



Clearing Permit Decision Report

1 Application details and outcome

1.1. Permit application details

Permit number:	CPS 9168/1
Permit type:	Purpose permit
Applicant name:	Main Roads Western Australia (MRWA)
Application received:	23 December 2020
Application area:	27.3 hectares of native vegetation in a 124.9 hectare clearing footprint
Purpose of clearing:	Constructing a second carriageway along Bussell Highway
Method of clearing:	Mechanical
Property:	Refer to Appendix A for the list of properties
Location (LGA area/s):	City of Busselton, Shire of Capel
Localities (suburb/s):	Ruabon, Ludlow, Yalyalup

1.2. Description of clearing activities

The application is to clear 27.3 hectares of native vegetation within an approximately 124.9 hectare clearing footprint within Bussell Highway Road reserve, for the purpose of the construction of a second carriageway along the existing two-lane single carriageway section between 31.15 to 44.0 straight line kilometres (SLK) (the project) (see Figure 1a – 1h, Section 1.5).

The project involves the construction of the remaining 12.8 kilometre two-lane carriageway (southbound) to duplicate the existing carriageway between Hutton Road and Sabina River bridge and other associated road infrastructure, including but not limited to bridges, culverts, lighting, noise barriers, fencing, landscaping, road safety barriers and signs (MRWA, 2020a). The project will upgrade this section of Bussell Highway to a four-lane highway consisting of two carriageways. Once the new southbound carriageway is constructed, the existing single carriageway will become the northbound carriageway. The new carriageway will typically be 31 metres wide and will accommodate (MRWA, 2020a):

- a fully sealed 2.5 m wide left shoulder
- a fully sealed 1.5 m wide right shoulder
- two 3.5 m wide lanes
- drainage and other infrastructure.

MRWA (2020a) advised that the project is required to:

- accommodate the current traffic volume
- accommodate predicted future volumes; and
- reduce the frequency, density and severity of traffic accidents that occur on the existing single carriageway.

The majority of the clearing footprint comprises of a mixture of planted native, non-native and regrowth vegetation (MRWA, 2020a). For the purpose of the assessment, MRWA considered all vegetation in the application area as native. MRWA (2020a) advised that some vegetation within the application area may be cleared in accordance with the Regulation 5, Item 15 exemption of the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* (Clearing Regulations). This exemption allows clearing of native vegetation to maintain existing cleared areas around infrastructure. MRWA advised that the relevant information will be provided to the Department of Water and Environmental Regulation (DWER) as part of its public consultation process.

Decision:	Granted
Decision date:	9 July 2021
Decision area:	27.3 hectares of native vegetation, as depicted in Section 1.5, below.

1.3. Reasons for decision

In undertaking the assessment, the Chief Executive Officer (CEO) of DWER had regard for:

- the application area site characteristics (Appendix B)
- the clearing principles set out in Schedule 5 of the *Environmental Protection Act 1986* (EP Act) (Appendix C)
- land degradation risks of soil subsystems mapped in the clearing footprint (Appendix E)
- the findings of biological surveys (Appendix G)
- relevant datasets available at the time of the assessment (Appendix I)
- actions taken by MRWA which resulted in the avoidance and minimisation of the extent of the clearing area and the mitigation of the impacts of clearing (Section 3.1 of this report)
- other matters considered relevant to the assessment (Section 3.3 of this report)
- advice from the Department of Biodiversity, Conservation and Attractions (DBCA) on the impacts of the proposed clearing on conservation significant fauna and flora and threatened and priority ecological communities (DBCA, 2021c; 2021e and 2021f)
- advice from DWER's Geopraphe Capes District branch on matters regulated under the *Rights in Water and Irrigation Act 1914* (RIWI Act) (DWER, 2021)
- comments on the application from the Capel Land Conservation District Committee (LCDC) during DWER's direct interest stakeholder engagement (Capel LCDC, 2021)
- the ongoing, cumulative impacts in the region from MRWA's Bunbury Outer Ring Road Northern and Central Sections projects (approved), MRWA's Bunbury Outer Ring Road Southern Section proposal (under assessment) and Rawling Road Pty Ltd's cold storage and distribution centre proposal (under assessment).

The clearing permit application was submitted, accepted, assessed and determined in accordance with section 51E and 51O of the EP Act. DWER advertised the application for 21 days. No public submissions were received.

After consideration of the above information, as well as the avoidance, minimisation and mitigation actions taken by MRWA, the CEO determined that the proposed clearing will result in the following significant residual impacts (SRI):

- loss of 27.3 hectares of native vegetation which is significant as a remnant in an area that has been extensively cleared
- loss of 24 hectares of significant habitat for *Pseudocheirus occidentalis* (western ringtail possum (WRP))
- loss of 20.8 hectares of critical habitat for *Calyptorhynchus latirostris* (Carnaby's cockatoo), *Calyptorhynchus banksia* subsp. *naso* (forest red-tailed black cockatoo) and *Calyptorhynchus baudinii* (Baudin's cockatoo) (collectively referred to as black cockatoo herein this report), including a tree with a hollow of a suitable size for nesting by black cockatoos
- loss of approximately two hectares of native vegetation which represents the 'Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain (SCP) ecological community' listed as 'Priority 3' priority ecological community (PEC) by DBCA and as an 'Critically Endangered' threatened ecological community (TEC) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (referred to as the Tuart Woodland TEC herein this report).

To address the above SRIs and applying the EPBC Offsets assessment guide (Commonwealth Offsets Calculator), the CEO determined that the following rehabilitation and land acquisition offsets are required:

- rehabilitation of 60.26 hectares of native vegetation in degraded (Keighery, 1994) condition in Ludlow State Forest No. 2, of which:
 - 60.26 hectares must provide habitat for WRP. This will address 62 percent of the SRIs of the proposed clearing to WRP;
 - 47.51 hectares must provide habitat for black cockatoos. This will address 100 percent of the SRIs of the proposed clearing to black cockatoo;
 - 8.95 hectares must represent the Tuart Woodland TEC at the completion of the rehabilitation activities. This will counterbalance 100 percent of the SRIs of the proposed clearing to this ecological community; and
- acquisition of 11.86 hectares of native vegetation at Lot 201 West Boundary Road, Manjimup, for the inclusion into adjacent Faunadale Nature Reserve (R 15762) containing habitat for WRP. This will address the remaining 38% of the SRIs of the proposed clearing to WRP.

The CEO considered that the rehabilitation within Ludlow State Forest No. 2, which would result in a net increase of vegetation in the locality of the application area, would directly address the long-term impacts to the local, SCP WRP population and was therefore appropriate to counterbalance the majority (68 percent) of the impacts to this species. The CEO noted that the acquisition of WRP habitat in Manjimup is in a different WRP management zone and bioregion to the population impacted, and considered that it was therefore appropriate for this land acquisition to counterbalance only a portion (32 percent) of the impacts to this species.

The above offset strategy will address 100 percent of the SRIs of the proposed clearing. The CEO therefore decided to grant a clearing permit subject to the following conditions imposed on the MRWA clearing permit:

- avoid, minimise to reduce the impacts and extent of clearing
- weed and dieback management to minimise the risk of introduction and spread of weeds
- Priority flora management to ensure that the conservation status of the impacted species is not threatened
- WRP and black cockatoo management to ensure that the proposed clearing will not adversely impact these species or individuals present at the time of clearing
- begin construction of the roadway within three months of the cessation of clearing to minimise the risk of wind erosion
- TEC and PEC management to limit the extent of the potential adverse impacts on the conservation category ecological communities
- submission of a rehabilitation plan for the rehabilitation of Ludlow State Forest No. 2 to offset the loss of:
 - WRP (in part) and black cockatoo habitat
 - significant remnant vegetation; and
 - the Tuart Woodland TEC
- acquisition of a portion Lot 201 West Boundary Road, Manjimup, to offset the remaining loss of WRP habitat.

Under Section 51O(3) of the EP Act, the CEO may approve clearing which is seriously at variance with a clearing principle if, and only if, in the CEO's opinion there is a good reason for doing so. In this instance, the CEO considers that the following good reasons exist for granting of Clearing Permit CPS 9168/1:

- Bussell Highway is the main link between Perth, Bunbury and the Busselton–Margaret River area which supports the tourism, forestry and agricultural industries in the region
- it is an important commuter link for residents who live in the Busselton or Margaret River area and work in the Bunbury or Perth Metropolitan areas
- the Bussell Highway traffic flow exceeds the capacity of the single carriageway section resulting in congestion, delay and safety concerns
- the project will improve the safety for passenger and heavy haulage vehicles. Bussell Highway was labelled as the most dangerous road in regional Western Australia in 2019 due to its narrow lanes, lack of overtaking opportunities and lack of a median strip/traffic separation (MRWA, 2020a). Between 2015 and 2019 there were 42 crashes within the single-carriageway section which resulted in 25 serious injuries and three deaths. Two double fatalities occurred along Bussell Highway in November 2020
- the impacts of the proposed clearing have been avoided or mitigated to the extent practicable
- the significant residual impacts of the clearing have been appropriately offset in accordance with the WA Offsets Policy 2011 and WA Environmental Offsets Guidelines (2014)
- the implementation of the offset strategy will result in a net gain of vegetation in the local area (a 10-kilometre radius measured from the perimeter of the clearing footprint).

1.4. Site maps



Figure 1a The areas cross-hatched yellow indicate the areas authorised to be cleared under the granted clearing permit.

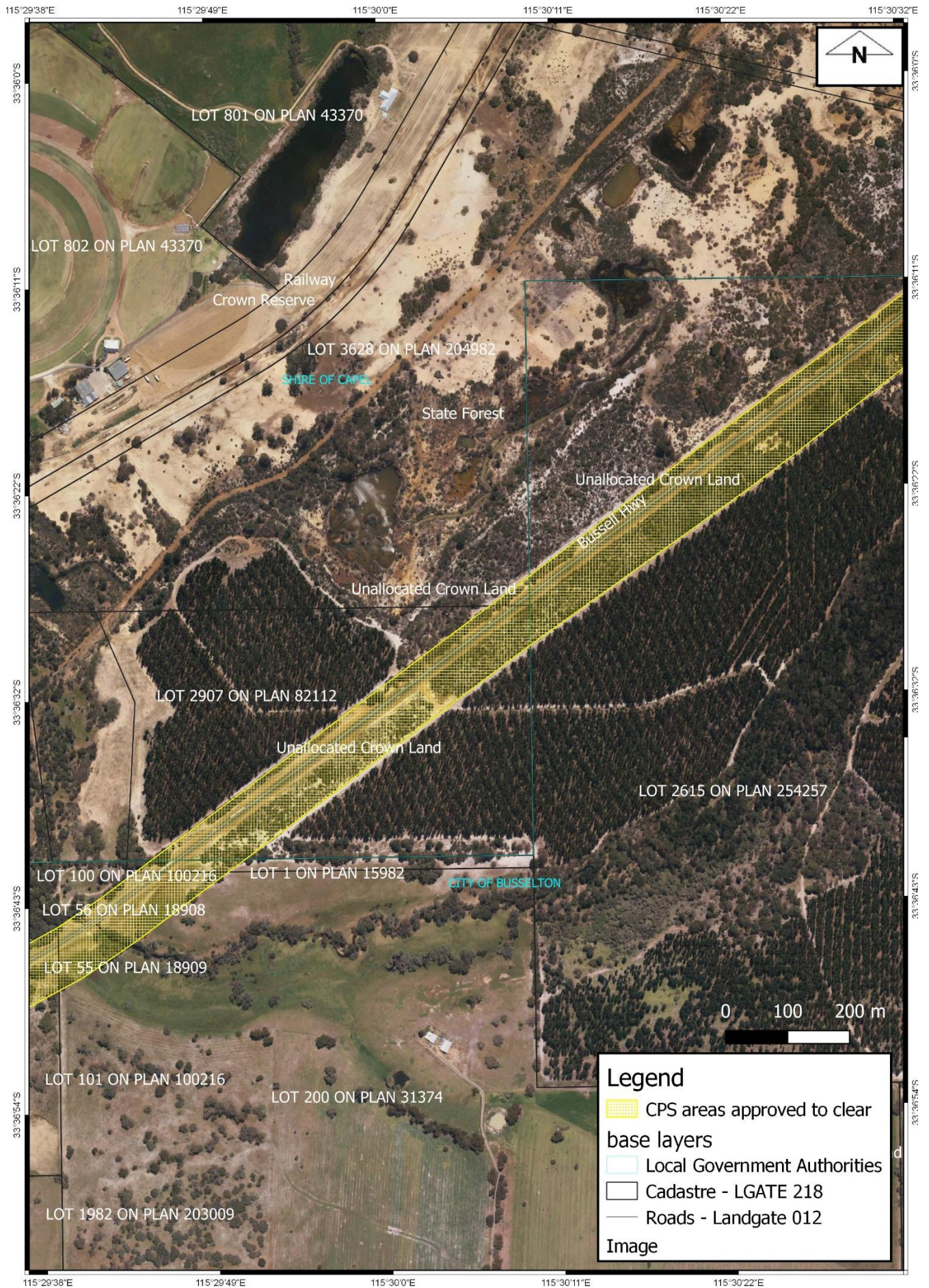


Figure 1b The areas cross-hatched yellow indicate the areas authorised to be cleared under the granted clearing permit.

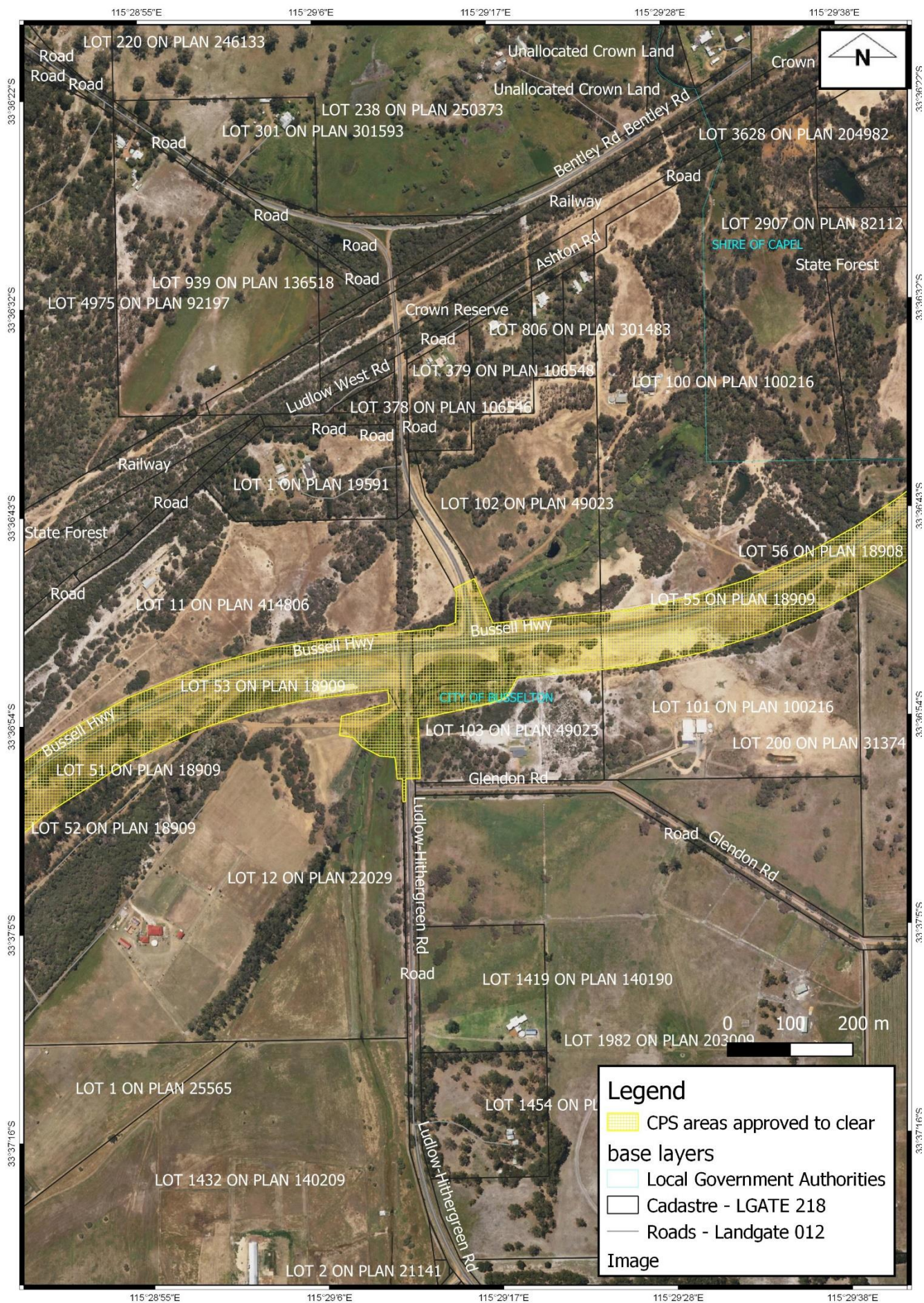


Figure 1c The areas cross-hatched yellow indicate the areas authorised to be cleared under the granted clearing permit.

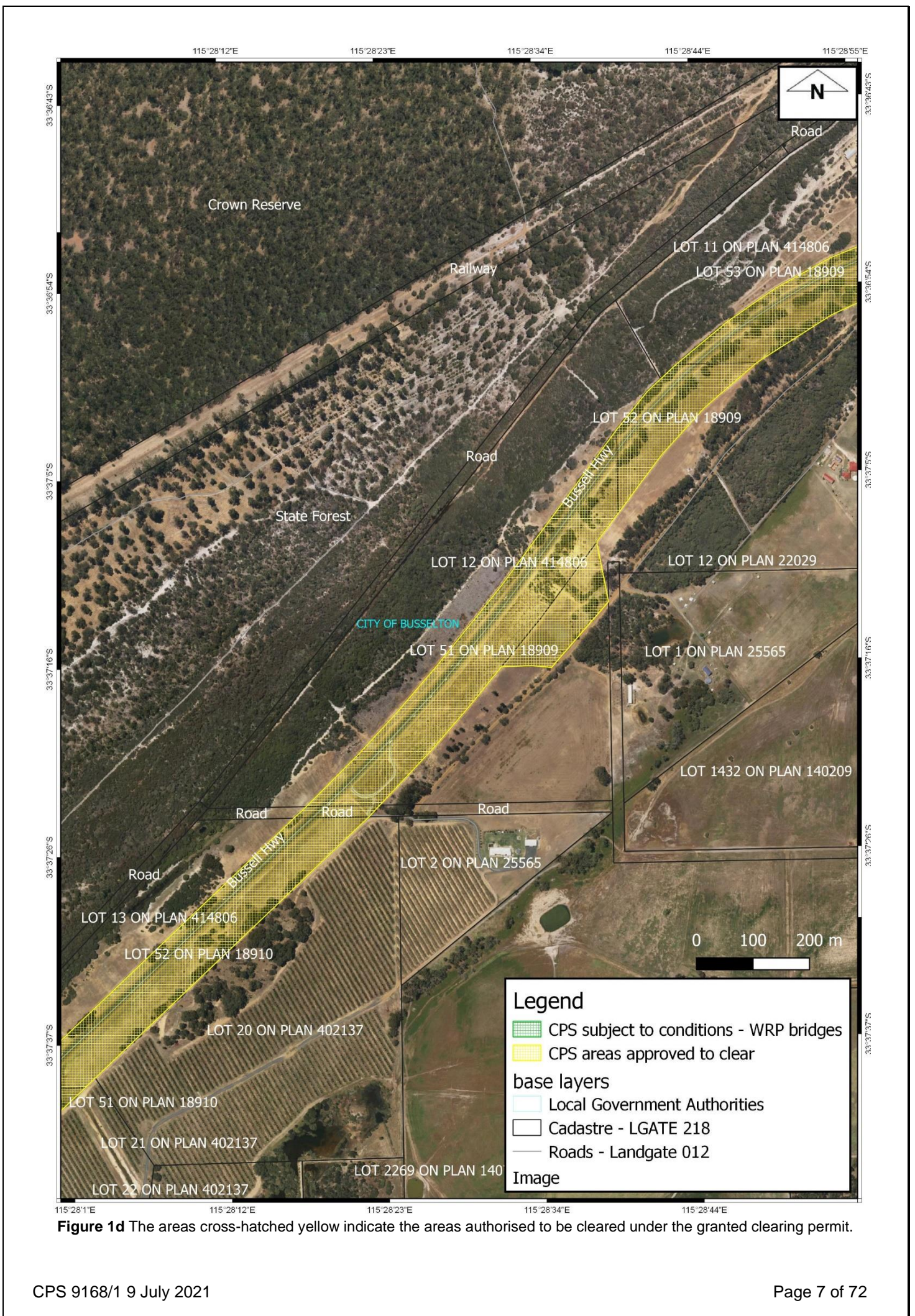




Figure 1e The areas cross-hatched yellow indicate the areas authorised to be cleared under the granted clearing permit. The area cross-hatched red indicates the area within which clearing activities must not be undertaken.



Figure 1f The areas cross-hatched yellow indicate the areas authorised to be cleared under the granted clearing permit.



Figure 1g The areas cross-hatched yellow indicate the areas authorised to be cleared under the granted clearing permit. The area cross-hatched green indicates the area within which a fauna underpass must be installed.

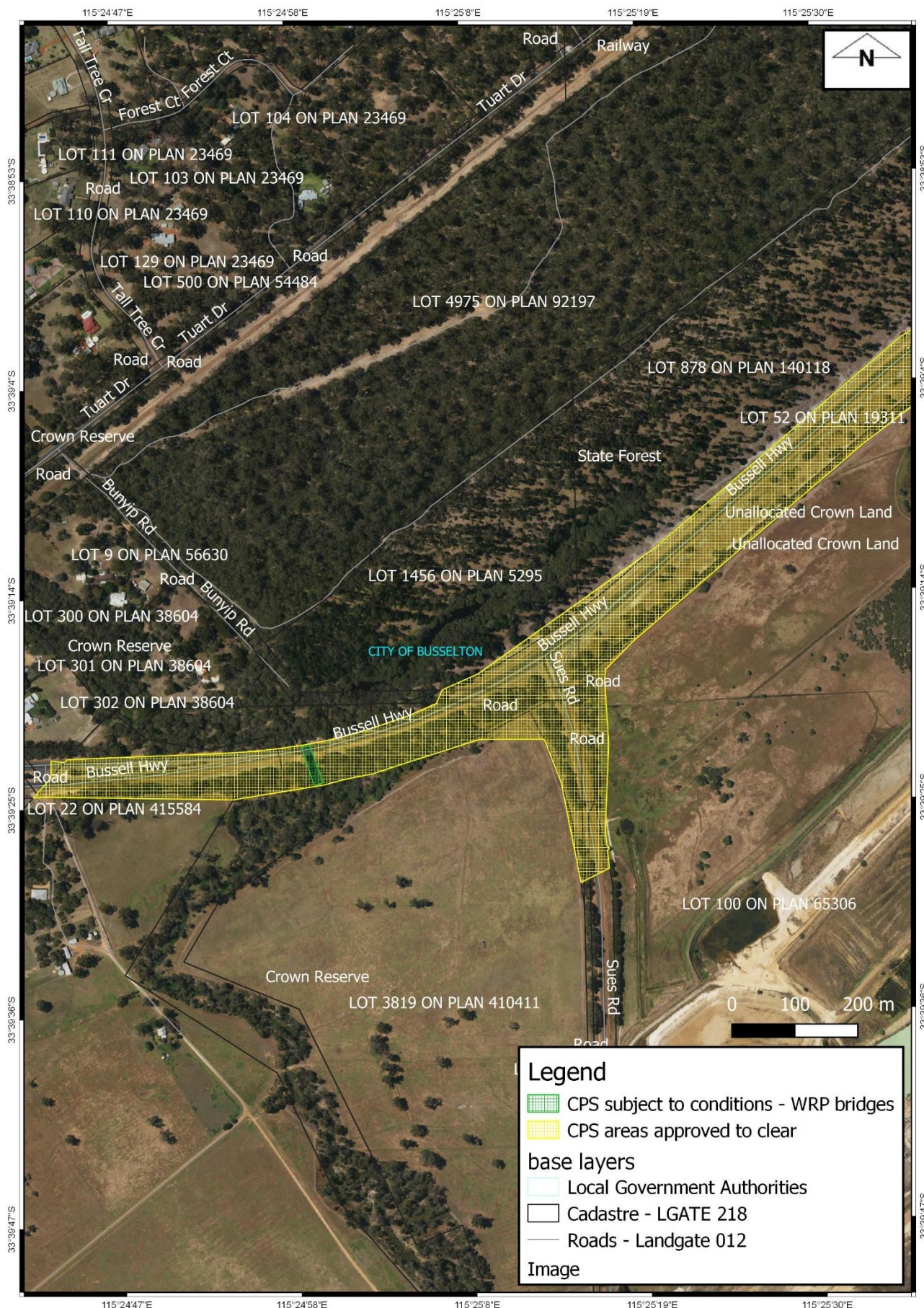


Figure 1h The areas cross-hatched yellow indicate the areas authorised to be cleared under the granted clearing permit. The area cross-hatched green indicates the area within which a fauna underpass must be installed.

2 Legislative context

The clearing of native vegetation in Western Australia is regulated under the EP Act and the Clearing Regulations.

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

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

Other legislation of relevance for this assessment include:

- *Biodiversity Conservation Act 2016* (WA) (BC Act)
- EPBC Act
- *Biosecurity and Agriculture Management Act 2007*
- *Aboriginal Heritage Act 1972*
- *Rights in Water and Irrigation Act 1914*

Relevant policies considered during the assessment include:

- WA Environmental Offsets Policy (2011) (the Offsets Policy).

The key guidance documents which inform this assessment are:

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

3 Detailed assessment of application

3.1. Avoidance and mitigation measures

MRWA advised that no feasible alternatives which would not involve clearing of native vegetation were identified (MRWA, 2020a). MRWA noted that the planning for the highway provided for the future duplication of the existing carriageway, with the second carriageway to be located to the east of the existing carriageway. The clearing footprint is situated within, and to the east, of the existing Bussell Highway Road reserve and follows the alignment of the existing single-lane carriageway.

MRWA stated that the following measures were incorporated into the project design to avoid the potential environmental impacts (MRWA, 2020a):

- refinement of the clearing footprint
- narrowing of the median where possible
- steepening of batters and drain slopes where possible
- retention of riparian vegetation adjacent to the Sabina and Abba Rivers.

In addition, MRWA (2020a) advised that the measures detailed in Table 1 were taken during the design of the project to minimise and mitigate the potential impacts of the project.

Table 1 Measures undertaken to avoid, minimise and mitigate the environmental impacts of the project (MRWA, 2020a)

Design measure	Discussion and justification
Steepen batter slopes	In the northern portion of the clearing footprint, MRWA intends to steepen batters or reduce drainage slopes to minimise the clearing. Due to the traffic volumes, vehicle type and posted speeds, batters cannot be changed significantly along the full length of the clearing footprint.
Installation of safety barriers	Barriers will be installed on the outside lanes where required; e.g., adjacent to culverts or where batters are steeper than 1:4. A single wire rope barrier will be installed in the median.
Simplification of design to reduce number of lanes and/or complexity of intersections	<p>Five design concepts were considered. Key selection criteria used in the assessment included:</p> <ul style="list-style-type: none"> • the amount of vegetation cleared/habitat loss • amount of fill material required • closeness to the existing carriageway; and • compliance with design standards. <p>The chosen option minimises impacts to native vegetation and habitat whilst maintaining necessary safety standards and an efficient use of resources.</p> <p>The project design and resulting application area were refined to avoid WRP and black cockatoo habitat where possible. This included reducing the median width, steepening batters and drainage slopes where possible.</p> <p>MRWA noted that the project scope cannot be further simplified whilst retaining the necessary safety benefits.</p>
Preferential use of existing cleared areas for access tracks, construction storage and stockpiling	<p>The existing carriageway will continue to be utilised while the second carriageway is under construction. Temporary side tracks may be required at each of the river crossings to enable access during construction. If these are required, they will consist of culverted causeways. Silt curtains/fences will be used as required to mitigate impacts from erosion and siltation.</p> <p>Storage and stockpiling of materials will occur within the road reserve or nearby cleared land. Similarly, the project site office and associated infrastructure will be located within the road reserve or on nearby cleared land. No temporary clearing will be undertaken as part of the project activities.</p>
Drainage modification	<p>The project required the duplication of the existing carriageway following the alignment of and immediately adjacent to the existing carriageway. The Project will maintain the existing drainage regime through standard engineering design with no change to water flows.</p> <p>Drainage for the project will be managed through standard engineering design to ensure no change to local drainage water flows to either the watercourses or low lying areas or to the vegetation these support.</p>
WRP movement structures	<p>To maintain and improve connectivity along riparian areas, MRWA proposed to install WRP rope bridges under road bridges on the Abba and Sabina Rivers where ecological linkage vegetation exists to allow this species to move between suitable habitat either side of the highway. The specific location(s) and design(s) will be developed in consultation with DBCA.</p> <p>Riparian vegetation adjacent to rivers will be retained where possible to enable possible installation of WRP movement structures and refuge areas.</p>

The abovementioned measures did not adequately demonstrate that all reasonable efforts had been taken to avoid and minimise potential impacts of the proposed clearing on a number of environmental values, including threatened and priority flora, conservation significant fauna and TECs.

Following receipt of DWER correspondence outlining the impacts identified during the assessment of the proposed clearing, MRWA advised that the application area was significantly reduced as part of the design process to achieve the current extent of 27.3 hectares. Without compromising road safety, MRWA was able to refine the design of the duplication such that the width of the median was narrowed by approximately 30 percent, which reduced the amount of clearing required. The narrowing resulted in the reduction of the application area by approximately 8 to 12 hectares. In addition, the standard construction working area clearing buffer was reduced from 5 metres to 2.5 metres, equating to an estimated further 2 hectare reduction in the application area (MRWA, 2021a).

In addition to the reduction in the application area, the narrowing of both the width of the median and the construction buffer has reduced impacts on (MRWA, 2021a):

- *Verticordia attenuata* (P3) – the number of individuals anticipated to be impacted was reduced to 1,233, avoiding 37 percent of known individuals within the road reserve
- habitat trees (trees with diameter at breast height (DBH) larger than 500 millimetres) – the number of habitat trees impacted by the proposed clearing was reduced by 13 percent (from 143 to 124 trees)
- threatened fauna – the amount of foraging habitat for black cockatoos and habitat for WRP cleared was reduced by more than 30 percent. The modification resulted in the retention of nine and 13 hectares of black cockatoo and WRP habitat, respectively
- TECs and PECs – reduction in the clearing of the Tuart Woodland TEC by approximately 30 percent and reduction in the clearing of Busselton Yate (*Eucalyptus cornuta*) Priority 1 ecological community by approximately 25 percent
- ecological linkages – the approximately 12.5 metre reduction in the clearing width across the clearing footprint has reduced impacts on connectivity of the three regional ecological linkages
- native vegetation considered significant in an extensively cleared landscape.

In addition to these avoidance and minimisation measures, MRWA reiterated it proposes to install WRP rope bridges beneath the road bridges over the Abba and Sabine rivers to facilitate WRP movement under the highway. The construction of the bridges will be undertaken in consultations with DBCA (MRWA, 2021a).

After consideration of the additional avoidance and mitigation measures, the CEO determined that offsets to counterbalance the significant residual impacts were necessary. In accordance with the Offsets Policy and Offsets Guidelines, these significant residual impacts have been addressed through the conditioning of environmental offset requirements on the permit. The nature and suitability of the offsets provided are summarised in Section 4.

3.2. Assessment of impacts on environmental values

In assessing the application, the CEO 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 (conservation significant flora and fauna, TECs and PECs)
- significant remnant vegetation
- conservation areas; and
- water resources.

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. Environmental value: biodiversity – Clearing Principles (a)

Assessment outcomes:

The assessment against Clearing Principle (a) identified that the proposed clearing will impact on native vegetation which contains a high level of biodiversity as the application area contains the following values:

- 27.3 hectares of significant remnant of native vegetation
- 24 hectares of significant habitat for WRP
- 20.8 hectares of critical habitat for black cockatoos, including nesting habitat containing a tree with a suitable sized hollow for black cockatoo nesting
- two hectares of native vegetation which represents the federally listed Tuart Woodland TEC; and
- six species of Priority flora, including 1,233 individuals of *Verticordia attenuata*.

Conditions:

Based on the outcomes of the assessment and in accordance with the risk mitigation hierarchy described in the Environmental Offsets Guideline, the CEO determined that the following management conditions on the clearing permit will adequately mitigate the potential impacts of the proposed clearing on the above environmental values:

- rehabilitation of 60.26 hectares of Ludlow State Forest No. 2
- acquisition and conservation of 11.86 hectares of native vegetation at Lot 201 on Plan 409860, Manjimup
- installation of fauna underpasses under Abba and Sabina River to mitigate impacts to ecological linkage values and allow the safe west – east movement of fauna
- installation of an artificial black cockatoo nesting hollow within a secured property identified by DBCA
- implementation and adherence to the WRP management plan approved by DWER and DBCA
- weed and dieback hygiene measures to mitigate the risk of impacts to adjacent native vegetation
- limitation of:
 - the number of *Verticordia attenuata* individuals authorised to be cleared to limit direct impacts on the species
 - the extent of WRP and black cockatoo habitat authorised to be cleared
 - the extent of clearing within the Tuart Woodland TEC
- seed collection, topsoil management and vegetative material management actions to further mitigate impacts to *Verticordia attenuata*.

Assessment:

Priority Flora

Based on the similarities between the soil and vegetation types within the application area and those present in habitats for priority flora recorded in the local area, the conservation significant flora as detailed in Appendix B were considered to potentially occur within the application area. To obtain a thorough understanding of the potential impacts of the proposed clearing on these species, MRWA engaged Ecoedge to conduct surveys, which encompassed the clearing footprint, described in Table 2 (MRWA, 2020a).

Table 2 A summary of the flora surveys undertaken in the clearing footprint

Author	Survey type	Date of field work	Consideration of the survey timing
Ecoedge (2019)	A detailed, reconnaissance and targeted survey	Five site visits between August and October (2018)	The optimal time for the South-West Botanical Provenance. Flowering was excellent with germination and growth of herbaceous species not expected to have been negatively affected by rainfall.
Ecoedge (2021a)	A targeted survey for <i>V. attenuata</i> within and adjacent to the clearing footprint	17 February 2021	<i>V. attenuata</i> plants were still in flower at the time of the survey so were easy to identify.
Ecoedge (2021b)	The survey report combines the results of the following surveys conducted in the clearing footprint: <ul style="list-style-type: none">• 2013: reconnaissance and targeted survey• 2016: flora survey targeting <i>Verticordia attenuata</i>• 2018: detailed reconnaissance and targeted survey. A separate report produced (Ecoedge, 2019)• 2020: reconnaissance and targeted survey of previously unsurveyed areas	22 and 23 October and 19 December 2013, 12 December 2016, 16 October 2020 *updated in May 2021	The optimal time for the South-West Botanical Provenance. Flowering was excellent with germination and growth of herbaceous species not expected to have been negatively affected by rainfall. The timing of the targeted survey for <i>Verticordia attenuata</i> was considered optimal.

The full summary of biological surveys undertaken to inform this application is provided in Appendix G.

The above surveys identified six Priority listed flora species within the clearing footprint (Ecoedge, 2021b). Noting the survey effort, survey timings and flowering periods of the species considered as potentially occurring within the application area, DWER considered that the application area is unlikely to provide habitat for other Priority flora identified in the local area.

Acacia flagelliformis

Acacia flagelliformis (Priority 4) is known from 13 populations with a known range of approximately 85 kilometres east - west and 102 kilometres north - south. Two of these populations provide quantitative data. The data indicates that the populations have 36 and 100 plants located within Ruabon Townsite Nature Reserve (R33269) and Fish Road Nature Reserve (R 23321), respectively. The nearest population of *A. flagelliformis* is recorded approximately 0.9 kilometres northwest of the application area (DBCA, 2021a).

MRWA (2020a) advised that approximately 52 individuals are proposed to be cleared from a total survey population of 53 individuals. Therefore, the proposed clearing may have significant impacts on the local population of *A. flagelliformis*. Noting that approximately 73 percent of individuals of this species occur within secure tenure in the local area, DBCA (2021c) advised that the proposed clearing may be of local significance, but is unlikely to be significant to the conservation of this species.

Eucalyptus rudis subsp. *cratyantha*

Eucalyptus rudis subsp. *cratyantha* (Priority 4) is known from nine populations with a known range of approximately 115 kilometres east - west and 155 kilometres north - south. Plant numbers have not been recorded at most locations. The nearest population of this flora species was recorded approximately 3 kilometres southwest of the application area (DBCA, 2021a).

MRWA (2020a) noted that 10 individuals of *E. rudis* subsp. *cratyantha* recorded during the flora survey will be cleared and two retained. Noting this, the impacts of the proposed clearing may be of local significance, but are unlikely to be significant to the conservation of the species (DBCA, 2021c).

Synaphea hians

Synaphea hians (Priority 3) is known from 13 populations with a known range of approximately 56 kilometres east - west and 58 kilometres north - south. The closest population was recorded approximately 3.8 kilometres southwest of the application area (DBCA, 2021a). MRWA has proposed to clear five of the 10 individuals of *S. hians* identified within the survey area (MRWA, 2020a). DBCA (2021c) advised that the potential impacts of the proposed clearing are unlikely to be considered significant to this species.

Synaphea petiolaris subsp. *simplex*

Synaphea petiolaris subsp. *simplex* (Priority 3) is known from seven populations with a known range of approximately 45 kilometres east - west and 30 kilometres north - south. Of these, five populations contain quantitative data, which ranges from 3 - 35 plants. The nearest population is located approximately 0.3 kilometres west of the application area (DBCA, 2021a). Ecoedge (2020) identified three individuals of *S. petiolaris* within the application, of which two are proposed to be cleared (MRWA, 2020a). Noting that the total of 60 individuals are located in secure tenure in Coolilup State Forest (F 12) and Ruabon Townsite Nature Reserve (R 33269), the impacts of the proposed clearing to the conservation of this species are unlikely to be significant (DBCA, 2021c).

Calothamnus quadrifidus subsp. *teretifolius*

Calothamnus quadrifidus subsp. *teretifolius* (Priority 4) occurs inland from Busselton in clay with ironstone, wet in winter, with tall shrubland and flowers between September and December (George and Gibson, 2010). The species is known from 69 populations with a known range of approximately 120 kilometres east – west and 130 kilometres north – south. According to available databases, the closest population has been recorded approximately 1.5 kilometres east of the clearing footprint (DBCA, 2021a). Ecoedge (2021c) identified six individuals of *C. quadrifidus* subsp. *teretifolius* within the clearing footprint. DBCA advised that the potential impacts to this species are unlikely to be significant (DBCA, 2021c).

Verticordia attenuata

Verticordia attenuata (Priority 3) is known from 19 populations in total with a known range of approximately 30 kilometres east - west and 55 kilometres north – south (DBCA, 2021a). MRWA commissioned Ecoedge (2021a) to conduct a Targeted Flora (*Verticordia attenuata*) survey to allow an accurate assessment of the potential impacts of the proposed clearing.

The estimate of the total number of plants located within the Bussell Highway Road reserve (Ecoedge, 2021a) was approximately one third less than previously estimated by Ecoedge (2021b) (1,966 plants recorded in 2021 versus 2,822 in 2017). A total of approximately 15,900 plants were found in the survey sites outside of the road reserve, with 4,597 plants recorded at a private property and 11,308 plants within the Coolilup State Forest (Ecoedge, 2021a). The survey (Ecoedge, 2021a) concluded that the new populations represent significant increases to the known numbers of *Verticordia attenuata* population. The combined total recorded population was calculated to be approximately 21,300 plants, approximately three times that of the pre-survey population records and seven times more than on DBCA databases (Ecoedge, 2021b).

DBCA (2021c) acknowledged that the Targeted survey (Ecoedge, 2021a) had estimated that approximately 1,966 plants of *Verticordia attenuata* occur within the Bussell Highway Road reserve. DBCA also noted that the Flora survey undertaken in 2017 recorded almost 3,000 individuals of this species which was confirmed in 2020. The Targeted survey report indicated that the reason for the discrepancy could be because of natural attrition of plants over the intervening four years, together with the fact that both counts were estimates (Ecoedge, 2021a). DBCA (2021c) asserted that if numbers were reconfirmed in 2020, the decline must have occurred in a year or less, and therefore, several dead plants would have been observed during the Targeted survey. Given this, in providing its advice, DBCA used the larger population estimate of 2,922, which makes the total number of known plants to be 22,305.

DBCA advised that approximately 13 percent (2,896 plants) of *Verticordia attenuata* are proposed to be impacted by the proposed clearing. The plants within the private property immediately adjacent to the proposed works are considered to be part of the same population as those found within the road reserve. Therefore, the potential impacts to this population are approximately 38.65 percent, which is considered significant at a local level (DBCA, 2021c). DBCA (2021c) noted that seed collection could assist in capturing the genetic diversity of this population.

Given the potential significant impacts on *Verticordia attenuata*, DWER requested MRWA to provide additional mitigation actions to demonstrate that the impacts on this species were not going to be significant.

In response, MRWA (2021) clarified that the surveys targeting *Verticordia attenuata* were conducted in December 2016 and February 2021. Another report was produced by Ecoedge in 2020 which included data about *V. attenuata* from the 2017 report; no new data was collected. Therefore, MRWA advised that the population numbers in the 2020 survey report should not be treated as recount for the species. MRWA further stated that the population estimate calculated during the Ecoedge (2021a) targeted survey was significantly more accurate than the 2016 estimate due to the additional survey efforts undertaken. Specifically, the 2021 survey was more systematic and more time was spent in the field estimating population numbers than in the 2016 survey. MRWA (2021a) acknowledged that some of the differences in the population estimates between 2016 and 2021 could be results of natural plant losses over the four year period.

Taking this into account, MRWA calculated that the clearing will impact up to 1,233 individuals of *Verticordia attenuata*, which represents:

- 63 percent of the known 1,966 individuals within the road reserve
- 19 percent of the known 6,563 individuals within the road reserve and immediately adjacent Jasper Farms
- 5.8 percent of the known 21,271 individuals overall.

The population of the *Verticordia attenuata* within the application area is shown in Figure 2 (Ecoedge, 2021a).



Figure 2 Population of *Verticordia attenuata* within the clearing footprint (Ecoedge, 2021a)

DBCA (2021f) advised that whilst the proposed clearing is considered significant, the proposed take of 1,233 plants is unlikely to be significant to the conservation of the species or result in a change in conservation status. DBCA acknowledged that *Verticordia attenuata* is classified as Priority flora, i.e., the species is poorly known or do not otherwise meet the survey criteria for threatened flora. This is consistent with Ecoedge's (2021a) report which identified areas of suitable habitat for this species which had not been surveyed and were considered highly possible for the occurrences of this taxon. Ecoedge (2021a) identified approximately 11,308 individuals of *V. attenuata* within Coolilup State Forest (Figure 3) and noted that much of it remains unsurveyed. Based on the survey observations, Ecoedge (2021a) estimated that the additional populations could increase the overall population to over 50,000 plants.

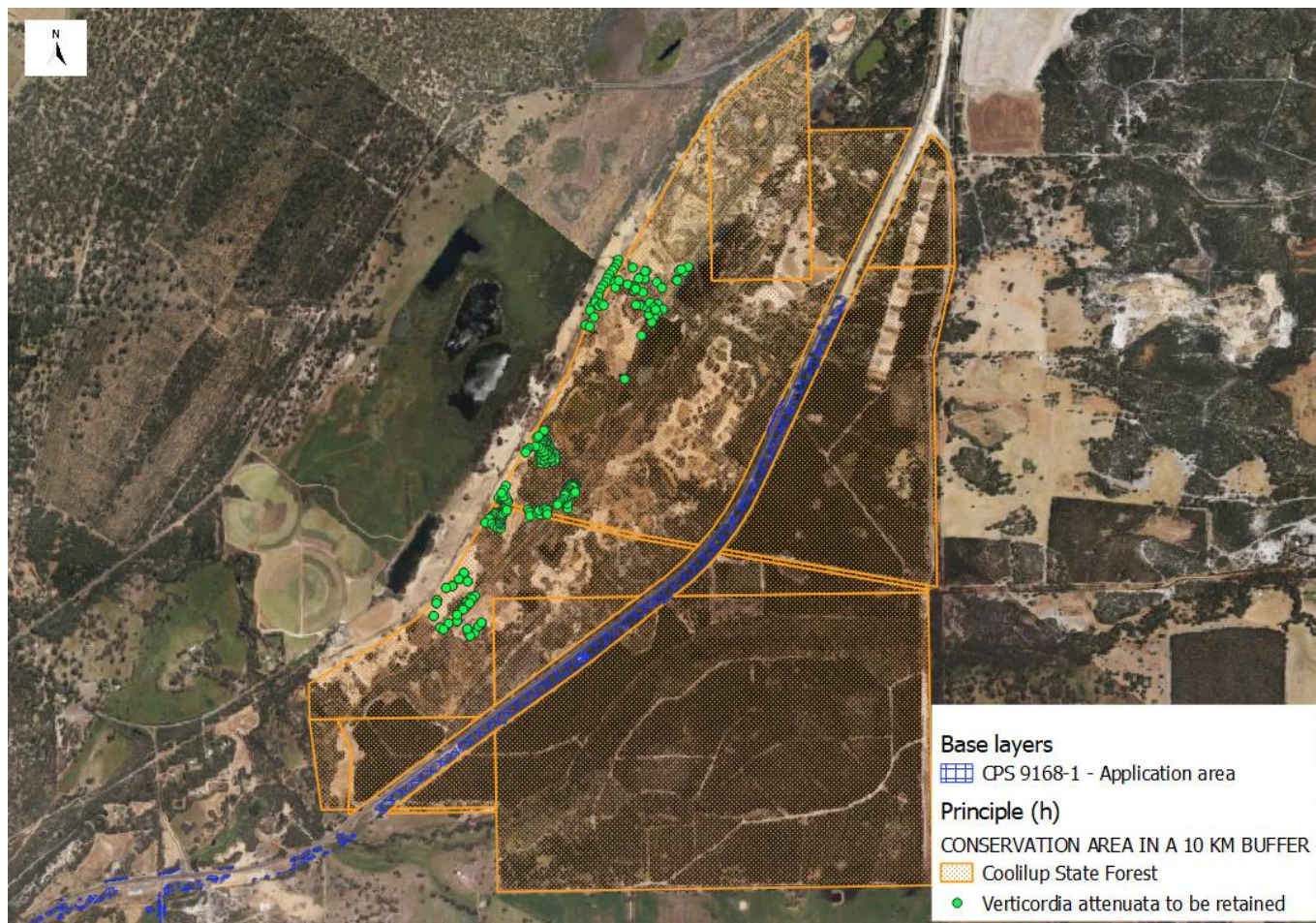


Figure 3 Population of *Verticordia attenuata* within Coolilup State Forest (Ecoedge, 2021a)

To compensate the loss of *Verticordia attenuata* individuals, MRWA (2021a) proposed to:

- collect vegetation material and topsoil from where *Verticordia attenuata* is proposed to be cleared. Where possible, this material will be used for rehabilitation works in the road reserve.
- conduct propagation trials for *Verticordia attenuata* (most likely from cuttings), and work with DBCA to identify secure locations to plant the propagated individuals (under an approved translocation proposal)
- undertake seed collection trials using 'bagging' techniques with the aim to collect sufficient seeds to propagate 250 seedlings and approximately 3,000 seeds to add to the seed bank.

DBCA (2021e) did not support the propagation trials given the risks associated with the translocation and higher degree of uncertainty in achieving environmental benefits. On the other hand, it supported the retention and collection of vegetative material, topsoils and seeds and provided a set of recommendations to ensure successful outcomes (DBCA, 2021c). The CEO reflected these recommendations into management conditions and imposed them on the clearing permit.

Priority ecological communities

Tuart Woodland TEC

The Tuart Woodland TEC is listed as 'Priority 3' PEC by DBCA and as a 'Critically Endangered' TEC under the EPBC Act.

A review of the available databases identified that this TEC is mapped approximately 53 metres from the application area. *Targeted Vegetation Survey of Threatened and Priority Ecological Communities* (the TEC/PEC assessment) (Ecoedge, 2021c) identified 24 patches of the Tuart Woodland TEC within the clearing footprint. Of these, three patches met the key diagnostic criteria of this community. The patches exceeded the minimum area threshold of five hectares to be considered an occurrence of the TEC regardless of condition. All remaining patches did not meet the minimum area and condition threshold, and were therefore, not representative of the Tuart Woodland TEC (Ecoedge, 2021c). The total area of these three patches is 29.02 hectares, of which approximately two hectares occurs within the application area.

Based on the approved conservation advice for this TEC, it is considered that the impacts to the two hectares of this TEC are significant. It is estimated that around 80 - 86 percent of the Tuart Woodland TEC has been lost as a result of clearing for agriculture, grazing, logging, mining and urban development (Threatened Species Scientific Committee (TSSC), 2019). All remaining patches have been disturbed to some degree and are at risk of losing further plant and animal species unless they are conserved and managed to prevent further degradation (TSSC, 2019). Given the high level of past loss to the ecological community and ongoing risk of degradation, the community is likely to be completely lost if it is not protected and restored (TSSC, 2019).

To mitigate the impacts of the proposed clearing on the Tuart Woodland TEC, MRWA committed to revegetating approximately 8.95 hectares of Ludlow State Forest No. 2 which, at the completion of the revegetation activities, will meet the key diagnostic criteria of this TEC. This commitment has been reflected into a management condition imposed on the clearing permit.

Banksia Woodland TEC

'Banksia Dominated Woodlands of the SCP Interim Biogeographic Regionalisation for Australia (IBRA) region' (Banksia Woodland TEC), listed as 'Priority 3' PEC by DBCA and as an 'Endangered' TEC under the EPBC Act, was mapped within the clearing footprint.

A survey undertaken by Ecoedge (2021c) identified several small patches of *Banksia attenuata*. The patches occurred in areas of degraded bushland and were less than two hectares in size. The survey concluded that the patches of *B. attenuata* do not meet the minimum area and condition threshold for the Banksia Woodland TEC. Therefore, the proposed clearing will not impact it (Ecoedge, 2021c).

Busselton Yate Community

'*Eucalyptus cornuta*, *Agonis flexuosa* and *Eucalyptus decipiens* forest on deep yellow-brown siliceous sands over limestone' (hereafter referred to as the Busselton Yate community) is listed as Priority 1 PEC by DBCA. The community was mapped approximately 360 metres west of the clearing footprint. The TEC/PEC assessment identified an approximately 0.8-hectare patch of this community with 14 *E. cornuta* trees within the most southern portion of the application area (Ecoedge, 2021c). The patch was considered to be in completely degraded (Keighery, 1994) condition, devoid of native understorey and the *E. cornuta* trees appeared to have been planted (Ecoedge, 2021c).

A detailed assessment of the potential impacts of the project activities on the Busselton Yate community identified that the proposed clearing is unlikely to significantly impact this community. The proposed clearing will result in the loss of 0.8 hectares of native vegetation which represents the Busselton Yate Community in completely degraded (Keighery, 1994) condition. DBCA (2021e) acknowledged that this PEC is exceptionally highly cleared and if this occurrence was a natural stand in degraded condition, DBCA would yet consider it as being of high conservation value. However, given the occurrence in the application area is planted, DBCA considered it to have low conservation value and the impacts of the proposed clearing on the Busselton Yate Community are not significant (DBCA, 2021e).

Southern SCP *Eucalyptus gomphocephala* – *Agonis flexuosa* woodlands (Floristic Community Type (FCT) 25)

This vegetation community is listed as Priority 3 by DBCA and Critically Endangered under the EPBC Act. It can form a component of the Banksia Woodland or Tuart Woodland TECs (DBCA, 2021c). The vegetation community is dominated by *Eucalyptus gomphocephala*. *Corymbia calophylla* and *E. decipiens* were also recorded as dominant species, tuart trees however occurred nearby. Banksia found in this community include *Banksia attenuata*, *B. grandis* and *B. littoralis* (DBCA, 2021b).

DBCA (2021c) noted that the application area contains a vegetation unit which may represent community FCT25. Ecoedge (2021c) subsequently reviewed the information obtained during the flora surveys and reiterated that given the completely degraded (Keighery, 1994) condition of the vegetation in the application area, the tuart woodland vegetation within the application area does not meet the patch size and condition thresholds to qualify as FCT25 (MRWA, 2021a).

Conservation significant fauna

As discussed in Section 3.2.2., the application area comprises native vegetation which provides critical habitat for black cockatoos, significant habitat for WRP, habitat for ground dwelling conservation significant fauna and support fauna movement across the extensively cleared landscape.

Threatened flora

As discussed in Section 3.2.3., the application area is unlikely to contain habitat for threatened flora species listed under the BC Act.

State listed threatened ecological communities

As discussed in Section 3.2.4., the proposed clearing is unlikely to impact on State listed TECs.

Significant remnant vegetation

As discussed in Section 3.2.5., the native vegetation proposed to be cleared is considered significant in the landscape which has been extensively cleared.

Conservation areas

As discussed in Section 3.2.8, the application area abuts Class A Coolilup State Forest, Ludlow State Forest No. 2 and Tuart forest National Park. The proposed clearing increases the risk of weed and dieback spreading into these conservation areas. Weed and dieback management practices will assist in mitigating impacts to adjacent vegetation (as conditioned on the clearing permit).

Weeds and dieback

Weeds are usually opportunistic plant species that are not native to an area, but once introduced, are able to compete effectively for resources (Department of Environment and Conservation (DEC), 1999). Weeds create numerous environmental impacts including resource competition and the prevention of seedling recruitment of native plant species, alteration of geomorphological and hydrological cycles, changes to soil nutrients, fire regimes and the abundance of indigenous fauna, and genetic changes (DEC, 1999).

Two pest plants, Arum Lily (*Zantedeschia aethiopica*) and Bridal Creeper (*Asparagus asparagoides*) listed under the *Biosecurity and Agriculture Management Act 2007*, were found within the survey area (MRWA, 2020a).

Disease occurrence surveys were undertaken in all assessable vegetation within the clearing footprint. The survey identified two infested areas, both influencing vegetation on both sides of the highway (MRWA, 2020a). The infested areas cover approximately 2.3 hectares. A single un-infested area occurring adjacent to infested vegetation in the Bussell Highway and Ruabon road intersection was also identified. This 0.3-hectare area was considered to be unprotectable from future disease spread. All other areas of assessable vegetation were determined to be uninterpretable due to a lack of susceptible species (MRWA, 2020a).

MRWA will be required (as conditioned on the clearing permit) to undertake weed and dieback management measures to minimise the risk of spread into adjacent native vegetation and nearby conservation areas. MRWA has therefore prepared an Environmental Management Plan (EMP) with a designated section for the management of the spread of weeds and dieback. A number of management measures were identified for the pre-, during and post work stages of the project. These measures include, but are not limited to the requirements to (MRWA, 2020a):

- remove or kill any weeds growing in the clearing footprint that are likely to spread and result in environmental harm to adjacent areas of native vegetation
- check that all vehicles and machinery are clean on entry
- treat nominated weed infestations as many times as necessary to control and eradicate the weed species in accordance with the approved weed control program
- ensure that no known weed, pest or disease affected soil, mulch, fill or other material is brought into the project area.

3.2.2. Environmental value: biological values (fauna) – Clearing Principle (b)

Assessment outcomes:

The assessment has identified that the proposed clearing will result in the following significant residual impacts:

- loss of 24 hectares of significant WRP habitat
- loss of 20.8 hectares of critical habitat for black cockatoos that supports breeding and roosting in an area which retains only 16 percent of its original vegetation extent
- loss of a tree containing a suitably sized hollow for black cockatoo nesting.

Taking into account MRWA's avoidance, minimisation and mitigation measures, which include the installation of one artificial black cockatoo nesting hollow within Ludlow State Forest No. 2, the CEO determined that the above significant residual impacts can be addressed through an adequate offsets strategy (as conditioned on the clearing permit). The strategy consists of:

- revegetation of approximately 60.26 hectares of Ludlow State Forest No. 2 with flora species which provide foraging, breeding and roosting habitat for WRP and black cockatoo to mitigate the impacts on local populations of these species; and
- acquisition and conservation of approximately 11.86 hectares of native vegetation at Lot 201 West Boundary Road, Manjimup.

Section 4 of this report provides further information on the offsets provided.

The CEO acknowledged that although the application area is not likely to provide significant habitat for ground-dwelling fauna (south-western brush-tailed phascogale, quenda and western brush wallaby), it may be used for fauna dispersal.

Conditions:

In addition to the offset described above, the CEO determined that the following management conditions on the clearing permit will adequately mitigate the potential impacts of the proposed clearing on the above environmental values:

- installation of fauna underpasses under Abba and Sabina River to mitigate impacts to ecological linkage values and allow the safe west–east movement of fauna
- installation of an artificial black cockatoo nesting hollow within a secured property identified by DBCA
- implementation and adherence to the WRP management plan approved by DWER and DBCA
- pre-clearance survey for the presence of WRP and black cockatoos to ensure that individuals are not harmed at the time of clearing
- weed and dieback hygiene measures to mitigate the risk of impacts to adjacent native vegetation
- limitation of the extent of WRP and black cockatoo habitat authorised to be cleared.

Assessment:

MRWA commissioned 360 Environmental, Greg Harewood, Biota Environmental Sciences and SW Environmental to conduct the following fauna surveys to determine the impacts of the proposed clearing on fauna:

- 360 Environmental (2017) assessed the clearing footprint for potential habitat and use by WRP and black cockatoo, verified the accuracy of desktop assessments and delineated and characterised the fauna assemblages and fauna habitat in the clearing footprint.
- Harewood (2018) undertook a targeted WRP survey and assessment of 92 habitat trees identified during the 360 Environmental (2017) survey.
- Biota Environmental Sciences (2020) carried out a targeted WRP survey within the clearing footprint and adjacent native vegetation to estimate the abundance of WRP within the clearing footprint and to map WRP habitat.
- SW Environmental (2020) conducted a camera pole and drone survey to determine the suitability of the hollows within the application area for black cockatoo nesting.

In addition to the above surveys, MRWA (2020b) investigated small portions of the clearing footprint which were not surveyed to obtain information about vegetation types and habitat values for WRP and black cockatoos.

360 Environmental (2017) mapped seven fauna habitat types within the application area, described in Table 3.

Table 3 Fauna habitat mapped within the application area (360 Environmental, 2017)

Habitat type	Area (in ha)
Acacia/Melaleuca shrubland	10.41
Marri/Eucalyptus woodland	2.86
Mosaic of Peppermint/Eucalyptus woodland and Melaleuca/Acacia shrubland	3.42
Peppermint woodland	1.70
Peppermint/Eucalyptus woodland	1.46
Scattered Acacia/Melaleuca shrubs	0.37
Scattered Marri/Eucalyptus	2.77

According to available databases, 65 conservation significant fauna species have been recorded within the local area (DBCA, 2021b). Noting the habitat requirements of the recorded species, the mapped vegetation type and the condition of the vegetation within the application area, the application area is likely to comprise suitable habitat for:

- Baudin's cockatoo (Endangered)
- Carnaby's cockatoo (Endangered)
- Carter's freshwater mussel (Vulnerable)
- Forest red-tailed black cockatoo (Vulnerable)
- Peregrine falcon (Other specially protected fauna)
- Quenda, southwestern brown bandicoot (Priority 4)
- South-western brush-tailed phascogale, wambenger (Conservation dependant fauna)
- Water rat, rakali (Priority 4)
- Western brush wallaby (Priority 4)
- Western ringtail possum, ngwayir (Critically Endangered)

Black cockatoos

The application area is mapped within the known distribution of black cockatoos (Commonwealth of Australia, 2012). The assessment has identified that the application area provides nesting habitat for black cockatoos comprising a tree with a suitably sized hollow for black cockatoo nesting. Suitable breeding habitat for black cockatoos includes trees which either have a suitable nest hollow or are of a suitable DBH to develop a nest hollow. For most tree species a suitable DBH is 500 millimetres (Commonwealth of Australia, 2012). MRWA (2020a) calculated that the application area contains 124 habitat trees.

The Fauna survey undertaken by 360 Environmental (2017) observed 92 habitat trees within the survey area. No suitable hollows for black cockatoo nesting were observed from the ground (360 Environmental, 2017). To verify the data obtained during the survey, MRWA commissioned Greg Harewood to assess the trees. Harewood (2018) did not identify 12 habitat trees previously identified by 360 Environmental but identified an additional 76 habitat trees. The author subsequently re-examined all habitat trees from the ground level for evidence of use using binoculars and identified that of the 156 habitat trees:

- 142 did not contain hollows of any size
- 12 contained one or more possible hollows considered not suitable for black cockatoo nesting
- two contained hollows potentially large enough to allow the entry of black cockatoos into a suitably sized and oriented branch/trunk. No evidence of use by black cockatoo was observed. (Harewood, 2018)

The survey was unable to conclude whether the large hollows were suitable for black cockatoo nesting (Harewood, 2018). MRWA (2020b) identified an additional seven habitat trees with no hollows within the areas which were not surveyed by either 360 Environmental (2017) or Harewood (2018).

To assess the suitability of the two trees with large hollows in relation to black cockatoo nesting, MRWA engaged SW Environmental. SW Environmental together with a professional tree climber identified that Tree 1 contained a large flared vertical hollow, with partially overhanging crown approximately 120 centimetre deep and 60 centimetre wide (Figure 4b). The hollow had possible old heavy chews around the bottom of the rim of the entrance. There did not appear to be any recent chews or obvious signs of black cockatoo activity. The hollow was considered to be suitable for black cockatoo nesting but not being used at the time of the inspection (SW Environmental, 2020).



Figure 4a Hollow in Tree 1 (SW Environmental, 2020)



Figure 4b Hollow in Tree 1 (SW Environmental, 2020)

Tree 2 contained multiple knot type hollows through the main trunk. While the entrances were suitably large for black cockatoo access, the hollow network was considered unlikely to be used by any nesting birds (e.g., black cockatoos) as the hollows appeared to be connected without a chamber (Figure 5a and 5b). Given this, the hollow in Tree 2 was not considered suitable for black cockatoo breeding (SW Environmental, 2020).



Figure 5a Hollow in Tree 2 (SW Environmental, 2020)

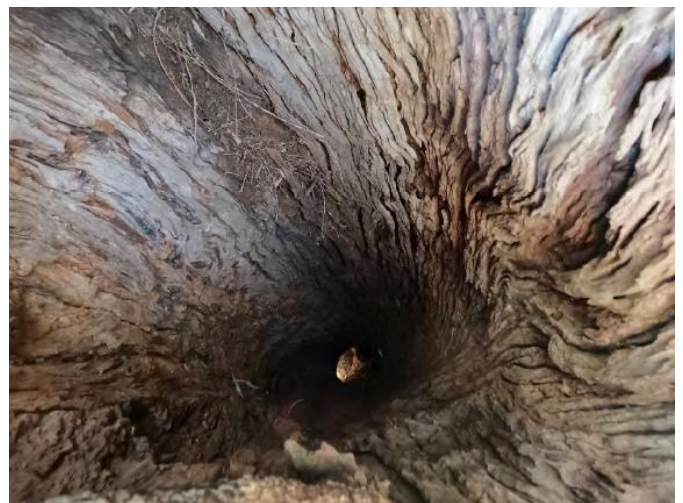


Figure 5b Hollow in Tree 2 (SW Environmental, 2020)

Foraging habitat for Carnaby's, Baudin's and forest red-tailed black cockatoo vary (Commonwealth of Australia, 2012). Forest red-tailed black cockatoo forages within jarrah and marri woodlands and forest, and edges of karri forests including wandoo and blackbutt, within the range of the subspecies (DBCA, 2017a). The species largely feeds on seeds of marri and jarrah, as well as other *Eucalyptus* species and *Allocasuarina* cones (Commonwealth of Australia, 2012). Baudin's cockatoo prefer foraging within eucalypt woodlands and forest, and proteaceous woodland and heath. Its diet consists mainly of seeds from marri but Baudin's also feed on various *Banksia* sp., *Hakea* sp. and jarrah, and occasionally insects and insect larvae (DBCA, 2017b). During the breeding season (October to late January/early February) this species has a preference for marri seeds. Outside the breeding season the species may feed in fruit orchards and tips of *Pinus* spp. (Commonwealth of Australia, 2012). Carnaby's cockatoo feeds on the seeds, nuts and flowers of a large variety of plants including Proteaceous species (*Banksia*, *Hakea* and *Grevillea*), as well as *Allocasuarina* and *Eucalyptus* species, marri and a range of introduced species (Valentine and Stock, 2008).

The assessment identified that the application area contains approximately 20.8 hectares of foraging habitat for all three species. Evidence of foraging was observed by 360 Environmental (2017) and Harewood (2018) in the form of chewed marri, tuart nuts and pine cones. Foraging species in the application area includes marri, tuart, flooded gum, *Acacia* sp., *Banksia* sp., peppermint and *Jacksonia* sp. (360 Environmental, 2017).

The assessment has further identified that the application area provides significant foraging habitat that supports black cockatoo breeding. Foraging habitat for black cockatoos within 7 kilometres of a breeding site is important to adequately support breeding pairs (EPA, 2019). The application area occurs within the mapped confirmed breeding area for Carnaby's cockatoo and according to available databases, there are two natural, confirmed breeding points within the local area located approximately 2 kilometres west and 3 kilometres east of the application area. Noting this, the proposed clearing will reduce the amount of food available to breeding birds.

The assessment has determined that the application area provides significant foraging habitat that supports black cockatoo night roosting. Individual night roosting sites need suitable foraging habitat and water within 6 kilometres (EPA, 2019). Overlapping foraging ranges within 12 kilometres also support roosting sites and maintain habitat connectivity and movement across the landscape (EPA, 2019). There are three confirmed black cockatoo roosting sites within the local area located approximately 1.5, 3.7 and 8 kilometres from the application area. Noting the distance from the roosting sites, the proposed clearing will impact significant foraging habitat supporting night roosting sites.

Considering the above, the application area is considered to represent critical habitat for black cockatoos.

Taking into account the linear shape of the application area spread across a large footprint, the proposed clearing is not likely to restrict black cockatoo ability to migrate across the landscape.

To mitigate the loss of approximately 20.8 hectares of significant black cockatoo foraging, MRWA has committed to rehabilitating approximately 47.51 hectares of Ludlow State Forest No. 2. Based on the Commonwealth Offsets Calculator, the rehabilitation will offset 100 percent of the significant residual impacts of the clearing on significant black cockatoo foraging habitat.

WRP

WRP is listed as Critically Endangered under the BC Act, as well as the EPBC Act. According to the WRP recovery plan (DPaW, 2017), habitat critical to survival for WRP is not well understood, and is therefore based on the habitat variables observed where WRP are most commonly recorded. These appear to vary between key management zones. The common themes however are high nutrient foliage availability for food, suitable structure for protection/nesting and canopy continuity to avoid/escape predation and other threats. Vegetation communities critical to the species include (DPaW, 2017):

- long unburnt mature remnants of peppermint (*Agonis flexuosa*) woodlands with high canopy continuity and high foliage nutrients (high in nitrogen and low toxin levels)
- jarrah (*Eucalyptus marginata*)/marri (*Corymbia calophylla*) forests and woodlands with limited anthropogenic disturbance (unlogged or lightly logged, and a low intensity and low frequency fire history), that are intensively fox-baited and have low indices of fragmentation
- coastal heath
- jarrah/marri woodland and forest
- peppermint woodlands
- myrtaceous heaths and shrublands
- Bullich (*Eucalyptus megacarpa*) dominated riparian zones; and
- karri forest.

The application area is located within one of three management zones identified by DPaW (2014a). The SCP zone incorporates the peppermint (*Agonis flexuosa*) woodlands and peppermint/tuart (*Eucalyptus gomphocephala*) forest on the southern extremity of the SCP, extending from north of Bunbury to Augusta, but principally around Busselton (DPaW 2014a). Populations occurring on the coastal strip near Busselton have higher population densities and reproduction rates than recorded elsewhere (Shedley and Williams, 2014). Much of the occupied coastal habitat is in a restricted and fragmented vegetation type that supports dense stands of peppermint (*Agonis flexuosa*), a preferred food resource in coastal settings that also provides shade and shelter from predators (Shedley and Williams, 2014).

Peppermint leaves form the basis of the WRP's diet in coastal areas (Jones *et al.* 1994) and home ranges in peppermint dominated habitat average 0.4 hectares and 0.3 hectares for females and males respectively (DPaW 2014; Jones *et al.* 1994). Resting sites include constructed dreys and tree hollows, with dreys constructed in the canopy when hollows are not available.

360 Environmental (2017) undertook a Level 1 fauna survey and subsequent targeted WRP survey over a larger area which encompassed the application area. The Level 1 fauna survey mapped approximately 33.96 hectares of WRP foraging and breeding habitat (360 Environmental, 2017) within the Bussell Highway Road reserve. WRP habitat was classified as vegetation containing species known to be used for shelter (dens and dreys) and species known to form part of their diet. This included areas with tuart, marri, peppermint, flooded gum, spearwood, *Melaleuca viminea*, Christmas tree (*Nuytsia floribunda*), woody pear (*Xylomelum occidentale*) and *Acacia saligna* (360 Environmental, 2017). No suitable hollows were observed.

The survey was followed up with a targeted WRP survey to provide greater clarity around the use of the application area by WRP. The targeted survey observed two individuals of WRP in large peppermint and tuart trees. No dreys were observed in the vicinity of the WRP sightings. The survey suggested that WRP are most likely foraging in the peppermints and possible denning nearby due to the presence of a small number of trees with hollow entrances that would be potentially suitable for WRP (360 Environmental, 2017). 360 Environmental reported that the likelihood of observing WRP was reduced due to weather conditions. The survey observed one drey in a peppermint tree with no evidence of use but old scats on the ground beneath (360 Environmental, 2017) (Figure 6). The drey was approximately 8 metres from the ground and it was therefore difficult to see if the drey was in use at the time of the survey (360 Environmental, 2017).



Figure 6 WRP drey in a peppermint tree in the application area (360 Environmental, 2017)

Given the 360 Environmental targeted survey of WRP was hindered to a certain degree by bad weather, MRWA engaged Greg Harewood to carry out an additional targeted WRP survey. The survey consisted of daytime assessment for signs of WRP and two night spotlight surveys of the clearing footprint. Harewood (2018) observed:

- 20 WRP dreys
- 14 trees with possible hollows, some of which may be suitable for WRPs to use for daytime refuge
- 14 individuals of WRP during the first nocturnal survey
- 22 individuals of WRP during the second nocturnal survey.

Based on the findings of the survey, Harewood (2018) concluded that WRP uses the vegetation along almost the entire length of the clearing footprint, primarily in the areas of relatively dense midstorey (low forest, woodland or thicket) vegetation and where peppermint trees occur.

To estimate the abundance of WRP within the clearing footprint and to map potential WRP habitat, MRWA commissioned Biota to undertake an additional targeted WRP survey. The survey generally extended 50 metres each side of the centreline of Bussell Highway. The survey covered approximately 175 ha and was separated into two phases. Phases 1 and Phase 2 of the survey, observed 55 and 77 individual WRPs from 41 and 74 observations,

respectively. A total of 51.85 hectares of vegetation was surveyed within the study area and the recorded abundances represent a Phase 1 and Phase 2 WRP density of 1.06 and 1.49 individuals per hectare, respectively. Highest abundances of WRP were located at the southern (Sabina River) end of the survey area (Biota, 2020).

The general locations of records within the study area remained similar across both phases with the exception of the area west of Ludlow Hithergreen Road intersection. In this area, no individuals of WRP were detected in Phase 1 but 10 were recorded during Phase 2 (Biota, 2020). Biota (2020) noted that this may represent a contraction of WRP individuals towards well-watered areas in the height of summer as well as the dense shade provided by peppermint trees.

The dominant vegetation types occurring within the study area comprise *Acacia/Melaleuca* shrubland, marri/*Eucalyptus* woodland and peppermint/*Eucalyptus* woodland (Biota, 2020). The approximate area of each of the habitat types and the numbers of WRP observed in each are detailed in Table 4. Those sections of the survey area containing uninterrupted vegetation support the highest abundances of WRP. Most WRP were observed in jarrah, marri, tuart and peppermint trees. Biota (2020) also observed WRP individuals in less typical habitat types such as in *Acacia* and *Melaleuca* shrubs (Biota, 2020).

Table 4 Habitat types within the study area and occurrence of Western Ringtail Possums in each (Biota, 2020)

Habitat type	Area (ha)	WRP individuals	
		Phase 1	Phase 2
<i>Acacia/Melaleuca</i> shrubland	17.1627	11	15
Marri/ <i>Eucalyptus</i> woodland	9.62746	8	6
Peppermint/ <i>Eucalyptus</i> woodland	9.11564	24	28
Scattered marri/ <i>Eucalyptus</i>	6.94668	11	11
Mosaic of peppermint/ <i>Eucalyptus</i> woodland and <i>Melaleuca/Acacia</i> shrubland	5.58458	1	5
Peppermint woodland	2.3108	0	10
Scattered <i>Acacia/Melaleuca</i> shrubs	1.10508	0	2
Bare ground	123.2	0	0
Total	175.0529	55	77

DPaW's (2017) WRP recovery plan states any habitat where WRP occur naturally is considered critical and worthy of protection (DPaW, 2017). MRWA (2020a) advised that the proposed clearing will result in the loss of 24 hectares for this species.

Advice from DBCA (2021c) noted that the majority of the proposed clearing is on the eastern side of Bussell Highway which has very little to no opportunities for natural dispersal of displaced possums without crossing the highway into the Ludlow State Forest. DBCA therefore advised that natural dispersal of WRP from this proposal is not an option. In addition, DBCA stated that the Ludlow State Forest on the west side of the highway is already at, or near, carrying capacity with WRP densities of 3.4 (+/-0.31) individuals per hectare (DBCA, 2021c). DBCA (2021c) concluded that the impacts of the proposed clearing can be adequately addressed through the development of a comprehensive WRP management plan.

Based on DBCA (2021c) advice, and in consultation with DBCA, MRWA prepared a WRP management plan to mitigate the impacts of the proposed clearing on individuals of WRP. The plan includes, but is not limited to, the following actions:

- Pre-clearing surveys conducted by a WRP specialist immediately prior to and during clearing operations to identify hollows, dreys, ground debris, dense ground-level vegetation, fallen timber and logs
- Temporary cessation of the clearing activities for up to 48 hours to allow for WRP individuals to disperse to a safe area outside the clearing footprint
- Collection of WRP individuals by a WRP specialist and relocation into refuge sites identified by DBCA where natural dispersal is not practical. (MRWA, 2021b)

MRWA will be required to implement and adhere to the WRP management plan as conditioned on the clearing permit.

To mitigate the loss of WRP habitat, MRWA proposed to install fauna underpasses under the road bridges on Abba and Sabina Rivers to allow WRP to move between suitable habitat. The specific locations and designs of the structures will be developed in consultation with DBCA.

The clearing permit will require MRWA to rehabilitate approximately 60.26 hectares of Ludlow State Forest No. 2 to restore habitat for WRP. This will mitigate approximately 61.99 percent of significant residual impacts of the proposed clearing on WRP. The remaining impacts will be counterbalanced by the acquisition of approximately 11.86 hectares of native vegetation at Lot 201 West Boundary Road which provides high quality habitat for WRP (Bio Diverse Solutions, 2020).

Peregrine falcon

The species is found in most habitats, from rainforests to arid zone and at most altitudes, from the coast to alpine areas. It requires abundant prey and secure nest sites and prefers coastal and inland cliffs or open woodlands near water and may even be found nesting on high city buildings (Australian Museum, 2020). This species is widespread, highly mobile and is found in various habitats. The application area may comprise suitable habitat for this species, however, noting habitat preferences and the small extent of the proposed clearing, the application area is unlikely to comprise a significant habitat for this species.

South-western brush-tailed phascogale, wambenger

The preferred habitat for this species in Western Australia is within dry sclerophyll forests and open woodlands that contain hollow bearing trees (DEC, 2012). Noting the historical disturbance of the site, limited continuous tree canopy linking nearby remnants which would assist this species in avoiding predators, the application area is unlikely to provide significant habitat for this species.

Quenda, southwestern brown bandicoot

Quenda (*Isoodon obesulus*), listed as priority 4 by DBCA, is known to inhabit scrubby, swampy vegetation with low, dense understorey, located nearby water courses, pasture, or forest/woodland that is regularly burnt and is in areas of pasture and cropland lying close to dense cover. Populations which inhabit jarrah and wandoo forests are usually associated with watercourses (DEC, 2012a). The application area comprises jarrah woodland near a watercourse so it may provide habitat for quenda. However, noting that the majority of the vegetation in the application area is in degraded (Keighery, 1994) to completely degraded (Keighery, 1994) condition with little areas of dense understorey, the application area does not provide significant habitat for this species.

Western brush wallaby

The western brush wallaby is now distributed across the south-west of Western Australia from north of Kalbarri to Cape Arid. Its 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 (DBCA, 2012). The closest individuals of western brush wallaby is recorded approximately 12 kilometres from the application area. Some vegetation in the application area may be used for western brush wallaby's dispersal, but noting the linear shape on the clearing footprint along the existing highway, the application area is unlikely to provide significant habitat for this fauna species.

Carter's freshwater mussel

Habitat for Carter's freshwater mussel is associated with riparian vegetation including *Eucalyptus rudis* (flooded gum), *Melaleuca* spp., *Casuarina* spp., *Acacia* spp., *Triglochin* spp., amongst many others. Relative abundance of adults are greatest amongst submerged, exposed tree roots along river banks (TSSC, 2017). This species is typical for freshwater ecosystems. Given the small extent of native vegetation along identified watercourses proposed to be cleared, the separation distance between the watercourse and carriageway and a number of actions implemented by MRWA to mitigate the potential impacts on surface water, the freshwater ecosystem is unlikely to be impacted by the clearing activities. Therefore, the proposed clearing is not likely to impact habitat for Carter's Freshwater Mussel.

Water rat

The species lives in the vicinity of permanent water bodies of fresh or brackish water and can travel a considerable distance overland (Van Dyck, 2008). Dens are made at the end of tunnels in banks or occasionally in logs. The Water Rat hunts on land but takes much of its food from the water, searching among vegetation along the shoreline and diving around submerged roots and logs. It is an opportunistic hunter and scavenger of large aquatic insects, fish, crustaceans and mussels, also taking frogs, lizards, water birds small mammals, turtles and their eggs, fresh carrion and a little plant material (Van Dyck, 2008). The application area intersects several waterways which may provide suitable habitat for water rat. However, given the relatively small extent of native vegetation growing along the watercourses proposed to be cleared, the application area does not provide significant habitat for this species.

Migratory birds

The application area occurs approximately 1.5 kilometres east of Vasse – Wonnerup System Ramsar Site which provides dry-season habitat for tens of thousands of resident and migrant waterbirds of a wide variety of species. It also regularly supports the largest breeding colony of *Cygnus atratus* (black swan) in south-western Australia (Ramsar Convention on Wetlands, 2014; DWER, 2018). At least seven species of marine fish are known to use the Site as nursery habitat (Wetland Research & Management, 2007).

Noting the separation distance between the application area and Vasse-Wonnerup System Ramsar Site, as well as the extent of the vegetation growing in the proximity of the rivers which flow into it, the proposed clearing is unlikely to impact the Ramsar Site, and therefore, impact habitat for migratory birds. MRWA has committed to implementing a number of measures to mitigate any potential impacts of the clearing on surface water (MRWA, 2020a).

Ecological linkage

As shown in Figure 7, the application area intersects three mapped South West Regional Ecological Linkages. These linkages allow fauna movement from Boyanup and Jarrahwood State Forest to Ludlow State Forest and Tuart Forest National Park. The linkages are already intersected by Bussell Hwy and the proposed clearing will create a wider barrier between stepping stones of habitat which facilitate the maintenance of ecological processes. Noting the extents of the vegetation in the application area at the intersections with the mapped ecological linkages, the proposed clearing is unlikely to have significant impacts on the linkages.

To mitigate the impacts on ecological linkages, Main Roads has proposed to install fauna underpasses under the bridges on Abba and Sabina Rivers to allow WRP to move between suitable habitat. The specific locations and designs will be developed in consultation with DBCA.



Figure 7 Position of the application area with respect to South West Regional Ecological Linkages

While some sections of the application area are unlikely to facilitate the fauna movement north–south, a portion of the application area may act as an ecological linkage. The section from Ruabon Road north to the Coolilup State Forest is largely bare ground and is unlikely to represent a linkage (Biota, 2020). The portion of the application area adjacent to Coolilup State Forest on the east side is continuously vegetated and supported WRP individuals. However, similar habitat is represented on the west side of Bussell Highway, which reduces the likelihood of the area to represent a linkage. The section between Layman and Ruabon Road (Figure 8) comprises continuous vegetation through cleared land, and therefore, may represent a linkage. Biota (2020) observed 25 individuals of WRP in this section.



Figure 8 Ecological linkage between Ruabon and Layman Road (Biota, 2020)

The CEO determined that the rehabilitation of approximately 60.26 hectare of nearby Ludlow State Forest No. 2 will mitigate the impacts of the clearing on native vegetation which provides ecological linkage values.

3.2.3. Environmental value: Threatened flora – Clearing Principle (c)

Assessment:

Based on the findings of the flora surveys (Ecoedge, 2017, 2019, 2020, 2021) and DBCA advice, DWER determined that the proposed clearing is unlikely to impact flora species listed as Threatened under the BC Act.

The assessment identified that the application area may provide suitable habitat for nine flora species listed as Threatened under the BC Act. To identify whether or not the application area contains these species, MRWA engaged Ecoedge to undertake four targeted surveys between 2016 and 2021. The surveys did not identify any Threatened flora species within the application area (Ecoedge, 2017, 2019, 2020, 2021).

DWER reviewed the survey reports and noted that the surveys targeting Threatened species were undertaken between August and October which was the optimal time for the majority of the species identified as potentially occurring within the application area. The timings of the surveys were not optimal for *Verticordia densiflora* var. *pedunculata* and *Verticordia plumosa* var. *ananeotes* which flower between December and January and November to December, respectively. However, given a survey targeting species with similar characteristics than *Verticordia densiflora* var. *pedunculata* and *Verticordia plumosa* var. *ananeotes* was undertaken, it was determined that this survey would have identified individuals of these species had they been present within the application area.

DBCA advised that the application area may provide habitat for *Drakaea elastica*. MRWA (2021a) advised that Ecoedge had undertaken a targeted survey for this species in 2018 at the appropriate time. Habitat suitable for *Drakaea elastica* was identified based on desktop assessment and knowledge of the site gained from previous surveys undertaken in the clearing footprint. All suitable habitats were thoroughly surveyed during the targeted survey and no individuals of the species were identified (MRWA, 2021a).

Conditions:

The CEO determined that no management conditions are required to be imposed on the clearing permit for this environmental value.

3.2.4. Environmental value: State listed TECs – Clearing Principle (d)

Assessment outcomes:

A review of the available biological databases and supporting information provided by MRWA (2020) indicated the application area may contain the following State listed TECs:

- Herb rich shrublands in clay pans (SCP08)
- Dense shrublands on clay flats (SCP09)
- *Corymbia calophylla* woodlands on heavy soils of the southern SCP (SCP1b).

Assessments against key diagnostic criteria of these communities determined that the clearing area (MRWA, 2021):

- is not likely to comprise native vegetation which represents SCP08 and SCP09; and
- comprises approximately 0.23 hectares of SCP1b. No clearing is proposed to be conducted within this area and the works will be limited to improvements and maintenance of the existing culvert only.

Conditions:

The CEO determined that not authorising clearing of native vegetation which represents the SCP1b community on the clearing permit will adequately mitigate the potential impacts of the proposed clearing on this environmental value.

Assessment:

SCP08

This vegetation community was endorsed by the WA Minister for the Environment as Vulnerable and is also listed as Critically Endangered under the EPBC Act. It typically occurs in low lying flats with a clay impeding layer allowing seasonal inundation (TSSC, 2011). While aquatic annuals are common, the pools are probably not inundated to the same depth or for the same length of time as in ecological community type 7. This vegetation community type is dominated by *Viminaria juncea*, *Melaleuca viminea*, *M. lateritia* (robin redbreast bush), broom bush, *Kunzea micrantha* or *K. recurve* with occasional emergents of *Eucalyptus wandoo* (wandoo). Species such as *Hypocalymma angustifolium* (white myrtle), *Acacia lasiocarpa* var. *bracteolata* long peduncle variant (G. J. Keighery 5026) and *Verticordia huegelii* (variegated featherflower) occur at moderate frequencies. This vegetation community type has a high percentage of weeds and appears to be the clay pan vegetation community type that has the greatest disturbance (TSSC, 2011).

Ecoedge (2021c) undertook a detailed multivariate analysis of the vegetation within the clearing footprint against key diagnostic criteria of SCP08. The data for the analysis was obtained from quadrats which were placed in parts of the survey area that appeared to have clay soils of the Cokelup vegetation complex, and/or that may have contained Claypan TEC vegetation. Quadrats were placed in the best vegetation condition in these areas.

The assessment concluded that SCP08 does not occur within the clearing footprint as the vegetation lacked the vegetation structure and species composition characteristic of the Claypan TEC. Annual herbaceous species which are a key characteristic of Claypan vegetation were not present (Ecoedge, 2020).

Based on the above, DBCA concluded that the potential for the FCT08 Claypan TEC within the clearing footprint is low (MRWA, 2021).

SCP09

Listed as Vulnerable by the WA Minister for Environment and Critically Endangered under the EPBC Act, this vegetation community type is described as shrublands or low open woodlands on clay flats that are inundated for long periods because it usually occurs very low in the landscape (TSSC, 2011). Sedges are more apparent in this ecological community and include *Chorizandra enodis* (black bristlerush), *Cyathochaeta avenacea*, *Lepidosperma longitudinale* (pithy sword-sedge) and *Meeboldina coangustata*. Shrubs include *Hakea varia* (variable-leaved hakea) and *Melaleuca viminea* and occasionally *Xanthorrhoea preissii*, *Xanthorrhoea drummondii* (grass trees) and *Kingia australis* (TSSC, 2011).

This vegetation community type has a lower species richness and weed frequency than in the other clay pan community types, presumably because of the longer inundation times (TSSC, 2011).

DBCA (2021a) advised that Vegetation Unit F in the application area may contain native vegetation which corresponds with SCP09. A multivariate analysis was therefore performed but did not confirm this (MRWA, 2021). To undertake the analysis, two quadrats were installed within representative vegetation in Unit F. The results of the analysis were subsequently compared with a subset of the Gibson et al., (1994) dataset. The resulting analysis grouped the six quadrats into three community types: SCP17, SCP16 and SCP06.

Ecoedge (2021) explained that Unit F was tentatively assigned to SCP17 because it does not have the characteristic salinity-adapted taxa of SCP16 (such as *Atriplex cinerea* or *Samolus repens*) and that SCP06 is a poorly defined community, characterised by weeds and occurring on heavy soils of the Pinjarra Plain. This community was considered by Gibson et al., (1994) as 'Well reserved' (i.e., known from two or more A class National Parks or Nature Reserves) and 'Low Risk' (i.e., a community that is not qualified as 'Presumed Destroyed', 'Critical', 'Endangered', 'Vulnerable' or 'Susceptible').

SCP1b

This vegetation community is listed as Vulnerable by the WA Minister for Environment and consists largely of *Corymbia calophylla* forests and woodlands of bushland remnants on the plain south of Capel (Gibson et al., 1994).

DBCA advised that given the application area comprises areas of marri dominated vegetation in good (Keighery, 1994) condition or better, it may contain native vegetation which represents the community SCP1b. Ecoedge (2021c) reviewed the potential occurrences of this community within the clearing footprint and identified that a portion of SCP1b was overlooked in the original survey. The area is located on largely undisturbed soils southwest of the Ruabon Road intersection. Ecoedge re-assessed this area against the key diagnostic criteria of SCP1b and estimated that approximately 0.23 hectares of the clearing footprint meet the diagnostic criteria of this community (Ecoedge, 2021b). No other potential occurrences of SCP1b were identified in the clearing footprint.



Figure 9 Location of SCP1b in the application area

MRWA advised that the only works proposed within the mapped occurrence of SCP1b are improvements and maintenance of an existing culvert. No clearing of native vegetation is proposed to take place within the area of the SCP1b TEC. Given this, the CEO did not authorise MRWA to clear native vegetation which represents the SCP1b community.

3.2.5. Environmental value: significant remnant vegetation– Clearing Principle (e)

Assessment outcome:

The proposed clearing will result in the loss of 27.3 hectares of native vegetation which is considered significant as a remnant in an area which has been extensively cleared. In accordance with the WA Offsets Policy, to mitigate this loss, MRWA will be required to revegetate approximately 60.26 hectares of Ludlow State Forest No. 2. The CEO considers that the offset is adequately proportionate to the impacts of the proposed clearing and in line with the Offsets Policy.

Conditions:

Based on the outcomes of the assessment and in accordance with the risk mitigation hierarchy described in the Environmental Offsets Guideline, the CEO determined that the following management conditions on the clearing permit will adequately mitigate the potential impacts of the proposed clearing on the above environmental value:

- rehabilitation of 60.26 hectares of Ludlow State Forest No. 2
- weed and dieback hygiene measures to mitigate the risk of impacts to adjacent native vegetation.

Assessment:

The national objectives and targets for biodiversity conservation in Australia has a target to prevent clearance of ecological communities with an extent below 30 percent of that present pre-1750, below which species loss appears to accelerate exponentially at an ecosystem level (Commonwealth of Australia, 2001).

The extent of native vegetation within the local area is not consistent with these thresholds as it retains approximately 16.35 percent vegetation cover (approximately 7,356 ha). The application represents approximately 0.37 percent of the remaining vegetation within the local area and the proposed clearing will reduce the extent of native vegetation within the local area to 7,328 ha. Given this, the application area is located within an extensively cleared landscape.

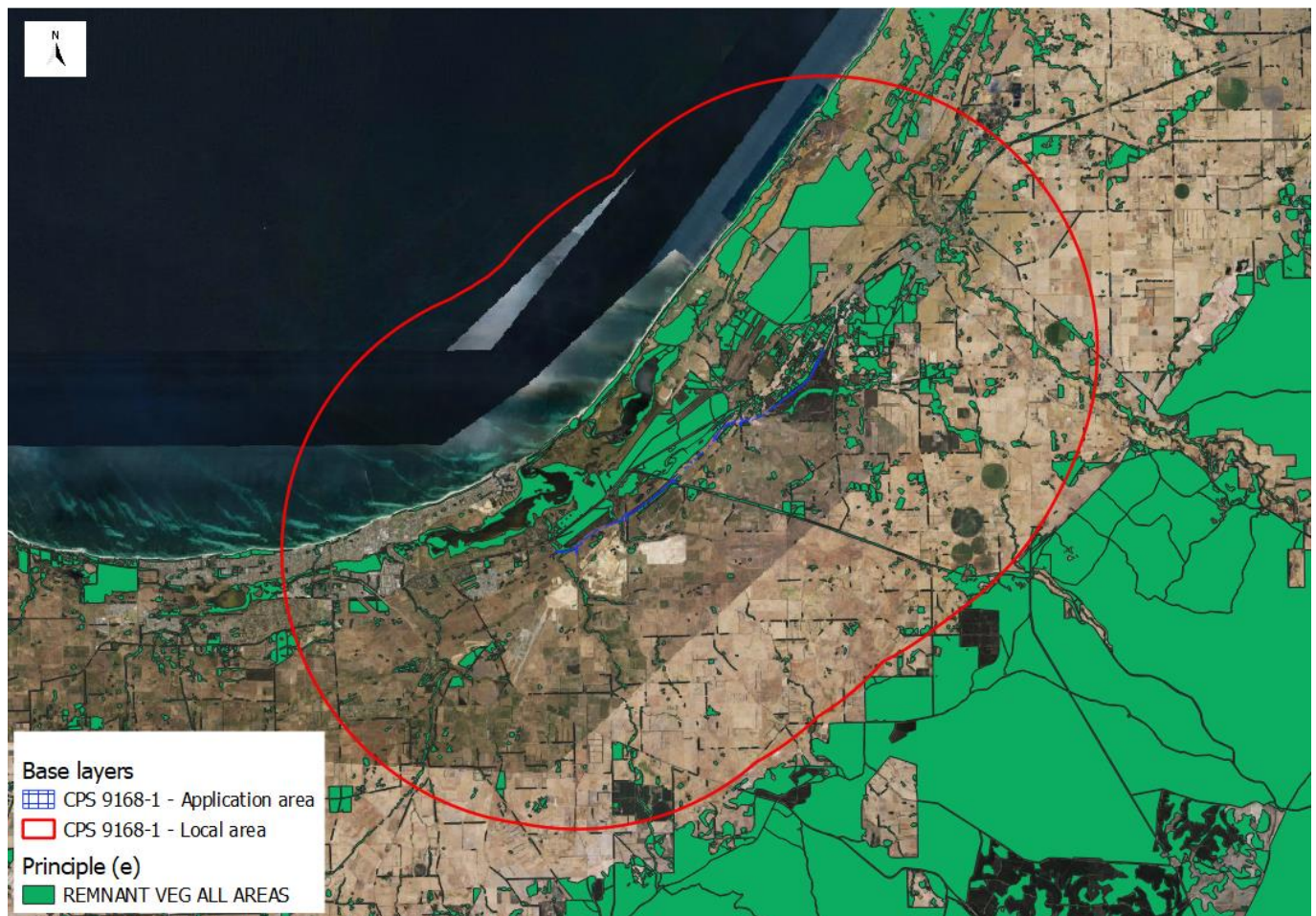


Figure 10 Extent of native vegetation in local area (Government of WA, 2019a)

The application area is located within the SCP IBRA bioregion which retains approximately 38.62 percent of its pre-European vegetation extent (Government of Western Australia, 2019a).

As described in Table 5, the SCP vegetation complexes Abba, Cokelup, Karakatta Complex-Central and South, Southern River and Yoongarillup retain approximately 6.54, 10.49, 23.49, 18.43 and 35.81 percent of their original

vegetation extents, respectively. The majority of the clearing (approximately 78 percent) will occur within the Southern River complex. While most of the mapped complexes have been extensively cleared, much of the vegetation in the application area comprises of a mixture of planted native, non-native and/or regrowth vegetation established as part of landscaping for the existing highway or historic mine sites rehabilitation (MRWA, 2020a). Therefore, the vegetation in the application area is not considered representative of the vegetation complexes.

Noting the application area contains the presence of conservation significant flora and fauna as well as vegetation representative of TECs and PECs, the proposed clearing area is considered to be a significant remnant of native vegetation in an area that has been extensively cleared.

Table 5 Vegetation statistics (Government of Western Australia, 2019a and 2019b)

	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	38.45	14.85
Vegetation complex**					
Abba	50,892.78	3,326.20	6.54	183.20	0.36
Cokelup	3,010.98	315.75	10.49	141.75	4.70
Karrakatta Complex-Central and South	53,080.99	12,467.20	23.49	4,282.73	8.07
Southern River	58,781.48	10,832.18	18.43	940.36	1.60
Yoongarillup	27,977.93	10,018.14	35.81	5,151.57	18.41
Local area (calculation - delete if not required)					
10km radius (excluding the ocean)	45,002.81	7,355.75	16.35	-	-

*Government of Western Australia (2019a)

**Government of Western Australia (2019b)

There is a risk of weeds and dieback spreading into remnants of native vegetation adjacent to the proposed clearing and the applicant will be required to adhere to weed and dieback management measures (as conditioned on the clearing permit) to minimise this risk.

3.2.6. Environmental value: vegetation growing in association with wetlands and/or watercourses – Clearing Principles (f)

Assessment outcome:

The assessment has identified that the proposed clearing will result in the loss of approximately 5.6 hectares of native vegetation which grows in association with wetlands or watercourses. These areas are scattered across the 124.9 hectare clearing footprint and the engineering design of the existing and post-construction drainage regime will ensure no changes to water flows. Noting this, the proposed clearing is unlikely to significantly impact upon riparian vegetation or have long-term adverse impacts on the hydrological and ecological values of the mapped wetlands and watercourses.

Conditions:

The CEO determined that no management conditions are required to be imposed on the clearing permit for this environmental value.

Assessment:

According to available databases, approximately 8.33 hectares of the application area scattered across four sections are mapped in the Geomorphic Wetlands SCP datasets (Figure 11). The 8.33 hectare areas are classified as Multiple Use wetlands with the exception of an approximately 0.005 hectare area which is mapped as a Conservation Category wetland. An area of approximately 4.13 hectares has been mapped in Green Growth Plan as High Value Wetlands.

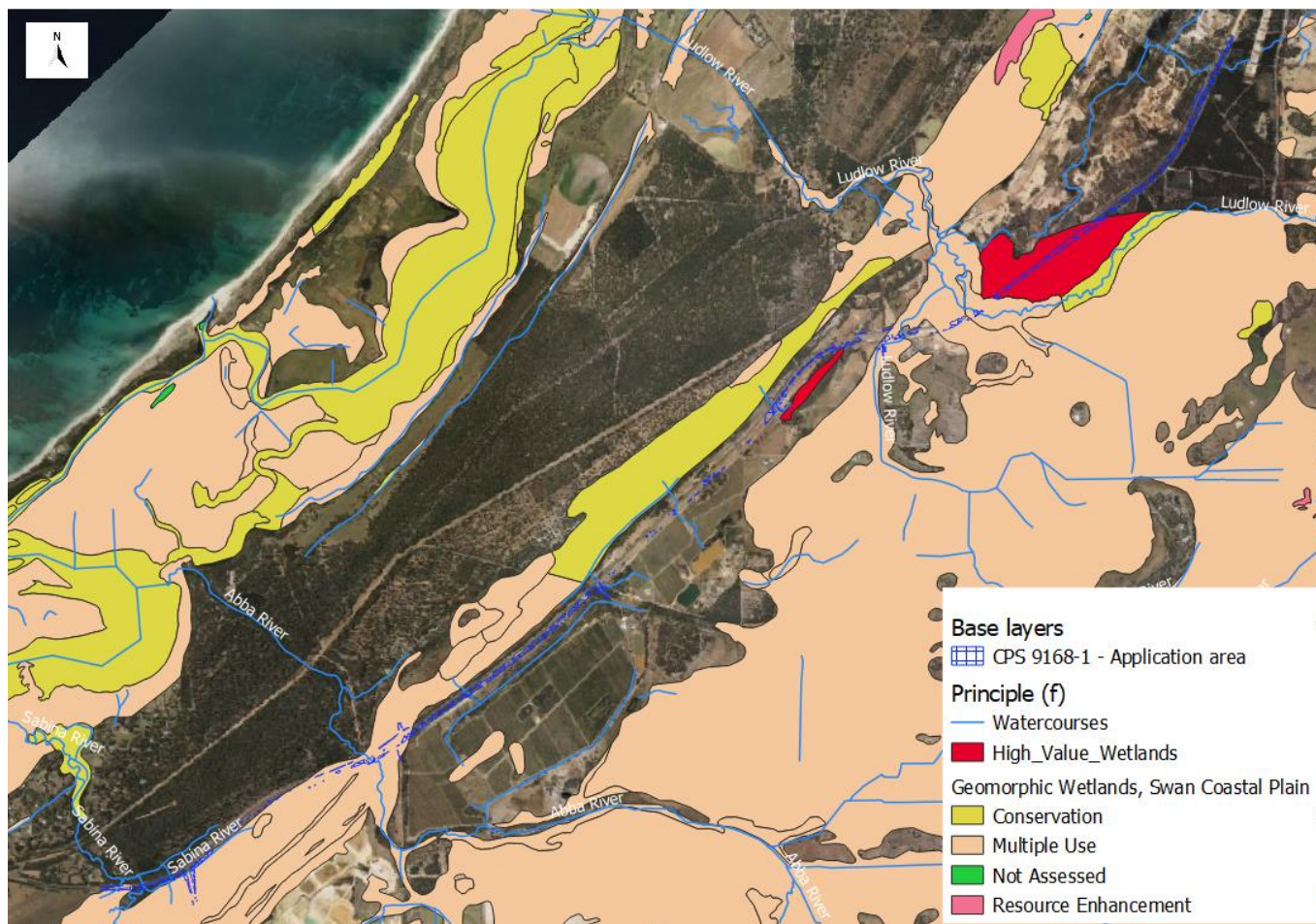


Figure 11 Wetlands and watercourses mapped within the proximity of the application area

Ecoedge (2021b) observed that the areas of mapped Multiple Use wetlands are associated with degraded, mostly cleared landscapes which do not support intact wetland vegetation. Approximately 5.6 hectares of the application area has been mapped as growing in association with wetlands or riparian areas (Ecoedge, 2021b):

- Approximately 5.1 hectares of flooded gum – marri woodland to very open woodland; and
- Approximately 0.5 hectares of melaleuca low open forest.

Department of Parks and Wildlife (DPAW) (2014b) describes Multiple Use wetlands as wetlands with few remaining important attributes and functions. It therefore recommends that use, development and management should be considered in the context of ecologically sustainable development and best management practice catchment planning through landcare (DPAW, 2014b).

The project requires the duplication of the existing carriageway following the alignment of and immediately adjacent to the existing carriageway. MRWA (2020a) advised that the project works will maintain the existing drainage regime through standard engineering design with no change to water flows. The project design incorporates table drains and flat-bottomed swale drains to facilitate infiltration of surface water runoff at source (MRWA, 2020a). Where culverts exist on the existing alignment, these will be duplicated on the new carriageway to maintain existing flow paths.

The application area also transects three ephemeral watercourses (Ludlow, Abba and Sabina Rivers) and a man-made drainage line. The project will require the construction of a bridge at each river crossing. Clear span bridges (removing the requirement for piers within the channel) will be constructed at all three crossings, with footings situated outside of the bed and banks of the channel. Bridge design will ensure drainage from the bridge surface to the roadside table drains. In high rainfall events, overland flows into the rivers may occur, as currently occurs along the existing Bussell Highway (MRWA, 2020a).

Temporary dewatering is likely to be required during the construction of the bridges. If required, and no exemption will apply, a dewatering licence will be obtained prior to the commencement of dewatering activities (MRWA, 2020a).

Where applicable, monitoring of adjacent vegetation will be undertaken during dewatering activities to avoid damage caused by changes to the water table level.

3.2.7. Environmental value: land degradation – Clearing Principles (g)

Assessment:

According to DPIRD's land degradation risk mapping, the soils mapped in the application area are generally considered to present low risk of water erosion, waterlogging, flooding and salinity, and a high risk of wind erosion. However, noting that some of the mapped landforms have light sandy substrates, there is a risk of wind erosion. This may result in appreciable land degradation should the soils remain exposed for an extended period post clearing.

To reduce the risk, MRWA (2020a) has committed to implementing a number of pre-, during and post works measures to mitigate the risk of erosion:

- ensure that recently cleared areas are protected from wind and soil erosion
- minimise exposed soil working surfaces or protect them from stormwater erosion
- stabilise disturbed areas as soon as practicable after construction activities are complete.

MRWA (2020a) further advised that the cleared areas will be covered by a hard-stand of bitumen (road surface), gravel (batters) or revegetation (median and verge) which will prevent any potential for long-term land degradation impacts.

Conditions:

The CEO determined that MRWA will be required to undertake road upgrade activities within three months of the cessation of clearing to reduce the exposure time of sandy soils. The condition imposed on the clearing permit will adequately mitigate the potential impacts of the proposed clearing on the above environmental value.

3.2.8. Environmental value: conservation areas – Clearing Principle (h)

Assessment:

The application area does not occur within conservation areas. Therefore the clearing will not result in direct impacts on them. However, the clearing footprint is adjacent to Coolilup and Ludlow State Forests and Tuart Forest National Park (Figure 12). If not adequately managed, the proposed clearing may indirectly impact these conservation areas through the spread of weeds and dieback. Weed and dieback management practices will assist in mitigating these impacts.

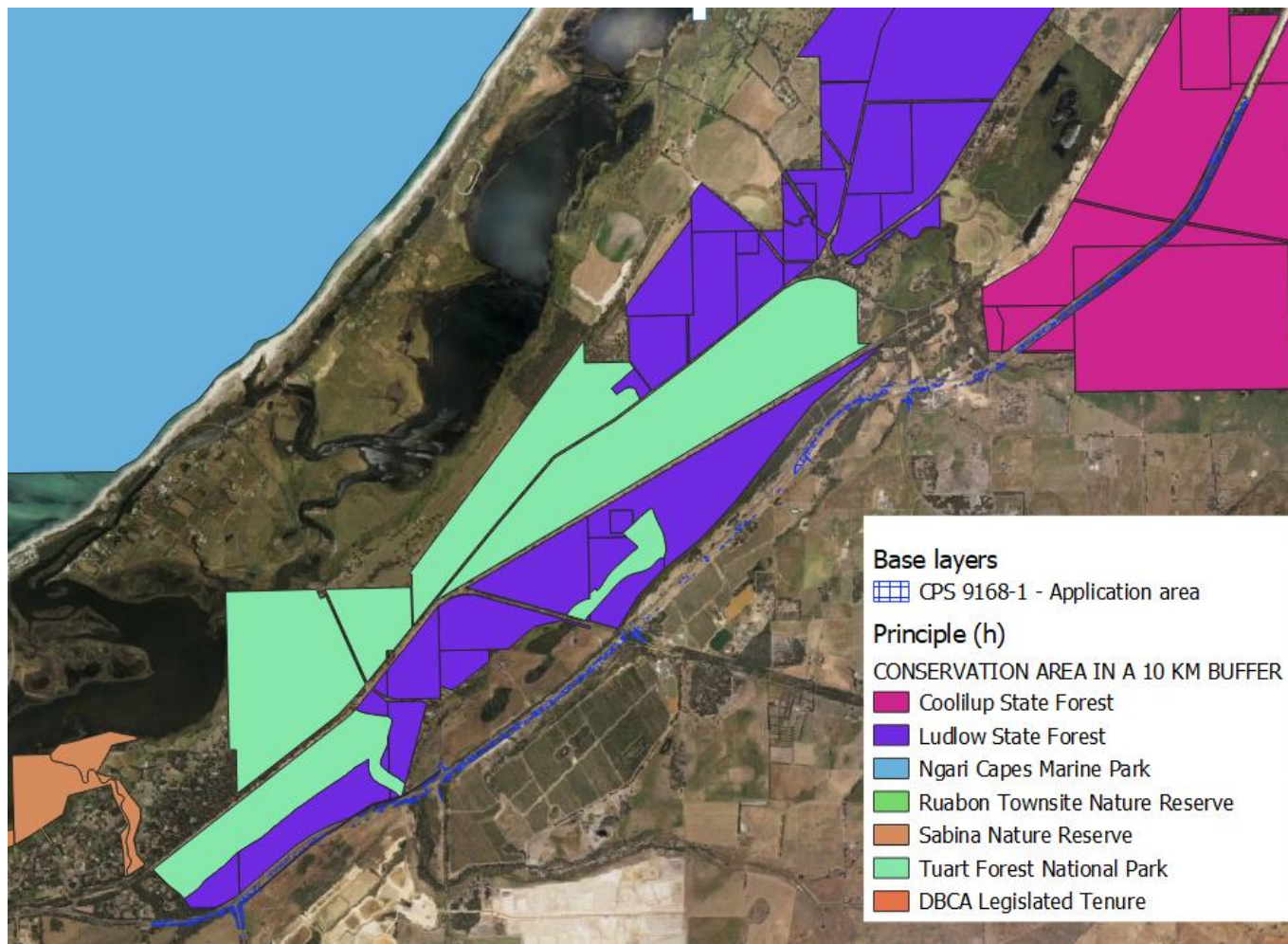


Figure 12 Conservation areas mapped in the proximity of the application area

MRWA advised it will undertake the following measures in line with the EMP to reduce the risk of spreading weeds and dieback (MRWA, 2020a):

- remove or kill any weeds growing in the clearing footprint that are likely to spread and result in environmental harm to adjacent areas of native vegetation
- check that all vehicles and machinery are clean on entry
- treat nominated weed infestations as many times as necessary to control and eradicate the weed species in accordance with the approved weed control program
- ensure that no known weed, pest or disease affected soil, mulch, fill or other material is brought into the project area.

Conditions:

The CEO determined that conditioning the requirement to undertake weed and dieback management will adequately mitigate the potential impacts of the proposed clearing on the above environmental value.

3.2.9. Environmental value: quality of surface and underground water – Clearing Principle (i)

Assessment outcome:

The proposed clearing will result in the loss of 5.6 hectares of riparian vegetation spread across the 124.9 hectare footprint. MRWA proposed a number of measures to mitigate the potential risks to surface and underground water. Noting this, the proposed clearing is not likely to cause deterioration in the quality of surface or underground water.

Conditions:

The CEO determined that no management conditions are required to be imposed on the clearing permit for this environmental value.

Assessment:

Surface water

Ecoedge (2021b) identified 5.6 hectares of vegetation growing in association with wetlands or watercourses within the 124.9 hectare footprint. The application area is not mapped within a proclaimed Surface Water Area but it intersects a manmade drain and three ephemeral watercourses which flow into the Vasse – Wonnerup Ramsar Site System. If not adequately managed, the proposed clearing and project works may increase turbidity and sedimentation of surface water via run-off from clearing areas or during bridge construction works.

MRWA (2020a) advised that the project works will maintain the existing drainage regime through standard engineering design with no anticipated changes to water flows. The project design incorporates table drains and flat-bottomed swale drains to facilitate infiltration of surface water runoff at source (MRWA, 2020a). Where culverts exist on the existing alignment, these will be duplicated on the new carriageway to maintain existing flow paths (MRWA, 2020a).

The project will require the construction of a bridge at three river crossings. Clear span bridges will be constructed at all three crossing, with footings situated outside of the bed and banks of the channel. The construction of bridge foundations (abutments and rock pitching) is likely to be undertaken during summer/autumn months when water levels and flows are low (MRWA, 2020a). Silt curtains will be installed where required during the construction stage to minimise the risk of sedimentation. Hydrocarbon booms will be used down gradient of works to contain and enable mitigation of any potential spills during construction (MRWA, 2020a).

Heavy rainfalls have the potential to mobilise spilled or leaked contaminants such as hydrocarbons and mobilise loose topsoil and sand disturbed during construction. The contamination of surface or underground water will be prevented through the best practice storage of hazardous materials and bunding of hydrocarbon storage and re-fuelling areas to prevent contaminated run-off (MRWA, 2020a). Mobilisation of suspended solids during frequent rainfall events will be managed via the implementation of best management practice techniques, including (MRWA, 2020a):

- incorporation of stormwater management measures into road design, such as temporary detention storage, drop structure and rock lined/pitched drainage channels; and
- implementation of temporary drainage infrastructure during construction to promote sediment fall out and prevent erosion.

The project will double the area over which the existing traffic travels. Existing drainage infrastructure will also be duplicated for the second carriageway which will improve drainage along Bussell Highway (MRWA, 2020a).

Underground water

The application area occurs within the mapped Busselton – Capel Groundwater Area. Groundwater salinity is mapped between 500 - 1000 milligrams per litre total dissolved solids which is considered to be marginal (Mayer, Ruprecht & Bari, 2005). Groundwater was present in the clearing footprint in April 2016 during geotechnical investigation in a number of boreholes, typically 2 to 3 metres below the surface (MRWA, 2020a). These levels were monitored with temporary monitoring wells that were installed over the route. The majority of the drains contain flowing water throughout winter which results in groundwater being typically within one metre of the surface (MRWA, 2020a).

Works in areas prone to flooding and waterlogging in winter will be delayed to the summer months to allow the groundwater to recede. This will allow for effective site remediation, services and culvert installation. Some localised areas may yet require temporary dewatering in summer (MRWA, 2020a).

Dewatering for the construction phase will be of a minor scale and short duration (MRWA, 2020a). Temporary dewatering will be required during bridge construction, which is intended to be undertaken during summer/autumn months when water levels and flows are low. As the rivers, which intersect the application area, are ephemeral, impacts to flows from these rivers into the Vasse–Wonnerup System as a result of dewatering activities at this time of year is not expected (MRWA, 2020a).

Due to the separation distance between the Vasse – Wonnerup System and dewatering activities, no impacts on the System are anticipated (MRWA, 2020a). The project is also unlikely to result into changes to hydrological regimes which could impact the System or the vegetation in the proximity of the application area.

Monitoring for localised dewatering impacts will be conducted where remnant vegetation remains adjacent to dewatering sites, including at the three bridge sites (MRWA, 2020a). Monitoring will include monthly plant health/stress assessments during, and three months post, dewatering activities. Should an impact be observed that is attributable to the dewatering actions, dewatering will be temporarily ceased and an investigation of appropriate mitigation measures will be undertaken (MRWA, 2020a).

The proposed clearing is limited to a total of 27.3 hectares within a linear 124.9 hectare footprint where some adjacent roadside vegetation will be retained. Noting this, as well as the mitigation actions proposed by MRWA, the proposed clearing is not likely to result in deterioration in the quality of groundwater in the form of salinity.

3.3. Relevant planning instruments and other matters

Four Aboriginal sites of significance have been mapped within the application area:

1. Ludlow River (type: Artefacts / Scatter)
2. Abba River (type: Historical, Mythological)
3. Sabina River (type: Historical, Mythological, Other: Pathway); and
4. Sabina River Camp Ground (type: Artefacts / Scatter, Historical, Arch Deposit, Camp).

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.

The proposal was referred to the DAWE for assessment under the EPBC Act in October 2020. DAWE granted Approval EPBC 2020/8800 on 30 June 2021 subject to land acquisition and revegetation offset conditions.

On 8 February 2021, DWER's Geographe Capes District branch advised that (DWER, 2021):

- a) given the rivers crossing the application area are not within a proclaimed surface water area, a permit to interfere with bed and banks is not required.
- b) Given the application area is within a proclaimed groundwater area, MRWA may require licences for dewatering and for taking water for the purpose of road construction. Advice acknowledged that these activities relate to actual road construction and not the clearing of native vegetation.

On 7 January 2021, in accordance with section 51E(4)(b) of the EP Act, comments on the application were sought from Shire of Capel, City of Busselton and Capel LCDC. No comments were received from the local governments. A summary of the Capel LCDC's comments and DWER's response to them is in Table 6.

Table 6 A summary of the Capel LCDC's submission (Capel LCDC, 2021)

Summary of comments	Consideration of comment
The Capel LCDC acknowledged the importance of the project but also recognised the need to conserve flora and fauna.	The impacts of the proposed clearing on flora and fauna were considered under Clearing Principles (a), (b) and (c). The CEO, based on advice from DBCA, determined that the proposed clearing will not impact the conservation status of Priority flora impacted by the clearing.
It further noted that the application area includes vegetated areas in good condition which contain Priority flora and are used by WRP and black cockatoos.	The assessment identified that the proposed clearing will impact on significant habitat for WRP and critical habitat for black cockatoos. An offset strategy has been developed to ensure that the clearing will not result in long-term impacts on these species.
Vegetation in good condition should be retained.	MRWA implemented a number of avoidance and minimisation measures as described in Section 3.1 of this report.

Summary of comments	Consideration of comment
Offset in degraded areas adjoining forest should be implemented	DWER determined that the impacts of the proposed clearing can be adequately addressed through the rehabilitation of approximately 60.26 hectares of Ludlow State Forest No. 2 which is adjacent to the application area, along with an acquisition of a property which contains habitat for WRP.
Capel LCDC expressed concerns about the amount of large scale road widening projects being undertaken in Western Australia.	<p>Cumulative impacts in the local area were assessed under Clearing Principle (e). The assessment identified that the proposed clearing will result in the loss on native vegetation considered significant in an area which has been extensively cleared.</p> <p>The assessment has also considered the ongoing, cumulative impacts in the region, e.g.; from MRWA's Bunbury Outer Ring Road Northern and Central Sections projects (approved), MRWA's Bunbury Outer Ring Road Southern Section proposal (under assessment) and Rawling Road Pty Ltd's cold storage and distribution centre proposal (under assessment).</p> <p>The CEO determined that the cumulative impacts can be adequately addressed through a revegetation of approximately 60.26 hectares of Ludlow State Forest No. 2. The implementation of the strategy will result in a net gain of vegetation in the local area.</p>

Stakeholder engagement

MRWA developed an internal Community and Stakeholder Engagement Strategy (CSES) which outlines the project objectives, potential issues and mitigation and the engagement and communication requirements for the proposal. It engaged a Stakeholder Engagement Manager for the project. The CSES also includes a communication action plan (MRWA, 2021e).

Since February 2020, MRWA has used a range of communication tools, such as phone, email, radio, website, social media and face-to-face briefings to communicate the project with the community, landowners, road users, industry, government and other stakeholders.

The community consultation identified significant community support for the project, which can be attributed to the need for safety improvements and current travel delays experienced during holiday times and long weekends (MRWA, 2021f).

Both the Shire of Capel and the City of Busselton support the Proposal (MRWA, 2021e). A workshop to discuss the Proposal with local government authorities was held on 4 August 2016 to obtain local knowledge and feedback regarding material sourcing, stakeholders and the environment. Both local government authorities will continue to be engaged prior to and during construction (MRWA, 2021e).

Consultation with DAWE occurred during DAWE's annual Main Roads site visit on 25 May 2018, which was also attended by a DWER representative.

Consultation with DBCA has been ongoing throughout the project planning and will continue during construction (MRWA, 2021e).

Traditional owners been engaged with through the Section 18 process under the *Aboriginal Heritage Act 1972*.

MRWA has also engaged with the Capel LCDC to address its concerns as provided to DWER (see Table 6 above) (MRWA, 2021e).

4 Suitability of offsets

Through the detailed assessment outlined in Section 3.2 above, the CEO has determined that the following SRIs remain after the application of the avoidance and mitigation measures summarised in Section 3.1:

- Loss of 27.3 hectares of native vegetation which is significant as a remnant of native vegetation in an area that has been extensively cleared
- Loss of 24 hectares of significant habitat for WRP
- Loss of 20.8 hectares of critical habitat for black cockatoos
- Loss of two hectares of native vegetation which represents the Tuart Woodland TEC.

To address the above residual impacts, MRWA has submitted environmental offsets comprising of:

- a) Rehabilitation of 60.26 hectares of native vegetation in a degraded (Keighery, 1994) condition within Ludlow State Forest No. 2 (Figure 13); of which:
- 60.26 hectares must provide habitat for WRP
 - 47.51 hectares must provide habitat for black cockatoos
 - 8.95 hectares must represent the Tuart Woodland TEC at the completion of the rehabilitation activities.

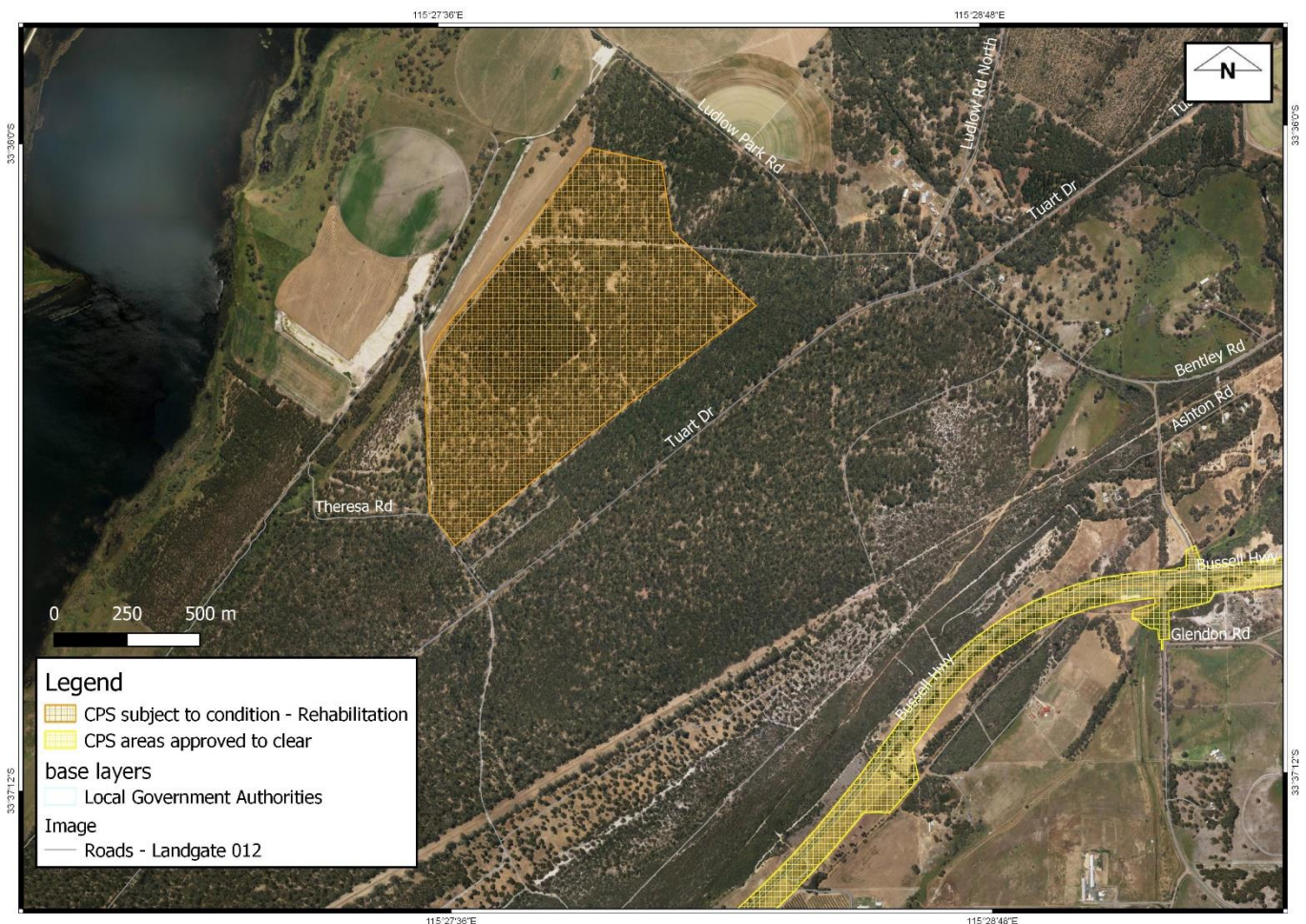


Figure 13 The area cross-hatched orange indicates the area within which a rehabilitation of 60.26 hectares must occur

Ludlow State Forest No. 2 is a proposed addition to Tuart Forest National Park. The addition reflects tenure recommendations in the Forest Management Plan 2014 – 2023 and the long-term intention to transfer all of Ludlow State Forest No. 2 to Tuart Forest National Park and rehabilitate with tuart following harvesting of plantation timber (DPaW, 2014). The vegetation within the rehabilitation areas currently provides habitat values for WRP and black cockatoo as it contains isolated scattered Tuart, Peppermint and Marri, with a mid-storey of scattered Acacia and Bull Banksia, and an understorey of weed species with isolated patches of sedge and rushes (MRWA, 2021c). The rehabilitation will:

- Be supported by a comprehensive rehabilitation plan, outlining rehabilitation activities, including completion criteria based on nearby reference sites

- restore habitat for WRP and black cockatoos, vegetation which represents the Tuart Woodland TEC and is considered significant in an extensively cleared landscape; and
 - address:
 - 100 percent of significant residual impacts on black cockatoos, significant remnant vegetation and the Tuart Woodland TEC
 - approximately 61.99 percent of significant residual impacts of the proposed clearing on WRP.
- b) Acquisition of approximately 11.86 hectares of native vegetation at Lot 201 West Boundary Road, Manjimup, for inclusion to adjacent Faunadale Nature Reserve (R 15762) (Figure 14). According to Reconnaissance flora and vegetation and targeted fauna survey, the property contains vegetation structure in good to very good (Keighery, 1994) condition consisting of a tree layer containing *Corymbia calophylla* (marri) and *Eucalyptus marginata* (jarrah) of various ages with a sparse, yet relatively diverse mid and understorey (Bio Diverse Solutions, 2020). The acquisition will:
- Provide 11.86 hectares of high quality habitat and ecological linkage values for WRP
 - Address 38.01 percent of SRIs of the proposed clearing on WRP.

The CEO also noted that the acquisition will also provide high quality habitat for black cockatoo, including nesting habitat in the form of suitably sized hollows with recent evidence of use (Bio Diverse Solutions, 2020).

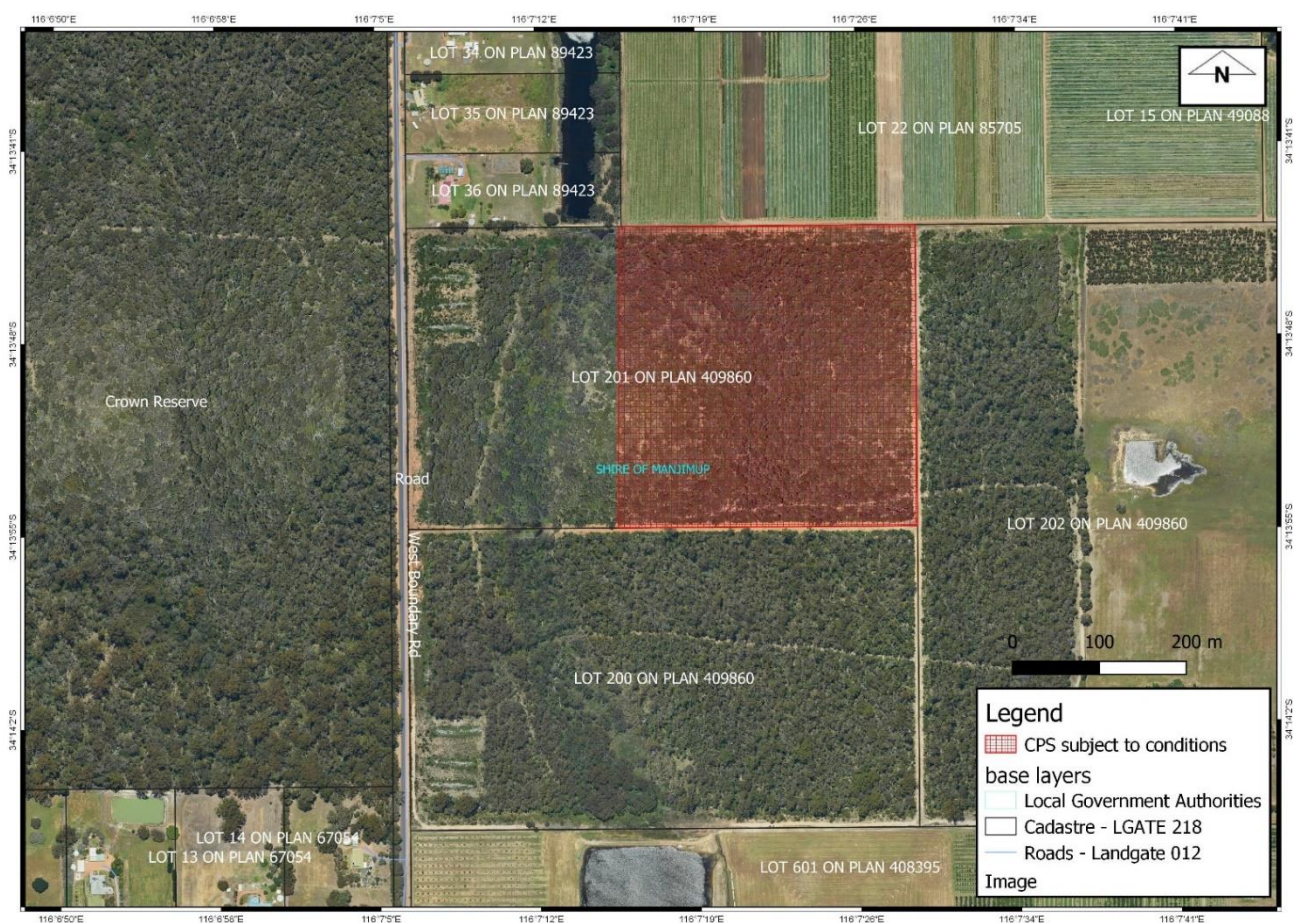


Figure 14 Acquisition offset - Lot 201 West Boundary Road, Manjimup

The CEO considered that the rehabilitation within Ludlow State Forest No. 2, which would result in a net increase of vegetation in the locality of the application area, would directly address the long-term impacts to the local SCP WRP population and was therefore appropriate to counterbalance the majority (68 percent) of the impacts to this species. The CEO noted that the acquisition of WRP habitat in Manjimup is in a different WRP management zone and bioregion to the population impacted, and considered that it was therefore appropriate for this land acquisition to counterbalance only a portion (32 percent) of the impacts to this species.

In assessing whether the proposed offset is adequately proportionate to the significance of the environmental values being impacted, DWER undertook a calculation using the Commonwealth Offsets Calculator. The calculator indicated that the above offset strategy will address 100 percent of the SRI of the proposed clearing and is consistent

with the WA Environmental Offsets Policy September 2011. The justification for the values used in the offset calculation is provided in Appendix F.

Noting that Lot 201 contains approximately 18 hectares of native vegetation and only 11.86 hectares is required for the project, the remaining balance of the property (approximately 6.14 hectares) will be used as a 'banked offset'. This offset can be used to satisfy future offset requirements approved through clearing permit conditions. The details of the offset will be updated in the WA Offsets Register.

MRWA also noted it had acquired Lot 200 on Plan 409860 for the addition to conservation areas, that contains the same values as Lot 201 which is also proposed to be used as a 'banked offset' (MRWA, 2021d). The CEO acknowledges the values of Lot 200 and accepts that Lot 200 may be used as a banked offset.

Appendix A - List of properties

Property	PIN	Locality
Lot 53 on Plan 19312	11422129, 11422128	Yalyalup
Lot 3819 on Plan 410411	12267364	Yalyalup
Lot 500 on Plan 19312	11947243	Yalyalup
Lot 4354 on Plan 209044 (Crown Reserve R 27534)	534514	Yalyalup
Bussell Highway Road reserve	1247124	Yalyalup
Lot 5193 on Plan 21119, Sues Road reserve	11429547	Yalyalup
Lot 5193 on Plan 21119	11429548	Yalyalup
Un-named road	11507305	Ruabon
Sues Road reserve	11380878, 11380823, 11380822	Yalyalup
Lot 100 on Plan 65306	11849853	Yalyalup
Lot 501 on Plan 19312	11947244	Yalyalup
Lot 4411 on Plan 213198	534525	Yalyalup
Lot 52 ON Plan 19311	11425078, 11425079	Yalyalup
Lot 4626 on Plan 47033 (Crown reserve R 33734)	534536	Yalyalup
Bussell Highway Road Reserve	11380879	Yalyalup
Layman Road reserve	11507303	Yalyalup/Ruabon
Wannerup South Road	11380879	Yalyalup/Ruabon
Lot 51 on Plan 19311	11425077	Ruabon
Lot 50 on Plan 19311	11425080	Ruabon
Ruabon Road reserve	11551801, 11507306, 11507327	Ruabon/Ludlow
Lot 114 on Plan 236759	11765105	Ruabon/Ludlow
Lot 51 on Plan 18910	11414648	Ruabon/Ludlow
Lot 21 on Plan 402137	12102506	Ludlow
Lot 52 on Plan 18910	11414649	Ludlow
Lot 51 on Plan 18909	11416794, 1416798	Ludlow
Lot 12 on Plan 22029	1200431	Ludlow
Lot 52 on Plan 18909	11416793	Ludlow
Lot 53 on Plan 18909	11416797	Ludlow
Ludlow-Hithergreen Road reserve	11551805	Ludlow
Lot 103 on Plan 49023	11520166	Ludlow
Lot 54 on Plan 18909	11416796	Ludlow
Lot 55 on Plan 18909	11416795	Ludlow
Lot 56 on Plan 18908	11567174	Ludlow
Lot 300 on Plan 18908	11947202	Ludlow
Lot 301 on Plan 18908	11947201	Ludlow
Lot 303 on Plan 18908	11947199	Ludlow
Lot 304 on Plan 18908	11947198	Ludlow
Lot 302 on Plan 18908	11947200	Ludlow

Appendix B - Site characteristics

B.1. Site characteristics

Characteristic	Details																					
Local context	<p>The application area is mapped within SCP IBRA bioregion in the intensive land use zone of Western Australia.</p> <p>The clearing footprint contains approximately 38.9 hectares of native vegetation, of which 27.3 is proposed to be cleared. It is surrounded by a landscape that has been extensively cleared.</p> <p>The current surrounding land uses are vested as both private and public lands. The Tuart Forest National Park lies to the west, while lands on the east side of the application area are used for agricultural, horticultural, forestry and/or industrial purposes.</p> <p>Spatial data indicate the local area (the 10-kilometre radius of the application area), which is equal to approximately 45,003 hectares (excluding the ocean) retains approximately 16.35 percent (approximately 7,356 hectares) of the original native vegetation cover. The majority (approximately 88 percent) of the remnant areas are less than 5 hectares.</p>																					
Ecological linkage	<p>The application area is intersected at three locations by South West Regional Ecological Linkages (axis IDs 36, 75 and 78).</p>																					
Conservation areas	<p>Approximately 20 percent of the local area (approximately 11,386 ha) occurs within DBCA managed lands. This includes approximately 7,356 hectares of Ngari Capes Marine Park (Class A).</p> <p>The application area is not located in mapped conservation areas, but some portions of it are adjacent to Coolilup and State Forest and Tuart Forest National Park (Class A).</p>																					
Vegetation description	<p>The application area is mapped within the SCP vegetation complexes described in Table 7.</p> <p>Table 7 SCP vegetation complexes mapped in the application area</p> <table><tr><th>SCP vegetation complex</th><th>Description (Hedde et al, 1980)</th><th>Area (ha)</th></tr><tr><td>Abba Complex</td><td>A mixture of open forest of <i>Corymbia calophylla</i> (Marri) - <i>Eucalyptus marginata</i> (Jarrah) - Banksia species and woodland of <i>Corymbia calophylla</i> (Marri) with minor occurrences of <i>Corymbia haematoxylon</i> (Mountain Marri). Woodland of <i>Eucalyptus rudis</i> (Flooded Gum) - Melaleuca species along creeks and on flood plains.</td><td>1.4</td></tr><tr><td>Cokelup complex</td><td>Closed-scrub/woodland of Melaleuca species over sedges and annually renewed herbs on inundated clay flats. Fringing open forest of <i>Eucalyptus rudis</i>, <i>Corymbia calophylla</i>, <i>Banksia littoralis</i>, <i>E.gomphocephala</i>.</td><td>2.3</td></tr><tr><td>Karrakatta Complex-Central and South</td><td>Predominantly open forest of <i>Eucalyptus gomphocephala</i> (Tuart) - <i>Eucalyptus marginata</i> (Jarrah) - <i>Corymbia calophylla</i> (Marri) and woodland of <i>Eucalyptus marginata</i> (Jarrah) - Banksia species. <i>Agonis flexuosa</i> (Peppermint) is co-dominant south of the Capel River.</td><td>2.0</td></tr><tr><td>Southern River Complex</td><td>Open woodland of <i>Corymbia calophylla</i> (Marri) - <i>Eucalyptus marginata</i> (Jarrah) - Banksia species with fringing woodland of <i>Eucalyptus rudis</i> (Flooded Gum) - <i>Melaleuca raphiophylla</i> (Swamp Paperbark) along creek beds.</td><td>21.3</td></tr><tr><td>Yoongarillup Complex</td><td>Woodland to tall woodland of <i>Eucalyptus gomphocephala</i> (Tuart) with <i>Agonis flexuosa</i> in the second storey. Less consistently an open forest of <i>Eucalyptus gomphocephala</i> (Tuart) - <i>Eucalyptus marginata</i> (Jarrah) - <i>Corymbia calophylla</i> (Marri). South of Bunbury is characterised by <i>Eucalyptus rudis</i> (Flooded Gum) – Melaleuca species open forests.</td><td>0.3</td></tr><tr><td>Total (ha)</td><td></td><td>27.3</td></tr></table> <p>According to MRWA (2020a), much of the vegetation in the application area comprises of a mixture of planted native, non-native and/or regrowth vegetation established as part of landscaping for the existing highway or historic mine sites rehabilitation. Therefore, the vegetation does not represent the mapped SCP vegetation complexes described in Table 7.</p>	SCP vegetation complex	Description (Hedde et al, 1980)	Area (ha)	Abba Complex	A mixture of open forest of <i>Corymbia calophylla</i> (Marri) - <i>Eucalyptus marginata</i> (Jarrah) - Banksia species and woodland of <i>Corymbia calophylla</i> (Marri) with minor occurrences of <i>Corymbia haematoxylon</i> (Mountain Marri). Woodland of <i>Eucalyptus rudis</i> (Flooded Gum) - Melaleuca species along creeks and on flood plains.	1.4	Cokelup complex	Closed-scrub/woodland of Melaleuca species over sedges and annually renewed herbs on inundated clay flats. Fringing open forest of <i>Eucalyptus rudis</i> , <i>Corymbia calophylla</i> , <i>Banksia littoralis</i> , <i>E.gomphocephala</i> .	2.3	Karrakatta Complex-Central and South	Predominantly open forest of <i>Eucalyptus gomphocephala</i> (Tuart) - <i>Eucalyptus marginata</i> (Jarrah) - <i>Corymbia calophylla</i> (Marri) and woodland of <i>Eucalyptus marginata</i> (Jarrah) - Banksia species. <i>Agonis flexuosa</i> (Peppermint) is co-dominant south of the Capel River.	2.0	Southern River Complex	Open woodland of <i>Corymbia calophylla</i> (Marri) - <i>Eucalyptus marginata</i> (Jarrah) - Banksia species with fringing woodland of <i>Eucalyptus rudis</i> (Flooded Gum) - <i>Melaleuca raphiophylla</i> (Swamp Paperbark) along creek beds.	21.3	Yoongarillup Complex	Woodland to tall woodland of <i>Eucalyptus gomphocephala</i> (Tuart) with <i>Agonis flexuosa</i> in the second storey. Less consistently an open forest of <i>Eucalyptus gomphocephala</i> (Tuart) - <i>Eucalyptus marginata</i> (Jarrah) - <i>Corymbia calophylla</i> (Marri). South of Bunbury is characterised by <i>Eucalyptus rudis</i> (Flooded Gum) – Melaleuca species open forests.	0.3	Total (ha)		27.3
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Karrakatta Complex-Central and South	Predominantly open forest of <i>Eucalyptus gomphocephala</i> (Tuart) - <i>Eucalyptus marginata</i> (Jarrah) - <i>Corymbia calophylla</i> (Marri) and woodland of <i>Eucalyptus marginata</i> (Jarrah) - Banksia species. <i>Agonis flexuosa</i> (Peppermint) is co-dominant south of the Capel River.	2.0																				
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Characteristic	Details																																																										
	<p>The Flora survey (Ecoedge, 2021b) indicates the vegetation within the proposed clearing area consists of the vegetation units described in Table 8. The full vegetation unit description is in Appendix H.</p> <p>Table 8 Vegetation units in the application area (Ecoedge, 2021b)</p> <table><tr><th>Veg Unit</th><th>Veg sub-unit</th><th>Name</th><th>Extent (ha)</th></tr><tr><td rowspan="2">A</td><td>A1</td><td>Peppermint – tuart woodland</td><td>2.721</td></tr><tr><td>A2</td><td>Yate – tuart – peppermint woodland</td><td>0.807</td></tr><tr><td>B</td><td></td><td>Flooded gum - marri woodland to very open woodland</td><td>6.159</td></tr><tr><td>C</td><td></td><td>Marri woodland</td><td>2.454</td></tr><tr><td rowspan="2">D</td><td>D1</td><td>*<i>Acacia</i> spp., <i>Kunzea glabrescens</i> tall shrubland/tall open shrubland/tall sparse shrubland</td><td>7.482</td></tr><tr><td>D2</td><td><i>Kunzea glabrescens</i>-<i>Jacksonia furcellata</i> tall shrubland/open shrubland.</td><td>8.931</td></tr><tr><td rowspan="5">E</td><td>E1</td><td>Marri – jarrah – Nuytsia open forest</td><td>1.905</td></tr><tr><td>E2</td><td>Marri – jarrah open forest</td><td>4.484</td></tr><tr><td>E2a</td><td>Tuart – marri – jarrah open forest</td><td>0.008</td></tr><tr><td>E3</td><td>Peppermint woodland</td><td>2.295</td></tr><tr><td>E4</td><td>Marri – bulk banksia open forest</td><td>0.827</td></tr><tr><td>F</td><td></td><td>Melaleuca low open forest</td><td>0.878</td></tr><tr><td>G</td><td></td><td>Revegetated <i>Eucalyptus gomphocephala</i> open forest</td><td>0.044</td></tr><tr><td>H</td><td></td><td></td><td>0.084</td></tr><tr><td></td><td></td><td></td><td>39.079</td></tr></table>	Veg Unit	Veg sub-unit	Name	Extent (ha)	A	A1	Peppermint – tuart woodland	2.721	A2	Yate – tuart – peppermint woodland	0.807	B		Flooded gum - marri woodland to very open woodland	6.159	C		Marri woodland	2.454	D	D1	* <i>Acacia</i> spp., <i>Kunzea glabrescens</i> tall shrubland/tall open shrubland/tall sparse shrubland	7.482	D2	<i>Kunzea glabrescens</i> - <i>Jacksonia furcellata</i> tall shrubland/open shrubland.	8.931	E	E1	Marri – jarrah – Nuytsia open forest	1.905	E2	Marri – jarrah open forest	4.484	E2a	Tuart – marri – jarrah open forest	0.008	E3	Peppermint woodland	2.295	E4	Marri – bulk banksia open forest	0.827	F		Melaleuca low open forest	0.878	G		Revegetated <i>Eucalyptus gomphocephala</i> open forest	0.044	H			0.084				39.079
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Vegetation condition	<p>The Flora survey (Ecoedge, 2021b) indicates the vegetation within the application area ranges from very good (Keighery, 1994) to completely degraded (Keighery, 1994) condition (Table 9).</p> <p>Table 9 Vegetation condition in the application area</p> <table><tr><th>SCP vegetation complex</th><th>Vegetation condition</th><th>Very good (Keighery, 1994) (ha)</th><th>Good (Keighery, 1994) (ha)</th><th>Degraded (Keighery, 1994) (ha)</th><th>Completely degraded (Keighery, 1994) (ha)</th><th>Total (ha)</th></tr><tr><td><i>Abba Complex</i></td><td></td><td></td><td>0.1</td><td>0.7</td><td>0.5</td><td>1.4</td></tr><tr><td><i>Cokelup complex</i></td><td></td><td></td><td>0.8</td><td>1.0</td><td>0.5</td><td>2.3</td></tr><tr><td><i>Karrakatta Complex-Central and South</i></td><td></td><td></td><td></td><td>0.2</td><td>1.8</td><td>2.0</td></tr><tr><td><i>Southern River Complex</i></td><td></td><td>1.1</td><td>4.8</td><td>14.3</td><td>1.2</td><td>21.3</td></tr><tr><td><i>Yoongarillup Complex</i></td><td></td><td></td><td></td><td></td><td>0.3</td><td>0.3</td></tr><tr><td>Total (ha)</td><td></td><td>1.1</td><td>5.9</td><td>16.2</td><td>4.3</td><td>27.3</td></tr></table> <p>The full Keighery (1994) condition rating scale is provided in Appendix D.</p>	SCP vegetation complex	Vegetation condition	Very good (Keighery, 1994) (ha)	Good (Keighery, 1994) (ha)	Degraded (Keighery, 1994) (ha)	Completely degraded (Keighery, 1994) (ha)	Total (ha)	<i>Abba Complex</i>			0.1	0.7	0.5	1.4	<i>Cokelup complex</i>			0.8	1.0	0.5	2.3	<i>Karrakatta Complex-Central and South</i>				0.2	1.8	2.0	<i>Southern River Complex</i>		1.1	4.8	14.3	1.2	21.3	<i>Yoongarillup Complex</i>					0.3	0.3	Total (ha)		1.1	5.9	16.2	4.3	27.3									
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Total (ha)		1.1	5.9	16.2	4.3	27.3																																																					
Climate, landform and topography	<p>Rainfall: 800 millimetres Evapotranspiration: 1,600 millimetres Groundwater Salinity (Total Dissolved Solids): 500-1000 milligrams per litre total dissolved solids</p> <p>The topography of the clearing footprint is flat. Ecoedge (2019) described the relief of it as falling from 20 metres above sea level in the northeast end of the footprint to 10 metres in the southwest end.</p>																																																										
Soil description	<p>The soils within the application area are mapped (Department of Primary Industries and Regional Development (DPIRD), 2021) as the subsystems described in Table 10.</p> <p>Table 104 Soils subsystems mapped within the application area (DPIRD, 2021)</p> <table><tr><th>Name</th><th>Brief description (Schoknecht et al., 2004)</th></tr><tr><td>Bassendean unmapped land, mine Phase</td><td>Mine, disturbed land.</td></tr><tr><td>Bassendean B1b Phase</td><td>Very low relief dunes of undulating sand plain with deep bleached grey sandy A2 horizons and pale yellow B horizons.</td></tr></table>	Name	Brief description (Schoknecht et al., 2004)	Bassendean unmapped land, mine Phase	Mine, disturbed land.	Bassendean B1b Phase	Very low relief dunes of undulating sand plain with deep bleached grey sandy A2 horizons and pale yellow B horizons.																																																				
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Characteristic	Details
	Sw - Swamp (Bassendean) Swamp.
	Bassendean B5 Phase Shallowly incised stream channels of minor creeks and rivers with deep grey siliceous sands or bleached sands, underlain at depths generally greater than 1.5 m by clay or less frequently a strong iron-organic hardpan.
	Abba wet vales Phase Small narrow swampy depressions along drainage lines. Alluvial soils.
	Bassendean Golf Course deep sandy rises Phase Gently sloping low dunes and rises (0-5 percent gradients) with deep bleached sands.
	Cokelup wet clayey flats Phase Poorly drained flats with heavy clayey (Cokelup) soils. Some areas saline in summer.
	Ludlow vales Phase Narrow floodplains in small depressions along creeks and rivers. Sandy alluvial soils.
	Ludlow flats Phase Flats and very low dunes. Deep yellow brown siliceous sands over limestone (i.e. Spearwood Sands).
	Ludlow wet flats Phase Flats with poor subsoil drainage in winter. Deep yellow brown siliceous sands over limestone (i.e. Spearwood Sands).
Land degradation risk	<p>The majority of the mapped soils within the application area has an increased risk of acidification, subsurface compaction and microbial purification.</p> <p>Portions of the application area have also medium or high risk of water repellance, water storage, flood, site drainage, waterlogging and phosphorus loss risk.</p> <p>The land degradations risks for all of the mapped soil subsystems is described in Appendix E.</p>
Waterbodies	<p>The application area intersects the following watercourses:</p> <ul style="list-style-type: none"> • Ludlow River (major river, perennial) • Abba River (minor river, nonperennial) • Sabina River (minor river, nonperennial) • Manmade drain (ID 8732, 8737, 8738, 4898). <p>The application area is also mapped within the following wetlands:</p> <ul style="list-style-type: none"> • Unknown multiple use palusplain (ID 814) • Unknown multiple use palusplain (ID 9589) • Unknown multiple use floodplain (ID 8386) • Unknown conservation palusplain (ID 2451). <p>A number of other watercourses and geomorphic wetlands of the SCP occur in the local area, including a conservation category, Ramsar-listed Vasse-Wonnerup Wetland System mapped approximately 500 metres northwest of the southern end of the application area.</p>
Hydrogeography	<p>According to available databases, the application area:</p> <ul style="list-style-type: none"> • is not mapped within any proclaimed surface water area • is mapped within a proclaimed Busselton-Capel Groundwater Area.
Flora	<p>According to available databases, 19 flora species listed as threatened under the BC Act and 44 Priority listed flora by DBCA have been recorded within the local area.</p> <p>Based on the similarities shared between the soil and vegetation types in habitats for these flora taxa and within the application area, it was determined that eight threatened and 36 Priority flora species (Appendix B.2) may occur within the application area.</p> <p>Of these, the Flora survey (Ecoedge, 2020) identified the following species within the application area:</p> <ul style="list-style-type: none"> • <i>Acacia flagelliformis</i> (Priority 4) • <i>Eucalyptus rudis</i> subsp. <i>cratyantha</i> (Priority 4) • <i>Synaphea hians</i> (Priority 3) • <i>Synaphea petiolaris</i> subsp. <i>simplex</i> (Priority 3) • <i>Verticordia attenuata</i> (Priority 3)

Characteristic	Details
Ecological communities	<p>According to available databases, seven and nine state listed TECs and PEC's are mapped within the local area, respectively.</p> <p>Of these, three priority and one TEC were considered likely to occur within the application area (Appendix B.4).</p>
Fauna	<p>According to available databases, 65 conservation significant fauna species have been recorded within the local area (DBCA, 2007).</p> <p>Given the boundary of the local area overlaps ocean, a number of the recorded species are exclusively associated with marine, estuarine or freshwater habitats that do not occur within the application area.</p> <p>Noting the habitat requirements, distribution of the recorded species, the mapped vegetation type, the condition of the vegetation within the application area, as well as the findings of the fauna surveys (360 Environmental, 2017), it was considered that the application area is likely to comprise suitable habitat for (Appendix B.3):</p> <ul style="list-style-type: none"> • Baudin's cockatoo (Endangered) • Carnaby's cockatoo (Endangered) • Carter's freshwater mussel (Vulnerable) • Forest red-tailed black cockatoo (Vulnerable) • Peregrine falcon (Other specially protected fauna) • Quenda, southwestern brown bandicoot (Priority 4) • South-western brush-tailed phascogale, wambenger (Conservation dependant fauna) • Water rat, rakali (Priority 4) • Western brush wallaby (Priority 4) • Western ringtail possum, ngwayir (Critically Endangered)

B.2. Flora analysis table

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

Species name	Conservation status	Suitable habitat features	Suitable vegetation type	Suitable soil type	Distance of closest record to application area (m)	Number of known records (total)	Are surveys adequate to identify
<i>Acacia flagelliformis</i>	4	Yes	Yes	Yes	858	13	Y
<i>Acacia semitrullata</i>	4	Yes	Yes	Yes	2,405	25	Y
<i>Adelphacme minima</i>	3	Yes	Yes	Yes	3,945	7	Y
<i>Amperea micrantha</i>	2	Yes	Yes	Yes	2,838	5	Y
<i>Aponogeton hexatepalus</i>	4	Yes	Yes	Yes	452	71	Y
<i>Banksia nivea</i> subsp. <i>uliginosa</i>	T	Yes	Yes	Yes	3,523	34	Y
<i>Blennospora doliiformis</i>	3	Yes	Yes	Yes	1,224	12	Y
<i>Boronia anceps</i>	3	Yes	Yes	Yes	3,562	15	Y
<i>Caladenia huegelii</i>	T	Yes	Yes	Yes	3,474	105	Y
<i>Caladenia procera</i>	T	Yes	Yes	Yes	6,807	22	Y
<i>Caladenia speciosa</i>	4	Yes	Yes	Yes	2,823	32	Y
<i>Calothamnus quadrifidus</i> subsp. <i>teretifolius</i>	4	Yes	Yes	Yes	5,247	28	Y
<i>Calytrix retrorsifolia</i>	1	Yes	Yes	Yes	5,464	8	Y
<i>Cardamine paucijuga</i>	2	Yes	Yes	Yes	525	5	Y
<i>Chamelaucium erythrochlorum</i>	4	Yes	Yes	Yes	7,163	14	Y
<i>Drakaea elastica</i>	T	Yes	Yes	Yes	1,679	80	Y
<i>Eryngium</i> sp. <i>Ferox</i> (G.J. Keighery 16034)	3	Yes	Yes	Yes	842	8	Y
<i>Eryngium</i> sp. <i>Subdecumbens</i> (G.J. Keighery 5390)	3	Yes	Yes	Yes	3,883	4	Y
<i>Eucalyptus rudis</i> subsp. <i>cratyantha</i>	4	Yes	Yes	Yes	425	5	Y
<i>Gastrolobium</i> sp. <i>Yoongarillup</i> (S. Dilkes s.n. 1/9/1969)	1	Yes	Yes	Yes	7,203	4	Y
<i>Grevillea brachystylis</i> subsp. <i>brachystylis</i>	3	Yes	Yes	Yes	3,627	17	Y
<i>Grevillea elongata</i>	T	Yes	Yes	Yes	5,458	18	Y
<i>Isopogon formosus</i> subsp. <i>dasylepis</i>	3	Yes	Yes	Yes	6,515	12	Y
<i>Jacksonia gracillima</i>	3	Yes	Yes	Yes	5,207	1	Y
<i>Johnsonia inconspicua</i>	3	Yes	Yes	Yes	7,038	13	Y
<i>Lasiopetalum membranaceum</i>	3	Yes	Yes	Yes	849	38	Y
<i>Lepyrodia heleocharoides</i>	3	Yes	Yes	Yes	8,926	7	Y
<i>Loxocarya magna</i>	3	Yes	Yes	Yes	9,926	9	Y
<i>Montia australasica</i>	2	Yes	Yes	Yes	1,303	5	Y
<i>Ornduffia submersa</i>	4	Yes	Yes	Yes	437	28	Y
<i>Schoenus benthamii</i>	3	Yes	Yes	Yes	8,787	8	Y
<i>Schoenus loliaceus</i>	2	Yes	Yes	Yes	1,526	2	Y

Species name	Conservation status	Suitable habitat features	Suitable vegetation type	Suitable soil type	Distance closest record application area (m)	Number of known records (total)	Are surveys adequate to identify
<i>Schoenus natans</i>	4	Yes	Yes	Yes	452	11	Y
<i>Schoenus pennisetis</i>	3	Yes	Yes	Yes	4,226	9	Y
<i>Stylidium longitubum</i>	4	Yes	Yes	Yes	557	24	Y
<i>Synaphea hians</i>	3	Yes	Yes	Yes	3,752	3	Y
<i>Synaphea petiolaris</i> subsp. <i>simplex</i>	3	Yes	Yes	Yes	286	7	Y
<i>Thysanotus glaucus</i>	4	Yes	Yes	Yes	3,405	11	Y
<i>Tripterococcus</i> sp. <i>Brachylobus</i> (A.S. George 14234)	4	Yes	Yes	Yes	3,352	15	Y
<i>Verticordia attenuata</i>	3	Yes	Yes	Yes	102	14	Y
<i>Verticordia densiflora</i> var. <i>pedunculata</i>	T	Yes	Yes	Yes	2,883	14	Y
<i>Verticordia lehmannii</i>	4	Yes	Yes	Yes	8,798	7	Y
<i>Verticordia plumosa</i> var. <i>ananeotes</i>	T	Yes	Yes	Yes	3,428	5	Y
<i>Verticordia plumosa</i> var. <i>vassensis</i>	T	Yes	Yes	Yes	209	34	Y

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

B.3. Fauna analysis table

Species name	Conservation status	Suitable habitat features	Suitable vegetation type	Distance closest record application area (m)	Are surveys adequate to identify
Baudin's cockatoo	EN	Yes	Yes	433	Yes
Carnaby's cockatoo	EN	Yes	Yes	528	Yes
Carter's freshwater mussel	VU	Yes	Yes	12	No
Forest red-tailed black cockatoo	VU	Yes	Yes	2,230	Yes
Peregrine falcon	OS	Yes	Yes	1,356	No
Quenda, southwestern brown bandicoot	P4	Yes	Yes	131	Yes
South-western brush-tailed phascogale, wambenger	CD	Yes	Yes	25	Yes
Water rat, rakali	P4	Yes	Yes	1,325	
Western brush wallaby	P4	Yes	Yes	743	Yes
Western ringtail possum, ngwayir	CR	Yes	Yes	0	Yes

EN: endangered, VU: vulnerable, OS: other specially protected fauna, CD: conservation dependant fauna, CR: critically endangered, P: priority,

IA (M): Migratory birds protected under an international agreement

B.4. Ecological community analysis table

Community name	State conservation status	Suitable habitat features	Suitable vegetation type	Suitable soil type	Distance closest record to application area (m)	Are surveys adequate to identify
Banksia Dominated Woodlands of the Swan Coastal Plain IBRA Region	P	Yes	Yes	Yes	0	Yes
<i>Eucalyptus cornuta</i> , <i>Agonis flexuosa</i> and <i>Eucalyptus decipiens</i> forest on deep yellow-brown siliceous sands over limestone	P	Yes	Yes	Yes	358	Yes

Community name	State conservation status	Suitable habitat features	Suitable vegetation type	Suitable soil type	Distance of closest record to application area (m)	Are surveys adequate to identify
Herb rich shrublands in clay pans (floristic community type 8 as originally described in Gibson et al. (1994))	VU	Yes	Yes	Yes	38	Yes
Tuart (<i>Eucalyptus gomphocephala</i>) woodlands and forests of the Swan Coastal Plain	P	Yes	Yes	Yes	53	Yes
<i>Corymbia calophylla</i> woodlands on heavy soils of the southern Swan Coastal Plain (floristic community type 1b as originally described in Gibson et al. (1994))	VU	Yes	Yes	Yes	1,134	Yes
Southern Swan Coastal Plain <i>Eucalyptus gomphocephala</i> – <i>Agonis flexuosa</i> woodlands	P	Yes	Yes	Yes	0	Yes
Dense shrublands on clay flats	VU	Yes	Yes	Yes	27,699	Yes

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

Appendix C - Assessment against the clearing principles

Assessment against the clearing principles	Variance level	Is further consideration required?
Environmental value: biological values		
<p>Principle (a): <i>"Native vegetation should not be cleared if it comprises a high level of biodiversity."</i></p> <p><u>Assessment:</u></p> <p>The application area contains a high level of biodiversity as it contains:</p> <ul style="list-style-type: none"> • Priority flora species • a federally listed TEC • habitat for conservation significant fauna • native vegetation considered significant in an area which has been extensively cleared • vegetation growing in association with wetlands or watercourses. 	At variance	Yes <i>Refer to Section 3.2.1, above.</i>
<p>Principle (b): <i>"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."</i></p> <p><u>Assessment:</u></p> <p>The application area contains critical habitat for black cockatoos and significant habitat for WRP. Ground dwelling conservation significant fauna may also utilise the application area. The application area intersects three South West Regional Ecological Linkage lines.</p>	Seriously at variance	Yes <i>Refer to Section 3.2.2, above.</i>
<p>Principle (c): <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></p> <p>Based on the findings of the flora surveys undertaken by Ecoedge (2019, 2021a, 2021b, 2021c) the application area is unlikely to contain habitat for Threatened flora.</p>	Not likely to be at variance	Yes <i>Refer to Section 3.2.3, above.</i>
<p>Principle (d): <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> Herb rich shrublands in clay pans (FCT 8 as originally described in Gibson et al. (1994)) has been mapped in the close proximity of the application area. Having installed quadrats in the potential occurrences of this TEC, the flora survey (Ecoedge, 2020) concluded that the application area does not contain species composition indicative of a TEC listed by the Western Australian Minister for Environment.</p>	Not likely to be at variance	Yes <i>Refer to Section 3.2.4, above.</i>
Environmental value: significant remnant vegetation and conservation areas		
<p>Principle (e): <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></p> <p>The extent of the mapped vegetation type and native vegetation in the local area is inconsistent with the national objectives and targets for biodiversity conservation in Australia. The application area provides habitat for conservation significant fauna species and include Priority flora species and occurrences of federally listed TEC. The application area is considered a significant remnant of native vegetation in an area that has been extensively cleared.</p>	At variance	Yes <i>Refer to Section 3.2.5, above.</i>

Assessment against the clearing principles	Variance level	Is further consideration required?
<p><u>Principle (h):</u> “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.”</p> <p><u>Assessment:</u></p> <p>Given the distance to the nearest conservation area, the proposed clearing may have an impact on the environmental values of adjacent conservation areas.</p>	May be at variance	Yes <i>Refer to Section 3.2.8, above.</i>
Environmental value: land and water resources		
<p><u>Principle (f):</u> “Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.”</p> <p><u>Assessment:</u></p> <p>The application area is mapped within Geomorphic Wetlands of the SCP and intersects three ephemeral watercourses. The vegetation proposed to be cleared is growing in an environment associated with a watercourse or wetland.</p> <p>Noting the extent of riparian vegetation identified (Ecoedge, 2021b) across the 124.9-hectare clearing footprint and the engineering design of current and future drainage system, the clearing is unlikely to impact on an environment associated with wetlands or watercourses.</p>	At variance	Yes <i>Refer to Section 3.2.6, above.</i>
<p><u>Principle (g):</u> “Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.”</p> <p><u>Assessment:</u></p> <p>Due to the presence of sandy soils within the application area, the proposed clearing may increase the risk of wind erosion. Noting the fragmented, highly modified condition of the application area, the proposed clearing is not likely to cause appreciable land degradation.</p>	Not likely to be at variance	Yes <i>Refer to Section 3.2.7, above.</i>
<p><u>Principle (i):</u> “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.”</p> <p><u>Assessment:</u></p> <p>The application area occurs in four mapped wetlands and intersects three ephemeral river. The proposed clearing may therefore impact surface or ground water quality.</p>	Not likely to be at variance	Yes <i>Refer to Section 3.2.9, above.</i>
<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></p> <p>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>	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 - Land degradation risk table

	Bassendean unmapped land, mine Phase	Bassendean B1b Phase	Sw - Swamp (Bassendean)	Bassendean B5 Phase	Abba wet vales Phase	Bassendean Golf Course deep sandy rises Phase	Cokelup wet clayey flats Phase	Ludlow vales Phase	Ludlow flats Phase	Ludlow wet flats Phase
Acidification risk	Very low	Medium	High	High	High	High	Medium	Medium	Medium	Medium
Salinity										
Salinity risk	Very low	Very low	Very low	Very low	Very low	Very low	Low	Very low	Very low	Very low
Surface salinity	Very low	Very low	Very low	Very low	Very low	Very low	Very low	Very low	Very low	Very low
Some plant limits										
Rooting depth	Very low	Very low	Low	Very low	Very low	Very low	Very low	Very low	Very low	Very low
Sub surface compact	Medium	Medium	Medium	Medium	Medium	Medium	Low	Medium	Medium	Medium
Water repel	Very low	High	Very low	Very low	Very low	High	Very low	Medium	Medium	Medium
Water storage	Very low	High	Very low	Very low	Very low	High	Medium	Low	Low	Low
Erosion										
Flood risk	Very low	Very low	Low	High	High	Very low	Very low	Low	Very low	Very low
Instability	Very low	Very low	Very low	Very low	Very low	Very low	Very low	Very low	Very low	Very low
Water erosion	Very low	Very low	Very low	Medium	Medium	Very low	Very low	Very low	Very low	Very low
Wind erosion	Very low	Low	Very low	Very low	Very low	Low	Very low	Low	Low	Low
Water & drainage										
Site drainage	Very low	Very low	Medium	Medium	High	Very low	High to medium	Very low	Very low	Very low
Waterlogging	Very low	Very low	High to medium	Very low	High	Very low	High to medium	Very low	Very low	Very low
Other qualities										
Excavation ease	Very low	Very low	Low	Low	Medium	Very low	Medium to low	Very low	Very low	Very low
Microbial purification	Very low	High	High	High	High	High	Medium to low	Medium	Medium	Medium
Phosphorus loss	Very low	Low	Low	High	High	Medium	Very low	Very low	Very low	Very low



Clearing Permit Decision Report

Appendix F - Offset calculator value justification

Offset Calculation: significant remnant - Revegetation of Ludlow State Forest No. 2

Field Name	Description	Justification for value used
<i>IUCN Criteria</i>	The IUCN criteria for the value being impacted	0.0 - afforded to native vegetation considered as significant remnant. The annual probability of extinction for this environmental value is 0.0%
<i>Area of impact (habitat/community) or Quantum of impact (features/individuals)</i>	The area of habitat/community impacted or number of features/individuals impacted	27.3 - the application area comprises 27.3 ha of native vegetation which is considered significant as a remnant in an area which has been extensively cleared
<i>Quality of impacted area (habitat/community)</i>	The quality score for area of habitat/community being impacted - a measure of how well a particular site supports a particular threatened species or ecological community and contributes to its ongoing viability	5 - the vegetation ranges from very good to completely degraded condition, with the majority in degraded to completely degraded condition. The application area provides critical habitat for black cockatoo, significant habitat for WRP, habitat for priority flora, a federally listed TEC and occurs in an extensively cleared landscape where only 16% of its original extent remain
<i>Time over which loss is averted (habitat/community)</i>	This describes the timeframe over which changes in the level of risk to the proposed offset site can be considered and quantified	20 - the revegetation site is located within state forest for future inclusion into the Tuart Forest National Park. Therefore, the maximum 20 years was used
<i>Time until ecological benefit (habitat/community) or Time horizon (features/individuals)</i>	This describes the estimated time (in years) that it will take for the main benefit of the quality (habitat/community) or value (features/individuals) improvement of the proposed offset to be realised	10 - The benefit of the revegetation is considered to be available after 10 years
<i>Start area (habitat/community) or Start value (features/individuals)</i>	The area of habitat/community or number of features/individuals proposed to offset the impacts	60.26 - calculated rehabilitation area in ha
<i>Start quality (habitat/community)</i>	The quality score for the area of habitat/community proposed as an offset - a measure of how well a particular site supports a particular threatened species or ecological community and contributes to its ongoing viability	2 - the revegetation site already contains some tuart and marri trees approximately 15 years old. The condition of vegetation at the site is considered degraded. MRWA revegetation plan notes that the site comprises isolated scattered Tuart, Peppermint and Marri, with a mid-storey of scattered Acacia and Bull Banksia, and an understorey of weed species with isolated patches of sedge and rushes.
<i>Future quality without offset (habitat/community) or Future value without offset (features/individuals)</i>	The predicted future quality score (habitat/community) or value (features/individuals) of the proposed offset site without the offset	2 - without revegetation activities, it is expected that the vegetation within the revegetation site would remain the same quality
<i>Future quality with offset (habitat/community) or Future value with offset (features/individuals)</i>	The predicted future quality score (habitat/community) or value (features/individuals) of the proposed offset site with the offset	5 - It is assumed that with appropriate revegetation/rehabilitation measures the sites will increase in condition, with the potential to get from a largely degraded to a good to very good condition.

<i>Risk of loss (%) without offset (habitat/community)</i>	This describes the chance that the habitat/community on the proposed offset site will be completely lost (i.e. no longer hold any value for the protected matter of concern) over the foreseeable future without an offset	15 - the revegetation site is Ludlow State Forest No. 2 which is considered to have a low risk of loss. The proposed rehabilitation will not mitigate all risks and some risks to the existing vegetation, such as wildfires or climate changes, remain. In addition, the Tuart Forest National Park, management plan 79 (2014) states that harvesting of plantation timber is proposed within the state forest. The harvesting activities may adversely impact the rehabilitation areas.
<i>Risk of loss (%) with offset (habitat/community)</i>	This describes the chance that the habitat/community on the proposed offset site will be completely lost (i.e., no longer hold any value for the protected matter of concern) over the foreseeable future with an offset	10 - given the site is proposed for future inclusion into the Tuart Forest National Park, and the rehabilitation measures proposed. The revegetation activities will not mitigate all risks (wildfires, climate changes). The offset will decrease the risk of negative impacts of harvesting.
<i>Confidence in result (%) – risk of loss (habitat/community)</i>	The capacity of measures to mitigate risk of loss of the proposed offset site	90 - there is a high level of confidence given DBCA's management of the rehabilitation areas
<i>Confidence in result (%) – Change in quality (habitat/community) or Change in value (features/individuals)</i>	The level of certainty about the successful achievement of the proposed change in quality (habitat/community) or value (features/individuals)	80 - there is a high level of confidence that the revegetation outcomes will be achieved given MRWA will be required to prepare a comprehensive revegetation plan for DWER and DBCA approval. Difficulty in increasing vegetation quality to good to very good condition has been taken into account in attributing this value.
<i>% of impact offset</i>	% of the significant residual impact that would be offset by the proposed offset (note: the offset calculations combined should equate to 100% for each residual impact)	100 - Revegetation of 60.26 hectares will offset 100% of the significant residual impacts of the proposed clearing on significant remnant of native vegetation
<i>Other comments</i>	Include here any relevant additional comments (e.g. the size of offset required to offset 100% of the residual impacts)	

Offset Calculation: the Tuart Woodland TEC - Revegetation of Ludlow State Forest No. 2

Field Name	Description	Justification for value used
<i>IUCN Criteria</i>	The IUCN criteria for the value being impacted	6.8 - afforded to native vegetation which represents Tuart (<i>Eucalyptus gomphocephala</i>) woodlands and forests of the Swan Coastal Plain ecological community listed as Critically Endangered under the EPBC Act.
<i>Area of impact (habitat/community) or Quantum of impact (features/individuals)</i>	The area of habitat/community impacted or number of features/individuals impacted	2 - the application area comprises 2 ha of native vegetation which represents the Tuart Woodland TEC
<i>Quality of impacted area (habitat/community)</i>	The quality score for area of habitat/community being impacted - a measure of how well a particular site supports a particular threatened species or ecological community and contributes to its ongoing viability	5 - the vegetation ranges from very good to completely degraded condition. Around 80 - 86% of the Tuart Woodland TEC have been lost as a result of clearing. Therefore, all remaining patches of a large size are considered significant
<i>Time over which loss is averted (habitat/community)</i>	This describes the timeframe over which changes in the level of risk to the proposed offset site can be considered and quantified	20 - the revegetation site is located within state forest for future inclusion into the Tuart Forest National Park. Therefore, the maximum 20 years was used
<i>Time until ecological benefit (habitat/community) or Time horizon (features/individuals)</i>	This describes the estimated time (in years) that it will take for the main benefit of the quality (habitat/community) or value (features/individuals) improvement of the proposed offset to be realised	10 - The benefit of the revegetation is considered to be available after 10 years
<i>Start area (habitat/community) or Start value (features/individuals)</i>	The area of habitat/community or number of features/individuals proposed to offset the impacts	8.95 - the area which must be rehabilitated to meet the completion criteria for the Tuart Woodland TEC
<i>Start quality (habitat/community)</i>	The quality score for the area of habitat/community proposed as an offset - a measure of how well a particular site supports a particular threatened species or ecological community and contributes to its ongoing viability	2 - the revegetation site already contains some tuart and marri trees approximately 15 years old. The condition of vegetation at the site is considered degraded. MRWA revegetation plan notes that the site comprises isolated scattered Tuart, Peppermint and Marri, with a mid-storey of scattered Acacia and Bull Banksia, and an understorey of weed species with isolated patches of sedge and rushes.
<i>Future quality without offset (habitat/community) or Future value without offset (features/individuals)</i>	The predicted future quality score (habitat/community) or value (features/individuals) of the proposed offset site without the offset	2 - without revegetation activities, it is expected that the vegetation within the revegetation site would remain the same quality
<i>Future quality with offset (habitat/community) or Future value with offset (features/individuals)</i>	The predicted future quality score (habitat/community) or value (features/individuals) of the proposed offset site with the offset	5 - It is assumed that with appropriate revegetation/rehabilitation measures the sites will increase in condition, with the potential to get from a largely degraded to a good to very good condition.
<i>Risk of loss (%) without offset (habitat/community)</i>	This describes the chance that the habitat/community on the proposed offset site will be completely lost (i.e. no longer hold any value for the protected matter of concern) over the foreseeable future without an offset	15 - the revegetation site is Ludlow State Forest No. 2 which is considered to have a low risk of loss. The proposed rehabilitation will not mitigate all risks and some risks to the existing vegetation, such as wildfires or climate changes, remain. In addition, the Tuart Forest National Park, management plan 79 (2014) states that harvesting of plantation timber is proposed within the state forest. The harvesting activities may adversely impact the rehabilitation areas.

<i>Risk of loss (%) with offset (habitat/community)</i>	This describes the chance that the habitat/community on the proposed offset site will be completely lost (i.e. no longer hold any value for the protected matter of concern) over the foreseeable future with an offset	10 - given the site is proposed for future inclusion into the Tuart Forest National Park, and the revegetation measures proposed. The revegetation activities will not mitigate all risks (wildfires, climate changes).
<i>Confidence in result (%) – risk of loss (habitat/community)</i>	The capacity of measures to mitigate risk of loss of the proposed offset site	90 - there is a high level of confidence given DBCA's management of the revegetation areas
<i>Confidence in result (%) – Change in quality (habitat/community) or Change in value (features/individuals)</i>	The level of certainty about the successful achievement of the proposed change in quality (habitat/community) or value (features/individuals)	80 - there is a high level of confidence that the revegetation outcomes will be achieved given MRWA will be required to prepare a comprehensive revegetation plan for DWER and DBCA approval. Difficulty in increasing vegetation quality to good to very good condition has been taken into account in attributing this value.
<i>% of impact offset</i>	% of the significant residual impact that would be offset by the proposed offset (note: the offset calculations combined should equate to 100% for each residual impact)	100 - Revegetation of 8.95 hectares, which at the completion of the activities will meet the key diagnostic criteria of the Tuart Woodland TEC, will offset 100% of the significant residual impacts of the proposed clearing on this community.
<i>Other comments</i>	Include here any relevant additional comments (e.g. the size of offset required to offset 100% of the residual impacts)	

Offset Calculation: black cockatoo - Revegetation of Ludlow State Forest No. 2

Field Name	Description	Justification for value used
<i>IUCN Criteria</i>	The IUCN criteria for the value being impacted	1.2 - afforded to three species of black cockatoo. Carnaby's and Baudin's are listed as Endangered under the EPBC Act and Forest red-tailed is listed as Vulnerable under the EPBC Act. Endangered has been used due to the higher value.
<i>Area of impact (habitat/community) or Quantum of impact (features/individuals)</i>	The area of habitat/community impacted or number of features/individuals impacted	20.8 - the application area comprises 20.8 ha of black cockatoo foraging habitat
<i>Quality of impacted area (habitat/community)</i>	The quality score for area of habitat/community being impacted - a measure of how well a particular site supports a particular threatened species or ecological community and contributes to its ongoing viability	6 - the vegetation ranges from very good to completely degraded condition and contains high quality black cockatoo foraging habitat which support roosting and breeding. The application area is also mapped as confirmed Carnaby's cockatoo breeding area and within extensively cleared landscape (approximately 16 percent of the vegetation extent remaining) (the value 6 is consistent with the Bussell Hwy Stage 1 project)
<i>Time over which loss is averted (habitat/community)</i>	This describes the timeframe over which changes in the level of risk to the proposed offset site can be considered and quantified	20 - the revegetation site is located within state forest for future inclusion into the Tuart Forest National Park. Therefore, the maximum 20 years was used
<i>Time until ecological benefit (habitat/community) or Time horizon (features/individuals)</i>	This describes the estimated time (in years) that it will take for the main benefit of the quality (habitat/community) or value (features/individuals) improvement of the proposed offset to be realised	10 - The benefit of the revegetation is considered to be available after 10 years
<i>Start area (habitat/community) or Start value (features/individuals)</i>	The area of habitat/community or number of features/individuals proposed to offset the impacts	47.51 - calculated rehabilitation area in ha
<i>Start quality (habitat/community)</i>	The quality score for the area of habitat/community proposed as an offset - a measure of how well a particular site supports a particular threatened species or ecological community and contributes to its ongoing viability	2 - the revegetation site already contains some tuart and marri trees approximately 15 years old. The condition of vegetation at the site is considered degraded. MRWA revegetation plan notes that the site comprises isolated scattered Tuart, Peppermint and Marri, with a mid-storey of scattered Acacia and Bull Banksia, and an understorey of weed species with isolated patches of sedge and rushes.
<i>Future quality without offset (habitat/community) or Future value without offset (features/individuals)</i>	The predicted future quality score (habitat/community) or value (features/individuals) of the proposed offset site without the offset	2 - without revegetation activities, it is expected that the vegetation within the revegetation site would remain the same quality
<i>Future quality with offset (habitat/community) or Future value with offset (features/individuals)</i>	The predicted future quality score (habitat/community) or value (features/individuals) of the proposed offset site with the offset	6 - The successful revegetation can result in high quality black cockatoo foraging habitat in good or better condition on the Swan Coastal Plain which supports breeding and roosting in an area which has been extensively cleared

<i>Risk of loss (%) without offset (habitat/community)</i>	This describes the chance that the habitat/community on the proposed offset site will be completely lost (i.e. no longer hold any value for the protected matter of concern) over the foreseeable future without an offset	15 - the revegetation site is in Ludlow State Forest No. 2 which is considered to have a low risk of loss. The proposed rehabilitation will not mitigate all risks and some risks to the existing vegetation, such as wildfires or climate changes, remain. In addition, the Tuart Forest National Park, management plan 79 (2014) states that harvesting of plantation timber is proposed within the state forest. The harvesting activities may adversely impact the rehabilitation areas.
<i>Risk of loss (%) with offset (habitat/community)</i>	This describes the chance that the habitat/community on the proposed offset site will be completely lost (i.e. no longer hold any value for the protected matter of concern) over the foreseeable future with an offset	10 - given the site is proposed for future inclusion into the Tuart Forest National Park, and the revegetation measures proposed. The revegetation activities will not mitigate all risks (wildfires, climate changes).
<i>Confidence in result (%) – risk of loss (habitat/community)</i>	The capacity of measures to mitigate risk of loss of the proposed offset site	90 - there is a high level of confidence given DBCA's management of the revegetation areas
<i>Confidence in result (%) – Change in quality (habitat/community) or Change in value (features/individuals)</i>	The level of certainty about the successful achievement of the proposed change in quality (habitat/community) or value (features/individuals)	80 - there is a high level of confidence that the revegetation outcomes will be achieved given MRWA will be required to prepare a comprehensive revegetation plan for DWER and DBCA approval. Difficulty in increasing vegetation quality to good to very good condition has been taken into account in attributing this value.
<i>% of impact offset</i>	% of the significant residual impact that would be offset by the proposed offset (note: the offset calculations combined should equate to 100% for each residual impact)	100 - The revegetation of 47.51 ha will offset 100 percent of significant residual impacts of the proposed clearing on black cockatoos. No additional offset is required
<i>Other comments</i>	Include here any relevant additional comments (e.g. the size of offset required to offset 100% of the residual impacts)	

Offset Calculation: WRP - Revegetation of Ludlow State Forest No. 2

Field Name	Description	Justification for value used
<i>IUCN Criteria</i>	The IUCN criteria for the value being impacted	6.8 - afforded to Western Ringtail Possum habitat as this species is listed and Critically Endangered under the Environmental Protection and Biodiversity Conservation Act 1999
<i>Area of impact (habitat/community) or Quantum of impact (features/individuals)</i>	The area of habitat/community impacted or number of features/individuals impacted	24 - application area comprises 24 ha of WRP habitat
<i>Quality of impacted area (habitat/community)</i>	The quality score for area of habitat/community being impacted - a measure of how well a particular site supports a particular threatened species or ecological community and contributes to its ongoing viability	6 - the vegetation ranges from a very good to a completely degraded condition. WRP uses the vegetation along almost the entire length of the clearing footprint, primarily where relatively dense midstorey (low forest, woodland or thicket) vegetation is present and where peppermint (<i>Agonis flexuosa</i>) occurs.
<i>Time over which loss is averted (habitat/community)</i>	This describes the timeframe over which changes in the level of risk to the proposed offset site can be considered and quantified	20 - the revegetation site is located within state forest for future inclusion into the Tuart Forest National Park. Therefore, the maximum 20 years was used
<i>Time until ecological benefit (habitat/community) or Time horizon (features/individuals)</i>	This describes the estimated time (in years) that it will take for the main benefit of the quality (habitat/community) or value (features/individuals) improvement of the proposed offset to be realised	10 - The benefit of the revegetation is considered to be available after 10 years
<i>Start area (habitat/community) or Start value (features/individuals)</i>	The area of habitat/community or number of features/individuals proposed to offset the impacts	41.12 - calculated revegetation area in ha
<i>Start quality (habitat/community)</i>	The quality score for the area of habitat/community proposed as an offset - a measure of how well a particular site supports a particular threatened species or ecological community and contributes to its ongoing viability	2 - the revegetation site already contains some peppermint and tuart trees approximately 15 years old. The condition of vegetation at the site is considered degraded. MRWA revegetation plan notes that the site comprises isolated scattered Tuart, Peppermint and Marri, with a mid-storey of scattered Acacia and Bull Banksia, and an understorey of weed species with isolated patches of sedge and rushes.
<i>Future quality without offset (habitat/community) or Future value without offset (features/individuals)</i>	The predicted future quality score (habitat/community) or value (features/individuals) of the proposed offset site without the offset	2 - without revegetation activities, it is expected that the vegetation within the revegetation site would remain the same quality
<i>Future quality with offset (habitat/community) or Future value with offset (features/individuals)</i>	The predicted future quality score (habitat/community) or value (features/individuals) of the proposed offset site with the offset	6 - The successful revegetation can achieve good or better vegetation quality. Noting that Ludlow State Forest supports high densities of WRPs (3.4 +- 0.31 (DBCA fauna advice for CPS 9168/1 - A1993954)) and the extensively cleared local area, the revegetation site will provide significant habitat for WRPs.

<i>Risk of loss (%) without offset (habitat/community)</i>	This describes the chance that the habitat/community on the proposed offset site will be completely lost (i.e. no longer hold any value for the protected matter of concern) over the foreseeable future without an offset	15 - the revegetation site is Ludlow State Forest No. 2 which is considered to have a low risk of loss. The proposed rehabilitation will not mitigate all risks and some risks to the existing vegetation, such as wildfires or climate changes, remain. In addition, the Tuart Forest National Park, management plan 79 (2014) states that harvesting of plantation timber is proposed within the state forest. The harvesting activities may adversely impact the rehabilitation areas.
<i>Risk of loss (%) with offset (habitat/community)</i>	This describes the chance that the habitat/community on the proposed offset site will be completely lost (i.e. no longer hold any value for the protected matter of concern) over the foreseeable future with an offset	10 - given the site is proposed for future inclusion into the Tuart Forest National Park, and the revegetation measures proposed. The revegetation activities will not mitigate all risks (wildfires, climate changes).
<i>Confidence in result (%) – risk of loss (habitat/community)</i>	The capacity of measures to mitigate risk of loss of the proposed offset site	90 - there is a high level of confidence given DBCA's management of the revegetation areas
<i>Confidence in result (%) – Change in quality (habitat/community) or Change in value (features/individuals)</i>	The level of certainty about the successful achievement of the proposed change in quality (habitat/community) or value (features/individuals)	80 - there is a high level of confidence that the revegetation outcomes will be achieved given MRWA will be required to prepare a comprehensive revegetation plan for DWER and DBCA approval. Difficulty in increasing vegetation quality to good to very good condition has been taken into account in attributing this value.
<i>% of impact offset</i>	% of the significant residual impact that would be offset by the proposed offset (note: the offset calculations combined should equate to 100% for each residual impact)	42.30 - The revegetation of 41.12 ha will offset 42.30 percent of significant residual impacts of the proposed clearing on WRP. The remaining 57.70% will be offset through the acquisition of Lot 201, West Boundary Road, Manjimup.
<i>Other comments</i>	Include here any relevant additional comments (e.g. the size of offset required to offset 100% of the residual impacts)	

Offset Calculation: WRP – Land acquisition (Lot 201 West Boundary Road, Manjimup)

Field Name	Description	Justification for value used
<i>IUCN Criteria</i>	The IUCN criteria for the value being impacted	6.8 - afforded to Western Ringtail Possum habitat as this species is listed and Critically Endangered under the <i>Environmental Protection and Biodiversity Conservation Act 1999</i>
<i>Area of impact (habitat/community) or Quantum of impact (features/individuals)</i>	The area of habitat/community impacted or number of features/individuals impacted	24 - application area comprises 24 ha of WRP habitat
<i>Quality of impacted area (habitat/community)</i>	The quality score for area of habitat/community being impacted - a measure of how well a particular site supports a particular threatened species or ecological community and contributes to its ongoing viability	6 - the vegetation ranges from a very good to a completely degraded condition. WRP uses the vegetation along almost the entire length of the clearing footprint, primarily where relatively dense midstorey (low forest, woodland or thicket) vegetation is present and where peppermint (<i>Agonis flexuosa</i>) generally occurs.
<i>Time over which loss is averted (habitat/community)</i>	This describes the timeframe over which changes in the level of risk to the proposed offset site can be considered and quantified	1 – The offset site will be protected in perpetuity. As per <i>How to use the offsets assessment guide</i> (DSEWPaC, 2012), "longer time frames are value more highly than shorter time frames." Accordingly, a value of 1 has been selected to maximise the value of the offset assigned by this component of the calculation.
<i>Time until ecological benefit (habitat/community) or Time horizon (features/individuals)</i>	This describes the estimated time (in years) that it will take for the main benefit of the quality (habitat/community) or value (features/individuals) improvement of the proposed offset to be realised	1 - the administrative changes associated with the offset implementation can be made in 1 year
<i>Start area (habitat/community) or Start value (features/individuals)</i>	The area of habitat/community or number of features/individuals proposed to offset the impacts	18 - the extent of WRP habitat at Lot 201, West Boundary Road, Manjimup as per the Bio Diverse Solutions (2020) <i>Reconnaissance flora and vegetation and targeted fauna survey report</i> .
<i>Start quality (habitat/community)</i>	The quality score for the area of habitat/community proposed as an offset - a measure of how well a particular site supports a particular threatened species or ecological community and contributes to its ongoing viability	7 - Lot 201 provides habitat for WRP as it contains: - vegetation structure consisted of a tree layer containing <i>Corymbia calophylla</i> (marri) and <i>Eucalyptus marginata</i> (jarrah) of various ages with a sparse, yet relatively diverse mid and understorey - vegetation in good to very good condition (Bio Diverse Solutions, 2020) - ecological linkage value for WRP.
<i>Future quality without offset (habitat/community) or Future value without offset (features/individuals)</i>	The predicted future quality score (habitat/community) or value (features/individuals) of the proposed offset site without the offset	6 - it is assumed that the offset vegetation may decrease in value slightly owing to clearing for exempt activities and other land degradation processes (e.g. weed/dieback introduction).
<i>Future quality with offset (habitat/community) or Future value with offset (features/individuals)</i>	The predicted future quality score (habitat/community) or value (features/individuals) of the proposed offset site with the offset	7 - it is assumed that the offset vegetation is likely to increase in value due to MRWA commitments to ongoing management measures

<i>Risk of loss (%) without offset (habitat/community)</i>	This describes the chance that the habitat/community on the proposed offset site will be completely lost (i.e. no longer hold any value for the protected matter of concern) over the foreseeable future without an offset	86.3 - The risk of loss is a weighted average for risk of loss across the site. Of the 18 hectares total, 16.9 is subject to a live clearing permit and has 90 percent risk of loss. Approximately 1.1 hectares is not subject to the permit and has 30 percent risk of loss. In setting a 90 percent risk of loss for the portion subject to a live clearing permit, DWER has considered the context of the neighbouring landholder and land uses, as indicative of a high likelihood of clearing occurring in the absence of the offset.
<i>Risk of loss (%) with offset (habitat/community)</i>	This describes the chance that the habitat/community on the proposed offset site will be completely lost (i.e. no longer hold any value for the protected matter of concern) over the foreseeable future with an offset	10 - DBCA's ownership will result in a substantial increased security. A letter from DBCA which demonstrates that Lot 201 is "a welcome and acceptable addition to the conservation estate" has been received.
<i>Confidence in result (%) – risk of loss (habitat/community)</i>	The capacity of measures to mitigate risk of loss of the proposed offset site	90 - The purchase of Lot 201 and transfer to conservation estate, together with ongoing management arrangements, has a high level of confidence that the measure will be successful in mitigating the future risk of loss of the site.
<i>Confidence in result (%) – Change in quality (habitat/community) or Change in value (features/individuals)</i>	The level of certainty about the successful achievement of the proposed change in quality (habitat/community) or value (features/individuals)	90 - there is a high level of confidence that the transfer of Lot 201 into conservation estate and ongoing management measures proposed by MRWA will improve the vegetation quality and habitat for WRP
<i>% of impact offset</i>	% of the significant residual impact that would be offset by the proposed offset (note: the offset calculations combined should equate to 100% for each residual impact)	57.70 - The acquisition of Lot 201 will offset 57.70% of significant residual impacts of the proposed clearing on WRP. Additional offset is required. Approximately 42.30 percent of the impacts will be addressed through revegetation of Ludlow State Forest No. 2.
<i>Other comments</i>	Include here any relevant additional comments (e.g. the size of offset required to offset 100% of the residual impacts)	

Appendix G – Summary of the biological surveys relevant to the application

Author	Survey type	Date of field work	Consideration of the survey timing
Flora			
(Ecoedge, 2019)	A detailed, reconnaissance and targeted survey	Five site visits between August and October (2018)	The optimal time for the South-West Botanical Provenance. Flowering was excellent for survey seasons with germination and growth of herbaceous species not expected to have been negatively affected by rainfall.
(Ecoedge, 2021a)	A targeted survey for <i>V. attenuata</i> within and adjacent to the clearing footprint	17 February 2021	<i>V. attenuata</i> plants were still in flower at the time of the survey so were easy to identify.
Ecoedge (2021b)	The survey report combines the results of the following surveys conducted in the clearing footprint: <ul style="list-style-type: none"> • 2013: reconnaissance and targeted survey • 2016: flora survey targeting <i>Verticordia attenuata</i> • 2018: detailed reconnaissance and targeted survey. A separate report produced (Ecoedge, 2019) • 2020: reconnaissance and targeted survey of previously unsurveyed areas 	22 and 23 October and 19 December 2013, 12 December 2016, 16 October 2020 *updated in May 2021	The optimal time for the South-West Botanical Provenance. Flowering was excellent with germination and growth of herbaceous species not expected to have been negatively affected by rainfall. The timing of the targeted survey for <i>Verticordia attenuata</i> was considered optimal.
(Bio Diverse Solutions, 2020)	Reconnaissance flora and vegetation and targeted fauna survey report	9 December 2019	Optimal flowering period for South West Botanical Provenance
TECs and PECs assessment			
(Ecoedge, 2021c)	A TEC/PEC assessment - 32.10 – 43.92 SLK	17 and 18 November and 12 and 17 December 2020 *updated in May 2021	The survey area recorded about average rainfall and temperatures in the lead up to the survey and ongoing rain in spring provided a sustained flowering of many species. This enabled identification of sufficient species for identification of TEC within the survey including the clay pan TEC as soil was still damp and water was still present meaning that most species were able to be confidently identified. Note: the survey report was updated during the assessment to address discrepancies in the mapping
Fauna			
(Harewood, 2018)	Targeted fauna survey	Daytime surveys: 10 November and 22 and 28 December 2017 Nocturnal surveys: 18 and 23 January 2018	
(360 Environmental, 2017)	Level 1 Fauna and Targeted WRP survey	Level 1: 16 and 17 June 2016 Targeted WRP surveys: 20 – 22 June 2017	
(MRWA, 2020)	Supplementary fauna habitat assessment result	9 November 2020	
(Biota, 2020)	WRP Assessment	Phase 1: 11 September and 19 October 2019 Phase 2: 10 February 2020	
SW Environmental (2020)	Camera pole and drone survey of hollows suitable for black cockatoo nesting	2 December 2020	

Appendix H – Vegetation Units mapped in the clearing footprint (Ecoedge, 2021b)

Veg Unit	Veg sub-unit	Name	Description (Ecoedge, 2021)	Veg condition (Keighery, 1994)	Extent (ha)
A	A1	Peppermint – tuart woodland	<i>Agonis flexuosa</i> low woodland/low open woodland with scattered <i>Eucalyptus gomphocephala</i> or <i>E. cornuta</i> or * <i>Pinus pinaster</i> over <i>Kunzea glabrescens</i> , (* <i>Acacia longifolia</i>) shrubland/open shrubland over introduced herbs and grasses including * <i>Lupinus angustifolius</i> , * <i>Ehrharta calycina</i> and * <i>E. longifolia</i> on grey-brown sand/sandy loam or yellow-grey sand.	Completely degraded	2.721
	A2	Yate – tuart – peppermint woodland	<i>Eucalyptus cornuta</i> , <i>Agonis flexuosa</i> mid-height woodland with isolated tall trees of <i>E. gomphocephala</i> over forbland including * <i>Lupinus angustifolius</i> and grassland of * <i>Ehrharta calycina</i> and * <i>E. longifolia</i> on grey-brown sand/sandy loam or yellowgrey sand.	Completely degraded	0.807
B		Flooded gum - marri woodland to very open woodland	<i>Eucalyptus rudis</i> subsp. <i>cratyantha</i> or <i>Corymbia calophylla</i> mid-height woodland/open forest over <i>Agonis flexuosa</i> , <i>Melaleuca preissii</i> low open woodland with occasional <i>M. raphiophylla</i> over <i>Acacia saligna</i> , <i>Astartea</i> sp., <i>Melaleuca viminea</i> open shrubland over introduced forbs and grasses including * <i>Ehrharta calycina</i> on grey-brown sandy-loam or loam.	Degraded to good	6.159
C		Marri woodland	<i>Corymbia calophylla</i> mid-height woodland (sometimes with <i>Melaleuca raphiophylla</i>) over * <i>Acacia</i> spp., <i>Hibbertia cuneiformis</i> , <i>Kunzea glabrescens</i> , (<i>Spyridium globulosum</i>) mid-height shrubland over * <i>Ehrharta calycina</i> , * <i>Eragrostis curvula</i> grassland and * <i>Zantedeschia aethiopica</i> open forbland on grey-brown or yellowbrown sand or sandy loam.	Completely degraded to degraded	2.454
D	D1	* <i>Acacia</i> spp., <i>Kunzea glabrescens</i> tall shrubland/tall open shrubland/tall sparse shrubland	(sometimes with emergent <i>Agonis flexuosa</i> or <i>Melaleuca preissiana</i>) over <i>Adenanthos meisneri</i> , <i>Gastrolobium praemorsum</i> , <i>Jacksonia furcellata</i> , <i>Kunzea recurva</i> , (<i>Leucopogon conostephioides</i>), <i>Melaleuca viminea</i> , (<i>Verticordia</i> sp., <i>Viminaria juncea</i>) low shrubland over <i>Loxocarya cinerea</i> and introduced herbs and grasses on grey or yellow-brown sand. (Revegetated mined areas and road embankments; is sometimes a tall shrubland/open shrubland dominated solely by <i>K. glabrescens</i>).	Completely degraded to good	7.482
	D2	<i>Kunzea glabrescens</i> - <i>Jacksonia furcellata</i> tall shrubland/open shrubland.	<i>Kunzea glabrescens</i> , <i>Jacksonia furcellata</i> , <i>Kunzea micrantha</i> , <i>Melaleuca viminea</i> , (<i>Viminaria juncea</i>) tall shrubland (sometimes with emergent <i>Agonis flexuosa</i> or <i>Melaleuca preissiana</i>) over open shrubland of <i>Adenanthos meisneri</i> and <i>Verticordia attenuata</i> over open herbland of <i>Conostylis aculeata</i> , <i>Hypolaena pubescens</i> , and scattered annual herbs including <i>Centrolepis aristata</i> , <i>Isolepis marginata</i> , * <i>Juncus capitatus</i> , <i>Microtis media</i> on yellow-brown sandy loam (Revegetated mined areas; damper sites than D1).	Degraded to good	8.931
E	E1	Marri – jarrah – Nuytsia open forest	<i>Corymbia calophylla</i> , (<i>Eucalyptus marginata</i> , <i>Nuytsia floribunda</i>) mid-height open forest over <i>Kunzea glabrescens</i> tall open shrubland over (<i>Gastrolobium praemorsum</i>), <i>Hibbertia hypericoides</i> , <i>Leucopogon parviflorus</i> , <i>Stirlingia latifolia</i> and <i>Xanthorrhoea brunonis</i> low shrubland and <i>Tetraria capillaris</i> and <i>T. octandra</i> isolated sedges on grey-brown or yellow brown sand.	Degraded to good	1.905
	E2	Marri – jarrah open forest	<i>Corymbia calophylla</i> and <i>Eucalyptus marginata</i> mid-height open forest/woodland over <i>Hibbertia cuneifolia</i> and <i>Kunzea glabrescens</i> tall open shrubland over * <i>Asparagus asparagoides</i> , <i>Brachyloma preissii</i> , <i>Brachysema praemorsum</i> and <i>Xanthorrhoea brunonis</i> mid-height shrubland over <i>Dampiera linearis</i> , <i>Dichopogon capillipes</i> , * <i>Hypochaeris glabra</i> open forbland and isolated <i>Lepidosperma squamatum</i> and <i>Tetraria octandra</i> sedges on yellow-brown or grey-brown sand.	Degraded to good	4.484

E2a	Tuart – marri – jarrah open forest	<i>Eucalyptus gomphocephala</i> , <i>Corymbia calophylla</i> and <i>Eucalyptus marginata</i> mid-height open forest/ woodland over <i>Agonis flexuosa</i> low open woodland over <i>Kunzea glabrescens</i> tall open shrubland over <i>Brachyloma preissii</i> , <i>Hibbertia hypericoides</i> , <i>Leucopogon racemulosus</i> low shrubland over <i>Conostylis aculeata</i> and <i>*Hypochaeris glabra</i> open forbland and isolated <i>Lepidosperma squamatum</i> and <i>Tetraria octandra</i> sedges on yellowbrown or grey-brown sand.	Completely degraded to good	0.008
E3	Peppermint woodland	<i>Agonis flexuosa</i> low woodland with emergent <i>*Pinus pinaster</i> and scattered <i>Eucalyptus marginata</i> or <i>Corymbia calophylla</i> , <i>Nuytsia floribunda</i> mid-height trees over <i>*Acacia longifolia</i> , <i>Kunzea glabrescens</i> tall shrubland over <i>*Asparagus asparagoides</i> <i>Pteridium esculentum</i> and <i>Conostylis aculeata</i> open forbland on greybrown sand.	Good	2.295
E4	Marri – bulk banksia open forest	<i>Corymbia calophylla</i> , (<i>Eucalyptus marginata</i>) mid-height open forest over <i>Agonis flexuosa</i> , <i>Banksia grandis</i> low woodland over <i>Kunzea glabrescens</i> tall open shrubland over <i>Acacia alata</i> , <i>Grevillea vestita</i> , <i>Hakea varia</i> , <i>Hibbertia cuneiformis</i> , <i>Leucopogon propinquus</i> , <i>Melaleuca incana</i> mid-height shrubland over <i>*Asparagus asparagoides</i> , <i>Brachysema praemorsum</i> , <i>Hardenbergia comptoniana</i> creepers over a variable open forbland including <i>Anigozanthos flavidus</i> , <i>Dichopogon capillipes</i> , <i>Lomandra micrantha</i> , <i>Opercularia hispidula</i> , <i>*Oxalis glabra</i> , <i>*O. pes-caprae</i> , <i>*Romulea rosea</i> on grey-brown loamy sand.	Very good	0.827
F	Melaleuca low open forest	<i>Melaleuca preissiana</i> low open forest/low woodland over <i>Acacia flagelliformis</i> , <i>Astartea scoparia</i> , <i>Melaleuca viminea</i> , <i>M. osullivanii</i> open mid-height shrubland over <i>Baumea juncea</i> open sedgeland on grey sand over clay.	Good to very good	0.878
G	Revegetated <i>Eucalyptus gomphocephala</i> open forest	<i>Eucalyptus gomphocephala</i> and occasional <i>E. rudis</i> mid-height open forest/woodland over <i>Agonis flexuosa</i> Low woodland with <i>Melaleuca raphiophylla</i> and <i>Casuarina obesa</i> in damp areas over <i>Melaleuca viminea</i> , <i>Melaleuca teretifolia</i> and <i>Calothamnus quadrifidus</i> subsp. <i>teretifolia</i> mid/tall height shrubland over an introduced grassland of <i>*Avena barbata</i> , <i>*Ehrharta calycina</i> and <i>*E. longiflora</i> and a herbland dominated by <i>*Trifolium</i> spp., <i>Ursinia anthemoides</i> , and <i>Oxalis glabra</i> .	Degraded	0.044
H		Exotic plants (trees / shrubs) that have been planted or self-sown.	Completely degraded	0.084

Appendix I - Sources of information

H.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
- Threatened Ecological Communities and Priority Ecological Communities (Buffers)

H.2. References

360 Environmental Pty Ltd. (2017). *Bussell Highway – Hutton road to Sabina section (30.91 – 44.18 SLK) Level 1 Fauna and Targeted Western Ringtail Possum Survey*. Supporting document prepared in relation to clearing permit application CPS 9168/1. Received by DWER on 23 December 2020. DWER Ref: A1968799.

Australian Museum (2020) Peregrine Falcon. Government of New South Wales. Available at: <https://australianmuseum.net.au/learn/animals/birds/peregrine-falcon/>.

- Bio Diverse Solutions. (2020). *Reconnaissance flora and vegetation and targeted fauna survey report*. Lot 201 on Plan 409860, West Boundary Road, Manjimup. Reconnaissance flora and targeted fauna assessment undertaken on 27 November and 9 December 2019, respectively. DWER Ref: A1888728.
- Biota Environmental Sciences Pty Ltd. (2020). *Bussell Highway (Hutton to Sabina) Western Ringtail Possum Assessment*. Supporting document prepared in relation to clearing permit application CPS 9168/1. Received by DWER on 23 December 2020. DWER Ref: A1968799.
- Capel Land Conservation District Committee. (2021). Comments on clearing permit application CPS 9168/1. Received by DWER on 27 January 2021 (DWER Ref: DWERDT406176).
- Commonwealth of Australia. (2001). *National Objectives and Targets for Biodiversity Conservation 2001-2005*, Canberra.
- Commonwealth of Australia. (2012). *EPBC Act referral guidelines for three threatened black cockatoo species: Carnaby's cockatoo (endangered), Calyptorhynchus latirostris Baudin's cockatoo (vulnerable), Calyptorhynchus baudinii Forest red-tailed black cockatoo (vulnerable) Calyptorhynchus banksii naso*.
- Department of Biodiversity, Conservation and Attractions (DBCA). (2012). Western Brush Wallaby *Macropus irma* (Jourdan, 1837). Retrieved from <https://library.dbca.wa.gov.au/static/FullTextFiles/071535.pdf>
- Department of Biodiversity, Conservation and Attractions. (2017a). Fauna Profile - Forest red-tailed black cockatoo *Calyptorhynchus banksii naso*. Retrieved from <http://www.dbca.wa.gov.au/>
- Department of Biodiversity, Conservation and Attractions. (2017b). Fauna Profile - Baudin's cockatoo *Calyptorhynchus baudinii*. Retrieved from <http://www.dbca.wa.gov.au/>
- Department of Biodiversity, Conservation and Attractions (DBCA). (2021a) Threatened and Priority Fauna Database Search. Accessed on July 21. Prepared by the Species and Communities Program for DWER for the assessment of clearing permit application CPS 9168/1.
- Department of Biodiversity, Conservation and Attractions (DBCA). (2021b) Threatened and Priority Flora Database Search. Accessed on July 21. Prepared by the Species and Communities Program for DWER for the assessment of clearing permit application CPS 9168/1.
- Department of Biodiversity, Conservation and Attractions (DBCA) (2021c) Species and Communities Branch TEC/flora advice for clearing permit application CPS 9168/1, received 1 April 2021. Department of Biodiversity, Conservation and Attractions, Western Australia (DWER Ref: A1993954).
- Department of Biodiversity, Conservation and Attractions (DBCA) (2021d) Parks and Wildlife Services. Priority ecological communities for Western Australia version 31. Species and Communities Program, DBCA. 20 March 2021. Retrieved from <https://www.dpaw.wa.gov.au/images/documents/plants-animals/threatened-species/Listings/Priority%20Ecological%20Communities%20list.pdf>
- Department of Biodiversity, Conservation and Attractions (DBCA) (2021e) Species and Communities Branch. Fauna, TEC, and flora advice for clearing permit application CPS 9168/1, received by DWER on 24 June 2021 (DWER Ref: A2020416 and A2020415).
- Department of Biodiversity, Conservation and Attractions (DBCA) (2021f) Species and Communities Branch. Advice for clearing permit application CPS 9168/1 on impacts on *Verticordia attenuata*. Received by DWER on 2 July 2021 (DWER Ref: A2022907).
- Department of Environment and Conservation (DEC). (1999). *Environmental Weed Strategy for Western Australia*. Retrieved from https://www.dpaw.wa.gov.au/images/documents/plants-animals/plants/weeds/environmental_weed_strategy_wa.pdf
- Department of Environment Regulation (DER) (2013). *A guide to the assessment of applications to clear native vegetation*. Perth. Available from: https://www.der.wa.gov.au/images/documents/your-environment/native-vegetation/Guidelines/Guide2_assessment_native_veg.pdf.
- Department of Parks and Wildlife (DPaW) (2014a) Western Ringtail Possum (*Pseudocheirus occidentalis*) Recovery Plan. Wildlife Management Program No. 58. Western Australia Department of Parks and Wildlife, now the Department of Biodiversity, Conservation and Attractions.
- Department of Parks and Wildlife (DPaW) (2014b). Wetlands mapping. Swan Coastal Plain. What do the wetland management categories mean? Accessed on 3 July 2021. Retrieved from <https://www.dpaw.wa.gov.au/management/wetlands/mapping-and-monitoring/220-wetlands-mapping?showall=&start=7>
- Department of Parks and Wildlife (DPaW) (2014c). *Tuart Forest National Park Management Plan 2014*. Management Plan number 79. Department of Park and Wildlife, Perth.
- Department of Parks and Wildlife (2015). Interim Recovery Plan 2015-2020 for Clay pans of the Swan Coastal Plain (Swan Coastal Plain community types 7, 8, 9 and 10a) and Clay pans with mid dense shrublands of 13 over herbs. Interim Recovery Plan No. 354. Perth.
- Department of Parks and Wildlife (DPaW). (2017). Western Ringtail Possum (*Pseudocheirus occidentalis*) Recovery Plan. Wildlife Management Program No. 58. Department of Parks and Wildlife, Perth, WA.
- Department of Primary Industries and Regional Development (DPIRD) (2021). *NRInfo Digital Mapping. Department of Primary Industries and Regional Development*. Government of Western Australia. URL: <https://maps.agric.wa.gov.au/nrm-info/> (accessed 4 July 2021).

- Department of Water and Environmental Regulation (DWER). (2018). *Vasse Wonnerup Wetlands*. Accessed on 15 June 2021. Retrieved from <https://rgw.dwer.wa.gov.au/vasse-wonnerup-wetland/>
- Department of Water and Environmental Regulation (DWER) (2019). *Procedure: Native vegetation clearing permits*. Joondalup. Available from: https://dwer.wa.gov.au/sites/default/files/Procedure_Native_vegetation_clearing_permits_v1.PDF.
- Department of Water and Environmental Regulation (DWER). Geographe Capes District. (2021). *Rights in Water and Irrigation Act 1914 advice for clearing permit application CPS 9168/1*. Received on 8 February 2021 (DWER Ref: A1978976).
- Ecoedge. (2019). *Detailed and Targeted Flora and Vegetation Survey along Bussell Highway, Hutton road to Sabina River (32.10 – 43.92 SLK)*. Biological survey undertaken in relation to the clearing permit application CPS 9168/1. Received by DWER on 23 December 2020. DWER Ref: A1968779.
- Ecoedge. (2021a). *Targeted Flora (Verticordia attenuata) Survey*. Bussell Highway between Hutton Road and Sabina River. Biological survey undertaken in relation to the clearing permit application CPS 9168/1. Received by DWER on 9 March 2021. DWER Ref: A1987003.
- Ecoedge. (2021b). *Detailed and Targeted Flora and Vegetation Survey along Bussell Highway, Hutton road to Sabina River (32.10 – 43.92 SLK)*. Biological survey prepared in relation to the clearing permit application CPS 9168/1. Received by DWER on 13 May 2021.
- Ecoedge. (2021c). *Targeted Vegetation survey of Threatened and Priority Ecological Communities Hutton road to Sabina River, Capel*. Biological survey prepared in relation to the clearing permit application CPS 9168/1. Received by DWER on 13 May 2021.
- Environmental Protection Authority (EPA) (2016). *Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment*. Available from: http://www.epa.wa.gov.au/sites/default/files/Policies_and_Guidance/EPA%20Technical%20Guidance%20-%20Flora%20and%20Vegetation%20survey_Dec13.pdf.
- Environmental Protection Authority (EPA) (2016). *Technical Guidance – Terrestrial Fauna Surveys*. Available from: https://www.epa.wa.gov.au/sites/default/files/Policies_and_Guidance/Tech%20guidance-%20Terrestrial%20Fauna%20Surveys-Dec-2016.pdf.
- George, A.S. & Gibson, N.. (2010). A revision of Calothamnus quadrifidus (Myrtaceae). 20. 57-77. Retrieved from <https://florabase.dpaw.wa.gov.au/science/nuytsia/587.pdf>
- Gibson, N., Keighery, B.J., Keighery, G.J., Burbidge, A.H. and Lyons, M.N. (1994). *A Floristic survey of the southern Swan Coastal Plain*. Unpublished Report for the Australian Heritage Commission prepared by Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.).
- Government of Western Australia (2019) *2018 South West Vegetation Complex Statistics. Current as of March 2019*. WA Department of Biodiversity, Conservation and Attractions, Perth, <https://catalogue.data.wa.gov.au/dataset/dbca>
- Government of Western Australia. (2019) *2018 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (Full Report). Current as of March 2019*. WA Department of Biodiversity, Conservation and Attractions. <https://catalogue.data.wa.gov.au/dataset/dbca-statewide-vegetation-statistics>
- Harewood, G., (2018). *Targeted Fauna Survey. Bussell Highway – Hutton to Sabina Section (31.25 – 43.67 SLK)*. Supporting document prepared in relation to clearing permit application CPS 9168/1. Received by DWER on 23 December 2020. DWER Ref: A1968799.
- Hedde, E. M., Loneragan, O. W., and Havel, J. J. (1980) *Vegetation Complexes of the Darling System, Western Australia*. In Department of Conservation and Environment, Atlas of Natural Resources, Darling System, Western Australia.
- Jones, B.A., How, R.A. and Kitchener, D.J. (1994). A Field Study of Pseudocheirus occidentalis (Marsupialia :Petauridae). II. Population Studies. Wildlife Research 21; 189-201.
- Keighery, B.J. (1994) *Bushland Plant Survey: A Guide to Plant Community Survey for the Community*. Wildflower Society of WA (Inc). Nedlands, Western Australia.
- Main Roads Western Australia. (2020a). Clearing Assessment Report. *Bussell Highway Duplication – Stage 2 Hutton to Sabina Proposal 31.15 to 44.0 SLK*. Supporting document in relation to clearing permit application CPS 9168/1. Received by DWER on 23 December 2020. DWER Ref: A1968799.
- Main Roads Western Australia. (2020b). *Bussell Highway (H043) Duplication Hutton Road to Sabina River Project: Supplementary fauna habitat assessment results*. Supporting document prepared in relation to clearing permit application CPS 9168/1. Received by DWER on 23 December 2020. DWER Ref: A1968799.
- Main Roads Western Australia. (2021a). Additional supporting information in relation to the clearing permit application CPS 9168/1. Received by DWER on 13 May 2021. DWER Ref: DWERDT451538.
- Main Roads Western Australia. (2021b). *Bussell Highway Duplication Stage 2 – Hutton to Sabina. Western Ringtail Possum Management Plan*. June 2021. Received by DWER on 29 June 2021. DWER Ref: A2021755.
- Main Roads Western Australia. (2021c). *Revegetation Plan. Bussell Highway (Capel to Hutton Section 23.38 – 32.15 SLK). State Forest No. 2 Offset Site*. Received by DWER on 4 April 2021. DWER Ref: A2014742.
- Main Roads Western Australia. (2021d). *Advice received in relation to clearing permit application CPS 9168/1*. Received by DWER on 6 July 2021. DWER Ref: A2023803.

- Main Roads Western Australia. (2021e). Advice on stakeholder engagement received. Received by DWER on 8 July 2021. DWER Ref: A2024328.
- Main Roads Western Australia. (2021f). *Bussell Highway Duplication Stage 2 Hutton to Sabina Section*. Preliminary documentation. EPBC 2020/8800. January 2021. Australian Government. Accessed on 8 July 2021. Retrieved from <https://www.mainroads.wa.gov.au/globalassets/projects-initiatives/projects/regional/bussell-highway-duplication/bussell-highway-duplication-epbc-preliminary-documentation.pdf>
- Mayer X., Ruprecht J., and Bari M. (2005). *Stream Salinity Status and Trends in South-west Western Australia*. Department of Environment. Salinity and land use impacts series. Report No. SLUI 38.
- Molloy, S., Wood, J., Hall, S., Wallrodt, S. and Whisson, G. (2009) *South West Regional Ecological Linkages Technical Report*, Western Australian Local Government Association and Department of Environment and Conservation, Perth.
- Ramsar Convention on Wetlands. (2014). *Vasse-Wonnerup System*. Accessed on 15 June 2021. Retrieved from <https://rsis Ramsar.org/ris/484>
- Schoknecht, N., Tille, P. and Purdie, B. (2004) *Soil-landscape mapping in South-Western Australia – Overview of Methodology and outputs* Resource Management Technical Report No. 280. Department of Agriculture.
- Shedley E and Williams K (2014) An assessment of habitat for western ringtail possum (*Pseudocheirus occidentalis*) on the southern Swan Coastal Plain. Unpublished report for the Department of Parks and Wildlife, Bunbury, Western Australia.
- Threatened Species Scientific Committee (TSSC) (2011). Advice to the Minister for Sustainability, Environment, Water, Population and Communities on an Amendment to the list of Threatened Ecological Communities under the EPBC Act. Retrieved from <http://www.environment.gov.au/biodiversity/threatened/communities/pubs/121-listing-advice.pdf>
- Threatened Species Scientific Committee (TSSC) (2017). Conservation advice for *Westralunio carteri* (Carter's freshwater mussel). The Minister approved this conservation advice and included this species in the Vulnerable category, effective from 15/02/2018. Retrieved from <https://www.environment.gov.au/biodiversity/threatened/species/pubs/86266-conservation-advice-15022018.pdf>
- Threatened Species Scientific Committee (TSSC) (2019). Approved Conservation Advice for the Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain. Canberra: Department of the Environment and Energy. Available from: <http://www.environment.gov.au/biodiversity/threatened/communities/pubs/153-conservation-advice.pdf>
- Valentine, L.E. and Stock, W. (2008) *Food Resources of Carnaby's Black Cockatoo (Calyptorhynchus latirostris) in the Gnaragar Sustainability Strategy Study Area*. Edith Cowan University and Department of Environment and Conservation. December 2008.
- Van Dyck, S., & Strahan, R. (2008). The Mammals of Australia. New South Wales: New Holland Publishers.
- WA Herbarium (1998-). *FloraBase - the Western Australian Flora*. Department of Biodiversity, Conservation and Attractions, Western Australia. <https://florabase.dpaw.wa.gov.au/> (Accessed April 2021)
- Wetland Research and Management (WRM). (2007). *Ecological Character Description for the Vasse-Wonnerup Wetlands Ramsar Site in South-west Western Australia*. Unpublished report to the Department of Environment and Conservation and Geopraphe Catchment Council Inc. by Wetland Research & Management. September 2007.