contain locally or regionally significant flora, fauna, habitats, assemblages of plants.</p> <p>Portions of the application area are mapped as the '<i>Eucalyptus gomphocephala</i>) woodlands and forests of the Swan Coastal Plain Threatened ecological community (TEC) and surveys completed have reported patches of this community within the clearing footprint.</p> <p>A priority 3 flora species was recorded within a 2021 survey of the clearing footprint.</p> <p>The application area contains habitat for fauna (Principle (b)).</p>	At variance	Yes <i>Refer to Section 3.2.1, above.</i>
<p><u>Principle (b):</u> "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."</p> <p><u>Assessment:</u> The area proposed to be cleared contains foraging and breeding habitat for conservation significant fauna. Surveys for black cockatoo habitat have been completed within application area.</p>	At variance	Yes <i>Refer to Section 3.2.1, above.</i>

Assessment against the clearing principles	Variance level	Is further consideration required?
<p><u>Principle (c):</u> <i>“Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, threatened flora.”</i></p> <p><u>Assessment:</u> Flora surveys have been conducted within the application area and no threatened flora have been recorded.</p>	Not likely to be at variance	No
<p><u>Principle (d):</u> <i>“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.”</i></p> <p><u>Assessment:</u> The area proposed to be cleared has been surveyed and is known to contain vegetation representative of a Threatened Ecological Community, the <i>Tuart Woodlands and Forests of the Swan Coastal Plain</i> (under the EPBC Act)</p> <p>The EPBC Act defines TECs as a community that is critically endangered, endangered, or vulnerable as defined under section 182.</p>	At variance	Yes <i>Refer to Section 3.2.2, above.</i>
Environmental value: significant remnant vegetation and conservation areas		
<p><u>Principle (e):</u> <i>“Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.”</i></p> <p><u>Assessment:</u> The extent of the mapped vegetation type and the native vegetation in the local area is consistent with the national objectives and targets for biodiversity conservation in Australia. The vegetation proposed to be cleared is within mapped ecological linkages.</p>	May be at variance	Yes Refer to Section 3.2.3, above.
<p><u>Principle (h):</u> <i>“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.”</i></p> <p><u>Assessment:</u> Given the distance to the nearest conservation areas, the proposed clearing may have an impact on the environmental values of nearby conservation areas.</p>	May be at variance	Yes Refer to Section 3.2.3, above.
Environmental value: land and water resources		
<p><u>Principle (f):</u> <i>“Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.”</i></p> <p><u>Assessment:</u> The application area (as revised) is not within a riparian zone of a wetland but does intersect an outer boundary of a mapped wetland. The vegetation within the application area is not considered riparian.</p>	Not at variance	No
<p><u>Principle (g):</u> <i>“Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.”</i></p> <p><u>Assessment:</u> Some of the mapped soils are moderately susceptible to wind erosion and some are susceptible to subsurface acidification and phosphorus export risk. Noting the linear shape of the application area where it intercepts these soil types, the proposed clearing is not likely to have an appreciable impact on land degradation.</p>	Not likely to be at variance	No
<p><u>Principle (i):</u> <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.”</i></p> <p><u>Assessment:</u> The application area is adjacent to a series of wetlands. However, as the application area closest to the wetlands is linear and the proposed clearing is for maintenance purposes and within a rail reserve at this</p>	Not likely to be at variance	No

Assessment against the clearing principles	Variance level	Is further consideration required?
location, it is considered the proposed clearing is not likely to cause deterioration of surface or underground water.		
<p><u>Principle (j)</u>: “Native vegetation should not be cleared if the clearing of the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.”</p> <p><u>Assessment</u>: The mapped soils and topographic contours in the surrounding area do not indicate the proposed clearing is likely to contribute to increased incidence or intensity of flooding.</p> <p>Although a wetland is recorded adjacent to the application area, it is considered the linear shape and purpose of the proposed clearing is not likely to contribute to increased risk of waterlogging.</p>	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. Biological survey information excerpts

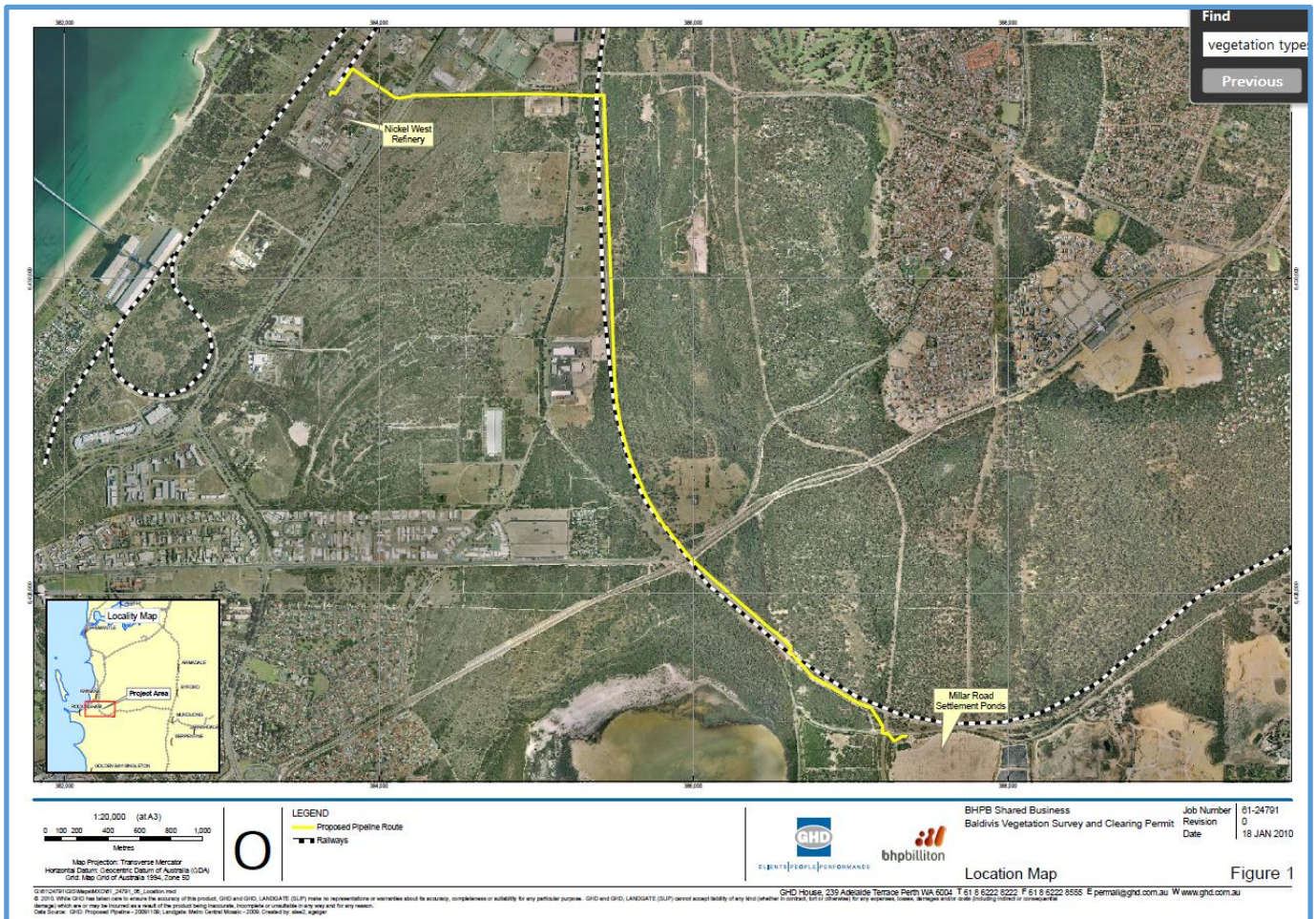


Figure 10: Map of area surveyed by GHD 2010.

V1: Planted native species over weed species.

V2: *Eucalyptus gomphocephalus* over weed species.

V3: Open Woodland of *Eucalyptus gomphocephalus* over Tall Scrub of *Spyridium globulosum* and/or *Acacia rostellifera* over weed species.

V4: Tall Closed Scrub of *Acacia saligna* over Closed Sedges of *Gahnia trifida* and *Tetaria capillaries* over Open Herbland of *Muehlenbeckia adpressa* over weed species.

V5: Closed Forest of *Eucalyptus gomphocephalus* over Open Woodland of *Melaleuca preissiana* and *M. raphiophylla* over Open Sedgeland of *Gahnia trifida* and weed species.

V6: Open Woodland of *Eucalyptus gomphocephalus* over Tall Scrub of *Banksia sessilis* over Shrubland of *Acacia saligna* and *Templetonia retusa* over weed species.

Figure 11: Extract of vegetation types within the survey area mapped above from GHD, 2010

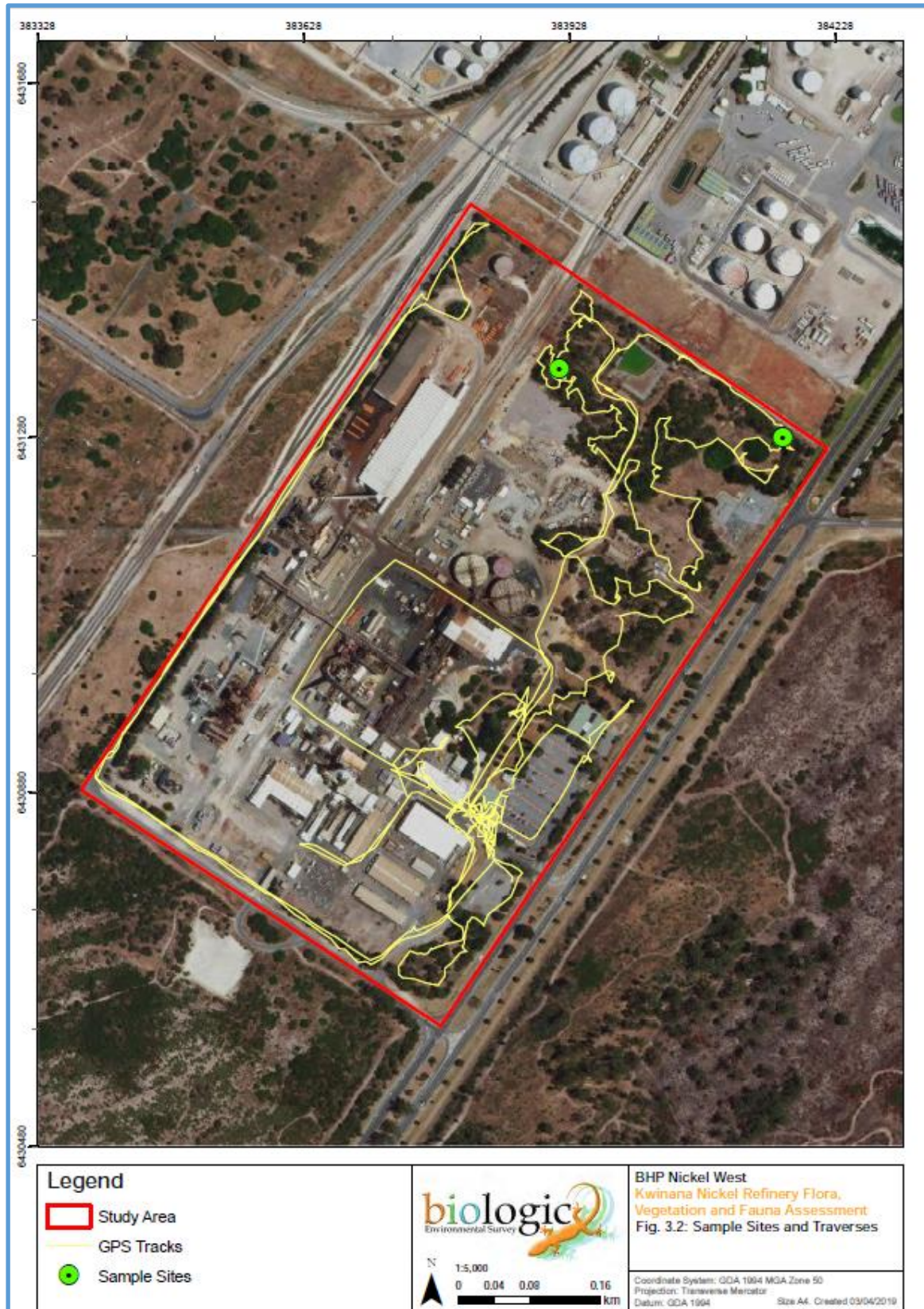


Figure 12: Map of area surveyed within the report by Biologic, 2019

Table 4.4: Vegetation Unit Descriptions



Code	Description	Extent (ha)	Features	Photo
Eg	<i>Eucalyptus gomphocephala</i> low to mid trees over disturbed understorey consisting of introduced grasses, herbs and managed lawns/ gardens	3.21	<ul style="list-style-type: none"> • Potential black cockatoo breeding trees 	
EgAf	<i>Eucalyptus gomphocephala</i> mid trees over <i>Agonis flexuosa</i> low trees over introduced grasses and herbs	0.36	<ul style="list-style-type: none"> • Potential black cockatoo breeding trees 	

Figure 13: Vegetation descriptions within the report by Biologic, 2019




Code	Description	Extent (ha)	Features	Photo
EgR	<i>Eucalyptus gomphocephala</i> mid open woodland over <i>Acacia cyclops</i> , <i>Acacia xanthina</i> and <i>Spyridium globulosum</i> scattered tall over <i>Rhagodia baccata</i> low open chenopod shrubland with introduced grasses and herbs	2.87	<ul style="list-style-type: none"> • Potential black cockatoo breeding trees • WoNS present 	
Esp	<i>Eucalyptus gomphocephala</i> , <i>Eucalyptus camaldulensis</i> and other naturalised low to mid trees over varying understorey consisting of native (<i>Meiakeuca lanceolata</i> , <i>Callitris preissii</i>) and non-native (* <i>Schinus terebinthifolia</i>) shrubs and introduced grasses and herbs	1.50	<ul style="list-style-type: none"> • Potential black cockatoo breeding trees • WoNS present 	
*Ta	* <i>Tamarix aphylla</i> low trees over disturbed understorey dominated by introduced grasses and herbs	2.51	<ul style="list-style-type: none"> • WoNS present 	

Figure 14: Vegetation descriptions within the report by Biologic, 2019



Figure 15: Mapped vegetation types by Biologic, 2019

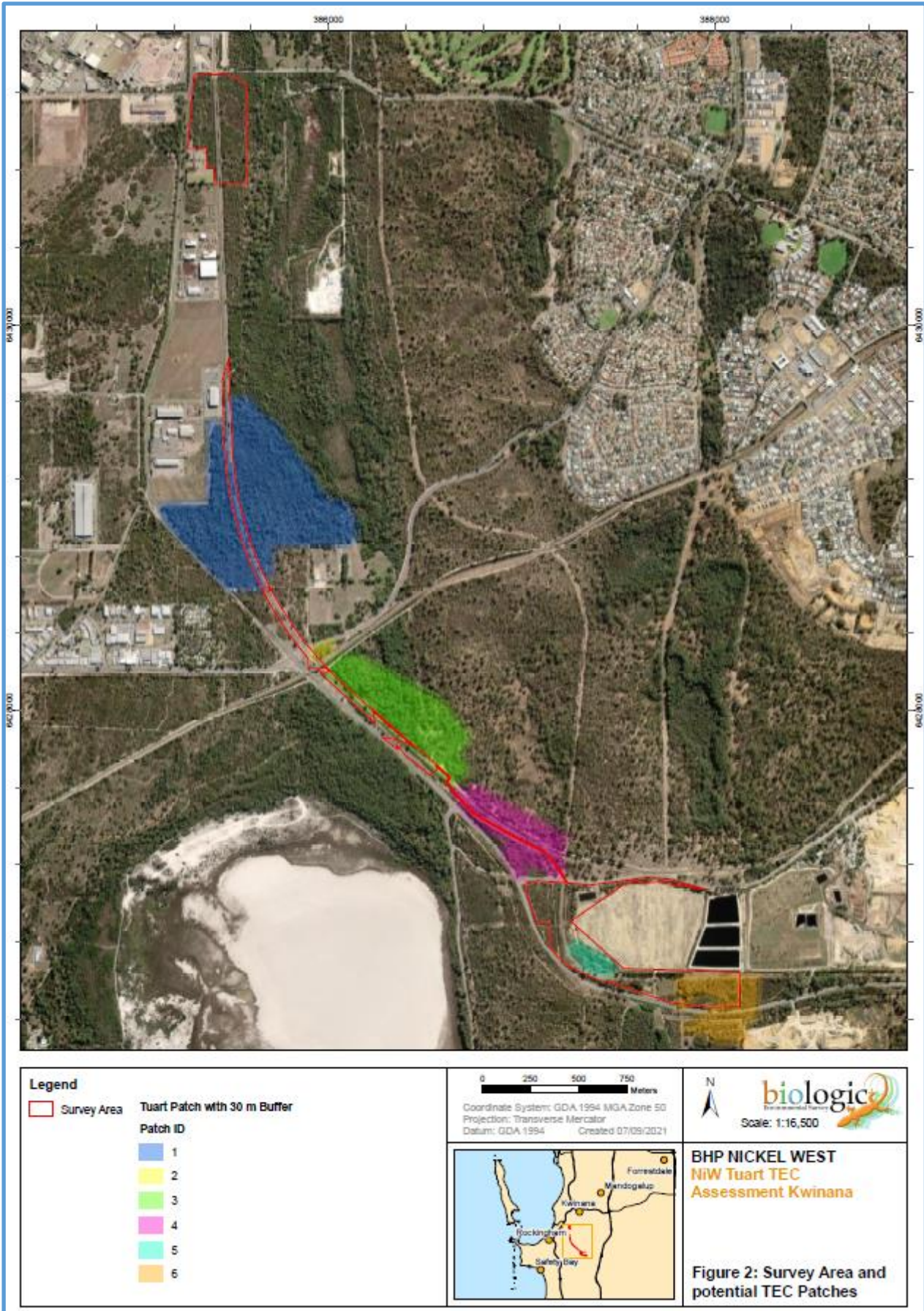


Figure 16: Results from the report 'Kwinana Nickel Refinery *Eucalyptus gomphocephala* (Tuart) TEC assessment (Biologic, 2021)

3. Results

Six potential Tuart TEC patches were identified as intersecting the Survey Area prior to mobilisation. These patches were ground-truthed during the field survey and assessed with the diagnostic characteristics for potential to represent the Tuart TEC (Table 1). A summary of the results is provided at Table 2, the full assessment for each patch is detailed in Appendix A with representative photos presented in Appendix B. All patches intersected the Survey Area, with the Survey Area intersection detailed in Figure 2. It is important to note that the boundaries of the patches in Figure 1 and Figure 2 are mapped to the area surveyed during the field visit and do have the potential to extend out past these mapped boundaries. Four potential patches met the initial diagnostic characteristics (Table 1) at step one, they were:

- Patch 1;
- Patch 3;
- Patch 4; and
- Patch 6.

These patches all met the following criteria:

- Occurring on the Swan Coastal Plain;
- Occurring on the Quindalup dune system;
- Presence of two or more alive tuart trees in the upper most canopy;
- Patches of vegetation supporting a low open woodland to low woodland of tuart trees; and
- Native understorey flora present (although in limited density and diversity).

These patches also met the condition thresholds and categories described in step two:

- The size of the patches is greater than 0.5 hectares (ha), but less than 5 ha; and
- Having a high condition rating.

Patch 2 and Patch 5 although meeting the initial diagnostic characteristics in step one of the assessment did not meet the criteria in step two. This was due to the patches size, condition, and the limited native understorey present (Table 2) (Appendix A). Patch 2, although in good condition and with a Moderate understorey condition, is less than 0.5 ha and does not form a continuous patch with surrounding vegetation (separated by 75 m from nearest patch), while patch 5 is 1.6 ha it contained less than four native understorey species (moderate condition) and less than 50 % understorey cover.

Table 2: Summary of patch criteria assessment

Criteria	Patch 1	Patch 2	Patch 3	Patch 4	Patch 5	Patch 6
Step 1 – Diagnostic Characteristics						
Location & Physical Environment	Yes	Yes	Yes	Yes	Yes	Yes
Soils and Landform	Yes	Yes	Yes	Yes	Yes	Yes
Composition	Yes	Yes	Yes	Yes	Yes	Yes
Structure – Woodland	Yes	Possible	Yes	Yes	Possible	Yes

Figure 17: Results from the report 'Kwinana Nickel Refinery *Eucalyptus gomphocephala* (Tuart) TEC assessment (Biologic, 2021)

Criteria	Patch 1	Patch 2	Patch 3	Patch 4	Patch 5	Patch 6
Structure – Associated Species	No	Yes	No	No	No	No
Structure – Understorey	Yes	Yes	Yes	Yes	Yes	Yes
Step 2 – Condition thresholds and categories						
Minimum size	Yes	No	Yes	Yes	Yes	Yes
Condition	High	Moderate	High	High	Moderate	High
Already part of the PEC	Yes	No	Yes	Yes	No	Yes
Related to any other TEC/PECs	No	No	No	No	No	No
Buffer zone – does it surround or adjoin native vegetation	No, but still meets criteria	No	No, but still meets criteria	No, but still meets criteria	No	No, but still meets criteria
Is it a revegetation area	N/A					
Is it a garden	N/A					
Conclusion						
Does this patch meet the criteria for inclusion as the TEC?	Yes	No	Yes	Yes	No	Yes

In step 1 of Table 2, one of the diagnostic characteristics of a Tuart TEC is the presence of key associated species. These species are significant indicators of the presence of a Tuart TEC and are often seen within the TEC. Table 3 presents these species, however only Patch 2 contained one of these species, the rest of the patches did not. Although only one patch contained one of these species, Patch 3 and Patch 6 did contain *Banksia sessilis* (Appendix C), however this is not a key associated species. All the flora species found during the field survey are in Appendix D.

Table 3: Presence of key associated species within patches

Species	Patch 1	Patch 2	Patch 3	Patch 4	Patch 5	Patch 6
<i>Agonis flexuosa</i>	None located					
<i>Banksia grandis</i>	None located					
<i>Banksia attenuata</i>	None located					
<i>Banksia menziesii</i>	None located					
<i>Banksia prionotes</i>	None located					
<i>Corymbia calophylla</i>	None located	Yes	None located			
<i>Eucalyptus marginata</i>	None located					

The overall vegetation condition of these patches ranged from very good to degraded with all patches containing a mixture of native species and introduced grasses and herbs, located predominantly in disturbed areas along roads, cleared vegetation and boundary lines. In relation to the patch criteria (Table 2), all the patches that were determined to be a part of the Tuart TEC were assessed as being in High condition ($\geq 60\%$ of all understorey vegetation cover is native and at least eight native understorey species per 0.01 ha), while Patch 2 and Patch 5 which are not considered to represent a Tuart TEC, were rated as being in Moderate condition ($\geq 50\%$ of all understorey vegetation cover is native or At least four native understorey species per 0.01 ha).

Figure 18: Results from the report 'Kwinana Nickel Refinery *Eucalyptus gomphocephala* (Tuart) TEC assessment (Biologic, 2021)

Appendix F. Sources of information

F.1. 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
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