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WESTERN AUSTRALIA

Native Vegetation Clearing Permit – Supporting Document

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Western Australia.*

Great Eastern Highway (H005)
'Coates Gully' Upgrade Project

SLK 56.6-67.5

June 2022

EOS: 2194

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1 PURPOSE

The purpose of this document is to provide supporting information for a native vegetation clearing Area Permit application under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 (Clearing Regulations) for the proposed Great Eastern Highway 56.6 – 67.5 SLK (Coates Gully) Upgrade Project.

The document describes the native vegetation present within the Proposal Area, outlines key activities associated with the Proposal, and defines the areal extent of clearing to be undertaken. It also summarises the Proposal's potential impacts in relation to the ten native vegetation Clearing Principles and strategies to be employed to minimise impacts to native vegetation.

2 SCOPE

2.1 Proposal Scope

Proposal Name: Great Eastern Highway 56.6-67.5 SLK (Coates Gully) Upgrade

Project Purpose / Components: The Great Eastern Highway (GEH) forms part of National Highway 94 and is a strategic freight, tourist and inter-town route. The efficiency and reliability of the Great Eastern Highway are vital to the mining and agricultural sectors of the Wheatbelt and Goldfields regions.

Significant age and wear along sections of GEH severely affect the highway's safety and efficiency. This route has been identified as the third riskiest road in regional WA for two consecutive RAC surveys due to poor road conditions. The inadequate road formation, seal widths, and the narrow or absent shoulders are of particular concern.

The Coates Gully proposal is to improve the GEH by reconstructing and realigning the existing 9 m formation and widening it to a 12 m formation, including a 1 m painted median strip. The proposal (referred to as GEH Coates Gully Upgrade) is to occur between SLK 56.6 to 67.5. The proposal will also include intersection improvements at Bodeguero Way, Wariin Road, Chedaring Rd, Hawke Ave, Inkpen Rd, Coates Road and Oyston Road.

The proposal was referred under the *Environment Protection and Biodiversity Conservation Act 1999* and determined to be a controlled action (EPBC 2022/9151). The proposal is not being assessed under the assessment bilateral agreement.

The proposed clearing to be undertaken is: 16.3 ha

No temporary clearing will be undertaken in the implementation of the Proposal.

Proposal Location(s): The Proposal area is located on Great Eastern Highway (H005), SLK 56.6 to 67.5 approximately 56 km west of the Perth city centre and 25 km west of Northam. The Proposal area spans 35.3 ha across the Shire of Mundaring and Shire of Northam. The proposal location is shown in Figure 2 with the proposal area as follows:

- MGA reference: GDA2020 Zone 50
 - Start: 438742 E, 6480454 N
 - End: 446715 E, 6486234 N

Throughout this supporting document, the term 'proposal area' has been used. This refers to the maximum area within which the clearing area will be located. This envelope is slightly larger to allow for minor changes to the proposal footprint as the design process continues, and to account for

unexpected changes that can occur during construction. All environmental values of the proposal area have been assessed.

2.2 Assessment Report Scope

The study area (see Figure 1) is confined to a local area of a 10 km radius of the proposal area. The proposal area is shown in Figure 2 and Figure 3 to Figure 6.

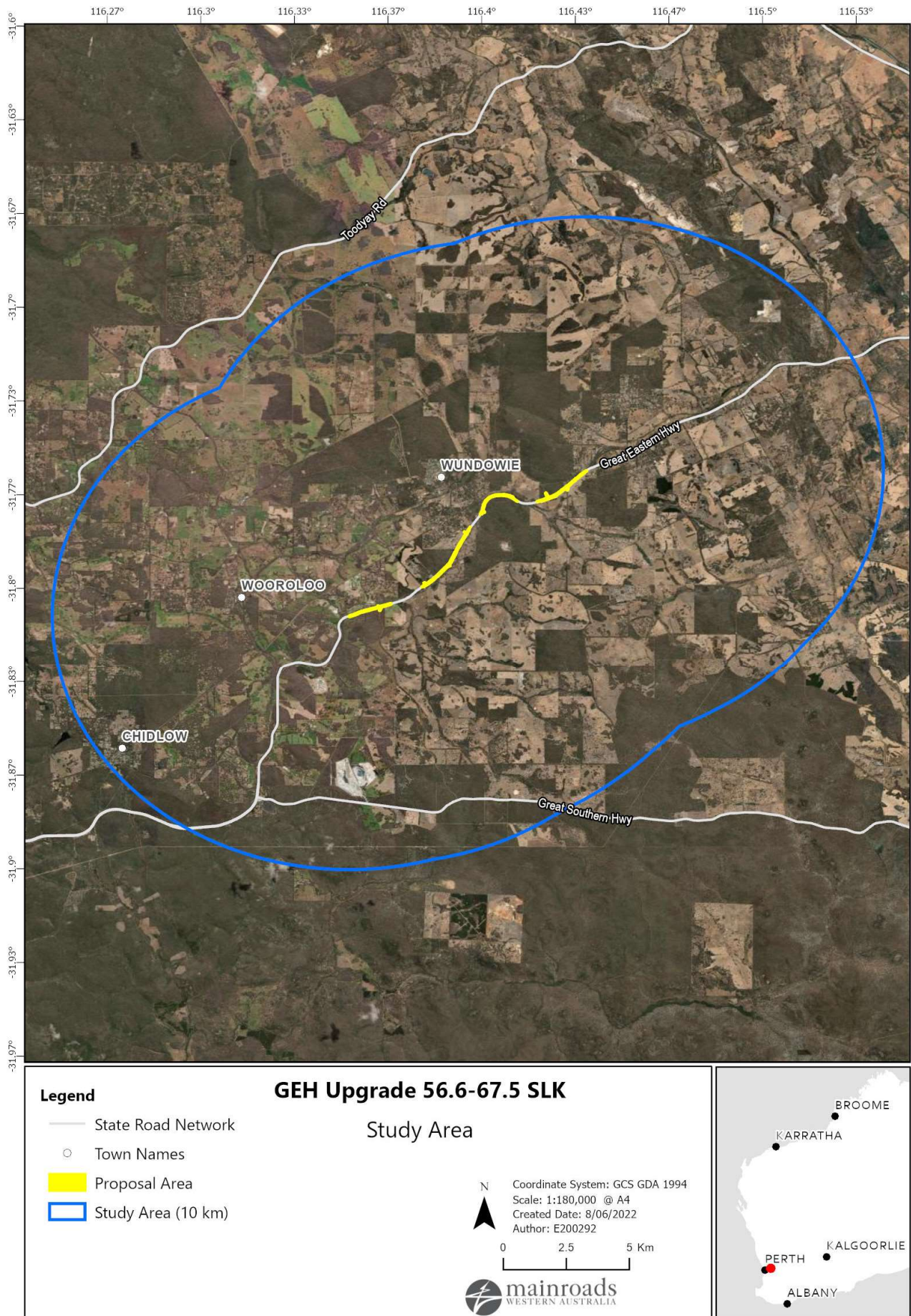


Figure 1. Study Area with a 10km Radius

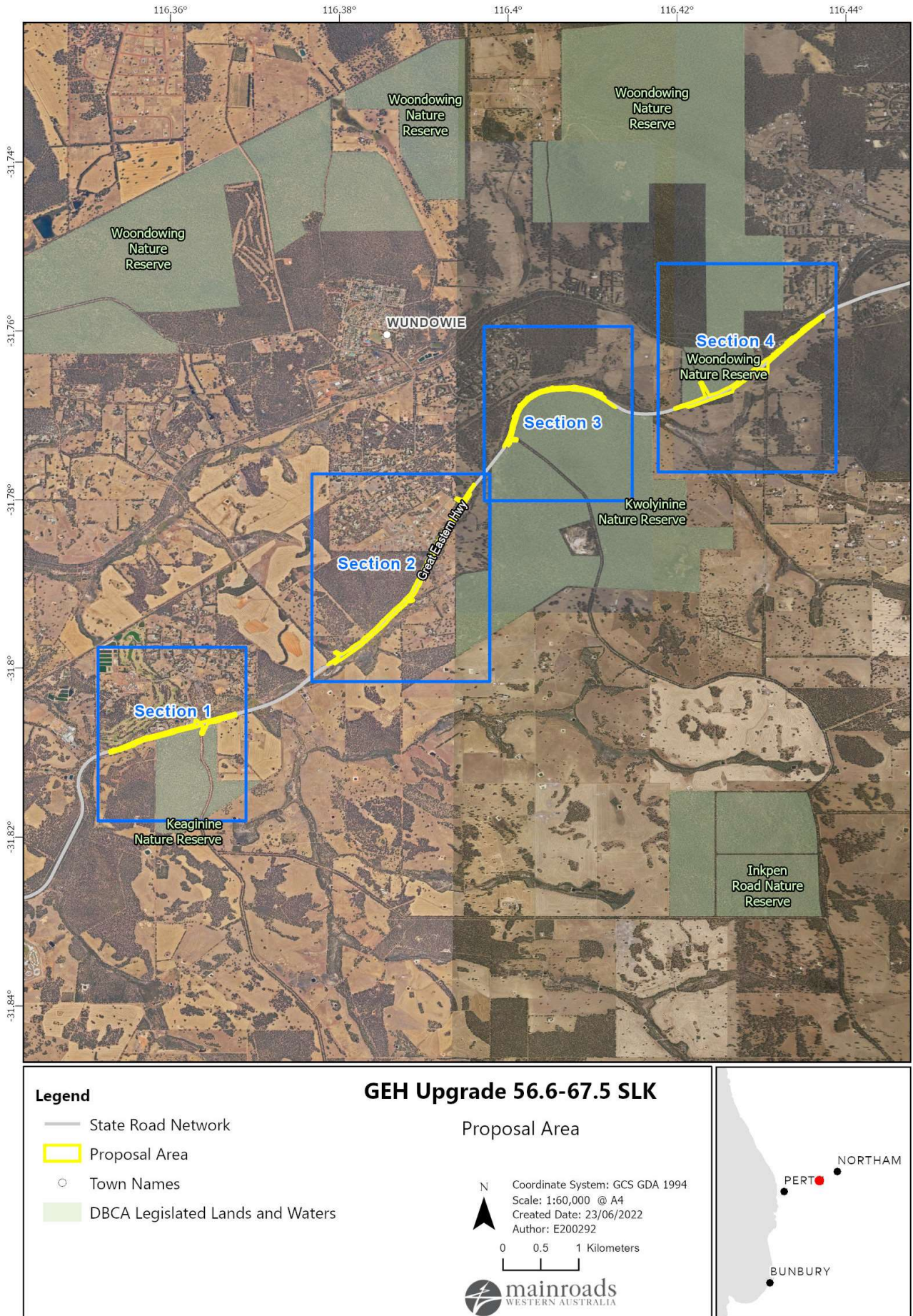


Figure 2. Proposal Area – Overview

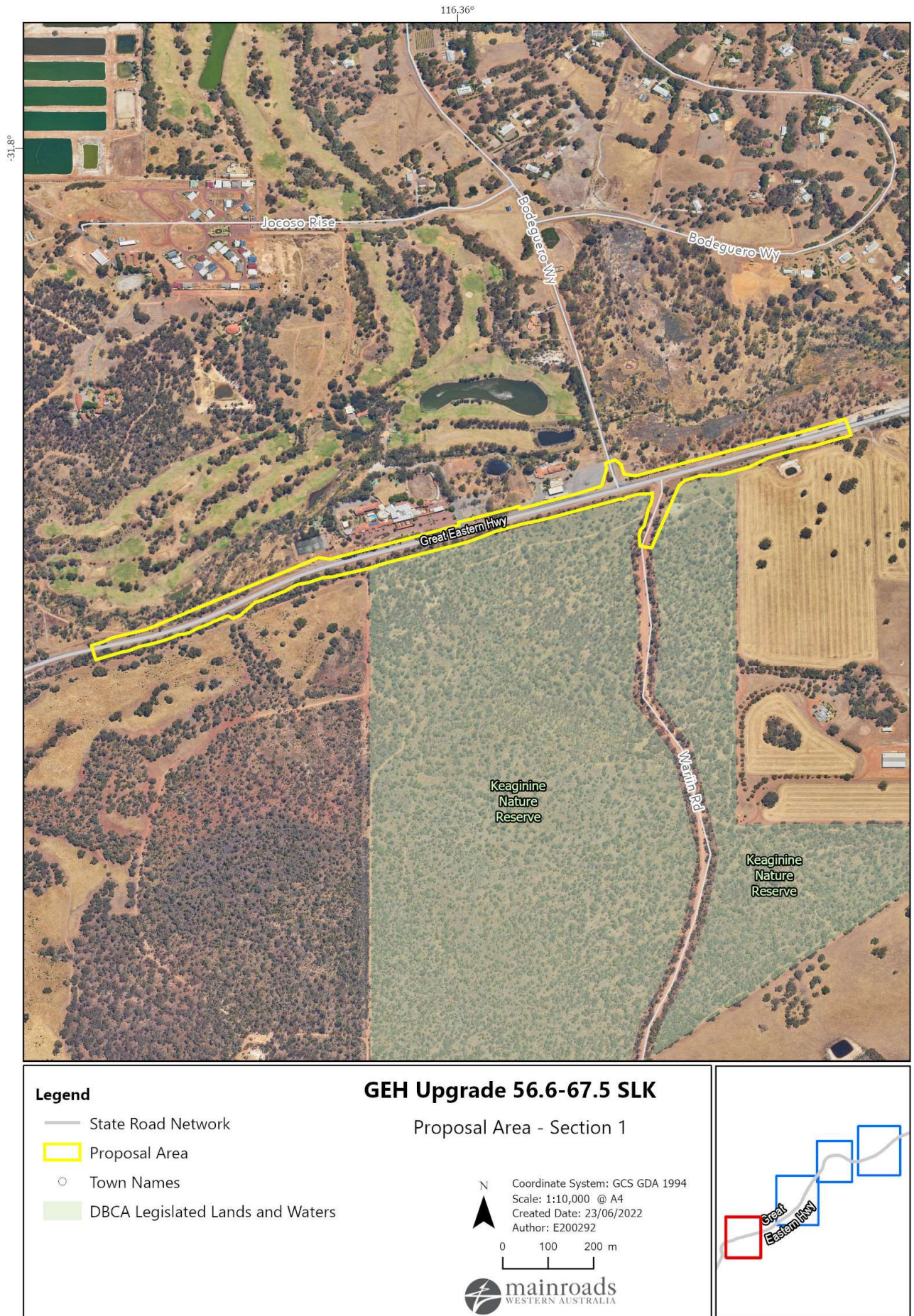


Figure 3. Proposal Area – Section 1

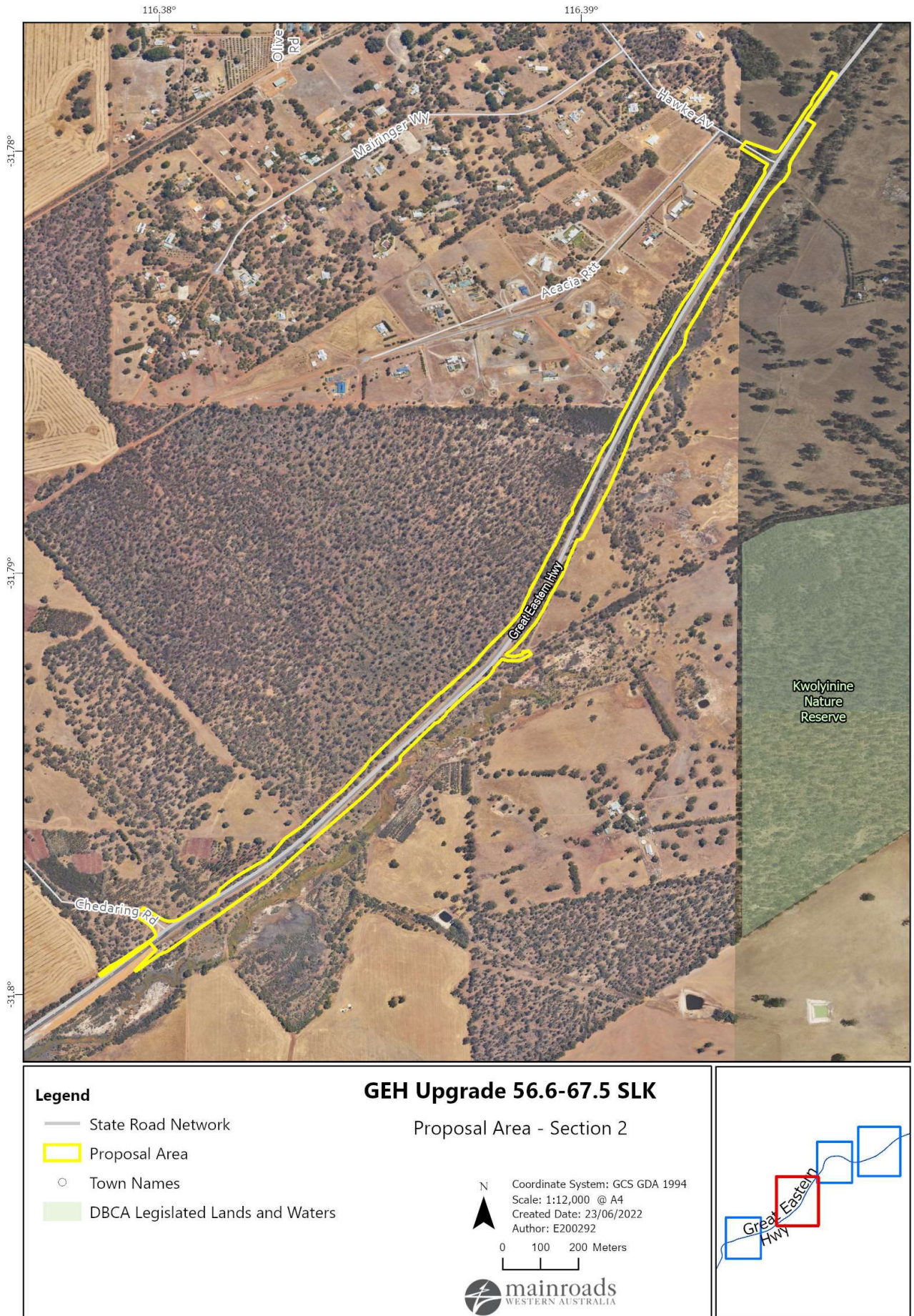


Figure 4. Proposal Area – Section 2

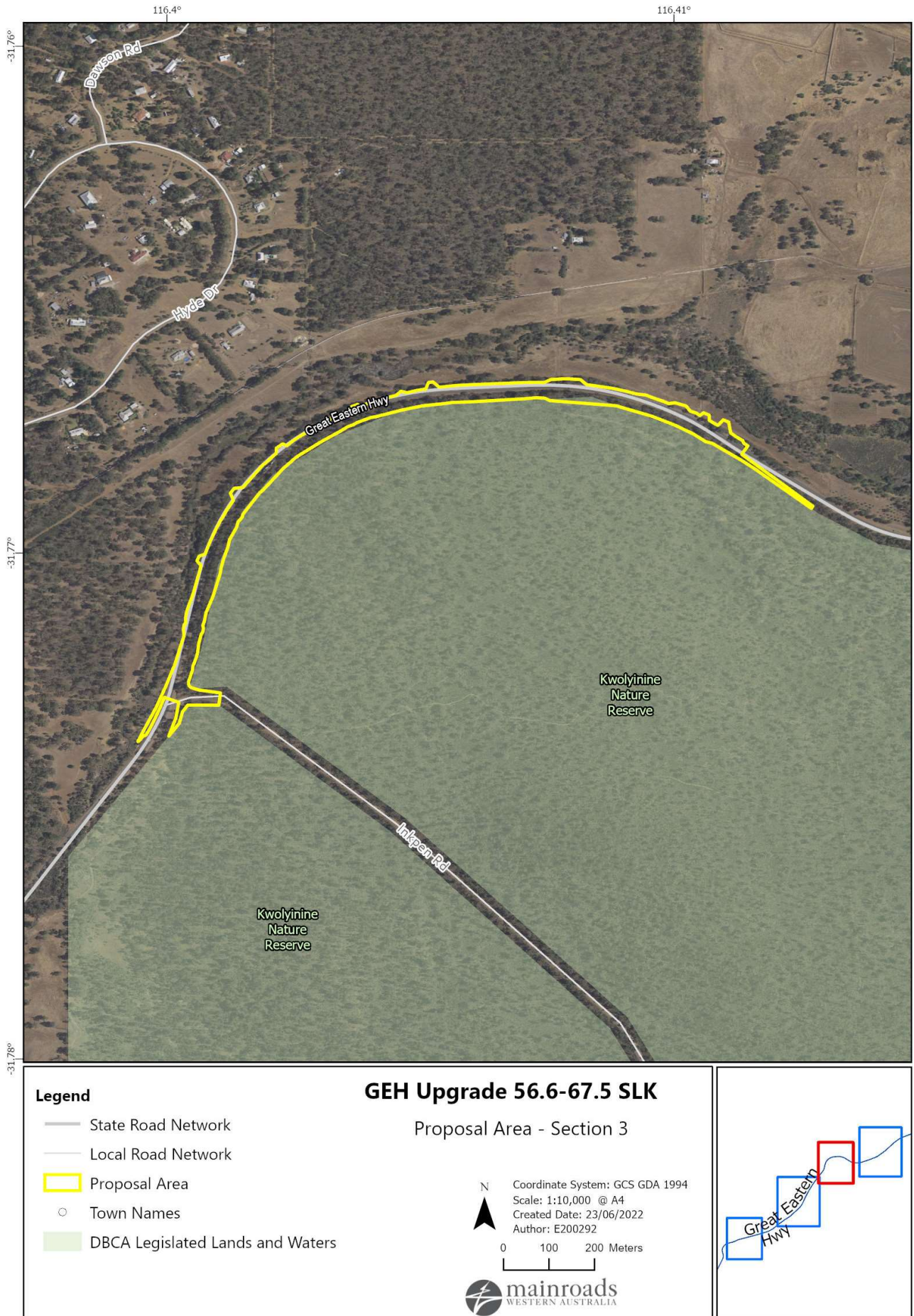


Figure 5. Proposal Area – Section 3

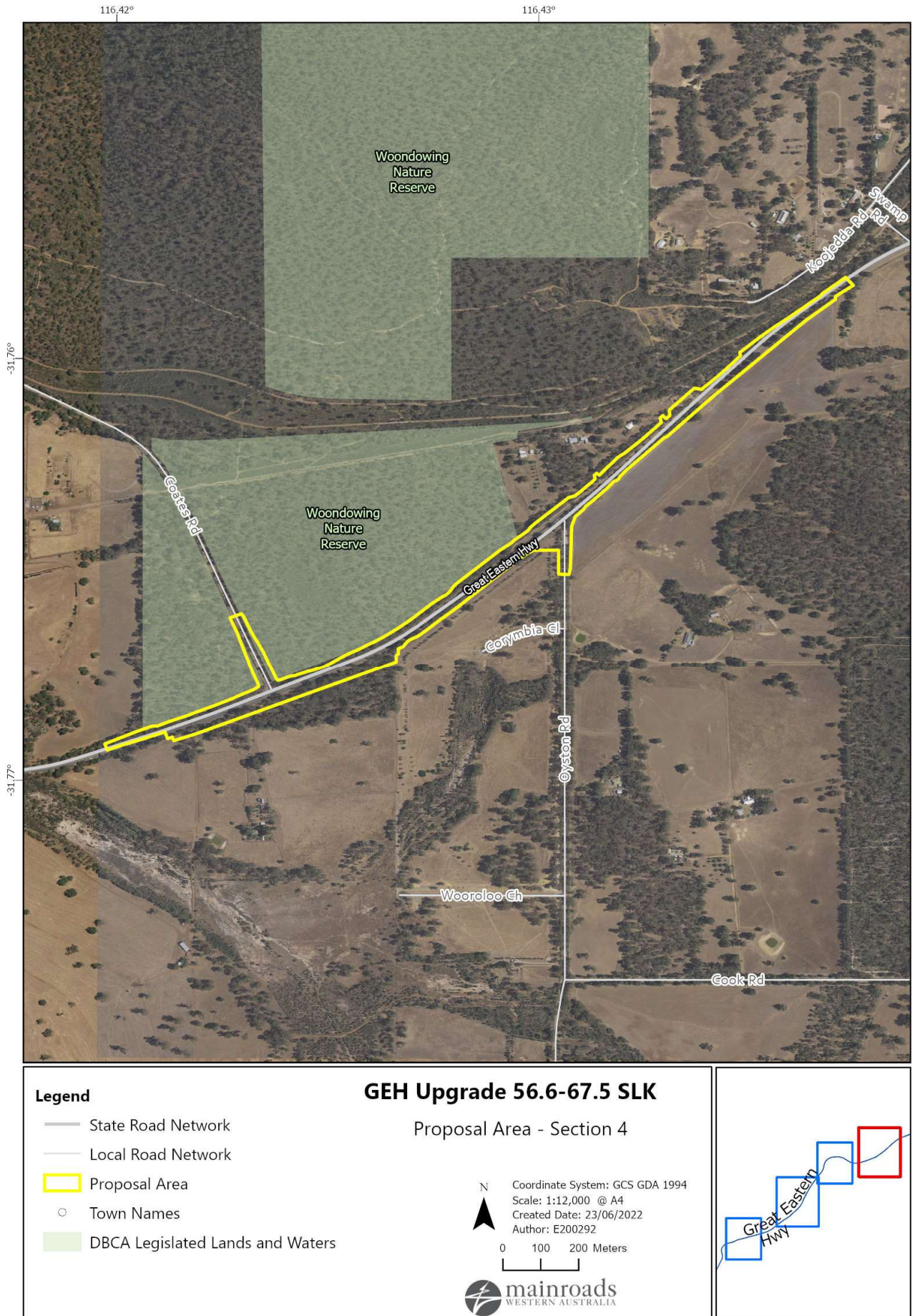


Figure 6. Proposal Area – Section 4

2.3 Alternatives to clearing

There are several factors driving the proposed widening and resealing of this section of GEH, including the significant age and wear of the pavement, narrow or absent shoulders, and poor geometry. The current condition of GEH does not meet current road safety standards leading to poor safety outcomes for road users. The project has been developed to reduce the area of clearing as much as possible; however, some clearing will be necessary to achieve the safety objectives of the proposal.

Temporary ancillary activities such as site offices, storage areas, laydown areas and stockpiles will be restricted to previously cleared areas. Materials for the project will also be sourced from existing cleared areas such as farm paddocks to avoid additional clearing.

2.4 Measures to Avoid, Minimise, Reduce and Manage Project Clearing Impacts

The design and management measures implemented to avoid and minimise the clearing impacts by the proposal are provided in Table 1.

Table 1. Measures undertaken to Avoid, Minimise, Reduce and Manage the Project Clearing Impacts

Design or Management Measure	Discussion and Justification
Steepen batter slopes	Batter slopes have been designed to align MRWA safety and maintenance standards. Due to the traffic volumes, vehicle type and posted speeds these batters cannot be changed significantly.
Installation of safety barriers	Where appropriate, the installation of safety barriers have been included in the design. The barriers have allowed for the implementation of steepened batters thereby reducing the clearing footprint.
Alignment to one side of existing road	The scope of the work is to widen the road mostly symmetrically on the current road centreline. Deviation from the current centreline would likely require additional clearing and earthworks to deliver a road formation to the equivalent standard of the proposed formation. Widening of the road symmetrically on the current road centreline is therefore deemed to be the minimal amount of clearing required for the works to proceed and maintain improved road user safety.
Installation of kerbing	Kerbing has been considered and implemented in the design where possible, particularly at the intersection upgrades. Kerbing has not been used for the verge or medians as this would require the implementation of street lighting in accordance with MRWA Road Lighting Application and Approval Guidelines. Kerbing also introduces a requirement of underground drainage, which would significantly increase the cost to the project and would not necessarily reduce the area of clearing in the Conceptual Footprint any further. Throughout the detailed design process, the introduction of kerbs in localised areas to direct water into the table drain beyond vegetation will be examined, and if viable used to retain vegetation where possible.
Simplification of design to reduce number of lanes and/or complexity of intersections	Due to the traffic counts, design speed and number of heavy vehicles, the scope of works for the realignment cannot be further simplified whilst retaining the necessary safety benefits. Main Roads investigated reducing the length of the proposed westbound over taking lane however this was not feasible. The project will not use a side track to divert traffic, which will reduce the footprint for the project.
Preferential use of existing cleared areas for access tracks, construction storage and stockpiling	There are minimal areas of existing cleared or disturbed land available for use due to the nature of the proposal location. Where existing cleared areas are present these have been used and included in the design. No temporary clearing is required to undertake the works outlined in the proposal.
Drainage modification	Majority of the new drainage will tie into the existing drainage on Great Eastern Highway.

2.5 Approved Policies and Planning Instruments

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

In addition to the matters considered in accordance with section 51O of the EP Act (see Section 1.3), Main Roads has also had regard to the below instruments.

Other Legislation of relevance for assessment of clearing and planning/other matters

- *Biodiversity Conservation Act 2016* (WA) (BC Act)
- *Conservation and Land Management Act 1984* (WA) (CALM Act)
- *Country Areas Water Supply Act 1947* (WA) (CAWS Act)
- *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act)
- *Planning and Development Act 2005* (WA) (P&D Act)
- *Soil and Land Conservation Act 1945* (WA)
- *Rights in Water and Irrigation Act 1914*
- *Aboriginal Heritage Act 1972* (WA)

Other Relevant policies and guidance documents:

- Environmental Offsets Policy (Government of Western Australia, 2011)
- A guide to the assessment of applications to clear native vegetation (DEC, 2014)
- Procedure: Native vegetation clearing permits (DWER, 2019)
- Environmental Offsets Guidelines (Government of Western Australia, 2014)
- Technical guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2016)
- Technical guidance – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA, 2020)
- Approved Conservation Advice for *Calyptorhynchus banksii naso* (Forest Red-tailed Black Cockatoo) (DoE 2009)
- Approved Conservation Advice for *Calyptorhynchus baudinii* (Baudin's Cockatoo) (TSSC 2018a)
- Approved Conservation Advice for *Westralunio carteri* (Carter's Freshwater Mussel) (TSSC 2018b)
- Carnaby's Cockatoo (*Calyptorhynchus latirostris*) Recovery Plan (DPaW 2013)
- Forest Black Cockatoo (Baudin's Cockatoo *Calyptorhynchus baudinii* and Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso*) Recovery Plan (DEC 2008)
- EPBC Act Referral guidelines for three black cockatoo species: Carnaby's cockatoo, Baudin's cockatoo and Forest red-tailed black cockatoo (DSEWPaC 2012)
- Perth and Peel @ 3.5 Million: Environmental impacts, risks and remedies (EPA 2015).

3 SUMMARY OF SURVEYS

3.1 Biological Surveys Completed

Main Roads has commissioned biological surveys over the proposal area to understand the environmental values present. To date, two biological surveys have been completed over the proposal area and these are summarised in Table 2 and a summary of the key findings is provided in Section 3.1.1.

Table 2. Summary of biological surveys completed over the proposal area

Consultant	Report	Survey Details
Bamford Consulting Ecologists	Great Eastern Highway SLK 55.8 – 68.5 Fauna and Black-Cockatoo Habitat Assessment	Survey Area: 229 ha from SLK 55.8 to 68.5 on the GEH Survey Type: Targeted fauna assessment including black cockatoo assessment Timing: field survey occurred in October 2015 Main Roads Reference: D21#449824
360 Environmental	Great Eastern Highway Coates Gully Project Detailed Flora and Vegetation Report (360 Environmental, 2020)	Survey Area: 59 ha from SLK 55.83 to 68.74 on the GEH Survey Type: Detailed Flora and Vegetation Timing: field survey occurred in October 2019 Main Roads Reference: D20#297336
Biologic Environmental Survey	H005 Great Eastern Highway Coates Gully (SLK 56.4-67.8) Biological Survey Report (Biologic, 2021)	Survey Area: 75 ha from SLK 56.4 to 67.8 on the GEH Survey Type: Detailed Flora and Vegetation, Basic Terrestrial Fauna and Black Cockatoo Habitat Assessment Timing: field survey occurred in October 2020 and November 2020 Main Roads Reference: D21#450212
Tony Kirkby	Black Cockatoo Breeding Hollow Inspection, Coates Gully, Wundowie	Survey Area: Targeted tree assessment Survey Type: Black cockatoo habitat assessment Timing: field survey occurred in June 2021 Main Roads Reference: D21#1153572

3.1.1 Summary of Biological Survey Results

Bamford Consulting Ecologists conducted a targeted fauna assessment (including a Black Cockatoo habitat assessment) of an early concept upgrade area for the GEH in 2015. The objective of the assessment was to identify key fauna values including critical breeding, foraging and roosting habitat for Black-Cockatoos (Carnaby's, Baudin's and Forest Red-tailed are all known to be present in the area). The potential for other conservation significant fauna species to occur in the area was also assessed during field investigations.

Field investigations identified 44 vertebrate fauna species comprising of: one frog, four reptiles, 33 bird, four native mammal and two introduced mammal species. Conservation significant fauna species recorded during the field survey included: three Black-Cockatoo species (Carnaby's, Baudin's and Forest Red-tailed) and one mammal species (Quenda). A total of 1,029 potential nest trees were recorded, which include 54 trees with suitable hollows but no breeding activity, and 54 trees with suitably sized hollows but are not vertical. No Black Cockatoo roosting was observed in the survey area but a roost site was recorded 600m west of the survey area. Isolated patches of foraging habitat ranged from negligible to moderate value and vegetation abutting nature reserves was assessed as moderate to high foraging value.

360 Environmental (360) completed a detailed flora and vegetation survey over the proposal area in October 2019. This survey focused on the GEH and did not include the intersection upgrades. During this survey 26 vegetation types were mapped ranging from intact woodlands in excellent condition to completely degraded scattered trees over weeds (360 Environmental, 2020). 360 Environmental recorded three Priority flora species during this survey, these being *Tetratheca pilifera* (P3), *Lechenaultia hortii* (P2) and *Grevillea olivacea* (P4) with the latter being planted at this location (360 Environmental, 2020). A total of 38 introduced species were recorded within the survey area, representing 23.6% of the total taxa recorded (360 Environmental, 2020).

In 2020, Biologic Environmental Survey (Biologic) completed a Detailed Flora and Vegetation, Basic Terrestrial Fauna and Black Cockatoo Habitat Assessment. The Detailed Flora and Vegetation component of the survey focused on areas not previously surveyed by 360 Environmental while the Basic Terrestrial Fauna and Black Cockatoo Habitat Assessment covered the full survey area encompassing the GEH and the intersection upgrades in the proposal area. This expanded on, and updated, the work completed by Bamford Consulting Ecologists in 2015 (Bamford Consulting Ecologists, 2015).

Biologic extended the 360 Environmental vegetation mapping and also identified an additional five vegetation types (Biologic, 2021). Biologic also recorded 19 additional individuals of *Tetratheca pilifera* (P3) and 49 introduced taxa (Biologic, 2021).

Biologic mapped six broad fauna habitats, comprising; *Eucalyptus wandoo* Woodland over *Banksia*, *Corymbia* and *Eucalyptus marginata* Woodland, *Melaleuca* Shrubland, Isolated Trees, and Sedgeland (Biologic, 2021). The field survey recorded 51 vertebrate fauna species, comprising of eight mammals, 39 birds, and four reptiles (Biologic, 2021). Four introduced mammal species were recorded within the survey area (Biologic, 2021).

Black cockatoos from all three species were identified during the field surveys via both direct observation and foraging evidence (Biologic, 2021). The survey area contains both High and Medium quality foraging habitat for black cockatoos and supports roosting and breeding sites, but also acts on a minor regional level as a "stepping-stone" between seasonal grounds (Biologic, 2021). Within the survey area, Biologic recorded 963 potential black cockatoo breeding trees of suitable diameter at breast height (DBH) to develop hollows with 106 of these trees containing hollows (Biologic, 2021). Within the 106 trees containing hollows, 88 hollows were considered to have some potential to support black cockatoo breeding in the future following consideration of attributes such as angle, tree species, presence of competitors, and potential depth (Biologic, 2021).

Black cockatoo specialist Tony Kirky conducted a detailed hollow assessment of 40 hollow-bearing trees recorded by Biologic that occur in or near the proposal area (Kirby, 2021). Hollows were first inspected from ground level for signs of use such as chewing or wear at the hollow entrance. Hollows which were deemed suitable were then inspected using a pole camera if it was safe to do so. A total of 70 hollows located in 40 trees were assessed. One hollow was found to be of suitable entrance size and orientation and had a worn entrance indicating it was possibly a black cockatoo breeding hollow. Due to the proximity to powerlines, this was the only hollow not inspected with a pole camera.

3.2 Summary of Phytophthora Dieback survey

Glevan Consulting completed a Phytophthora Dieback Survey along Great Eastern Highway from SLK 55.8 to 68.5, which includes the proposal area, in August 2021. This survey was a recheck of

Phytophthora Dieback status from a previous survey along the same stretch of the Great Eastern Highway completed in 2020. The broad vegetation of the proposal area includes Wandoo woodland and Jarrah/Marri forest, the latter with a relatively high susceptibility to Phytophthora dieback and generally providing good levels of disease expression, assisting in the detection and mapping of infested areas (Glevan Consulting, 2021).

No additional infested areas were mapped during the 2021 survey (Glevan Consulting, 2021). Within the proposal area from SLK 56.6 to 58.2 the Dieback status is mapped as 'Uninfested Unprotectable' with a small section of 'Uninfested Protectable' from SLK 57.2 to 57.7 (Glevan Consulting, 2021). From SLK 60 to 61 the Dieback status is mapped as 'Uninfested Protectable' into 'Uninterpretable Protectable' (Glevan Consulting, 2021). While from SLK 63 to 65 the Dieback status is 'Uninfested Protectable' with a section within this extent mapped as 'Temporarily Uninterpretable' due to a recent bushfire (Glevan Consulting, 2021). Within the proposal area from SLK 65.4 to 67.5 the Dieback status is mapped as 'Uninfested Protectable' (Glevan Consulting, 2021).

4 VEGETATION DETAILS

4.1.1 Pre-European Vegetation Description

The proposal is located in the eastern Jarrah forest within two vegetation associations as mapped by Beard (1990) and reinterpreted by Shepherd (2002). These are:

- 1006: Jarrah, marri and wandoo woodlands; and
- 3003: Mainly jarrah and marri forests.

Table 3 and Table 4 provide details of the Pre-European Vegetation Associations which the proposal area is within and the remaining extents of these associations.

Table 3. Summary of Project Area's Mapped Pre-European Vegetation Associations

Vegetation Association	Clearing Description	Vegetation Condition	Comments
Vegetation Association 1006 described as woodland southwest, jarrah (<i>Eucalyptus marginata</i>), marri (<i>Corymbia calophylla</i>) and wandoo (<i>Eucalyptus wandoo</i>)	16.3 ha to allow for road widening, intersection upgrades and service relocations	Ranges from Completely Degraded to Excellent	Vegetation description and condition determined from 360 Environmental and Biologic Environmental Survey respective reports.
Vegetation Association 3003 described as forest, mainly jarrah (<i>Eucalyptus marginata</i>) and marri (<i>Corymbia calophylla</i>)			

Table 4. Pre-European Vegetation Representation

Pre-European Vegetation Association	Scale	Pre-European (ha)	Current Extent (ha)	%Remaining	%Remaining in DBCA reserves
Veg Assoc No. 1006	Statewide	44,908.3	21,769.5	48.4	22.9
	IBRA Bioregion Jarrah Forest	44,908.3	21,769.5	48.4	22.9
	IBRA Sub-region Northern Jarrah Forest	44,908.3	21,769.5	48.4	22.9
	Local Government Authority Shire of Northam	13,906.85	5,962.9	42.8	12.9
Veg Assoc No. 3003	Statewide	66,451.5	39,061.7	58.7	27.2
	IBRA Bioregion Jarrah Forest	66,451.5	39,061.7	58.7	27.2
	IBRA Sub-region Northern Jarrah Forest	66,451.5	39,061.7	58.7	27.2
	Local Government Authority Shire of Northam	16,259.06	8,709.5	53.5	22.9
	Local Government Authority Shire of Mundaring	25,152.4	15,106.8	60.06	35.7

The information in Table 4 is taken from the 2019 Statewide Vegetation Statistics (Government of Western Australia, 2019).

4.1.2 Vegetation Complexes and Representation

Vegetation complexes of the south-west of WA have been mapped at a finer scale than the Beard and Sheppard mapping of vegetation associations (outlined in Section 4.1.2). The combined vegetation complex mapping of the southwest and Swan Coastal Plain from the Perth Biodiversity Project (2013) combines mapping by Havel & Matiske (2000) and Vegetation Mapping of the South West Forest Regions of Western Australia by Heddle, Loneragan & Havel (1980).

The proposal area intersects with five vegetation complexes, these being:

- Murray 2 (My2) – open forest of *Eucalyptus marginata* subsp. *thalassica*, *Corymbia calophylla*, *E. patens* and woodland of *E. wandoo* with some *E. accedens* on valley slopes to woodland of *E. rudis* and *Melaleuca raphiophylla* on the valley floors in semiarid and arid zones;
- Pindalup (Pn) – open forest of *E. marginata* subsp. *thalassica*, *C. calophylla* on slopes and open woodland of *E. wandoo* with some *E. patens* on the lower slopes in semiarid and arid zones;
- Yalanbee (Y5) – Mixture of open forest of *E. marginata* subsp. *thalassica*, *C. calophylla* and woodland of *E. wandoo* on lateritic uplands in semiarid to perarid zones;
- Yalanbee (Y6) – Woodland of *E. wandoo* and *E. accedens* and less consistently open forest of *E. marginata* subsp. *thalassica* and *C. calophylla* on lateritic uplands and breakaway landscapes in arid and perarid zones; and
- Coolakin (Ck) – Woodland of *E. wandoo* with mixtures of *E. patens*, *E. marginata* subsp. *thalassica* and *C. calophylla* on the valley slopes in arid and perarid zones.

A summary of the mapped extents and remaining percentages of these vegetation complexes is provided Table 5. Vegetation complexes that are less than 10% of the original extent are considered to be significant with focus on the retention of the remaining vegetation complex within the SCP and southwest. All vegetation complexes have more than 10% remaining at a regional scale.

Table 5. Vegetation Complexes within the Proposal Area

Vegetation Complex	Pre-European Extent (ha)	2013 Vegetation Extent	% Remaining
Murray 2 (My2)	59,317.10	40,952.07	69.04
Pindalup (Pn)	167,151.00	128,358.24	76.79
Yalanbee (Y5)	126,609.77	83,829.11	66.21
Yalanbee (Y6)	197,849.01	92,080.88	46.54
Coolakin (Ck)	163,991.68	64,204.65	39.15

4.1.3 Local Vegetation

Within the wider survey area, which covered 61.2 ha, 31 vegetation associations were recorded and mapped (360 Environmental, 2020; Biologic, 2021). Of these, 19 are mapped within the Proposal area and are described in Table 6 and shown in Figure 7 to Figure 11. The vegetation condition within the proposal area ranges from completely degraded to excellent.

Table 7 and Figure 12).

Table 6. Vegetation Associations within the Proposal Area (360 Environmental, 2020; Biologic, 2021)

Vegetation Association*	Description	Extent in Mapped Area (ha)	Extent in Proposal Area (ha)
AhEw	Mid Open forest of <i>Allocasuarina huegeliana</i> with either <i>Eucalyptus wandoo</i> , <i>Corymbia calophylla</i> and <i>Eucalyptus marginata</i> over Tall sparse shrubland of <i>Banksia sessilis</i> , <i>Banksia squarrosa</i> over mid open shrubland of <i>Hakea lissocarpha</i> , <i>Hibbertia hypericoides</i> , <i>Hibbertia commutata</i> over low sparse sedgeland of <i>Tetraria octandra</i> , <i>Lepidosperma aff. costatale</i> on rocky lateritic undulating hills and hill slopes.	3.5	2.11
Bsq	Tall <i>Banksia squarrosa</i> shrubland over mid sparse shrubland of <i>Xanthorrhoea preissii</i> , <i>Macrozamia riedlei</i> and <i>Dianella revoluta</i> with occasional scattered low <i>Eucalyptus wandoo</i> saplings (regrowth from gravel extraction pit) on rocky lateritic undulating hills and hill slopes.	0.2	0.06
Cc	Isolated <i>Corymbia calophylla</i> on roadsides.	1.5	1.55
Em	Isolated <i>Eucalyptus marginata</i> on roadsides.	<0.1	0.02
EmCc	Mid Woodland of <i>Eucalyptus marginata</i> and <i>Corymbia calophylla</i> over mid sparse shrubland of <i>Xanthorrhoea preissii</i> , <i>Phyllanthus calycinus</i> , <i>Bossiaea eriocarpa</i> , <i>Gastrolobium spinosum</i> over low sparse sedgeland of <i>Tetraria octandra</i> on sandy undulating plains, hillslopes and roadsides.	0.8	0.15
EpEw	Mid Woodland of <i>Eucalyptus patens</i> and <i>Eucalyptus wandoo</i> over Mid sparse shrubland of <i>Xanthorrhoea preissii</i> , <i>Hakea prostrata</i> , <i>Billardiera fusiformis</i> and <i>Mesomelaena tetragona</i> on rocky lateritic gullies and lower slopes.	1.0	0.04
Er	Stand of <i>Eucalyptus rudis</i> on roadsides.	1.1	0.98
ErAh	Mid Woodland of <i>Eucalyptus rudis</i> and <i>Allocasuarina huegeliana</i> over weeds on roadsides	0.7	0.39
ErErc	Mid woodland of <i>Eucalyptus rudis</i> over tall open shrubland of <i>Hakea prostrata</i> over tall weedy grassland of <i>*Eragrostis curvula</i> , <i>*Ehrharta calycina</i> and <i>*Avena barbata</i> with scattered dense patches of <i>*Watsonia meriana</i> on sandy clay on roadsides.	0.5	0.34
Ew	Stand of <i>Eucalyptus wandoo</i> on roadsides	1.8	0.64
EwAla	Mid woodland of <i>Eucalyptus wandoo</i> over low open shrubland of <i>Acacia lasiocarpa</i> , <i>Gastrolobium hookeri</i> and <i>Hakea lissocarpha</i> over scattered low shrubs and grasses on rocky lateritic hill slopes and roadsides.	0.5	0.12
EwBsq	Mid Open Forest of <i>Eucalyptus wandoo</i> over Tall sparse shrubland of <i>Banksia squarrosa</i> , <i>Banksia sessilis</i> and <i>Gastrolobium spinosum</i> over Low open shrubland of <i>Hibbertia hypericoides</i> , <i>Dampiera lavandulacea</i> over Low sparse sedgeland of <i>Lepidosperma aff. apricola</i> and <i>Lepidosperma aff. costale</i> on rocky lateritic undulating hills, hillslopes and roadsides.	8.4	4.72

Vegetation Association*	Description	Extent in Mapped Area (ha)	Extent in Proposal Area (ha)
EwCc	Mid Woodland of <i>Eucalyptus wandoo</i> , <i>Eucalyptus marginata</i> , <i>Corymbia calophylla</i> over Mid shrubland of <i>Banksia sessilis</i> , <i>Xanthorrhoea preissii</i> , <i>Hakea lissocarpa</i> and <i>Hibbertia diamesogenos</i> over Low sedgeland of <i>Lepidosperma aff. apricola</i> , <i>Tetraria octandra</i> and <i>Lepidosperma aff. costale</i> on sandy and rocky lateritic undulating hills, hillslopes and roadsides.	8.6	4.56
EwXp	Mid Woodland of <i>Eucalyptus wandoo</i> over Mid open shrubland of <i>Xanthorrhoea preissii</i> , <i>Macrozamia riedlei</i> and <i>Dianella revoluta</i> (regrowth from gravel extraction pit).	1.0	0.41
MaArc	Planted low scattered trees of <i>*Melia azedarach</i> over low mixed hermland and grassland of <i>*Arctotheca calendula</i> and grassy weeds on roadsides.	0.2	0.08
Mv*Ja	Tall closed shrubland of <i>Melaleuca viminea</i> over Low sedgeland of <i>*Juncus acutus</i> on sandy clay on drainage areas.	0.6	0.05
MvEw	Tall closed shrubland of <i>Melaleuca viminea</i> with scattered <i>Eucalyptus wandoo</i> on roadsides.	0.8	0.03
MvTI	Tall, scattered <i>Melaleuca viminea</i> shrubs over tall <i>*Juncus acutus</i> and <i>Bolboschoenus caldwellii</i> mixed open sedgeland and rushland over low open <i>Tecticornia lepidosperma</i> samphire shrubland over low open <i>*Cynodon dactylon</i> grassland on clay on salines drainage areas and minor drainage lines.	0.6	0.04
		Total	16.30

*Areas assigned a vegetation type of 'Cleared', 'Road' or 'Pasture' have not been included, due to absence of native vegetation.

Table 7. Native Vegetation Condition within the Proposal Area (360 Environmental, 2020; Biologic, 2021)

Vegetation Condition*	Extent in Proposal Area (ha)
Excellent	6.68
Very Good	1.70
Good	3.22
Degraded	2.17
Degraded-Completely Degraded	0.43
Completely Degraded	2.11
Total	16.30

*Areas assigned a condition rating of 'Cleared' or 'Pasture' have not been included, due to absence of native vegetation.

5 ASSESSMENT AGAINST THE TEN CLEARING PRINCIPLES

In assessing whether the project's proposed clearing is likely to have a significant impact on the environment, the project was assessed against the ten Clearing Principles (*Environmental Protection Act 1986*, Schedule 5).

Each principle has been assessed in accordance with DWER's 'A Guide to the Assessment of Applications to Clear Native Vegetation' and other relevant CPS Decision Reports prepared by DWER (2014). The proposed clearing is at or may be at variance with one or more of the 10 Clearing Principles.

(a) Native vegetation should not be cleared if it comprises a high level of biological diversity.

Proposed clearing is not likely to be at variance to this Principle

Comment

The Proposal will require the removal of up to 16.30 ha of native vegetation along Great Eastern Highway for the purpose of road upgrades. Surveys have identified 18 vegetation types occurring within the Proposal area (360 Environmental, 2020; Biologic, 2021).

The vegetation assemblages recorded during the surveys are not exclusive to the proposal area and occur in this locality within sections of the road reserve, and adjacent reserves, on both sides of Great Eastern Highway (Figure 7 to Figure 11). None of these vegetation types are representative of a threatened or priority ecological community. 360 Environmental (2020) noted that the vegetation types EwCc and EwBsq have similar characteristics to the 'Eucalypt woodlands of the Western Australian Wheatbelt' Threatened Ecological Community, however; the survey area falls outside the average rainfall isohyet of <600 mm required for the occurrence of this ecological community. As such, these vegetation types are not considered to represent this ecological community.

The vegetation condition within the proposal area ranges from excellent to completely degraded (360 Environmental, 2020; Biologic, 2021). The main disturbances observed in the survey area are mainly associated with GEH, including clearing, weeds and rubbish (Biologic, 2021).

A total of 223 discrete vascular flora taxa from 55 families and 149 genera (Biologic, 2021) were recorded within the wider survey area. Of these, *Tetratheca pilifera* (P3) and *Grevillea olivacea* (P4) were the only species of conservation significance recorded, with 19 individuals of *Tetratheca pilifera* (P3) and 3 individuals of *Grevillea olivacea* (P4) recorded in the wider survey area. Clearing for the Proposal will only directly impact on 10 individuals of *Tetratheca pilifera* (P3), representing 52% of the recorded population in the survey area. This species is broadly distributed throughout the Jarrah Forest and Swan Coastal Plain IBRA bioregions of south-west Western Australia, on gravelly soils on the northern and north-eastern outskirts of the city of Perth. According to the WA Herbarium (2021), there are 122 known records of this species in the state, including 6 individuals recorded in the study area. There are known records of this species in adjacent remnant vegetation, including Woondowing Nature Reserve. It is likely that more records occur in adjacent remnant vegetation and nature reserves (Biologic, 2021). The removal of up to 10 individuals of *Tetratheca pilifera*, which represents 8% of total individuals in the state, will not result in a significant impact to the species or alter its conservation status.

The desktop assessment has identified 33 significant vertebrate fauna species known from previous records in the vicinity of the proposal, comprising 14 mammals, 18 birds (including migratory species, and excluding the *Calyptorhynchus sp. 'white-tailed black cockatoo'*), and one reptile (Biologic, 2021). Of these 20 are listed as Critically Endangered, Endangered, Vulnerable, Conservation Dependent, or Specially Protected under the EPBC Act and/or BC Act, a further eight are listed as Migratory under the EPBC Act and/or BC Act, including some species also listed in the Threatened categories above and seven species are listed as Priority by the DBCA (Biologic, 2021).

The fauna survey completed by Biologic in 2020 identified and mapped five broad fauna habitats in the proposal area comprising; *Eucalyptus wandoo* Woodland over *Banksia*, *Corymbia* and *Eucalyptus marginata* Woodland, *Melaleuca* Shrubland and Isolated Trees (Biologic, 2021). Of these, the 'woodland' habitats are significant for black cockatoos, with wandoo, marri, and jarrah recognised nesting tree species for all three cockatoo species and also providing foraging value (Biologic, 2021). A total of 13.46 ha of woodland habitat types were mapped in the proposal area, and a further 15.16 ha mapped outside the proposal area in the survey area (Biologic, 2021). In consideration of the habitat types and utilisation observed by black cockatoos during the survey, the foraging habitat in the survey area is valued not only on a local level to support roosting and breeding sites, but also on a minor regional level as a "stepping-stone" between seasonal grounds (Biologic, 2021).

In addition to black cockatoos, the composition and density of the 'woodland' habitat types provides the potential to support other conservation significant species such as quenda and western brush wallaby and may also provide denning habitat for chuditch and south-western brush-tailed phascogale, as they contain core habitat requirements such as hollows and logs (Biologic, 2021).

The field survey recorded 51 vertebrate fauna species, comprising of eight mammals, 39 birds, four reptiles and four introduced mammal species (Biologic, 2021). Four significant fauna species have been recorded from the biological survey including Carnaby's cockatoo *Calyptorhynchus latirostris*, Baudin's cockatoo *Calyptorhynchus baudinii*, forest red-tailed black cockatoo *Calyptorhynchus banksii naso*, and quenda *Isoodon fusciventer* (Biologic, 2021).

The biological surveys (360 Environmental, 2020; Biologic, 2021) identified four weed species in the proposal area listed as a Declared Pest under the *Biosecurity and Agricultural Management Act 2007* and/or Weed of National Significance (WoNS). Dieback surveys have not detected any *Phytophthora* dieback infestations in or adjacent to the proposal area, however vegetation adjacent to nature reserves was mapped as protectable (Glevan, 2021). Weeds and dieback have the potential to affect the biodiversity of an area by reducing species diversity and fauna habitat. Risks associated with the introduction or spread of weeds and dieback will be addressed in a Construction Environmental Management Plan (CEMP), including ensuring vehicles and machinery are clean on entry and exit to the site, establishing Clean on Entry points for protectable areas and conducting weed control targeting Declared Pests and WoNS.

The proposal requires the clearing of up to 16.30 ha of vegetation that is characteristic of the local and regional area and does not contain a biodiversity value greater than the vegetation which is located outside and adjacent to the proposal area. In consideration of the '*guide to the assessment of applications to clear native vegetation*' (DER, 2014), vegetation to be cleared does not:

- represent of an area of high biodiversity, as defined by the Threatened Species Scientific Committee for the Australian Government
- comprise of a diverse native vegetation remnant that supports the whole, or a part of, a significant population of priority flora
- comprise of a diverse native vegetation remnant that comprises the whole, or a part of, a significant occurrence of a priority ecological community
- consist of higher diversity than other examples of an ecological community in a bioregion
- contain native vegetation that is in 'degraded' condition yet is in better condition than other vegetation of the same ecological community in the local area

While noting that the vegetation does support habitat for significant fauna species (black cockatoo), in considering the above and that this habitat also extends well outside of the proposal area, the proposed clearing is not likely to be at variance to this principle.

Methodology

Great Eastern Highway Coates Gully Project Detailed Flora and Vegetation Report (360 Environmental, 2020)

H005 Great Eastern Highway Coates Gully (SLK 56.4-67.8) Biological Survey Report (Biologic, 2021)

NatureMap accessed 14/10/2021 (NatureMap, 2021)
 Protected Matters Search Tool accessed 14/10/2021 (DAWE, 2020a)
 DBCA Threatened and Priority Flora, Fauna and Communities Shapefiles
 Main Roads GIS Shapefiles

(b) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.

Proposed clearing is at variance to this Principle

Comment

There are five broad fauna habitats that have been mapped within the Proposal area, these fauna habitats are described as:

- *Eucalyptus wandoo* Woodland over *Banksia*;
- *Corymbia* and *Eucalyptus marginata* Woodland;
- *Melaleuca* Shrubland;
- Isolated Trees.

Desktop assessments identified 33 significant vertebrate fauna species occurring within the vicinity of the Proposal, comprising 14 mammals, 18 birds (including migratory species, and excluding the *Calyptorhynchus* sp. 'white-tailed black cockatoo'), and one reptile (Biologic, 2021). Of these, 20 are listed as Critically Endangered, Endangered, Vulnerable, Conservation Dependent, or Specially Protected under the EPBC Act and/or BC Act, a further eight are listed as Migratory under the EPBC Act and/or BC Act, including some species also listed in the Threatened categories above and seven species listed as Priority by the DBCA (Biologic, 2021).

Biologic (2021) recorded 51 vertebrate fauna species, comprising of eight mammals, 39 birds, four reptiles and four introduced mammal species (Biologic, 2021). Four significant fauna species have been recorded from the biological survey including Carnaby's cockatoo (*Calyptorhynchus latirostris*), Baudin's cockatoo (*Calyptorhynchus baudinii*), forest red-tailed black cockatoo (*Calyptorhynchus banksii naso*), and quenda (*Isoodon fusciventer*) (Biologic, 2021). A further five significant fauna species were considered possible to occur (Biologic, 2021). These include:

- *Dasyurus geoffroii* (Chuditch)
- *Phascogale tapoatafa wambenger* (South-western brush-tailed phascogale)
- *Notamacropus irma* (Western brush wallaby)
- *Apus pacificus* (Fork-tailed swift)
- *Falco peregrinus* (Peregrine falcon)

The '*Corymbia* and *Eucalyptus marginata* Woodland' habitat is considered to provide high quality foraging habitat for all three species of black cockatoo. This habitat type provides a high abundance of core primary resources for these species, namely mature Marri and Jarrah trees. Marri and Jarrah comprise 90% of the diet of the Forest Red-tailed Black Cockatoo (Johnstone, Kirkby, & Sarti, 2013) and is also a core component of foraging diet for Baudin's Cockatoo (Weerheim, 2008). Secondary foraging species such as *Allocasuarina*, *Hakea*, and Blackbutt are also present within this habitat (Biologic, 2021).

Foraging evidence attributed to both Baudin's and Carnaby's Cockatoo was recorded during the field survey (Biologic, 2021). This habitat type is mapped across 4.3 ha of the survey area, of which 1.66 ha is within the proposal area. This equates to a loss of 39.0% of the mapped extent of this habitat. However, given the vast foraging habitat available in the direct vicinity of the proposal area (including Keaginine Nature Reserve [92 ha], Woondowing Nature Reserve [1,526 ha], Kwolyinine Nature Reserve [544 ha] and Inkpen Road Nature Reserve [263 ha]) the loss of 1.66 ha of high-quality foraging habitat is not considered to be significant in the broader context.

The '*Eucalyptus wandoo* Woodland over *Banksia*' habitat is considered to provide medium quality foraging habitat for all three species of black cockatoo. Wandoo is not a primary food resource for black cockatoos and is used more as a potential breeding tree species, particularly for Carnaby's Cockatoo (Cale, 2003). However, the presence of scattered or small patches of Marri and Jarrah and a mid-storey of *Banksia* species (e.g. *B. squarrosa*, *B. sessilis*) make the habitat valuable for foraging resources. The *Banksia* species present is considered of most significance for Carnaby's Cockatoo due to its strong association with *Banksia* species for foraging in comparison to the other black cockatoo species (TSSC, 2016). Secondary foraging species such as *Allocasuarina*, *Hakea*, and Blackbutt were also present within this habitat. Individuals of all three species were observed during the field survey. This habitat type is mapped across 25.4 ha within the survey area of which 12.69 ha is within the proposal area. This equates to a loss of 50.0% of the mapped extent of this habitat. As stated above, over 2,400 ha of foraging habitat is available in conservation reserves in the direct vicinity of the proposal area (including Keaginine Nature Reserve, Woondowing Nature Reserve, Kwolyinine Nature Reserve and Inkpen Road Nature Reserve); however, the loss of medium quality foraging habitat of significant to Carnaby's Cockatoo may be significant for this species.

The remaining habitats are considered of low-quality foraging value for all species of black cockatoos due to the general characteristic of containing only individual or small stands of foraging plants. However, the presence of foraging evidence indicates that individual trees still contain some foraging value for black cockatoos. The 'Isolated Trees' habitat type is mapped across 7.4 ha within the survey area, of which 2.16 ha is within the proposal area respectively. This equates to a loss of 29% of the mapped extent of this habitat.

In consideration of the habitat types and utilisation observed by black cockatoos during the survey, the foraging habitat in the survey area is valued not only on a local level to support roosting and breeding sites, but also on a minor regional level as a "stepping-stone" between seasonal grounds (Biologic, 2021).

No roosting sites for black cockatoos occur within the proposal area. Roosting sites are known to occur within the wider vicinity and within 20 km of the proposal area. From BirdLife Australia survey information there is a confirmed roost site located approximately 600 m to the west of the proposal area and a second confirmed roost site located approximately 500 m north of the GEH proposal area. The foraging habitat surrounding these roost sites is highly likely to be utilised by black cockatoos and may include habitat within the proposal area.

The proposed clearing will remove up to 453 trees with a suitable DBH to form hollows for black cockatoo breeding. A total of 1,029 DBH trees have been recorded within and surrounding the proposal area (Bamford, 2015). Additional survey and data consolidation undertaken by Biologic (2021) identified 963 DBH trees within the current survey area (474 recorded by Bamford (2015) and 489 recorded by Biologic (2021)).

Forty hollow-bearing trees recorded by Biologic in the survey area were subsequently assessed by Kirkby (2021), which determined that:

- Four trees are lost to fire
- 49 hollows were too small at the entrance to be used
- 17 hollows were determined to be either blocked or had insufficient floor space
- Four hollows were assessed as suitable, with one considered a likely breeding hollow.

Of the four hollows assessed as suitable, one hollow, considered likely to be a breeding hollow, coincides with the Proposal area. A further 11 trees with potentially suitable hollows recorded by Bamford (2015) also occur in the proposal area.

Carnaby's Cockatoo breeding is known to occur in the local area, with two breeding pairs recorded within the Wundowie Reserve, approximately 5 km from the Proposal area (Biologic, 2021). Clearing for the Proposal can result in localised impacts to breeding pairs of Carnaby's Cockatoo which may be significant. However, given the presence of over 6,000 ha of remnant vegetation within 6 km of the Proposal area, of

which 2,385 ha is within the DBCA conservation estate, it is considered unlikely that these impacts will result in a long-term decrease in the population.

In addition, the following hollow bearing trees are located within close proximity to, and outside of, the proposal area:

- *Eucalyptus wandoo*, DBH 1,217 mm, four hollows one of which is a likely breeding hollow and has chew marks is located 8 m from the proposal boundary
- *Eucalyptus marginata*, DBH 780 mm, one hollow with slight chew marks at the entrance located 7 m from the proposal boundary
- *Eucalyptus wandoo*, DBH 939 mm, five hollows one of which is a likely breeding hollow and has chew marks is located 16 m from the proposal boundary

These trees will not be removed as part of the works however construction activities may affect breeding pairs utilising the hollow/s should the delivery of the project coincide with the black cockatoo breeding season. As such, pre-clearance surveys will be undertaken for these hollows where adjacent vegetation is proposed to be cleared within the breeding period for black cockatoos. The ability to avoid these trees in the design has a positive outcome for the local retention of hollow bearing trees.

The survey (Biologic, 2021) recorded secondary evidence of quenda in the form of diggings towards the northern section of the survey within *Eucalyptus wandoo* woodland over *Banksia* habitat adjacent to Kwolyinine Nature Reserve and Woondowing Nature Reserve. Quenda was also observed in the 2015 fauna survey within the *Corymbia* and *Eucalyptus marginata* woodland and *Melaleuca* shrubland habitats (Bamford, 2021). In total, 13.59 ha of native vegetation in the proposal area is considered suitable habitat for this species. The survey concluded quenda are most likely to use the vegetation for dispersal between larger areas of native vegetation, such as conservation reserves that abut the road reserve (eg. Keaginine, Kwolyinine and Woondowing nature reserves). Given the proposal is for linear clearing along an existing road, the vegetation likely represents the fringes of the species' preferred habitat, and individuals are unlikely to permanently reside in the proposal area.

Chuditch and South-western brush-tailed phascogale have been not recorded in the proposal area. The survey (Biologic, 2021) concluded these species are considered possible to occur given the proximity of recent records in the study area and the presence of woodland habitat types to provide foraging habitat and denning habitat (such as logs and tree hollows). Habitat in the proposal area is restricted to linear strips of native vegetation that may provide some foraging resources and dispersal opportunities between larger patches of vegetation. However, the vegetation is unlikely to form a significant habitat for individuals given the proximity and extent of native vegetation in the surrounding area.

Western brush wallaby inhabits a wide range of habitats including low *Banksia* woodlands, jarrah/marri woodlands and moist *Melaleuca* lowlands, favouring open, grassy areas (Biologic, 2021). This species has not been previously recorded in the proposal area. Western brush wallaby may utilise the two woodland habitat types in the proposal area for foraging and dispersal. Noting this species is highly mobile and the extent and proximity of suitable habitat in the surrounding area, the proposed clearing is unlikely to impact on significant habitat for this species.

Peregrine falcon and fork-tailed swift may infrequently flyover the proposal area when foraging however these species would not be reliant on the proposal area for habitat. The proposed clearing is unlikely to significantly impact these species.

In consideration of the above, the proposal will reduce the local foraging habitat for black cockatoos and remove a likely breeding hollow and 11 potentially suitable breeding hollows along the existing alignment of the Great Eastern Highway. The proposal has the potential to indirectly impact on the usage of nearby hollows through avoidance by breeding pairs in subsequent years from increased proximity to the road. During the works, there is also the potential to indirectly impact on local roost sites as black cockatoos may avoid using roost locations in proximity (500 m) of the works area. The proposed clearing will also reduce the extent of suitable foraging habitat and denning habitat for significant mammals, however the vegetation

<p>is not likely to form significant habitat for these species. The proposed clearing is considered at variance to this Principle.</p>
<p>Methodology Great Eastern Highway Coates Gully Project Detailed Flora and Vegetation Report (360 Environmental, 2020) H005 Great Eastern Highway Coates Gully (SLK 56.4-67.8) Biological Survey Report (Biologic, 2021) Black Cockatoo Breeding Hollow Inspection, Coates Gully, Wundowie (Kirkby, 2021) NatureMap accessed 14/10/2021 (NatureMap, 2021) Protected Matters Search Tool accessed 14/10/2021 (DAWE, 2020a) DBCA Threatened and Priority Flora, Fauna and Communities Shapefiles Main Roads GIS Shapefiles</p>

(c) Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.

<p>Proposed clearing is not at variance to this Principle</p>
<p>Comment No rare flora have been recorded during detailed and targeted searches within the proposal area and none are considered likely or possible to occur (Biologic, 2021). The proposed clearing of up to 16.30 ha in the proposal area is not expected to be at variance with this Clearing Principle as there is no clearing of rare or listed threatened flora, and there is no clearing of areas necessary to maintain ecological processes and functions for rare flora.</p>
<p>Methodology Great Eastern Highway Coates Gully Project Detailed Flora and Vegetation Report (360 Environmental, 2020) H005 Great Eastern Highway Coates Gully (SLK 56.4-67.8) Biological Survey Report (Biologic, 2021)</p>

(d) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a threatened ecological community.

<p>Proposed clearing is not at variance to this Principle</p>
<p>Comment Nineteen vegetation associations have been mapped within the proposal area. None of these vegetation associations are representative of a Threatened Ecological Community (Biologic, 2021). The proposed clearing is not considered at variance to this principle.</p>
<p>Methodology H005 Great Eastern Highway Coates Gully (SLK 56.4-67.8) Biological Survey Report (Biologic, 2021) DBCA Threatened and Priority Flora, Fauna and Communities Shapefiles</p>

(e) Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.**Proposed clearing is not at variance to this Principle****Comment**

The proposed clearing within the proposal area occurs within Beard vegetation associations 1006 and 3003. As described below.

Summary of Project Area's Mapped Pre-European Vegetation Associations

Pre-European Vegetation Association(s)	Clearing Description	Vegetation Condition	Comments
Vegetation Association 1006 described as woodland southwest, jarrah (<i>Eucalyptus marginata</i>), marri (<i>Corymbia calophylla</i>) and wandoo (<i>Eucalyptus wandoo</i>)	16.30 ha to allow for road widening and service relocations	Ranges from Completely Degraded to Excellent	Vegetation description and condition determined from 360 Environmental and Biologic Environmental Survey respective reports.
Vegetation Association 3003 described as forest, mainly jarrah (<i>Eucalyptus marginata</i>) and marri (<i>Corymbia calophylla</i>)			

Pre-European Vegetation Representation

Pre-European Vegetation Association	Scale	Pre-European (ha)	Current Extent (ha)	%Remaining	%Remaining in DBCA reserves
Veg Assoc No. 1006	Statewide	44,908.3	21,769.5	48.4	22.9
	IBRA Bioregion Jarrah Forest	44,908.3	21,769.5	48.4	22.9
	IBRA Sub-region Northern Jarrah Forest	44,908.3	21,769.5	48.4	22.9
	Local Government Authority Shire of Northam	13,906.85	5,962.9	42.8	12.9
Veg Assoc No. 3003	Statewide	66,451.5	39,061.7	58.7	27.2
	IBRA Bioregion Jarrah Forest	66,451.5	39,061.7	58.7	27.2
	IBRA Sub-region Northern Jarrah Forest	66,451.5	39,061.7	58.7	27.2
	Local Government Authority Shire of Northam	16,259.06	8,709.5	53.5	22.9
	Local Government Authority Shire of Mundaring	25,152.4	15,106.8	60.06	35.7

The National Objectives and Targets for Biodiversity Conservation recognise that the retention of 30% or more of the pre-clearing extent of each ecological community is necessary if Australia's biological diversity is to be protected (Commonwealth of Australia, 2001). Vegetation that has less than 30% remaining is said to represent an area that is significant as a remnant vegetation, below this threshold, species loss appears to accelerate exponentially at an ecosystem level. At all scales there is over 30% remaining of both

vegetation associations. Consequently, Vegetation Associations 1006 and 3003 are not significant as remnant vegetation.

With regards to ecological linkages, the Proposal will require the removal of a small section of vegetation, comprising of 16.30 ha over approximately 5 km. The width of vegetation to be removed from the edge of the road will range from between 5 to 18 m. Based on vegetation mapping and aerial imagery, vegetation will be retained in the road reserve on one or both sides of GEH.

It is noted that sections of the proposal area are adjacent to large remnants of native vegetation, including Keaginine Nature Reserve, Kwolyinine Nature Reserve and Woondowing Nature Reserve. Vegetation between these reserves may contribute to landscape connectivity and fauna dispersal between larger patches of remnant vegetation. However, it is noted from aerial imagery that there is a vegetated riparian corridor along Coates Gully which runs parallel to GEH. There are also remnant patches of varying sizes providing connectivity through private property, and along the Railway Reserves Heritage Trail which is situated towards the northern extent of the proposal area. As such, clearing will not result in the removal of vegetation that will create a barrier to, or impede, the movement of fauna through the regional landscape, or sever connections between conservations reserves. Noting this, it is considered unlikely that the removal of this vegetation will reduce ecosystem functioning or will be a barrier to ecological linkages.

Given the local area and mapped vegetation complexes retain above the recommended threshold and clearing consists of linear strips of vegetation that is not likely to comprise a high level of biological diversity, habitat for rare flora or a TEC, the proposal area is not likely to be significant as a remnant of native vegetation in an area that has been extensively cleared.

Based on the above the proposed clearing is not likely to be at variance to this Principle.

Methodology

- Aerial photography
- Great Eastern Highway Coates Gully Project Detailed Flora and Vegetation Report (360 Environmental, 2020)
- H005 Great Eastern Highway Coates Gully (SLK 56.4-67.8) Biological Survey Report (Biologic, 2021)
- EPA Technical Guidance (EPA, 2016)
- Statewide Vegetation Statistics (Government of Western Australia, 2019)
- Shepherd Report (Shepherd, Beeston, & Hopkins, 2002)
- Perth Biodiversity Project (Perth Biodiversity Project, 2013)
- Main Roads GIS Shapefiles
- DPIRD GIS shapefiles (pre-european vegetation)

(f) Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.

Proposed clearing is not at variance to this Principle

Comment

There are no wetlands (RAMSAR or geomorphic) located within the Proposal area. The Proposal area does not intersect with any mapped watercourse or drainage line. None of the vegetation types mapped within the proposal area are associated with wetland/dampland or riparian in nature.

The proposed clearing will not impact on riparian vegetation or any mapped watercourse of wetland. As such, the proposed clearing is not at variance to this Principle.

Methodology

- Great Eastern Highway Coates Gully Project Detailed Flora and Vegetation Report (360 Environmental, 2020)

H005 Great Eastern Highway Coates Gully (SLK 56.4-67.8) Biological Survey Report (Biologic, 2021)
 DWER and DBCA shapefiles

(g) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.

Proposed clearing is not likely to be at variance to this Principle

Comment
 Soil landscapes and land system mapping of Western Australia describes the broad soil and landscape characteristics from regional and local scales. The proposal area is within the Boyagin System (253By) and the Murray Valleys System (255Mv). The Boyagin system is described as large duricrust remnants surrounded by stripped terrain of rock outcrops and fresh soils in the Eastern Darling Range Zone (DPIRD, 2021). Gravels have jarrah-marri-parrotbush (*Eucalyptus marginata-Corymbia calophylla-Banksia sessilis*) forests (DPIRD, 2021).
 Loams and duplexes with york and wandoo (*Eucalyptus loxophleba* and *Eucalyptus wandoo*), with mallet and powderbark (*Eucalyptus astringens* and *Eucalyptus accedens*) on the scarp (DPIRD, 2021). The Murray Valleys system is described as the Western Darling Range from the Avon Valley to Harvey in the south (DPIRD, 2021). Valleys are deeply incised with red earthy loams, shallow duplexes and rock outcrop, and jarrah-marri-wandoo (*Eucalyptus marginata-Corymbia calophylla-Eucalyptus wandoo*) forests and woodlands with mixed shrubland (DPIRD, 2021).

Aspect	Risk
Flood Risk	Murray System: Up to 53% of map unit has a moderate to high flood hazard Boyagin System: 0% of map unit has a moderate to high flood hazard
Salinity	Murray System: Up to 53% of map unit has a moderate to high salinity hazard Boyagin System: 2% of map unit has a moderate to high salinity hazard
Waterlogging	Murray System: Up to 53% of map unit has a moderate to very high waterlogging hazard Boyagin System: 0% of map unit has a moderate to very high waterlogging hazard
Water Erosion	Murray System: Up to 53% of map unit has a very high to extreme water erosion hazard Boyagin System: Up to 9% of map unit has a very high to extreme water erosion hazard
Wind Erosion	Murray System: Up to 63% of map unit has a very high to extreme wind erosion hazard Boyagin System: Up to 95% of map unit has a very high to extreme wind erosion hazard

The table above indicate the project area is located in a zone classified as exhibiting appreciable risks of flooding, salinity, waterlogging and erosion. The proposal area will be cleared for a road realignment and associated infrastructure. The potential impacts of clearing and construction, such as land degradation from erosion and sedimentation, will be managed by Main Roads through the implementation of standard avoidance and mitigation measures applicable to construction activities, such as the demarcation of the proposed clearing boundary to avoid over clearing into adjacent vegetation. The road design incorporates the construction of new drainage structures that will maintain existing surface water flows.

The ASRIS database indicates that acid sulphate soils (ASS) has an 'Extremely Low Probability of Occurrence' in this area (CSIRO, 2015).

The proposed clearing is not expected to cause appreciable land degradation and is not likely to be at variance to this Principle.

Methodology

Great Eastern Highway Coates Gully Project Detailed Flora and Vegetation Report (360 Environmental, 2020)
 H005 Great Eastern Highway Coates Gully (SLK 56.4-67.8) Biological Survey Report (Biologic, 2021)
 Soil Landscape Mapping (DPIRD, 2021)
 Soil-landscapes of Western Australia's rangelands and arid interior (Tille, 2006)
 ASRIS (CSIRO, 2015)

(h) Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.

Proposed clearing may be at variance to this Principle**Comment**

The proposal area intersects with two reserves or DBCA managed lands and waters:

- Keaginine Nature Reserve (R14278) which is 91 ha
- Woondowing Nature Reserve (R14275) which is 1,526 ha
- Kwolyinine Nature Reserve (R14276) which is 544 ha

Woondowing Nature Reserve comprises multiple, geographically separated parcels of land totalling 1,526 ha. The proposal affects two areas of the reserve adjacent to GEH, which total 46 ha in area. The proposal area will involve a small area of clearing (0.55 ha) within the current cadastral boundary of Woondowing Nature Reserve to allow for an intersection upgrade with the GEH and Coates Road and a slight improvement to the curvature of GEH. The clearing represents 1% of affected parcels of Woondowing Nature Reserve. The vegetation to be cleared has been mapped as EwCc in very good to excellent condition.

Minor clearing totalling 0.25 ha is required within the current cadastral boundary of Kwolyinine Nature Reserve to improve the curvature of the GEH. The proposed clearing represents 0.05% of the reserve. The vegetation to be cleared has been mapped as a mix of AhEw, EwBsq, EwCc, Ew and Bsq in good to excellent condition.

Clearing within these two reserves is unavoidable as the clearing is required to meet the required design standards to reduce curvature and improve sightlines. The affected land will transfer into the GEH road reserve. The total area of clearing within DBCA managed land (0.8 ha or 1.25% of the affected nature reserves) is unlikely to have a detrimental impact on the wider environmental values within the reserves.

The proposal also shares a boundary with Keaginine Nature Reserve. No clearing is proposed within this reserve however the removal of vegetation from the road reserve may increase the occurrence of edge effects along the reserve's northern boundary. Noting the total size of the reserve (92 ha) and north-south orientation, the potential impact to the values of this reserve as a result of the clearing is likely to be restricted to a relatively small area.

In addition, there are several surrounding DBCA managed reserves in proximity to the proposal area. These include:

- Inkpen Road Nature Reserve (R 45833) located 5 km south of the proposal area; and
- Additional areas of Woondowing Nature Reserve located north of the proposal area with the closest reserve parcel 600 m from the proposal area and up to 5 km from the proposal area.

The proposed activities within the proposal area will not have an impact on the above listed reserves and reserve parcels. The proposed clearing will not impact on the connectivity between these reserves as the clearing is linear in nature and will only affect a thin strip of vegetation along the edge of the existing road. As discussed in principle (e), landscape connectivity will be maintained along Coates Gully and remnant vegetation in private property.

The proposal has the potential to introduce weeds and dieback to conservation reserves during clearing activities, as well as reduce the vegetated buffer between the cleared road corridor and vegetation in the reserves, leading to an increase in edge effects. The implementation of a Construction Environmental Management Plan (CEMP) will manage direct and indirect impacts to the adjacent and surrounding reserves. The CEMP will include management controls to prevent the introduction and spread of weeds, management of hydrocarbons, prevent soil erosion and ensure clearing is contained in the approved area. A Dieback Management Plan will also be implemented to manage hygiene and reduce the potential spread of *Phytophthora* Dieback. Main Roads will also undertake annual weed control to prevent the spread of weeds into areas of vegetation of higher quality.

The proposal area is not located within an Environmentally Sensitive Area.

Given the above, the proposed clearing may be at variance to this principle.

Methodology
 Great Eastern Highway Coates Gully Project Detailed Flora and Vegetation Report (360 Environmental, 2020)
 H005 Great Eastern Highway Coates Gully (SLK 56.4-67.8) Biological Survey Report (Biologic, 2021)
 DBCA shapefiles

(i) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.

Proposed clearing is not likely to be at variance to this Principle

Comment
 Clearing for the Proposal will not impact on the water quality of any known watercourse as the Proposal does not intersect any mapped watercourse. Coates Gully, a minor, non-perennial watercourse occurs in close proximity to the Project area (35 m at closest point). The proposed clearing is not expected to impact on surface water flows or quality, following the implementation of management measures, such as prohibiting refuelling or storage of chemicals within 100 m of the watercourse and minimising the occurrence of soil erosion and sedimentation.

The proposal area does not occur within a Public Drinking Water Source Area. The proposed linear clearing of 16.30 ha of native vegetation along an existing major road is not likely to alter groundwater quality in the area.

Based on the above, the proposed clearing is not likely to be at variance to this principle.

Methodology
 Great Eastern Highway Coates Gully Project Detailed Flora and Vegetation Report (360 Environmental, 2020)
 H005 Great Eastern Highway Coates Gully (SLK 56.4-67.8) Biological Survey Report (Biologic, 2021)
 DWER shapefiles

(j) Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.

Proposed clearing is not likely to be at variance to this Principle

Comment
 The project area receives a moderate annual average rainfall of 597 mm (Bakers Hill Station No 010244) and the desktop assessment indicated a high risk of waterlogging and flooding in that area. As the proposal area

is composed predominately of sandy soils, it will have high infiltration rates that will lower the probability of flooding.

Furthermore, the proposal area has a linear and narrow geometry and the removal of a narrow segment of native vegetation on each side of the road makes it unlikely that the incidence or intensity of flooding will increase. The road widening design which will also implement a flatter batter slope will also reduce flood risk by decreasing the velocity and volume of water flow.

Based on the soil properties, project design, small area of native vegetation to be removed and the amount of remaining native vegetation in the surrounding area, it is unlikely that this project will cause or exacerbate the incidence or intensity of flooding.

Based on the above the proposed clearing is not likely to be at variance to this Principle.

Methodology

Great Eastern Highway Coates Gully Project Detailed Flora and Vegetation Report (360 Environmental, 2020)

H005 Great Eastern Highway Coates Gully (SLK 56.4-67.8) Biological Survey Report (Biologic, 2021)

Soil Landscape Mapping (DPIRD, 2021)

ASRIS (CSIRO, 2015)

Bureau of Meteorology – Climate Statistics (BoM, 2021)

6 VEGETATION MANAGEMENT

Main Roads will avoid clearing native vegetation where possible. Where clearing cannot be avoided, clearing will be kept to a minimum. A project specific Vegetation Management Plan (VMP) has been developed for the project, which includes measures to manage vegetation clearing and indirect impacts to vegetation during construction. These management measures are provided in Appendix D and D.1.

7 STAKEHOLDER CONSULTATION

The following stakeholder consultation has been undertaken to date:

Stakeholder	Aspect	Outcome
Shire of Northam	Lands	The Shire of Northam passed a resolution at its Council meeting of 16 February 2022 to dedicate the land as per Main Roads land dealings plans pursuant to <i>Land Administration Act 1997</i> .
DBCA	Lands	The DBCA Perth Hills District has provided support to access DBCA-managed land to construct the project. The DBCA land services area is also being consulted regarding the change in tenure for parts of Kwolyinine Nature Reserve and Woondowing Nature Reserve to road reserve. Final endorsement from the Conservation Commission is still to be received.

8 REFERENCES

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9 APPENDICES

Appendix	Title
Appendix A	Biological Survey Reports
Appendix B	Vegetation Association Mapping
Appendix C	Vegetation Condition Mapping
Appendix D	Vegetation Management Plan
Appendix D.1	Vegetation Management Principal Environmental Management Requirements (PEMRs)

Appendix A: Biological Survey Reports

Consultant	Report	Reference
Bamford Consulting Ecologists	Great Eastern Highway SLK 55.8 – 68.5 Fauna and Black-Cockatoo Habitat Assessment	Main Roads Reference: D21#449824
360 Environmental	Great Eastern Highway Coates Gully Project Detailed Flora and Vegetation Report (360 Environmental, 2020)	Main Roads Reference: D20#297336
Biologic Environmental Survey	H005 Great Eastern Highway Coates Gully (SLK 56.4-67.8) Biological Survey Report (Biologic, 2021)	Main Roads Reference: D21#450212
Tony Kirkby	Black Cockatoo Breeding Hollow Inspection, Coates Gully, Wundowie (Kirkby, 2021)	Main Roads Reference: D21#1153572

Appendix B: Vegetation Association Mapping

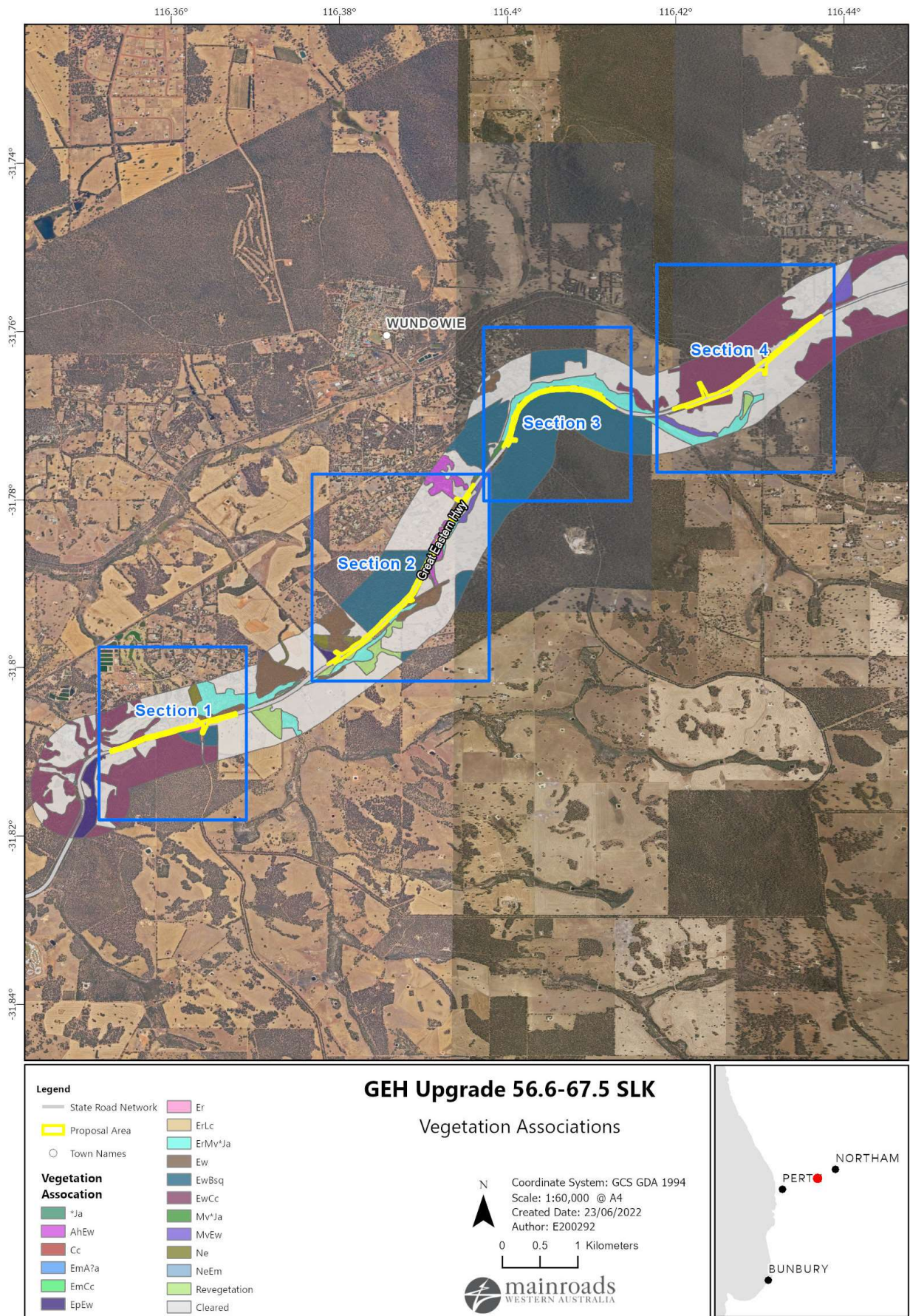


Figure 7. Local Vegetation Associations of the Proposal Area (360 Environmental, 2020; Biologic, 2021)

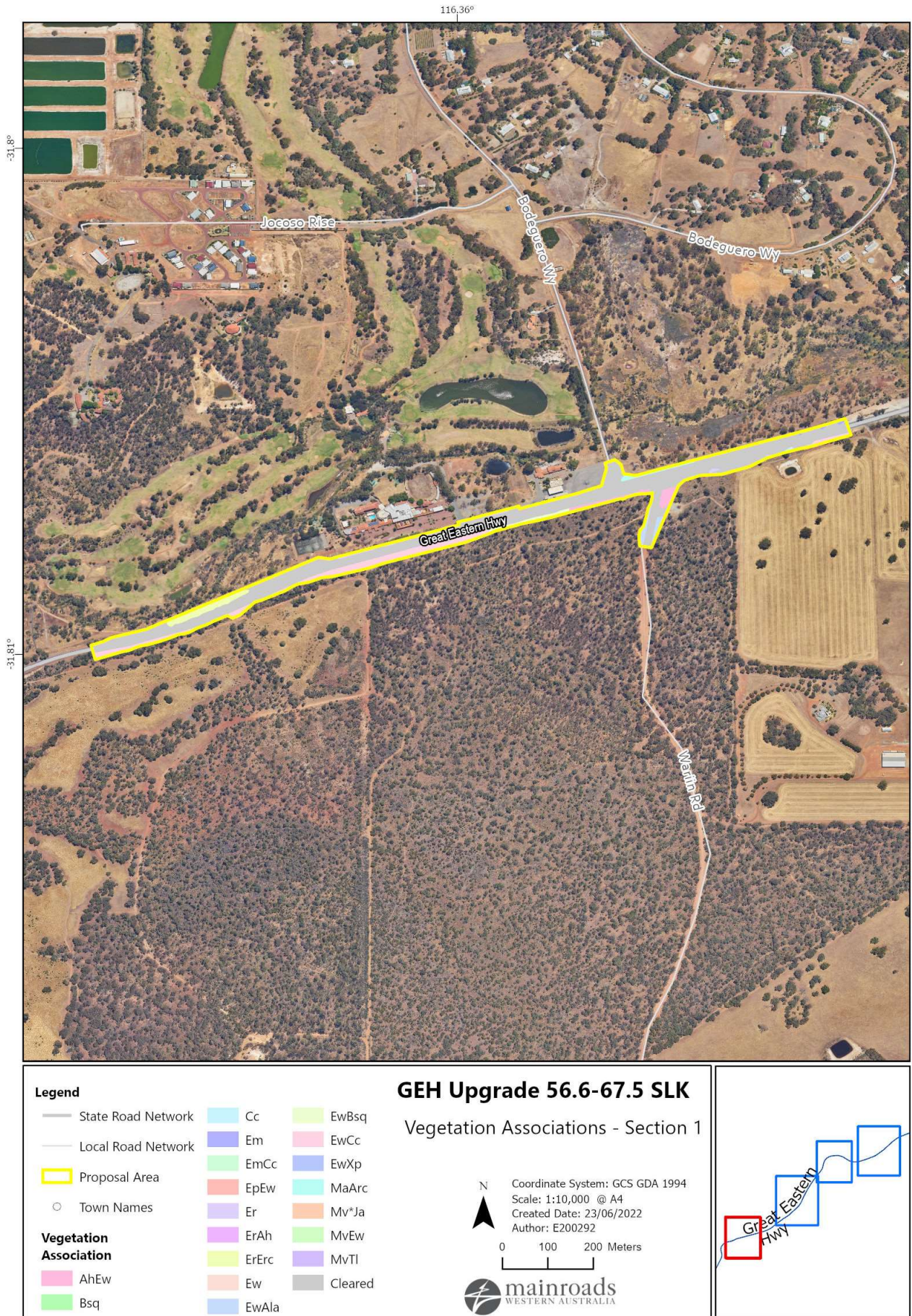


Figure 8. Local Vegetation Associations of the Proposal Area – Section 1 (360 Environmental, 2020; Biologic, 2021)

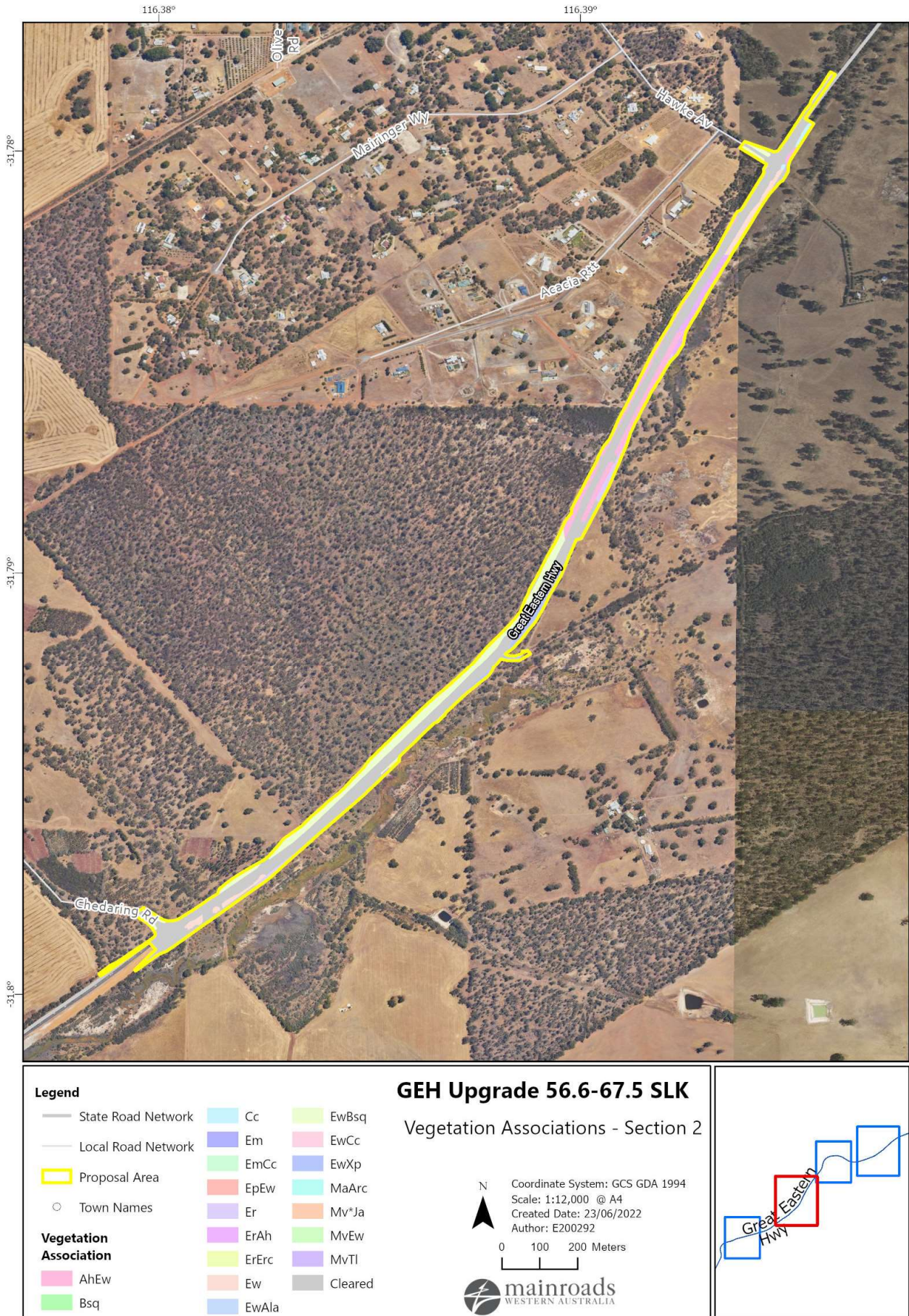


Figure 9. Local Vegetation Associations of the Proposal Area – Section 2 (360 Environmental, 2020; Biologic, 2021)

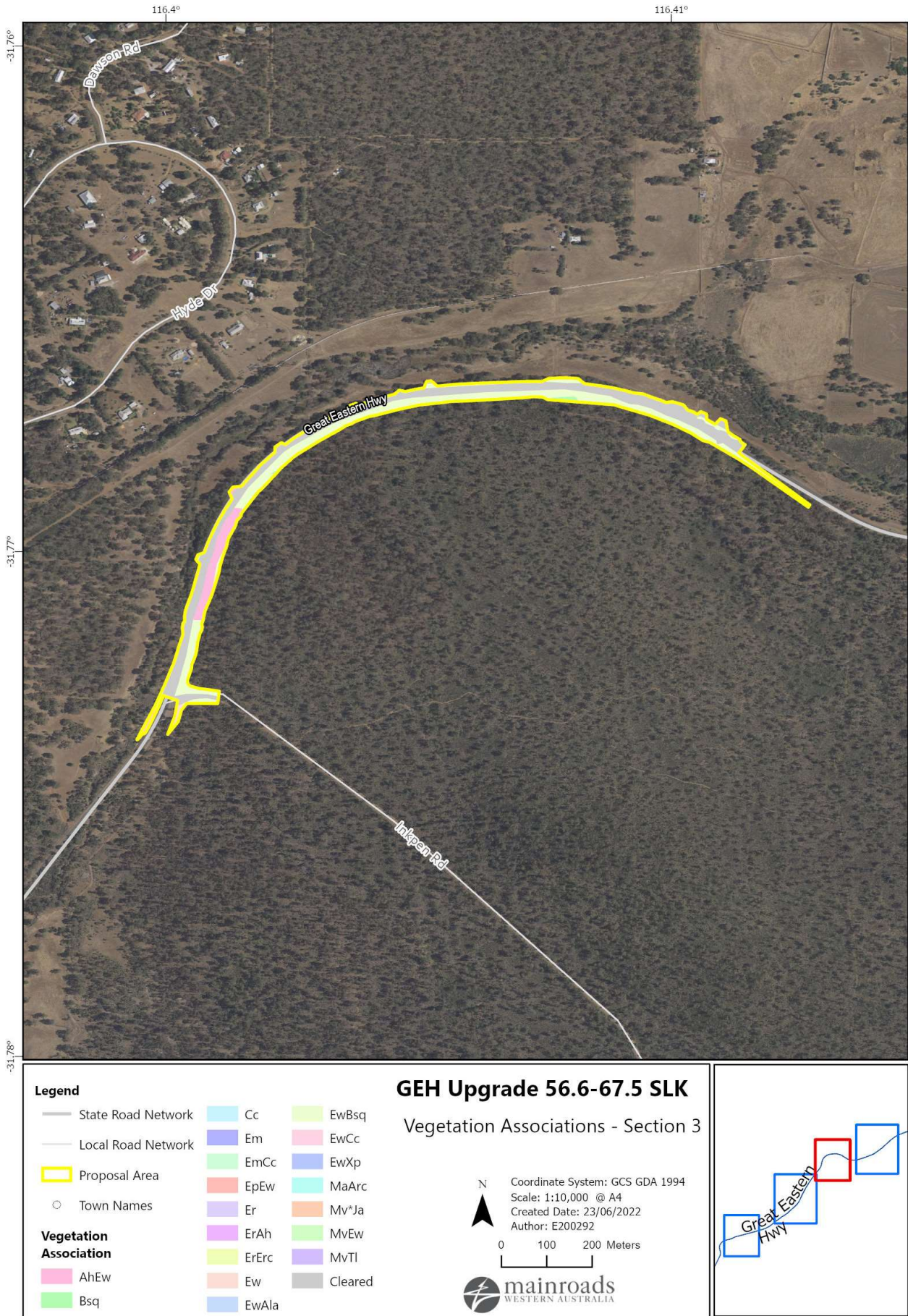


Figure 10. Local Vegetation Associations of the Proposal Area – Section 3 (360 Environmental, 2020; Biologic, 2021)



Figure 11. Local Vegetation Associations of the Proposal Area – Section 4 (360 Environmental, 2020; Biologic, 2021)

Appendix C: Vegetation Condition Mapping

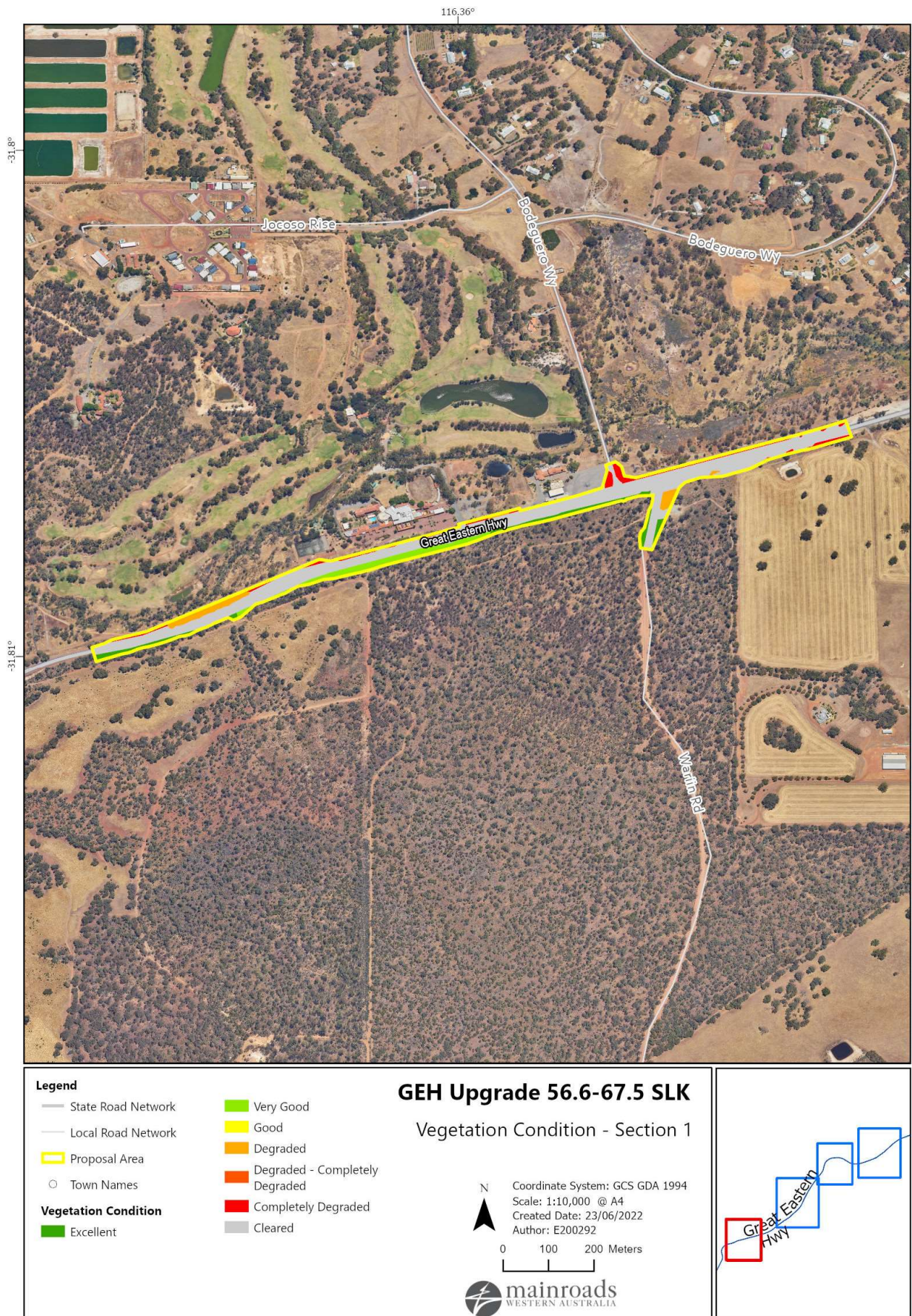


Figure 12. Vegetation Condition of the Proposal Area – Section 1 (360 Environmental, 2020; Biologic, 2021)

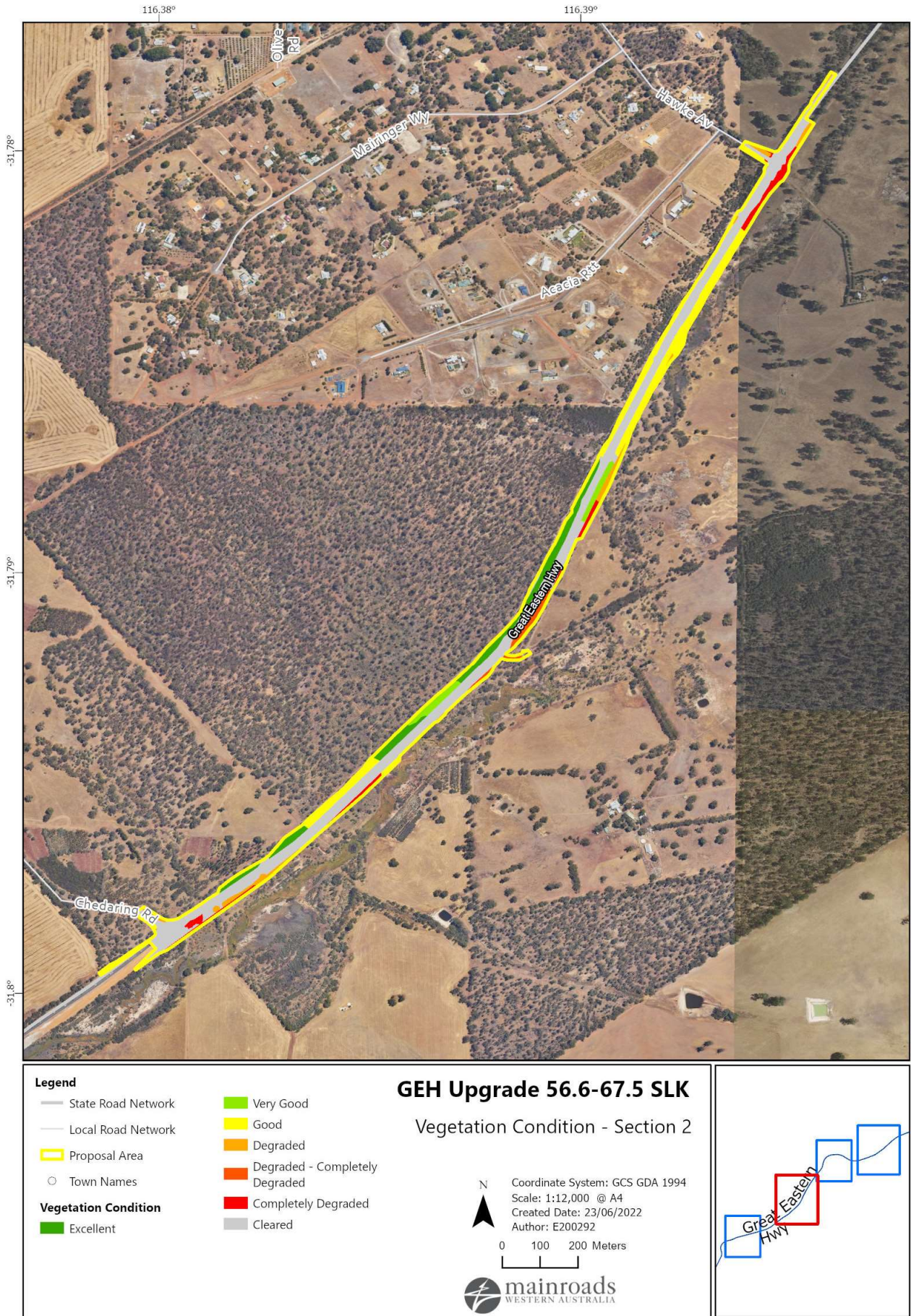


Figure 13. Vegetation Condition of the Proposal Area – Section 2 (360 Environmental, 2020; Biologic, 2021)

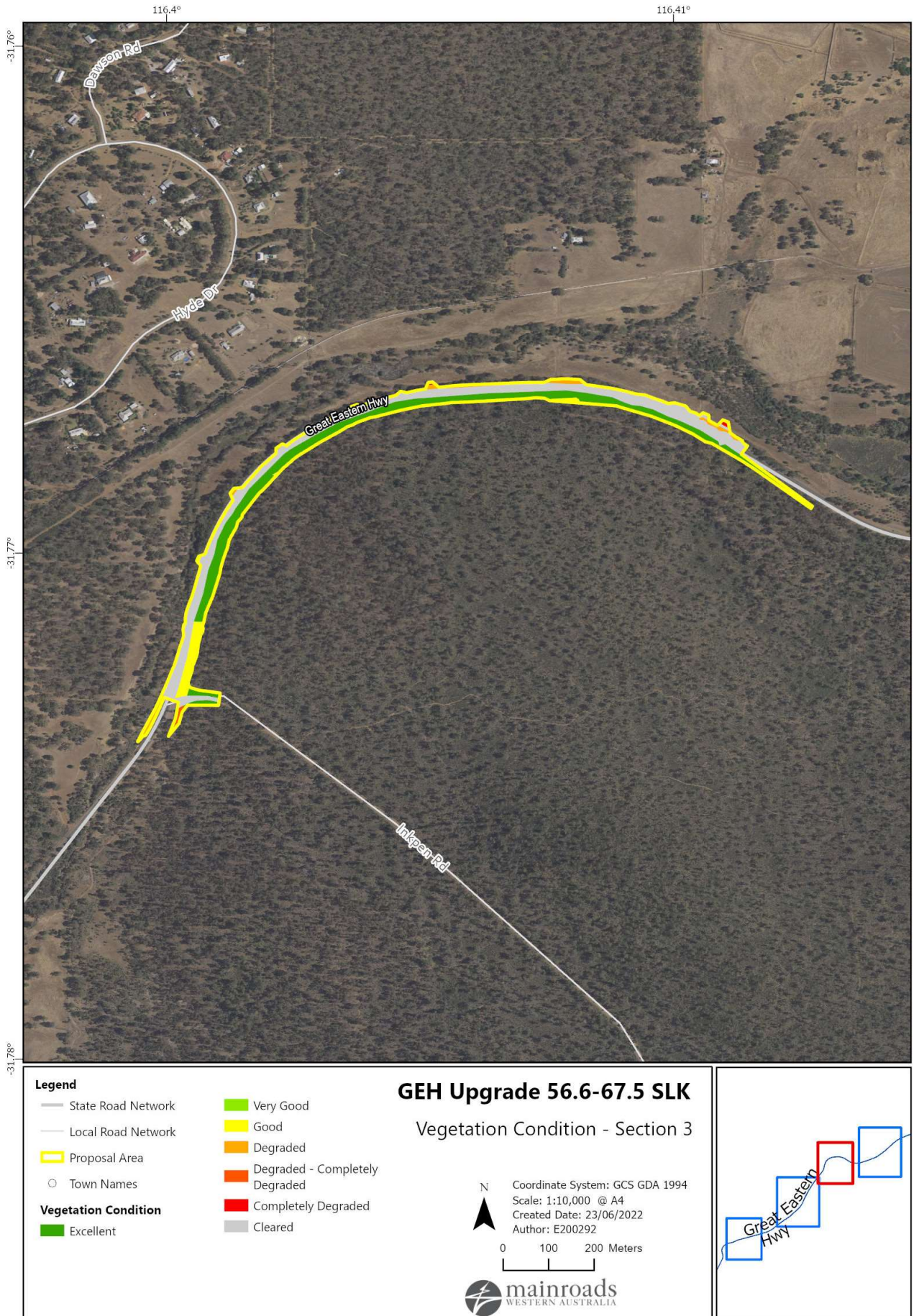


Figure 14. Vegetation Condition of the Proposal Area – Section 3 (360 Environmental, 2020; Biologic, 2021)

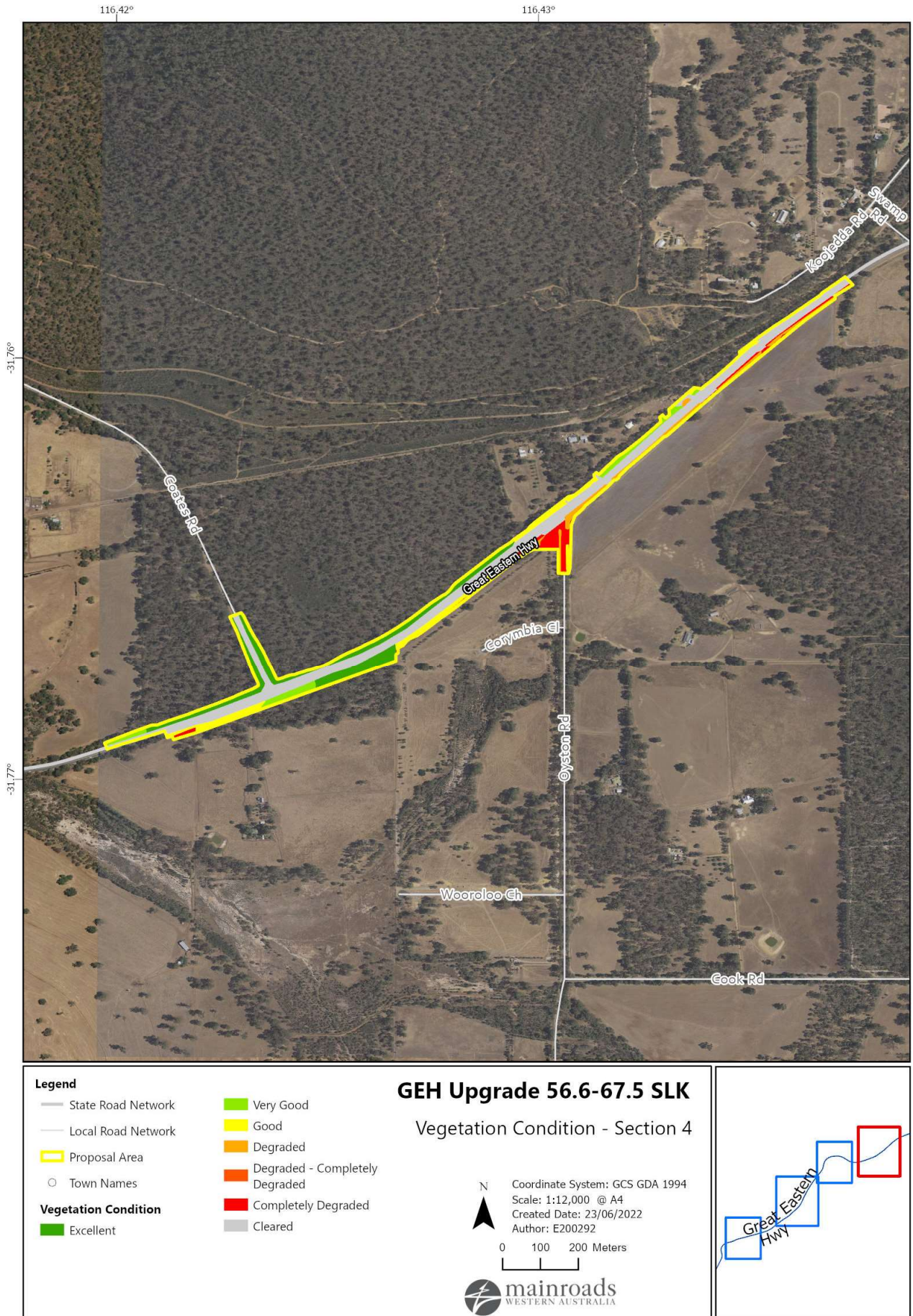


Figure 15. Vegetation Condition of the Proposal Area – Section 4 (360 Environmental, 2020; Biologic, 2021)

Appendix D: Vegetation Management Plan

GREAT EASTERN HIGHWAY 56.6 – 67.5 SLK UPGRADE

Purpose and Scope

This Vegetation Management Plan (VMP) has been prepared by Main Roads for the purpose of managing native vegetation clearing impacts associated with the GEH Upgrade project.

GEH forms part of National Highway 94, and is a strategic freight, tourist and inter-town route. The efficiency and reliability of Great Eastern Highway is vital to the mining and agricultural sectors of the Wheatbelt and Goldfields regions.

Significant age and wear along sections of GEH is severely affecting the safety and efficiency of the highway. This route has been identified as the third riskiest road in regional WA for two consecutive RAC surveys, owing to the poor road condition. Of particular concern is the inadequate road formation and seal widths, and the narrow or absent shoulders.

The Coates Gully proposal is to improve the GEH through the reconstruction and realignment of the existing 9m formation and widening to a 12m formation including a 1m painted median strip. The Coates Gully proposal is to occur between SLK 56.6 to 67.5. The proposal will also include intersection improvements at Bodeguero Way, Wariin Road, Chedaring Rd, Hawke Ave, Inkpen Rd, Coates Road and Oyston Road.

In specified circumstances, Main Roads VMP is required to be approved by Department of Water and Environmental Regulation (DWER) as a condition of Main Roads Statewide Clearing Permit CPS 818.

Action

Appendix B.1 references the standard Principal Environmental Management Requirements (PEMRs) that will be utilised for all projects that involve clearing to avoid, mitigate and manage the environmental impacts of the project.

Project Specific Environmental Management Requirements are contained in Table 1.

Timeframes

Actions shall be undertaken in accordance with those described in the relevant PEMR and the Project Specific Environmental Management Requirements.

Responsibilities

It is the responsibility of the Superintendent's Contract Management Team to ensure that the requirements are implemented by the Contractor. This shall be done by adhering to the Environmental Measurement and Evaluation Checklist.

Appendix D.1. Vegetation Management

VMP Requirement	Standard Management Action	Specific Management Action/s
Clearing	<p>Refer to Table C.1. Clearing PEMR</p> <ul style="list-style-type: none"> • Specification 204 Environmental Management • Construction Environmental Management Plan • Specification 301 Vegetation Clearing and Demolition • Environment Measurement and Evaluation Checklist (for release of HOLD POINTS) <p>Contract Tender Documents available at https://www.mainroads.wa.gov.au/technical-commercial/tender-preparation/</p>	Not applicable
Dieback Management	<p>Refer to Table C.2. Dieback PEMR</p> <ul style="list-style-type: none"> • Specification 204 Environmental Management • Construction Environmental Management Plan <p>Contract Tender Documents available at https://www.mainroads.wa.gov.au/technical-commercial/tender-preparation/</p>	Clean on entry points have been identified by Glevan Consulting, to maintain the integrity of an area identified as 'Uninterpretable' 'Protectable'. 'Clean on Entry' is required between SLK 57.0 and 57.7 SLK 63.0 and 63.58 SLK 65.5 and 66.5, and SLK 67.14 and 67.35
Erosion and Sedimentation Control	<p>Refer to Table C.3. Erosion and Sedimentation Control PEMR</p> <ul style="list-style-type: none"> • Specification 204 Environmental Management • Construction Environmental Management Plan <p>Contract Tender Documents available at https://www.mainroads.wa.gov.au/technical-commercial/tender-preparation/</p>	Not applicable
Fauna	<p>Refer to Table C.4. Fauna PEMR</p> <ul style="list-style-type: none"> • Specification 204 Environmental Management • Construction Environmental Management Plan <p>Contract Tender Documents available at https://www.mainroads.wa.gov.au/technical-commercial/tender-preparation/</p>	Pre-clearing inspection of suitable black cockatoo hollows if clearing undertaken in breeding period.
Machinery and Vehicle Management	<p>Refer to Table C.5. Machinery and Vehicle Management PEMR</p> <ul style="list-style-type: none"> • Specification 204 Environmental Management • Construction Environmental Management Plan <p>Contract Tender Documents available at https://www.mainroads.wa.gov.au/technical-commercial/tender-preparation/</p>	Not applicable
Mulch and Topsoil Management	<p>Refer to Table C.6. Mulch and Topsoil Management</p> <ul style="list-style-type: none"> • Specification 204 Environmental Management 	Not applicable

VMP Requirement	Standard Management Action	Specific Management Action/s
	<ul style="list-style-type: none"> Construction Environmental Management Plan Specification 301 Vegetation Clearing Specification 304 Revegetation and Landscaping Contract Tender Documents available at https://www.mainroads.wa.gov.au/technical-commercial/tender-preparation/	
Pegging and Flagging	Refer to Table C.7. Pegging and Flagging PEMR <ul style="list-style-type: none"> Specification 204 Environmental Management Construction Environmental Management Plan Specification 301 Vegetation Clearing and Demolition Contract Tender Documents available at https://www.mainroads.wa.gov.au/technical-commercial/tender-preparation/	Not applicable
Water Drainage Management	Refer to Table C.8. Water Drainage PEMR <ul style="list-style-type: none"> Specification 204 Environmental Management Construction Environmental Management Plan 	Not applicable
Weed Management	Refer to Table C.9. Weed Management PEMR <ul style="list-style-type: none"> Specification 204 Environmental Management Construction Environmental Management Plan Contract Tender Documents available at https://www.mainroads.wa.gov.au/technical-commercial/tender-preparation/	Not applicable
Monitoring	<ul style="list-style-type: none"> Specification 204 Environmental Management Construction Environmental Management Plan Superintendent's Contract Management Plan & Environmental Measurement and Evaluation Checklist. Contract Tender Documents available at https://www.mainroads.wa.gov.au/technical-commercial/tender-preparation/	Not applicable
Auditing	<ul style="list-style-type: none"> Specification 204 Environmental Management Superintendent's Contract Management Plan & Environmental Measurement and Evaluation Checklist. Contract Tender Documents available at https://www.mainroads.wa.gov.au/technical-commercial/tender-preparation/	Not applicable

Principal Environmental Management Requirements (PEMR's)

Table 1. Clearing PEMR

STANDARD MANAGEMENT ACTIONS

STANDARD MANAGEMENT REQUIREMENTS
<p>PRE WORKS</p> <ol style="list-style-type: none">1. The Contractor must prepare, implement and maintain processes to ensure that the movement of all vehicles, plant and machinery does not occur outside of the Limits of Vegetation Clearing. This must include all turnaround areas.2. The Contractor must minimise vegetation clearing and the area of disturbance on ground by utilising existing cleared area where possible.
<p>DURING WORKS</p> <ol style="list-style-type: none">1. The Contractor must report any damage to vegetation beyond the Limits of Vegetation Clearing as an Environment Incident.2. The Contractor must ensure Movements are confined to the Limits of Vegetation Clearing during the works3. The Contractor must undertake the clearing in accordance with the Fauna PEMR.
<p>POST WORKS</p> <ol style="list-style-type: none">1. NIL

Table C.2. Dieback PEMR

STANDARD MANAGEMENT ACTIONS

STANDARD MANAGEMENT REQUIREMENTS
<p>PRE WORKS</p> <ol style="list-style-type: none"> 1. Contractor’s Pre-starts must detail the requirements from the DMP/HMP, where relevant, dieback management areas and the requirements of each area, maps of infested and uninfested locations, and hygiene requirements 2. Where relevant a copy of the DMP/HMP must be onsite. This plan will include maps of management areas and obligatory control actions 3. Prescribe where vehicles, machinery and plant are going to be stored/parked during the works. 4. Use the Plant, Vehicle and Equipment Hygiene Checklist or equivalent Hygiene form to check that all machinery and vehicles are clean on entry (i.e. free of soil and vegetation).
<p>DURING WORKS</p> <ol style="list-style-type: none"> 1. If required, locations of dieback infested or dieback free areas and hygiene control locations marked on site in accordance with contract HMP or DMP. 2. Hygiene works to be undertaken as per the HMP or DMP, where required. 3. Restrict movement of machines and other vehicles to the Limits of Vegetation Clearing. 4. Ensure no known weed affected soil, mulch, fill or other material is brought into the Limits of Vegetation Clearing. 5. Ensure cleared materials are stockpiled or disposed at waste at the locations approved by the Superintendent.
<p>POST WORKS</p> <ol style="list-style-type: none"> 1. Record that the project was undertaken in dry soil conditions (unless an approved DMP authorises otherwise). 2. Use the Plant, Vehicle and Equipment Hygiene Checklist to check that all machinery and vehicles are clean on exit (i.e. free of soil and vegetation).

Table C.3. Erosion and Sedimentation PEMR

<p>PRE WORKS</p> <p>1. The Contractor must develop, implement and maintain processes and procedures to ensure that:</p> <ul style="list-style-type: none">• The Contractor is responsive to and addresses incidents of erosion and sedimentation within and adjacent to the work areas.• Prevent water and wind soil erosion within and adjacent to the works areas.• Prevent the sedimentation and siltation of watercourses located within and adjacent to the works area.• Ensure that sedimentation and siltation of drainage lines due to the removal of riparian vegetation is avoided, minimised and mitigated.• Ensure that loose surfaces and recently cleared areas are protected from wind and soil erosion.• Minimise exposed soil working surfaces or protect them from stormwater erosion.• Ensure material such as gravel, crushed rock and excavated material is stockpiled away from drainage paths and covered to prevent erosion.• Ensure that water quality monitoring is undertaken when turbidity and sedimentation is an issue.
<p>DURING WORKS</p> <p>1. Implement, monitor and adhere to the sedimentation and erosion processes developed to address the requirements in the pre-works.</p>
<p>POST WORKS</p> <p>1. If required, the Contractor must continue to monitor water quality until the turbidity/sedimentation dissipates.</p> <p>2. The Contractor must ensure that disturbed areas are stabilised as soon as is practicable after construction activities are completed.</p>

Table C.4. Fauna PEMR

<p>PRE WORKS</p> <ol style="list-style-type: none">1. The Contractor must ensure that fauna management requirements are communicated to the crew undertaking the clearing works during the induction and pre-start meeting.2. Where active nests, burrows or dens are identified, works must not proceed until the Contractor obtains the Superintendents approval of the management of active nests, burrows or dens adheres to the Superintendents advice.
<p>DURING WORKS</p> <ol style="list-style-type: none">1. The Contractor must undertake the clearing in the following manner to allow fauna to move out of the clearing area;<ol style="list-style-type: none">i. Prior to the clearing activities commencing, use machinery to tap large trees with habitat hollows to encourage any animals evacuate.ii. Undertake the clearing in one direction and towards areas of native vegetation to allow the animals to escape to adjacent habitat.2. The Contractor must ensure that all onsite personnel undertake visual monitoring and are vigilant to the presence of fauna. Any sightings of fauna, including injury or fatality, must be reported as an Environmental Incident.3. The Contractor must ensure that;<ol style="list-style-type: none">i. No pets, traps or firearms are brought into the project area.ii. Fauna are not fediii. Fauna are not intentionally harmed or killediv. Fauna that venture into the work area are encouraged to leave in a manner that does not harm the animal or operator (loud noise, slowly approaching in a vehicle etc.)4. The Contractor must ensure that in the event that sick, injured or orphaned native wildlife are located on the project site, the WILDCARE Helpline ((08) 9474 9055) will be contacted for assistance. The Contractor must maintain records of any animal taken to a wildlife carer.
<p>POST WORKS</p> <ol style="list-style-type: none">1. The Contractor must provide any records of fauna impact to the Superintendent.

Table C.5. Machinery and Vehicle Management PEMR

<p>PRE WORKS</p> <ol style="list-style-type: none"> 1. The Contractor must ensure that all areas associated with the storage, parking, servicing, wash down and refuelling of all vehicles, plant and machinery is located within the Limits of Clearing and approved by the Superintendent. 2. The Contractor must ensure that all vehicles, machinery and plant are clean on entry (i.e. free of all soil and vegetation material) and comply with the requirements of 204.B.32. 3. The Contractor must ensure that vehicle servicing and refuelling will be undertaken at designated areas approved by the Superintendent. 4. The Contractor must ensure that all staff suitably qualified and competent to undertake works, especially refuelling activities.
<p>DURING WORKS</p> <ol style="list-style-type: none"> 1. The Contractor must maintain records of checking all vehicles, machinery and plant are clean on entry.
<p>POST WORKS</p>

Table C.6. Mulch and Topsoil Management PEMR

<p>PRE WORKS</p> <ol style="list-style-type: none"> 1. The Contractor must ensure that the movement of soil and vegetation is only undertaken in dry conditions unless otherwise approved and / or directed by the Superintendent. 2. The Contractor must ensure that poor quality topsoil and mulched vegetation does not contaminate the good quality topsoil and vegetation.
<p>DURING WORKS</p> <ol style="list-style-type: none"> 1. The Contractor must ensure that all machinery used in the removal of weed-infested topsoil must be cleaned down before and between operations to prevent the introduction and spread of weeds. 2. The Contractor must ensure the movement of large equipment over topsoil materials is avoided to minimise compaction. 3. The Contractor must ensure that Dieback and weed infected topsoil and mulch vegetation must be handled separately to minimise the risk of spreading dieback and weed species across the site and stockpiles. 4. The Contractor must ensure that stockpiling operations must occur in a manner to ensure that the properties of the topsoil are not degraded and the topsoil made unsuitable for use in revegetation.
<p>POST WORKS</p>

Table C.7. Pegging and Flagging PEMR

<p>PRE WORKS</p> <ol style="list-style-type: none"> 1. Pegging must be done in accordance with the requirements detailed in Specification 301. 2. The Contractor must clearly communicate, either at the pre-start meeting or equivalent, to the crew undertaking the clearing works, through clear maps and other additional means, what the Pegging represents.
<p>DURING WORKS</p> <ol style="list-style-type: none"> 1. The Contractor must peg the Limits of Clearing by PINK flagging tape. 2. The Contractor peg/demarcate vegetation proposed to be retained is demarcated by WHITE flagging tape. 3. The Contractor must ensure that the vegetation demarcated with PINK and WHITE flagging tape is consistent with the approved clearing areas.
<p>POST WORKS</p> <ol style="list-style-type: none"> 1. The Contractor remove and dispose of appropriately any demarcation, pegging or flagging once project works are completed.

Table C.8. Water Drainage PEMR

<p>PRE WORKS</p> <ol style="list-style-type: none"> 1. Use pollution control and containment strategies for project activities in Public Drinking Water Source Areas (PDWSAs) / Underground Water Pollution Control Areas (UWPCAs) and liaise with the DWER where necessary
<p>DURING WORKS</p> <ol style="list-style-type: none"> 1. Existing natural drainage paths and channels along the road or the vicinity of the project area will not be unnecessarily blocked or restricted. 2. Temporary drainage systems may be installed to carry surface water away from the areas where excavation and foundation construction work is taking place or from any other area where the accumulation of water could cause delay or damage to the work. 3. Maintain these drainage systems in proper working order at all times. 4. Runoff from disturbed areas must be managed to minimise adverse impacts on surrounding vegetation, watercourses and properties. 5. Booms and silt fences must be used when working over or adjacent to areas of surface water in order to protect the quality of surface water from construction impacts.
<p>POST WORKS</p> <ol style="list-style-type: none"> 1. Water quality monitoring to be undertaken (if turbidity/ sedimentation is an issue).

2. Prior to backfilling the completed pipe work certify that the entire system is flushed clean and tested
3. Disturbed areas will be stabilised soon after construction activities are completed.
4. Culvert and drainage structures will be free of all grass, weeds, silt and debris

Table C.9. Weed Management PEMR

<p>PRE WORKS</p> <ol style="list-style-type: none">1. The Contractor must remove or kill any weeds growing in project area that are likely to spread and result in environmental harm to adjacent areas of native vegetation that are in good or better condition.2. The Contractor must develop, implement and maintain procedures to identify and control declared and invasive weed species within the Contract areas, to the satisfaction of the Superintendent.3. The Contractor must prepare a weed control program, for nominated weed species for control and disposal, to the satisfaction of the Superintendent.4. The Contractor must undertake weed management in Stockpiles as directed by the Superintendent.
<p>DURING WORKS</p> <ol style="list-style-type: none">1. The Contractor must implement the weed control procedures and management plan and record and manage records of its implementation.2. The Contractor must treat nominated weed infestations as many times as necessary to control and eradicate the weed species in accordance with the approved weed control program3. The contractor must ensure that no known weed, pest or diseased affected soil, mulch, fill or other material is brought into the Site.
<p>POST WORKS</p> <ol style="list-style-type: none">1. The relevant Vegetation Maintenance Record Sheets available at: https://www.mainroads.wa.gov.au/BuildingRoads/Contracting/Pages/ReportingForms.aspx must be completed and sent to the Superintendent.