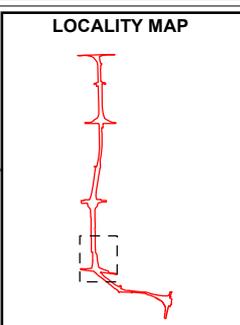


- Legend**
- Proposed Action
 - Vegetation condition**
 - Very good
 - Good
 - Degraded
 - Completely degraded
 - Local and regional roads

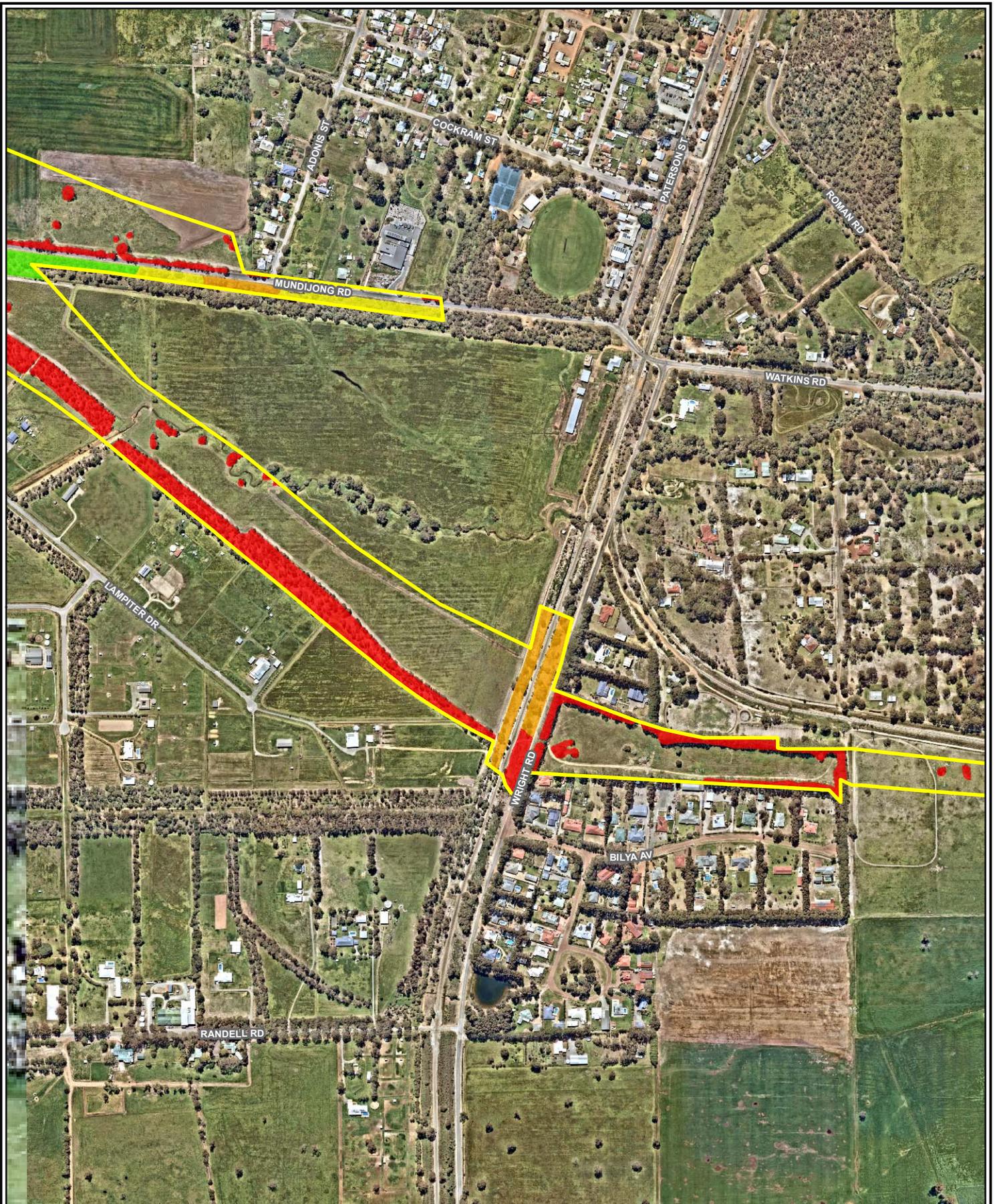


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Job No: 58910		
Client: Main Roads Western Australia		
Version: A	Date: 20-Jan-2021	
Drawn By: hsullivan	Checked By: DN	

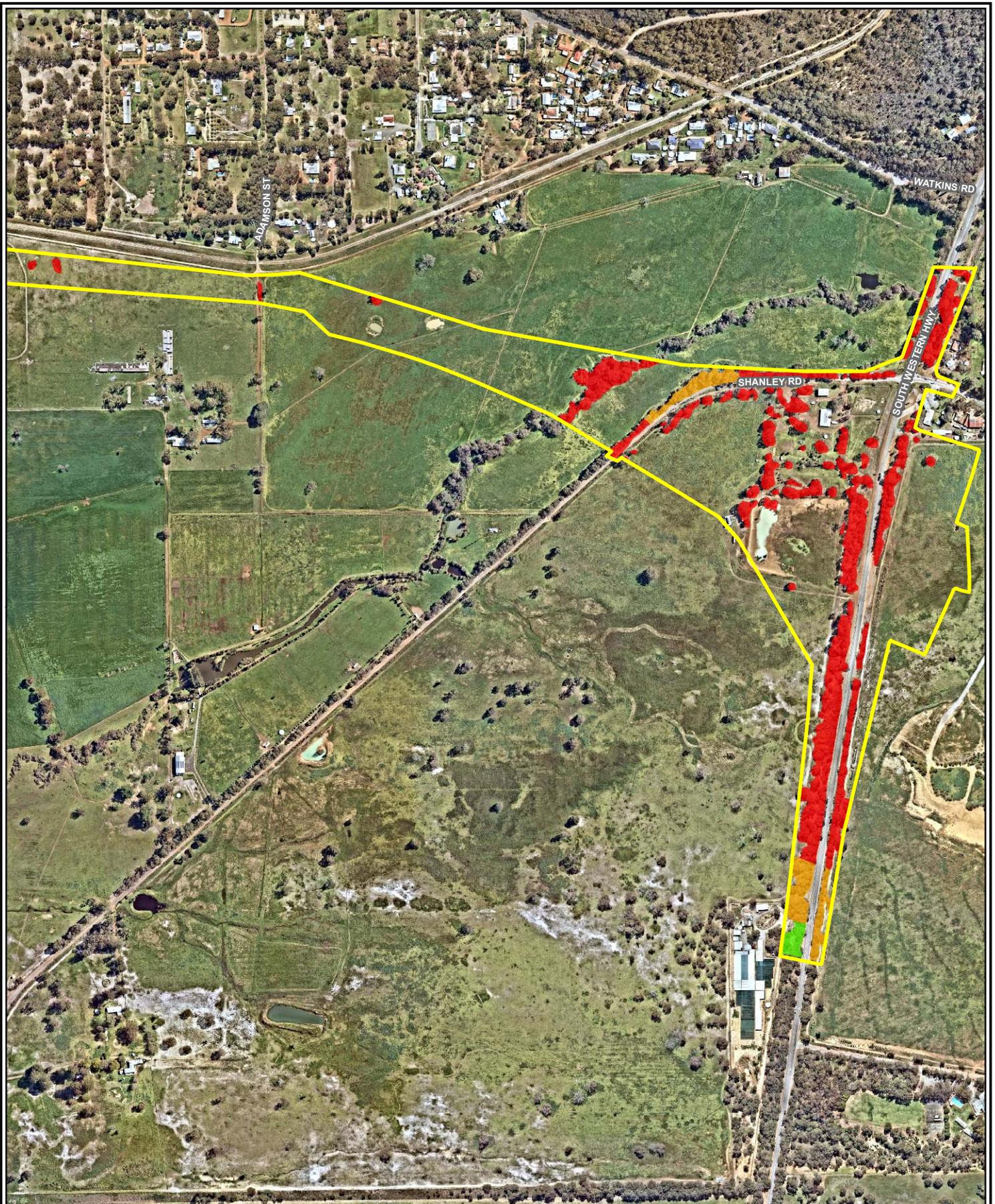
**Tonkin Highway Extension
WA**

VEGETATION CONDITION

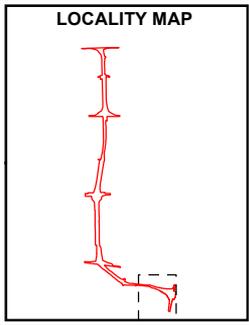
FIGURE 9 **PAGE 6**



Legend Proposed Action Vegetation condition Very good Good Degraded Completely degraded Local and regional roads	LOCALITY MAP 		Scale 1:9,000 at A4 		Tonkin Highway Extension WA	
	Coord. Sys. GDA 1994 MGA Zone 50 		VEGETATION CONDITION			
	Job No: 58910 Client: Main Roads Western Australia		Version: A Date: 20-Jan-2021		FIGURE 9 PAGE 7	
	Drawn By: hsullivan Checked By: DN					



- Legend**
- Proposed Action
 - Vegetation condition**
 - Very good
 - Degraded
 - Completely degraded
 - Local and regional roads



Scale 1:9,000 at A4		0 100 200 Meters
Coord. Sys. GDA 1994 MGA Zone 50		↑
Job No: 58910		
Client: Main Roads Western Australia		
Version: A	Date: 20-Jan-2021	
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Tonkin Highway Extension WA

VEGETATION CONDITION

FIGURE 9 PAGE 8

3.3 Technical Reports

The previous and additional technical studies undertaken to inform the assessment are summarised in Table 3.4.

Following referral of the Proposal in December 2019, additional surveys targeting threatened flora, fauna and ecological communities were undertaken to address additional information needed to conduct a comprehensive impact assessment.

Table 3.4: Summary of technical studies and surveys relevant to the Proposed Action

Report Title and Author	Dates	Location	Methodology
Surveys undertaken for the Proposal prior to referral			
Vegetation and Flora			
Mundijong Road Spring Flora Survey – Eco Logical (2019)	15 th November 2018	8.9 hectares of road reserve along Mundijong Road from Pure Steel Lane to Adonis Street, Mundijong.	Detailed and Targeted Survey
Tonkin Highway Extension (Thomas Road to South Western Highway) Reconnaissance Vegetation Survey – Woodman Consulting (2019)	24 th May 2019	Survey Area (Figure 3)	Reconnaissance Vegetation Survey – Vegetated areas assessed via series of relevés
Fauna			
Black Cockatoo Breeding, Feeding and Roosting Habitat Assessment, Tonkin Highway Extension – Tony Kirkby (2019)	Between 16 th April and 5 th May 2019.	Survey Area (Figure 3)	Trees within the study area were assessed for their significance to Black Cockatoo species
Fauna Assessment – Proposed Extension of Tonkin Highway	8 May 2019	Survey Area (Figure 3)	Level 1 survey - Site walkover of fauna habitats and opportunistic observations
Further surveys undertaken for the Proposal following referral to provide supplementary information			
Vegetation and Flora			
Tonkin Highway Extension (Thomas Road to South Western Highway) Flora and Vegetation Assessment – Woodman Consulting (2020)	Six site visits between 24 th May 2019 and 7 th April 2020.	Survey area (Figure 3)	Detailed and Targeted Survey – 11 non-permanent 10 x 10m flora survey quadrats with 14 relevés
Tonkin Highway Extension Phytophthora Dieback occurrence assessment – Glevan Consulting (2020)	16 th June 2020	Survey area (Figure 3) informed by Woodman	Survey undertaken in accordance with DBCA guidelines
Tonkin Highway Extension, Threatened Ecological Community Site Visit – Main Roads Western Australia (Draft Memorandum) (2020)	16 th September 2020	Within patches of SCP3a mapped by Woodman (2020)	Site visit attended by two representatives of the Main Roads Environment Branch and three representatives from the DBCA Species and Communities Branch to confirm the presence and extent of SCP3a
Tonkin Highway Extension <i>Phytophthora</i> Dieback occurrence assessment – Glevan Consulting (2020)	September 2020	Survey Area (Figure 3)	Diagnosis and mapping were performed to standards and procedures defined in FEM047 Chapter 6 (DPAW 2015)
Fauna			
Assessment of Potential Black Cockatoo <i>Calyptorhynchus</i> spp. Breeding Hollows, Tonkin Highway Extension – Tony Kirkby (2020)	1 st September 2020	Trees identified as having potentially suitable hollows by Kirkby (2019)	Updated assessment of Black Cockatoo habitat values to assess trees previously identified as containing hollows (from the ground)

Report Title and Author	Dates	Location	Methodology
			using a pole camera to determine suitability.
Black Cockatoo foraging habitat assessment – Strategen-JBS&G (2020)	8 th and 16 th September 2020	Survey Area (Figure 3)	With reference to vegetation mapping, assessment conducted with reference to both the existing guidelines (DSEWPaC 2012) as well as the recently revised draft guidelines (DEE 2017). In addition, survey methodology followed the recommendations listed on the DAWE’s Species Profile and Threats Database (DAWE 2020b).

4. Listed Threatened Species and Communities

4.1 Clay Pans TEC

The 'Clay Pans of the Swan Coastal Plain' ecological community (Clay Pans TEC) is listed as a 'Critically Endangered' (EPBC-CE) Threatened Ecological Community (TEC) under the *Environment Protection and Biodiversity Conservation Act 1999* (C'th) (EPBC Act) (DAWE,2012a).

4.1.1 Abundance, Distribution and Ecology

The DAWE (2012a, 2012b) and DBCA (2019) describe the key structural features and characteristics of the Clay Pans TEC as:

- Occurs predominately within the Swan Coastal Plain Interim Biogeographic Regionalisation for Australia (IBRA) bioregion (excepting a small number of locations in the Jarrah Forest IBRA bioregion) extending approximately 350 km from Jurien (north) to Dunsborough (south).
- Restricted to approximately 909 ha in area across 110 occurrences (DBCA, 2015), with individual occurrences generally < 10 ha (mean 6.2 ha). No minimum 'patch size' exists for the ecological community due to the occurrences being naturally small.
- Occurs where clay soils form an impermeable layer close to the landscape surface, forming wetlands solely reliant on rainfall to fill, which then dry to impervious pans in summer. The ecology is entirely dependent on the hydrological functioning of the clay pan; with no connection to the local groundwater.
- Vegetation generally occurs as a shrubland over a ground layer of geophytes, herbs and sedges. Vegetation exhibits a high species richness of flora taxa, however, there are no dominant flora taxa characteristic of the entire ecological community.
- Comprises ecological community 'types' of:
 - 'Herb rich saline shrublands in clay pans' (SCP07).
 - 'Herb rich shrublands in clay pans' (SCP08).
 - 'Dense shrublands on clay flats' (SCP09).
 - 'Shrublands on dry clay flats' (SCP10a).
 - 'Clay pans with shrubs over herbs' (Community 117).
- The condition of the vegetation must be 'Pristine', 'Excellent', 'Very Good' or 'Good' to be considered part of the Clay Pans TEC (i.e. 'condition threshold'). Vegetation in a 'Degraded' or 'Very Degraded' condition is not considered part of the Clay Pans TEC, however, may be ecologically important in supporting adjacent areas which meet the condition criteria (i.e. a 'buffer zone' from external impacts).
- Provides habitat for a variety of native fauna taxa, including 'Threatened' flora and fauna taxa under the EPBC Act.

It is estimated that > 90 % of the original extent of the Clay Pans TEC has been cleared for agricultural use, due to the seasonally inundated clay pans being considered relatively productive agricultural soils (Gibson *et al.* 2005 cited in DBCA & DAWE 2019). Additionally, parts of the Clay Pans TEC have also been historically mined for clay for its use in manufacturing bricks and tiles (DBCA & DAWE 2019), and more recently, cleared for urban development (DAWE 2012a, 2012b).

Of the remaining 909 ha of the Clay Pans TEC, approximately 60 % (540 ha) is protected within conservation reserves (DBCA & DAWE 2019). Of the approximately 190 ha of the Clay Pans TEC

occurring within a 5 km radius of the Proposed Action, approximately 9% (16.6 ha) is protected within conservation reserves (DBCA 2019, 2020; Figure 11).

The DAWE (2012b) provides criteria for determining the presence of the Clay Pans TEC. These criteria were used to assess the vegetation community’s representative of the Clay Pans TEC during the biological surveys for the Proposed Action.

4.1.2 Impacts of Proposed Action

Woodman (2020) defined vegetation occurring within vegetation unit VT1, to represent the Clay Pans TEC based on statistical similarity to SCP08, a component of the Clay Pans TEC (Figure 10). The Proposed Action will not directly impact on any vegetation representative of the Clay Pans TEC (Figure 10).

The Proposed Action includes 0.23 ha of vegetation consistent with the SCP08 community, where 0.17 ha (73.9%) is in ‘Degraded’ condition and the remaining 0.05 ha (21.7%) is in ‘Very Good’ condition (Figure 10). As a result, the 0.05 ha ‘Very Good’ condition patch is considered representative of the Clay Pans TEC (Table 5.1) and the 0.17 ha does not meet the criteria to be considered TEC. The Proposed Action may therefore present a risk of indirect impact to the TEC.

4.1.3 Quality and Importance

Within the area of the Proposed Action, Woodman (2020) assessed the condition of the occurrence of the Clay Pan TEC (0.05 ha) to be in a ‘Very Good’ condition in accordance with the Keighery (1994) condition rating scale.

Notably, as indicated by Table 4.1, the extent of the vegetation type is larger with an additional area (0.17 ha) in ‘Degraded’ condition which does not meet the condition criteria for the Clay Pans TEC.

Table 4.1: Clay Pans TEC Locations

TEC TYPE	SITE	LOCATION	TEC AREA (PATCH)	DIRECT IMPACT	VEGETATION DESCRIPTION / CONDITION
Clay Pans TEC (EPBC-CE)	1	SE corner Mundijong Rd. and Lampiter Dr. intersection.	0.05 ha	0.0 ha	Vegetation Description: VT1 (0.228 ha) - Mid-sparse shrubland of <i>X. preissii</i> and <i>K. australis</i> over low open shrubland of <i>V. densiflora</i> var. <i>densiflora</i> over low sparse sedgeland and grassland of mixed species on brown sandy clay with occasional laterite pebbles on seasonally inundated flats. (SCP08) Vegetation Condition: ‘Very Good’ (0.05 ha), ‘Degraded’ (0.17 ha) While the TEC is within the Proposed Action area, it will not be directly impacted.

4.1.4 Local Distribution

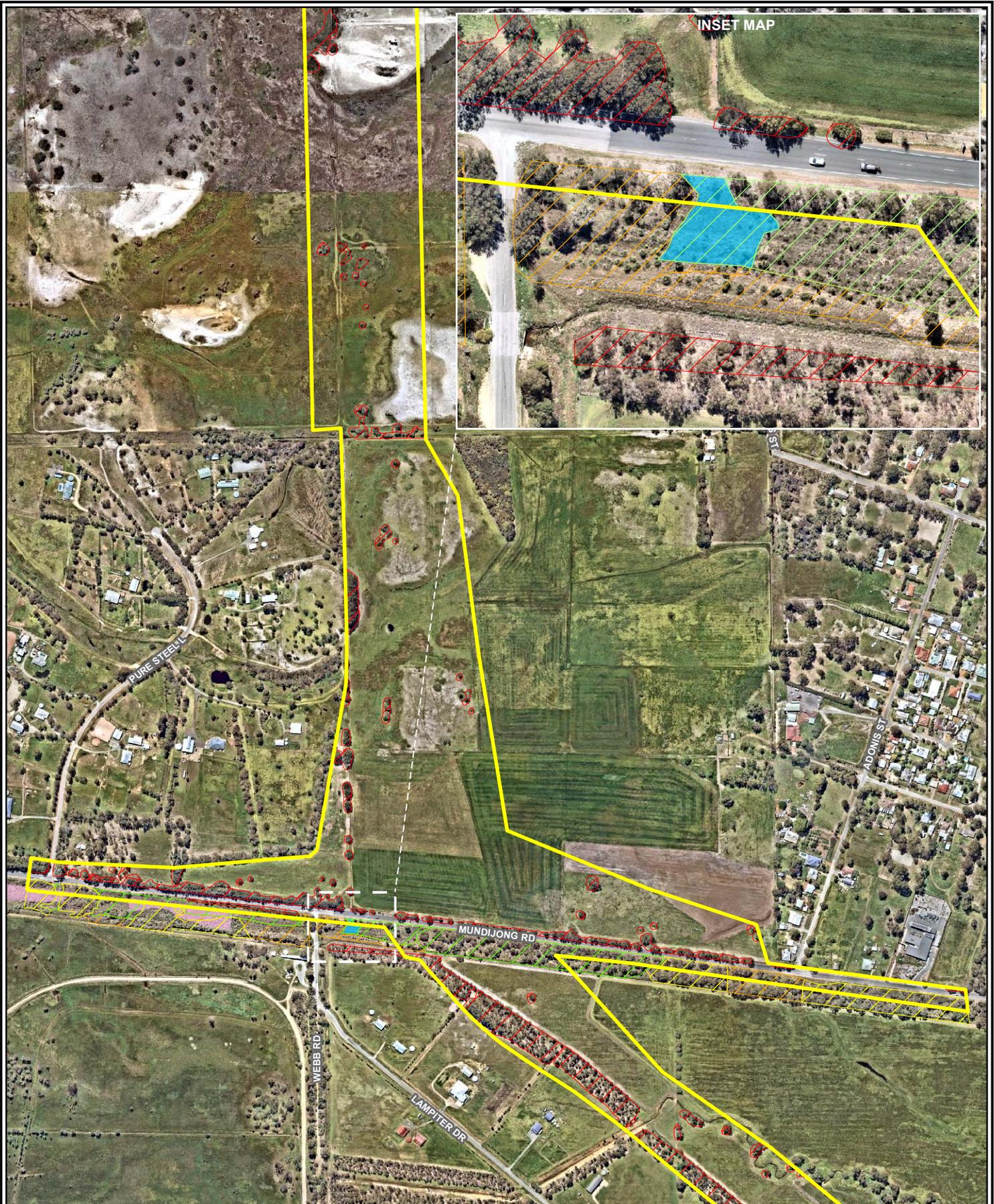
The occurrence of the Clay Pans TEC within the Proposed Action was not known to DBCA. Three occurrences of Clay Pan TEC mapped polygons intersect with the Proposed Action area (Figure 10) and five occurrences totalling approximately 190 ha occur within a 5 km radius of the Proposed Action (Figure 11). Approximately 16.6 ha is protected within conservation reserves.

Woodman (2020) assessed all known occurrences within the Survey Area and none of the three DBCA mapped occurrences were considered to contain vegetation similar to the Clay Pans TEC. They were therefore assigned alternate vegetation types.

None of the Clay Pans TEC will be directly impacted by the Proposed Action; however, given its close proximity, the occurrence totalling 0.054 ha may be subject indirect impacts particularly through altered surface and groundwater hydrology cycles.

4.1.5 Survey Adequacy and Limitations

The flora and vegetation field surveys were undertaken by suitably qualified and experienced personnel, within appropriate seasonal times, site access and resources. There are nil constraints which are considered to have affected the accuracy or reliability of the survey outcomes which would affect the assessment of the Proposed Action. An assessment of the potential for constraints of the flora and vegetation field surveys is presented in Appendix G.

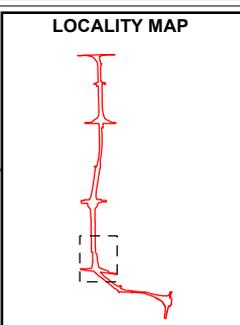


Legend

- Proposed Action
- Clay Pans TEC (EPBC-CE) – Survey area (Woodman 2020)
- Clay Pans TEC (EPBC-CE) – Regional distribution (DBCÁ, 2019)

Vegetation condition

- Very good
- Good
- Degraded
- Completely degraded
- Local and regional roads

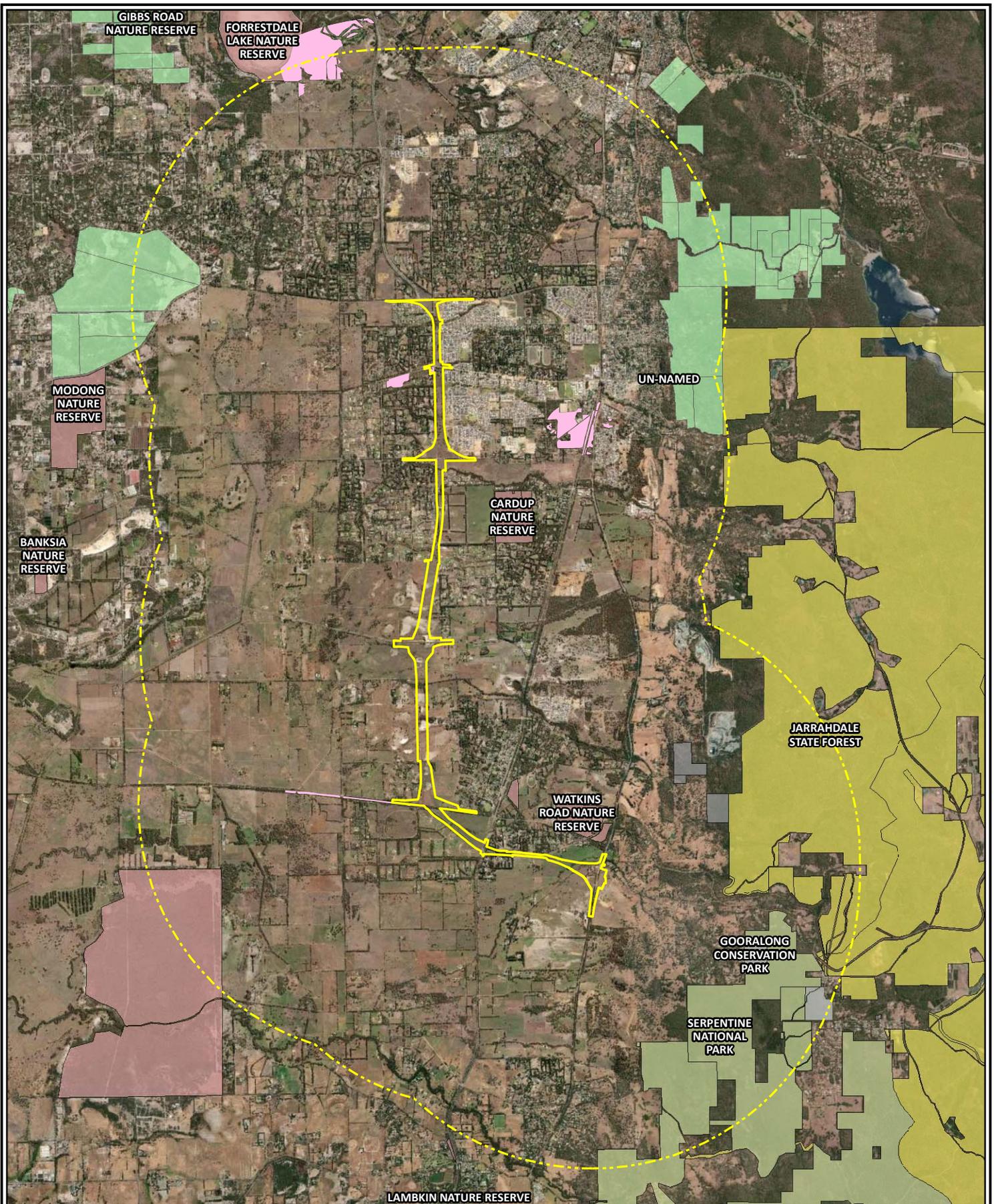


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Client: Main Roads Western Australia		
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Tonkin Highway Extension WA

CLAY PANS TEC (EPBC-CE) CONDITION WITHIN THE PROPOSED CONSTRUCTION FOOTPRINT

FIGURE 10



Legend Proposed Action 5 km radius of Proposed Action Clay Pans TEC (EPBC-CE) – Regional distribution (DBCA, 2019)	Legislated lands and waters (DBCA) National Park Crown Freehold - Dept Managed Section 5(1)(h) Reserve Nature Reserve State Forest Other Reserves	Scale 1:100,000 at A4	Tonkin Highway Extension WA
		Coord. Sys. GDA 1994 MGA Zone 50	CLAY PANS TEC (EPBC-CE) - REGIONAL OCCURRENCE (5 KM)
		Job No: 58910	FIGURE 11
		Client: Main Roads Western Australia	
Version: A	Date: 20-Jan-2021	Drawn By: hsullivan	

4.2 *Corymbia-Kingia* TEC (SCP 3a)

The '*Corymbia calophylla* - *Kingia australis* Woodlands on heavy soils of the Swan Coastal Plain' ecological community (*Corymbia-Kingia* TEC) is listed as an Endangered TEC under the EPBC Act. Woodman (2020) identified one patch of the *Corymbia-Kingia* TEC within the broader survey area.

4.2.1 Abundance, Distribution and Ecology

The DAWE (2000a, 2017a) and DBCA (2000a) describe the key structural features and characteristics of the *Corymbia-Kingia* TEC as:

- Occurs on the Swan Coastal Plain IBRA extending approximately 200 km from Guildford (near Perth, north) to Ruabon (near Busselton, south).
- Restricted to approximately 192 ha in area across 41 occurrences, with individual occurrences ranging from < 1 ha to near 30 ha. No minimum 'patch size' or 'condition thresholds' apply for the ecological community due to the restricted area remaining, with all occurrences forming part of the ecological community.
- This ecological community aligns with the Gibson et al. (1994) community type 3a.
- Occurs on a variety of land units and soil types, however, the soils in each occurrence all contain an impervious clay layer which act as a barrier to drainage of water through the soil, with occurrences inundated by rainfall and surface water during wetter months.
- Typical dominant flora taxa include the tree taxon *Corymbia calophylla* and the shrub taxa *Kingia australis*, *Dryandra nivea*, *Eriostemon spicatus* and *Xanthorrhoea preissii*.
- Groundwater is generally shallow at ≤ 3 m from the ground surface, indicating the ecological community is likely to be groundwater dependent (WA DEC 2011 cited in DAWE 2000a; Freund et al. 2004 cited in DAWE 2017a).
- Provides habitat for a variety of native flora and fauna taxa. No EPBC Act-listed 'Threatened' flora and fauna taxa are dependent on this ecological community, however some EPBC Act-listed fauna taxa (such as Black Cockatoos) may use part of this habitat for foraging.

It is estimated that > 90% of the original extent of the *Corymbia-Kingia* TEC has been cleared for agricultural use (DAWE 2000a, 2017a).

Of the >150 ha within a 5 km radius of the Proposed Action, approximately 30% (48 ha) of the *Corymbia-Kingia* TEC is protected within conservation reserves (DBCA 2019, 2020).

The DAWE (2000a, 2017a) provides criteria for determining the presence of the *Corymbia-Kingia* TEC. These criteria were used to assess the vegetation community's representative of the *Corymbia-Kingia* TEC during the biological surveys for the Proposed Action. In particular, the DAWE (2000a) identifies the typical and dominant flora taxa which distinguish the *Corymbia-Kingia* TEC from other known *Corymbia*-dominated ecological communities.

4.2.2 Impact of Proposed Action

The biological surveys by Woodman (2020) mapped a total of 2.08 ha of the *Corymbia-Kingia* TEC at one occurrence within the broader Survey Area (Figure 12). Woodman (2020) defined vegetation occurring within vegetation unit VT2 and VT3, to represent the *Corymbia-Kingia* TEC based on statistical similarity to SCP3a. The Proposed Action will impact 0.13 ha of the mapped *Corymbia-Kingia* TEC area, as identified by Figure 12. As a result, of the total 2.08 ha patch of the TEC identified during the survey, 0.13 ha is proposed to be cleared.

4.2.3 Quality and Importance

The location, vegetation type and condition of the *Corymbia-Kingia* TEC is identified by Table 4.2. The *Corymbia-Kingia* TEC comprises two vegetation types, with the condition ranging from 'Very

Good' (1.33 ha) to 'Degraded' (0.75 ha). Of the 0.13 ha of *Corymbia-Kingia* TEC that will be impacted for the Proposed Action, 0.10 ha is in 'Very Good' condition and the remaining 0.03 ha is in 'Degraded' condition (Figure 12).

The area of *Corymbia-Kingia* TEC not proposed to be directly impacted (1.95 ha) will be retained within the road reserve. Indirect impacts will be minimised through the implementation of management measures defined in Section 6.

Table 4.2: Corymbia-Kingia TEC (EPBC-E) Locations

TEC TYPE	SITE	LOCATION	TEC AREA (PATCH)	DIRECT IMPACT	VEGETATION DESCRIPTION / CONDITION
<i>Corymbia-Kingia</i> TEC (EPBC-E)	1	South side Mundijong Rd. near Lampiter Dr. intersection. (previously recorded DBCA 2000a Occurrence 7 at 1.2 ha)	2.08 ha	0.13 ha	Vegetation Description: VT2 (0.51 ha) - Tall sparse shrubland dominated by <i>Jacksonia sternbergiana</i> , <i>Kingia australis</i> and <i>Xanthorrhoea preissii</i> over low sparse shrubland, over low open sedgeland and grassland of mixed species, over low sparse shrubland of mixed species on brown sandy loam on seasonally moist flats VT3 (1.57 ha) - Tall to mid sparse shrubland dominated by <i>J. sternbergiana</i> , <i>K. australis</i> and <i>X. preissii</i> over mid sparse shrubland of mixed species, over shrubland to open shrubland of mixed species, over low open rushland and sedgeland of mixed species on brown sandy clay on seasonally moist flats. Vegetation Condition: 'Very Good' (1.33 ha), 'Degraded' (0.75 ha)

At a local scale, regional mapping indicates there is over 150 ha (~80 %) of the *Corymbia-Kingia* TEC within a 5 km radius of the Proposed Action (DBCA 2019). This represents < 1 % (0.7 %) of the recorded regional distribution (192 ha) and < 1 % of the local distribution of the *Corymbia-Kingia* TEC (> 150 ha). This TEC occurrence is located in an isolated area between an existing road and an agricultural drain. Critical habitat for the TEC is defined by the interim recovery plan as "...the heavy soils on which the community occurs, the fresh groundwater, and/or surface water that helps sustain flora species in this wetland community, and the catchment for this groundwater and surface water" (DBCA 2000a). The 0.13 ha of *Corymbia-Kingia* TEC within the Proposed Action area meets these criteria and is therefore considered critical.

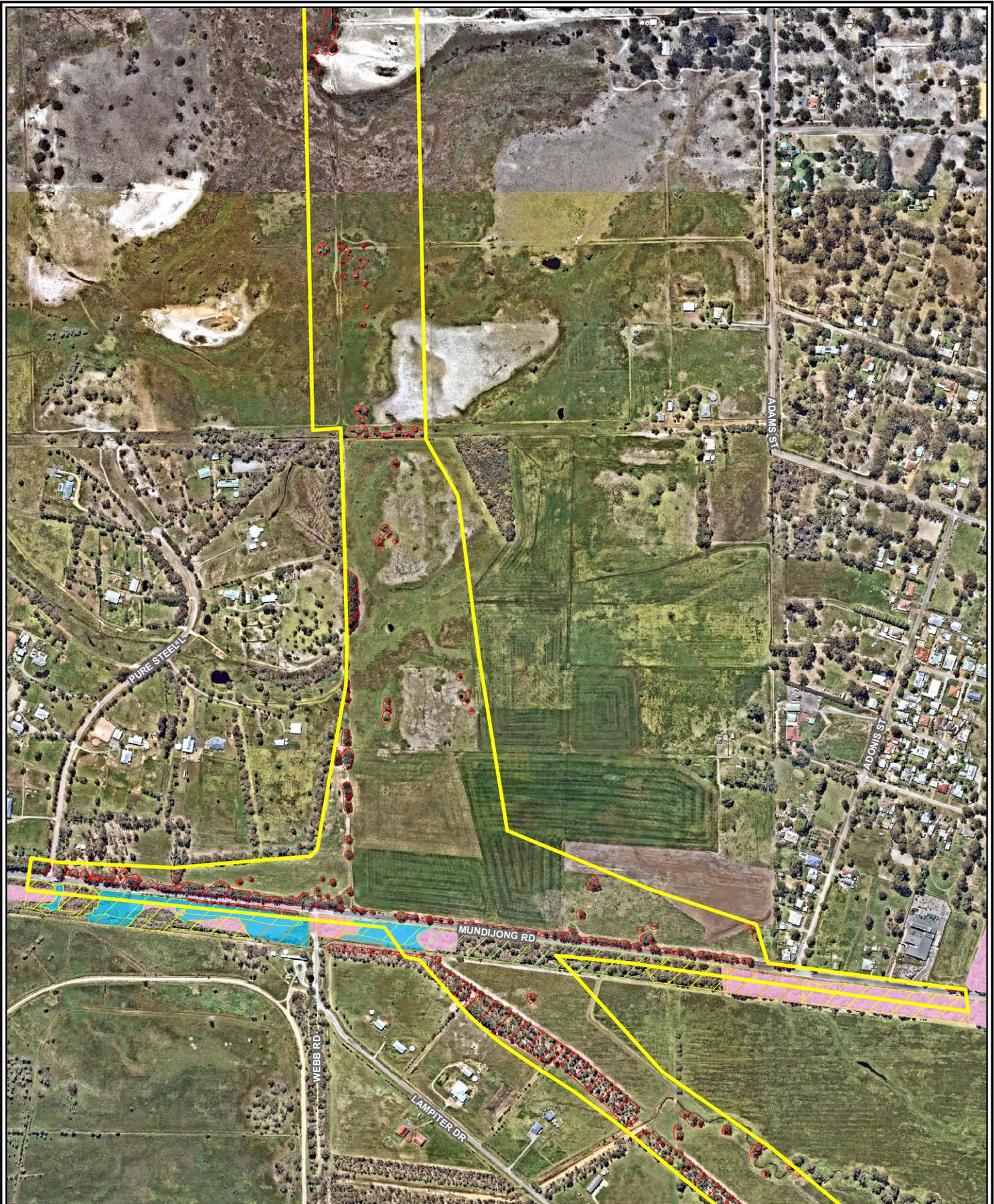
4.2.4 Local Distribution

Three occurrences of *Corymbia-Kingia* TEC are mapped by DBCA within the Proposed Action area (Figure 10). Woodman (2020) assessed all known occurrences within the proposed action area and only those along the western extent of Mudijong Road were found to represent the TEC.

Mapping for the TEC indicates that 152.56 ha (79.5 %) of the known *Corymbia-Kingia* TEC extent occurs within a 5 km radius of the Proposed Action (DBCA 2019). It should be noted that the best-available TEC mapping is broad in nature and overlaps in some places with the Clay Pans TEC and the *Corymbia-Xanthorrhoea* TEC (Figure 13).

4.2.5 Survey Adequacy and Limitations

The flora and vegetation field surveys were undertaken by suitably qualified and experienced personnel, within appropriate seasonal times, site access and resources. There are nil constraints which are considered to have affected the accuracy or reliability of the survey outcomes which would affect the assessment of the Proposed Action. An assessment of the potential for constraints of the flora and vegetation field surveys is presented in Appendix G.



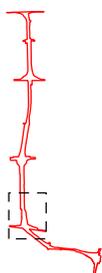
Legend

- Proposed Action
- Corymbia-Kingia* TEC (EPBC-E) – Survey area (Woodman 2020)
- Corymbia-Kingia* TEC (EPBC-E) – Regional distribution (DBCA, 2019)

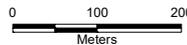
Vegetation condition

- Very good
- Good
- Degraded
- Completely degraded

LOCALITY MAP



Scale 1:9,000 at A4



Coord. Sys. GDA 1994 MGA Zone 50



Job No: 58910

Client: Main Roads Western Australia

Version: A

Date: 20-Jan-2021

Drawn By: hsullivan

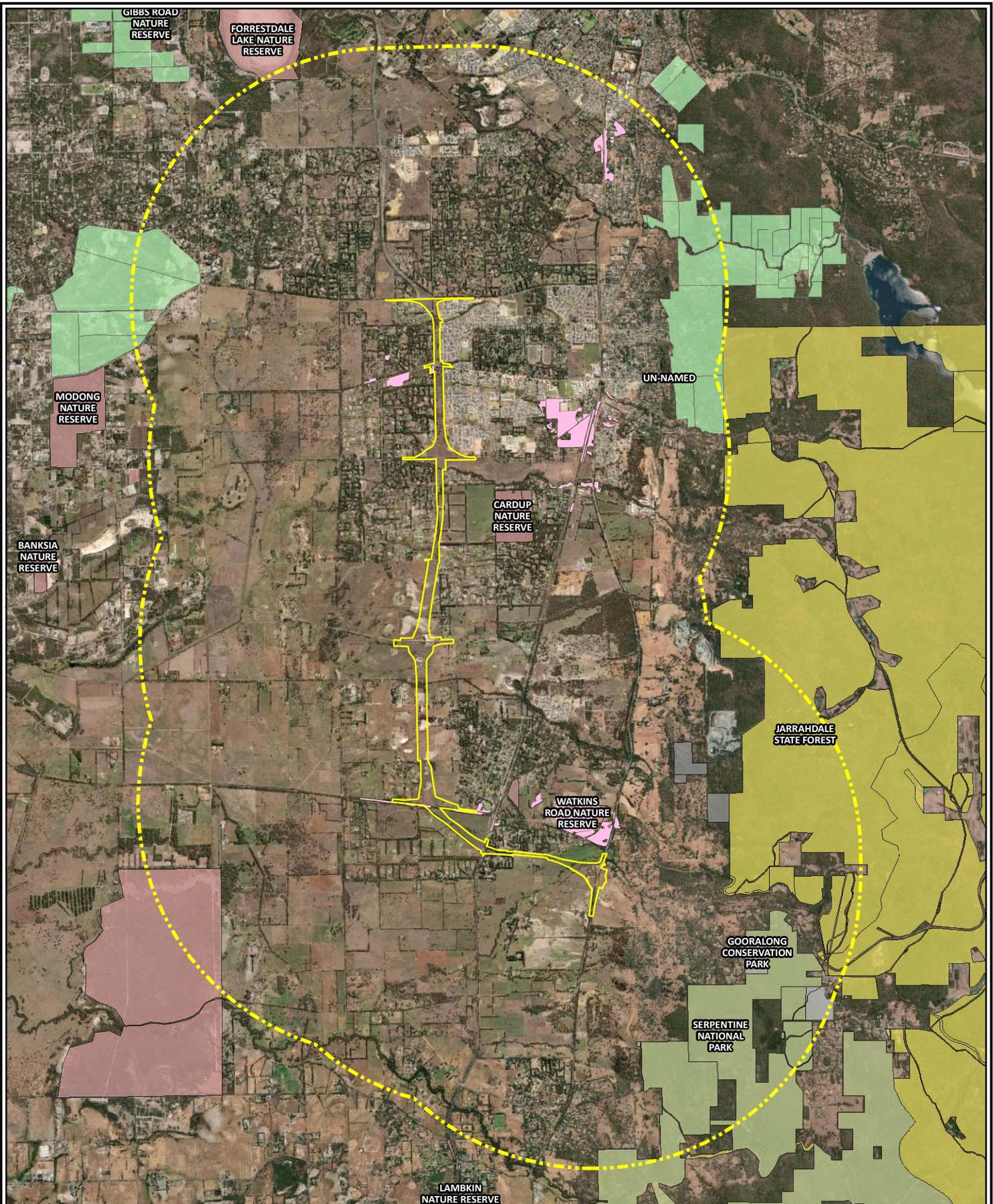
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Tonkin Highway Extension WA

CORYMBIA-KINGIA TEC (EPBC-E) CONDITION AND DIEBACK MAPPING WITHIN THE PROPOSED ACTION

FIGURE 12



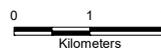


Legend

- Proposed Action
- 5 km radius of Proposed Action
- Corymbia-Kingia* TEC (EPBC-E) – Regional distribution (DBCA, 2019)

- Legislated lands and waters (DBCA)**
- National Park
 - Crown Freehold - Dept Managed
 - Section 5(1)(h) Reserve
 - Nature Reserve
 - State Forest
 - Other Reserves

Scale 1:100,000 at A4



Coord. Sys. GDA 1994 MGA Zone 50



Job No: 58910

Client: Main Roads Western Australia

Version: A

Date: 20-Jan-2021

Drawn By: hsullivan

Checked By: CT

Tonkin Highway Extension WA

CORYMBIA-KINGIA TEC (EPBC-E) - REGIONAL OCCURENCE (5 KM)

FIGURE 13



4.3 *Corymbia-Xanthorrhoea* TEC (SCP 3c)

The '*Corymbia calophylla* – *Xanthorrhoea preissii* woodlands and shrublands of the Swan Coastal Plain' ecological community (*Corymbia-Xanthorrhoea* TEC) is listed as an Endangered TEC under the EPBC Act. Eight patches of *Corymbia-Xanthorrhoea* TEC were identified within the broader survey area (Woodman 2020). One additional patch of VT5 was reported to display superficial similarities to the TEC, however Woodman (2020) concluded it did not represent the *Corymbia-Xanthorrhoea* TEC.

Subsequent to the Woodman (2020) survey, DBCA advised during a site visit (GHD 2020) that vegetation in 'Degraded' or 'Completely Degraded' condition is not representative of the TEC given such vegetation lacks the required structure and species assemblages to be considered the *Corymbia-Xanthorrhoea* TEC. DAWE have advised that all patches of the *Corymbia-Xanthorrhoea* TEC are required to be included in the TEC extent, regardless of condition. The assessment of the *Corymbia-Xanthorrhoea* TEC present within the Proposed Action has been amended to be consistent with this advice.

4.3.1 Abundance, Distribution and Ecology

The DAWE (2000b 2017b) and DBCA (2000b) describe the key structural features and characteristics of the *Corymbia-Xanthorrhoea* TEC as:

- Occurs on heavy soils on the eastern side Swan Coastal Plain extending approximately 200 km from Bullsbrook (north of Perth) to Capel (south, towards Bunbury).
- Restricted to approximately 115 ha in area across 29 occurrences. No minimum patch size or condition thresholds apply for the ecological community due to the restricted area remaining, with all occurrences forming part of the ecological community.
- Occurs mainly on soils that contain a clay layer that is quite impervious, resulting in occurrences frequently becoming inundated in the wetter months due to rainfall and surface flows.
- This ecological community aligns with the Gibson et al. (1994) community type 3c.
- Typical dominant flora taxa include the tree taxon *Corymbia calophylla* and occasionally *Eucalyptus wandoo*, and the shrub taxa *Xanthorrhoea preissii*, *Acacia pulchella*, *Banksia dallanneyi*, *Dryandra nivea*, *Gompholobium marginatum* and *Hypocalymma angustifolia*.
- Provides habitat for a variety of native flora and fauna taxa. No EPBC Act-listed 'Threatened' flora and fauna taxa are dependent on this ecological community, however some EPBC Act-listed fauna taxa (such as Black Cockatoos) may use part of this habitat for foraging.

It is estimated that > 90 % of the original extent of the *Corymbia-Xanthorrhoea* TEC has been cleared for agricultural use (DAWE 2000b, 2017b).

Local mapping indicates > 60 ha of the *Corymbia-Xanthorrhoea* TEC in 10 occurrences within a 5 km radius of the Proposed Action, of which approximately 10% (7.8 ha) is protected within conservation reserves (DBCA 2019, 2020)).

The DAWE (2000b, 2017c) provides criteria for determining the presence of the *Corymbia-Xanthorrhoea* TEC. These criteria were used to assess the vegetation community's representative of the *Corymbia-Xanthorrhoea* TEC during the biological surveys for the Proposed Action. In particular, the DAWE (2000b) identifies the typical and dominant flora taxa which distinguish the *Corymbia-Xanthorrhoea* TEC from other known *Corymbia* dominated ecological communities.

4.3.2 Impact of Proposed Action

A total of 8.94 ha of *Corymbia-Xanthorrhoea* TEC was mapped within the broader Survey Area, across eight occurrences (Table 4.3, Figure 14). Vegetation consistent with the *Corymbia-*

Xanthorrhoea TEC was identified as VT4 and VT6 (Table 3.1) given their statistical similarity to the TEC. All occurrences of the TEC within the survey area were previously known as per DBCA mapping.

A total of 3.94 ha of the TEC will be subject to impact by the Proposed Action across seven patches. One of the patches mapped by Woodman (2020) at the south western corner of the Abernethy Road and Hopkinson Road intersection will not be impacted. Of the 3.94 ha to be impacted, 1.16 ha (29.4%) is in 'Very Good' condition, 0.29 ha (7.4%) is in 'Good' condition, 1.92 ha (48.7%) is in 'Degraded' condition, and 0.57 ha (14.5%) is in 'Completely Degraded' condition. (Table 4.3).

4.3.3 Quality and Importance

The location, vegetation type and condition of each recorded occurrence of the *Corymbia-Xanthorrhoea* TEC is identified in Table 4.3. The *Corymbia-Xanthorrhoea* TEC comprises two vegetation types within the broader Survey Area (VT4 and VT6). A combined 63.9% of the total mapped area of the ecological community is in 'Degraded' to 'Completely Degraded' condition.

Table 4.3: *Corymbia-Xanthorrhoea* TEC (EPBC-E) Locations

TEC TYPE	SITE	LOCATION	TEC AREA (PATCH)	DIRECT IMPACT	VEGETATION DESCRIPTION / CONDITION
<i>Corymbia-Xanthorrhoea</i> TEC (EPBC-E)	1	W side of Hopkinson Rd. between Jersey Rd. and Charolais Ct.	0.13 ha	0.13 ha	Vegetation Description: VT4 (0.13 ha) - Mid open forest of <i>Corymbia calophylla</i> over tall to mid sparse shrubland dominated by <i>Xanthorrhoea preissii</i> and <i>Kingia australis</i> over low sedgeland to open sedgeland over low sparse forbland of mixed species on grey or brown sand or sandy loam on dry flats. Vegetation Condition: 'Good' (0.13 ha)
	2	SW corner of Abernethy Rd and Hopkinson Rd intersection	0.90 ha	0.0 ha	Vegetation Description: VT4 (0.9 ha) - Mid open forest of <i>C. calophylla</i> over tall to mid sparse shrubland dominated by <i>X. preissii</i> and <i>K. australis</i> over low sedgeland to open sedgeland over low sparse forbland of mixed species on grey or brown sand or sandy loam on dry flats. Vegetation Condition: 'Very Good' (0.24 ha) Degraded' (0.65 ha)
	3	N side of Orton Rd between Bullock Dr and Hopkinson Rd.	0.48 ha	0.41 ha	Vegetation Description: VT4 (0.48 ha) - Mid open forest of <i>C. calophylla</i> over tall to mid sparse shrubland dominated by <i>X. preissii</i> and <i>K. australis</i> over low sedgeland to open sedgeland over low sparse forbland of mixed species on grey or brown sand or sandy loam on dry flats. Vegetation Condition: 'Degraded' (0.37 ha) 'Completely Degraded' (0.11 ha)
	4	W side of Hopkinson Rd between Cavanagh Cl and Gossage Rd	0.56 ha	0.34 ha	Vegetation Description: VT4 (0.56 ha) - Mid open forest of <i>C. calophylla</i> over tall to mid sparse shrubland dominated by <i>X. preissii</i> and <i>K. australis</i> over low sedgeland to open sedgeland over low sparse forbland of mixed species on grey or brown sand or sandy loam on dry flats. 'Degraded' (0.56 ha)

TEC TYPE	SITE	LOCATION	TEC AREA (PATCH)	DIRECT IMPACT	VEGETATION DESCRIPTION / CONDITION
	5	N side of Bishop Rd between Kargotich Rd and Hopkinson Rd.	0.30 ha	0.30 ha	Vegetation Description: VT4 (0.38 ha) - Mid open forest of <i>C. calophylla</i> over tall to mid sparse shrubland dominated by <i>X. preissii</i> and <i>K. australis</i> over low sedgeland to open sedgeland over low sparse forbland of mixed species on grey or brown sand or sandy loam on dry flats. Vegetation Condition: 'Degraded' (0.30 ha)
	6	S side of Mundijong Rd. between Lampiter Dr. and Paterson St. (previously recorded DBCA 2000b Occurrence 5 at 3.6 ha)	4.31 ha	1.39 ha	Vegetation Description: VT4 (4.31 ha) - Mid open forest of <i>C. calophylla</i> over tall to mid sparse shrubland dominated by <i>X. preissii</i> and <i>K. australis</i> over low sedgeland to open sedgeland over low sparse forbland of mixed species on grey or brown sand or sandy loam on dry flats. Vegetation Condition: 'Very Good' (1.84 ha) 'Good' (1.86 ha) 'Degraded' (0.61 ha)
	7	E and W sides of railway line adjacent to Wright Rd between Mundijong Rd and Bilya Ave.	1.45 ha	0.66 ha	Vegetation Description: VT4 (4.31 ha) - Mid open forest of <i>C. calophylla</i> over tall to mid sparse shrubland dominated by <i>X. preissii</i> and <i>K. australis</i> over low sedgeland to open sedgeland over low sparse forbland of mixed species on grey or brown sand or sandy loam on dry flats. Vegetation Condition: 'Degraded' (1.18 ha) 'Completely Degraded' (0.27 ha)
	8	W and N sides of Shanley Rd west of South Western Highway	0.73 ha	0.71 ha	Vegetation Description: VT6 (0.73 ha) – Mid open forest of <i>C. calophylla</i> over mid sparse shrubland of <i>X. preissii</i> and <i>K. australis</i> over low sparse shrubland, low open sedgeland, low open introduced grassland, low open shrubland and forbland on brown sandy loam on mid to lower slopes of foothills. Vegetation Condition: 'Degraded' (0.36 ha) 'Completely Degraded' (0.37 ha)

The Proposed Action will require the clearing of 3.94 ha of the *Corymbia-Xanthorrhoea* TEC, representing approximately 3.4% of the total recorded regional distribution (115 ha) and 6.4% of the local distribution within 5 km (61.8 ha).

Critical habitat for this TEC is defined within the Approved Conservation Advice as "...the heavy soils on which it occurs, the fresh superficial groundwater, and/or surface water that may help sustain flora species in this community, and the catchment for this groundwater and surface water. Because of its very restricted distribution, no condition thresholds have been applied to the nationally-listed ecological community and hence all areas meeting the description of the ecological community are habitat areas critical to its survival" (DotEE 2017). The 3.94 ha of *Corymbia-Xanthorrhoea* TEC within the Proposed Action meets these criteria and is therefore considered critical.

4.3.4 Local Distribution

No DBCA known occurrences are located within the Proposed Action area and the *Corymbia-Xanthorrhoea* TEC was not included within the Preliminary Documentation request for

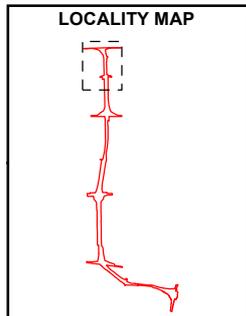
more information. Mapping for the TEC indicates eight occurrences totalling over 60 ha (~53.7%) of the regional *Corymbia-Xanthorrhoea* TEC exists within a 5 km radius of the Proposed Action. Approximately 10% (7.8 ha) of this is protected within conservation reserves (DBCA 2019, 2020, Figure 15). Biological surveys identified that the *Corymbia- Xanthorrhoea* TEC was previously mapped by DBCA as the *Corymbia- Kingia* TEC within the Proposed Action area/Survey Area.

4.3.5 Survey Adequacy and Limitations

The flora and vegetation field surveys were undertaken by suitably qualified and experienced personnel, within appropriate seasonal times, site access and resources. There are nil constraints which are considered to have affected the accuracy or reliability of the survey outcomes which would affect the assessment of the Proposed Action. An assessment of the potential for constraints of the flora and vegetation field surveys is presented in Appendix G.



- Legend**
- Proposed Action
 - Corymbia-Xanthorrhoea* TEC (EPBC-E) – Regional distribution (DBCA, 2019)
 - Corymbia-Xanthorrhoea* TEC (EPBC-E) – Survey area (Woodman 2020)
- Vegetation condition
- Very good
 - Good
 - Degraded
 - Completely degraded

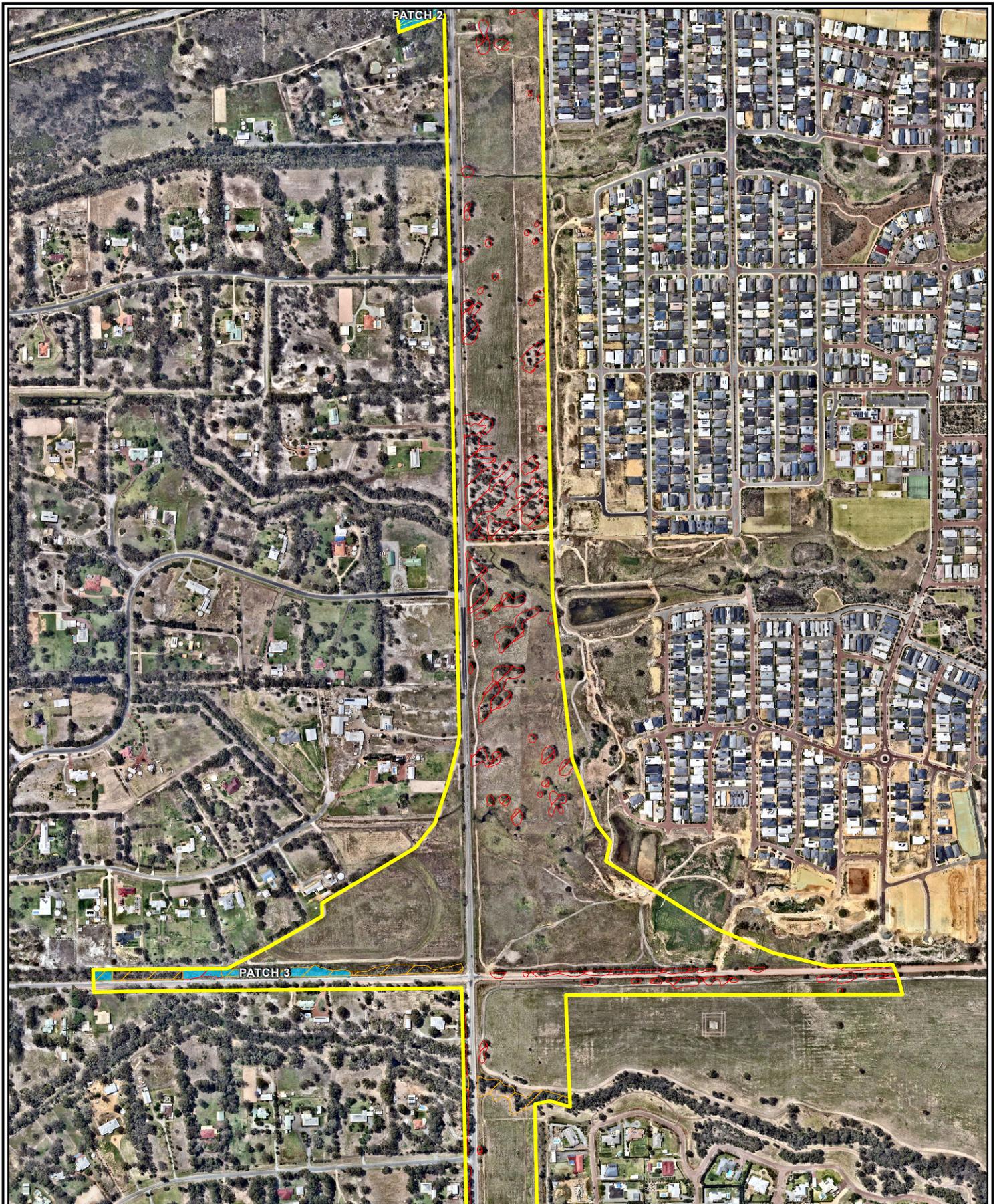


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Coord. Sys. GDA 1994 MGA Zone 50		
Job No: 58910		
Client: Main Roads Western Australia		
Version: A	Date: 02-Jun-2021	
Drawn By: hsullivan	Checked By: DN	

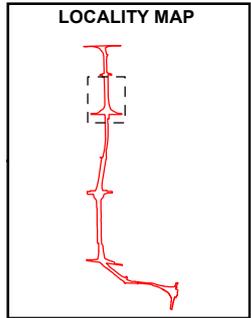
Tonkin Highway Extension WA

CORYMBIA-XANTHORRHOEA TEC (EPBC-E) CONDITION WITHIN THE AREA OF THE PROPOSED ACTION

FIGURE 14 **PAGE 1**



- Legend**
- Proposed Action
 - Corymbia-Xanthorrhoea* TEC (EPBC-E) – Regional distribution (DBCA, 2019)
 - Corymbia-Xanthorrhoea* TEC (EPBC-E) – Survey area (Woodman 2020)
- Vegetation condition
- Very good
 - Good
 - Degraded
 - Completely degraded

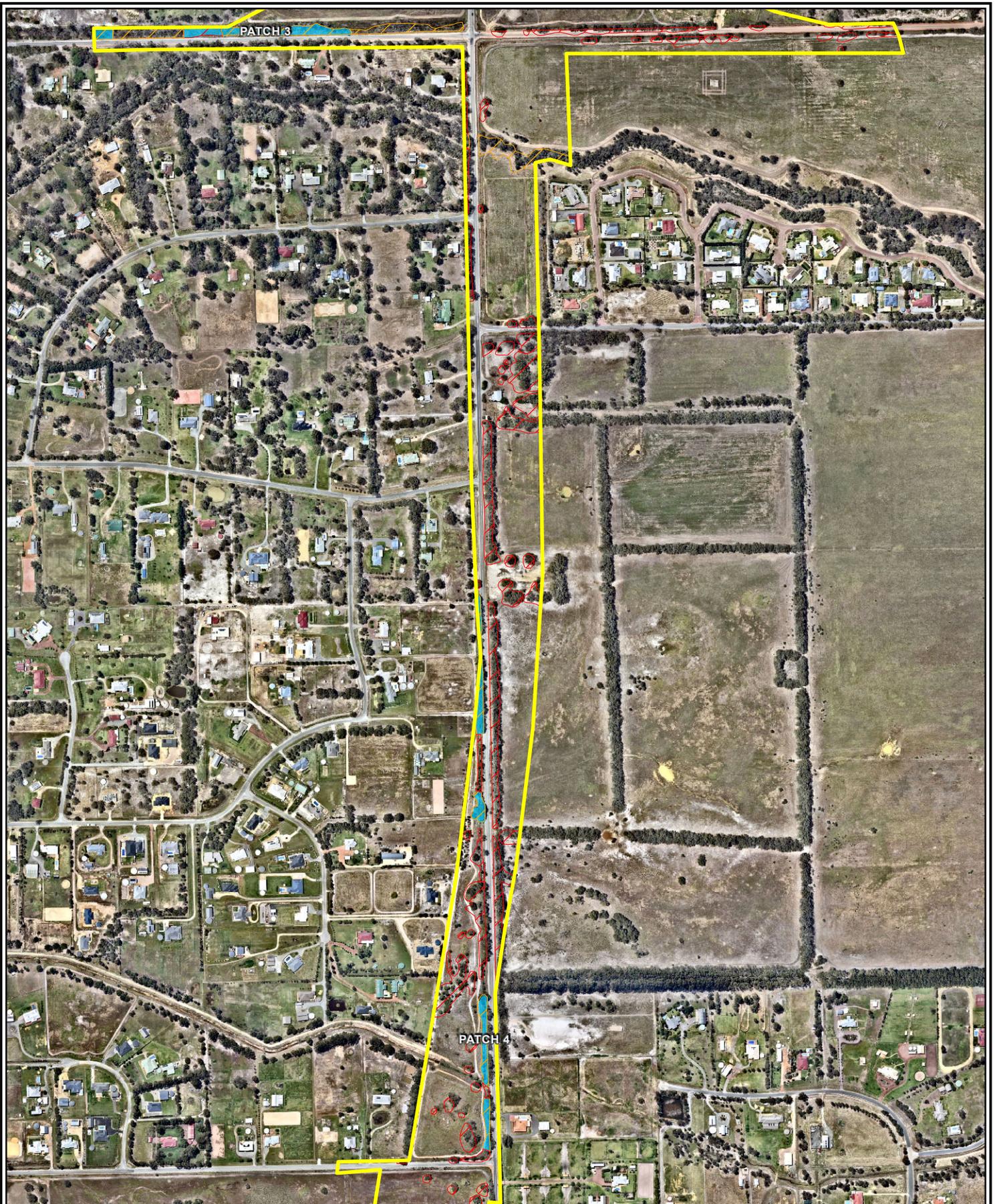


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Client: Main Roads Western Australia		
Version: A	Date: 02-Jun-2021	
Drawn By: hsullivan	Checked By: DN	

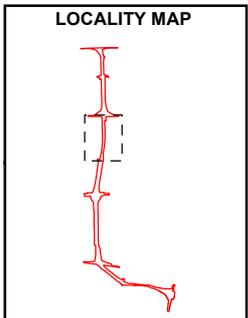
Tonkin Highway Extension WA

CORYMBIA-XANTHORRHOEA TEC (EPBC-E) CONDITION WITHIN THE AREA OF THE PROPOSED ACTION

FIGURE 14 **PAGE 2**



- Legend**
- Proposed Action
 - Corymbia-Xanthorrhoea* TEC (EPBC-E) – Regional distribution (DBCA, 2019)
 - Corymbia-Xanthorrhoea* TEC (EPBC-E) – Survey area (Woodman 2020)
- Vegetation condition
- Very good
 - Good
 - Degraded
 - Completely degraded

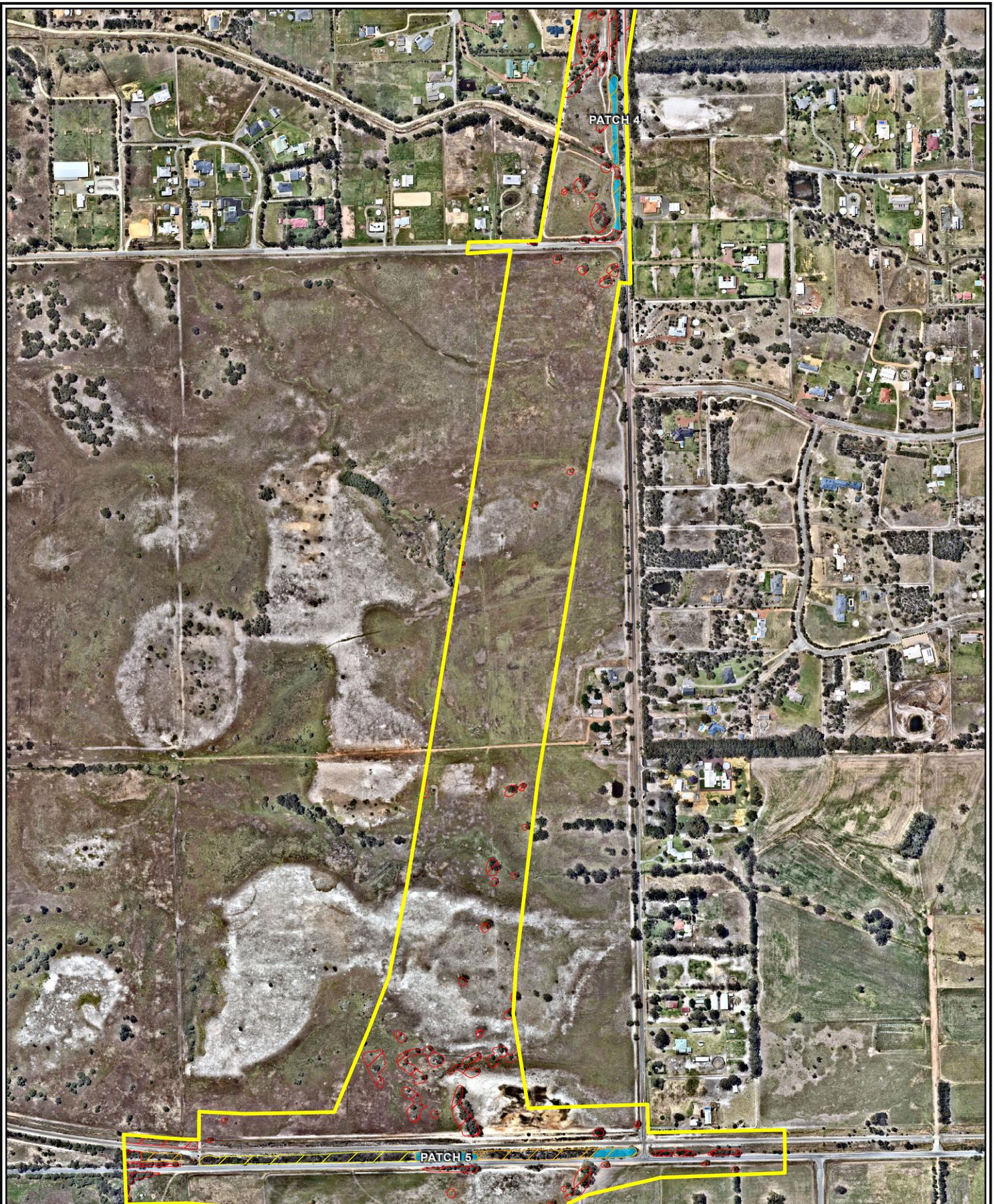


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Version: A	Date: 02-Jun-2021	
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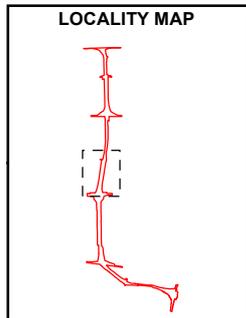
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CORYMBIA-XANTHORRHOEA TEC (EPBC-E) CONDITION WITHIN THE AREA OF THE PROPOSED ACTION

FIGURE 14 **PAGE 3**



- Legend**
- Proposed Action
 - Corymbia-Xanthorrhoea* TEC (EPBC-E) – Regional distribution (DBCA, 2019)
 - Corymbia-Xanthorrhoea* TEC (EPBC-E) – Survey area (Woodman 2020)
- Vegetation condition
- Very good
 - Good
 - Degraded
 - Completely degraded

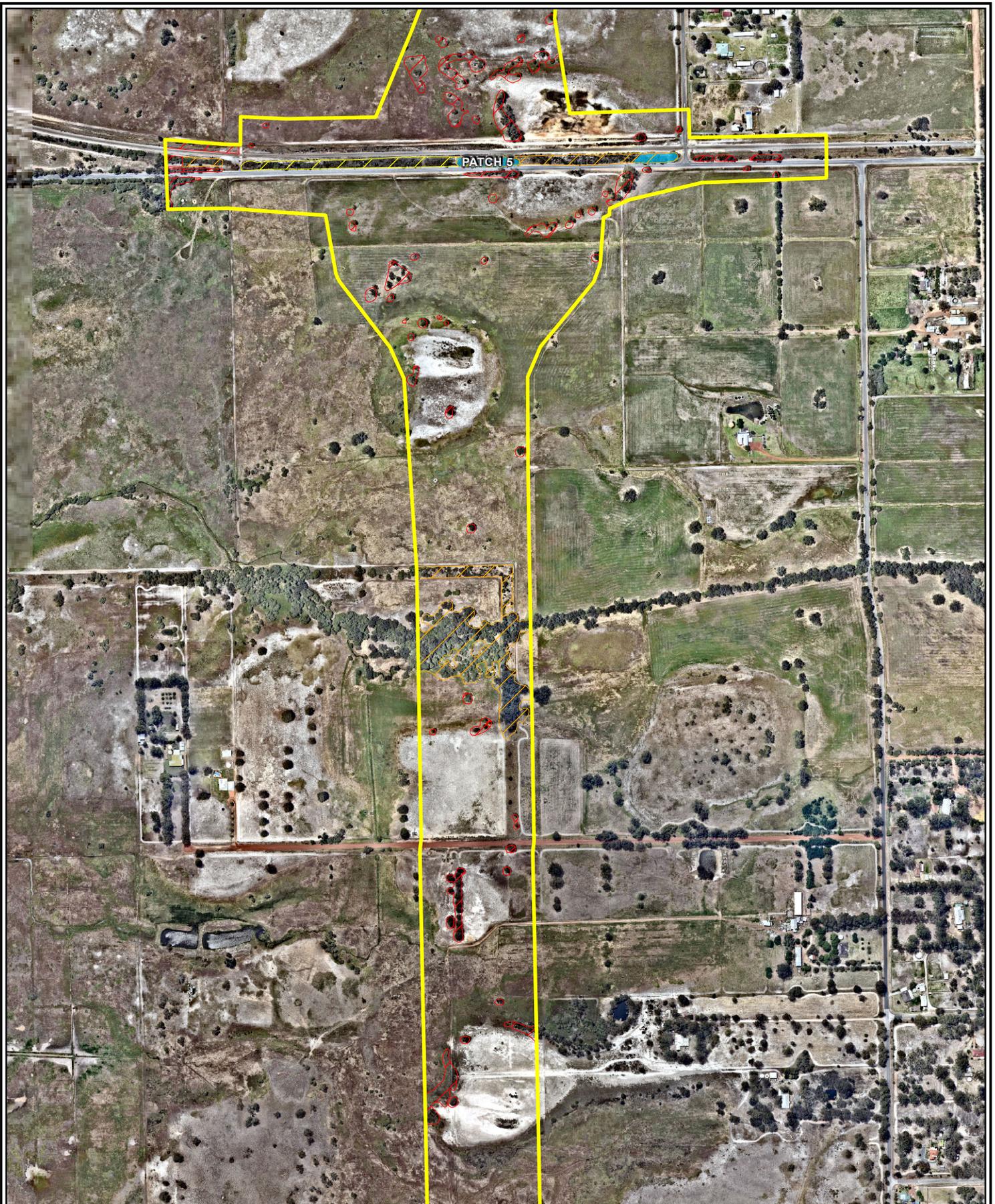


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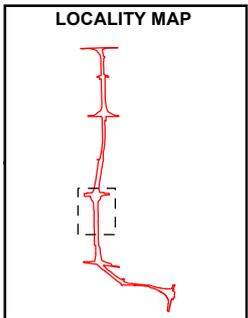
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CORYMBIA-XANTHORRHOEA TEC (EPBC-E) CONDITION WITHIN THE AREA OF THE PROPOSED ACTION

FIGURE 14 **PAGE 4**



- Legend**
- Proposed Action
 - Corymbia-Xanthorrhoea* TEC (EPBC-E) – Regional distribution (DBCA, 2019)
 - Corymbia-Xanthorrhoea* TEC (EPBC-E) – Survey area (Woodman 2020)
- Vegetation condition**
- Very good
 - Good
 - Degraded
 - Completely degraded

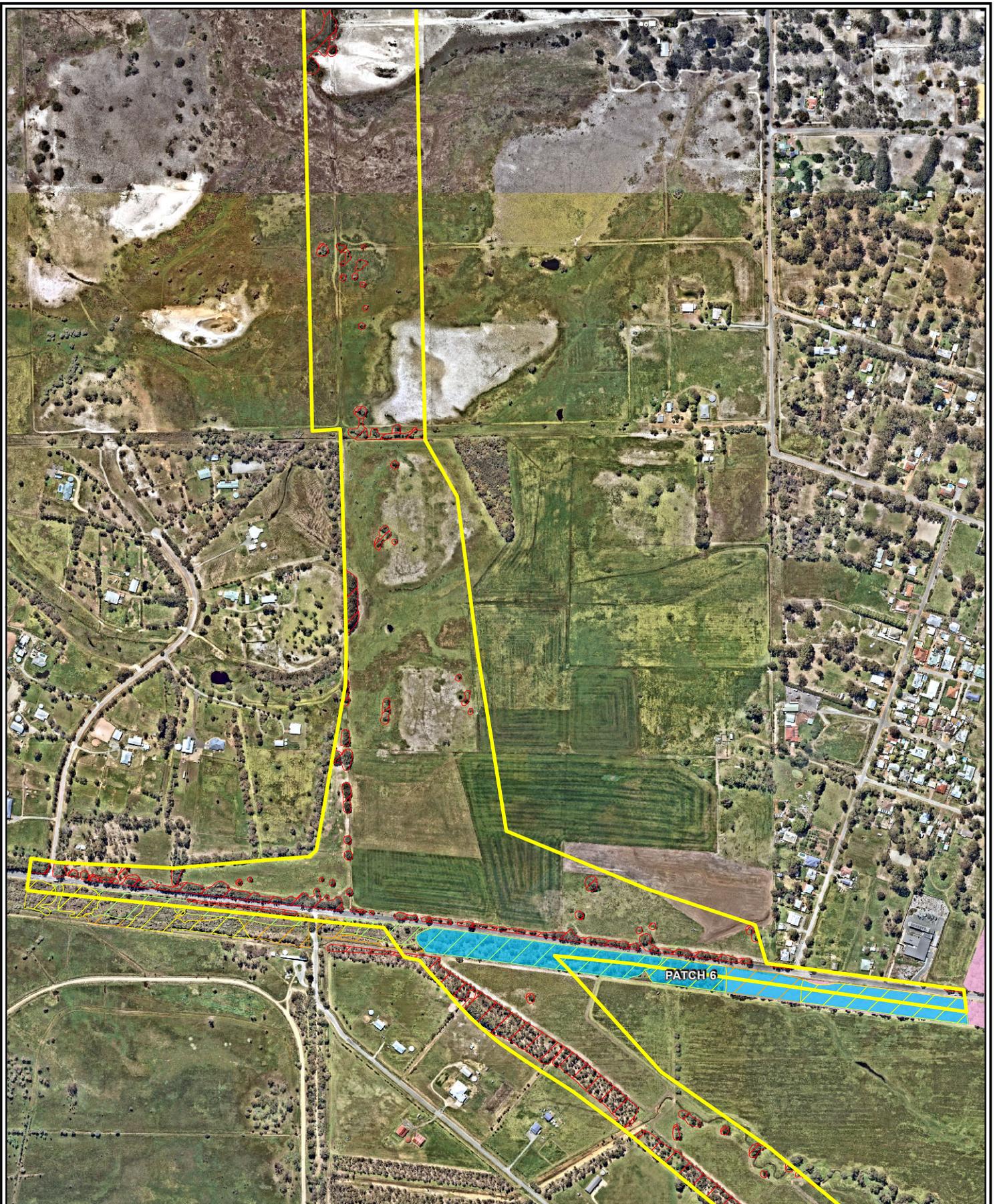


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Client: Main Roads Western Australia			
Version: A	Date: 02-Jun-2021		
Drawn By: hsullivan	Checked By: DN		

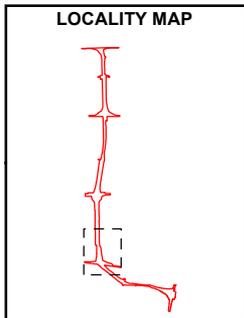
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CORYMBIA-XANTHORRHOEA TEC (EPBC-E) CONDITION WITHIN THE AREA OF THE PROPOSED ACTION

FIGURE 14 **PAGE 5**



- Legend**
- Proposed Action
 - Corymbia-Xanthorrhoea* TEC (EPBC-E) – Regional distribution (DBCA, 2019)
 - Corymbia-Xanthorrhoea* TEC (EPBC-E) – Survey area (Woodman 2020)
- Vegetation condition
- Very good
 - Good
 - Degraded
 - Completely degraded

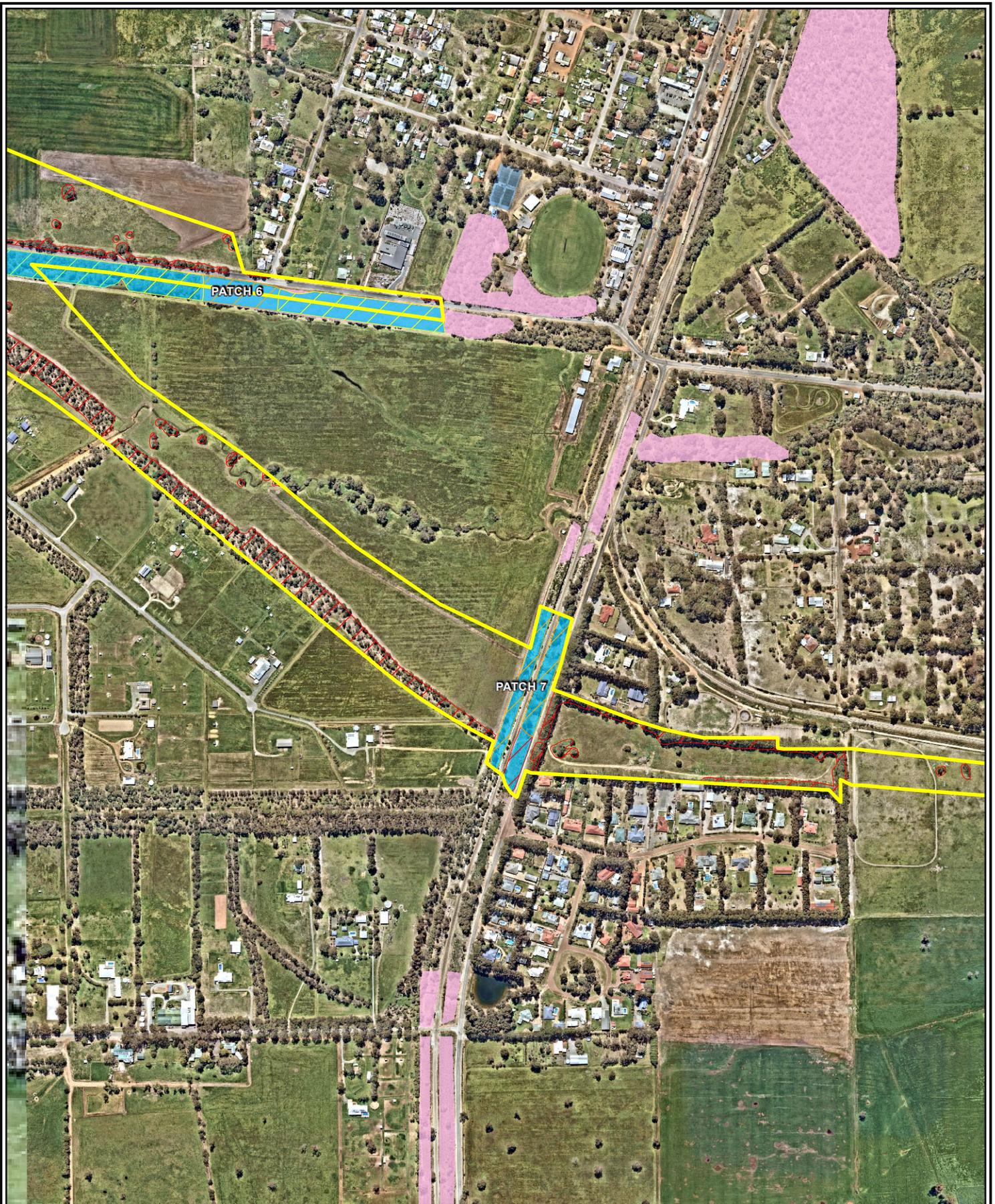


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Client: Main Roads Western Australia		
Version: A	Date: 02-Jun-2021	
Drawn By: hsullivan	Checked By: DN	

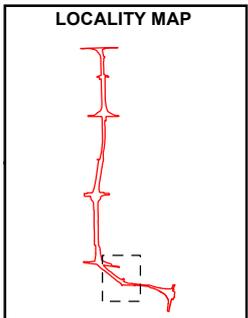
Tonkin Highway Extension WA

CORYMBIA-XANTHORRHOEA TEC (EPBC-E) CONDITION WITHIN THE AREA OF THE PROPOSED ACTION

FIGURE 14 **PAGE 6**



- Legend**
- Proposed Action
 - Corymbia-Xanthorrhoea* TEC (EPBC-E) – Regional distribution (DBCA, 2019)
 - Corymbia-Xanthorrhoea* TEC (EPBC-E) – Survey area (Woodman 2020)
- Vegetation condition
- Very good
 - Good
 - Degraded
 - Completely degraded

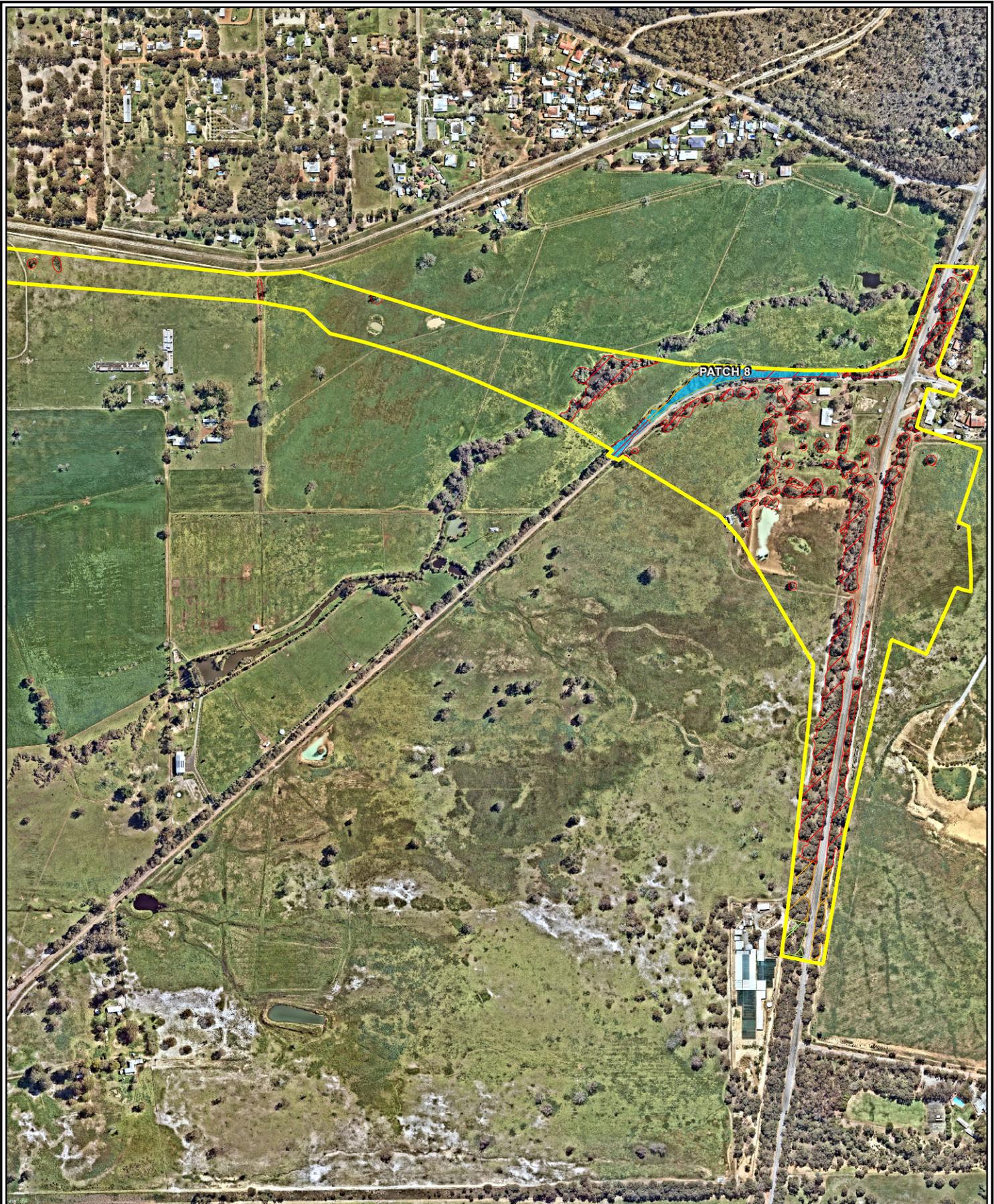


Scale 1:9,000 at A4		0 100 200 metres	
Coord. Sys. GDA 1994 MGA Zone 50		↑	
Job No: 58910			
Client: Main Roads Western Australia			
Version: A	Date: 02-Jun-2021		
Drawn By: hsullivan	Checked By: DN		

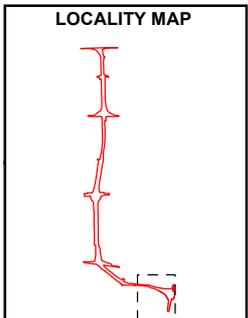
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CORYMBIA-XANTHORRHOEA TEC (EPBC-E) CONDITION WITHIN THE AREA OF THE PROPOSED ACTION

FIGURE 14 **PAGE 7**



- Legend**
- Proposed Action
 - Corymbia-Xanthorrhoea* TEC (EPBC-E) – Regional distribution (DBCA, 2019)
 - Corymbia-Xanthorrhoea* TEC (EPBC-E) – Survey area (Woodman 2020)
- Vegetation condition
- Very good
 - Good
 - Degraded
 - Completely degraded

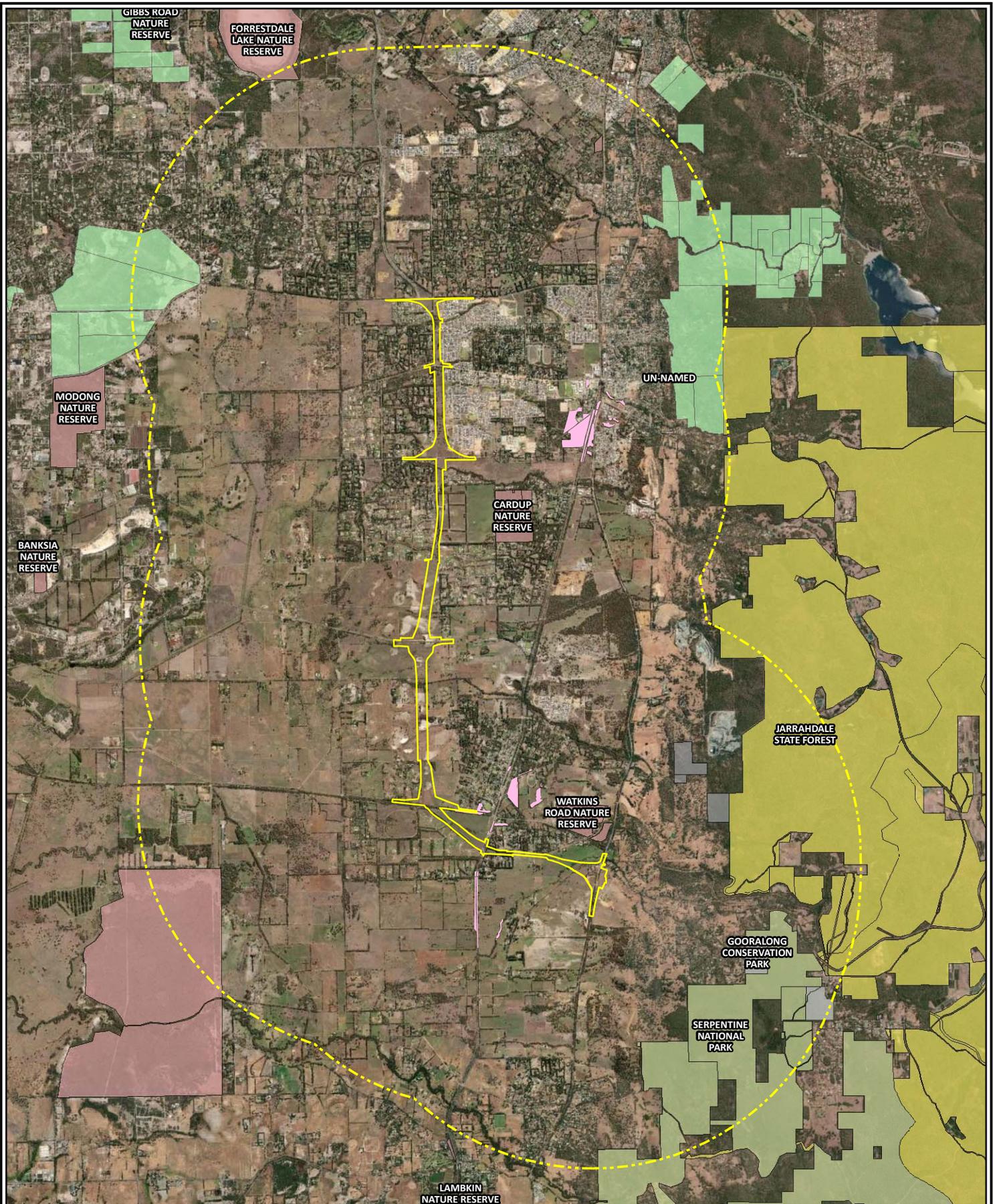


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Job No: 58910		
Client: Main Roads Western Australia		
Version: A	Date: 02-Jun-2021	
Drawn By: hsullivan	Checked By: DN	

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CORYMBIA-XANTHORRHOEA TEC (EPBC-E) CONDITION WITHIN THE AREA OF THE PROPOSED ACTION

FIGURE 14 **PAGE 8**



Legend

- Proposed Action
- 5 km radius of Proposed Action
- Corymbia-Xanthorrhoea* TEC (EPBC-E) – Regional distribution (DBCA, 2019)

- Legislated lands and waters (DBCA)**
- National Park
 - Crown Freehold - Dept Managed
 - Section 5(1)(h) Reserve
 - Nature Reserve
 - State Forest
 - Other Reserves

Scale 1:100,000 at A4



Coord. Sys. GDA 1994 MGA Zone 50



Job No: 58910

Client: Main Roads Western Australia

Version: A

Date: 20-Jan-2021

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Checked By: DN

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***CORYMBIA-XANTHORRHOEA* TEC (EPBC-E) - REGIONAL OCCURRENCE (5 KM)**

FIGURE 15



4.4 *Synaphea* sp. Serpentine

Synaphea sp. Serpentine (G.R. Brand 103) (Threatened) is an erect clumped shrub growing up to 0.6 m high occurring in seasonally wet areas (WA Herbarium 1998-) (Plate 1). This species is listed as Critically Endangered under both the BC Act and EPBC Act (DBCA 2018b, DAWE 2020). It is endemic to Western Australia (ALA 2020), occurring over a narrow geographic range from west of Byford to south of Serpentine, growing predominantly in grey-brown sandy-loam or clay (DPaW 2017).

4.4.1 Abundance, Distribution and Ecology

The Interim Recovery Plan for *Synaphea* sp. Serpentine indicates the species is known from 12 highly fragmented populations, with the majority of plants occurring on weedy road and rail reserves, and part of one population occurring within conservation tenure (DPaW 2017).

The Conservation Advice for the species documented a total of 1,328 individuals of the species across six populations in Mundijong, Cardup and Serpentine (TSSC 2018). Subsequent surveys have increased the known number of individuals to 1,834 mature plants, which is inclusive of the 551 individuals identified by Woodman Environmental (Woodman 2020). Further to this, recent advice from the DBCA estimates the total population size to be 4,801 individuals across six populations.

Synaphea sp. Serpentine was recorded in VTs 1 and 2 within the Proposed Action area, and additionally in VTs 3 and 7 in the Survey Area but external to the Proposed Action area (Woodman 2020). Habitat for the species within the Proposed Action area mainly comprises mid to tall shrubland, chiefly dominated by *Xanthorrhoea preissii* and *Kingia australis* over mixed shrubs, sedges and grasses, on sandy clays and loams, on dry to seasonally inundated flats (Woodman 2020).



Plate 1: *Synaphea* sp. Serpentine (G.R. Brand 103) (Threatened) (Woodman Environmental)

4.4.2 Impact of Proposed Action

A single population of *Synaphea* sp. Serpentine is located within the Mundijong Road reserve, within the Proposed Action (Woodman 2020). This population has previously been recorded by DBCA and is known as TPFL Population 5, comprised of 48 mature and 53 juvenile plants (Woodman 2020).

The majority of TPFL Population 5 falls within the Proposed Action area, with an additional 13 populations known from within a 5km radius of the Proposed Action (TSSC 2018).

Targeted surveys for *Synaphea* sp. Serpentine were conducted in September and October 2019 by Woodman Environmental (Woodman 2020) during the known flowering period for the species (late August – November). Targeted surveys were undertaken at multiple locations where habitat suitable for the species occurred within the broader survey area. A total of 551 individuals at 268 locations were recorded within the survey area, of which three will be impacted by the Proposed Action (Woodman 2020, Figure 16). Therefore, three individuals are proposed to be cleared and the remaining 548 will be retained (Figure 16).

Up to 0.13 ha of potential habitat for *Synaphea* sp. Serpentine occurs within the Proposed Action within VT 2 (Woodman 2020). Outside of the Proposed Action, within the broader survey area, the species was identified within VT1, VT3 and VT7. All vegetation types comprising potential habitat for *Synaphea* sp. Serpentine (i.e. VTs 1, 2, 3 and 7) were subject to targeted searches for the species and no further individuals, beyond the 551 reported, were located.

4.4.3 Quality and Importance

Up to 0.13 ha of suitable habitat for *Synaphea* sp. Serpentine is proposed to be cleared within the Proposed Action area, comprising 0.10 ha in ‘Very Good’ condition, and the remainder in ‘Degraded’ condition. A total of three individuals of *Synaphea* sp. Serpentine are proposed to be taken. Given the limitations of the point data associated with the DBCA mapping for Population 5 (i.e. the population is represented by a single point location) it is unclear exactly how much of the population will be impacted. Based on the revised total known population of *Synaphea* sp. Serpentine (4,801 mature individuals) clearing for the Proposed Action will impact on 0.06% of the known population.

Critical habitat for this species is defined within the Interim Recovery Plan (DPaW 2017) as: “...all known habitat for natural populations... and.... natural populations are important populations. Habitat critical to the survival of the species includes the area of occupancy of populations and areas of similar habitat surrounding and linking populations (these providing potential habitat for population expansion and for pollinators). It may also include additional occurrences of similar habitat that may contain undiscovered populations of the species or be suitable for future translocations, and the local catchment for the surface and/or groundwater that maintains the habitat of the species.” The 0.13 ha of suitable habitat for *Synaphea* sp. Serpentine within the Proposed Action may be considered critical as it is located adjacent to an existing population (TPFL Population 5).

4.4.4 Local Distribution

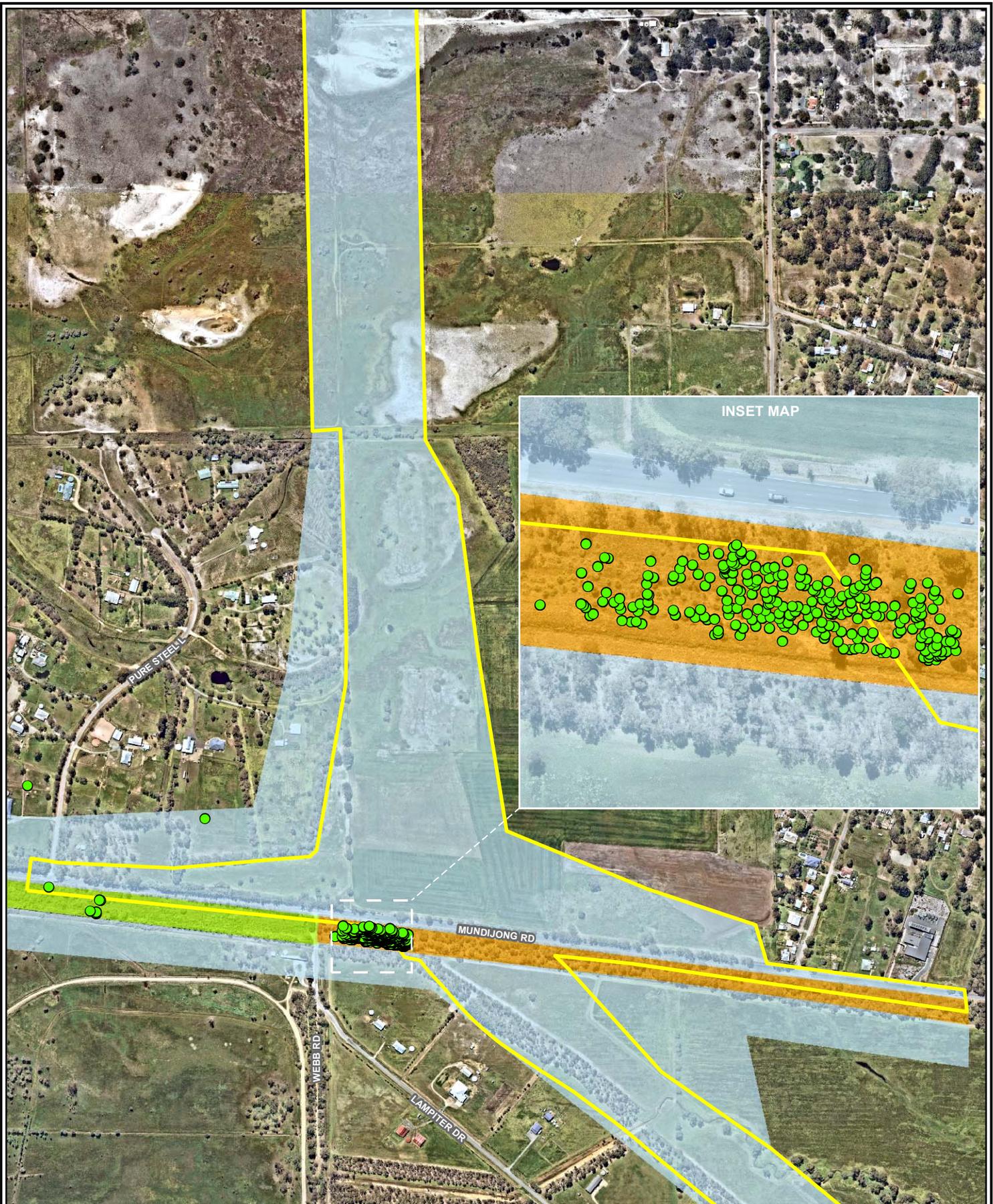
The Interim Recovery Plan for *Synaphea* sp. Serpentine indicates the species is known from six populations (DPaW 2017). One of these, TPFL Population 5, is located within the Proposed Action. Three individuals that form part of this population will be impacted while the remainder will be retained. Database searches through DBCA and the Western Australian Herbarium indicate that the species is known from 13 locations within a 5 km radius of the Proposed Action area (DBCA 2019c).

Targeted surveys are currently being undertaken within vegetated areas within the known range of *Synaphea* sp. Serpentine on the Swan Coastal Plain to obtain more accurate and up-to-date counts of the species. Additionally, other areas of suitable habitat will be identified through desktop study of aerial photography and publicly available vegetation information. These areas will be subject to targeted surveys, with the purpose of collecting data on any additional populations in the locality.

4.4.5 Survey Adequacy and Limitations

The flora and vegetation field surveys were undertaken by suitably qualified and experienced personnel, within appropriate seasonal times, site access and resources. There are nil constraints

which are considered to have affected the accuracy or reliability of the survey outcomes which would affect the assessment of the Proposed Action. An assessment of the potential for constraints of the flora and vegetation field surveys is presented in Appendix G.

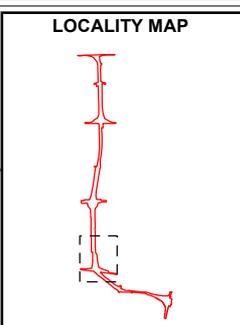


Legend

- Proposed Action
- *Synaphea* sp. Serpentine (CE) locations

Phytophthora Dieback status

- Excluded
- Infested
- Uninterpretable unprotectable



Scale 1:9,000 at A4		0 100 200 Meters	
Coord. Sys. GDA 1994 MGA Zone 50		↑	
Job No: 58910			
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Drawn By: hsullivan	Checked By: DN		

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SYNAPHEA SP. SERPENTINE LOCATIONS AND PHYTOPHTHORA DIEBACK STATUS WITHIN AREA OF THE PROPOSED ACTION

FIGURE 16

4.5 *Synaphea* sp. Pinjarra Plain

Synaphea sp. Pinjarra Plain (A.S. George 17182) (Threatened) is an erect clumped shrub growing up to 0.8 m high occurring on flats and seasonally wet areas and depressions (WA Herbarium 1998-) (Plate 2). This taxon is listed as Endangered under both the BC Act and EPBC Act (DBCA 2018b, DAWE 2020). It is endemic to Western Australia (ALA 2020), found in a linear band from just north of Mundijong to West Coolup, growing predominantly in grey-brown sandy loams but also less often in heavier brown clay-sand overlain by laterite pebbles (DPaW 2016). The Proposed Action is located within the known range of this taxon.

4.5.1 Abundance, Distribution and Ecology

The Interim Recovery Plan for *Synaphea* sp. Pinjarra Plain indicates the species is known from 12 populations comprising 707 mature plants (DPaW 2016). Most populations exist on disturbed road and rail reserves, and part of one population occurs within conservation tenure. Recent advice from the DBCA estimates the total population to be 748 individuals across 12 populations.

Eight records of *Synaphea* sp. Pinjarra Plain were recorded within the Proposed Action area, situated within VT3, which represents the preferred habitat for this taxon (Woodman 2020).



Plate 2: *Synaphea* sp. Pinjarra Plain (A.S. George 17182) (Threatened) (Woodman Environmental)

4.5.2 Impact of Proposed Action

A single population of *Synaphea* sp. Pinjarra Plain is located within the Mundijong Road reserve, partially within the Proposed Action area, however, no individuals will be directly impacted (Woodman 2020). This population has previously been recorded by DBCA and is known as TPFL Population 10 (Woodman 2020).

DBCA data indicates TPFL Population 10 is comprised of 3 individuals (DBCA 2019c) while two individuals were recorded by Eco Logical (2019). Targeted surveys for *Synaphea* sp. Pinjarra Plain were conducted in September and October 2019 by Woodman Environmental (2020) during the known flowering period for the species (September – November). Targeted surveys were undertaken at multiple locations within the broader survey area where suitable habitat for the

species was recorded. A total of 66 individuals were recorded that form part of TPFL Population 10 (Figure 17). This brings the total size of TPFL Population 10 to 69 individuals. None of these individuals will be impacted directly by the Proposed Action (Woodman 2020, Figure 17).

The additional 66 individuals recorded during surveys by Woodman Environmental increased the total known number of individuals for the species to 773 mature plants (Woodman 2020).

No potential habitat for *Synaphea* sp. Pinjarra Plain (VT3) exists within the Proposed Action area within VT3 (Woodman 2020).

4.5.3 Quality and Importance

The Proposed Action will not result in any direct impact to individuals of, or habitat for, *Synaphea* sp. Pinjarra Plain. A total of 69 individuals were recorded within the Survey Area (Woodman 2020). These individuals are located within roadside vegetation along the western side Mundijong Road (Woodman 2020) and comprise TPFL Population 10. TPFL Population 10 extends beyond the boundary of the Proposed Action area. The population will remain in-tact within the Mundijong Road reserve, within vegetation that ranges from 'Good' to 'Very Good' condition. The known population of the species will remain at 773 individuals following the Proposed Action.

The Interim Recovery Plan (DPaW 2016) states that: "It is considered that all known habitat for wild populations is critical to the survival of *Synaphea* sp. Pinjarra Plain, and that all wild populations are important populations. Habitat critical to the survival of the species includes the area of occupancy of populations and areas of similar habitat surrounding and linking populations (these providing potential habitat for expansion and for pollinators). It may also include additional occurrences of similar habitat that may contain undiscovered populations of the species or be suitable for future translocations, and the local catchment for the surface and/or groundwater that maintains the habitat of the species." No individuals or critical habitat for *Synaphea* sp. Pinjarra Plain will be removed or directly impacted by the Proposed Action.

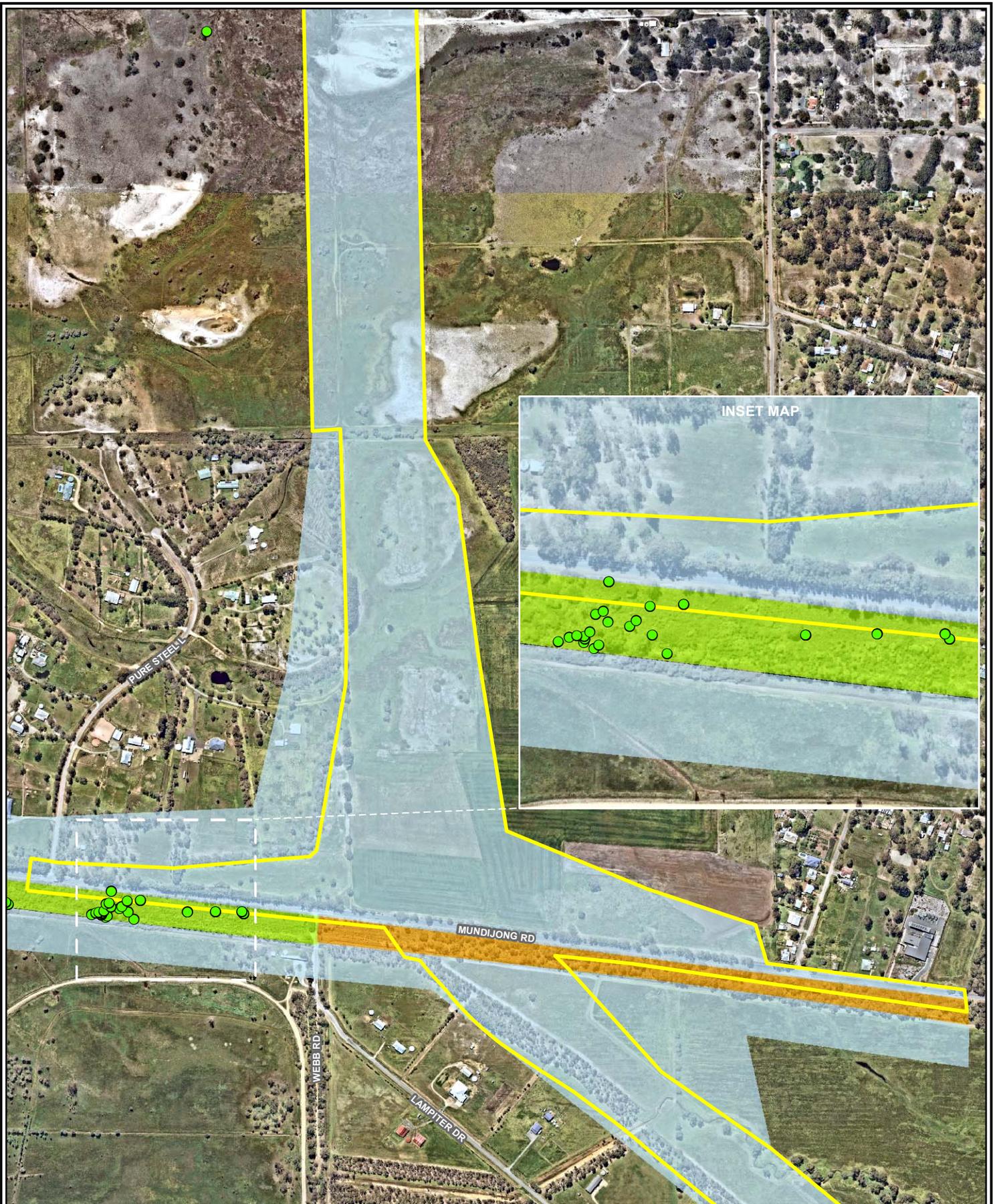
4.5.4 Local Distribution

A total of twelve populations of *Synaphea* sp. Pinjarra Plain are known in the region, including one that is partially protected within conservation tenure. The species occurs at 10 locations within a 5 km radius of the Proposed Action area (Woodman 2020).

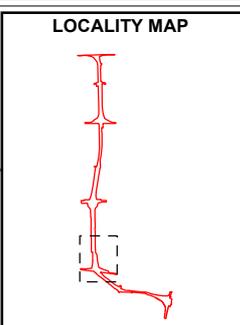
The twelve known populations comprise 707 individual plants. The additional 66 plants recorded by Woodman (2020) have now increased the known size of TPFL Population 10 to 69, and the total known population to 773.

4.5.5 Survey Adequacy and Limitations

The flora and vegetation field surveys were undertaken by suitably qualified and experienced personnel, within appropriate seasonal times, site access and resources. There are nil constraints which are considered to have affected the accuracy or reliability of the survey outcomes which would affect the assessment of the Proposed Action. An assessment of the potential for constraints of the flora and vegetation field surveys is presented in Appendix G.



- Legend**
- Proposed Action
 - *Synaphea* sp. Pinjarra Plain (E) locations
- Phytophthora* Dieback status
- Excluded
 - Infested
 - Uninterpretable unprotectable



Scale 1:9,000 at A4		
Coord. Sys. GDA 1994 MGA Zone 50		
Job No: 58910		
Client: Main Roads Western Australia		
Version: A	Date: 16-Feb-2021	
Drawn By: hsullivan	Checked By: DN	

Tonkin Highway Extension WA

SYNAPHEA SP. PINJARRA PLAIN LOCATIONS AND PHYTOPHTHORA DIEBACK STATUS WITHIN THE AREA OF THE PROPOSED ACTION

FIGURE 17

4.6 *Tetraria australiensis*

Tetraria australiensis (Threatened) is a rhizomatous tufted perennial herb growing to 1 m high occurring on sand over clay flats (WA Herbarium 1998-) (Plate 3). This taxon is listed as Vulnerable under both the BC Act and EPBC Act (DBCA 2018c, DAWE 2020). It is endemic to Western Australia (ALA 2020), occurring over a range of approximately 197 km from Ferndale (Perth) in the north to near Busselton in the south (DBCA 2007-).

4.6.1 Abundance, Distribution and Ecology

DBCA data previously indicated that 66 locations of *Tetraria australiensis* were known comprising 17,900 individuals (DBCA 2020). Recent correspondence from DBCA indicates this number has recently been revised to 21,500 plants across 18 populations (DBCA 2020). At least three of the populations occur in conservation tenure (Watkins Road Nature Reserve, Lambkin Nature Reserve, Ruabon Nature Reserve) (DBCA 2007-).

Tetraria australiensis was recorded within VTs 2 and 4, which represent the preferred habitat for this species (Woodman 2020; Figure 18). Habitat within the Proposed Action area ranged from tall sparse shrubland of *Jacksonia sternbergiana*, *Kingia australis* and *Xanthorrhoea preissii* over mixed sedges and shrubs on brown sandy loam soils on seasonally moist flats, to mid open forest of *Corymbia calophylla* over shrubland dominated by *Xanthorrhoea preissii* and *Kingia australis* over sedges and forbs on grey or brown sand or sandy loam on dry flats (Woodman 2020).



Plate 3: *Tetraria australiensis* (T) (Woodman Environmental)

4.6.2 Impact of Proposed Action

A single population occurs within the Proposed Action area in the Mundijong Road reserve with two smaller populations recorded in the Survey Area (Woodman 2020). The main population has previously been recorded by DBCA and is known as TPFL Population 10 (Woodman 2020). Another recorded population, TPFL Population 8, occurs immediately north of the eastern end of the Proposed Action area along Mundijong Road near the Mundijong sports complex. TPFL Populations 8 and 10 are likely to be sub-populations of a single population (Woodman 2020). TPFL Population 8

has not been subject to recent assessments due to access constraints; however, the last DBCA survey recorded 483 individuals (Woodman 2020). This number is still considered accurate (Woodman 2020).

DBCA data indicates previous surveys of TPFL population 10 have recorded 1,054 individuals (DBCA 2019c). Targeted surveys for *Tetraria australiensis* were conducted in September and October 2019 by Woodman Environmental (Woodman 2020). While this was not conducted during the known flowering period for *Tetraria australiensis* (November – December) however the species is identifiable without the presence of flowers and thus can be identified year-round (Woodman 2020). Targeted surveys were undertaken at multiple locations where habitat suitable for the species occurred within the broader Survey Area (Woodman 2020). Woodman (2020) recorded a total of 1,214 individuals within the Survey Area, of which 1,208 at 290 locations fell within the Proposed Action area. Of these, 165 are proposed to be cleared. These individuals are considered part of TPFL Population 10.

An additional population of *Tetraria australiensis* was opportunistically recorded well to the west of the Proposed Action area, at which six individuals were recorded at a single location (Woodman 2020).

4.6.3 Quality and Importance

Approximately 3.44 ha of suitable habitat for *Tetraria australiensis* is proposed to be cleared within the Proposed Action, including 1.27 ha in 'Very Good' condition, 0.29 ha in 'Good' condition and the remainder in 'Degraded' to 'Completely Degraded' condition.

Targeted surveys identified that 1,049 individuals of *Tetraria australiensis* exist within the Proposed Action area that will not be impacted (Woodman 2020). DBCA records of *Tetraria australiensis* do not indicate how many separate populations are known for this species (Woodman 2020).

The Proposed Action will impact 165 individuals which represents approximately 13.6% of TPFL Population 10. However, as TPFL Populations 10 and 8 (483 individuals) are likely form part of a single population, the impact to 165 individuals represents 9.7% of the combined TPFL Population 8 and 10.

The most recent estimate of the total population for *Tetraria australiensis* is 21,500 individuals (DBCA 2020). The proposed impact to 165 individuals therefore represents a maximum reduction of 0.8% of the total known population.

4.6.4 Local Distribution

Tetraria australiensis has been recorded at 16 locations within a 5 km radius of the Proposed Action (Woodman 2020). Due to limitations of the abundance information provided in DBCA and Western Australian Herbarium spatial datasets, the number of individuals within a 5 km radius of the Proposed Action area cannot be explicitly quantified. However, it is estimated at approximately 3,000 individuals (DBCA unpublished data). Targeted surveys are currently being undertaken within vegetated areas considered to contain suitable habitat for the species on the Swan Coastal Plain to improve population estimates within 5 km of the Proposed Action.

4.6.5 Survey Adequacy and Limitations

The flora and vegetation field surveys were undertaken by suitably qualified and experienced personnel, within appropriate seasonal times, site access and resources. There are nil constraints which are considered to have affected the accuracy or reliability of the survey outcomes which would affect the assessment of the Proposed Action. An assessment of the potential for constraints of the flora and vegetation field surveys is presented in Appendix G.