Level 2, 27-31 Troode Street
West Perth WA 6005
T +61 8 9211 1111

Our ref: EEL11266.011

Date: 28 February 2020

Department of Water and Environment Regulation
Locked Bag 33 Cloisters Square
PERTH WA 6850

Dear Sir / Madam,

Amendment to Clearing Permit (CPS 8037/1): Peel Business Park trunk services extension

Please find attached an application to amend the approved CPS 8031/1 clearing area (Appendix A) to facilitate the installation and extension of sewer and water infrastructure to the Peel Business Park (Lot 600 Lakes Road, Stake Hill). The amendment of the approved CPS 8031/1 clearing area will result in approximately 3.154 hectares (ha) of native vegetation being required, which is a minor (0.135 ha) increase from the approved 3.015 ha clearing area.

Background

Clearing Permit (CPS 80371/1) approval

The Peel Business Park requires the delivery of trunk services infrastructure (sewer, power and water) between Gordon Road, Parklands, in the City of Mandurah to Paterson Road, Nambeelup, in the Shire of Murray (SoM) to support future industrial development. The installation of underground power along Patterson Road was completed in 2019, however the installation of sewer and water infrastructure from the Water Corporation's Mandurah No 1 Wastewater Treatment Plant to the Peel Business Park is currently pending.

The route for the extension of the sewer, power and water infrastructure was subject to a Reconnaissance Flora and Vegetation Survey, inclusive of a targeted black cockatoo tree assessment, in September 2017 (RPS 2018[1]). Much of the RPS (2018) survey area traversed cleared agricultural land where vegetation within the road reserves comprised scattered native trees over an understorey of weeds. However, along Gordon, Fowler and Fishhawk Roads the vegetation was relatively intact with areas of Tuart Woodland, Banksia Woodland, wetland-fringing *Eucalyptus rudis* and *Melaleuca* spp. over sedgelands, either within or adjacent to the road reserves.

A Purpose Permit clearing application for the sewer, power and water infrastructure alignment was prepared in March 2018. Clearing permit (CPS 8037/1) was subsequently approved by the Department of Water and Environmental Regulation (DWER) in September 2018. CPS 8037/1 allows for the clearing of up to 3.015 ha of native vegetation within the proposed clearing area (Appendix B).

[1] RPS. 2017. Road Reserve Reconnaissance Flora and Vegetation Survey, Peel Business Park Trunk Infrastructure Extension. Unpublished report prepared for LandCorp.

Rationale for amendment to the approved CPS 8031/1 clearing area

The Water Corporation has recently advised that alternative approaches to the siting and construction of the sewer and water infrastructure between the wastewater treatment plant and the Peel Business Park are required, including situating the infrastructure on the opposite side of the road. There are minor areas within the Lakes Road reservation and to the east of the Serpentine River which were identified as potential future locations for the sewer and water infrastructure which were not surveyed as part of RPS (2018). Additionally, these minor areas are outside of the approved CPS 8037/1 clearing area.

A flora and vegetation field survey was undertaken by RPS for the additional areas in November 2019 to characterise the flora, delineate vegetation units, provide an assessment of the conservation significance of the flora and vegetation and identify any potential breeding trees for black cockatoos. An addendum to RPS (2018) was subsequently prepared to assist in informing potential revisions to the sewer and water infrastructure alignments (Appendix C).

The proposed engineering design and construction methods for the installation of the sewer and water services infrastructure within the additional areas have been underpinned by the findings of the November 2019 flora and vegetation survey. Specifically, the clearing of native vegetation associated with more sensitive environmental features, such as stands of significant trees and conservation significant flora species, has been avoided (wherever practicable).

Supporting the application to amend the approved CPS 8031/1 clearing area, the following figures and documents have been provided:

- Figures A-0 to A-32: Trunk infrastructure – native vegetation clearing areas
- Appendix A: Application for an amendment to a clearing permit
- Appendix B: Clearing Permit (CPS 8031/1)
- Appendix C: Road Reserve Reconnaissance Flora and Vegetation Survey (RPS 2018) and addendum (RPS 2020[2])
- Appendix D: Letters of support
- Appendix E: Tree assessment on Fishhawk Road, Stake Hill.
- IBSA and Shapefile datapacks – attachment.

Landholder context

DevelopmentWA (DevWA) is proposing to vary the installation of the sewer and water services primarily within road reserves under the management of the SoM and within a landholding managed by Main Roads Western Australia (Main Roads) to address the Water Corporation's requirements. The SoM have been consulted regarding the proposed revisions to the clearing of native vegetation within their road reserves required to install the trunk services infrastructure. Main Roads have also been consulted regarding the installation of the trunk services infrastructure within their landholding (Lot 329 Lakelands Road, Stake Hill).

The SoM has agreed to the clearing of native vegetation within their road reserves, however did have concerns relating to the loss of one jarrah tree dead - with hollows (Figure A-8; Appendix C). To compensate the SoM for the loss of the one jarrah tree, DevWA has agreed to supply and install one nesting box within the Nambeelup Brook foreshore reserve (Appendix D).

Main Roads have provided endorsement for the clearing of native vegetation within Lot 329 to facilitate the installation of the sewer and water infrastructure (Appendix D).

[2] RPS. 2020. Reconnaissance Flora and Vegetation Survey Addendum, Peel Business Park. Unpublished report prepared for DevelopmentWA

Clearing area revisions

Figures A to A-32 show the spatial extent of the approved CPS 8031/1 clearing area, which has been primarily denoted as ‘Clearing Permit CPS 8037/1’ (i.e. orange border). The previously approved clearing of 0.546 ha of native vegetation, ranging from “Very Good” to “Completely Degraded” condition, on the western side of the Fowler and Fishhawk road reserves is no longer required. This change has been denoted as ‘Clearing Permit CPS 8037/1 – no longer being required’ in the figures (i.e. red hatch) in Figures A-5 to A-8.

Up to 0.685 ha of additional clearing of native vegetation ranging in condition from “Good” to “Completely Degraded” is now required along the eastern side of Fowler and Fishhawk roads (Figures A-5 to A-8) and within a portion of Lot 329 (Figure A-32) to address the Water Corporation’s requirements. This additional clearing has been denoted as ‘Additional clearing’ in the figures (i.e. blue border), with the native vegetation extents informed by the findings of Road Reserve Reconnaissance Flora and Vegetation Survey (RPS 2018) and Addendum (RPS 2020). Isolated trees or shrubs assessed as being in “Completely Degraded” condition by the RPS (2020) flora and vegetation survey and situated within additional clearing areas are also proposed to be cleared. Due to the “Completely Degraded” condition of the native vegetation these individuals have not been individually mapped by Figures A-5 to A-11.

One additional significant tree, *Eucalyptus marginata* (jarrah) tree (Figure A-8); in the eastern side of Fishhawk Road (Figure A-8), and six *Jacksonia gracilima* (Priority 3) plants with Lot 329 are now also proposed to be cleared. Ten *Jacksonia gracilima* (Priority 3) plants recorded by RPS (2020) have been avoided.

A summary of the revisions to the approved CPS 8031/1 clearing area is provided below in Table 1.

Table 1: Summary of revisions to approved CPS 8031/1 clearing area

Location	Portions of road reserves within the Shire of Murray and Lot 329 Lakelands Road
Area of approved CPS 8031/1 clearing area - no longer required to be cleared (i.e. red hatch in the figures)	0.905 ha
Area of additional clearing area (i.e. blue border in the figures)	2.397 ha
Area of clearing area (total) (i.e. approved CPS 8031/1 clearing area – no longer required to be areas + additional clearing areas)	19.002 ha (i.e. 17.51 ha – 0.905 ha + 2.397 ha = 19.002 ha)
Vegetation extents within approved CPS 8031/1 clearing area - no longer required to be cleared (i.e. red hatch in the figures)	0.546 ha of native vegetation clearing within approved CPS 8031/1 clearing area is no longer required to be cleared
Vegetation extents within the additional clearing areas (i.e. blue border in the figures)	Up to 0.685 ha of native vegetation within the additional areas is proposed to be cleared
Vegetation extents to be cleared (total) (i.e. approved CPS 8031/1 clearing area – no longer required to be areas + additional clearing areas)	Up to 3.154 ha of native vegetation within approved CPS 8031/1 clearing area and additional areas is proposed to be cleared (i.e. 3.015 ha – 0.546 + 0.685 ha = 3.154 ha)
Timing	Clearing of the Patterson Road to facilitate the installation of underground power along Patterson Road was completed in 2019. Clearing of the remaining extents between the wastewater treatment plant and the Peel Business Park is proposed to occur in as one action during the 2020 calendar year.
Clearing method	The native vegetation clearing between the wastewater treatment plant and the Peel Business Park is proposed to be cleared mechanically.
Purpose of clearing	To facilitate the installation of trunk (sewer and water) infrastructure.
Vegetation within approved CPS 8031/1 clearing area - no longer required (i.e. red hatch in the figures)	• Approximately 0.540 ha of Banksia woodland ranging in condition from “Very Good” to “Completely Degraded” condition (Figures A-5 to A-8; Appendix C). • Approximately 0.006 ha of Remnant marri primarily in “Very Good” condition (Figure A-8; Appendix C).
Vegetation proposed to be cleared within the additional clearing areas (i.e. blue border in the figures)	• Approximately 0.257 ha of Banksia woodland primarily in “Degraded” or worse condition (Figures A-5 to A-8; Appendix C). • Approximately 0.237 ha of Remnant *Melaleuca preissiana* in “Completely Degraded” condition (Figure A-32; Appendix C). • Approximately 0.149 ha of Remnant Mixed Trees in “Degraded” condition (Figure A-32; Appendix C). • Approximately 0.041 ha of Planted Trees and Shrubs in “Degraded” condition (Figure A-32; Appendix C).

Vegetation clearing (total) (i.e. approved CPS 8031/1 clearing area – no longer required to be areas + additional clearing areas)	• Approximately 0.807 ha of Scrub in “Degraded” of worse condition (Figures A-24 to 27; Appendix C). • Approximately 0.731 ha of Planted Trees and Shrubs in “Degraded” or worse condition (Figures A-4 and A-32; Appendix C). • Approximately 0.593 ha of Remnant Mixed Trees in “Degraded” or worse condition (Figures A-19 to 20 and A-32; Appendix C). • Approximately 0.478 ha of Remnant *Melaleuca preissiana* in “Degraded” or worse condition (Figure A-14, A-27, A-29 to A-32; Appendix C). • Approximately 0.257 ha of Banksia woodland primarily in “Degraded” or worse condition (Figures A-5 to A-8; Appendix C). • Approximately 0.048 ha of Flooded Gum Woodland in “Good-Very Good” condition (Figure A-5; Appendix C). • Approximately 0.008 ha of Flooded Gum Forest over Sedgeland in “Degraded” or worse condition (Figure A-5; Appendix C). • Approximately 0.005 ha of Remnant Tuart in “Degraded” or worse condition (Figure A-4; Appendix C).
Flora clearing within approved CPS 8031/1 clearing area - no longer required (i.e. red hatch in the figures)	No conservation significant flora species were recorded within the approved CPS 8031/1 clearing area or by RPS (2018)
Flora clearing with the additional clearing areas (i.e. blue border in the figures)	Up to 6 *Jacksonia gracilima* (Priority 3) plants (Figure A-32; Appendix C).
Flora clearing (total) (i.e. approved CPS 8031/1 clearing area – no longer required to be areas + additional clearing areas)	Up to 6 *Jacksonia gracilima* (Priority 3) plants.
Significant trees within approved CPS 8031/1 clearing area - no longer required (i.e. red hatch in the figures)	No tree significant trees were recorded within approved CPS 8031/1 clearing area - no longer required.
Significant trees proposed to be cleared within additional clearing areas (i.e. blue border in the figures)	1 jarrah tree dead - with hollows (Figure A-8; Appendix C).
Significant tree clearing (total) (i.e. approved CPS 8031/1 clearing area – no longer required to be areas + additional clearing areas)	• Approximately 0.151 ha of remnant marri ranging from “Degraded” to “Completely Degraded” condition (Figure A-10; Appendix C). (7 alive trees - no hollows; two dead trees - no hollows). • Approximately 0.042 ha of Remnant Jarrah in “Degraded” condition (Figures A-8 to A-9; Appendix C). (4 trees alive - no hollows; 1 dead jarrah tree – with hollows). • Approximately 0.027 ha of Remnant Flooded Gum in “Completely Degraded” condition (Figure A-10 and A-25; Appendix C) (2 trees alive – no hollows).

Vegetation and flora

The Reconnaissance Flora and Vegetation Survey Addendum (RPS 2020) was undertaken in accordance with the Environmental Protection Authority's (EPA) Technical Guidance: *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016)[3].

The additional clearing areas are a subset of the flora and vegetation survey addendum area, with the eastern side of Fowler and Fishhawk roads previously being surveyed by RPS (2018). The findings of the Reconnaissance Flora and Vegetation Survey Addendum (RPS 2020) of relevance to the additional clearing areas are summarised as follows:

- No Threatened flora species listed under the *Biodiversity Conservation Act 2016* (BC Act) or any species protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) were recorded within the additional clearing areas.
- Six Department of Biodiversity Conservation and Attractions (DBCA)-listed *Jacksonia gracilima* (Priority 3) plants were recorded within the Lot 329 (Figure A-32). Ten *Jacksonia gracilima* (Priority 3) plants recorded by RPS (2020) have been avoided.
- Vegetation units described and mapped within the additional clearing areas were the same as those previously recorded by RPS (2018) and include
  - **Scrub** - *Kunzea glabrescens / Adenanthos cygnorum / Jacksonia furcellata* Closed Tall Scrub to Tall Shrubland over a degraded understorey of naturalised alien (weed) herbs and grasses
  - **Planted Trees and Shrubs** - planted (non-endemic) eucalypts over emergent and planted native shrubs
  - **Remnant Mixed Trees** - Scattered *Eucalyptus marginata* (Jarrah), *Corymbia calophylla* (marri), *Allocasuarina fraseriana* (Sheoak), *Banksia* spp. and *Melaleuca preissiana* trees over a degraded understorey of naturalised alien (weed) herbs and grasses
  - **Remnant *Melaleuca preissiana*** - *Melaleuca preissiana* remnant trees over a degraded understorey of exotic grasses
  - ***Banksia* Woodland** - Scattered *Eucalyptus marginata* (Jarrah) and *Corymbia calophylla* (Marri) over *Banksia menziesii, B attenuata* and *ilicifolia* Low Open Woodland over mixed Shrubland over an exotic Closed Grassland
  - **Flooded Gum Woodland** - *Eucalyptus rudis* subsp. *rudis* Low Open Woodland over *Jacksonia sternbergiana, J furcellata* and *Kunzea glabrescens* Tall Shrubland over *Grevillea vestita* and *Regelia inops* Shrubland over a mixed Open Sedgeland / Herbland / Grassland
  - **Flooded Gum Forest over Sedgeland** - *Eucalyptus rudis* subsp. rudis and *Melaleuca rhaphiophylla* Low Open to Closed Forest over *Baumea juncea* and *Lepidosperma* sp. Closed Sedgeland
  - **Remnant Tuart** - *Eucalyptus gomphocephala* (tuart) remnant trees over a degraded understorey of annual and perennial naturalised alien (weed) herbs and grasses.
- Vegetation condition within the additional clearing areas is primarily "Degraded" to "Completely Degraded".
- Banksia Woodland vegetation within the clearing area is not considered to have adequate conservation value to be considered a Matter of National Environmental Significance, and protected under the EBPC Act.
- Remnant *Eucalyptus gomphocephala* (tuart) trees mapped within the within the RPS (2018) and RPS (2020) survey areas were considered to be representative of the Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain ecological community recently listed under the EPBC Act. No clearing of tuart trees has been proposed within either the additional clearing areas or within the approved CPS 8031/1 clearing area.

[3] Environmental Protection Authority. 2016. Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment. EPA, Western Australia

Significant fauna habitat

The Revised Draft Referral Guideline for the Three Threatened Black Cockatoo Species (Department of the Environment and Energy [DEE] 2017)[4] provides updated information and requirements on habitat quality, survey expectations, standards for mitigating impacts and significant impacts for black cockatoo species.

In addition to the information contained in the earlier 2012 guidance, the revised draft referral guideline identifies that the following actions are likely to result in significant impacts to these species:

1. Clearing of known nesting tree[5] or breeding habitat
2. Complete clearance of roost sites that are close to high quality foraging habitat and water resources in non-breeding areas
3. Clearing very high to high quality foraging habitat.

Potential foraging habitat

The reconnaissance and addendum surveys (RPS 2018; 2020) identified vegetation types considered to be potential black cockatoo foraging habitat within the proposed clearing area (Table 2).

Table 2:: Potential black cockatoo foraging habitat within the revised clearing area

Vegetation type	Vegetation condition	Clearing area extent
Banksia Woodland	"Good"	0.083
	"Degraded" or worse	0.175
Remnant Mixed Trees	"Degraded" or worse	0.593
Remnant Marri	"Degraded" or worse	0.151
Remnant Jarrah	"Degraded"	0.042
Remnant Tuart	"Degraded" or worse	0.005
Total		**1.050 ha**

(Source: RPS 2020)

The 1.050 ha of potential black cockatoo foraging habitat represent small stands of foraging plants or individual trees within the 19.002 ha clearing area. Approximately 0.967 ha of the potential black cockatoo foraging habitat is in "Degraded" or worse condition, whilst the extent of potential foraging habitat in "Good" condition is only 0.083 ha. The revised total of 1.050 ha is approximately 0.139 ha less than that previously identified under the approved CPS 8031/1 clearing area.

Potential breeding habitat

The Reconnaissance Flora and Vegetation Addendum Survey (RPS 2020) identified 22 remnant trees within the survey area with a diameter at breast height (DBH) greater than 500 millimetres (mm) (Appendix C). These native trees are considered potential breeding habitat for black cockatoo species.

All the 22 remnant trees recorded by RPS (2020) have been avoided by the additional clearing requirements. However, one *Eucalyptus marginata* (jarrah) tree in the eastern side of Fishhawk Road, which was recorded by RPS (2018), is proposed to be cleared.

The jarrah tree was identified by RPS (2018) as being dead with hollows (Figure A-8). A targeted inspection of the hollows in the jarrah tree was undertaken by Terrestrial Ecosystems on 10 December 2019. None of the hollows has any evidence of existing or previous use by black cockatoos for nesting (Appendix E).

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[4] Department of Environment and Energy. 2017. Revised draft referral guideline for three threatened black cockatoo species: Carnaby's cockatoo (Endangered) *Calyptorhynchus latirostris*, Baudin's cockatoo (Vulnerable) *Calyptorhynchus baudinii* and Forest red-tailed black cockatoo (Vulnerable) *Calyptorhynchus banksii naso*. Canberra, Australian Capital Territory.

[5] Any existing tree in which breeding has been recorded or suspected.

Fifteen potential habitat trees were approved to be cleared under CPS 8031/1, the addition of the jarrah tree brings the cumulative total to sixteen. The clearing of one additional potential breeding tree is unlikely to result in a significant impact to black cockatoos being realised. However to compensate the SoM for the loss of the jarrah tree, DevWA has agreed to supply and install one nest box within the Nambeelup Brook foreshore reserve (Appendix D).

Assessment Against the 10 Clearing Principles

Table 3 below provides an assessment of the proposed clearing activities against the "10 Clearing Principles" as outlined in Schedule 5 of the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 to determine whether the proposed clearing is at variance to the Principles.

Table 3: Assessment of the additional clearing areas against the 10 Clearing Principles

Principle	Assessment	Outcome
Native vegetation should not be cleared if it comprises a high level of biological diversity	The floristic diversity of the Reconnaissance Flora and Vegetation Survey Addendum (RPS 2020) survey area was assessed as low (Appendix C). Vegetation condition within the additional clearing areas is primarily "Degraded" to "Completely Degraded".	The proposal is not likely to be at variance with the Principle
Native vegetation should not be cleared if it comprises the whole or part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous Western Australia	The minor extent of potential foraging habitat approved to be cleared under CPS 8031/1 (approximately 1.189 ha) has been reduced by 0.139 ha. One jarrah tree in the eastern side of Fishhawk Road is proposed to be cleared. Fifteen potential trees were approved to be cleared under CPS 8031/1, the addition of the jarrah tree brings the cumulative total to sixteen. The clearing of one additional potential habitat tree is unlikely to result in a significant impact to black cockatoos being realised. However to compensate the SoM for the loss of the jarrah tree, DevWA has agreed to supply and install one nest box within the Nambeelup Brook foreshore reserve (Appendix D).	The proposal is not likely to be at variance with the Principle
Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.	No Threatened flora species listed under the BC or EPBC Acts were recorded within the additional clearing area (Appendix C). Six DBCA-listed *Jacksonia gracilima* (Priority 3) plants were recoded within the additional clearing areas.	The proposal is not likely to be at variance with the Principle
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	Remnant *Eucalyptus gomphocephala* (tuart) trees mapped within the RPS (2018) and RPS (2020) survey areas were considered to be representative of the Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain ecological community recently listed under the EPBC Act. No clearing of tuart trees has been proposed within either the additional clearing areas or within the approved CPS 8031/1 clearing area.	The proposal is not likely to be at variance with the Principle
Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared	The native vegetation within the clearing area is identified as belonging to Heddle's Bassendean Complex – Central and South complex. This vegetation complex has approximately 27.7% of its Pre-European extent remaining on the Swan Coastal Plain (Appendix C). Given that the majority of the vegetation within the additional clearing area is in "Degraded" or worse condition, it is not considered to be of conservation significance.	The proposal is not likely to be at variance with the Principle
Native vegetation should not be cleared if it is growing in or in association with a watercourse or wetland.	Clearing of native vegetation within the mapped extent of Conservation Category wetlands (CCW) (UFI 3941, UFI 3843 and UFI 15239) has been avoided (Appendix C), however some minor clearing has been proposed within the mapped buffer of CCW UFI 15239 (Figure A-7). The minor extents of native vegetation proposed to be cleared within the CCW buffer is generally in "Degraded" or worse condition and is less than that previously approved under CPS 8031/1 (Appendix C).	The proposal is at variance with the Principle
Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	Due to the "Degraded" or worse condition of the majority of native vegetation within the additional clearing area, it is no considered that the proposed clearing would cause appreciable land degradation.	The proposal is not likely to be at variance with the Principle

Principle	Assessment	Outcome
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.	The additional clearing areas are not directly adjacent to a conservation area, however are proximate to the Goegrup Nature Reserve (Figure A-5; Appendix C). It is considered very unlikely that the clearing would result in significant impacts to the environmental values of the Goegrup Nature Reserve.	The proposal is not likely to be at variance with the Principle
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	Given the minor extent of native vegetation which is primarily in "Degraded" or worse condition that is being proposed to be cleared, it is not considered likely that the clearing would result in significant impacts to ecological values of surface or underground water sources.	The proposal is not likely to be at variance with the Principle
Native vegetation should not be cleared if the clearing of the vegetation is likely to cause, or exacerbate, the intensity of flooding.	Given the minor extent of native vegetation which is primarily in "Degraded" or worse condition that is being proposed to be cleared, it is not considered likely that the clearing would cause or exacerbate the intensity of flooding. Surface water flows within the road reservations are unlikely to be significantly altered by the clearing of native vegetation.	The proposal is not likely to be at variance with the Principle

Conclusions

The amendment of the approved CPS 8031/1 clearing area will result in:

- 3.154 ha of native vegetation clearing being required. This is a minor (0.135 ha) increase from 3.015 ha clearing extent approved under CPS 8031/1
- 0.139 ha reduction in potential black cockatoo foraging habitat being cleared
- one jarrah tree in the eastern side of Fishhawk Road being proposed to be cleared. Fifteen potential habitat trees were approved to be cleared under CPS 8031/1, the addition of the jarrah tree brings the cumulative total to 16
- Six *Jacksonia gracilima* (Priority 3) plants being required to be cleared. Ten *Jacksonia gracilima* (Priority 3) plants recorded by RPS (2020) have been avoided.

The SoM and Main Roads have been consulted regarding the proposed clearing of native vegetation within their landholdings under their respective management to facilitate the installation of the sewer and water infrastructure. The SoM has agreed to the clearing of native vegetation within their road reserves, however did have concerns relating to the loss of one jarrah tree dead - with hollows. To compensate the SoM for the loss of the one jarrah tree, DevWA has agreed to supply and install one nesting box within the Nambeelup Brook foreshore reserve (Appendix D). Main Roads have provided endorsement for the clearing of native vegetation within Lot 329 to facilitate the installation of the sewer and water infrastructure (Appendix D).

We trust this information is sufficient for your purposes, however should you require further details or clarification, please do not hesitate to contact the writer by telephone.

Contact details redacted

Our ref: EEL11266.011

cc: Figures
Appendix A: Application for an amendment to a clearing permit
Appendix B: Clearing Permit (CPS 8031/1)
Appendix C: Road Reserve Reconnaissance Flora and Vegetation Survey (RPS 2018) and addendum (RPS 2020)
Appendix D: Letters of support
Appendix E: Tree assessment on Fishhawk Road, Stake Hill

FIGURES

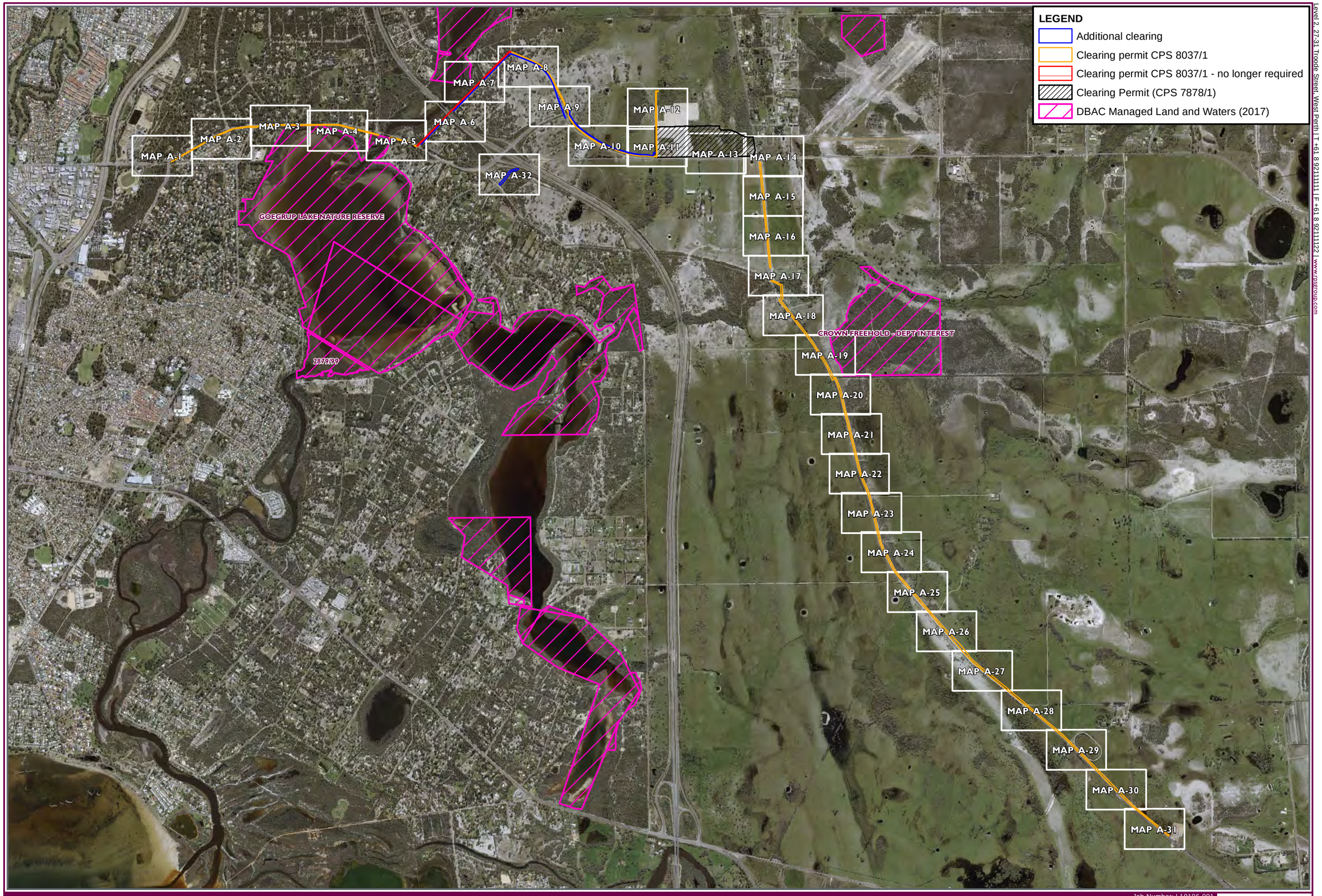

Figure A
Map Index
Trunk Infrastructure - Native Vegetation Clearing Areas

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Figure A-1

Trunk Infrastructure - Native Vegetation Clearing Areas

GDA 1994 MGA Zone 50

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Doc Number: 001 Map Book
Date: 12.02.20
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Figure A-2

Trunk Infrastructure - Native Vegetation Clearing Areas

GDA 1994 MGA Zone 50

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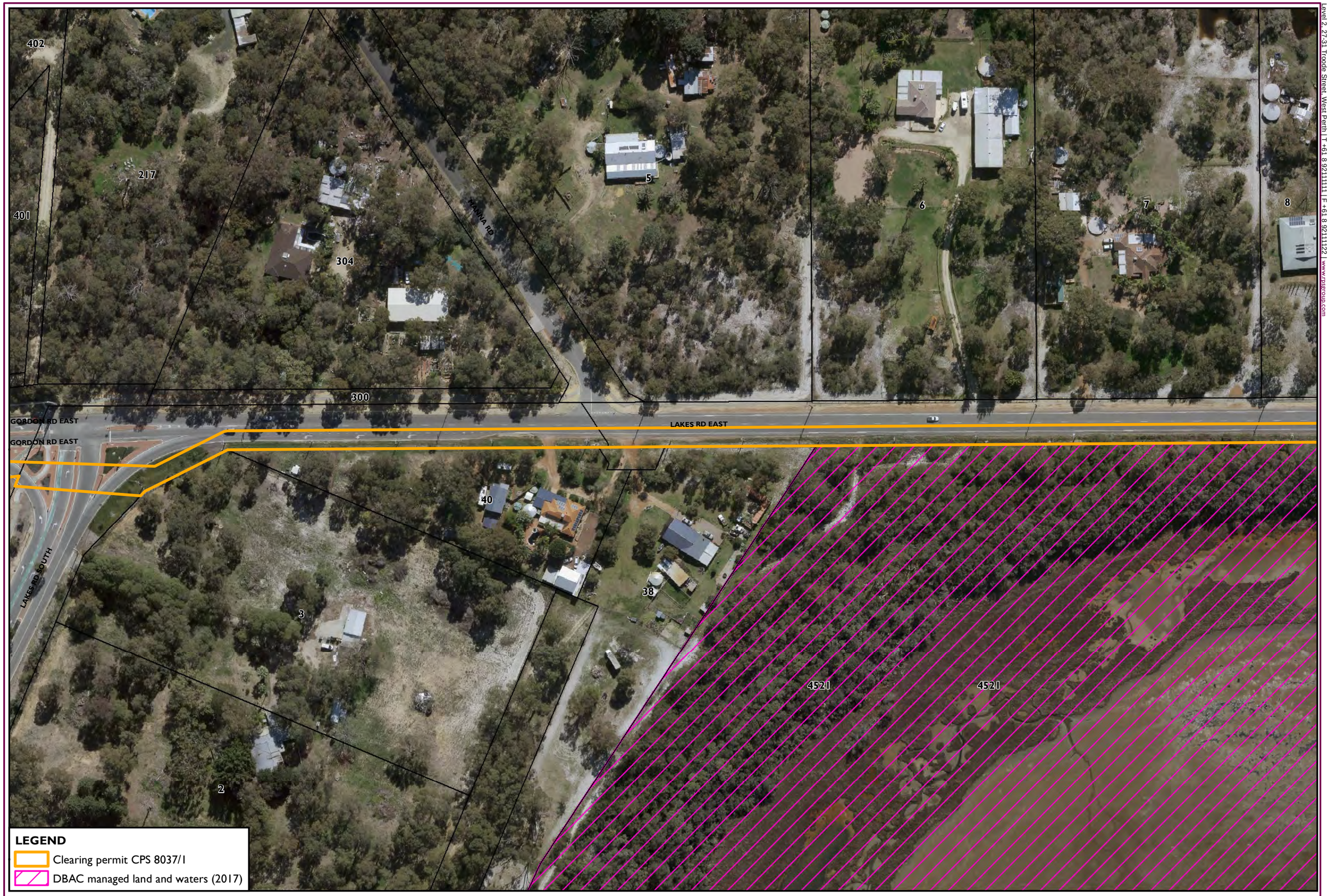

Figure A-3

Trunk Infrastructure - Native Vegetation Clearing Areas

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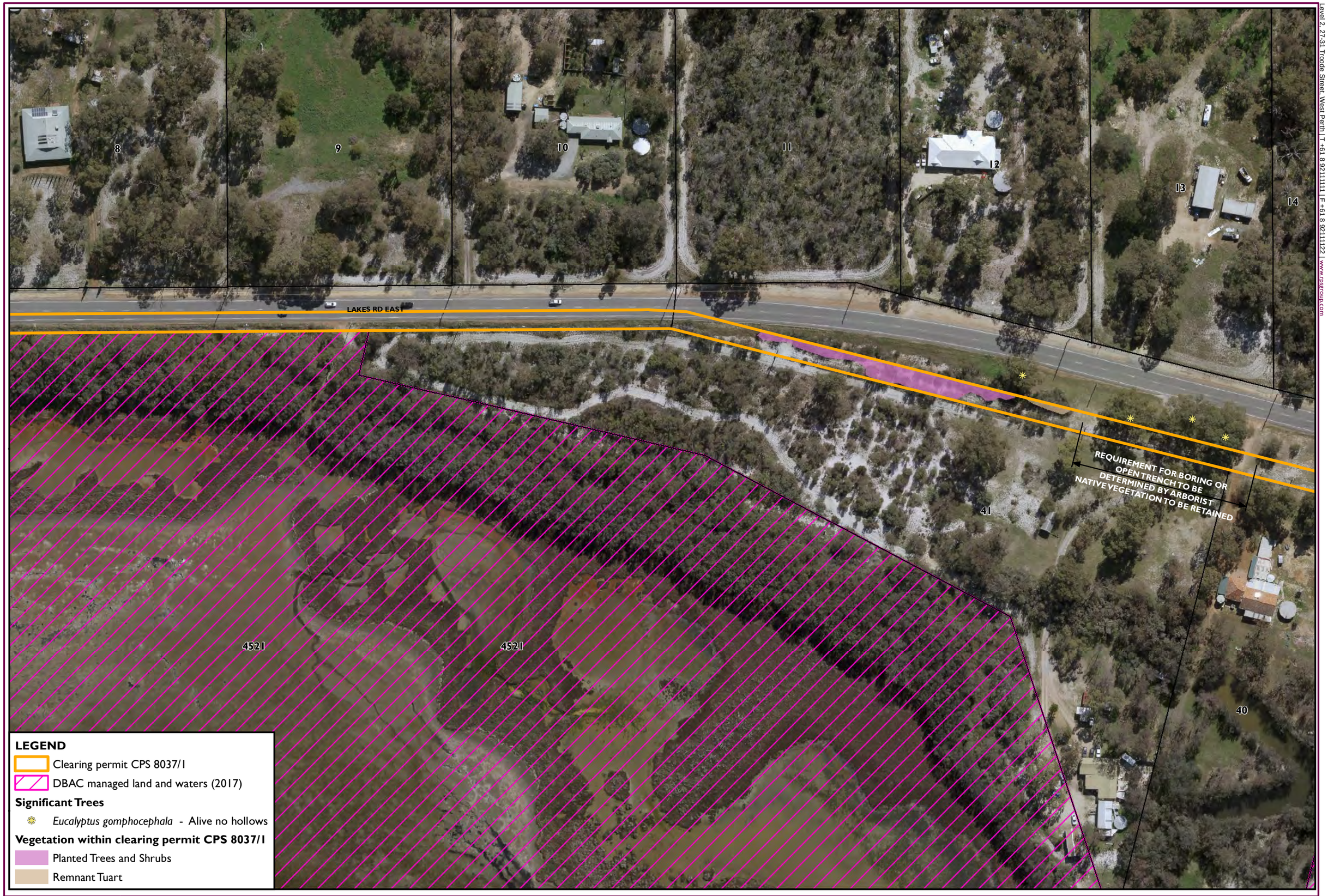

Figure A-4

Trunk Infrastructure - Native Vegetation Clearing Areas

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Created by: MA
Source: Cadastre - Landgate, 2020 Orthophoto - Landgate, Aug 2019

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Figure A-5

Trunk Infrastructure - Native Vegetation Clearing Areas

GDA 1994 MGA Zone 50

0 12.5 25 50 m

Job Number: L11266-011
Doc Number: 001 Map Book
Date: 12.02.20
Scale: 1:1,500 @ A3
Created by: MA
Source: Cadastre - Landgate, 2020 Orthophoto - Landgate, Aug 2019

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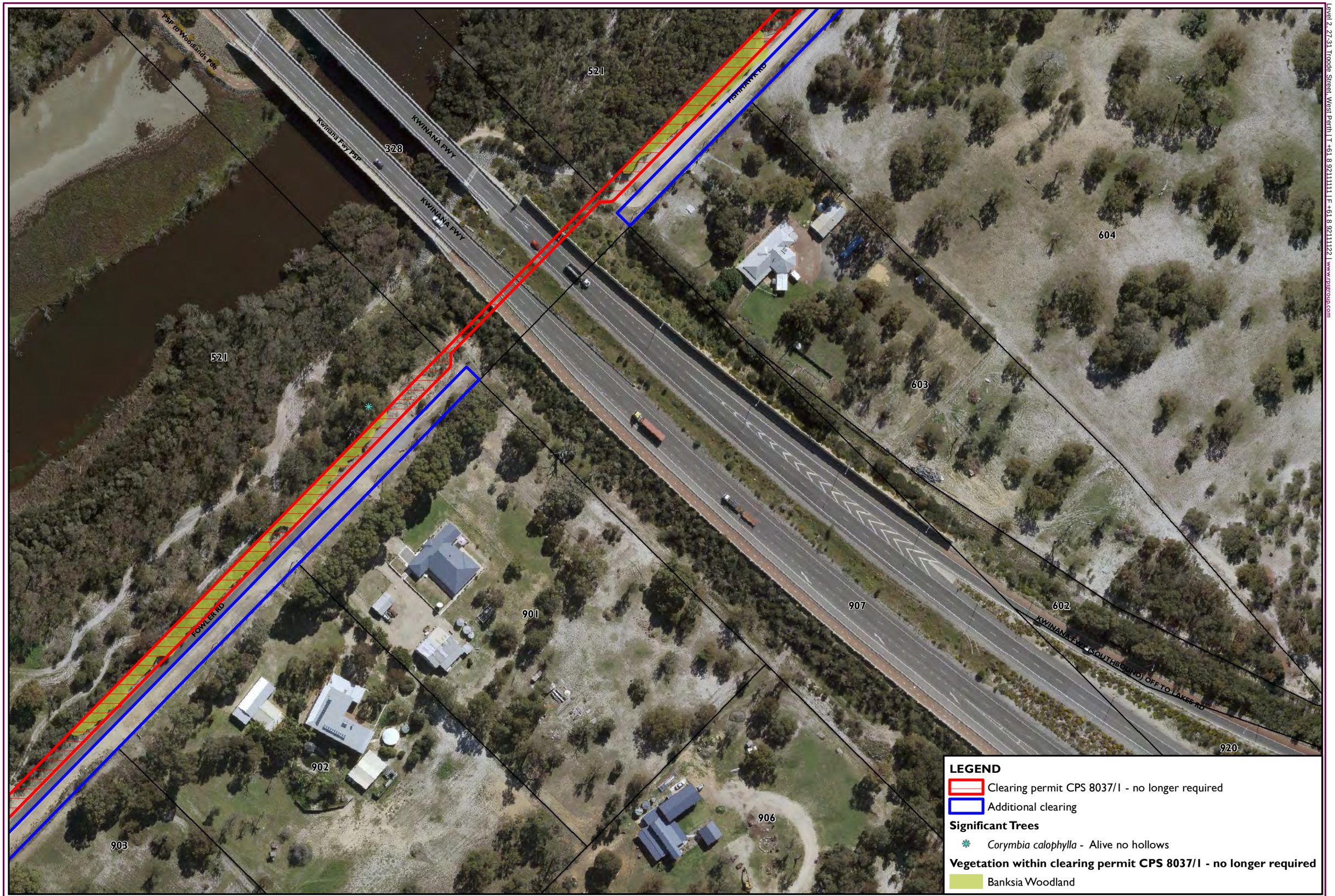

Figure A-6

Trunk Infrastructure - Native Vegetation Clearing Areas

GDA 1994 MGA Zone 50

0 12.5 25 50 m

Job Number: L11266-011
Doc Number: 001 Map Book
Date: 12.02.20
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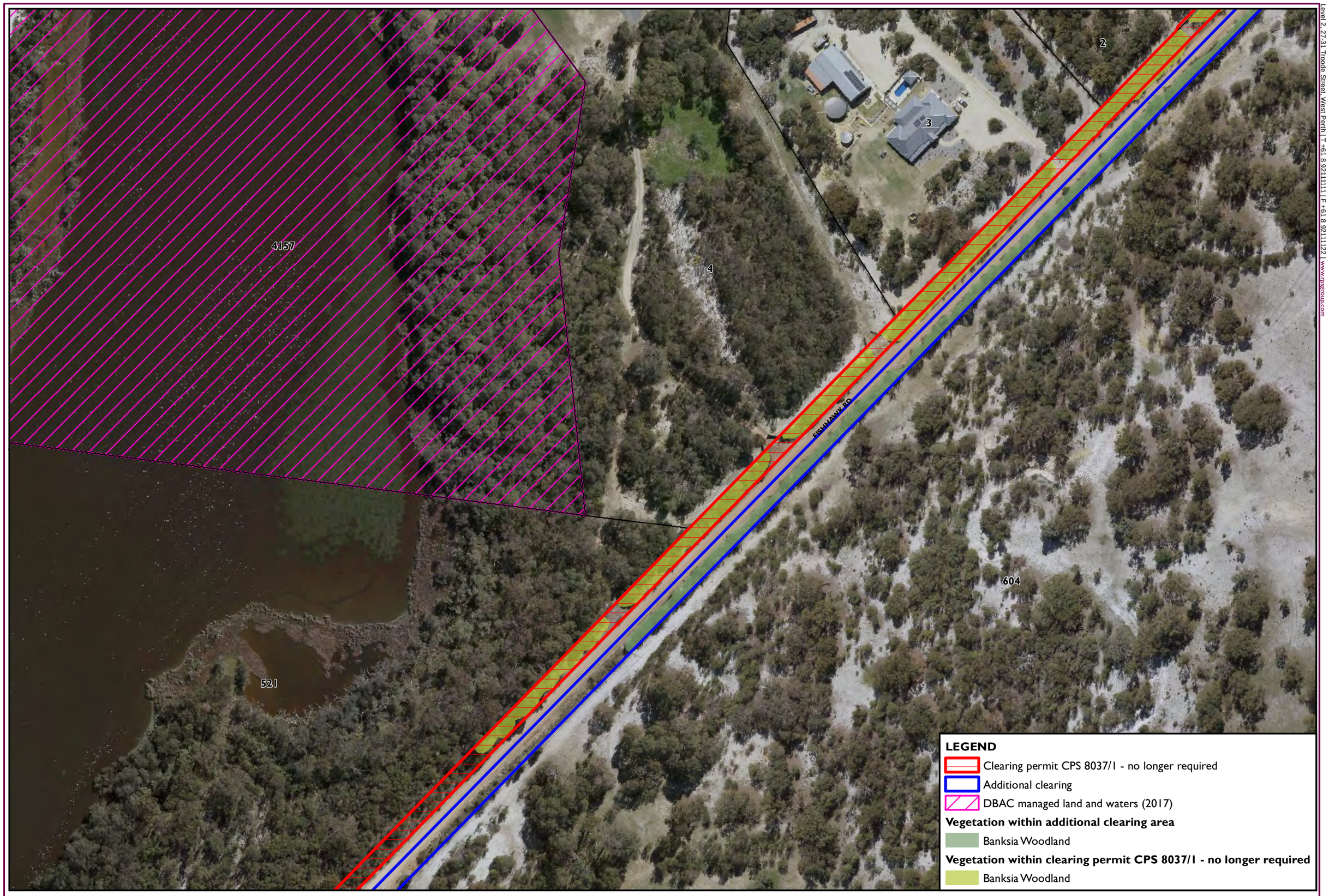

Figure A-7

Trunk Infrastructure - Native Vegetation Clearing Areas

GDA 1994 MGA Zone 50

0 12.5 25 50 m

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Figure A-8

Trunk Infrastructure - Native Vegetation Clearing Areas

GDA 1994 MGA Zone 50

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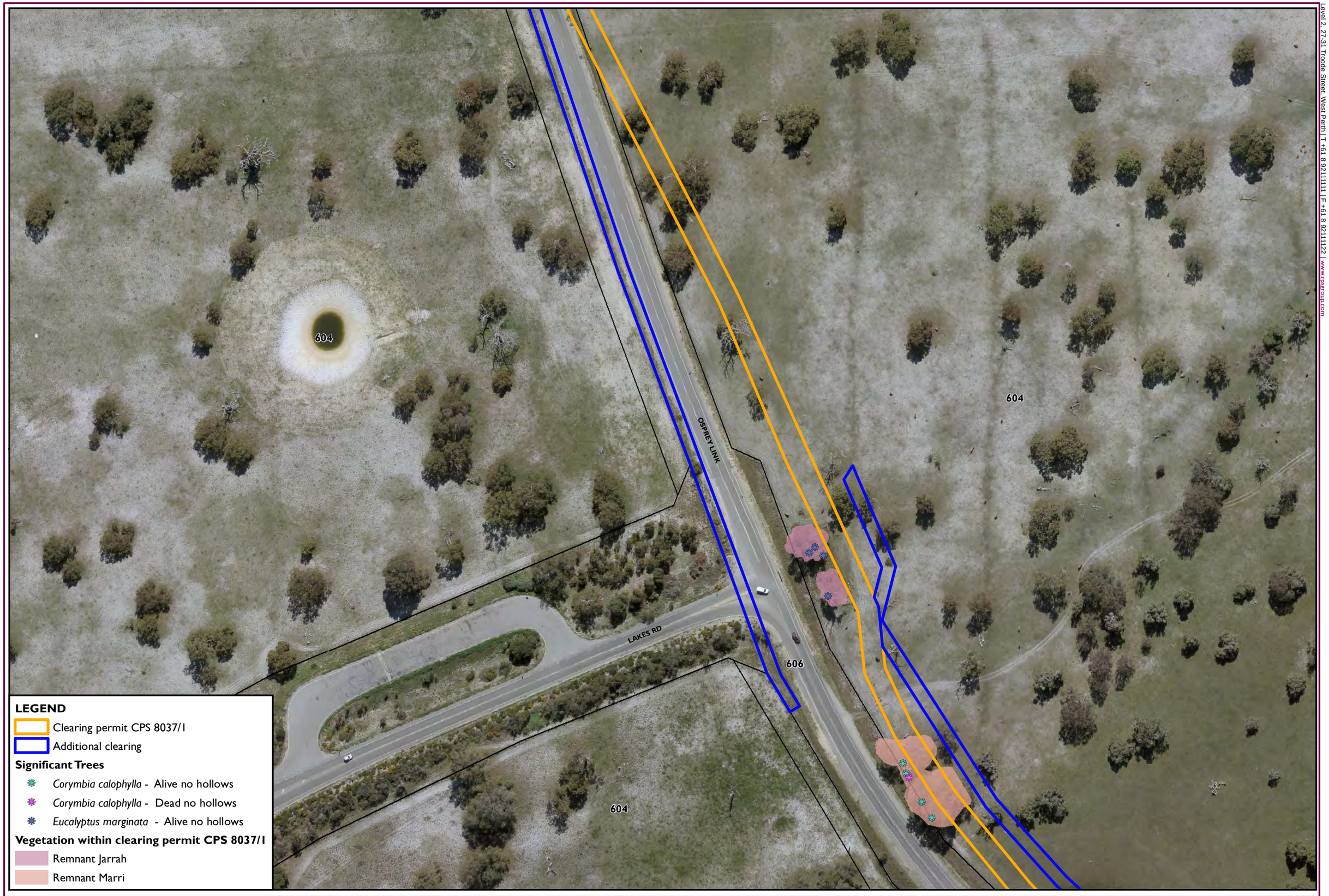

Figure A-9

Trunk Infrastructure - Native Vegetation Clearing Areas

GDA 1994 MGA Zone 50

0 12.5 25 50 m

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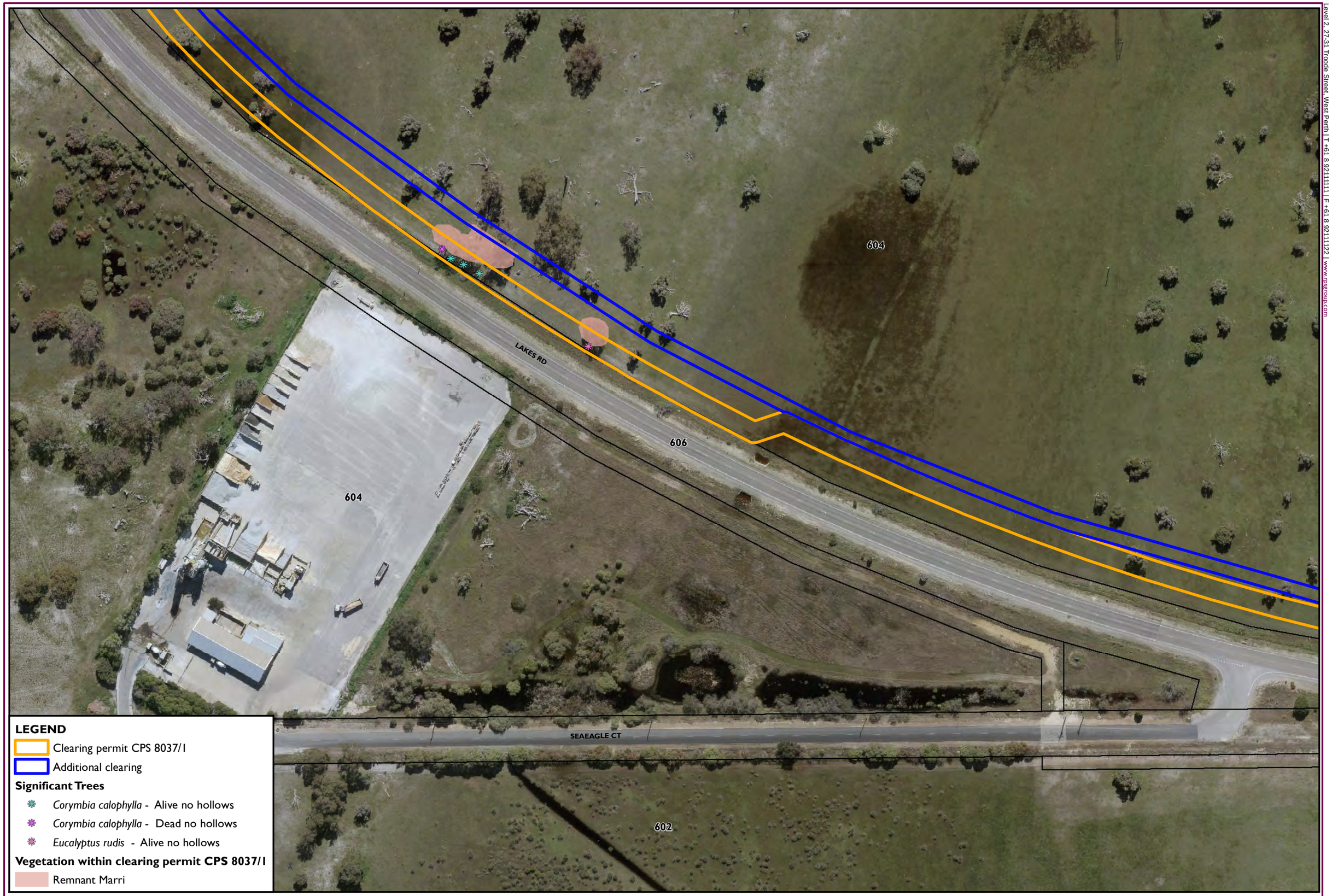

Figure A-10

Trunk Infrastructure - Native Vegetation Clearing Areas

GDA 1994 MGA Zone 50

0 12.5 25 50 m

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Figure A-11

Trunk Infrastructure - Native Vegetation Clearing Areas

GDA 1994 MGA Zone 50

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Figure A-12

Trunk Infrastructure - Native Vegetation Clearing Areas

GDA 1994 MGA Zone 50

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Figure A-13

Trunk Infrastructure - Native Vegetation Clearing Areas

GDA 1994 MGA Zone 50

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Figure A-14

Trunk Infrastructure - Native Vegetation Clearing Areas

GDA 1994 MGA Zone 50

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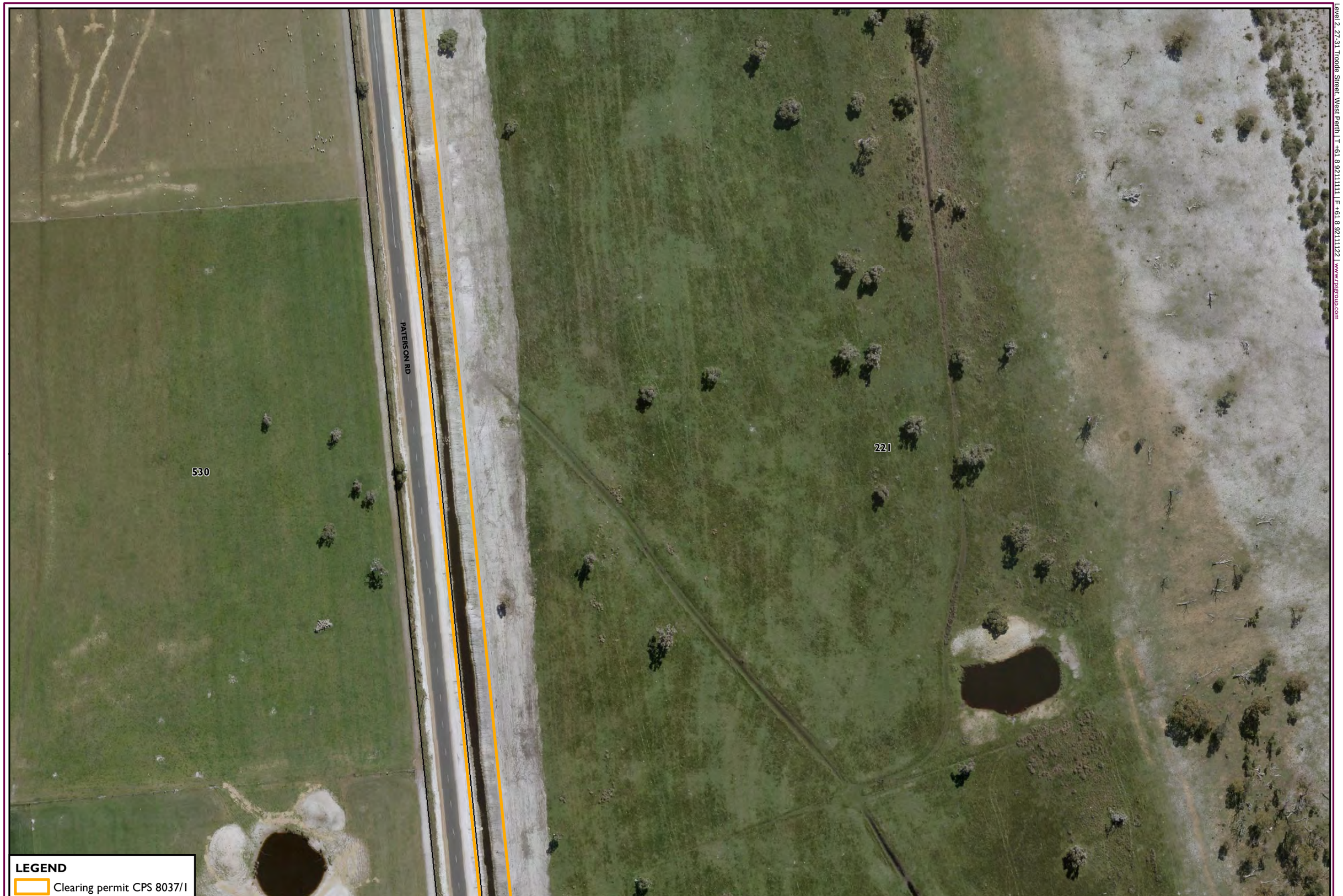

Figure A-15

Trunk Infrastructure - Native Vegetation Clearing Areas

GDA 1994 MGA Zone 50

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Figure A-16

Trunk Infrastructure - Native Vegetation Clearing Areas

GDA 1994 MGA Zone 50

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Figure A-17

Trunk Infrastructure - Native Vegetation Clearing Areas

GDA 1994 MGA Zone 50

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Figure A-18

Trunk Infrastructure - Native Vegetation Clearing Areas

GDA 1994 MGA Zone 50

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Figure A-19

Trunk Infrastructure - Native Vegetation Clearing Areas

GDA 1994 MGA Zone 50

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Figure A-20

Trunk Infrastructure - Native Vegetation Clearing Areas

GDA 1994 MGA Zone 50

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Figure A-21

Trunk Infrastructure - Native Vegetation Clearing Areas

GDA 1994 MGA Zone 50

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Figure A-22

Trunk Infrastructure - Native Vegetation Clearing Areas

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Figure A-23

Trunk Infrastructure - Native Vegetation Clearing Areas

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Figure A-24

Trunk Infrastructure - Native Vegetation Clearing Areas

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Figure A-25

Trunk Infrastructure - Native Vegetation Clearing Areas

GDA 1994 MGA Zone 50

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Figure A-26

Trunk Infrastructure - Native Vegetation Clearing Areas

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Figure A-27

Trunk Infrastructure - Native Vegetation Clearing Areas

GDA 1994 MGA Zone 50

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Figure A-28

Trunk Infrastructure - Native Vegetation Clearing Areas

GDA 1994 MGA Zone 50

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Figure A-29

Trunk Infrastructure - Native Vegetation Clearing Areas

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Figure A-30

Trunk Infrastructure - Native Vegetation Clearing Areas

GDA 1994 MGA Zone 50

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Figure A-31

Trunk Infrastructure - Native Vegetation Clearing Areas

GDA 1994 MGA Zone 50

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Figure A-32

Trunk Infrastructure - Native Vegetation Clearing Areas

GDA 1994 MGA Zone 50

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Appendix C

Road Reserve Reconnaissance Flora and Vegetation Survey (RPS 2018) and addendum (RPS 2020)

REPORT

Road Reserve Reconnaissance Flora and Vegetation Survey

Peel Business Park Trunk Infrastructure Extension

Prepared by: **RPS AUSTRALIA WEST PTY LTD**
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Approved: John Halleen

No: EEL11266.006

Version: Rev 0

Date: April 2018

Document Status

Version	Purpose of Document	Author	Reviewed by	Review Date
Draft A	Draft for Client Review	CarGil	GilGla	13.11.17
Rev 0	Final for Issue	GilGla	JohHal	27.03.18

Approval for Issue of Final Report

Name	Signature	Date
J. Halleen		04.04.18

Contents

Tables

(contained within report text)

Figures

(compiled at rear of report)

Plates

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Appendices

Summary

RPS Australia West Pty Ltd (RPS) was commissioned by LandCorp to undertake a reconnaissance flora and vegetation survey, inclusive of a targeted black cockatoo tree assessment, of approximately 15.7 kilometres (km) of road reserve in the Parklands, Stake Hill and Nambeelup localities (the survey area).

The reconnaissance flora and vegetation survey was undertaken in accordance with the Environmental Protection Authority's (EPA) Technical Guidance: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016).

The findings of the assessment can be summarised as follows:

- A total of 69 plant taxa were recorded for the current survey 14 of which were exotic (weed) species.
- No Threatened Flora (TF) species listed under the *Wildlife Conservation Act 1950*[1] (WC Act) or under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) were recorded within the survey area.
- No Priority Flora (PF) species listed by the Department of Biodiversity Conservation and Attractions (DBCA) were recorded within the survey area.
- Naturalised bushland weeds were recorded at high densities throughout all of the survey area, except for areas mapped in "Very Good" condition where disturbance by weeds was low.
- Of the 14 weed species recorded, none were determined to be Declared Pests under the *Biosecurity and Agriculture Management Act 2007* (BAM Act) nor were they classified as Weed of National Significance (WONS).
- Eleven upland and dampland/wetland vegetation units were described and mapped for the remnant vegetation within the survey area. A description of these vegetation units follows
  - Remnant Tuart (Upland) – *Eucalyptus gomphocephala* (tuart) remnant trees over a degraded understorey of annual and perennial naturalised alien (weed) herbs and grasses
  - Planted Trees and Shrubs (Upland) – planted (non-endemic) eucalypts over emergent and planted native shrubs
  - Remnant Marri (Upland/Damplands) – *Corymbia calophylla* (marri) remnant trees over a degraded understorey of naturalised alien (weed) herbs and grasses
  - Flooded Gum Woodland (Dampland) – *Eucalyptus rudis* subsp. *rudis* Low Open Woodland over *Jacksonia sternbergiana*, *J furcellata* and *Kunzea glabrescens* Tall Shrubland over *Grevillea vestita* and *Regelia inops* Shrubland over a mixed Open Sedgeland / Herbland / Grassland
  - Flooded Gum Forest over Sedgeland (Dampland) – *Eucalyptus* rudis subsp. rudis and *Melaleuca rhaphiophylla* Low Open to Closed Forest over *Baumea juncea* and *Lepidosperma* sp. Closed Sedgeland
  - *Casuarina obesa* Forest (Wetland) – *Casuarina obesa* Closed Forest over *Lepidosperma* sp., *Baumea juncea*, *Gahnia trifida* and *Juncus krausii* Closed Sedgeland

[1] The *Biodiversity Conservation Act 2016* will eventually fully replace the *Wildlife Conservation Act 1950* in listing threatened species and regulating the protection of native species, however these provisions cannot be brought into effect until the necessary Biodiversity Conservation Regulations have been endorsed.

- Samphire-dominated Saltmarsh (Wetland) – *Tecticornia ?halocnemoides*, *T indica* subsp. *bidens* and *Cotula coronopifolia* Closed Herbland
- Banksia Woodland (Upland) – Scattered Eucalyptus marginata (jarrah) and Corymbia calophylla (marri) over *Banksia menziesii*, *B attenuata* and ilicifolia Low Open Woodland over mixed Shrubland over an exotic Closed Grassland
- Remnant Melaleuca preissiana (Dampland/Wetland) – *Melaleuca preissiana* remnant trees over a degraded understorey of exotic grasses
- Melaleuca Closed Forest (Wetland) – *Eucalyptus rudis* subsp. *rudis* (flooded gum) and *Melaleuca rhaphiophylla* Closed Forest over *Taxandria linearifolia* and *Astartea scoparia* Open Shrubland over *Juncus pallidus*, *Baumea juncea*, *Lepidosperma* sp. and **Watsonia* sp. Closed Sedgeland/ Herbland
- Remnant Mixed Trees (Upland and Dampland) – Scattered *Eucalyptus marginata* (jarrah), *Corymbia calophylla* (marri), *Allocasuarina fraseriana* (sheoak), Banksia spp. and *Melaleuca preissiana* trees over a degraded understorey of naturalised alien (weed) herbs and grasses
- Scrub (Dampland) – *Kunzea glabrescens* / *Adenanthos cygnorum* / *Jacksonia furcellata* Closed Tall Scrub to Tall Shrubland over a degraded understorey of naturalised alien (weed) herbs and grasses.

- Vegetation condition ranged from “Very Good” to “Completely Degraded” throughout the survey area, with the majority of the vegetation within the road reserve, and areas adjacent to the road reserve and within the survey area, recorded in “Completely Degraded” condition. The vegetation associated with the Conservation Category Wetlands (CCW) was generally floristically and structurally intact and was mapped variously as “Good”, “Good to Very Good” and “Very Good” condition.
- In assessing the conservation significance of flora within the survey area, consideration is given to rarity, biodiversity, endemism and representativeness of the flora in the area. Outcomes were as follows
  - Rarity of the survey area flora was assessed as low.
  - Floristic diversity was assessed as moderate.
  - Banksia Woodland vegetation within the survey area is not considered to have adequate conservation value to be considered a Matter of National Environmental Significance (MNES), and protected under the EBPC Act.
  - The samphire-dominated saltmarsh vegetation within the survey area is considered to have adequate conservation value to be considered a MNES, and protected under the EBPC Act.
  - The remnant *Eucalyptus gomphocephala* (tuart) remnant trees mapped within the survey area are associated with a large mapped patch of tuart woodland they would likely be considered a high priority for protection and management.
- The 74 remnant trees within the survey area with a diameter at breast height (DBH) greater than 500 millimetres (mm) are considered potential night roosting and breeding habitat for black cockatoo species and therefore conservation significant.
- The survey area lies adjacent to, and in some places intersects with, environmental features identified in the desktop survey, most notably CCWs associated with Goegrup Lake and the Serpentine River on Gordon Road (Rd), and the CCW on Patterson Rd.

Conclusions

Much of the 15.7 km survey area alignment is in “Degraded” or worse condition with little or no intact native understorey. Sections of the survey area, however, are adjacent to, or intersect environmental features identified in the desktop survey such as mapped CCWs, records of the EPBC Act listed Subtropical and Temperate Coastal Saltmarsh ecological community and remnant trees associated with potential black cockatoo habitat.

1 Introduction

1.1 Project Background

RPS was commissioned by LandCorp to undertake a reconnaissance flora and vegetation survey, inclusive of a targeted black cockatoo tree assessment, of approximately 15.7 km of road reserve in the Parklands, Stake Hill and Nambeelup localities (the survey area; Figure A).

The Peel Business Park project requires the delivery of trunk infrastructure (sewer, power and water services) between Gordon Rd, Parklands, in the City of Mandurah to Paterson Rd, Nambeelup, in the Shire of Murray. The purpose of the reconnaissance survey is to investigate the flora and vegetation values and identify potential black cockatoo habitat within the proposed trunk infrastructure alignment and in the immediate vicinity. The findings of the reconnaissance survey will be used to inform the location of the trunk infrastructure and construction methods to be employed.

Much of the 15.7 km alignment (the eastern half) traverses cleared agricultural land where vegetation within the road reserves comprises scattered native trees over an understorey of weeds. However along Gordon Rd, Lakes Rd, Fowler Rd and Fishhawk Rd (the western portion of the alignment), native vegetation is generally more intact with areas of Tuart Woodland, Banksia Woodland, wetland-fringing *Eucalyptus rudis* subsp. *rudis* and *Melaleuca* spp. over sedgelands, either within or adjacent to the road reserve. This western portion of the alignment intersects a mapped Environmentally Sensitive Area (ESA) and Confirmed Roosting Habitat for black cockatoos (Western Australian Local Government Authority [WALGA] 2017).

1.2 Report Objectives

This reconnaissance flora and vegetation survey report presents the findings of the vegetation assessment and black cockatoo habitat tree assessment within the survey area. The assessment includes:

- desktop survey involving
  - a review of available literature, aerial imagery and spatial datasets to identify records of conservation significant flora, vegetation, and fauna
  - searches of the DBCA's Threatened and Priority Flora database (DEFL) and the Western Australian Herbarium's (WAH) Specimen and Ecological Communities database to identify records of significant flora and vegetation within the vicinity
- site visit to assess the vegetation type and condition within the survey area, confirm the presence of significant features identified in the database searches, and to produce maps of the proposed alignment identifying the location of any constraints identified
- targeted search for any Threatened Flora (TF) or Priority Flora (PF) species known from the area (as recorded in the DBCA database and NatureMap searches) in likely habitat
- targeted tree survey to identify potential black cockatoo breeding habitat
- assessment of the conservation significance of the vegetation and the identification of other mapped environmental constraints (e.g. wetlands and ESAs).

1.3 Legislative Context

State and Commonwealth legislation pertaining to the conservation of native flora, vegetation and fauna include (but are not limited to) the *Environmental Protection Act 1986* (EP Act), WC Act and EPBC Act.

Section 4A of the EP Act states that the following principles should be adhered to in order to protect the environment:

- Precautionary Principle – Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.
- Principle of Intergenerational Equity – The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.
- Principle of the Conservation of Biological Diversity and Ecological Integrity – Conservation of biological diversity and ecological integrity should be a fundamental consideration.

1.3.1 Flora of Conservation Significance

TF are listed under listed if they are considered to be in danger of extinction, rare or otherwise in need of special protection. These taxa are legally protected under the WC Act. The removal of these taxa or impact to their surroundings is not permitted without prior ministerial approval. The DBCA maintains a list of PF species, which may be rare or threatened but for which there are either insufficient survey data to accurately determine their status, or which are rare but not currently considered to be threatened. A PF taxon is assigned to one of five priority categories. TF and PF categories are defined in Appendix A (Table A-1).

Many taxa listed as TF under the WC Act have additional protection as they are also listed as TF under one of six threat categories (Extinct; Extinct in the wild; Critically Endangered; Endangered; Vulnerable; or Conservation Dependent) under the EPBC Act. TF taxa are defined as MNES under the EPBC Act and penalties apply for any damage to individuals, populations or habitats of these flora species. EPBC Act conservation categories are defined in Appendix A (Table A-2).

1.3.2 Vegetation of Conservation Significance

Floristic Community Types (FCTs) are based on a survey of the vegetation of the Swan Coastal Plain (SCP) from Seabird to Dunsborough, completed by Gibson *et al.* (1994). The purpose of the Gibson *et al.* (1994) survey was to determine the number and type of vegetation communities present across the southern SCP and to then assess how much of each remained and whether they were protected within reserves. There were 509 bounded 10 metres (m) × 10 m floristic sites surveyed. Each FCT defined as a result of Gibson *et al.* (1994) was given a Reservation Status and a Conservation Status (Appendix A, Tables A-3 and A-4).

Most of the SCP Threatened Ecological Communities (TECs) and/or Priority Ecological Communities (PECs) are defined by their FCT in Gibson *et al.* (1994).

TECs classified by DBCA in one of the TEC categories (Appendix A, Table A-5) have limited protection under State legislation. Other ecological communities are classified by DBCA in the category of PEC pending further survey and/or definition. PECs are not currently protected. Some TECs are also listed under the EPBC Act.

1.3.3 Revised Draft Referral Guideline for Black Cockatoos

The Revised Draft Referral Guideline for the Three Threatened Black Cockatoo Species (Department of the Environment and Energy [DEE] 2017) provides updated information and requirements on habitat quality, survey expectations, standards for mitigating impacts and significant impacts for black cockatoo species.

In addition to the information contained in the earlier 2012 guidance, the revised draft referral guideline identifies that the following actions are likely to result in significant impacts to these species:

1. Clearing of known nesting tree[2] or breeding habitat.
2. Complete clearance of roost sites that are close to high quality foraging habitat and water resources in non-breeding areas.
3. Clearing very high to high quality foraging habitat.

[2] Any existing tree in which breeding has been recorded or suspected.

2 Methods

The reconnaissance flora and vegetation survey was undertaken in accordance with the EPA's Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016).

As stated in the guidance, a reconnaissance level survey is undertaken to provide context and gather broad information about a survey area. Generally, a reconnaissance survey is required where flora and vegetation values are well defined, the area is not likely to support significant flora or vegetation and the scale and nature of potential impacts are not likely to be significant. A reconnaissance survey is undertaken to verify the information obtained from the desktop study, characterise the flora and delineate the vegetation units present using low intensity sampling of the flora and vegetation, and identify the potential impacts of the proposed development on local flora and vegetation values particularly flora taxa of conservation significance.

In addition to delineation of vegetation units, the survey area was traversed to compile a flora inventory, and to search for conservation significant taxa that were identified in the desktop study as potentially occurring there.

2.1 Desktop Assessment

The main objective of the desktop assessment was to determine any environmental constraints that occur, or are likely to occur within the survey area or vicinity, and so assist in identifying conservation significant features during the field survey. Constraints included:

- ESAs (Declared by the Minister under section 51B of the EP Act)
- MNES (Protected under the EPBC Act)
- flora taxa and vegetation communities of conservation significance.

A review was undertaken of the flora, vegetation and other environmental data available for the survey area and surrounds which incorporated the following:

- regional historical climate, geological, soil and landform data
- regional vegetation mapping and datasets.

In addition, searches of the following State and Commonwealth databases were undertaken to identify constraints that may occur in the vicinity of the survey area:

- DBCA Flora and Ecological Communities databases
- NatureMap database – conservation significant flora and vegetation
- Protected Matters Search Tool (DEE) - MNES
- Landgate WAATLAS Shared Land Information Platform portal – Geomorphic Wetlands of the Swan Coastal Plain.

The database searches were conducted within a 5 km radial area of the alignment for the DBCA flora database search and a 3 km radial area of the alignment for the DBCA ecological communities database search.

2.2 Field Survey

2.2.1 Reconnaissance Flora and Vegetation Assessment

The reconnaissance survey was carried out by qualified RPS Botanist Caroline Gill (under Licence for Scientific or Other Prescribed Purposes No. SL012170) between 26 and 27 September 2017 in accordance with the methods prescribed in the EPA's Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016).

The field survey involved traversing the survey area in a vehicle and on foot to:

- Verify the data from the desktop survey at a local scale.
- Characterise the vegetation within the road reserve.
- Record mature remnant eucalyptus and corymbia trees within the road reserve that were of adequate size to provide roosting and nesting habitat for black cockatoo species.
- Identify any constraints and potential impacts of the proposed development on local flora, vegetation and fauna values, or other environmental features such as wetlands.

The total alignment was divided up into 16 sections (map units). For each section the following was documented and mapped:

- waypoint recorded on a hand-held GPS marking the photo-point and the point where the information was recorded
- photographs of the road reserve
- description of the remnant vegetation type (if any) and condition (adapted from Keighery 1994 and Trudgen 1988) within the road reserve
- identified constraints to clearing of the vegetation including vegetation in "Good" or better condition, flora or vegetation of conservation significance, mature remnant native trees, conservation significant wetlands and ESAs
- inventory of all the flora species recorded within the survey area.

2.2.2 Significant Tree Inventory

The Significant Tree Inventory was undertaken concurrently with the reconnaissance flora and vegetation assessment. The survey methods were informed by the Revised Draft Referral Guideline for three threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black Cockatoo. (DEE 2017a).

All Eucalyptus and Corymbia trees (alive and dead) that occurred within the survey area and had a DBH of 500 mm or greater were recorded using a hand-held GPS. The tree species name, health and presence of hollows were noted.

2.3 Data Analysis

2.3.1 Flora and Taxonomy

A vascular flora inventory was compiled from flora species recorded and collected within the road reserve survey area. Flora specimens were either identified in the field, or collected and identified using the resources (keys, publications and databases) of the WAH. Nomenclature was aligned with the current names in the DPaW WAH public interface database (WAH 2017).

2.3.2 Vegetation Mapping

Mapping was conducted using a combination of publicly available datasets (Heddle vegetation complexes, Geomorphic Wetlands of the Swan Coastal Plain, ESAs and DBCA Conservation Estates), aerial photo-interpretation, and on-ground validation.

Vegetation description and mapping was conducted using a combination of aerial photo-interpretation, regional vegetation mapping, on-ground confirmation and vegetation structure data. Each vegetation unit was defined by the dominant plant species using the vegetation structure classes established under Bush Forever (Western Australian Planning Commission 2000) (Appendix A, Table A-6).

Vegetation condition mapping was conducted using aerial photo-interpretation and on-site confirmation. Vegetation condition was assessed using the Vegetation Condition Scale adapted from Keighery (1994) and Trudgen (1988) recommended in the EPA's Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016) (Appendix A, Table A-7).

3 Existing Information

3.1 Climate

The survey area is located on the SCP, which experiences a Mediterranean climate characterised by hot, dry summers and cool, wet winters, with an average maximum summer temperature of 30.5 °C and an average minimum winter temperature of 7 °C (Bureau of Meteorology 2017).

3.2 Geology and Soils

The SCP consists of five major geomorphological elements as defined by McArthur and Bettanay (1960). From west to east these are the Quindalup Dunes, Spearwood Dunes, Bassendean Dunes, Pinjarra Plain; and Ridge Hill Shelf. These systems lie roughly parallel to the coast and are distinguished by their geology, topography, vegetation and soils. The survey area traverses the Spearwood Dune System to the west of Goegrup Lake, and Bassendean Dunes and Pinjarra Plain east of Goegrup Lake. The Spearwood Dune System consists of slightly calcareous aeolian sand remnant from leaching of the underlying Pleistocene Tamala limestone. The Bassendean Dune System is described as being of generally low relief, often with broad swales or relatively flat sand sheets between the low dunes. Soils are predominantly deep grey leached quartz sands. The Pinjarra Plain is a piedmont and valley-flat alluvial plain consisting predominantly of clayey alluvium that has been transported by rivers and streams from the Darling and Dandaragan Plateaus.

3.3 Interim Biogeographical Regionalisation of Australia

The Interim Biogeographic Regionalisation for Australia (IBRA) divides Australia into bioregions based on major biological and geographical/geological attributes (Thackway and Cresswell 1995). The IBRA currently recognises 89 bioregions and 419 biological subregions in Australia. The survey area lies within the Perth (SWA02) subregion of the SCP bioregion.

The Perth subregion is composed of colluvial and aeolian sands, alluvial river flats and coastal limestone and the vegetation is described by Mitchell *et al.* (2002) as Heath and/or Tuart woodlands on limestone, Banksia and Jarrah-Banksia woodlands on Quaternary marine dunes of various ages and Marri on colluvial and alluvials.

3.4 Beard Vegetation Mapping

The survey area is situated in South West Botanical Province and the Darling Botanical District (Beard 1990). This region typically consists of forest country with related woodlands and is divided into four botanic subdistricts. The survey area is located within the SCP Subregion in the Drummond Botanical Subdistrict, which consists mainly of the following vegetation communities according to Beard (1990):

- *Banksia* Low Woodland on leached sands and *Melaleuca* Swamps in poorly drained areas
- woodland of tuart (*Eucalyptus gomphocephala*); and jarrah (*Eucalyptus marginata*) and marri (*Corymbia calophylla*) on less leached soils.

Vegetation mapping of the region was completed by Beard (1981) at a scale of 1:250,000. Shepherd *et al.* (2002) reassessed Beard's existing mapping dividing some of the broader vegetation units into smaller units.

The vegetation within the survey area is mapped as:

- Vegetation Association 1001 – Medium very sparse woodland; jarrah, with low woodland; banksia and casuarina

- Vegetation Association 1000 – Mosaic: Medium forest; jarrah-marri / Low woodland; banksia / Low forest; teatree (Melaleuca spp.)
- Vegetation Association 968 – Medium woodland; jarrah, marri and wandoo.

The remnant extent and reservation status of these vegetation associations within the IBRA Subregion is presented in Table 1.

Table 1 Pre-European Extent, Current Extent and Reservation Status within the Perth IBRA Subregion of the Swan Coastal Plain (SWA02) of the Beard Vegetation Associations Represented within the Survey Area

Vegetation Association	Pre-European Extent (ha)	Current Extent (ha)	Extent Remaining (%)	Extent Remaining Protected for Conservation (%)
968	136,188	8,967	6.5	1.19
1000	94,175	23,670	25.13	2.06
1001	57,410	12,792	22.28	2.80

Source: Government of Western Australia 2016

3.5 Heddle Vegetation Complexes

Vegetation complexes are vegetation associations that are characteristic of various combinations of soil, landform and rainfall. A large part of the SCP has been mapped for vegetation complexes by Heddle *et al.* (1980). These complexes are closely related to the SCP Dune Systems (Quindalup, Spearwood, Bassendean, and Pinjarra Plain) and north to south variations in climate and rainfall.

Heddle *et al.* (1980) mapped the vegetation within the survey area (west to east) as:

- Yoongarillup Complex: Woodland to tall woodland of *E. gomphocephala* with *Agonis flexuosa* in the second storey. Less consistently an open forest of *E. gomphocephala - E. marginata - E. calophylla*
- Herdsman Complex: Sedgelands and fringing Woodlands
- Bassendean Complex Central and South: Vegetation ranges from woodland of *E. marginata* – C. *fraserana* – *Banksia* spp. to low woodland of *Melaleuca* spp. and sedgelands on the moister sites.

The remnant extent and reservation status of these vegetation complexes on the SCP is presented in Table 2. Vegetation complex mapping is presented in Figure B.

Table 2 Pre-European Extent, 2013 Extent and Reservation Status on the Swan Coastal Plain of the Heddle Vegetation Complexes Represented within the Survey Area

Vegetation Complex	Pre-European Extent (ha)	2013 Extent (ha)	Extent Remaining (%)	Extent Remaining with Formal Protection (%)
Yoongarillup	26,982	10,448	38.72	15.41
Herdsman	8,309	2,877	34.63	21.41
Bassendean Central and South	87,392	24,206	27.70	2.57

Source: Perth Biodiversity Program 2013

4 Results

4.1 Desktop Assessment

4.1.1 Threatened and Priority Flora Database Search Results

Searches of the DBCA Threatened and Priority Flora database and the WAH Specimen database were undertaken within a 5 km radius of the centre of the survey area.

A total of 22 species of conservation significance were found to occur within the 5 km search radius comprising six Threatened flora species, one Priority 1, two Priority 2, five Priority 3 and eight flora taxa (Table 3). Table 3 additionally identifies the listed species protection status under the EPBC Act.

The listed species were ranked in terms of their "likelihood of occurrence" within the survey area based on proximity of known records and habitat preference. Thirteen species listed in Table 3 were assessed as likely or possibly occurring within, or in close proximity to, the survey area based primarily on habitat preferences.

Conservation significant species records in the vicinity of the survey area are shown in Figure B.

Table 3 Threatened and Priority Flora Recorded within a 5 km Radius of the Survey Area

Species	WC Act Status*	EPBC Act Status†	Likelihood of Occurrence within the Survey Area
Caladenia huegelii	T	CR	Unlikely
Diuris drummondii	T	VU	Unlikely
Drakaea elastica	T	CR	Likely/Possible
Synaphea sp. Fairbridge Farm (D. Papenfus 696)	T	CR	Possible
Synaphea sp. Pinjarra (R. Davis 6578)	T	CR	Unlikely
Tetraria australiensis	T	VU	Unlikely
Acacia lasiocarpa var. bracteolata long peduncle variant (G.J. Keighery 5026)	P1	-	Possible
Acacia benthamii	P2	-	Possible
Johnsonia pubescens subsp. cygnorum	P2	-	Possible
Beyeria cinerea subsp. *cinerea*	P3	-	Unlikely
Boronia capitata subsp. gracilis	P3	-	Possible
Cyathochaeta teretifolia	P3	-	Possible
Dillwynia dillwynioides	P3	-	Likely/Possible
Pimelea calcicola	P3	-	Unlikely
Caladenia speciosa	P4	-	Possible
Drosera occidentalis subsp. occidentalis	P4	-	Unlikely
Eucalyptus rudis subsp. *cratyantha*	P4	-	Likely/Possible

Species	WC Act Status*	EPBC Act Status†	Likelihood of Occurrence within the Survey Area
Jacksonia sericea	P4	-	Unlikely
Microtis quadrata	P4	-	Unlikely
Ornduffia submersa	P4	-	Possible
Parsonsia diaphanophleba	P4	-	Possible
Rumex drummondii	P4	-	Possible

*WC Act
† EPBC Act.

4.1.2 Ecological Communities Database Search Results

A search of the DBCA's Ecological Communities database was undertaken for TECs and PECs with records within a 3 km radius of the survey area.

The database searches returned 382 records of two EPBC listed TECs, Banksia Woodlands of the Swan Coastal Plain (371 records); and Subtropical and Temperate Coastal Saltmarsh ecological communities (seven records), one record of a Priority 3 PEC, and two records of a P2 PEC within a 3 km radius of the survey area. It should be noted that a number of FCTs, defined as part of the Floristic Survey of the SCP (Gibson *et al.* 1994), are included within the Banksia Woodlands ecological community. Some of these sub-communities within the Banksia Woodlands are highly restricted and listed as TECs or PECs in Western Australia. These have higher significance than sub-types known to be more common and should be provided specific or additional protection, particularly where assigned a higher threat rank than the Banksia Woodlands listing (DEE 2016). In this case FCTs 22 and 21c, listed as PECs are considered components of the EPBC listed Banksia Woodlands of the Swan Coastal Plain TEC.

Conservation significant ecological community records in the vicinity of the survey area are shown in Figure B. A description of these ecological communities is presented in Table 4. The survey area intersects the buffers of two of these EPBC listed TECs, Banksia Woodlands of the Swan Coastal Plain ecological community and Subtropical and Temperate Coastal Saltmarsh ecological community.

Table 4 TEC / PEC Records Within a 3 km Radius of the Survey Area

TEC / PEC	Description	WC Act Status*	EPBC Act Status†
Banksia Woodlands of the Swan Coastal Plain ecological community	The ecological community is a woodland associated with the Swan Coastal Plain of south-west Western Australia. A key diagnostic feature is a prominent tree layer of Banksia, with scattered eucalypts and other tree species often present among or emerging above the Banksia canopy. The understorey is a species rich mix of sclerophyllous shrubs, graminoids and forbs. The ecological community is characterised by a high endemism and considerable localised variation in species composition across its range (DEE 2016).	-	Endangered

TEC / PEC	Description	WC Act Status*	EPBC Act Status†
Subtropical and Temperate Coastal Saltmarsh ecological community	The Subtropical and Temperate Coastal Saltmarsh (hereafter Coastal Saltmarsh) ecological community occurs within a relatively narrow margin of the Australian coastline, within the subtropical and temperate climatic zones south of the South-east Queensland IBRA bioregion boundary at 23°37' latitude along the east coast and south of (and including) Shark Bay at 26° on the west coast. The community consists mainly of salt-tolerant vegetation (halophytes) including grasses, herbs, reeds, sedges and shrubs. Succulent herbs and grasses generally dominate and vegetation is generally <0.5 m tall with the exception of some reeds and sedges. Many species of non-vascular plants are also found in saltmarsh, including epiphytic algae, diatoms and cyanobacterial mats (DEE 2013).	Priority 3	Vulnerable
FCT 22 – *Banksia ilicifolia* woodlands (A component of the Endangered Banksia Woodlands of the Swan Coastal Plain EPBC listed TEC)	Low lying sites generally consisting of *Banksia ilicifolia – B. attenuata* woodlands, but *Melaleuca preissiana* woodlands and scrubs are also recorded. Occurs on Bassendean and Spearwood systems in the central Swan Coastal Plain north of Rockingham. Typically has very open understorey, and sites are likely to be seasonally waterlogged.	Priority 3	Endangered
FCT 21c – Low-lying *Banksia attenuata* woodlands or shrublands (A component of the Endangered Banksia Woodlands of the Swan Coastal Plain EPBC listed TEC)	This type occurs sporadically between Gingin and Bunbury, and is largely restricted to the Bassendean system. The type tends to occupy lower lying wetter sites and is variously dominated by *Melaleuca preissiana*, *Banksia attenuata*, *B. menziesii*, *Regelia ciliata*, *Eucalyptus marginata* or *Corymbia calophylla*. Structurally, this community type may be 23 either a woodland or occasionally shrubland.	Priority 3	Endangered

*WC Act
†EPBC Act

4.1.3 Geomorphic Wetlands of the Swan Coastal Plain

DBCA has developed a dataset which maps the location, boundaries and management category of wetlands on the SCP. A management category (Conservation, Resource Enhancement and Multiple Use in order of conservation priority) was assigned to each wetland to guide their management and protection.

The survey area intersects the mapped extents of three CCWs and one Resource Enhancement Wetland (REW) (Figure B; Table 5). The definitions and management objectives for the three wetland management categories see Appendix A, Table A-8).

Table 5 Geomorphic Wetlands of the SCP in the Vicinity of the Survey Area

ID	Management Category	Location	Figure No.
3941	Conservation	Survey area crosses river	Figure B-3
15239	Conservation	Survey area abuts wetland boundary	Figure B-4
14608	Conservation	Survey area intersects wetland	Figure B-9
4832	Conservation	Survey area intersects wetland	Figure B-9
4585	Resource Enhancement	Survey area abuts wetland boundary	Figure B-7

4.1.4 Environmentally Sensitive Areas

ESAs are declared by the Minister for Environment under section 51B of the EP Act and protected under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 (the Regulations) in an effort to prevent the incremental degradation of important environmental values such as TF, TECs or conservation significant wetlands (CCWs and REWs).

Exemptions for the clearing of native vegetation under the Regulations do not apply in ESAs. Clearing permits are generally required to support the clearing of native vegetation within ESAs.

The ESAs intersecting the survey area are presented in Table 6 and shown in Figure B.

Table 6 ESAs Intersecting the Survey Area

Environmentally Sensitive Areas	Figure No.
Subtropical and Temperate Coastal Saltmarsh – EPBC-listed TEC buffer Conservation Category Wetland UFI 3941 – Serpentine River and buffer	Figure B-3
Conservation Category Wetland UFI 15239 – Serpentine River and buffer	Figure B-4
Conservation Category Wetland UFI 4832 and 14608 and buffer	Figure B-9 and Figure B-10

4.1.5 DBCA Managed Lands

The survey area adjoins one A Class Nature Reserve (Goegrup Lake Nature Reserve) on Gordon Rd, Parklands (Figure B-2).

4.2 Field Survey

4.2.1 Flora

4.2.1.1 Flora Statistics

A total of 69 plant taxa were recorded for the current survey 14 of which were exotic (weed) species. In addition to this there were numerous planted tree and shrub species which were not recorded for this survey. The list of species recorded for the survey area is presented in Appendix B. It should be noted that this list is by no means exhaustive - this reconnaissance level survey involved low-level sampling of the flora, with a focus primarily on dominant and keystone species (to accurately characterise the vegetation types present), as well as species of conservation significance (including environmentally significant weeds). As such the list does not include some common pasture weeds (grasses and herbs) and native and weed microflora which were likely present at the time of the survey.

These taxa represent 54 genera from 25 families. The families and genera represented by the greatest number of species are presented in Table 7 and Table 8.

Table 7 Dominant Families within the Survey Area

Family	Common Name	No. of Taxa
MYRTACEAE	Myrtles	14
POACEAE	Grasses	7
PROTEACEAE	Proteas	6
CYPERACEAE	Sedges	6
FABACEAE	Peas	6

Table 8 Dominant Genera within the Survey Area

Genus	Common Name	No. of Taxa
Banksia	Banksias	4
Eucalyptus/Corymbia	Eucalypts	4
Jacksonia		3

4.2.1.2 Flora of Conservation Significance

No TF species listed under the WC Act or under the EPBC Act were recorded within the survey area.

No PF species as currently listed by the DBCA were recorded within the survey area.

4.2.1.3 Introduced Flora (Weeds)

Fourteen introduced flora taxa were recorded from the survey area representing 20% of the total flora taxa recorded. Naturalised bushland weeds were recorded at high densities throughout all of the survey area except for areas mapped in “Very Good” condition where disturbance by weeds was low.

The Western Australian Organism List (WAOL) database was searched to determine the legal status of each weed recorded, and any control requirements. Of the 14 weed species recorded, none were determined to be Declared Pests under the BAM Act nor were they classified as WONS.

4.2.2 Vegetation

4.2.2.1 Vegetation Units

For the current survey eleven upland and dampland/wetland vegetation units were described and mapped for all of the remnant vegetation within the survey area. It should be noted that most of these units represented highly modified vegetation in degraded condition no longer representative of the original floristic communities that would have occurred there. The only units representing structurally and floristically intact vegetation communities were those associated with the Serpentine River and Goegrup Lake foreshores, and to a lesser extent the CCW wetland (UFI 4832) on Patterson Rd, Nambeelup (Flooded Gum Woodland; *Casuarina obesa* Woodland; Samphire-dominated Saltmarsh; and Melaleuca Closed Forest).

A description of these 11 vegetation units follows. Vegetation Unit mapping is presented in Figure C at the rear of the report.

4.2.2.1.1 Remnant Tuart (Upland)

Eucalyptus gomphocephala (Tuart) remnant trees over a degraded understorey of annual and perennial naturalised alien (weed) herbs and grasses – This vegetation occurred within the road reserve along sections of Gordon and Lakes Rds within the western portion of the survey area. Remnant Tuart trees within the road reserve are shown in Figures C-1; C-2; and C-3 and Plate 1. The trees recorded along Gordon Rd belong to a medium-sized patch (>10 ha ≤ 100 ha) as defined by DEE (2017b) of mapped Tuart Woodland (WALGA 2017).

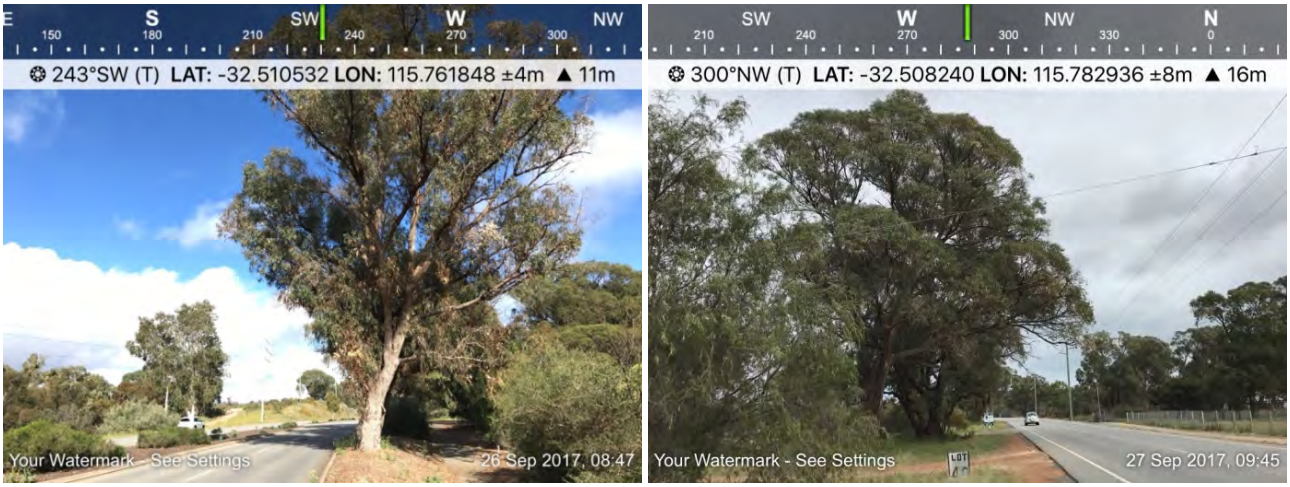

Plate 1 Remnant *Eucalyptus gomphocephala* (Tuart), Gordon Rd Reserve

4.2.2.1.2 Planted Trees and Shrubs (Upland)

Planted (non-endemic) eucalypts over emergent and planted native shrubs occurred within the southern road reserve of Gordon Rd (Figure C1 and Plate 2), and are the product of historical road-side landscaping.

Plate 2 Planted Trees and Shrubs, Gordon Rd and Lakes Rd

4.2.2.1.3 Remnant Marri (Upland/Dampland)

Corymbia calophylla (Marri) remnant trees over a degraded understorey of naturalised alien (weed) herbs and grasses occurred at numerous locations along the alignment (Figure C3, C4, C5, C9, and C10 and Plate 3) within and adjacent to the road reserve. These trees were mature and generally in excellent health except for several dead individuals recorded on Patterson Rd.

Plate 3 Remnant Corymbia calophylla (Marri), Lakes Rd

4.2.2.1.4 Flooded Gum Woodland (Dampland)

Eucalyptus rudis subsp*. rudis* Low Open Woodland over *Jacksonia sternbergiana, J. furcellata* and *Kunzea glabrescens* Tall Shrubland over *Grevillea vestita* and *Regelia inops* Shrubland over a mixed Open Sedgeland / Herbland / Grassland. This vegetation was in “Good” to “Very Good” condition and recorded on Lakes Rd in close proximity to the Serpentine River (Figure B-3 and Plate 4). This vegetation comprised remnant and recovering (after clearing) vegetation with an altered structure but floristically intact.

Plate 4 Eucalyptus rudis subsp. rudis (Flooded Gum) Woodland, Serpentine River, Lakes Rd

4.2.2.1.5 Flooded Gum Forest over Sedgeland (Dampland)

Eucalyptus rudis subsp. *rudis* and *Melaleuca rhaphiophylla* Low Open to Closed Forest over *Baumea juncea* and *Lepidosperma* sp. Closed Sedgeland (Figure B-3 and Plate 5). This vegetation interfaced the Flooded Gum Woodland upslope (described above) and the *Casuarina obesa* Closed Forest. It was intact structurally and floristically and ranged in condition from “Very Good” to “Good” depending on the disturbance level from weeds.

Plate 5 Eucalyptus rudis subsp. rudis (Flooded Gum) Forest over Sedgeland, Serpentine River, Lakes Rd

4.2.2.1.6 Casuarina obesa Forest (Wetland)

Casuarina obesa Closed Forest over *Lepidosperma* sp., *Baumea juncea, Gahnia trifida* and *Juncus krausii* Closed Sedgeland (Figure B-3 and Plate 6). This vegetation fringed the saltmarsh and extended along the river foreshore on both sides of the Serpentine River.

Plate 6 Casuarina obesa Closed Forest over Closed Sedgeland, Serpentine River, Lakes Rd

4.2.2.1.7 Samphire-dominated Saltmarsh (Wetland)

Tecticornia ?halocnemoides, *T. indica* subsp. *bidens* and *Cotula coronopifolia* Closed Herbland. This saltmarsh vegetation is fringed by *Casuarina obesa* Closed Forest and extends from the foreshore of the Serpentine River to the shore of Goegrup Lake to the west (Figure B-3 and Plate 7). This vegetation is synonymous with the conservation significant Subtropical and Temperate Coastal Saltmarsh ecological community which is listed as Vulnerable under the EPBC Act and Priority 3 by the Western Australian state government. The extent of this ecological community record buffer (retrieved from the DBCA database search) is presented in Figure B-3.

Plate 7 Samphire-dominated Saltmarsh, Serpentine River, Lakes Rd

4.2.2.1.8 Banksia Woodland (Upland)

Scattered *Eucalyptus marginata* (Jarrah) and *Corymbia calophylla* (Marri) over *Banksia menziesii*, *B. attenuata* and *B. ilicifolia* Low Open Woodland over mixed Shrubland over an exotic Closed Grassland (Plate 8). This vegetation was mapped within the road reserve along Fowler and Fishhawk Rds (Figures C-3 and C-4), with condition generally ranging from “Degraded” to “Good” throughout its extent (Figures D-3 and D-4).

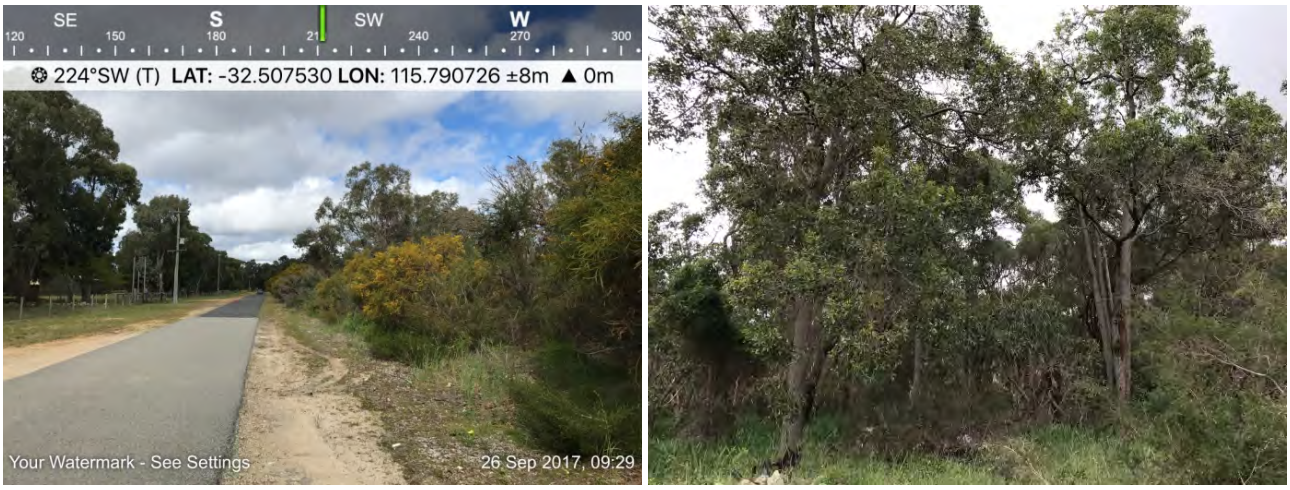

Plate 8 Banksia Woodland, Fowler and Fishhawk Rds

4.2.2.1.9 Remnant Melaleuca preissiana (Dampland/Wetland)

Melaleuca preissiana remnant trees over a degraded understorey of exotic grasses (Plate 9). This vegetation occurred throughout much of the eastern portion of the survey area along Lakes Rd, Gull Rd and Patterson Rd (Figures C-5 to C-9 and C-14 to C-16) in “Completely Degraded” condition due to the absence of an intact understorey.

Plate 9 Remnant *Melaleuca preissiana* Trees, Lakes, Gull and Patterson Rds

4.2.2.1.10 Melaleuca Closed Forest (Wetland)

Eucalyptus rudis subsp. rudis (Flooded Gum) and Melaleuca rhaphiophylla Closed Forest over Taxandria linearifolia and Astartea scoparia Open Shrubland over Juncus pallidus, Baumea juncea, Lepidosperma sp. and *Watsonia Sp. Closed Sedgeland/Herbland (Figures C-9 and C-10; Plate 10). This vegetation unit was mapped for the CCW UFI 4832 on Patterson Rd and was in generally “Good” condition based on the high weed load within the understorey.

Plate 10 Melaleuca Closed Forest, CCW UFI 4832, Patterson Rd

4.2.2.1.11 Remnant Mixed Trees (Upland and Dampland)

Scattered *Eucalyptus marginata* (Jarrah), *Corymbia calophylla* (Marri), *Allocasuarina fraseriana* (Sheoak), *Banksia* spp. and *Melaleuca preissiana* trees over a degraded understorey of naturalised alien (weed) herbs and grasses (Plate 11). This vegetation was mapped for sections of Patterson Rd (Figure C-10 to C-12).

Plate 11 Remnant Mixed Trees, Patterson Rd

4.2.2.1.12 Scrub (Dampland)

Kunzea glabrescens / Adenanthos cygnorum / Jacksonia furcellata Closed Tall Scrub to Tall Shrubland over a degraded understorey of naturalised alien (weed) herbs and grasses (Plate 12). This vegetation was mapped for sections of Patterson Rd (Figure C-13 and C-14).

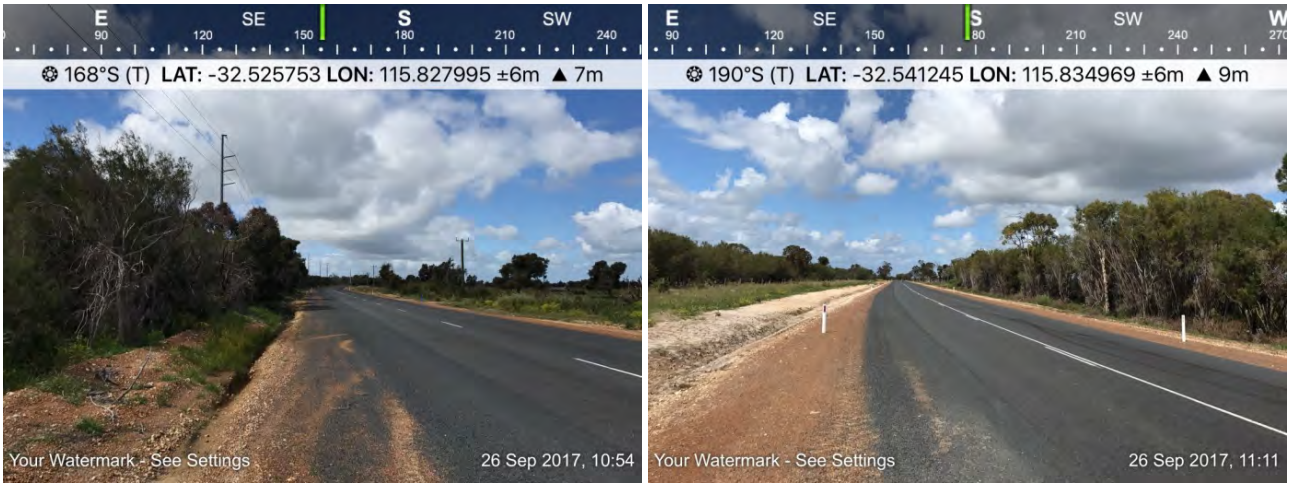

Plate 12 *Kunzea glabrescens* / *Adenanthos cygnorum/Jacksonia furcellata* Scrub, Patterson Rd

4.2.2.2 Vegetation Condition

Vegetation condition ranged from “Very Good” to “Completely Degraded” throughout the survey area, with the majority of the vegetation within the road reserve, and areas adjacent to the road reserve and within the survey area, recorded in “Completely Degraded” condition. The vegetation associated with the CCW wetlands (Serpentine River and CCW UFI 4832 on Patterson Rd, Nambeelup) was generally floristically and structurally intact and was mapped variously as “Good”, “Good to Very Good” and “Very Good” condition, apart from these small intact areas however, most of the vegetation within the survey area had a generally high weed load. Vegetation condition mapping is presented in Figures D-1 to D-16 at the rear of the report.

4.2.3 Significant Trees

A total of 74 trees with a DBH greater than 500 mm within the survey area were recorded (Appendix C; Figures C-1 to C-16). The number of trees recorded for each species is presented in Table 9.

Table 9 Tree Species Recorded with a DBH >500 mm

Species	Number recorded
Eucalyptus gomphocephala (tuart)	23
Corymbia calophylla (marri)	18
Eucalyptus rudis subsp. *rudis* (flooded gum)	20
Eucalyptus marginata subsp. *marginata* (jarrah)	9
Planted non-endemic eucalypt	4

Eucalyptus gomphocephala (tuart), Corymbia calophylla (marri), Eucalyptus rudis subsp. rudis (flooded gum), and Eucalyptus marginata (jarrah) are recognised by the DEE (2017a) to provide potential breeding and night-roosting habitat for black cockatoos.

5 Discussion

5.1 Floristic Diversity and Representation

In assessing the conservation significance of flora within the survey area, consideration is given to rarity, biodiversity, endemism and representativeness of the flora in the area.

5.1.1 Rarity

The rarity of the flora was assessed via the various categories of TF (protected under the WC Act and under the EPBC Act) and PF (listed by DBCA).

No TF were recorded within the survey area for the current survey.

No PF species as currently listed by DBCA were recorded within the survey area.

The rarity of the survey area flora was assessed as low.

5.1.2 Biodiversity

A total of fifty-six native taxa were recorded for the survey area.

Floristic diversity was assessed as moderate.

5.2 Vegetation Conservation Significance

5.2.1 Bioregional Representation

On a regional scale the survey area is mapped as vegetation association Vegetation Associations 968; 1000; and 1001 (Shepherd *et al.* 2002) and Bassendean Complex Central and South; Herdsman Complex; and Yoongarillup Complex (Heddle *et al.* 1980). Of these three associations the one with the least remaining is Vegetation Association 968 (Medium woodland; jarrah, marri & wandoo) which has only 6.5% (8,967 ha) of its original (pre-European) extent remaining and only 1.2% protected for conservation (Government of Western Australia 2016). Vegetation Association 968 is mapped for a patch of remnant vegetation adjacent to a section of road reserve on Patterson Rd (Figure D-12 and D-13), however, the intact portions of this patch occur outside the survey area to the east of the road reserve. There are no records of this vegetation in “Good” or better condition within the survey area.

5.2.2 National Threatened Ecological Communities

The survey area intersects the buffers of two EPBC listed TECs, Banksia Woodlands of the Swan Coastal Plain ecological community and Subtropical and Temperate Coastal Saltmarsh ecological community.

A third potential nationally significant ecological community also intersects the survey area - the state listed Priority 3 PEC Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain ecological community has recently been nominated to the Australian Government to be considered for listing as threatened under the EPBC Act. The nomination was assessed by the independent Threatened Species Scientific Committee and the outcomes documented in the Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain Ecological Community Draft Conservation Advice (DEE 2017b).

These three nationally-significant communities and their representation within the survey area are discussed below.

5.2.2.1 Banksia Woodlands of the Swan Coastal Plain Ecological Community

The Banksia Woodland vegetation mapped for the survey area potentially corresponds to the Banksia Woodlands of the Swan Coastal Plain Ecological Community TEC. However, in order to qualify as a legitimate TEC record the Banksia vegetation within the survey area must satisfy the key diagnostic characteristics for the ecological community as set out in the Conservation Advice for the species (DEE 2016) in terms of its location and physical environment, soils and landform, structure and composition. It must:

- occur within the Swan Coastal Plain IBRA bioregion
- occur on well-drained, low nutrient soils on deep Bassendean sands
- have a distinctive upper sclerophyllous layer of low trees, dominated by *Banksia attenuata* (and/or *B. ilicifolia*), have an emergent tree layer (*Eucalyptus marginata*), have an understorey of a layer of sclerophyllous shrubs of various heights and a herbaceous ground layer of cord rushes, sedges and perennial and ephemeral forbs, that sometimes includes grasses.

Additionally the vegetation must meet the minimum condition threshold of Good (adapted from Keighery 1994 and Trudgen 1988).

Finally, the vegetation must meet the minimum patch size thresholds (>0.5 ha in “Excellent” condition; >1 ha in “Very Good” condition; or 2 ha in “Good” condition).

Although the Banksia Woodland within the survey area meets the diagnostic characteristics for the TEC, it does not meet the minimum condition or patch size thresholds because there is less than 1 ha in “Good” condition within the survey area.

The Banksia Woodland vegetation within the survey area is not considered to be representative of the EPBC listed Banksia Woodlands of the Swan Coastal Plain Ecological Community TEC.

5.2.2.2 Subtropical and Temperate Coastal Saltmarsh Ecological Community

Subtropical and Temperate Coastal Saltmarsh ecological community, is listed by DBCA as a Priority 3 PEC, and listed under the EPBC Act as a Vulnerable TEC.

Documented occurrences of this community are located at Goegrup Lake and at the Lakes Rd crossing of the Serpentine River within the survey area (Figures B-1 to B-3). The samphire-dominated saltmarsh vegetation unit described and mapped for the current survey (Figure C-3; Section 4.2.2.1) was assessed against the key diagnostic characteristics set out in the Conservation Advice (Threatened Species Scientific Committee 2013) in order to determine if this vegetation constitutes a record of the TEC. As stated in the Conservation Advice, to qualify as a record of this TEC the vegetation must:

- occur south of 23° 37' S latitude - from the central Mackay coast on the east coast of Australia, southerly around to Shark Bay on the west coast of Australia (26° latitude), and including the Tasmanian coast and islands within the above range
- occur on the coastal margin, along estuaries and coastal embayments and on low wave energy coasts
- occur on places with at least some tidal connection, including rarely-inundated supratidal areas, intermittently opened or closed lagoons, and groundwater tidal influences, but not areas receiving only aerosol spray
- occur on sandy or muddy substrate and may include coastal clay pans (and the like)
- consist of dense to patchy areas of characteristic coastal saltmarsh plant species (i.e. salt-tolerant herbs, succulent shrubs or grasses, that may also include bare sediment as part of the mosaic)
- have proportional cover by tree canopy such as mangroves, Melaleucas or Casuarinas not greater than 50%.

Additionally the vegetation must meet the minimum condition threshold of < 50% weed cover i.e. the saltmarsh must be dominated by native saltmarsh plants, and the patch must be greater in size than 0.1 ha.

The samphire-dominated saltmarsh vegetation within the survey area meets the diagnostic characteristics for the TEC, and the minimum condition and patch size thresholds.

The samphire-dominated saltmarsh vegetation within the survey area is considered to have adequate conservation value to be considered a MNES, and protected under the EBPC Act.

5.2.2.3 Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain Ecological Community

The remnant *Eucalyptus gomphocephala* (Tuart) remnant trees mapped for the current survey within the road reserve along sections of Gordon and Lakes Rds in the western portion of the survey area were assessed against the key diagnostic characteristics set out in the Conservation Advice (DEE 2017b) in order to determine if this vegetation constitutes a record of the TEC. As stated in the Conservation Advice, to qualify as a record of this TEC the vegetation must:

- occur in the Swan Coastal Plain Bioregion within the state of Western Australia and primarily occur on the Spearwood and Quindalup dune systems, but can also occur on the Bassendean dunes and Pinjarra Plain,on the banks of rivers and wetlands, or below the Darling and Whicher escarpments where they define a plateau to the east of the Swan Coastal Plain
- occur (most commonly) as a woodland, or in a variety of structural forms, including closed forest, open forest, woodland, open woodland, closed mallee forest, open mallee forest, mallee woodland and open mallee woodland
- have a dominant canopy of tuart (*Eucalyptus gomphocephala*)
- have established tuart trees present, meeting the patch definition.

The remnant Eucalyptus gomphocephala (Tuart) remnant trees mapped within the road reserve along Gordon and Lakes Rds have not retained an intact native understorey and are in “Degraded” condition however, because they are associated with a large mapped patch of Tuart Woodland (WALGA 2017) they would likely be considered a high priority for protection and management.

5.2.3 Western Australian Threatened and Priority Ecological Communities

No state-listed TECs were recorded within the survey area for the current survey.

The three EPBC-listed TECs discussed in Section 5.2.2 are listed at a state level as PECs.

5.3 Fauna Habitat

The 74 remnant trees within the survey area with a DBH greater than 500 mm are considered potential night roosting and breeding habitat for black cockatoos and therefore conservation significant.

5.4 Other Conservation Significant Features

The survey area lies adjacent to, and in some places intersects with, environmental features identified in the desktop survey such as CCWs and ESAs. Most notably these include the CCWs associated with Goegrup Lake and the Serpentine River on Gordon Rd, and the CCW on Patterson Rd.

6 Conclusions

Much of the 15.7 km survey area alignment is in Degraded or Completely Degraded condition with little or no intact native understorey. Sections of the survey area, however, are adjacent to, or intersect environmental features identified in the desktop survey such as remnant tuart trees associated with Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain ecological community which is listed as Endangered and protected under the EPBC Act, records of Subtropical and Temperate Coastal Saltmarsh ecological community which is listed as Vulnerable and protected under the EPBC Act, Conservation Category Wetlands, and potential breeding and roosting habitat trees for Endangered Fauna species (black cockatoos)

No conservation significant flora (TF or PF), identified in the database searches as occurring within a 5 km radius of the alignment, were recorded. Given that most of the survey area lacks an intact native understorey, and/or vegetation in “Good” or better condition (deemed suitable habitat) it is not likely that any remnant vegetation within the road reserve is necessary for the continued existence of TF or PF.

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Figures

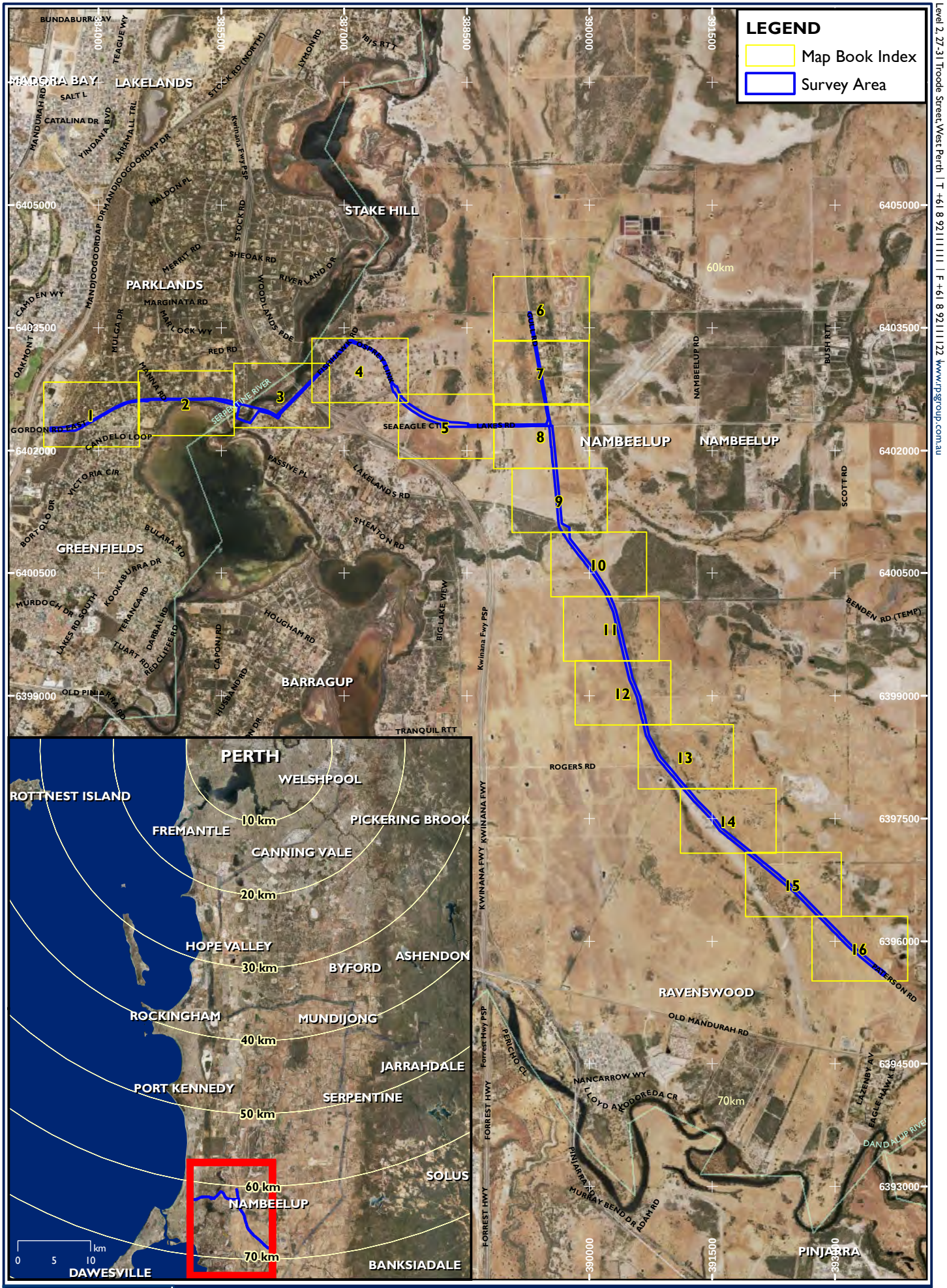

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Figure A

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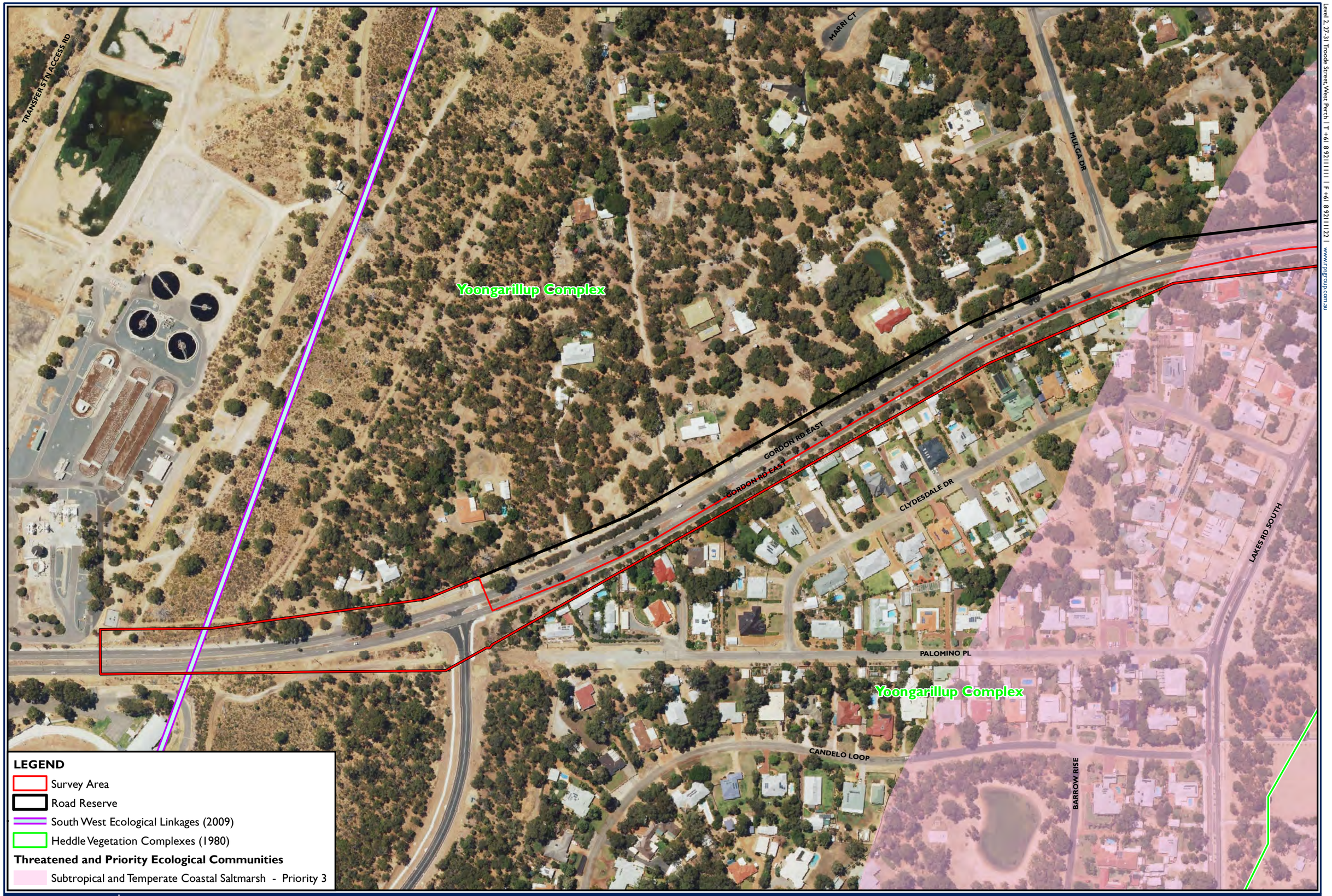

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Figure B-1

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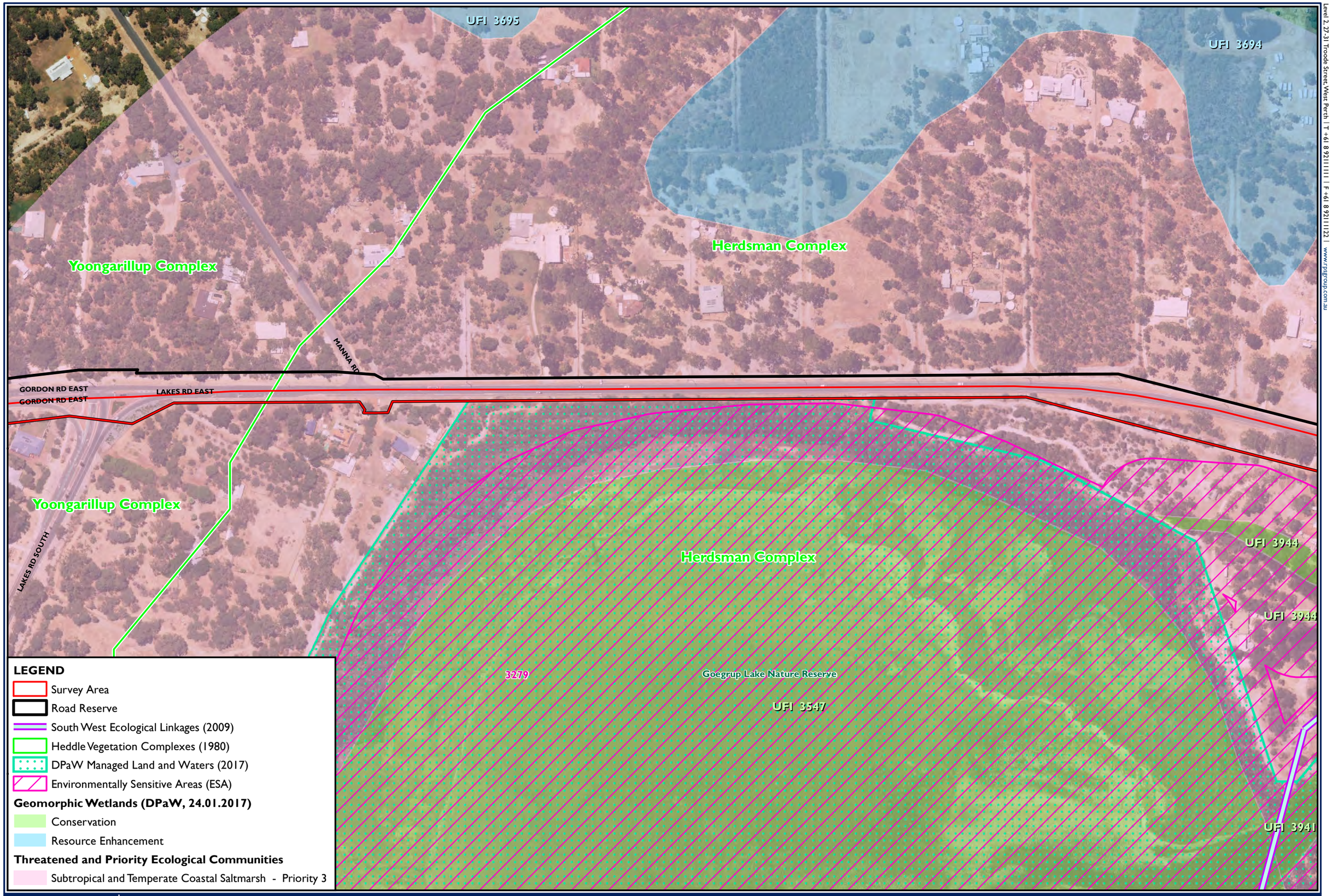

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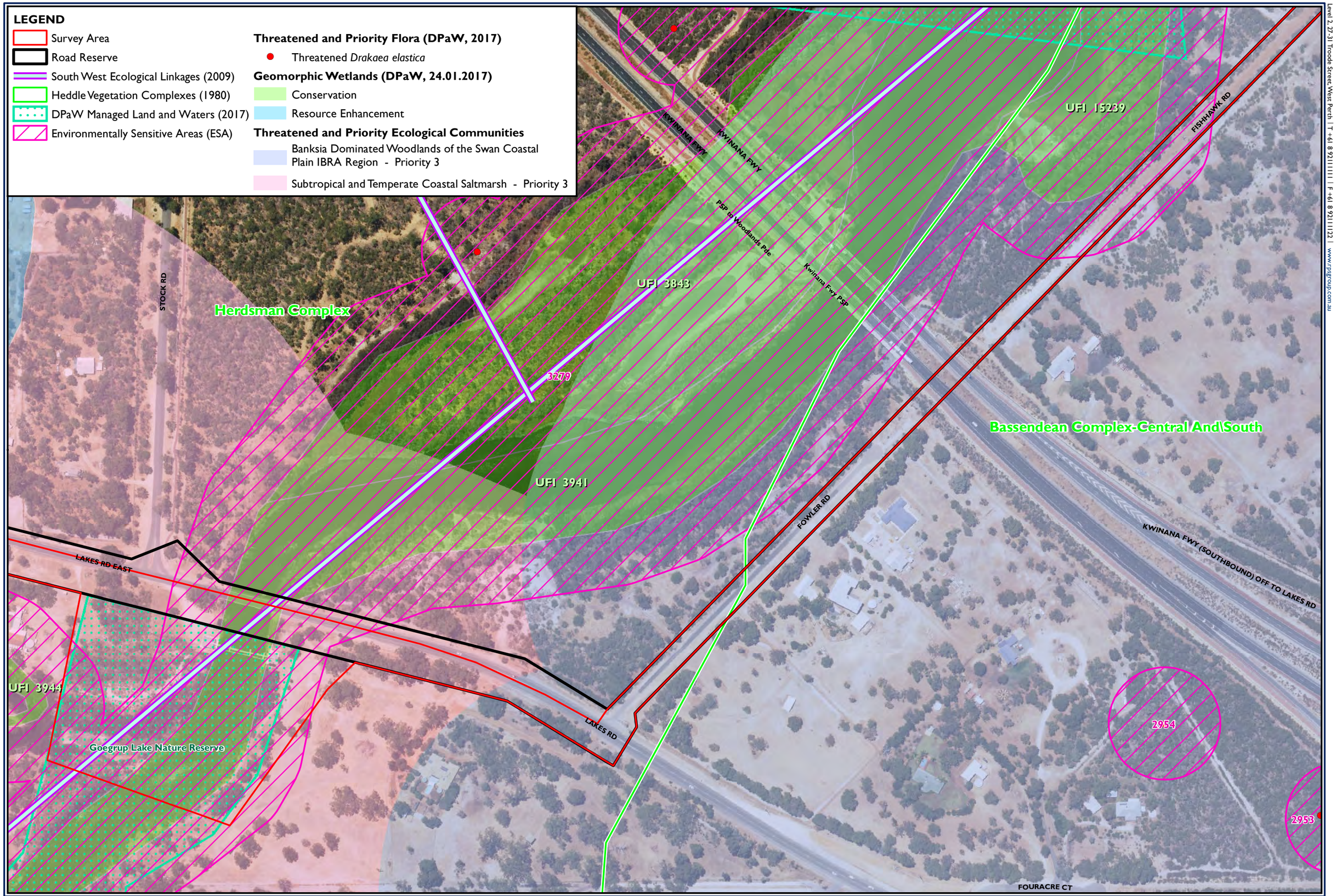

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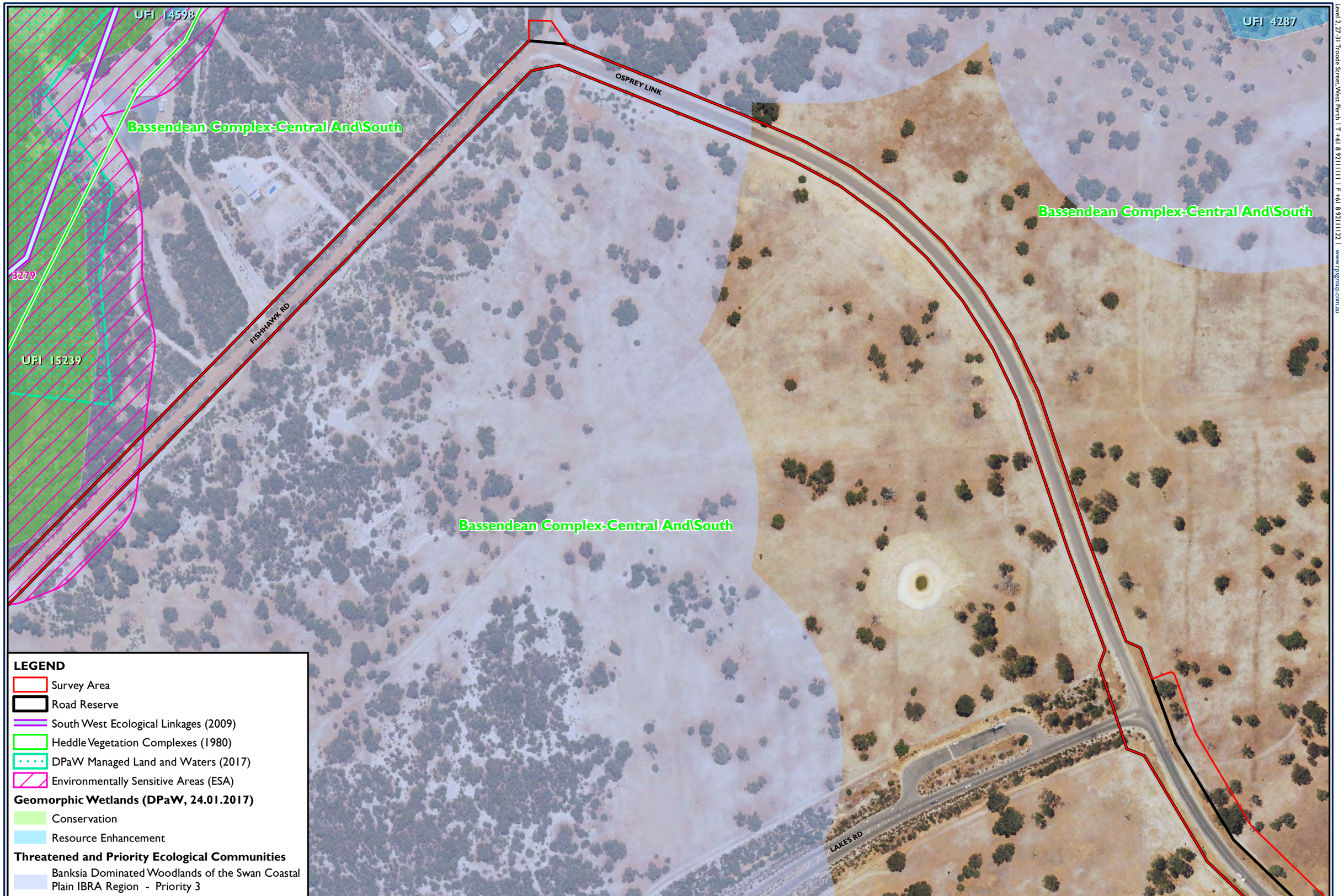

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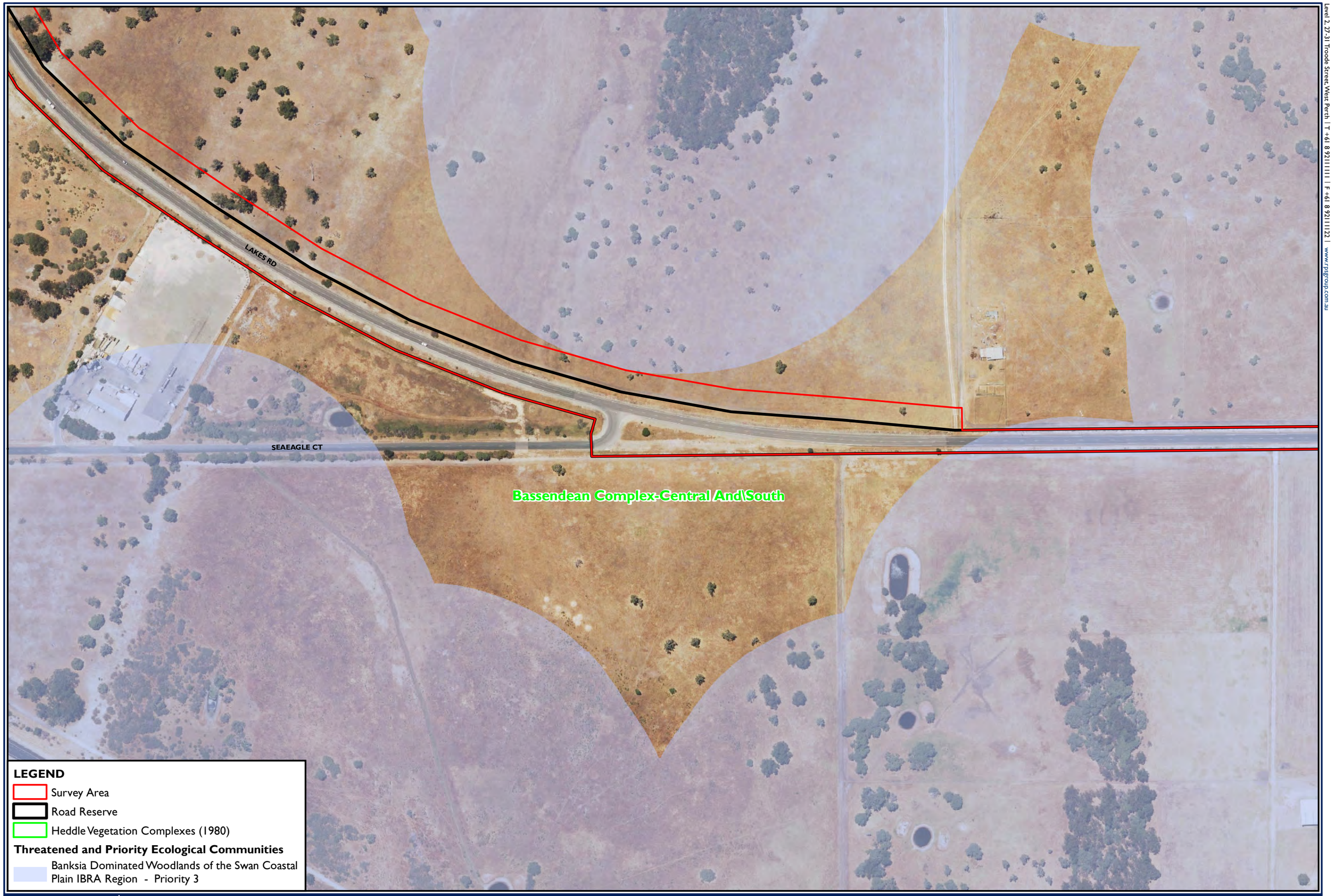

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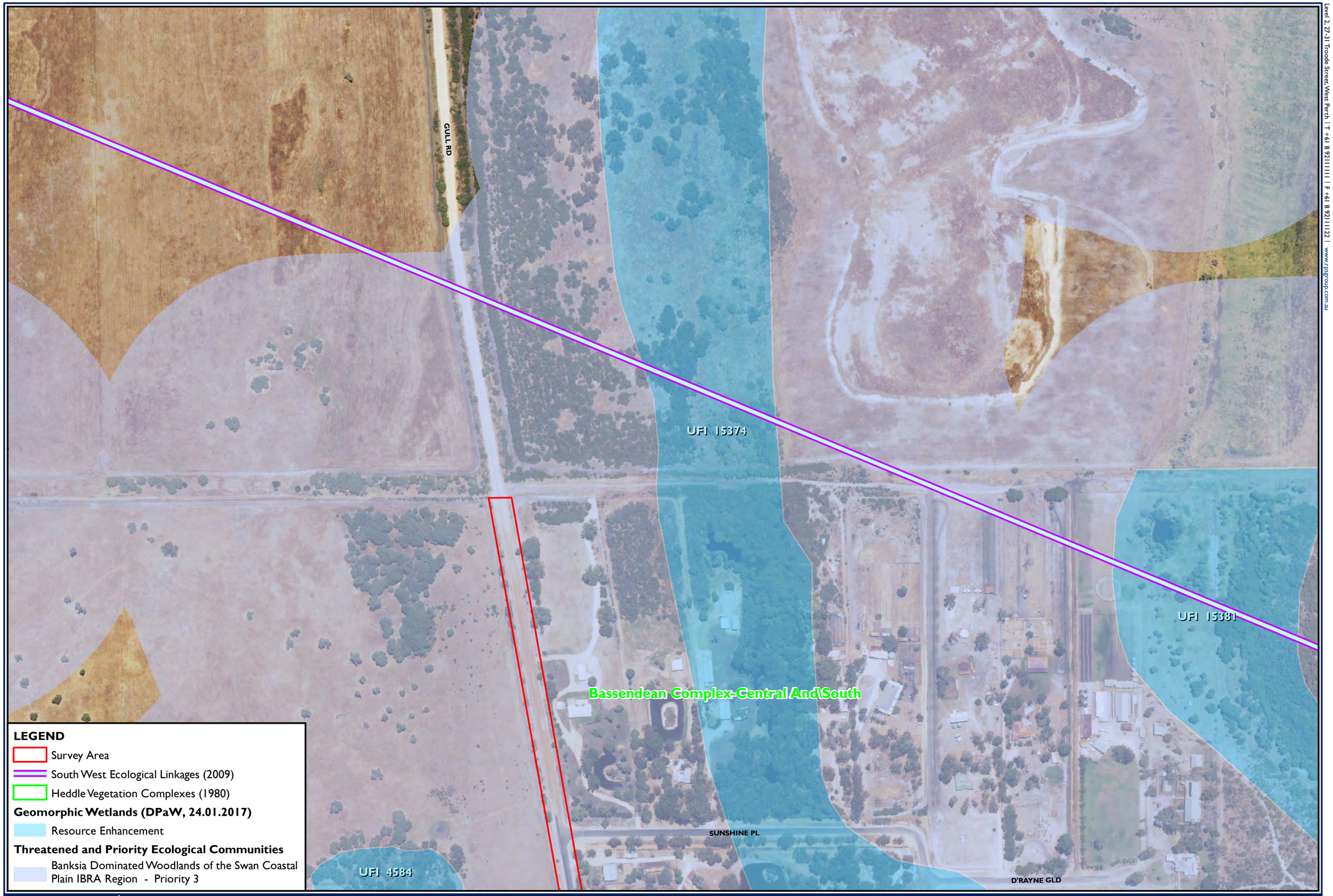

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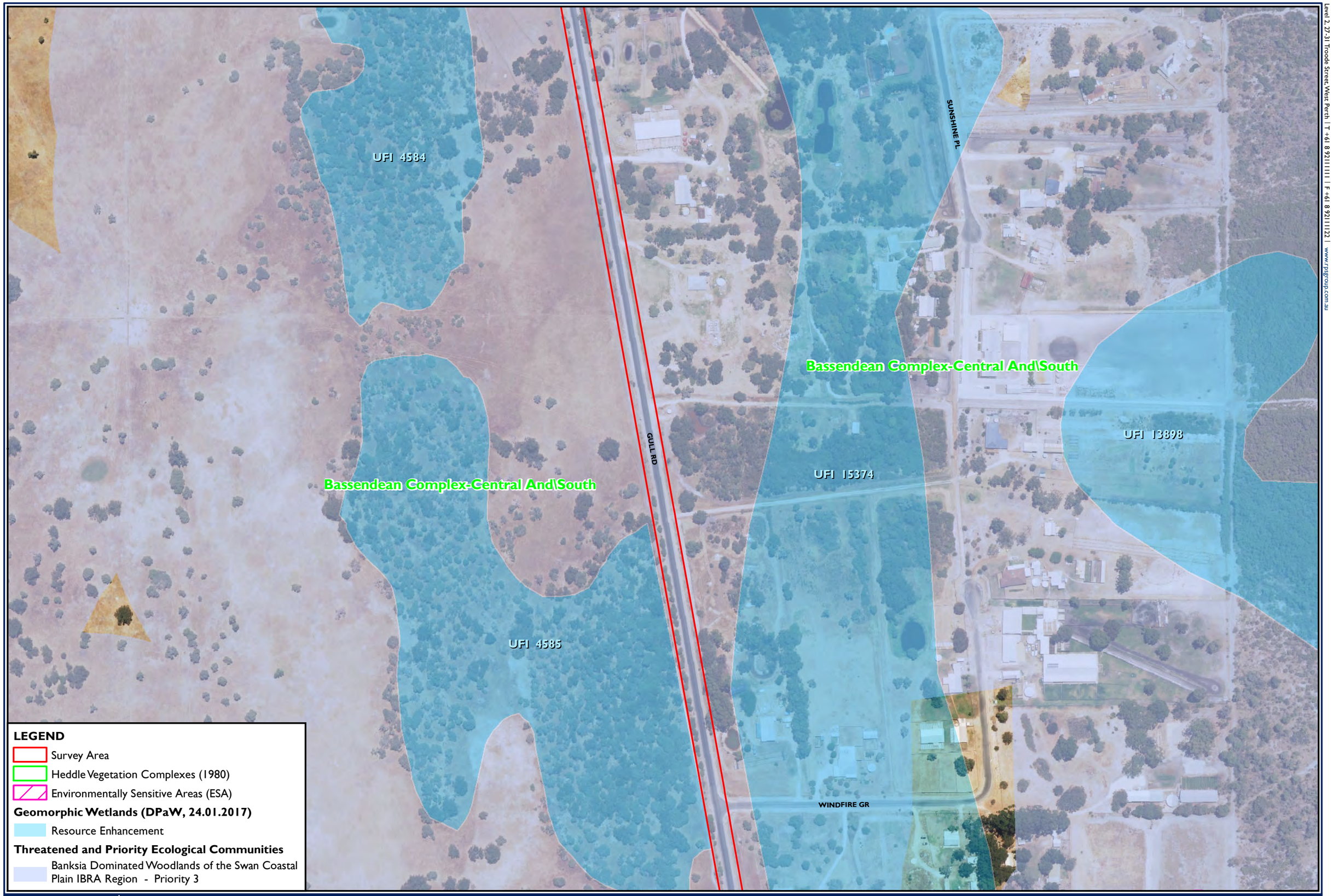

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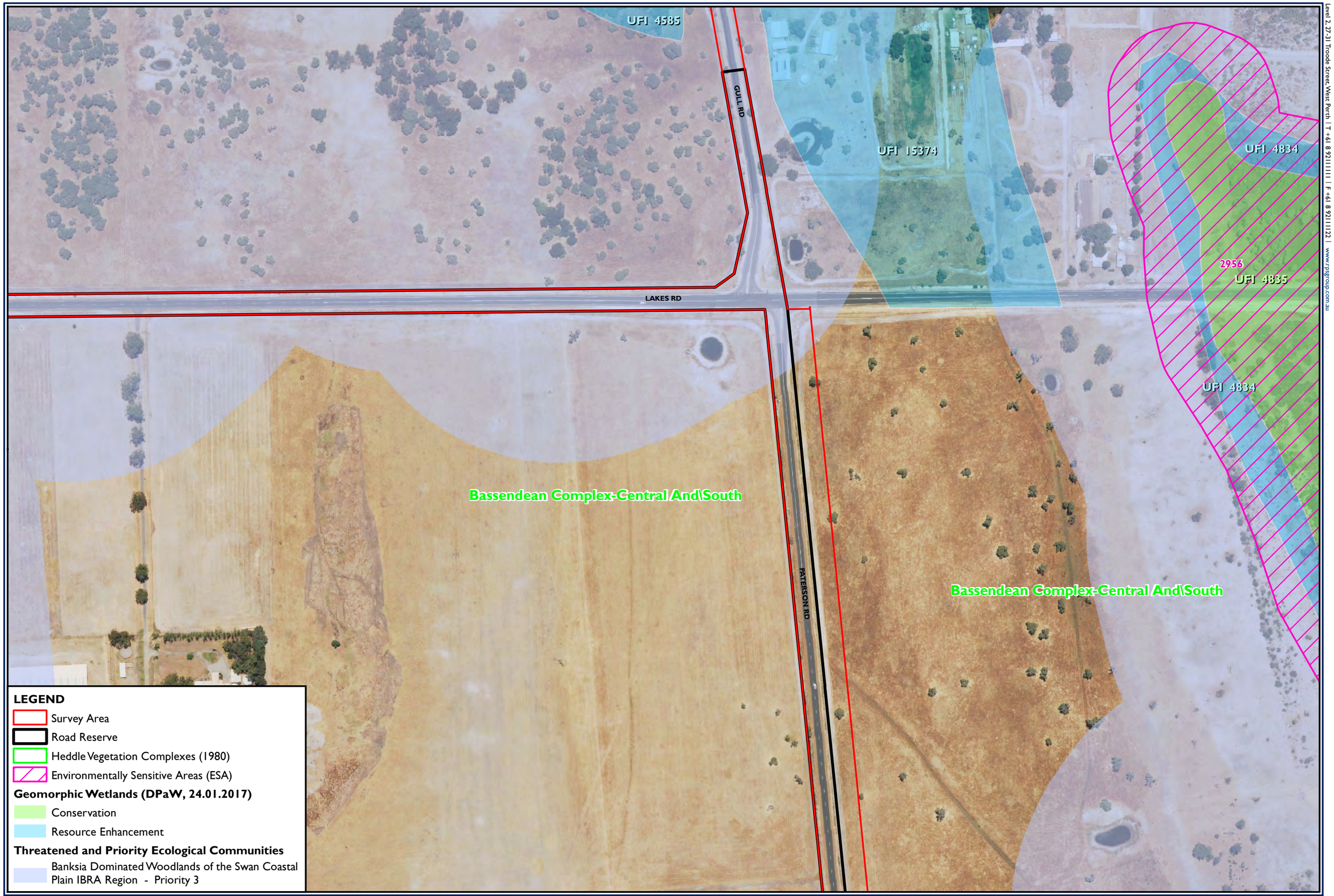

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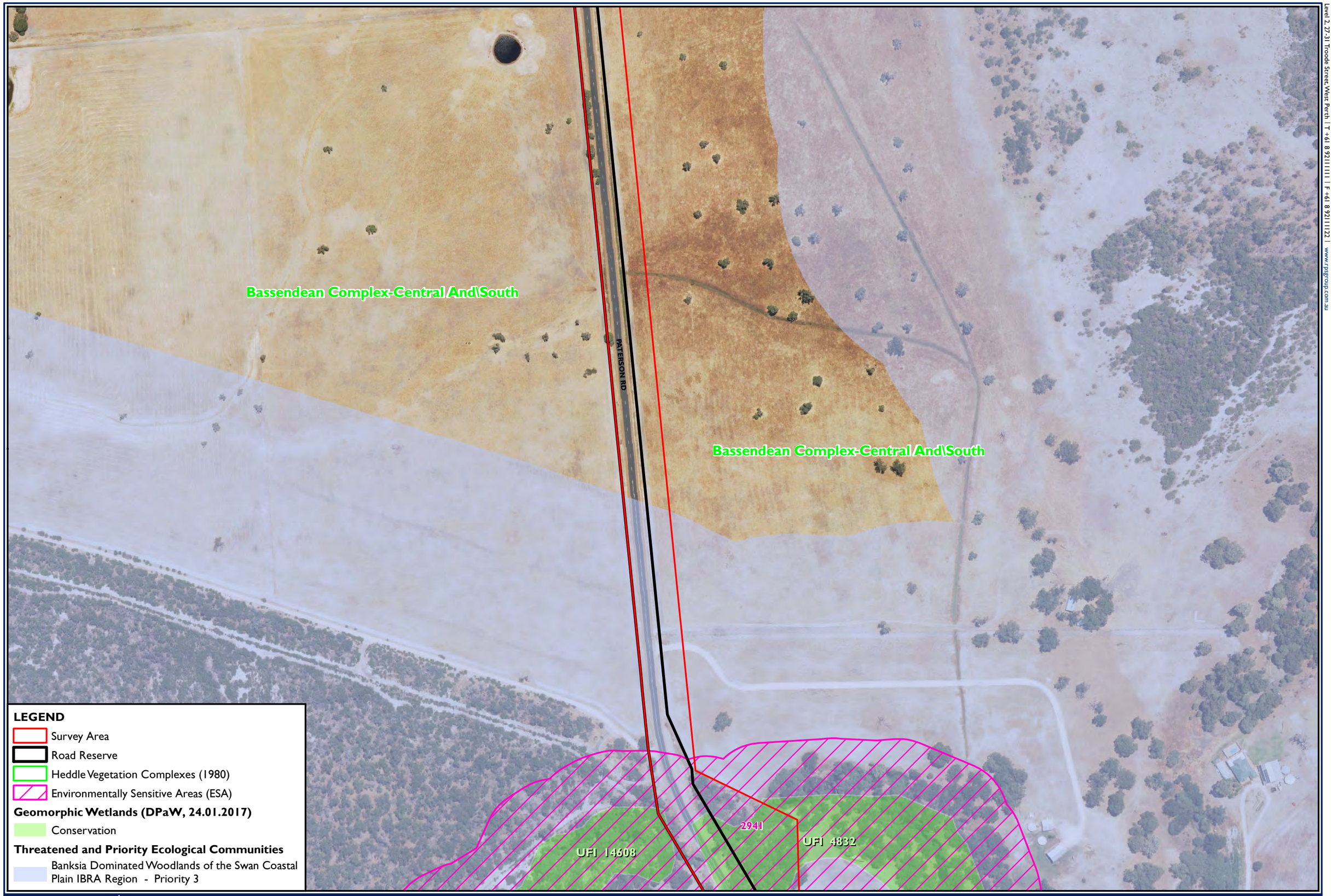

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Source: Cadastre - Landgate, 2017 Orthophoto - Landgate, Feb 2017

GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure B-9

Desktop Study Results

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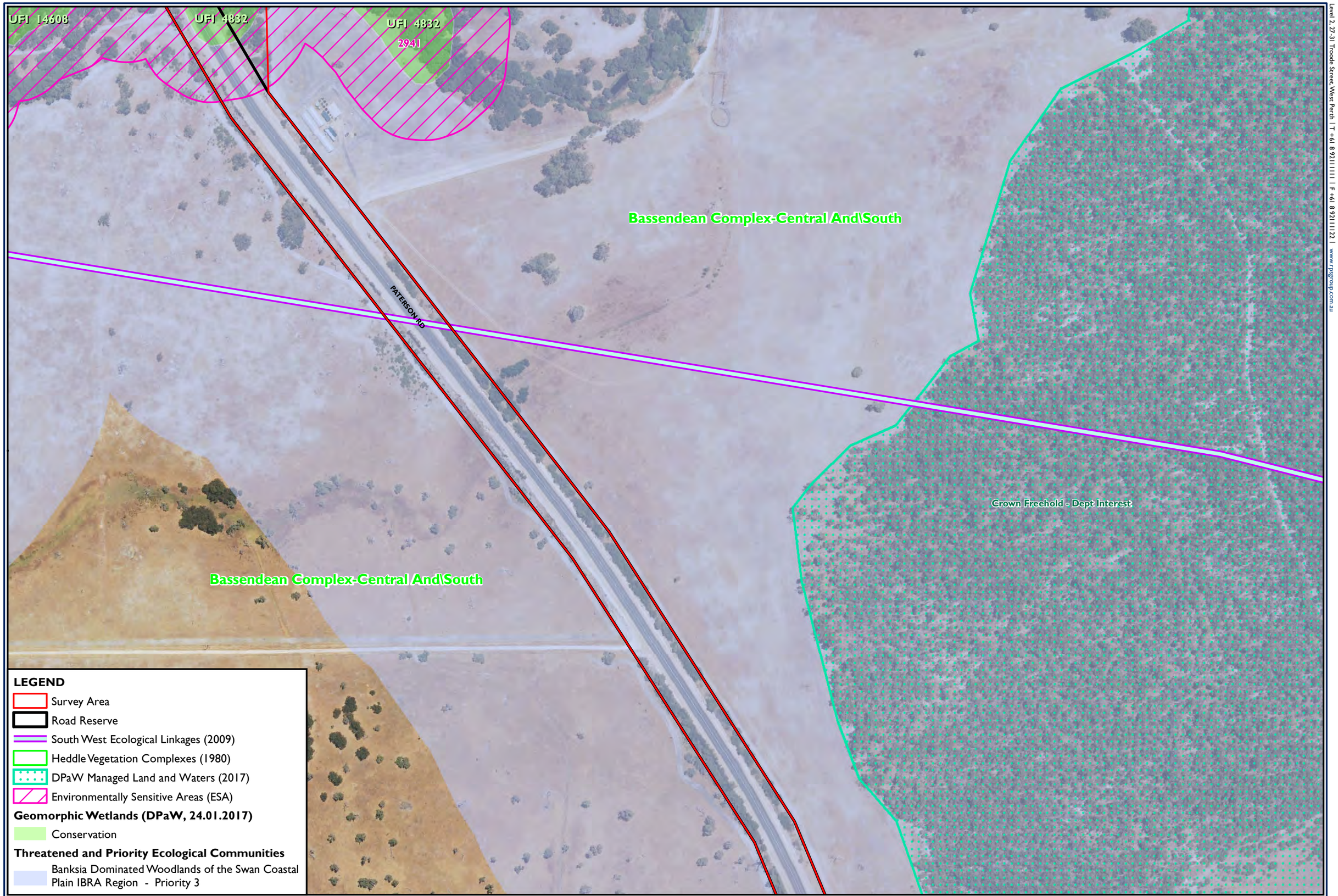

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Doc Number: 001
Date: 04.07.17
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Created by: MA
Source: Cadastre - Landgate, 2017 Orthophoto - Landgate, Feb 2017

GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure B-10

Desktop Study Results

Document Path: G:\Jobs\L_Jobs\L11266 - LandCorp Nambeelup Industrial Estate\Figures L1126606 Flora and Fauna\L11266_006_G_002_FigB 1-16 Desktop Study Results_171109.mxd

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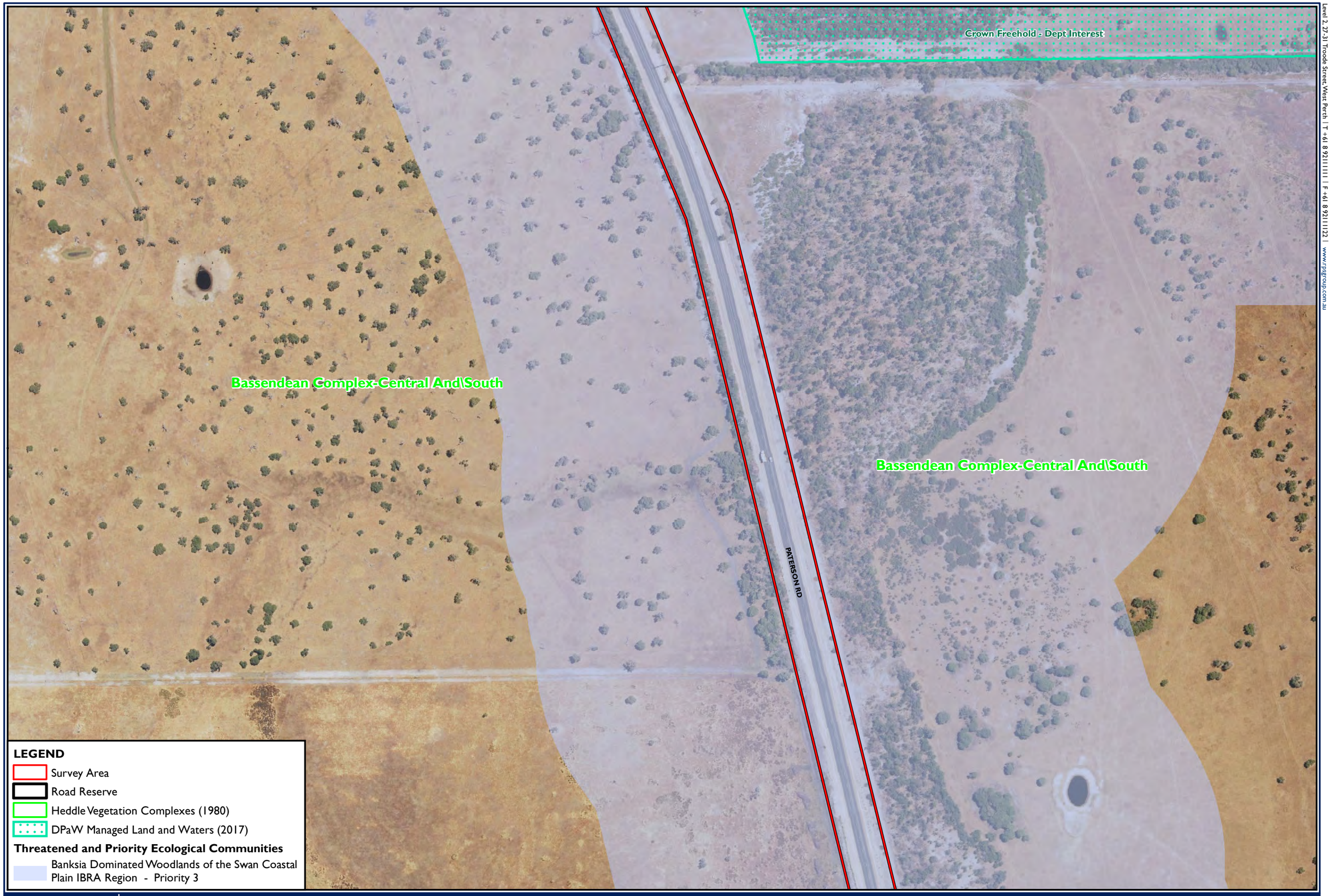

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Scale: 1:3,000 @ A3
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Source: Cadastre - Landgate, 2017 Orthophoto - Landgate, Feb 2017

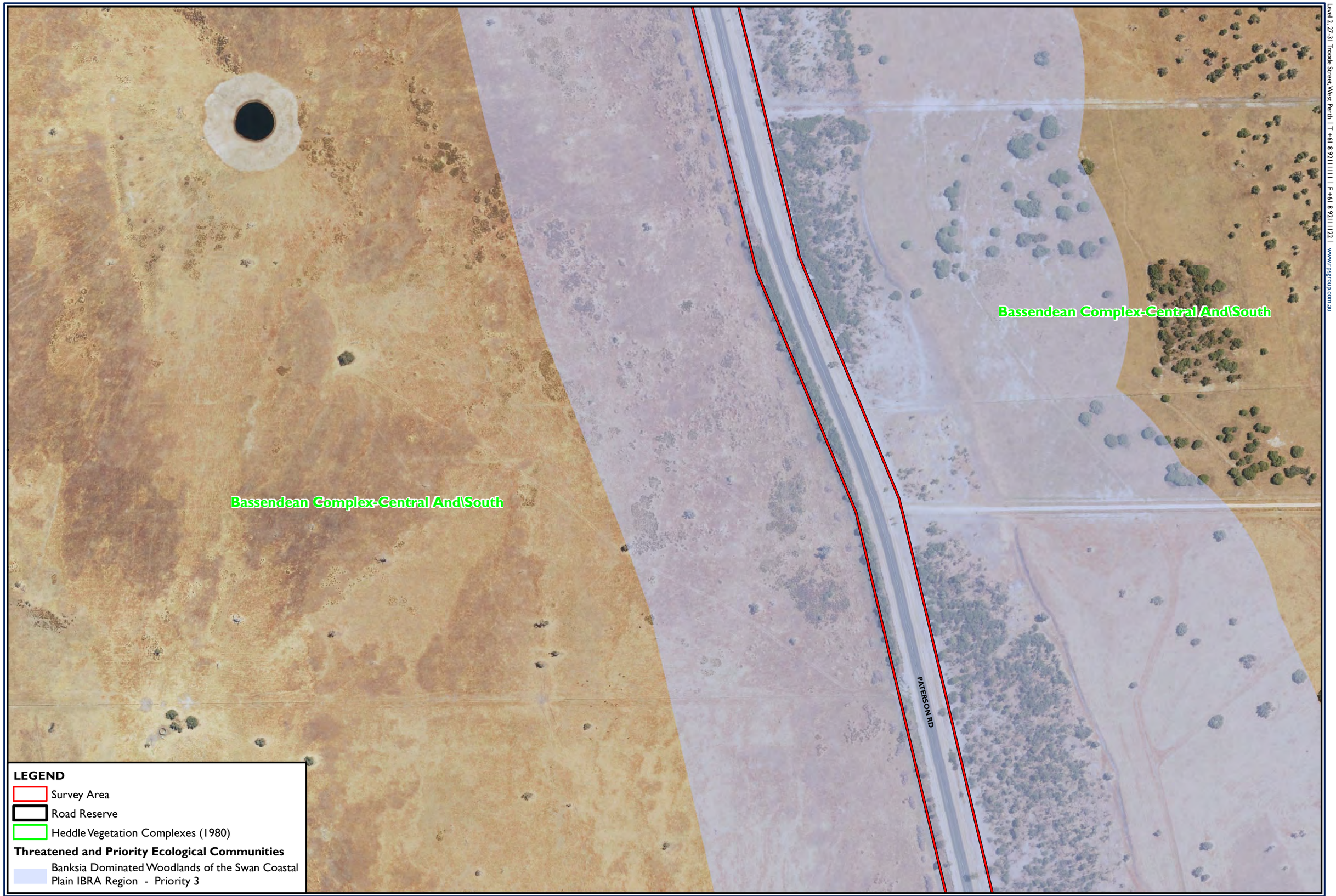
GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure B-11

Desktop Study Results

Document Path: G:\Jobs\L_Jobs\L11266 - LandCorp Nambeelup Industrial Estate\Figures L1126606 Flora and Fauna\L11266_006_G_002_FigB 1-16 Desktop Study Results_171109.mxd



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Source: Cadastre - Landgate, 2017 Orthophoto - Landgate, Feb 2017

GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure B-12

Desktop Study Results

Document Path: G:\Jobs\L_Jobs\L11266 - LandCorp Nambeelup Industrial Estate\Figures L1126606 Flora and Fauna\L11266_006_G_002_FigB 1-16 Desktop Study Results_171109.mxd

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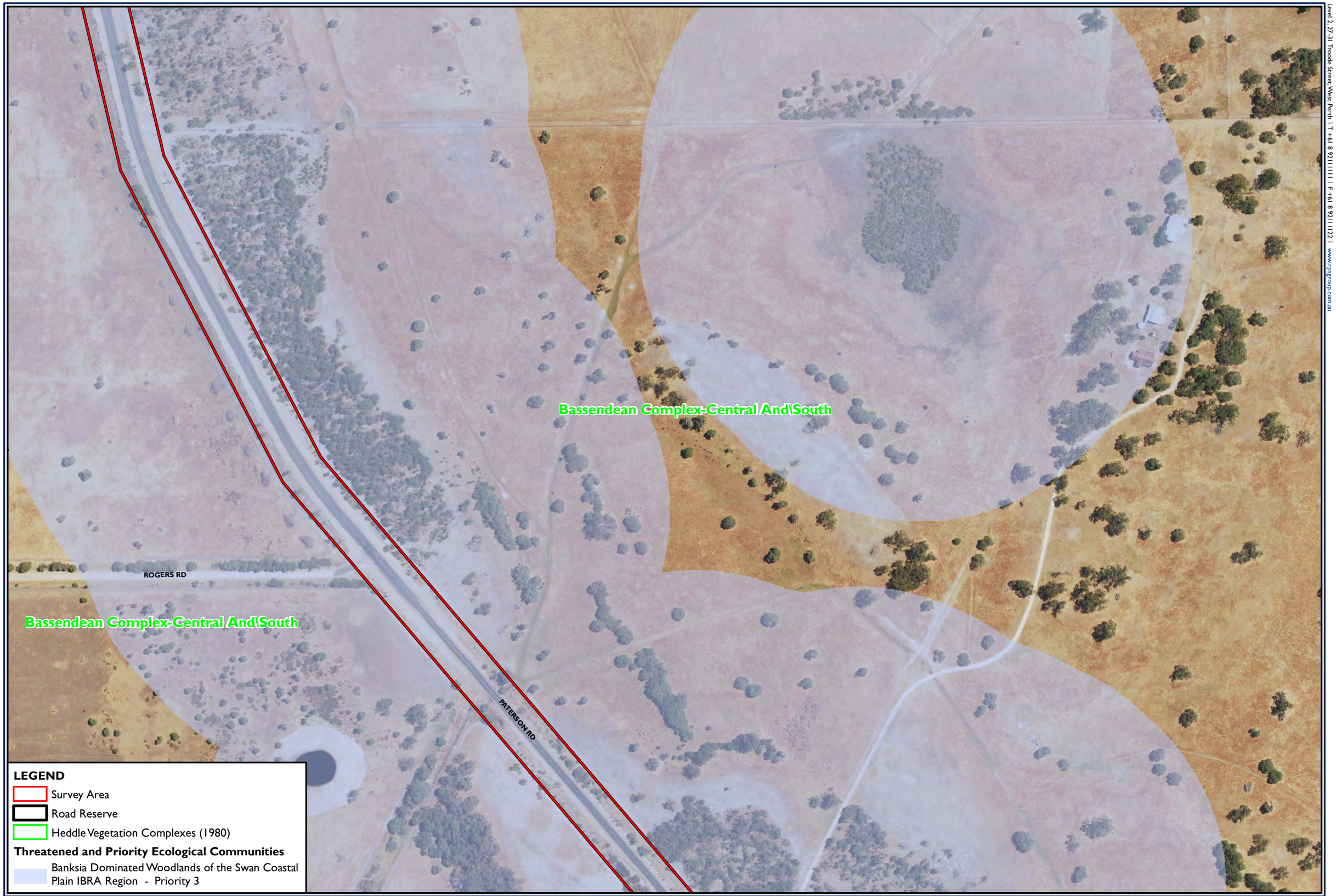

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GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure B-13

Desktop Study Results

Document Path: G:\Jobs\L_Jobs\L11266 - LandCorp Nambeelup Industrial Estate\Figures L1126606 Flora and Fauna\L11266_006_G_002_FigB 1-16 Desktop Study Results_171109.mxd

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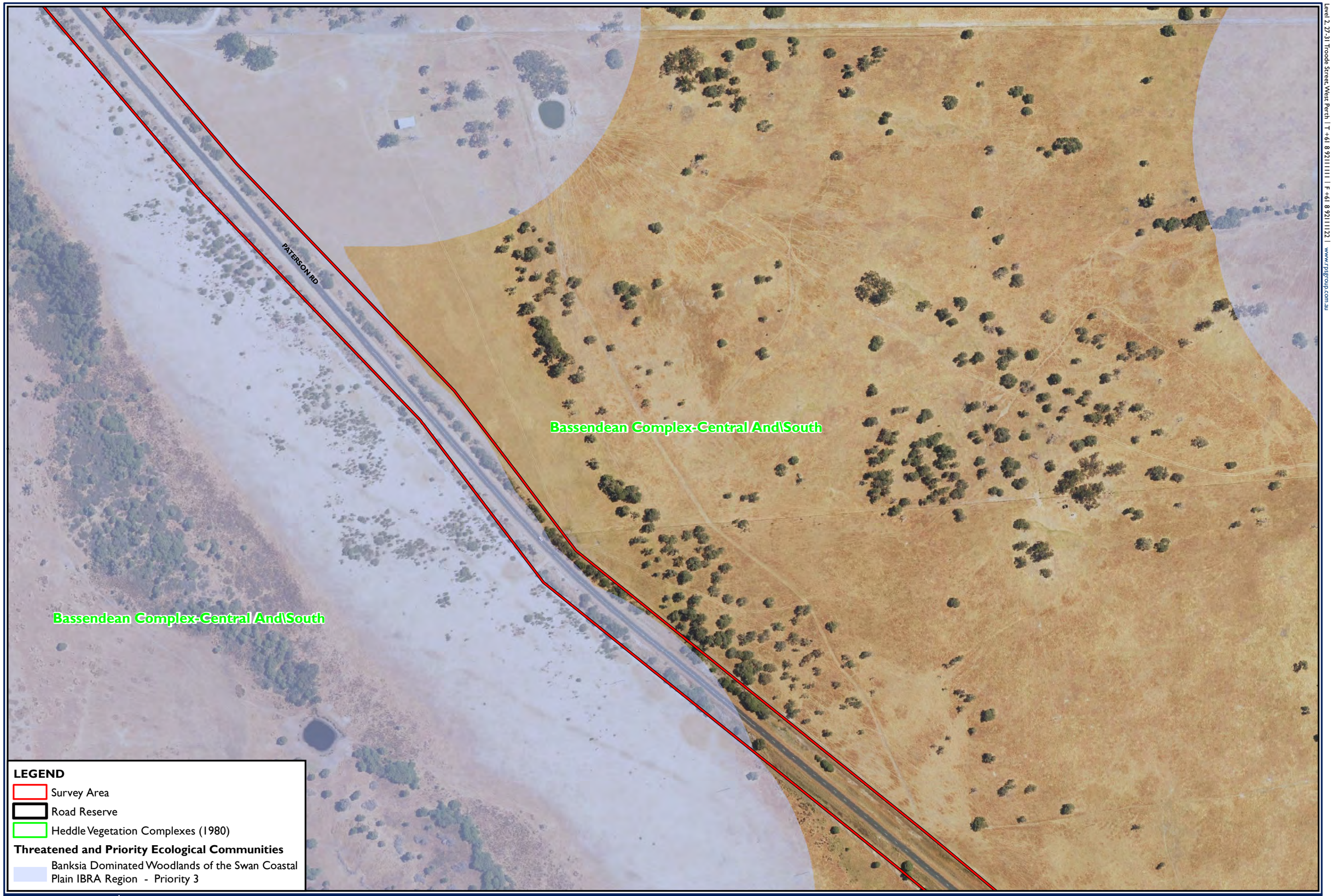

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GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure B-14

Desktop Study Results

Document Path: G:\Jobs\L_Jobs\L11266 - LandCorp Nambeelup Industrial Estate\Figures L1126606 Flora and Fauna\L11266_006_G_002_FigB 1-16 Desktop Study Results_171109.mxd

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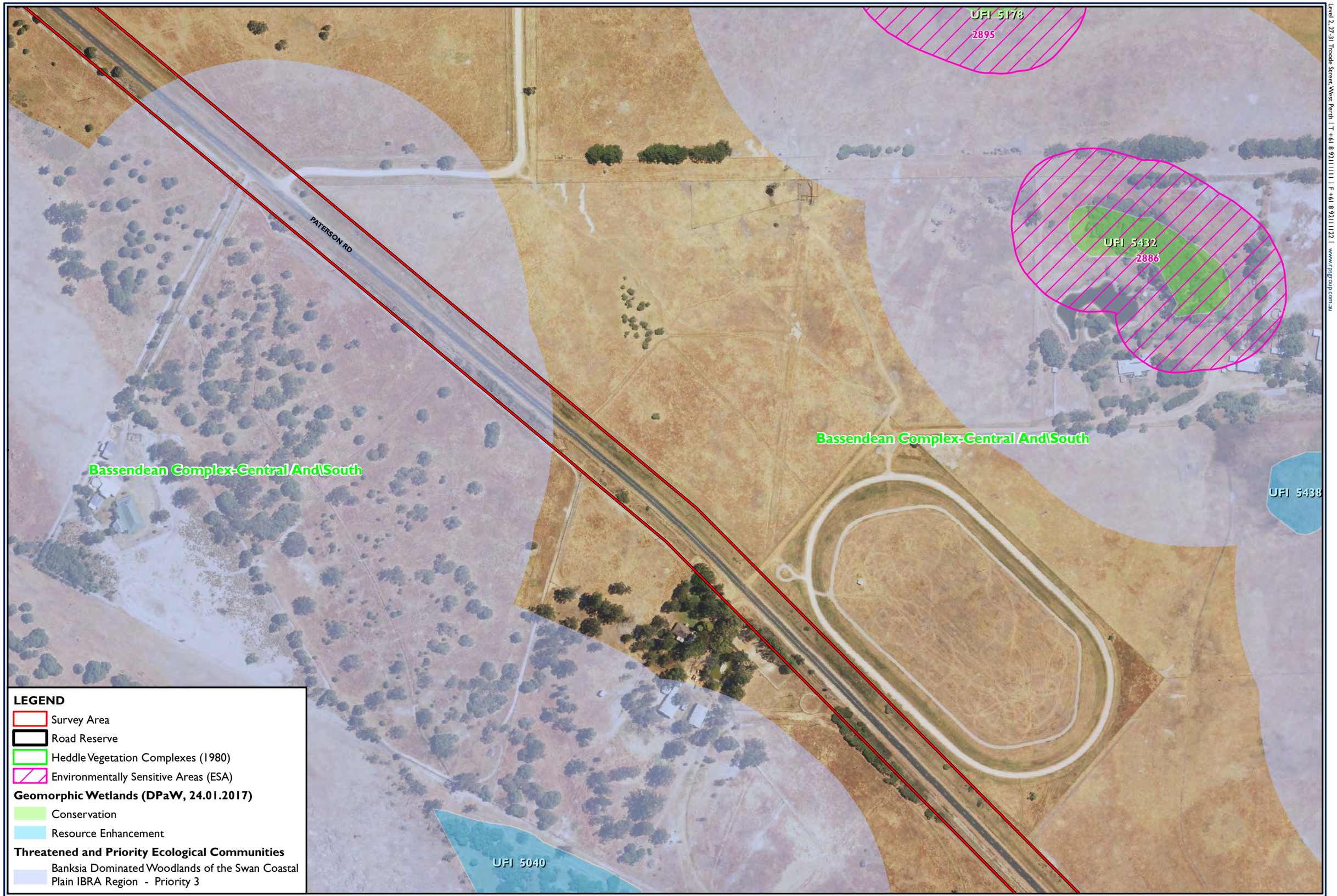

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GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure B-15

Desktop Study Results

Document Path: G:\Jobs\L_Jobs\L11266 - LandCorp Nambeelup Industrial Estate\Figures L1126606 Flora and Fauna\L11266_006_G_002_FigB 1-16 Desktop Study Results_171109.mxd

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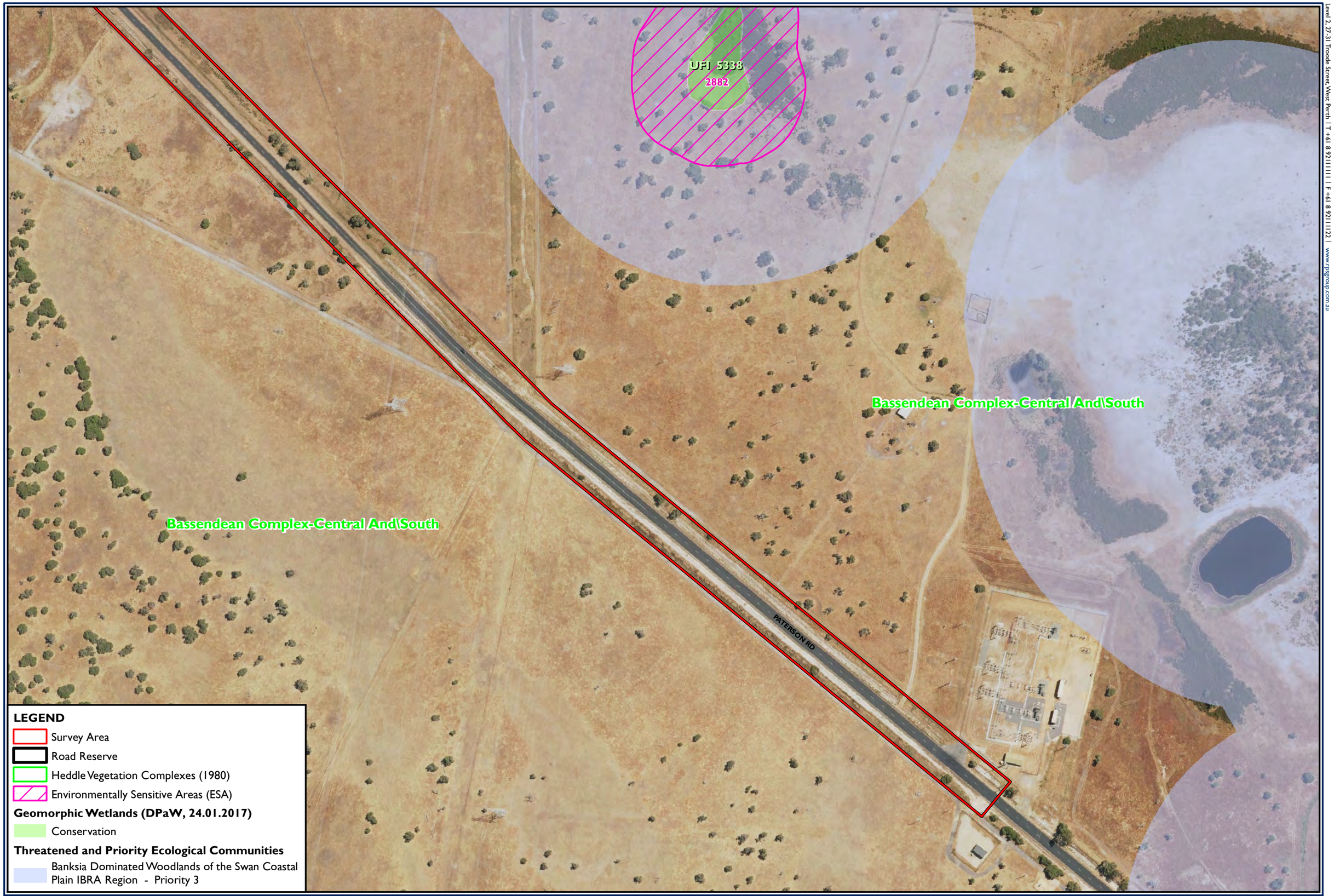

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Source: Cadastre - Landgate, 2017 Orthophoto - Landgate, Feb 2017

GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure B-16

Desktop Study Results

Document Path: G:\Jobs\L_Jobs\L11266 - LandCorp Nambeelup Industrial Estate\Figures L1126606 Flora and Fauna\L11266_006_G_002_FigB 1-16 Desktop Study Results_171109.mxd

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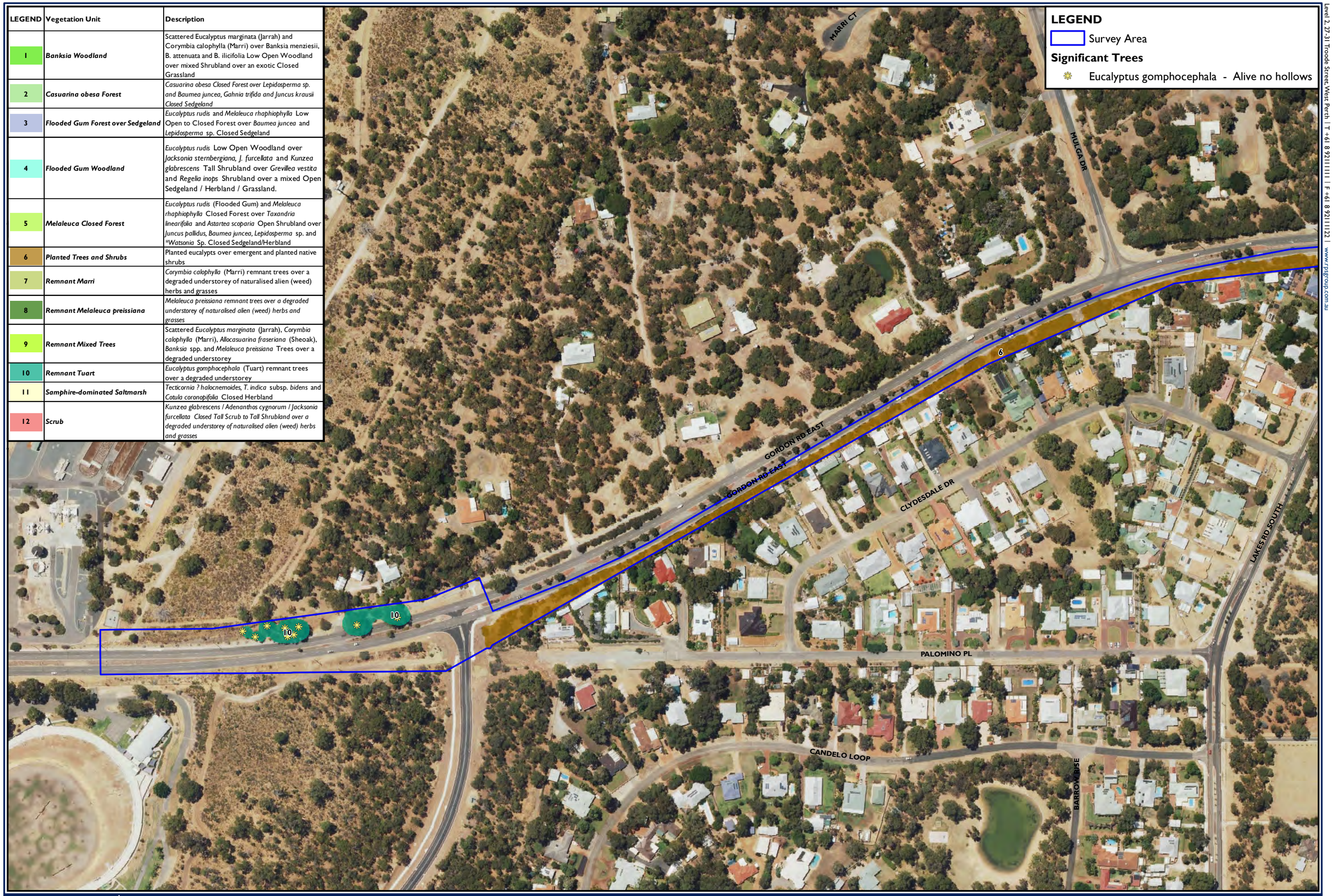
LEGEND	Vegetation Unit	Description
1	***Banksia Woodland***	Scattered Eucalyptus marginata (Jarrah) and Corymbia calophylla (Marri) over Banksia menziesii, B. attenuata and B. ilicifolia Low Open Woodland over mixed Shrubland over an exotic Closed Grassland
2	***Casuarina obesa Forest***	*Casuarina obesa Closed Forest over Lepidosperma sp. and Baumea juncea, Gahnia trifida and Juncus krausii Closed Sedgeland*
3	***Flooded Gum Forest over Sedgeland***	*Eucalyptus rudis* and *Melaleuca rhaphiophylla* Low Open to Closed Forest over *Baumea juncea* and *Lepidosperma* sp. Closed Sedgeland
4	***Flooded Gum Woodland***	*Eucalyptus rudis* Low Open Woodland over *Jacksonia sternbergiana, J. furcellata* and *Kunzea glabrescens* Tall Shrubland over *Grevillea vestita* and *Regelia inops* Shrubland over a mixed Open Sedgeland / Herbland / Grassland.
5	***Melaleuca Closed Forest***	*Eucalyptus rudis* (Flooded Gum) and *Melaleuca rhaphiophylla* Closed Forest over *Taxandria linearifolia* and *Astartea scoparia* Open Shrubland over *Juncus pallidus, Baumea juncea, Lepidosperma* sp. and **Watsonia* Sp. Closed Sedgeland/Herbland
6	***Planted Trees and Shrubs***	Planted eucalypts over emergent and planted native shrubs
7	***Remnant Marri***	*Corymbia calophylla* (Marri) remnant trees over a degraded understorey of naturalised alien (weed) herbs and grasses
8	***Remnant Melaleuca preissiana***	*Melaleuca preissiana remnant trees over a degraded understorey of naturalised alien (weed) herbs and grasses*
9	***Remnant Mixed Trees***	Scattered *Eucalyptus marginata* (Jarrah), *Corymbia calophylla* (Marri), *Allocasuarina fraseriana* (Sheoak), *Banksia* spp. and *Melaleuca preissiana* Trees over a degraded understorey
10	***Remnant Tuart***	*Eucalyptus gomphocephala* (Tuart) remnant trees over a degraded understorey
11	***Samphire-dominated Saltmarsh***	*Tecticornia ? halocnemoides, T. indica* subsp. *bidens* and *Cotula coronopifolia* Closed Herbland
12	***Scrub***	*Kunzea glabrescens / Adenanthos cygnorum / Jacksonia furcellata Closed Tall Scrub to Tall Shrubland over a degraded understorey of naturalised alien (weed) herbs and grasses*



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Date: 08.07.17
Scale: 1:3,000 @ A3
Created by: MA
Source: Cadastre - Landgate, 2017 Orthophoto - Landgate, Feb 2017

GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure C-1

Vegetation Units

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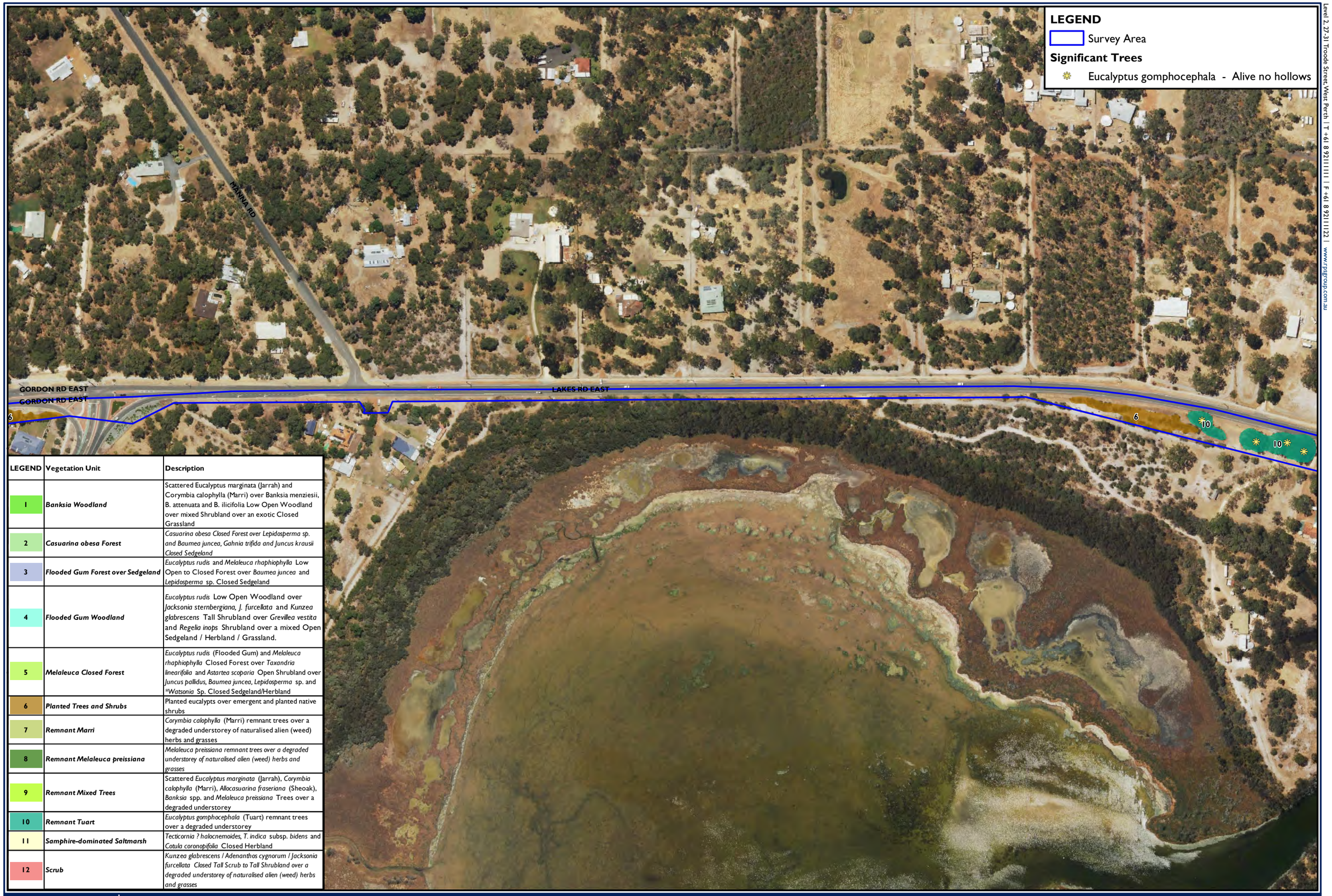

LEGEND	Vegetation Unit	Description
1	***Banksia Woodland***	Scattered Eucalyptus marginata (Jarrah) and Corymbia calophylla (Marri) over Banksia menziesii, B. attenuata and B. ilicifolia Low Open Woodland over mixed Shrubland over an exotic Closed Grassland
2	***Casuarina obesa Forest***	*Casuarina obesa Closed Forest over Lepidosperma sp. and Baumea juncea, Gahnia trifida and Juncus krausii Closed Sedgeland*
3	***Flooded Gum Forest over Sedgeland***	*Eucalyptus rudis* and *Melaleuca rhaphiophylla* Low Open to Closed Forest over *Baumea juncea* and *Lepidosperma* sp. Closed Sedgeland
4	***Flooded Gum Woodland***	*Eucalyptus rudis* Low Open Woodland over *Jacksonia sternbergiana, J. furcellata* and *Kunzea glabrescens* Tall Shrubland over *Grevillea vestita* and *Regelia inops* Shrubland over a mixed Open Sedgeland / Herbland / Grassland.
5	***Melaleuca Closed Forest***	*Eucalyptus rudis* (Flooded Gum) and *Melaleuca rhaphiophylla* Closed Forest over *Taxandria linearifolia* and *Astartea scoparia* Open Shrubland over *Juncus pallidus, Baumea juncea, Lepidosperma* sp. and **Watsonia* Sp. Closed Sedgeland/Herbland
6	***Planted Trees and Shrubs***	Planted eucalypts over emergent and planted native shrubs
7	***Remnant Marri***	*Corymbia calophylla* (Marri) remnant trees over a degraded understorey of naturalised alien (weed) herbs and grasses
8	***Remnant Melaleuca preissiana***	*Melaleuca preissiana remnant trees over a degraded understorey of naturalised alien (weed) herbs and grasses*
9	***Remnant Mixed Trees***	Scattered *Eucalyptus marginata* (Jarrah), *Corymbia calophylla* (Marri), *Allocasuarina fraseriana* (Sheoak), *Banksia* spp. and *Melaleuca preissiana* Trees over a degraded understorey
10	***Remnant Tuart***	*Eucalyptus gomphocephala* (Tuart) remnant trees over a degraded understorey
11	***Samphire-dominated Saltmarsh***	*Tecticornia ? halocnemoides, T. indica* subsp. *bidens* and *Cotula coronopifolia* Closed Herbland
12	***Scrub***	*Kunzea glabrescens / Adenanthos cygnorum / Jacksonia furcellata Closed Tall Scrub to Tall Shrubland over a degraded understorey of naturalised alien (weed) herbs and grasses*

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GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure C-2

Vegetation Units

Document Path: G:\Jobs\L_Jobs\L11266 - LandCorp Nambeelup Industrial Estate\Figures L1126606 Flora and Fauna\L11266_006_G_003_FigC 1-16 Vegetation Units_171108.mxd

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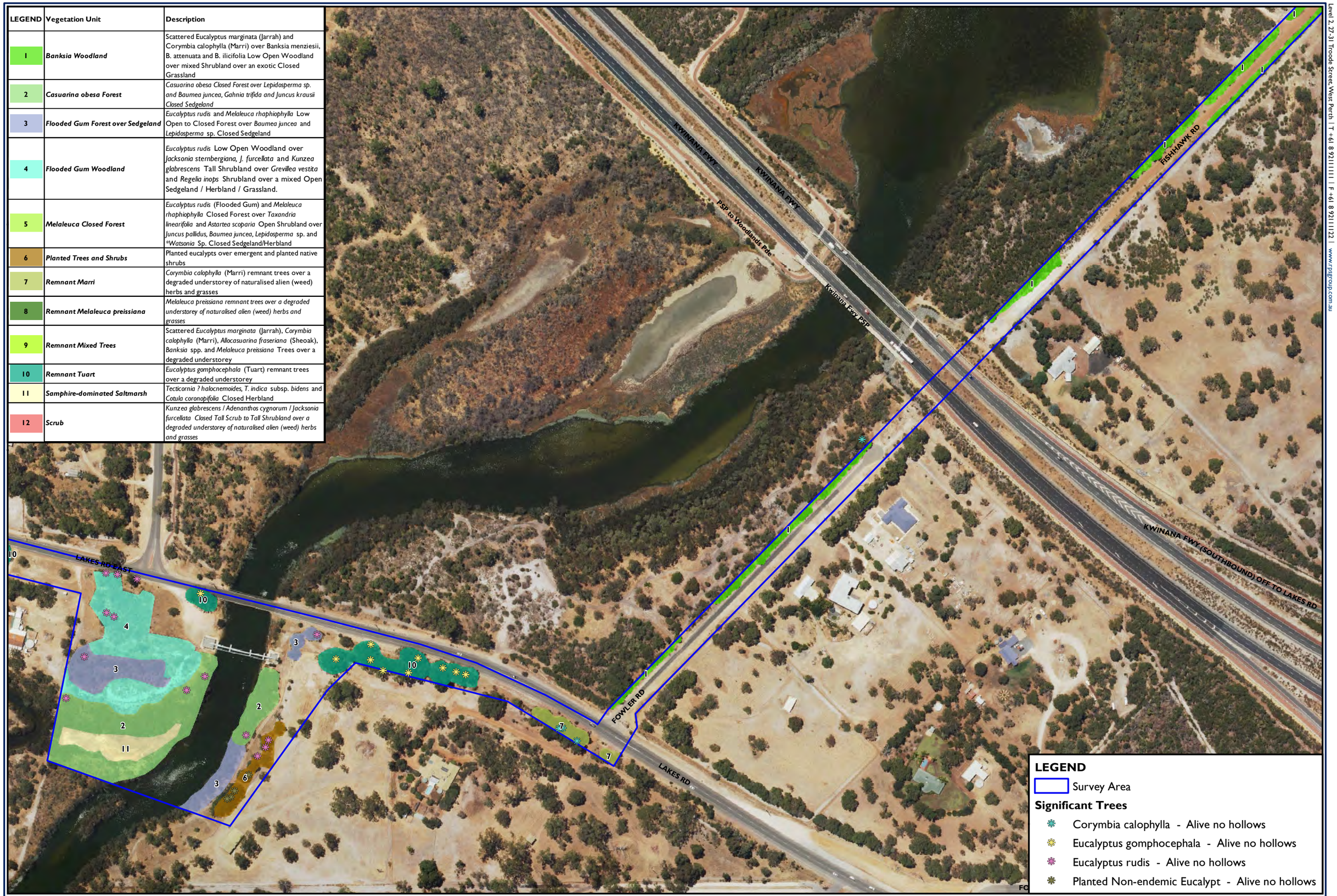
LEGEND	Vegetation Unit	Description
1	***Banksia Woodland***	Scattered Eucalyptus marginata (Jarrah) and Corymbia calophylla (Marri) over Banksia menziesii, B. attenuata and B. ilicifolia Low Open Woodland over mixed Shrubland over an exotic Closed Grassland
2	***Casuarina obesa Forest***	*Casuarina obesa Closed Forest over Lepidosperma sp. and Baumea juncea, Gahnia trifida and Juncus krausii Closed Sedgeland*
3	***Flooded Gum Forest over Sedgeland***	*Eucalyptus rudis* and *Melaleuca rhaphiophylla* Low Open to Closed Forest over *Baumea juncea* and *Lepidosperma* sp. Closed Sedgeland
4	***Flooded Gum Woodland***	*Eucalyptus rudis* Low Open Woodland over *Jacksonia sternbergiana, J. furcellata* and *Kunzea glabrescens* Tall Shrubland over *Grevillea vestita* and *Regelia inops* Shrubland over a mixed Open Sedgeland / Herbland / Grassland.
5	***Melaleuca Closed Forest***	*Eucalyptus rudis* (Flooded Gum) and *Melaleuca rhaphiophylla* Closed Forest over *Taxandria linearifolia* and *Astartea scoparia* Open Shrubland over *Juncus pallidus, Baumea juncea, Lepidosperma* sp. and **Watsonia* Sp. Closed Sedgeland/Herbland
6	***Planted Trees and Shrubs***	Planted eucalypts over emergent and planted native shrubs
7	***Remnant Marri***	*Corymbia calophylla* (Marri) remnant trees over a degraded understorey of naturalised alien (weed) herbs and grasses
8	***Remnant Melaleuca preissiana***	*Melaleuca preissiana remnant trees over a degraded understorey of naturalised alien (weed) herbs and grasses*
9	***Remnant Mixed Trees***	Scattered *Eucalyptus marginata* (Jarrah), *Corymbia calophylla* (Marri), *Allocasuarina fraseriana* (Sheoak), *Banksia* spp. and *Melaleuca preissiana* Trees over a degraded understorey
10	***Remnant Tuart***	*Eucalyptus gomphocephala* (Tuart) remnant trees over a degraded understorey
11	***Samphire-dominated Saltmarsh***	*Tecticornia ? halocnemoides, T. indica* subsp. *bidens* and *Cotula coronopifolia* Closed Herbland
12	***Scrub***	*Kunzea glabrescens / Adenanthos cygnorum / Jacksonia furcellata Closed Tall Scrub to Tall Shrubland over a degraded understorey of naturalised alien (weed) herbs and grasses*



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Source: Cadastre - Landgate, 2017 Orthophoto - Landgate, Feb 2017

GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure C-3

Vegetation Units

Document Path: G:\Jobs\L_Jobs\L11266 - LandCorp Nambeelup Industrial Estate\Figures L1126606 Flora and Fauna\L11266_006_G_003_FigC 1-16 Vegetation Units_171108.mxd

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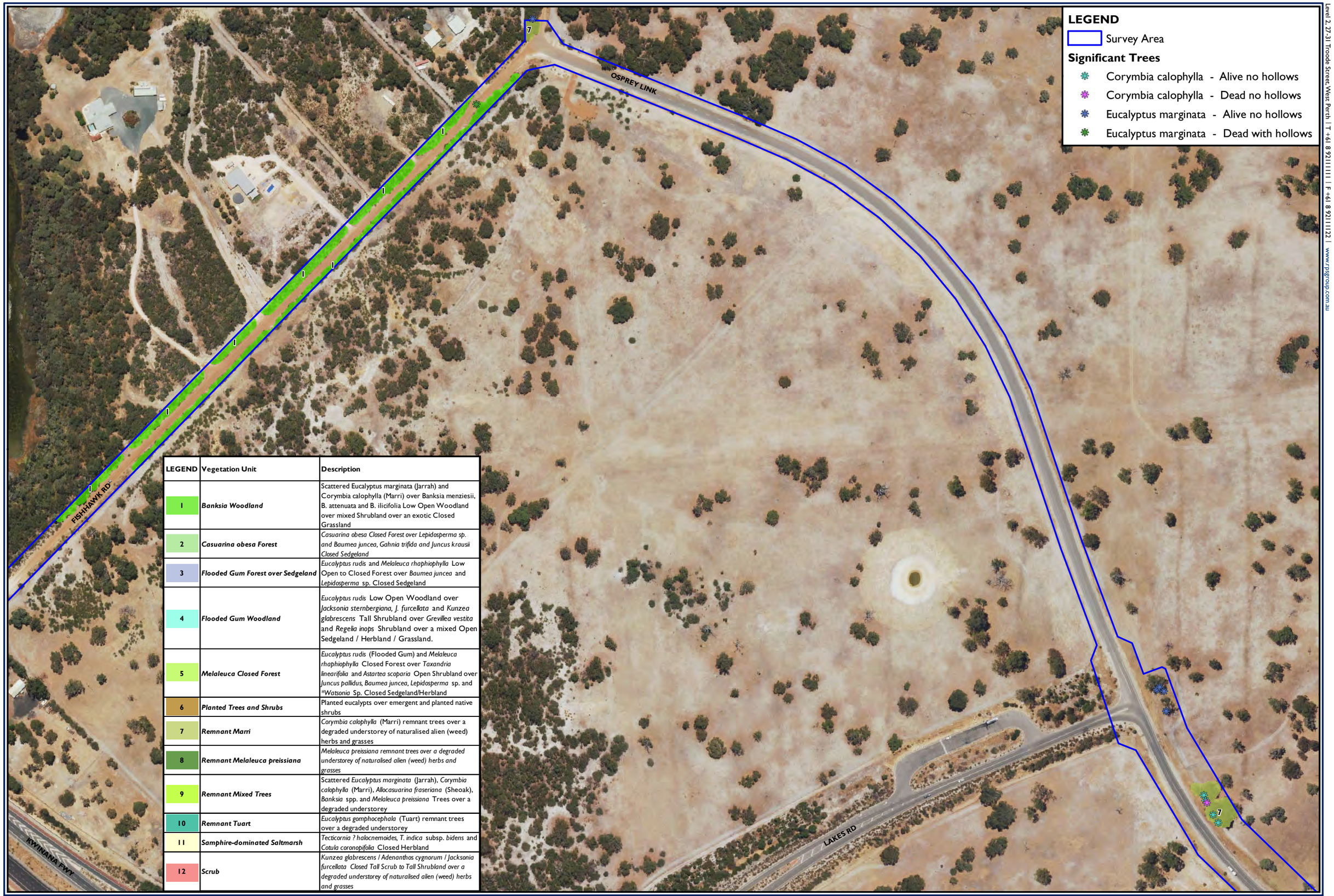

LEGEND	Vegetation Unit	Description
1	***Banksia Woodland***	Scattered Eucalyptus marginata (Jarrah) and Corymbia calophylla (Marri) over Banksia menziesii, B. attenuata and B. ilicifolia Low Open Woodland over mixed Shrubland over an exotic Closed Grassland
2	***Casuarina obesa Forest***	*Casuarina obesa Closed Forest over Lepidosperma sp. and Baumea juncea, Gahnia trifida and Juncus krausii Closed Sedgeland*
3	***Flooded Gum Forest over Sedgeland***	*Eucalyptus rudis* and *Melaleuca rhaphiophylla* Low Open to Closed Forest over *Baumea juncea* and *Lepidosperma* sp. Closed Sedgeland
4	***Flooded Gum Woodland***	*Eucalyptus rudis* Low Open Woodland over *Jacksonia sternbergiana, J. furcellata* and *Kunzea glabrescens* Tall Shrubland over *Grevillea vestita* and *Regelia inops* Shrubland over a mixed Open Sedgeland / Herbland / Grassland.
5	***Melaleuca Closed Forest***	*Eucalyptus rudis* (Flooded Gum) and *Melaleuca rhaphiophylla* Closed Forest over *Taxandria linearifolia* and *Astartea scoparia* Open Shrubland over *Juncus pallidus, Baumea juncea, Lepidosperma* sp. and **Watsonia* Sp. Closed Sedgeland/Herbland
6	***Planted Trees and Shrubs***	Planted eucalypts over emergent and planted native shrubs
7	***Remnant Marri***	*Corymbia calophylla* (Marri) remnant trees over a degraded understorey of naturalised alien (weed) herbs and grasses
8	***Remnant Melaleuca preissiana***	*Melaleuca preissiana remnant trees over a degraded understorey of naturalised alien (weed) herbs and grasses*
9	***Remnant Mixed Trees***	Scattered *Eucalyptus marginata* (Jarrah), *Corymbia calophylla* (Marri), *Allocasuarina fraseriana* (Sheoak), *Banksia* spp. and *Melaleuca preissiana* Trees over a degraded understorey
10	***Remnant Tuart***	*Eucalyptus gomphocephala* (Tuart) remnant trees over a degraded understorey
11	***Samphire-dominated Saltmarsh***	*Tecticornia ? halocnemoides, T. indica* subsp. *bidens* and *Cotula coronopifolia* Closed Herbland
12	***Scrub***	*Kunzea glabrescens / Adenanthos cygnorum / Jacksonia furcellata Closed Tall Scrub to Tall Shrubland over a degraded understorey of naturalised alien (weed) herbs and grasses*

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Doc Number: 003
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GDA 1994 MGA Zone 50
0 12.5 25 50 75 100 m

Figure C-4

Vegetation Units

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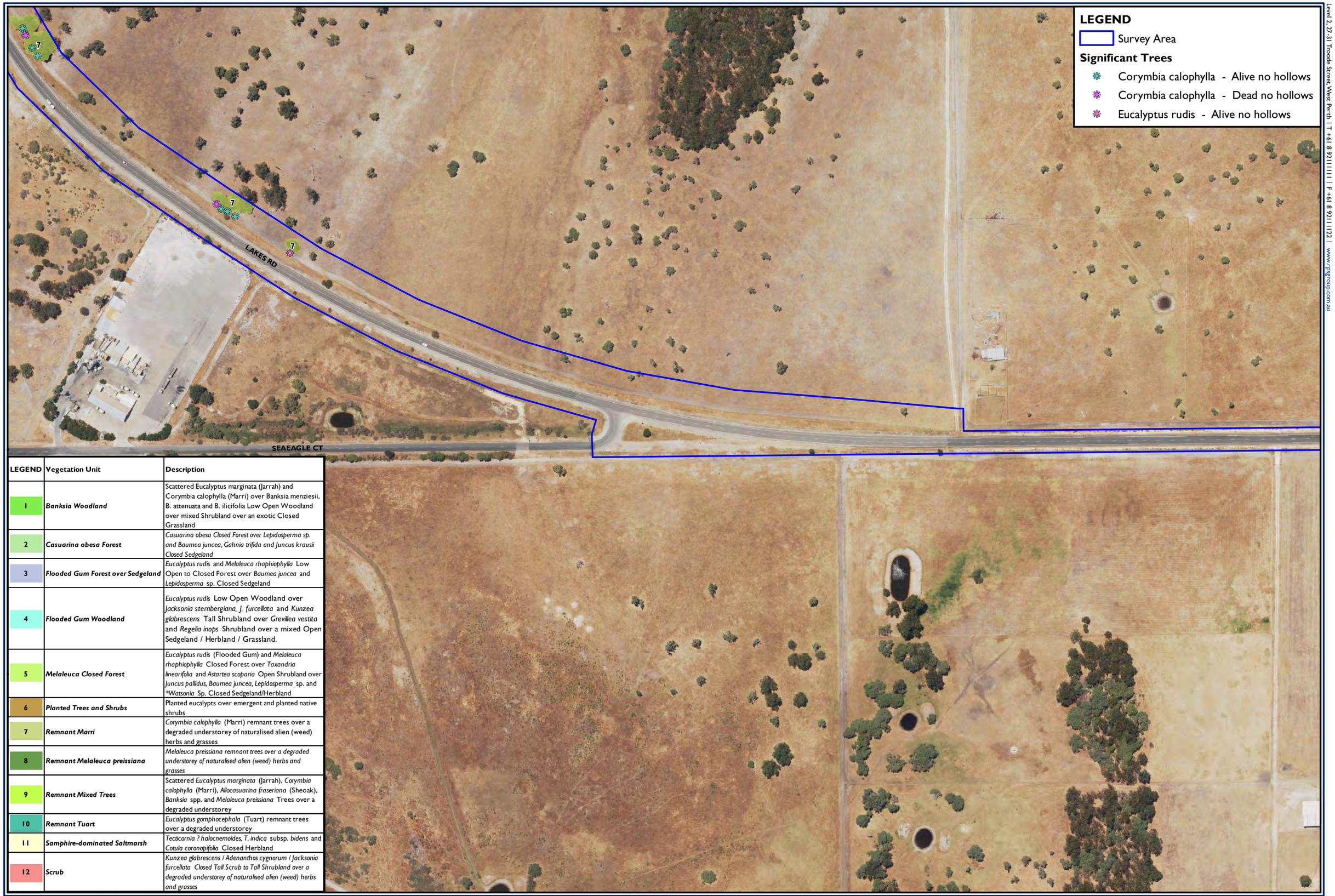

LEGEND	Vegetation Unit	Description
1	***Banksia Woodland***	Scattered Eucalyptus marginata (Jarrah) and Corymbia calophylla (Marri) over Banksia menziesii, B. attenuata and B. ilicifolia Low Open Woodland over mixed Shrubland over an exotic Closed Grassland
2	***Casuarina obesa Forest***	*Casuarina obesa Closed Forest over Lepidosperma sp. and Baumea juncea, Gahnia trifida and Juncus krausii Closed Sedgeland*
3	***Flooded Gum Forest over Sedgeland***	*Eucalyptus rudis* and *Melaleuca rhaphiophylla* Low Open to Closed Forest over *Baumea juncea* and *Lepidosperma* sp. Closed Sedgeland
4	***Flooded Gum Woodland***	*Eucalyptus rudis* Low Open Woodland over *Jacksonia sternbergiana, J. furcellata* and *Kunzea glabrescens* Tall Shrubland over *Grevillea vestita* and *Regelia inops* Shrubland over a mixed Open Sedgeland / Herbland / Grassland.
5	***Melaleuca Closed Forest***	*Eucalyptus rudis* (Flooded Gum) and *Melaleuca rhaphiophylla* Closed Forest over *Taxandria linearifolia* and *Astartea scoparia* Open Shrubland over *Juncus pallidus, Baumea juncea, Lepidosperma* sp. and **Watsonia* Sp. Closed Sedgeland/Herbland
6	***Planted Trees and Shrubs***	Planted eucalypts over emergent and planted native shrubs
7	***Remnant Marri***	*Corymbia calophylla* (Marri) remnant trees over a degraded understorey of naturalised alien (weed) herbs and grasses
8	***Remnant Melaleuca preissiana***	*Melaleuca preissiana remnant trees over a degraded understorey of naturalised alien (weed) herbs and grasses*
9	***Remnant Mixed Trees***	Scattered *Eucalyptus marginata* (Jarrah), *Corymbia calophylla* (Marri), *Allocasuarina fraseriana* (Sheoak), *Banksia* spp. and *Melaleuca preissiana* Trees over a degraded understorey
10	***Remnant Tuart***	*Eucalyptus gomphocephala* (Tuart) remnant trees over a degraded understorey
11	***Samphire-dominated Saltmarsh***	*Tecticornia ? halocnemoides, T. indica* subsp. *bidens* and *Cotula coronopifolia* Closed Herbland
12	***Scrub***	*Kunzea glabrescens / Adenanthos cygnorum / Jacksonia furcellata Closed Tall Scrub to Tall Shrubland over a degraded understorey of naturalised alien (weed) herbs and grasses*

RPS

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GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure C-5

Vegetation Units

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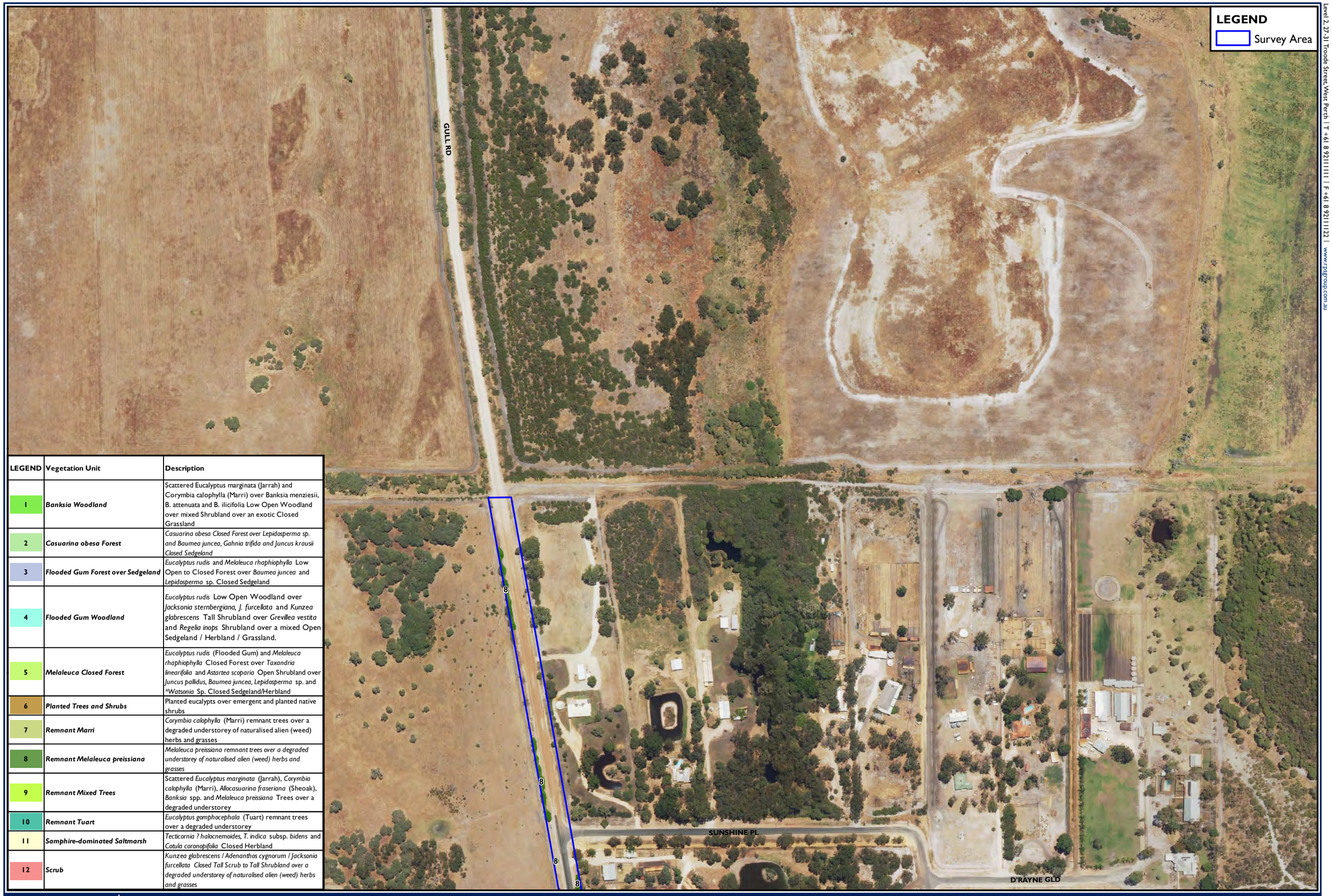

LEGEND	Vegetation Unit	Description
1	***Banksia Woodland***	Scattered Eucalyptus marginata (Jarrah) and Corymbia calophylla (Marri) over Banksia menziesii, B. attenuata and B. ilicifolia Low Open Woodland over mixed Shrubland over an exotic Closed Grassland
2	***Casuarina obesa Forest***	*Casuarina obesa Closed Forest over Lepidosperma sp. and Baumea juncea, Gahnia trifida and Juncus krausii Closed Sedgeland*
3	***Flooded Gum Forest over Sedgeland***	*Eucalyptus rudis* and *Melaleuca rhaphiophylla* Low Open to Closed Forest over *Baumea juncea* and *Lepidosperma* sp. Closed Sedgeland
4	***Flooded Gum Woodland***	*Eucalyptus rudis* Low Open Woodland over *Jacksonia sternbergiana, J. furcellata* and *Kunzea glabrescens* Tall Shrubland over *Grevillea vestita* and *Regelia inops* Shrubland over a mixed Open Sedgeland / Herbland / Grassland.
5	***Melaleuca Closed Forest***	*Eucalyptus rudis* (Flooded Gum) and *Melaleuca rhaphiophylla* Closed Forest over *Taxandria linearifolia* and *Astartea scoparia* Open Shrubland over *Juncus pallidus, Baumea juncea, Lepidosperma* sp. and **Watsonia* Sp. Closed Sedgeland/Herbland
6	***Planted Trees and Shrubs***	Planted eucalypts over emergent and planted native shrubs
7	***Remnant Marri***	*Corymbia calophylla* (Marri) remnant trees over a degraded understorey of naturalised alien (weed) herbs and grasses
8	***Remnant Melaleuca preissiana***	*Melaleuca preissiana remnant trees over a degraded understorey of naturalised alien (weed) herbs and grasses*
9	***Remnant Mixed Trees***	Scattered *Eucalyptus marginata* (Jarrah), *Corymbia calophylla* (Marri), *Allocasuarina fraseriana* (Sheoak), *Banksia* spp. and *Melaleuca preissiana* Trees over a degraded understorey
10	***Remnant Tuart***	*Eucalyptus gomphocephala* (Tuart) remnant trees over a degraded understorey
11	***Samphire-dominated Saltmarsh***	*Tecticornia ? halocnemoides, T. indica* subsp. *bidens* and *Cotula coronopifolia* Closed Herbland
12	***Scrub***	*Kunzea glabrescens / Adenanthos cygnorum / Jacksonia furcellata Closed Tall Scrub to Tall Shrubland over a degraded understorey of naturalised alien (weed) herbs and grasses*

RPS

Job Number: L11266.006
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GDA 1994 MGA Zone 50
0 12.5 25 50 75 100 m

Figure C-6

Vegetation Units

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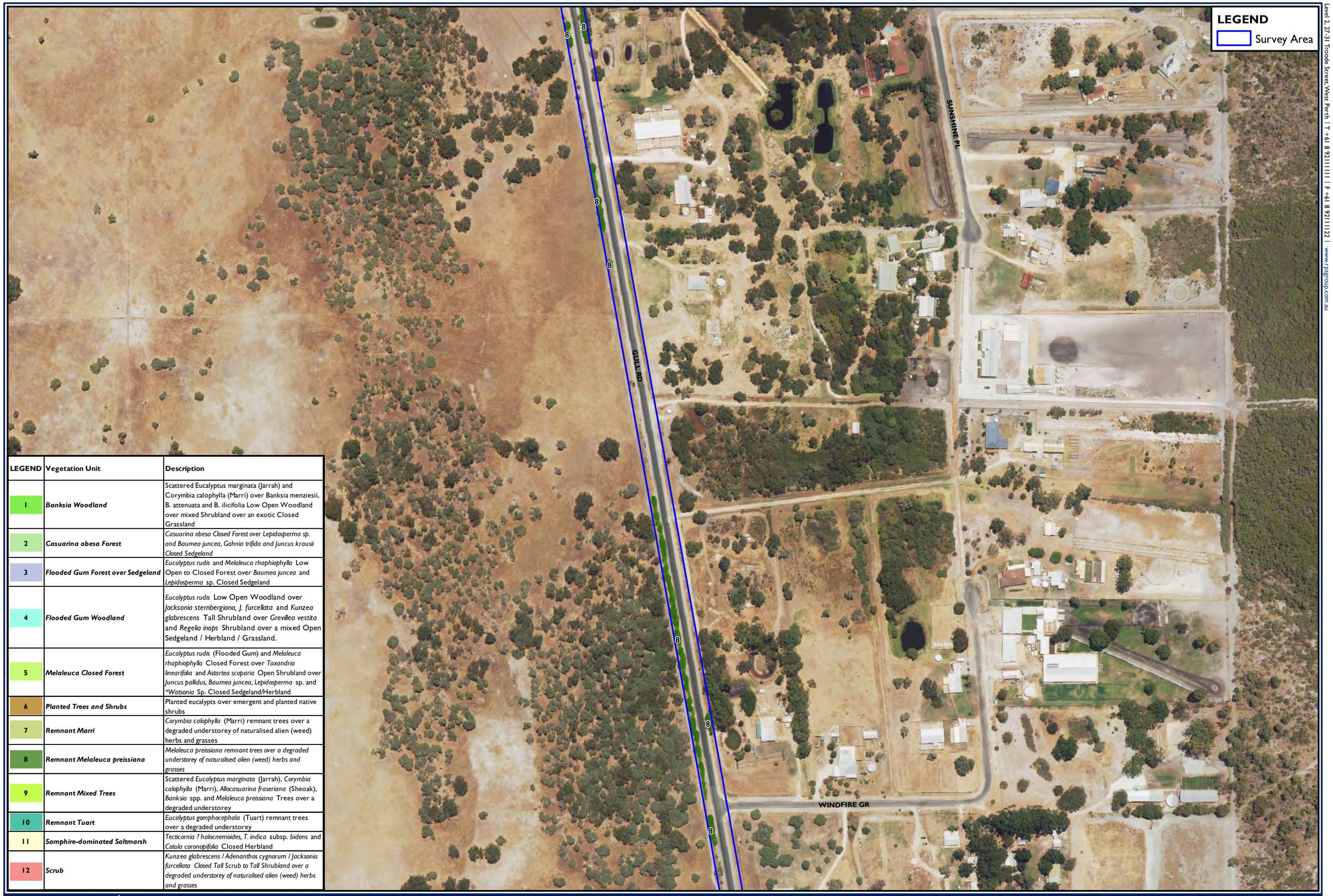

LEGEND	Vegetation Unit	Description
1	***Banksia Woodland***	Scattered Eucalyptus marginata (Jarrah) and Corymbia calophylla (Marri) over Banksia menziesii, B. attenuata and B. ilicifolia Low Open Woodland over mixed Shrubland over an exotic Closed Grassland
2	***Casuarina obesa Forest***	*Casuarina obesa Closed Forest over Lepidosperma sp. and Baumea juncea, Gahnia trifida and Juncus krausii Closed Sedgeland*
3	***Flooded Gum Forest over Sedgeland***	*Eucalyptus rudis* and *Melaleuca rhaphiophylla* Low Open to Closed Forest over *Baumea juncea* and *Lepidosperma* sp. Closed Sedgeland
4	***Flooded Gum Woodland***	*Eucalyptus rudis* Low Open Woodland over *Jacksonia sternbergiana, J. furcellata* and *Kunzea glabrescens* Tall Shrubland over *Grevillea vestita* and *Regelia inops* Shrubland over a mixed Open Sedgeland / Herbland / Grassland.
5	***Melaleuca Closed Forest***	*Eucalyptus rudis* (Flooded Gum) and *Melaleuca rhaphiophylla* Closed Forest over *Taxandria linearifolia* and *Astartea scoparia* Open Shrubland over *Juncus pallidus, Baumea juncea, Lepidosperma* sp. and **Watsonia* Sp. Closed Sedgeland/Herbland
6	***Planted Trees and Shrubs***	Planted eucalypts over emergent and planted native shrubs
7	***Remnant Marri***	*Corymbia calophylla* (Marri) remnant trees over a degraded understorey of naturalised alien (weed) herbs and grasses
8	***Remnant Melaleuca preissiana***	*Melaleuca preissiana remnant trees over a degraded understorey of naturalised alien (weed) herbs and grasses*
9	***Remnant Mixed Trees***	Scattered *Eucalyptus marginata* (Jarrah), *Corymbia calophylla* (Marri), *Allocasuarina fraseriana* (Sheoak), *Banksia* spp. and *Melaleuca preissiana* Trees over a degraded understorey
10	***Remnant Tuart***	*Eucalyptus gomphocephala* (Tuart) remnant trees over a degraded understorey
11	***Samphire-dominated Saltmarsh***	*Tecticornia ? halocnemoides, T. indica* subsp. *bidens* and *Cotula coronopifolia* Closed Herbland
12	***Scrub***	*Kunzea glabrescens / Adenanthos cygnorum / Jacksonia furcellata Closed Tall Scrub to Tall Shrubland over a degraded understorey of naturalised alien (weed) herbs and grasses*

RPS

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GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure C-7

Vegetation Units

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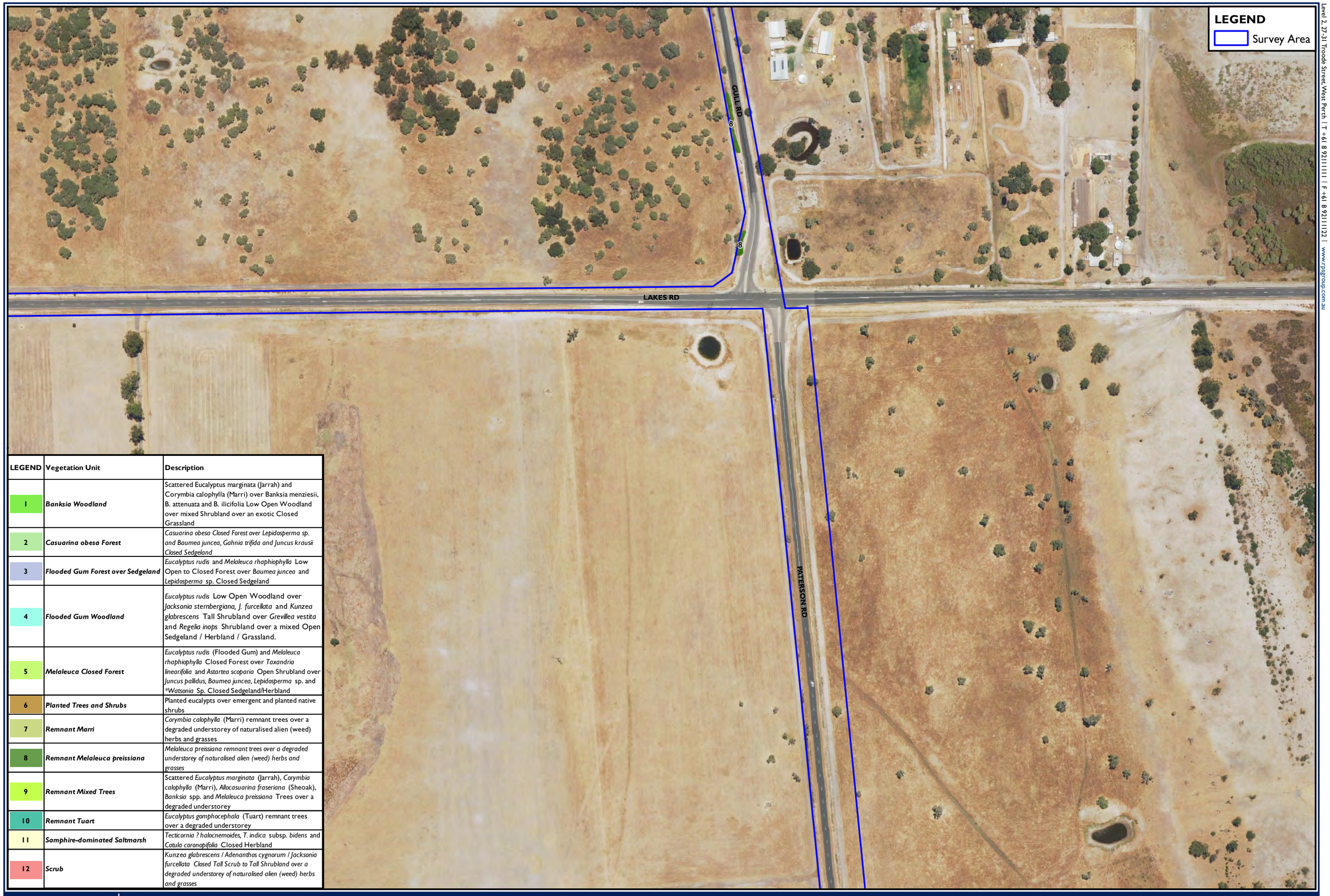

LEGEND	Vegetation Unit	Description
1	***Banksia Woodland***	Scattered Eucalyptus marginata (Jarrah) and Corymbia calophylla (Marri) over Banksia menziesii, B. attenuata and B. ilicifolia Low Open Woodland over mixed Shrubland over an exotic Closed Grassland
2	***Casuarina obesa Forest***	*Casuarina obesa Closed Forest over Lepidosperma sp. and Baumea juncea, Gahnia trifida and Juncus krausii Closed Sedgeland*
3	***Flooded Gum Forest over Sedgeland***	*Eucalyptus rudis* and *Melaleuca rhaphiophylla* Low Open to Closed Forest over *Baumea juncea* and *Lepidosperma* sp. Closed Sedgeland
4	***Flooded Gum Woodland***	*Eucalyptus rudis* Low Open Woodland over *Jacksonia sternbergiana, J. furcellata* and *Kunzea glabrescens* Tall Shrubland over *Grevillea vestita* and *Regelia inops* Shrubland over a mixed Open Sedgeland / Herbland / Grassland.
5	***Melaleuca Closed Forest***	*Eucalyptus rudis* (Flooded Gum) and *Melaleuca rhaphiophylla* Closed Forest over *Taxandria linearifolia* and *Astartea scoparia* Open Shrubland over *Juncus pallidus, Baumea juncea, Lepidosperma* sp. and **Watsonia* Sp. Closed Sedgeland/Herbland
6	***Planted Trees and Shrubs***	Planted eucalypts over emergent and planted native shrubs
7	***Remnant Marri***	*Corymbia calophylla* (Marri) remnant trees over a degraded understorey of naturalised alien (weed) herbs and grasses
8	***Remnant Melaleuca preissiana***	*Melaleuca preissiana remnant trees over a degraded understorey of naturalised alien (weed) herbs and grasses*
9	***Remnant Mixed Trees***	Scattered *Eucalyptus marginata* (Jarrah), *Corymbia calophylla* (Marri), *Allocasuarina fraseriana* (Sheoak), *Banksia* spp. and *Melaleuca preissiana* Trees over a degraded understorey
10	***Remnant Tuart***	*Eucalyptus gomphocephala* (Tuart) remnant trees over a degraded understorey
11	***Samphire-dominated Saltmarsh***	*Tecticornia ? halocnemoides, T. indica* subsp. *bidens* and *Cotula coronopifolia* Closed Herbland
12	***Scrub***	*Kunzea glabrescens / Adenanthos cygnorum / Jacksonia furcellata Closed Tall Scrub to Tall Shrubland over a degraded understorey of naturalised alien (weed) herbs and grasses*

RPS

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GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure C-8

Vegetation Units

Document Path: G:\Jobs\L_Jobs\L11266 - LandCorp Nambeelup Industrial Estate\Figures L1126606 Flora and Fauna\L11266_006_G_003_FigC 1-16 Vegetation Units_171108.mxd

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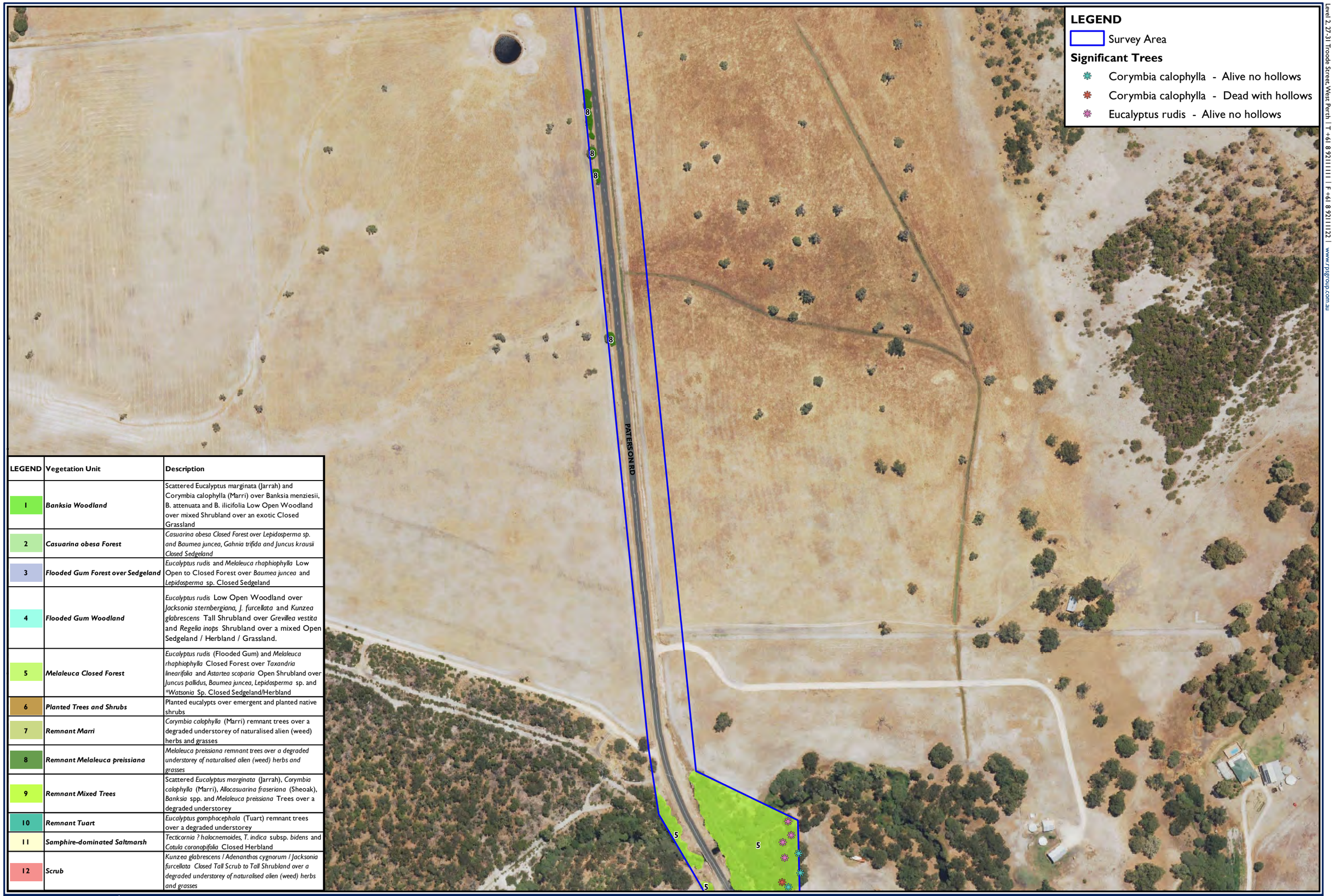

LEGEND	Vegetation Unit	Description
1	***Banksia Woodland***	Scattered Eucalyptus marginata (Jarrah) and Corymbia calophylla (Marri) over Banksia menziesii, B. attenuata and B. ilicifolia Low Open Woodland over mixed Shrubland over an exotic Closed Grassland
2	***Casuarina obesa Forest***	*Casuarina obesa Closed Forest over Lepidosperma sp. and Baumea juncea, Gahnia trifida and Juncus krausii Closed Sedgeland*
3	***Flooded Gum Forest over Sedgeland***	*Eucalyptus rudis* and *Melaleuca rhaphiophylla* Low Open to Closed Forest over *Baumea juncea* and *Lepidosperma* sp. Closed Sedgeland
4	***Flooded Gum Woodland***	*Eucalyptus rudis* Low Open Woodland over *Jacksonia sternbergiana, J. furcellata* and *Kunzea glabrescens* Tall Shrubland over *Grevillea vestita* and *Regelia inops* Shrubland over a mixed Open Sedgeland / Herbland / Grassland.
5	***Melaleuca Closed Forest***	*Eucalyptus rudis* (Flooded Gum) and *Melaleuca rhaphiophylla* Closed Forest over *Taxandria linearifolia* and *Astartea scoparia* Open Shrubland over *Juncus pallidus, Baumea juncea, Lepidosperma* sp. and **Watsonia* Sp. Closed Sedgeland/Herbland
6	***Planted Trees and Shrubs***	Planted eucalypts over emergent and planted native shrubs
7	***Remnant Marri***	*Corymbia calophylla* (Marri) remnant trees over a degraded understorey of naturalised alien (weed) herbs and grasses
8	***Remnant Melaleuca preissiana***	*Melaleuca preissiana remnant trees over a degraded understorey of naturalised alien (weed) herbs and grasses*
9	***Remnant Mixed Trees***	Scattered *Eucalyptus marginata* (Jarrah), *Corymbia calophylla* (Marri), *Allocasuarina fraseriana* (Sheoak), *Banksia* spp. and *Melaleuca preissiana* Trees over a degraded understorey
10	***Remnant Tuart***	*Eucalyptus gomphocephala* (Tuart) remnant trees over a degraded understorey
11	***Samphire-dominated Saltmarsh***	*Tecticornia ? halocnemoides, T. indica* subsp. *bidens* and *Cotula coronopifolia* Closed Herbland
12	***Scrub***	*Kunzea glabrescens / Adenanthos cygnorum / Jacksonia furcellata Closed Tall Scrub to Tall Shrubland over a degraded understorey of naturalised alien (weed) herbs and grasses*

RPS

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GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure C-9

Vegetation Units

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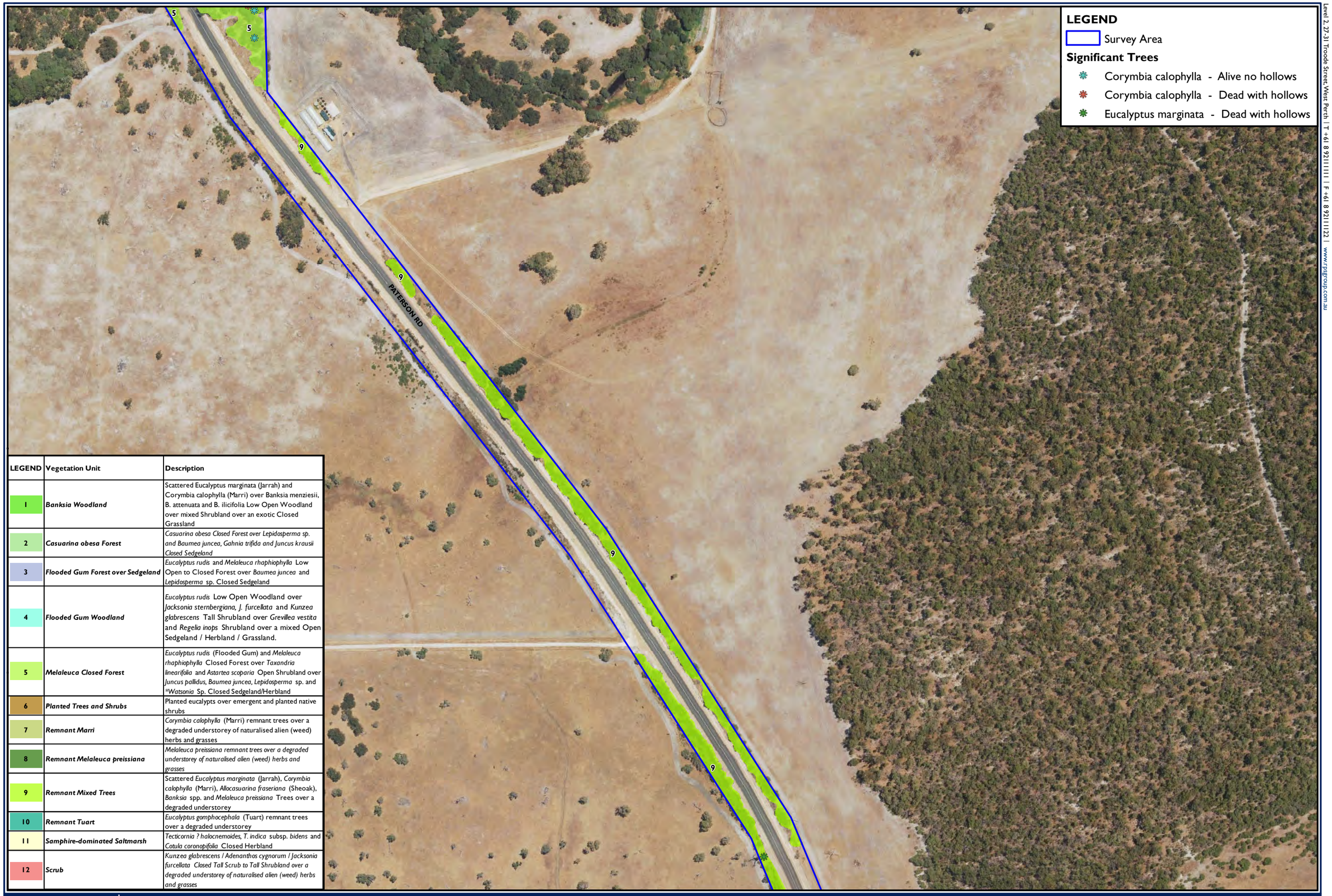

LEGEND	Vegetation Unit	Description
1	***Banksia Woodland***	Scattered Eucalyptus marginata (Jarrah) and Corymbia calophylla (Marri) over Banksia menziesii, B. attenuata and B. ilicifolia Low Open Woodland over mixed Shrubland over an exotic Closed Grassland
2	***Casuarina obesa Forest***	*Casuarina obesa Closed Forest over Lepidosperma sp. and Baumea juncea, Gahnia trifida and Juncus krausii Closed Sedgeland*
3	***Flooded Gum Forest over Sedgeland***	*Eucalyptus rudis* and *Melaleuca rhaphiophylla* Low Open to Closed Forest over *Baumea juncea* and *Lepidosperma* sp. Closed Sedgeland
4	***Flooded Gum Woodland***	*Eucalyptus rudis* Low Open Woodland over *Jacksonia sternbergiana, J. furcellata* and *Kunzea glabrescens* Tall Shrubland over *Grevillea vestita* and *Regelia inops* Shrubland over a mixed Open Sedgeland / Herbland / Grassland.
5	***Melaleuca Closed Forest***	*Eucalyptus rudis* (Flooded Gum) and *Melaleuca rhaphiophylla* Closed Forest over *Taxandria linearifolia* and *Astartea scoparia* Open Shrubland over *Juncus pallidus, Baumea juncea, Lepidosperma* sp. and **Watsonia* Sp. Closed Sedgeland/Herbland
6	***Planted Trees and Shrubs***	Planted eucalypts over emergent and planted native shrubs
7	***Remnant Marri***	*Corymbia calophylla* (Marri) remnant trees over a degraded understorey of naturalised alien (weed) herbs and grasses
8	***Remnant Melaleuca preissiana***	*Melaleuca preissiana remnant trees over a degraded understorey of naturalised alien (weed) herbs and grasses*
9	***Remnant Mixed Trees***	Scattered *Eucalyptus marginata* (Jarrah), *Corymbia calophylla* (Marri), *Allocasuarina fraseriana* (Sheoak), *Banksia* spp. and *Melaleuca preissiana* Trees over a degraded understorey
10	***Remnant Tuart***	*Eucalyptus gomphocephala* (Tuart) remnant trees over a degraded understorey
11	***Samphire-dominated Saltmarsh***	*Tecticornia ? halocnemoides, T. indica* subsp. *bidens* and *Cotula coronopifolia* Closed Herbland
12	***Scrub***	*Kunzea glabrescens / Adenanthos cygnorum / Jacksonia furcellata Closed Tall Scrub to Tall Shrubland over a degraded understorey of naturalised alien (weed) herbs and grasses*

RPS

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GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure C-10

Vegetation Units

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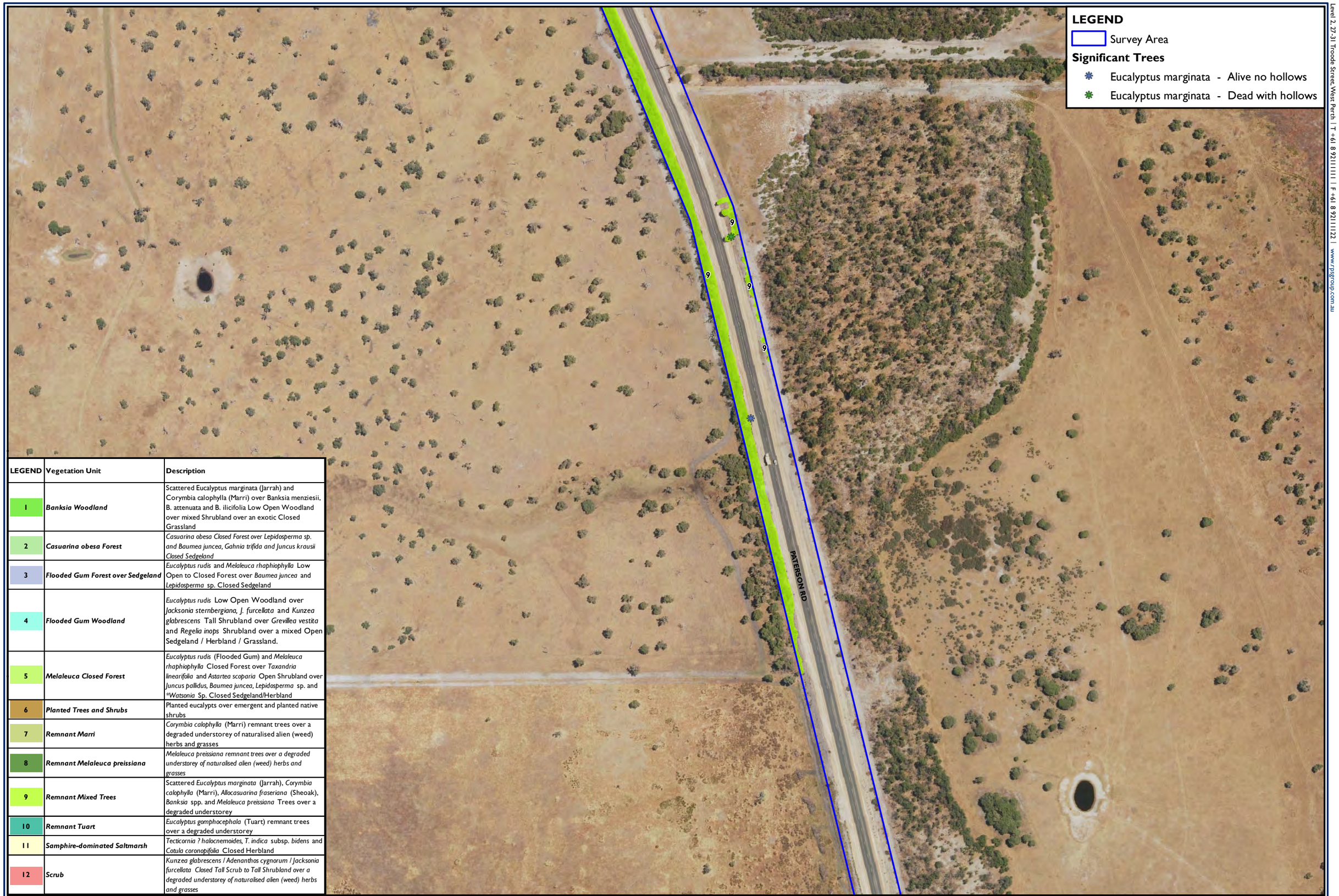

LEGEND	Vegetation Unit	Description
1	***Banksia Woodland***	Scattered Eucalyptus marginata (Jarrah) and Corymbia calophylla (Marri) over Banksia menziesii, B. attenuata and B. ilicifolia Low Open Woodland over mixed Shrubland over an exotic Closed Grassland
2	***Casuarina obesa Forest***	*Casuarina obesa Closed Forest over Lepidosperma sp. and Baumea juncea, Gahnia trifida and Juncus krausii Closed Sedgeland*
3	***Flooded Gum Forest over Sedgeland***	*Eucalyptus rudis* and *Melaleuca rhaphiophylla* Low Open to Closed Forest over *Baumea juncea* and *Lepidosperma* sp. Closed Sedgeland
4	***Flooded Gum Woodland***	*Eucalyptus rudis* Low Open Woodland over *Jacksonia sternbergiana, J. furcellata* and *Kunzea glabrescens* Tall Shrubland over *Grevillea vestita* and *Regelia inops* Shrubland over a mixed Open Sedgeland / Herbland / Grassland.
5	***Melaleuca Closed Forest***	*Eucalyptus rudis* (Flooded Gum) and *Melaleuca rhaphiophylla* Closed Forest over *Taxandria linearifolia* and *Astartea scoparia* Open Shrubland over *Juncus pallidus, Baumea juncea, Lepidosperma* sp. and **Watsonia* Sp. Closed Sedgeland/Herbland
6	***Planted Trees and Shrubs***	Planted eucalypts over emergent and planted native shrubs
7	***Remnant Marri***	*Corymbia calophylla* (Marri) remnant trees over a degraded understorey of naturalised alien (weed) herbs and grasses
8	***Remnant Melaleuca preissiana***	*Melaleuca preissiana remnant trees over a degraded understorey of naturalised alien (weed) herbs and grasses*
9	***Remnant Mixed Trees***	Scattered *Eucalyptus marginata* (Jarrah), *Corymbia calophylla* (Marri), *Allocasuarina fraseriana* (Sheoak), *Banksia* spp. and *Melaleuca preissiana* Trees over a degraded understorey
10	***Remnant Tuart***	*Eucalyptus gomphocephala* (Tuart) remnant trees over a degraded understorey
11	***Samphire-dominated Saltmarsh***	*Tecticornia ? halocnemoides, T. indica* subsp. *bidens* and *Cotula coronopifolia* Closed Herbland
12	***Scrub***	*Kunzea glabrescens / Adenanthos cygnorum / Jacksonia furcellata Closed Tall Scrub to Tall Shrubland over a degraded understorey of naturalised alien (weed) herbs and grasses*

RPS

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GDA 1994 MGA Zone 50
0 12.5 25 50 75 100 m

Figure C-11

Vegetation Units

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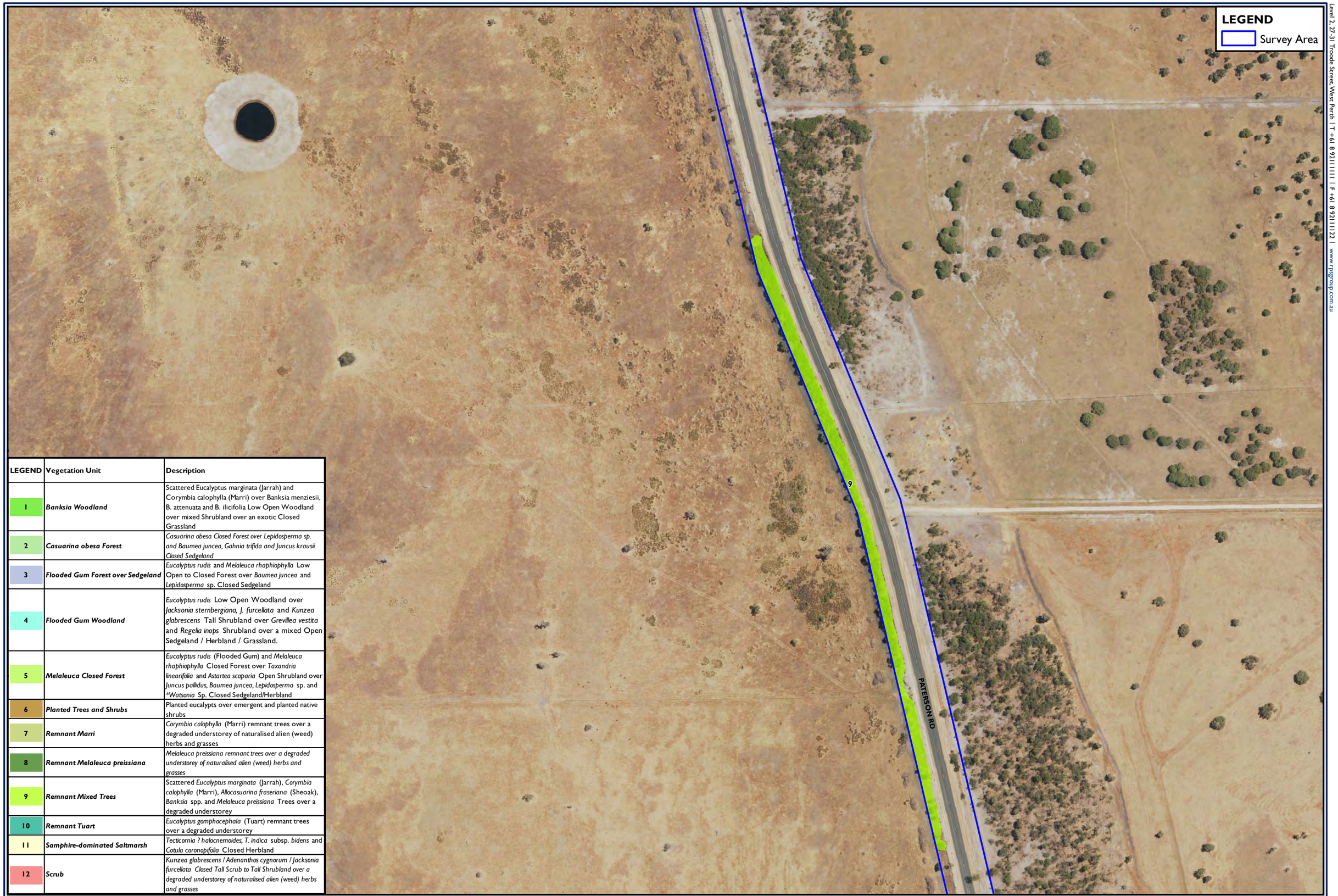

LEGEND	Vegetation Unit	Description
1	***Banksia Woodland***	Scattered Eucalyptus marginata (Jarrah) and Corymbia calophylla (Marri) over Banksia menziesii, B. attenuata and B. ilicifolia Low Open Woodland over mixed Shrubland over an exotic Closed Grassland
2	***Casuarina obesa Forest***	*Casuarina obesa Closed Forest over Lepidosperma sp. and Baumea juncea, Gahnia trifida and Juncus krausii Closed Sedgeland*
3	***Flooded Gum Forest over Sedgeland***	*Eucalyptus rudis* and *Melaleuca rhaphiophylla* Low Open to Closed Forest over *Baumea juncea* and *Lepidosperma* sp. Closed Sedgeland
4	***Flooded Gum Woodland***	*Eucalyptus rudis* Low Open Woodland over *Jacksonia sternbergiana, J. furcellata* and *Kunzea glabrescens* Tall Shrubland over *Grevillea vestita* and *Regelia inops* Shrubland over a mixed Open Sedgeland / Herbland / Grassland.
5	***Melaleuca Closed Forest***	*Eucalyptus rudis* (Flooded Gum) and *Melaleuca rhaphiophylla* Closed Forest over *Taxandria linearifolia* and *Astartea scoparia* Open Shrubland over *Juncus pallidus, Baumea juncea, Lepidosperma* sp. and **Watsonia* Sp. Closed Sedgeland/Herbland
6	***Planted Trees and Shrubs***	Planted eucalypts over emergent and planted native shrubs
7	***Remnant Marri***	*Corymbia calophylla* (Marri) remnant trees over a degraded understorey of naturalised alien (weed) herbs and grasses
8	***Remnant Melaleuca preissiana***	*Melaleuca preissiana remnant trees over a degraded understorey of naturalised alien (weed) herbs and grasses*
9	***Remnant Mixed Trees***	Scattered *Eucalyptus marginata* (Jarrah), *Corymbia calophylla* (Marri), *Allocasuarina fraseriana* (Sheoak), *Banksia* spp. and *Melaleuca preissiana* Trees over a degraded understorey
10	***Remnant Tuart***	*Eucalyptus gomphocephala* (Tuart) remnant trees over a degraded understorey
11	***Samphire-dominated Saltmarsh***	*Tecticornia ? halocnemoides, T. indica* subsp. *bidens* and *Cotula coronopifolia* Closed Herbland
12	***Scrub***	*Kunzea glabrescens / Adenanthos cygnorum / Jacksonia furcellata Closed Tall Scrub to Tall Shrubland over a degraded understorey of naturalised alien (weed) herbs and grasses*

RPS

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GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure C-12

Vegetation Units

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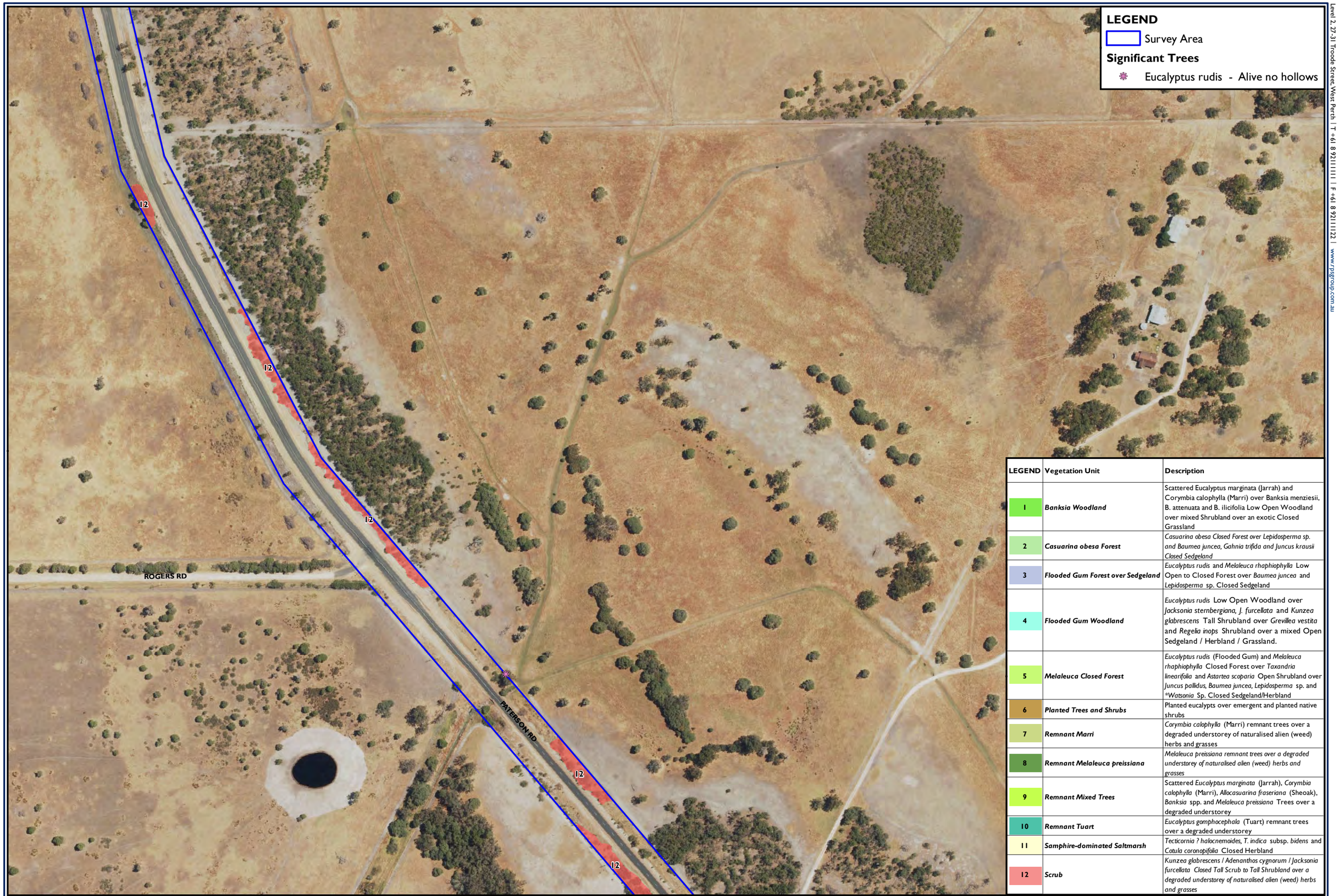

LEGEND	Vegetation Unit	Description
1	***Banksia Woodland***	Scattered Eucalyptus marginata (Jarrah) and Corymbia calophylla (Marri) over Banksia menziesii, B. attenuata and B. ilicifolia Low Open Woodland over mixed Shrubland over an exotic Closed Grassland
2	***Casuarina obesa Forest***	*Casuarina obesa Closed Forest over Lepidosperma sp. and Baumea juncea, Gahnia trifida and Juncus krausii Closed Sedgeland*
3	***Flooded Gum Forest over Sedgeland***	*Eucalyptus rudis* and *Melaleuca rhaphiophylla* Low Open to Closed Forest over *Baumea juncea* and *Lepidosperma* sp. Closed Sedgeland
4	***Flooded Gum Woodland***	*Eucalyptus rudis* Low Open Woodland over *Jacksonia sternbergiana, J. furcellata* and *Kunzea glabrescens* Tall Shrubland over *Grevillea vestita* and *Regelia inops* Shrubland over a mixed Open Sedgeland / Herbland / Grassland.
5	***Melaleuca Closed Forest***	*Eucalyptus rudis* (Flooded Gum) and *Melaleuca rhaphiophylla* Closed Forest over *Taxandria linearifolia* and *Astartea scoparia* Open Shrubland over *Juncus pallidus, Baumea juncea, Lepidosperma* sp. and **Watsonia* Sp. Closed Sedgeland/Herbland
6	***Planted Trees and Shrubs***	Planted eucalypts over emergent and planted native shrubs
7	***Remnant Marri***	*Corymbia calophylla* (Marri) remnant trees over a degraded understorey of naturalised alien (weed) herbs and grasses
8	***Remnant Melaleuca preissiana***	*Melaleuca preissiana remnant trees over a degraded understorey of naturalised alien (weed) herbs and grasses*
9	***Remnant Mixed Trees***	Scattered *Eucalyptus marginata* (Jarrah), *Corymbia calophylla* (Marri), *Allocasuarina fraseriana* (Sheoak), *Banksia* spp. and *Melaleuca preissiana* Trees over a degraded understorey
10	***Remnant Tuart***	*Eucalyptus gomphocephala* (Tuart) remnant trees over a degraded understorey
11	***Samphire-dominated Saltmarsh***	*Tecticornia ? halocnemoides, T. indica* subsp. *bidens* and *Cotula coronopifolia* Closed Herbland
12	***Scrub***	*Kunzea glabrescens / Adenanthos cygnorum / Jacksonia furcellata Closed Tall Scrub to Tall Shrubland over a degraded understorey of naturalised alien (weed) herbs and grasses*

RPS

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GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure C-13

Vegetation Units

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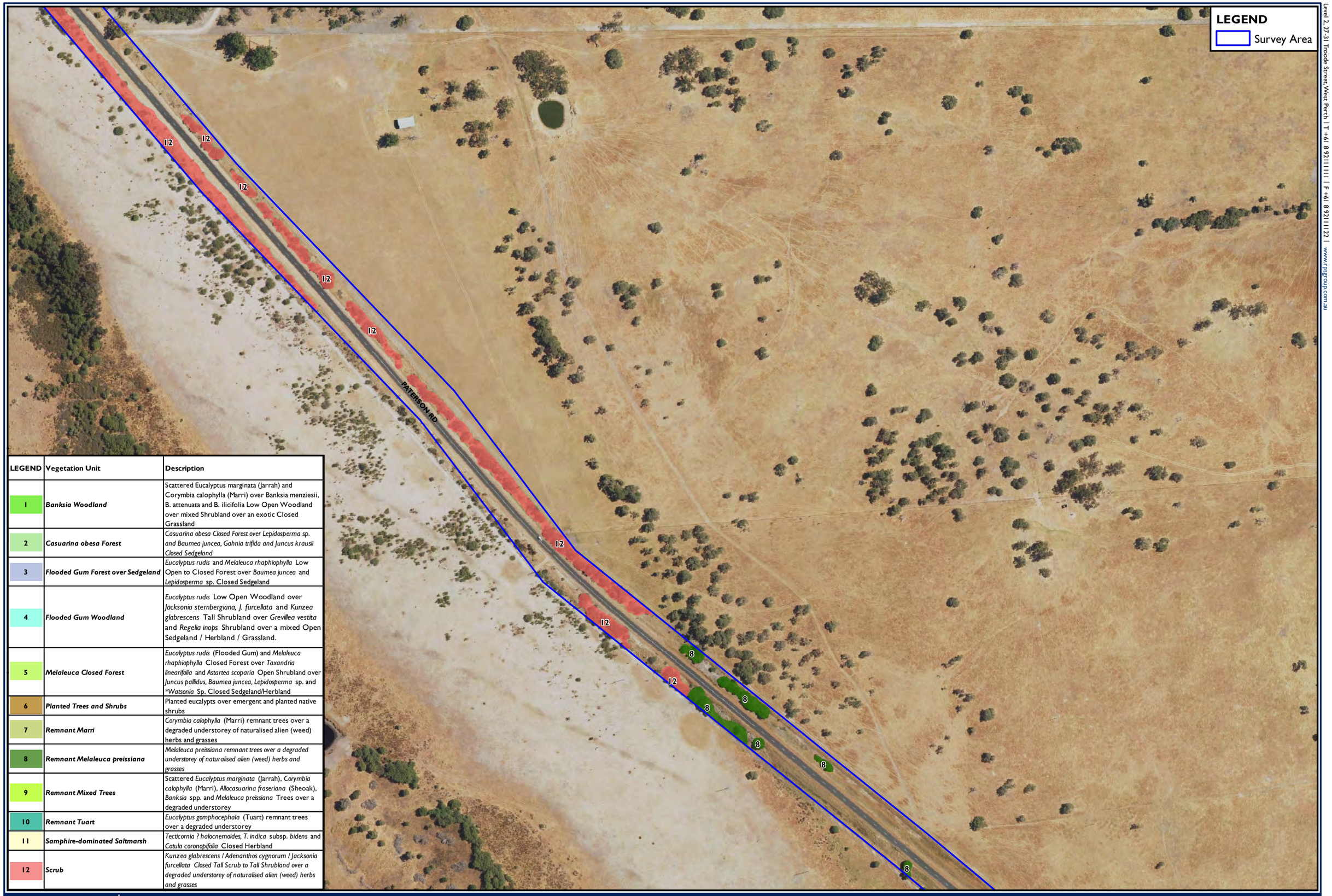

LEGEND	Vegetation Unit	Description
1	***Banksia Woodland***	Scattered Eucalyptus marginata (Jarrah) and Corymbia calophylla (Marri) over Banksia menziesii, B. attenuata and B. ilicifolia Low Open Woodland over mixed Shrubland over an exotic Closed Grassland
2	***Casuarina obesa Forest***	*Casuarina obesa Closed Forest over Lepidosperma sp. and Baumea juncea, Gahnia trifida and Juncus krausii Closed Sedgeland*
3	***Flooded Gum Forest over Sedgeland***	*Eucalyptus rudis* and *Melaleuca rhaphiophylla* Low Open to Closed Forest over *Baumea juncea* and *Lepidosperma* sp. Closed Sedgeland
4	***Flooded Gum Woodland***	*Eucalyptus rudis* Low Open Woodland over *Jacksonia sternbergiana, J. furcellata* and *Kunzea glabrescens* Tall Shrubland over *Grevillea vestita* and *Regelia inops* Shrubland over a mixed Open Sedgeland / Herbland / Grassland.
5	***Melaleuca Closed Forest***	*Eucalyptus rudis* (Flooded Gum) and *Melaleuca rhaphiophylla* Closed Forest over *Taxandria linearifolia* and *Astartea scoparia* Open Shrubland over *Juncus pallidus, Baumea juncea, Lepidosperma* sp. and **Watsonia* Sp. Closed Sedgeland/Herbland
6	***Planted Trees and Shrubs***	Planted eucalypts over emergent and planted native shrubs
7	***Remnant Marri***	*Corymbia calophylla* (Marri) remnant trees over a degraded understorey of naturalised alien (weed) herbs and grasses
8	***Remnant Melaleuca preissiana***	*Melaleuca preissiana remnant trees over a degraded understorey of naturalised alien (weed) herbs and grasses*
9	***Remnant Mixed Trees***	Scattered *Eucalyptus marginata* (Jarrah), *Corymbia calophylla* (Marri), *Allocasuarina fraseriana* (Sheoak), *Banksia* spp. and *Melaleuca preissiana* Trees over a degraded understorey
10	***Remnant Tuart***	*Eucalyptus gomphocephala* (Tuart) remnant trees over a degraded understorey
11	***Samphire-dominated Saltmarsh***	*Tecticornia ? halocnemoides, T. indica* subsp. *bidens* and *Cotula coronopifolia* Closed Herbland
12	***Scrub***	*Kunzea glabrescens / Adenanthos cygnorum / Jacksonia furcellata Closed Tall Scrub to Tall Shrubland over a degraded understorey of naturalised alien (weed) herbs and grasses*

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Doc Number: 003
Date: 08.07.17
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Created by: MA
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GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure C-14

Vegetation Units

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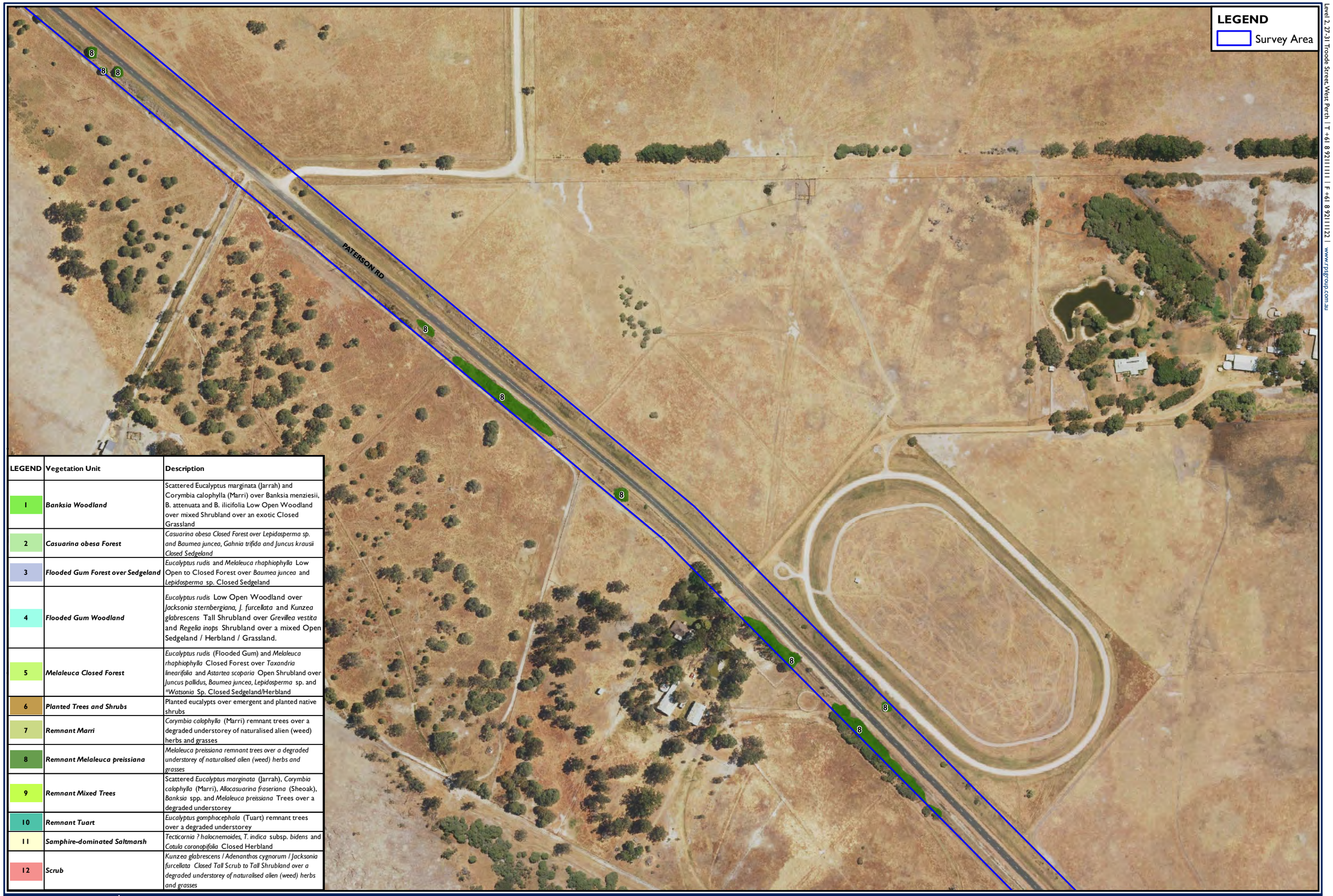

LEGEND	Vegetation Unit	Description
1	***Banksia Woodland***	Scattered Eucalyptus marginata (Jarrah) and Corymbia calophylla (Marri) over Banksia menziesii, B. attenuata and B. ilicifolia Low Open Woodland over mixed Shrubland over an exotic Closed Grassland
2	***Casuarina obesa Forest***	*Casuarina obesa Closed Forest over Lepidosperma sp. and Baumea juncea, Gahnia trifida and Juncus krausii Closed Sedgeland*
3	***Flooded Gum Forest over Sedgeland***	*Eucalyptus rudis* and *Melaleuca rhaphiophylla* Low Open to Closed Forest over *Baumea juncea* and *Lepidosperma* sp. Closed Sedgeland
4	***Flooded Gum Woodland***	*Eucalyptus rudis* Low Open Woodland over *Jacksonia sternbergiana, J. furcellata* and *Kunzea glabrescens* Tall Shrubland over *Grevillea vestita* and *Regelia inops* Shrubland over a mixed Open Sedgeland / Herbland / Grassland.
5	***Melaleuca Closed Forest***	*Eucalyptus rudis* (Flooded Gum) and *Melaleuca rhaphiophylla* Closed Forest over *Taxandria linearifolia* and *Astartea scoparia* Open Shrubland over *Juncus pallidus, Baumea juncea, Lepidosperma* sp. and **Watsonia* Sp. Closed Sedgeland/Herbland
6	***Planted Trees and Shrubs***	Planted eucalypts over emergent and planted native shrubs
7	***Remnant Marri***	*Corymbia calophylla* (Marri) remnant trees over a degraded understorey of naturalised alien (weed) herbs and grasses
8	***Remnant Melaleuca preissiana***	*Melaleuca preissiana remnant trees over a degraded understorey of naturalised alien (weed) herbs and grasses*
9	***Remnant Mixed Trees***	Scattered *Eucalyptus marginata* (Jarrah), *Corymbia calophylla* (Marri), *Allocasuarina fraseriana* (Sheoak), *Banksia* spp. and *Melaleuca preissiana* Trees over a degraded understorey
10	***Remnant Tuart***	*Eucalyptus gomphocephala* (Tuart) remnant trees over a degraded understorey
11	***Samphire-dominated Saltmarsh***	*Tecticornia ? halocnemoides, T. indica* subsp. *bidens* and *Cotula coronopifolia* Closed Herbland
12	***Scrub***	*Kunzea glabrescens / Adenanthos cygnorum / Jacksonia furcellata Closed Tall Scrub to Tall Shrubland over a degraded understorey of naturalised alien (weed) herbs and grasses*

RPS

Job Number: L11266.006
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GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure C-15

Vegetation Units

Document Path: G:\Jobs\L_Jobs\L11266 - LandCorp Nambeelup Industrial Estate\Figures L1126606 Flora and Fauna\L11266_006_G_003_FigC 1-16 Vegetation Units_171108.mxd

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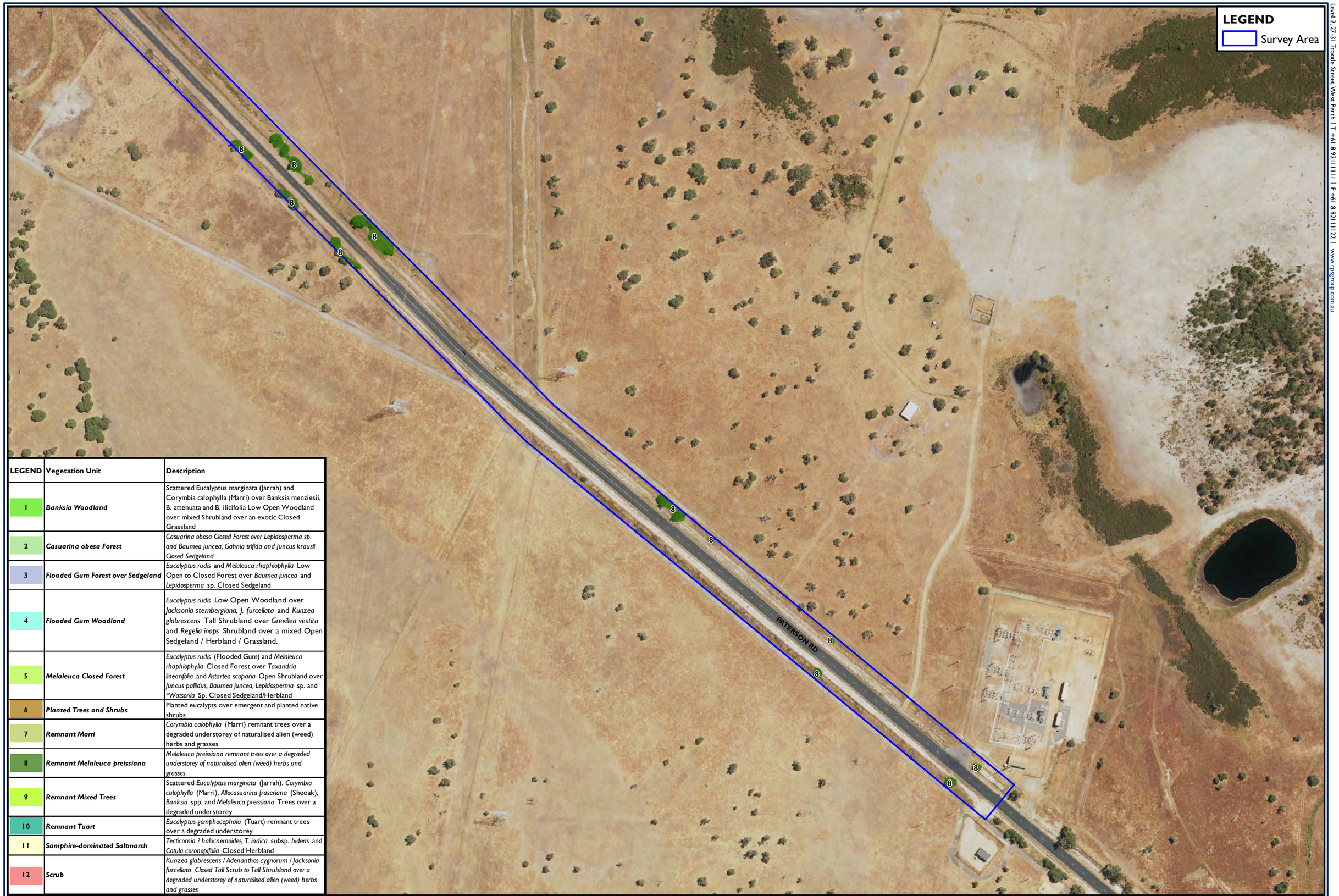

LEGEND	Vegetation Unit	Description
1	***Banksia Woodland***	Scattered Eucalyptus marginata (Jarrah) and Corymbia calophylla (Marri) over Banksia menziesii, B. attenuata and B. ilicifolia Low Open Woodland over mixed Shrubland over an exotic Closed Grassland
2	***Casuarina obesa Forest***	*Casuarina obesa Closed Forest over Lepidosperma sp. and Baumea juncea, Gahnia trifida and Juncus krausii Closed Sedgeland*
3	***Flooded Gum Forest over Sedgeland***	*Eucalyptus rudis* and *Melaleuca rhaphiophylla* Low Open to Closed Forest over *Baumea juncea* and *Lepidosperma* sp. Closed Sedgeland
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5	***Melaleuca Closed Forest***	*Eucalyptus rudis* (Flooded Gum) and *Melaleuca rhaphiophylla* Closed Forest over *Taxandria linearifolia* and *Astartea scoparia* Open Shrubland over *Juncus pallidus, Baumea juncea, Lepidosperma* sp. and **Watsonia* Sp. Closed Sedgeland/Herbland
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12	***Scrub***	*Kunzea glabrescens / Adenanthos cygnorum / Jacksonia furcellata Closed Tall Scrub to Tall Shrubland over a degraded understorey of naturalised alien (weed) herbs and grasses*

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GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure C-16

Vegetation Units

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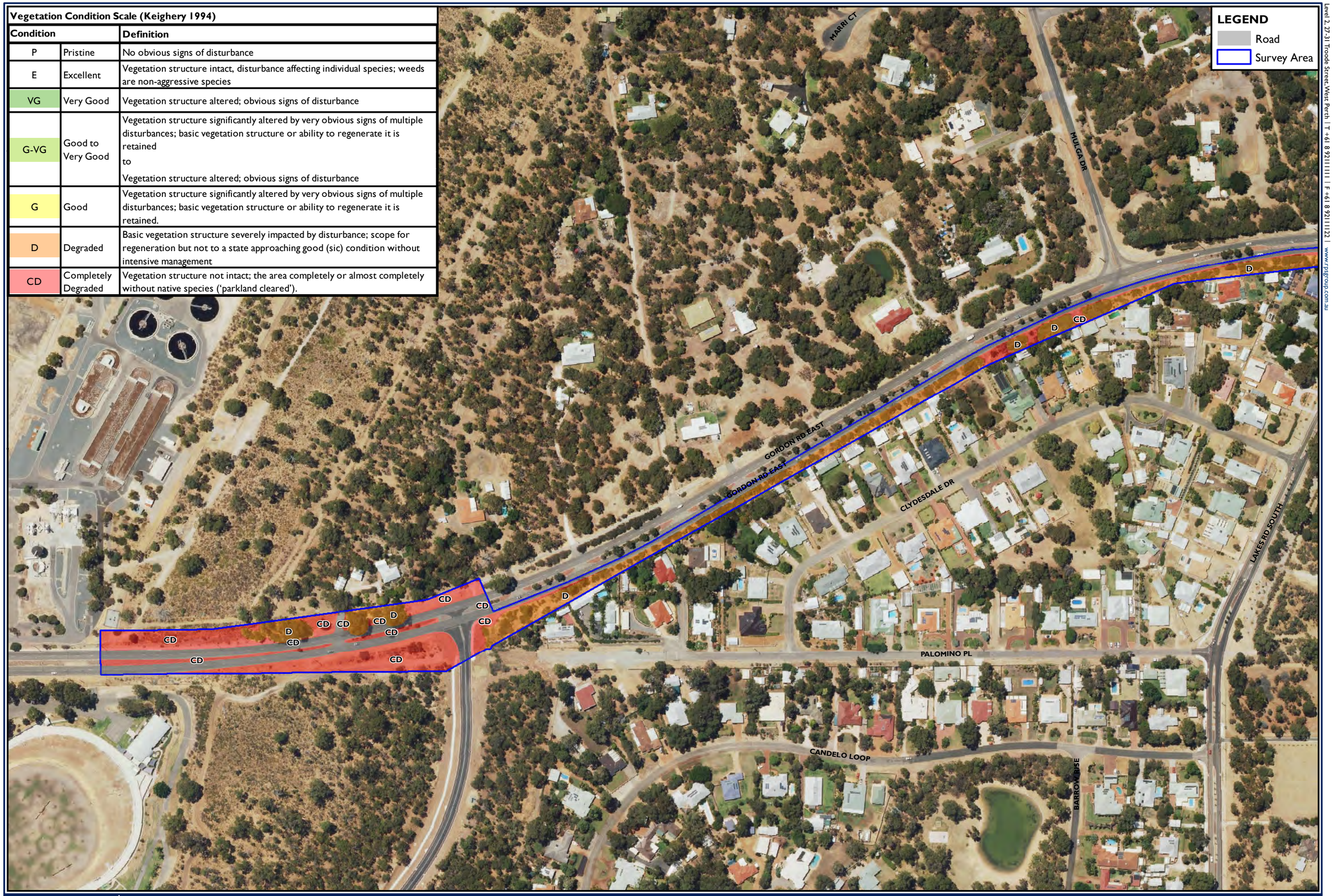
Vegetation Condition Scale (Keighery 1994)		
Condition		**Definition**
P	Pristine	No obvious signs of disturbance
E	Excellent	Vegetation structure intact, disturbance affecting individual species; weeds are non-aggressive species
VG	Very Good	Vegetation structure altered; obvious signs of disturbance
G-VG	Good to Very Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances; basic vegetation structure or ability to regenerate it is retained to Vegetation structure altered; obvious signs of disturbance
G	Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances; basic vegetation structure or ability to regenerate it is retained.
D	Degraded	Basic vegetation structure severely impacted by disturbance; scope for regeneration but not to a state approaching good (sic) condition without intensive management
CD	Completely Degraded	Vegetation structure not intact; the area completely or almost completely without native species ('parkland cleared').



RPS

Job Number: L11266.006
Doc Number: 004
Date: 04.07.17
Scale: 1:3,000 @ A3
Created by: MA
Source: Cadastre - Landgate, 2017 Orthophoto - Landgate, Feb 2017

GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure D-1

Vegetation Condition

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Vegetation Condition Scale (Keighery 1994)		
Condition		**Definition**
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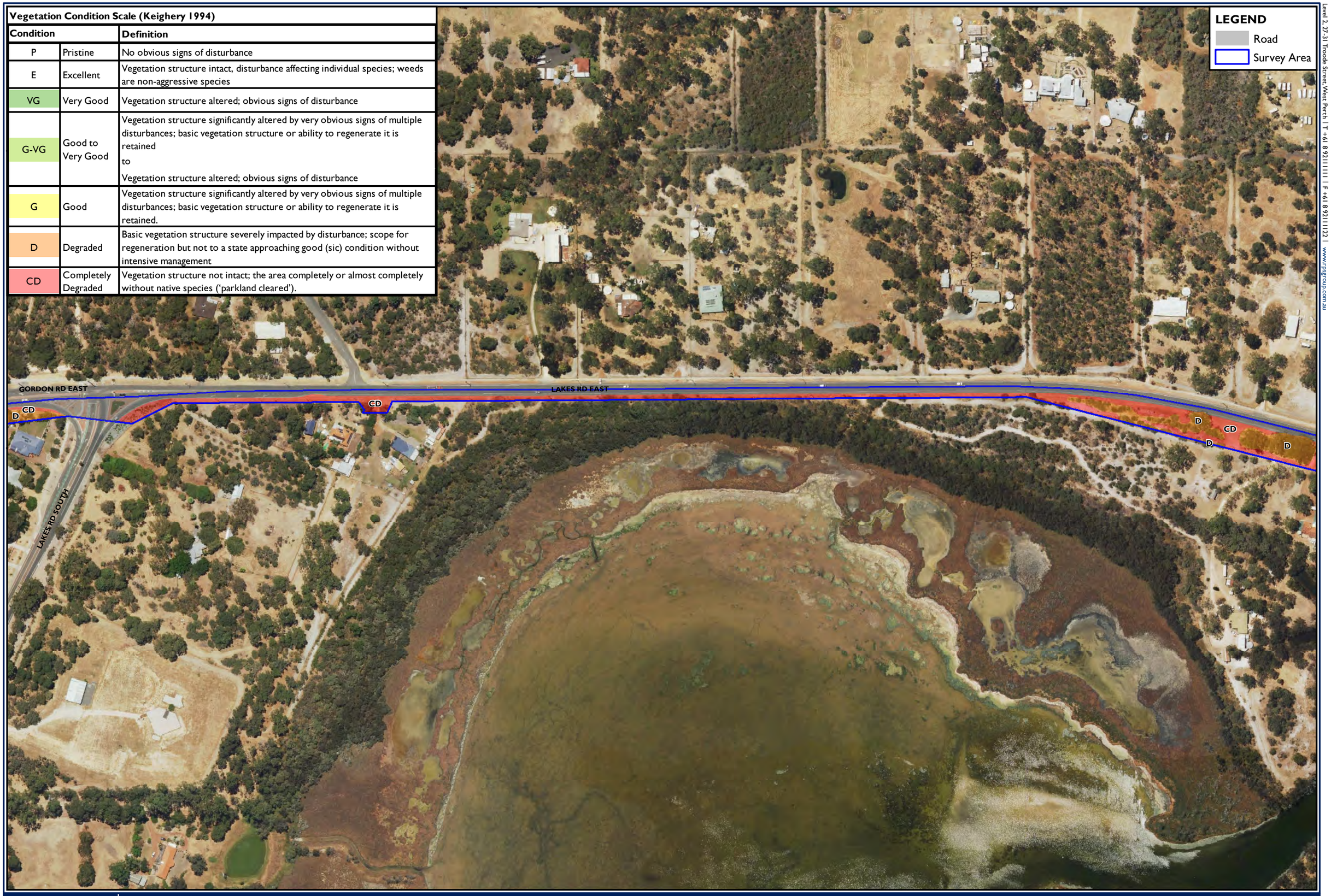

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Job Number: L11266.006
Doc Number: 004
Date: 04.07.17
Scale: 1:3,000 @ A3
Created by: MA
Source: Cadastre - Landgate, 2017 Orthophoto - Landgate, Feb 2017

GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure D-2

Vegetation Condition

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Vegetation Condition Scale (Keighery 1994)

Condition		Definition
P	Pristine	No obvious signs of disturbance
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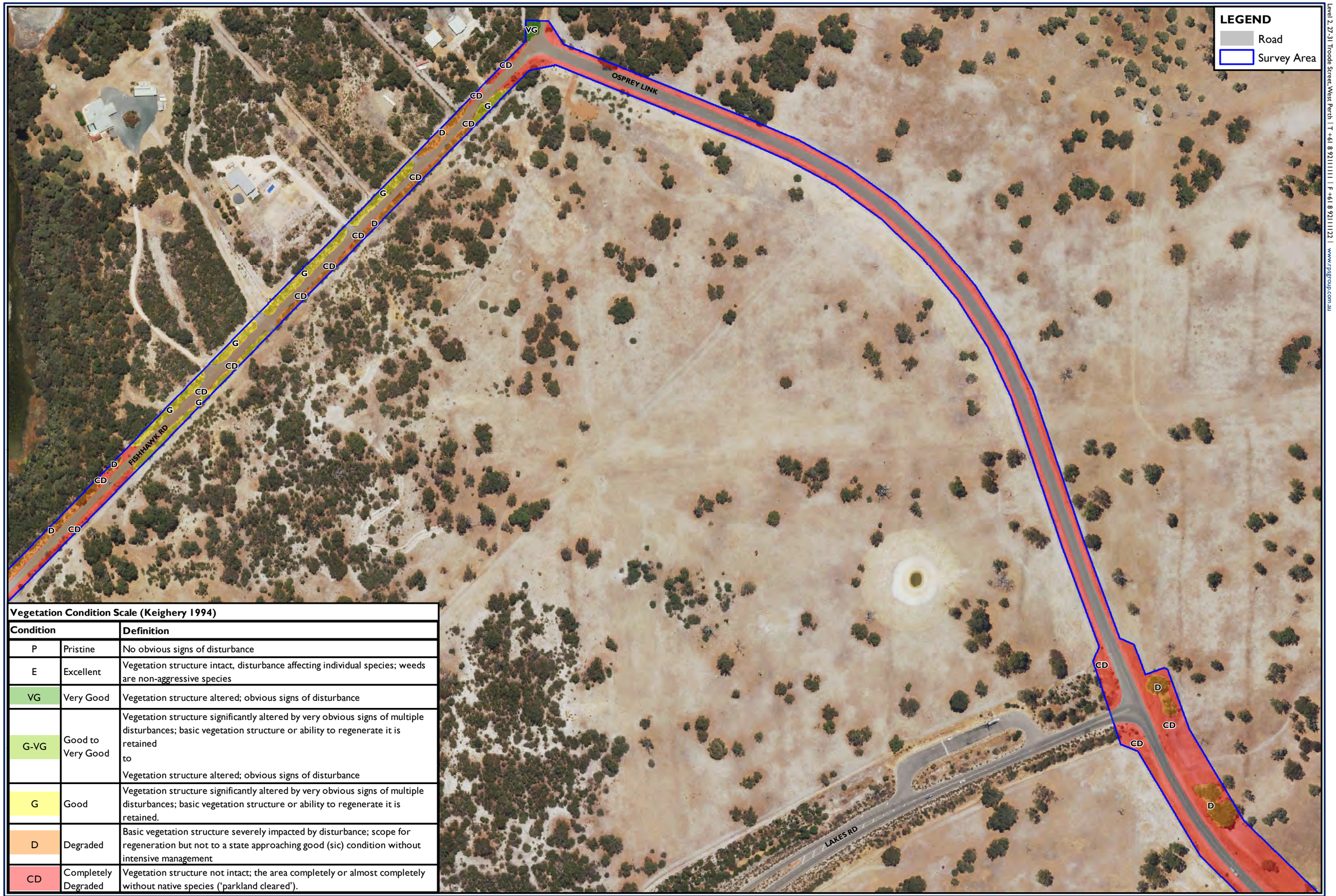
0 12.5 25 50 75 100 m

Figure D-3

Vegetation Condition

Level 2, 27-31 Troode Street, West Perth | T +61 8 9211 1111 | F +61 8 9211 1122 | www.rpsgroup.com.au



Vegetation Condition Scale (Keighery 1994)

Condition		Definition
P	Pristine	No obvious signs of disturbance
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Job Number: L11266.006
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Date: 04.07.17
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0 12.5 25 50 75 100 m

Figure D-4

Vegetation Condition

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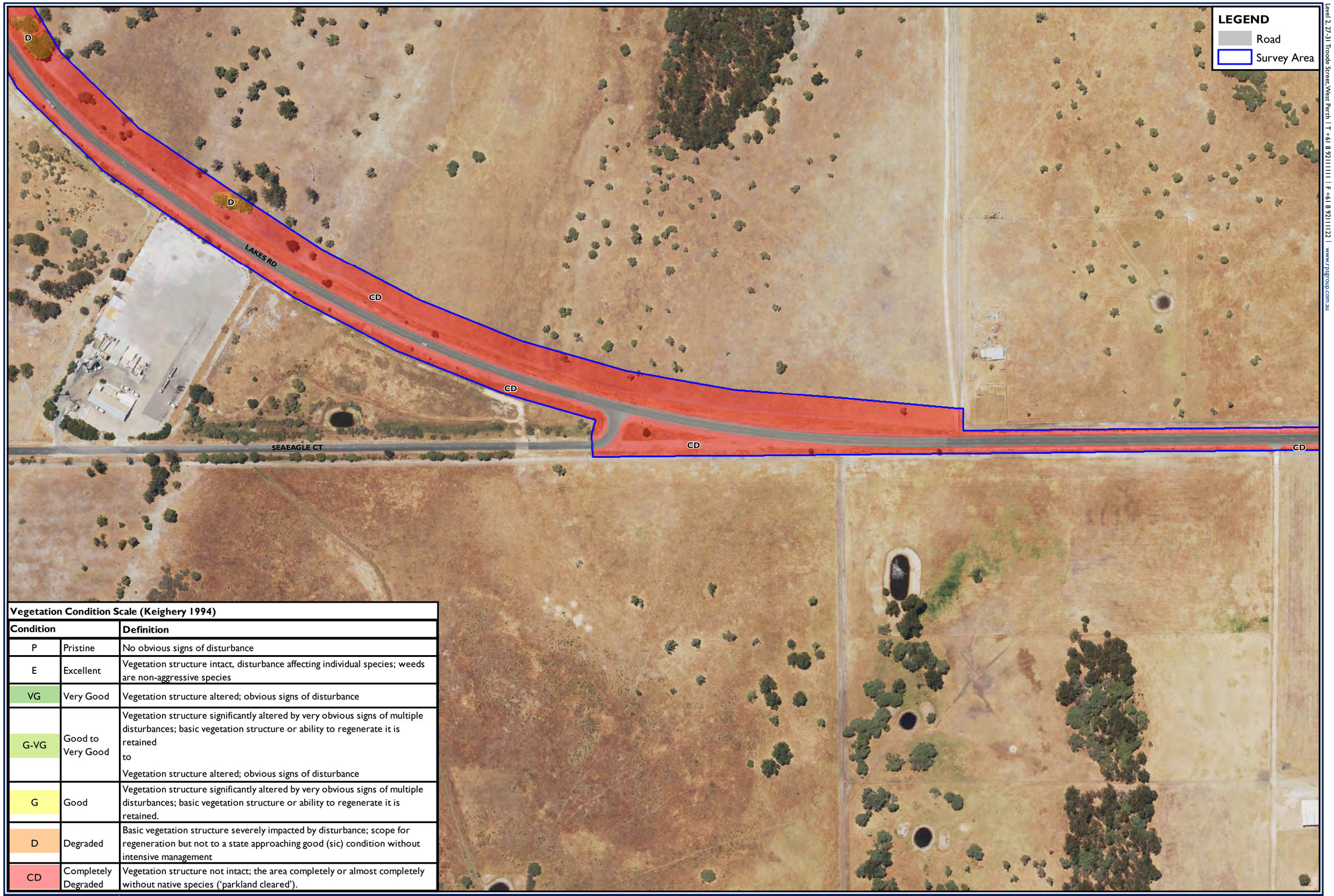

Vegetation Condition Scale (Keighery 1994)

Condition		Definition
P	Pristine	No obvious signs of disturbance
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RPS

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Figure D-5

Vegetation Condition

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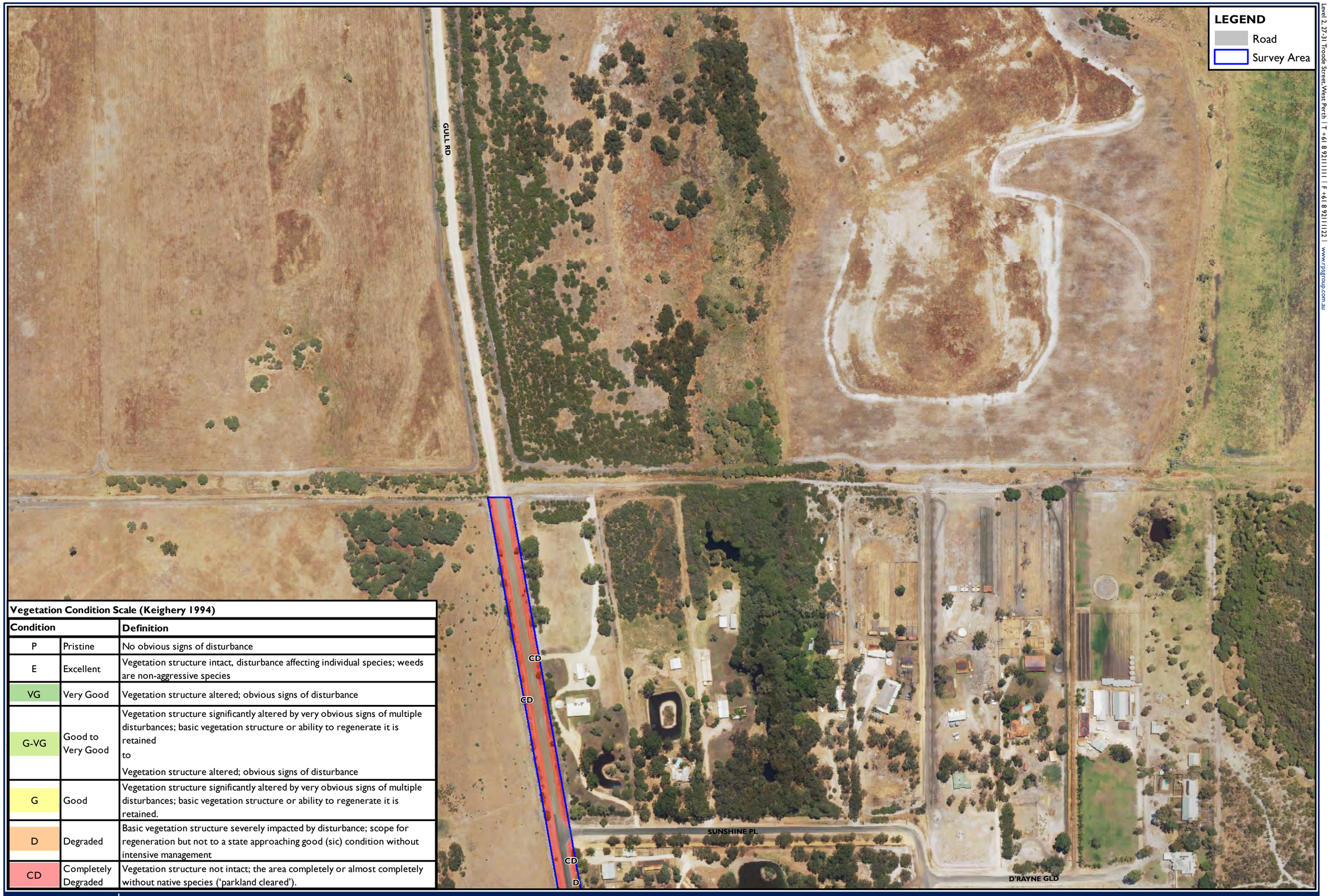

Vegetation Condition Scale (Keighery 1994)

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RPS

Job Number: L11266.006
Doc Number: 004
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Figure D-6

Vegetation Condition

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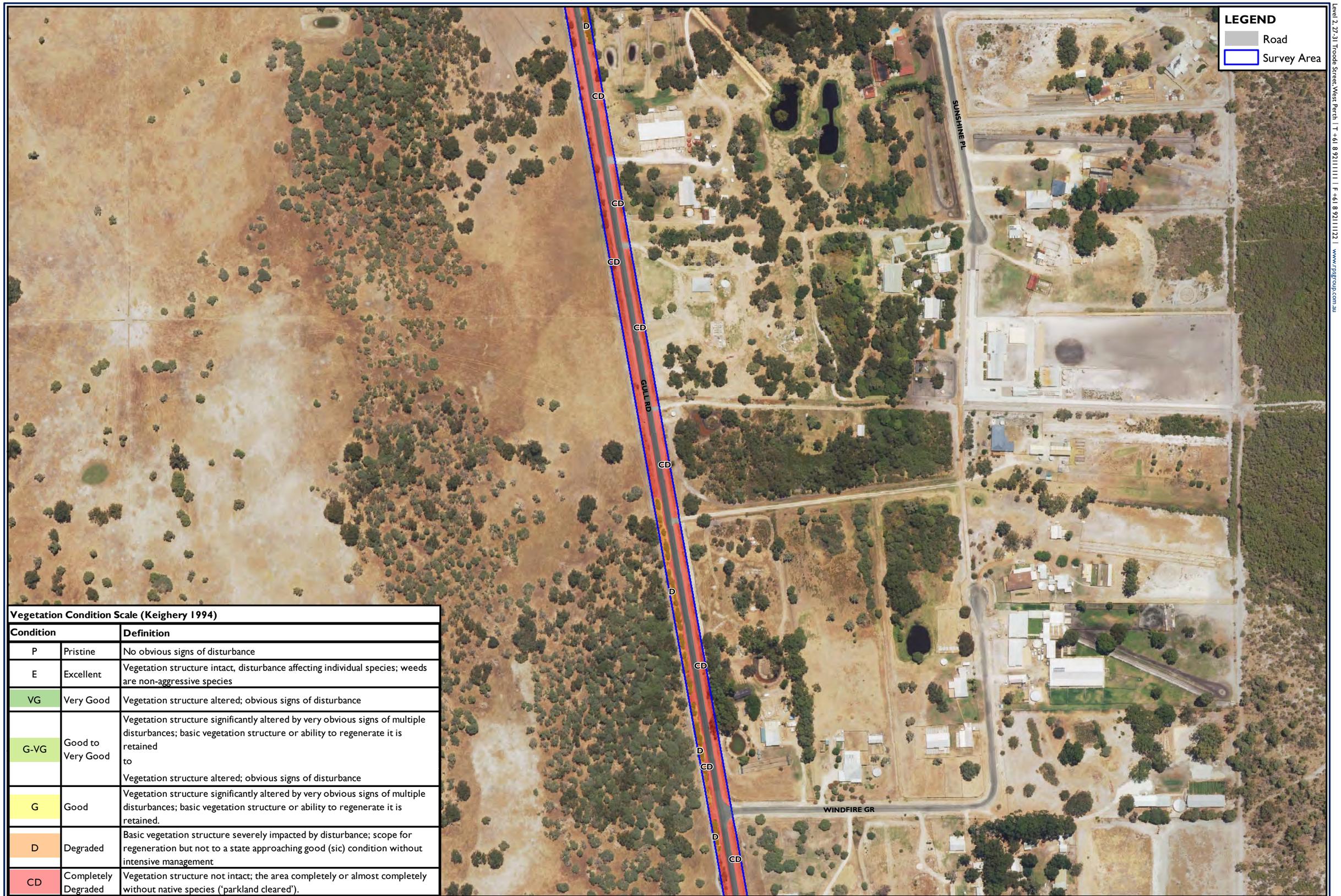

Vegetation Condition Scale (Keighery 1994)

Condition		Definition
P	Pristine	No obvious signs of disturbance
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Created by: MA
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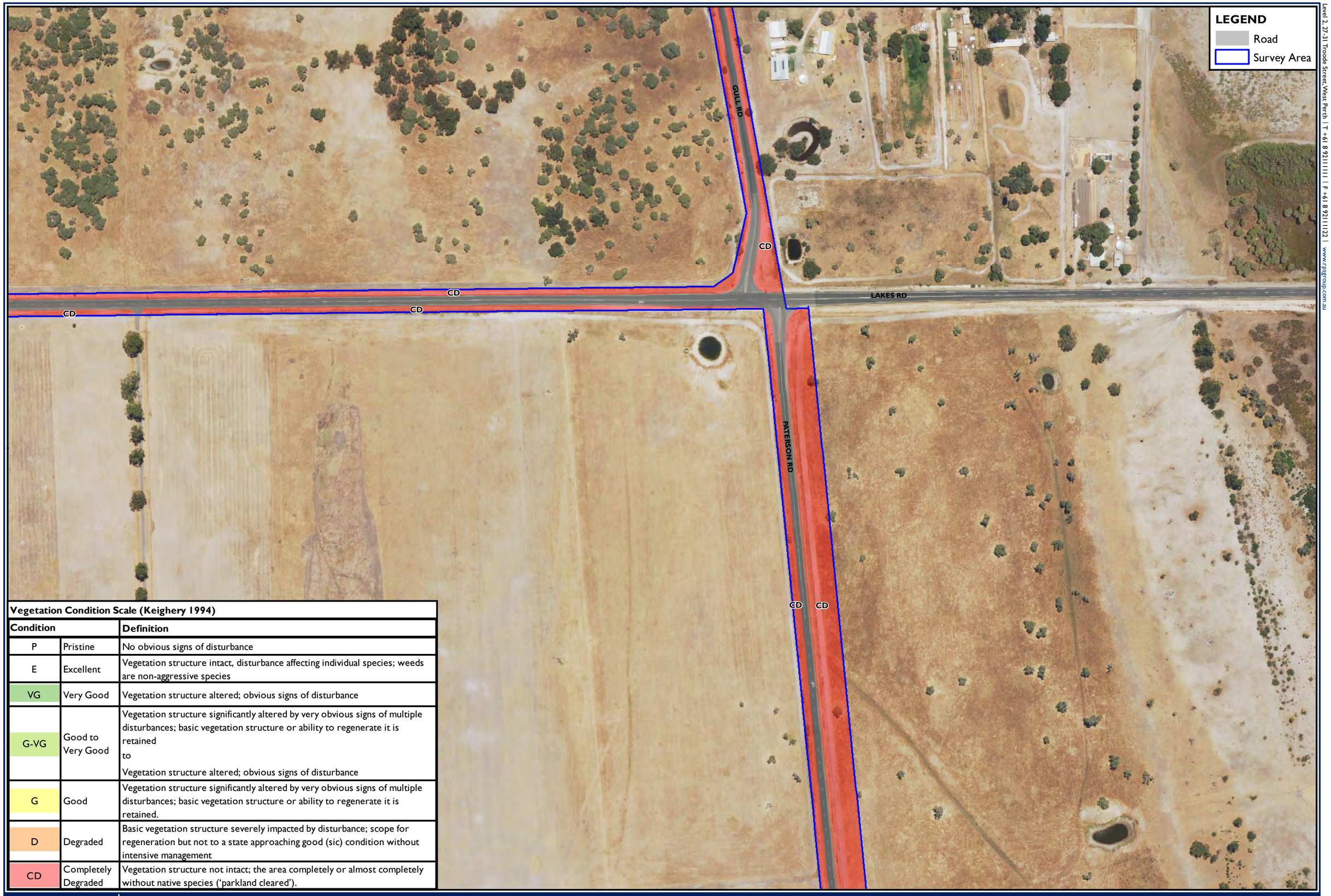
0 12.5 25 50 75 100 m

Figure D-7

Vegetation Condition

Level 2, 27-31 Troode Street, West Perth | T +61 8 9211 1111 | F +61 8 9211 1122 | www.rpsgroup.com.au



Vegetation Condition Scale (Keighery 1994)

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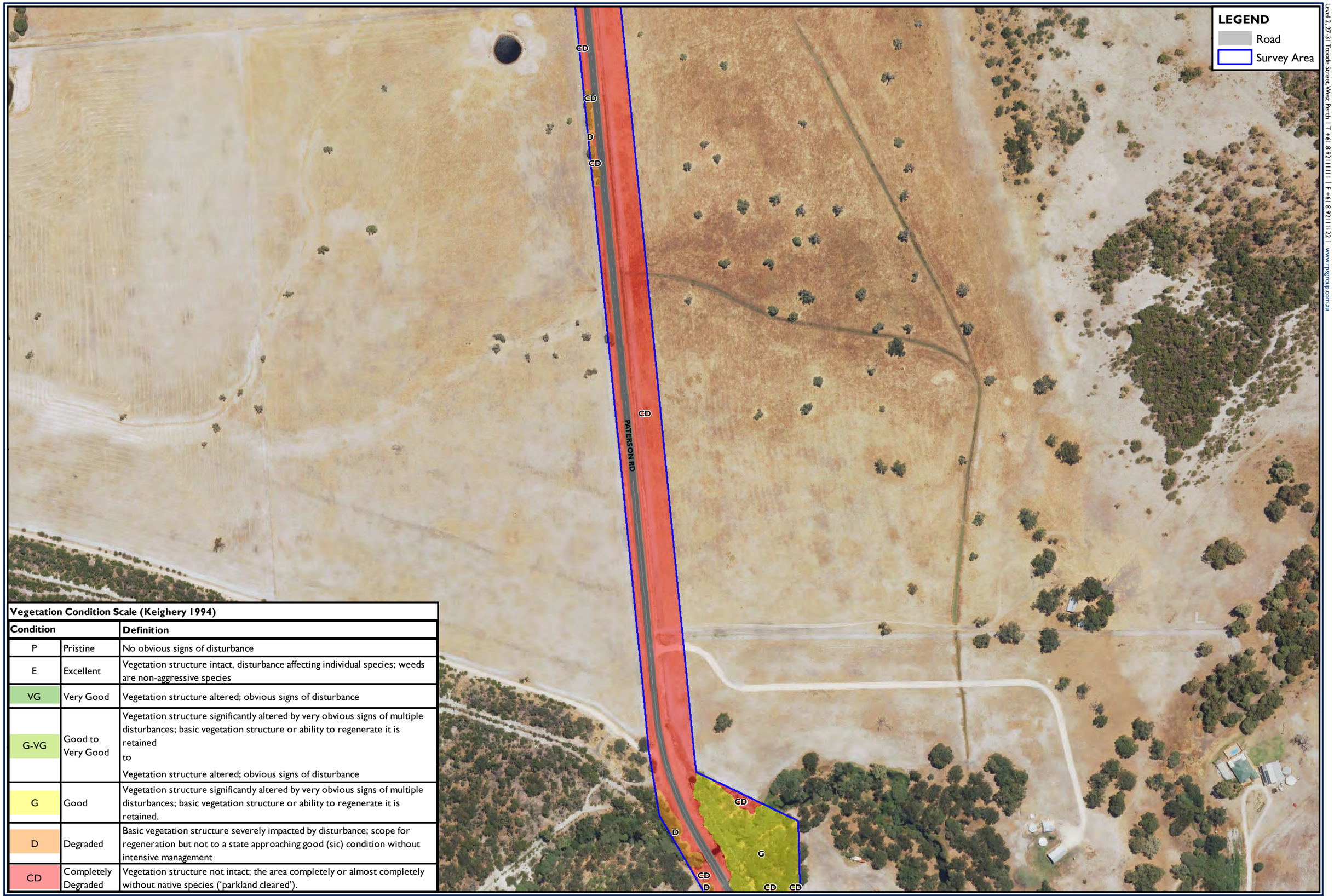
GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure D-8

Vegetation Condition

Level 2, 27-31 Troode Street, West Perth | T +61 8 9211 1111 | F +61 8 9211 1122 | www.rpsgroup.com.au



Vegetation Condition Scale (Keighery 1994)

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Source: Cadastre - Landgate, 2017 Orthophoto - Landgate, Feb 2017

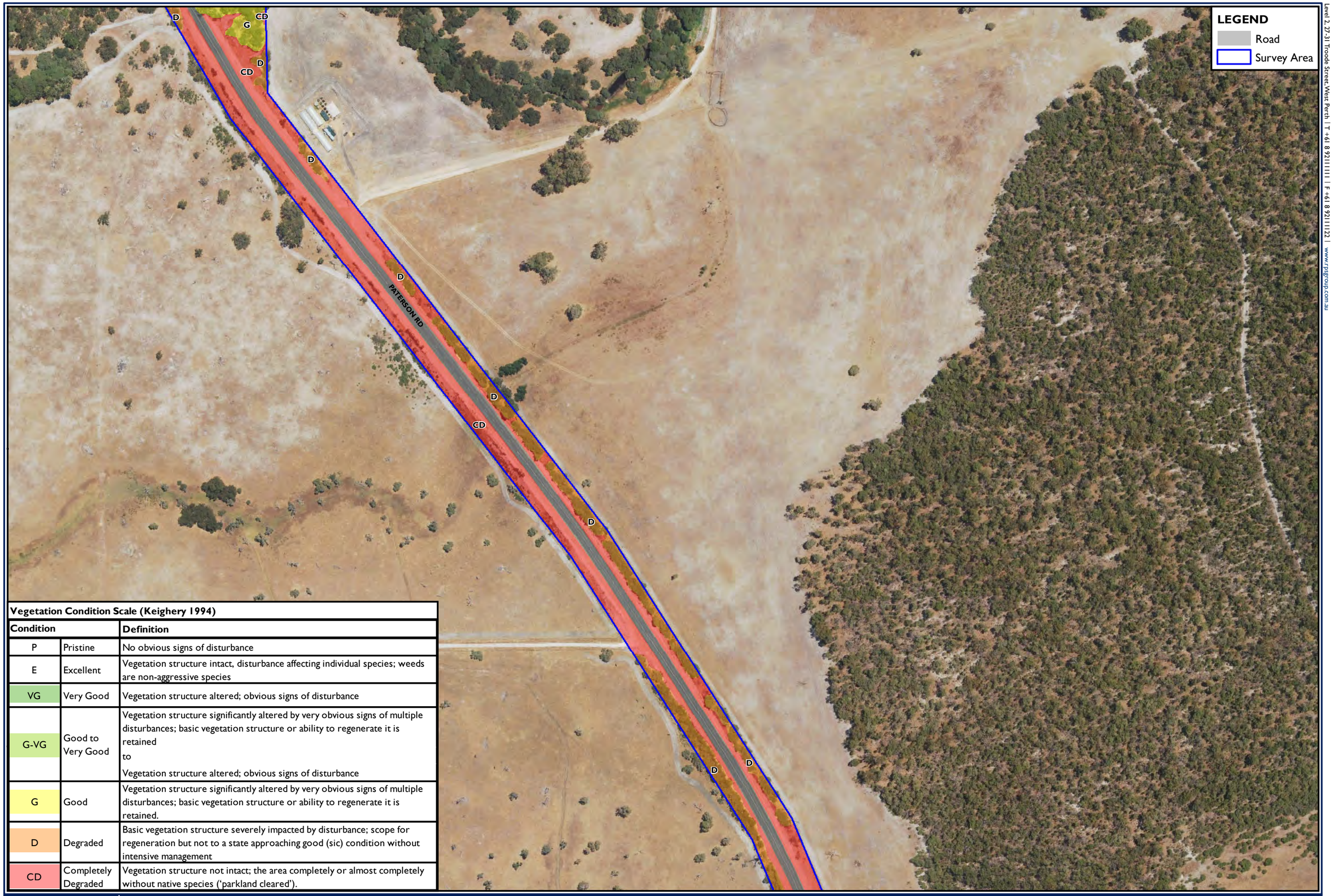
GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure D-9

Vegetation Condition

Level 2, 27-31 Troode Street, West Perth | T +61 8 9211 1111 | F +61 8 9211 1122 | www.rpsgroup.com.au



Vegetation Condition Scale (Keighery 1994)

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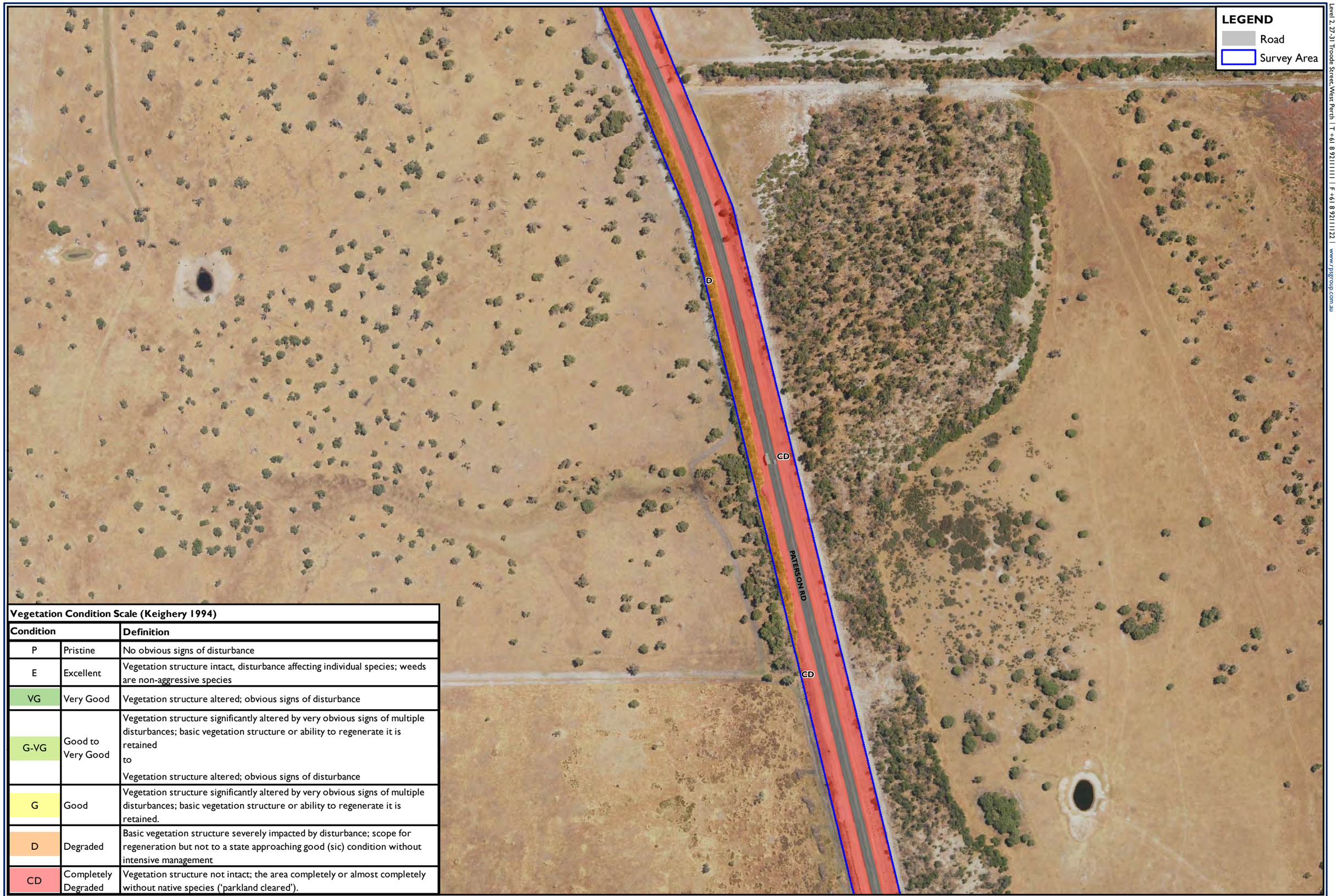
GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure D-10

Vegetation Condition

Level 2, 27-31 Troode Street, West Perth | T +61 8 9211 1111 | F +61 8 9211 1122 | www.rpsgroup.com.au



Vegetation Condition Scale (Keighery 1994)

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GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure D-11

Vegetation Condition

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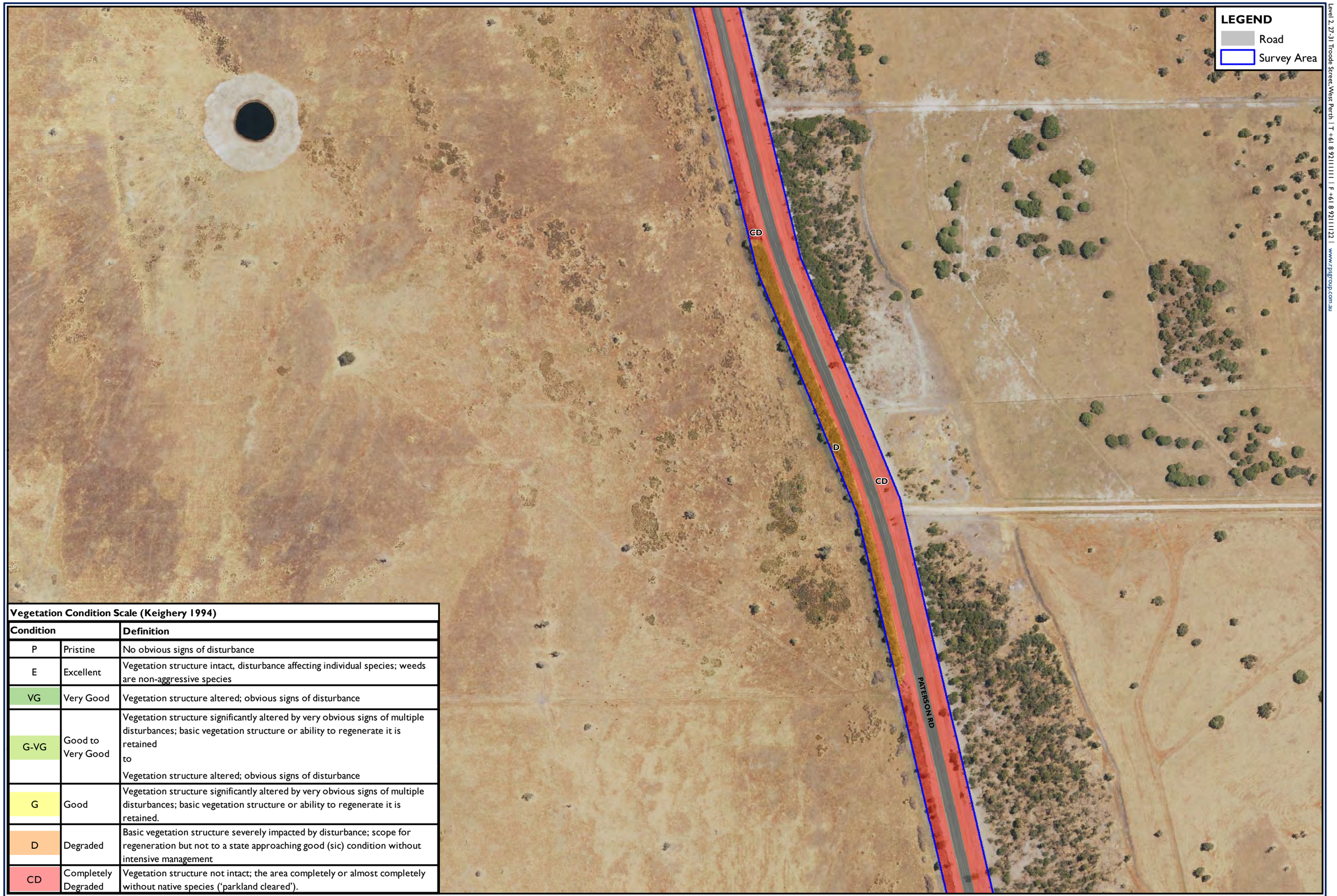

Vegetation Condition Scale (Keighery 1994)

Condition		Definition
P	Pristine	No obvious signs of disturbance
E	Excellent	Vegetation structure intact, disturbance affecting individual species; weeds are non-aggressive species
VG	Very Good	Vegetation structure altered; obvious signs of disturbance
G-VG	Good to Very Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances; basic vegetation structure or ability to regenerate it is retained to Vegetation structure altered; obvious signs of disturbance
G	Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances; basic vegetation structure or ability to regenerate it is retained.
D	Degraded	Basic vegetation structure severely impacted by disturbance; scope for regeneration but not to a state approaching good (sic) condition without intensive management
CD	Completely Degraded	Vegetation structure not intact; the area completely or almost completely without native species ('parkland cleared').

RPS

Job Number: L11266.006
Doc Number: 004
Date: 04.07.17
Scale: 1:3,000 @ A3
Created by: MA
Source: Cadastre - Landgate, 2017 Orthophoto - Landgate, Feb 2017

GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure D-12

Vegetation Condition

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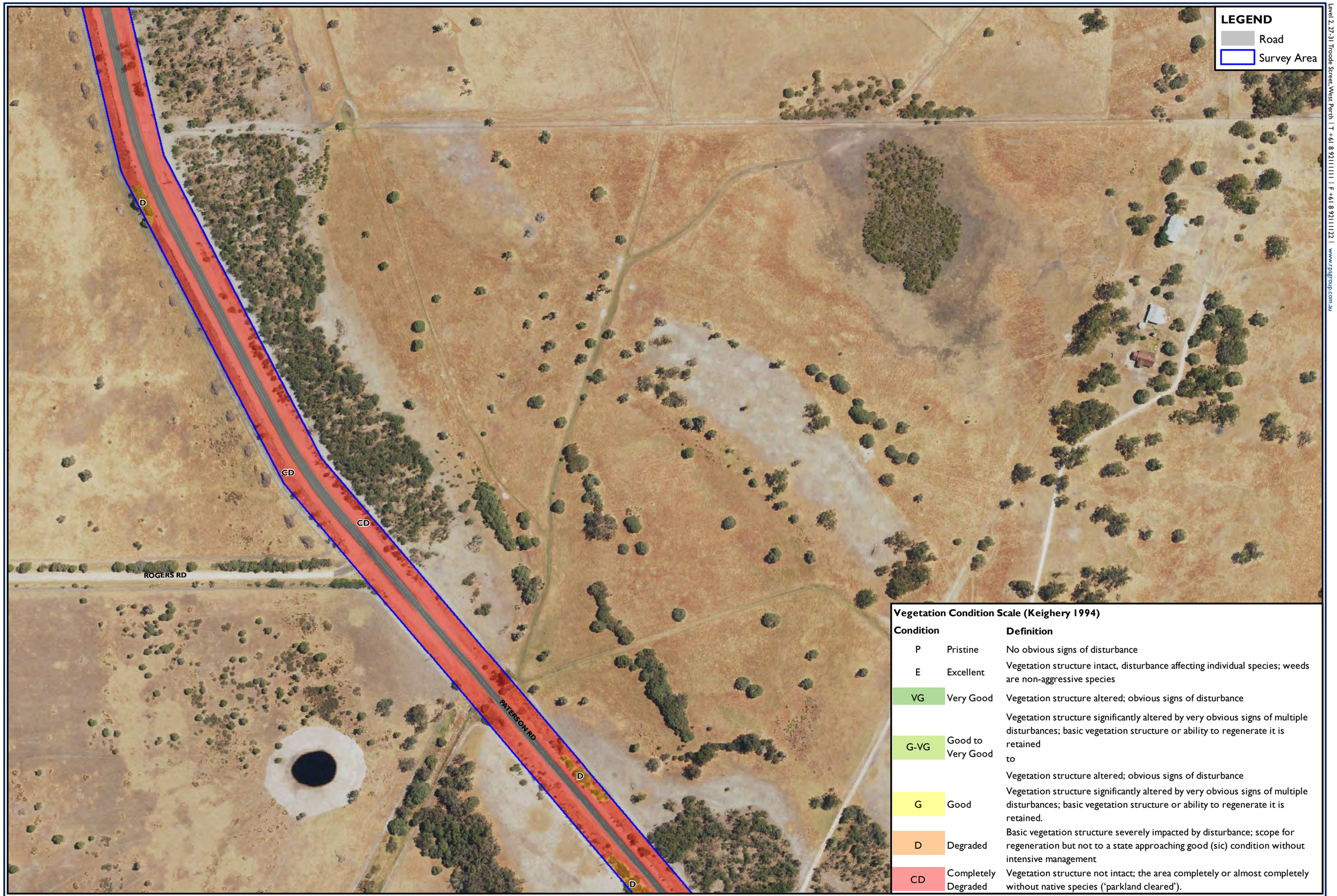

Vegetation Condition Scale (Keighery 1994)

Condition		Definition
P	Pristine	No obvious signs of disturbance
E	Excellent	Vegetation structure intact, disturbance affecting individual species; weeds are non-aggressive species
VG	Very Good	Vegetation structure altered; obvious signs of disturbance
G-VG	Good to Very Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances; basic vegetation structure or ability to regenerate it is retained to Vegetation structure altered; obvious signs of disturbance
G	Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances; basic vegetation structure or ability to regenerate it is retained.
D	Degraded	Basic vegetation structure severely impacted by disturbance; scope for regeneration but not to a state approaching good (sic) condition without intensive management
CD	Completely Degraded	Vegetation structure not intact; the area completely or almost completely without native species ('parkland cleared').

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Scale: 1:3,000 @ A3
Created by: MA
Source: Cadastre - Landgate, 2017 Orthophoto - Landgate, Feb 2017

GDA 1994 MGA Zone 50
0 12.5 25 50 75 100 m

Figure D-13

Vegetation Condition

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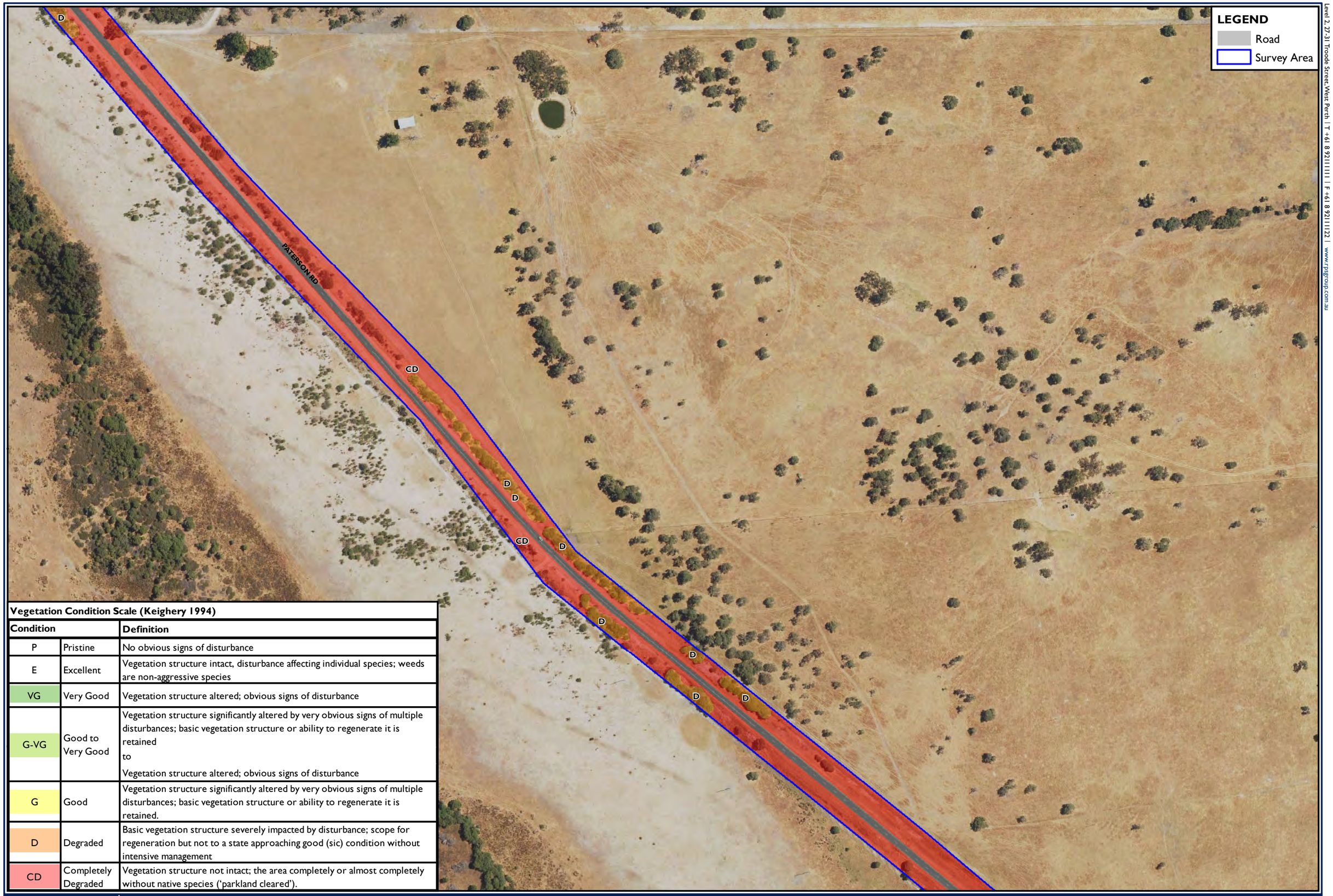

Vegetation Condition Scale (Keighery 1994)

Condition		Definition
P	Pristine	No obvious signs of disturbance
E	Excellent	Vegetation structure intact, disturbance affecting individual species; weeds are non-aggressive species
VG	Very Good	Vegetation structure altered; obvious signs of disturbance
G-VG	Good to Very Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances; basic vegetation structure or ability to regenerate it is retained to Vegetation structure altered; obvious signs of disturbance
G	Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances; basic vegetation structure or ability to regenerate it is retained.
D	Degraded	Basic vegetation structure severely impacted by disturbance; scope for regeneration but not to a state approaching good (sic) condition without intensive management
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Scale: 1:3,000 @ A3
Created by: MA
Source: Cadastre - Landgate, 2017 Orthophoto - Landgate, Feb 2017

GDA 1994 MGA Zone 50
0 12.5 25 50 75 100 m

Figure D-14

Vegetation Condition

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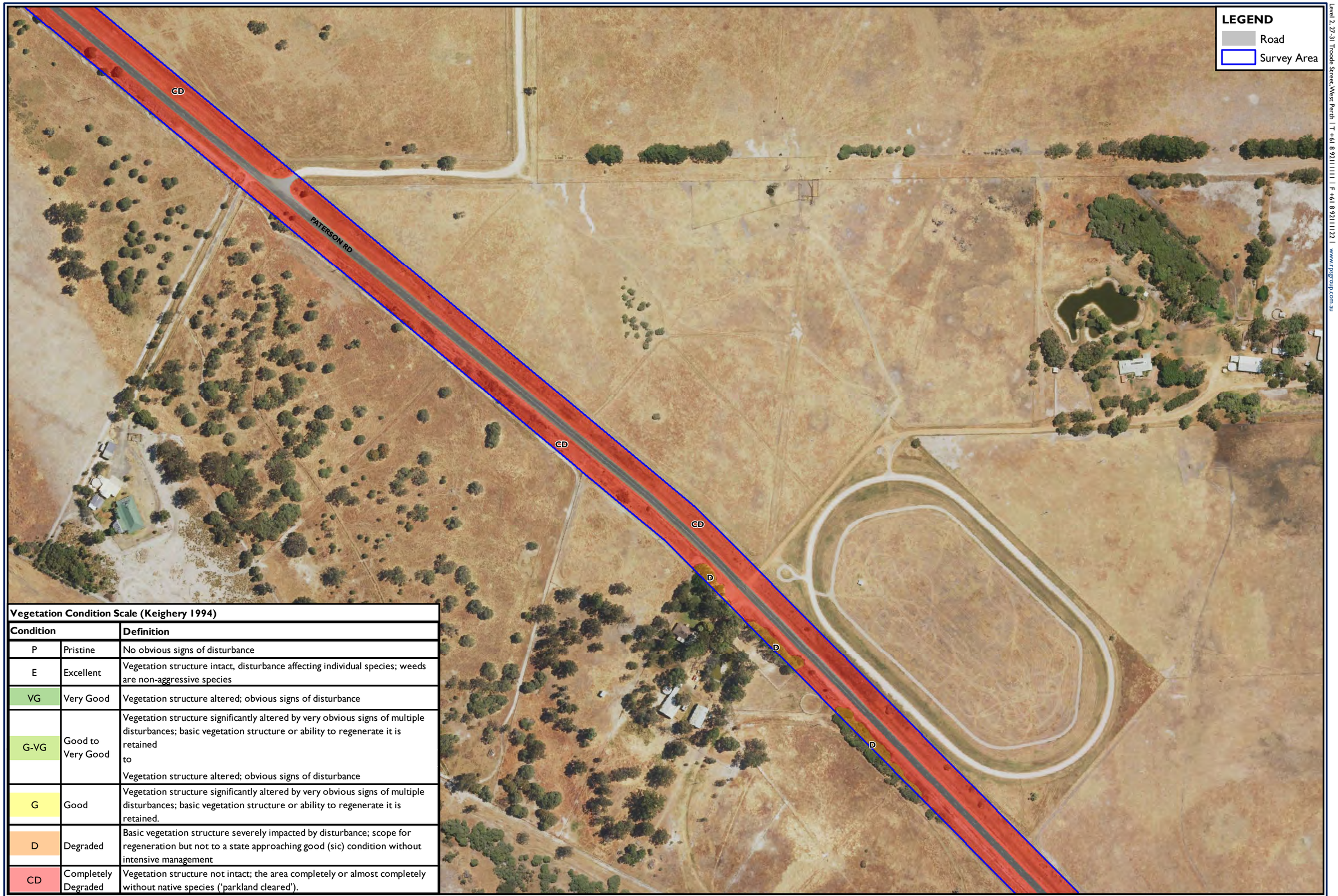

Vegetation Condition Scale (Keighery 1994)

Condition		Definition
P	Pristine	No obvious signs of disturbance
E	Excellent	Vegetation structure intact, disturbance affecting individual species; weeds are non-aggressive species
VG	Very Good	Vegetation structure altered; obvious signs of disturbance
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G	Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances; basic vegetation structure or ability to regenerate it is retained.
D	Degraded	Basic vegetation structure severely impacted by disturbance; scope for regeneration but not to a state approaching good (sic) condition without intensive management
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RPS

Job Number: L11266.006
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Date: 04.07.17
Scale: 1:3,000 @ A3
Created by: MA
Source: Cadastre - Landgate, 2017 Orthophoto - Landgate, Feb 2017

GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure D-15

Vegetation Condition

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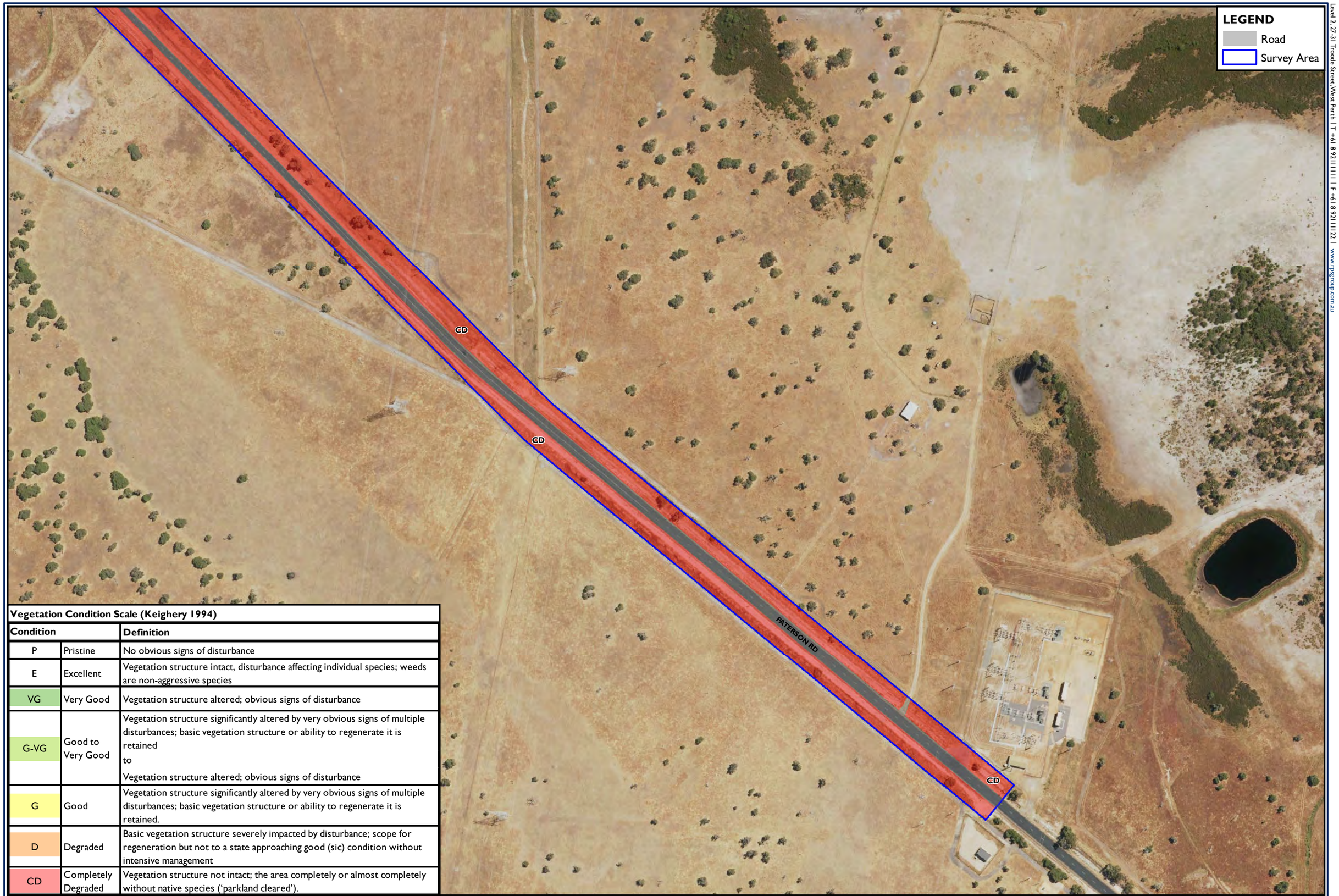

Vegetation Condition Scale (Keighery 1994)

Condition		Definition
P	Pristine	No obvious signs of disturbance
E	Excellent	Vegetation structure intact, disturbance affecting individual species; weeds are non-aggressive species
VG	Very Good	Vegetation structure altered; obvious signs of disturbance
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G	Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances; basic vegetation structure or ability to regenerate it is retained.
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RPS

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Date: 04.07.17
Scale: 1:3,000 @ A3
Created by: MA
Source: Cadastre - Landgate, 2017 Orthophoto - Landgate, Feb 2017

GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure D-16

Vegetation Condition

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Appendix A

Definitions

Appendix A Definitions

Table A-1 Conservation Codes for Western Australian Flora (WAH 2017)

Category	Definition
T	**Threatened Flora (Extant)** Taxa that have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such (Schedule 1 of the Wildlife Conservation (Rare Flora) Notice under the *Wildlife Conservation Act 1950*). Threatened Flora (Schedule 1) are further ranked by the Department according to their level of threat using IUCN Red List criteria: CR: Critically Endangered – considered to be facing an extremely high risk of extinction in the wild EN: Endangered – considered to be facing a very high risk of extinction in the wild VU: Vulnerable – considered to be facing a high risk of extinction in the wild.
X	**Presumed Extinct Flora** Taxa which have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such (Schedule 2 of the Wildlife Conservation (Rare Flora) Notice under the *Wildlife Conservation Act 1950*).
P1	**Priority One: Poorly-known Taxa** Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey
P2	**Priority Two: Poorly-known Taxa** Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
P3	**Priority Three: Poorly-known Taxa** Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
P4	**Priority Four: Rare, Near Threatened and Other Taxa in Need of Monitoring** (a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for Vulnerable, but are not listed as Conservation Dependent. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

Table A-2 EPBC Act Conservation Codes (IUCN Red List 2017)

Category	Definition
EX	**Extinct** A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual) throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
EW	**Extinct in the Wild** A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalised population (or populations) well outside the past range. A taxon is presumed Extinct in the Wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual) throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
CR	**Critically Endangered** A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered (see Section V), and it is therefore considered to be facing an extremely high risk of extinction in the wild.
EN	**Endangered** A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered (see Section V), and it is therefore considered to be facing a very high risk of extinction in the wild.
VU	**Vulnerable** A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable (see Section V), and it is therefore considered to be facing a high risk of extinction in the wild.
NT	**Near Threatened** A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.
LC	**Least Concern** A taxon is Least Concern when it has been evaluated against the criteria and it does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.
DD	**Data Deficient** A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases, great care should be exercised in choosing between DD and a threatened status. If the range of a taxon is suspected to be relatively circumscribed, and a considerable period has elapsed since the last record of the taxon, threatened status may well be justified.
NE	**Not Evaluated** A taxon is Not Evaluated when it has not yet been evaluated against the criteria.

Table A-3 FCT Reservation Status Categories (Gibson et al. 1994)

Reservation Status	Description
Well Reserved	Known from two or more A class National Parks or Nature Reserves
Poorly Reserved	Known from a single A class National Park or Nature Reserve
Unreserved	Not known to occur in any A class National Park or Nature Reserve.

Table A-4 FCT Conservation Status Categories (Gibson et al. 1994)

Conservation Status	Description
Presumed Destroyed	A community that is totally destroyed or so extensively modified that it is unlikely to re-establish ecosystem processes in the foreseeable future.
Critical	A community with most or all of its known occurrences facing severe modification or destruction in the immediate future.
Endangered	A community in danger of severe modification or destruction throughout its range, if causal factors continue operating.
Vulnerable	A community likely to move into the endangered category in the near future if the causal factors continue operating.
Susceptible	A community of concern because there is evidence that it can be modified or destroyed by human activities or would be vulnerable to new threatening process.
Low Risk	A community that does not qualify for one of the above categories
Insufficiently Known	A community for which there is inadequate data to assign to one of the above categories.

Table A-5 Threatened Ecological Communities Category of Threat (English and Blyth 1997)

Category	Definition
Presumed Totally Destroyed (PD)	An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies: a. Records within the last 50 years have not been confirmed despite thorough searches or known or likely habitats or. b. All occurrences recorded within the last 50 years have since been destroyed.
Critically Endangered (CR)	An ecological community will be listed as **Critically Endangered** when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting **any one or more** of the following criteria: a. The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and **either or both** of the following apply: • Geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately five years).

Category	Definition
	• Modification throughout its range is continuing such that in the immediate future (within approximately five years) the community is unlikely to be capable of being substantially rehabilitated. b. Current distribution is limited, and **one or more** of the following apply (i, ii or iii): i. Geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes, which are likely to result in total destruction throughout its range in the immediate future (within approximately five years). ii. There are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes. iii. There may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes. c. The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately five years).
Endangered (EN)	An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C): a. The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 70% and either or both of the following apply (i or ii) i. Geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term (within approximately 10 years). ii. Modification throughout its range is continuing such that in the short-term future (within approximately 10 years) the community is unlikely to be capable of being substantially restored or rehabilitated. b. Current distribution is limited, and one or more of the following apply (i, ii or iii): i. Geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 10 years). ii. There are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes. iii. There may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes. c. The ecological community exists only as highly modified occurrences, which may be capable of being rehabilitated if such work begins in the short-term future (within approximately 10 years).
Vulnerable (VU)	An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction in the medium to long term future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C): a. The ecological community exists largely as modified occurrences, which are likely to be capable of being substantially restored or rehabilitated. b. The ecological community can be modified or destroyed and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations. c. The ecological community may still be widespread but is believed likely to move into a category of higher threat in the medium to long-term future because of existing or impending threatening processes.

Category	Definition
Data Deficient (DD)	An ecological community, which has not been adequately evaluated with respect to status or where there is currently insufficient information to assign it to a particular category. (An ecological community with poorly known distribution or biology that is suspected to belong to any of the above categories. These ecological communities have a high priority for survey and/or research).
Lower Risk (LR)	An ecological community that has been adequately surveyed and does not qualify for any of the above categories of threat and appears unlikely to be under threat of significant modification or destruction in the short to medium term future.

Table A-6 Vegetation Structure Classes (WAPC 2000)

Life Form/ Height Class	Canopy Cover (Percentage)			
	100% – 70%	70% – 30%	30% – 10%	10% – 2%
Trees 10–30 m	Closed Forest	Open Forest	Woodland	Open Woodland
Trees <10 m	Low Closed Forest	Low Open Forest	Low Woodland	Low Open Woodland
Shrub Mallee	Closed Shrub Mallee	Shrub Mallee	Open Shrub Mallee	Very Open Scrub Mallee
Shrubs >2 m	Closed Tall Scrub	Tall Open Scrub	Tall Shrubland	Tall Open Shrubland
Shrubs 1–2 m	Closed Heath	Open Heath	Shrubland	Open Shrubland
Shrubs <1 m	Closed Low Heath	Open Low Heath	Low Shrubland	Low Open Shrubland
Grasses	Closed Grassland	Grassland	Open Grassland	Very Open Grassland
Herbs	Closed Herbland	Herbland	Open Herbland	Very Open Herbland
Sedges	Closed Sedgeland	Sedgeland	Open Sedgeland	Very Open Sedgeland

(Source: Western Australian Planning Commission 2000)

Table A-7 Vegetation Condition Scale (adapted from Keighery 1994 and Trudgen 1988)

Condition		Definition
P	Pristine	No obvious signs of disturbance.
E	Excellent	Vegetation structure intact, disturbance affecting individual species ; weeds are non-aggressive species
V	Very Good	Vegetation structure altered; obvious signs of disturbance
G	Good	Vegetation structure significantly altered by very obvious signs of multiple disturbance; basic vegetation structure or ability to regenerate it is retained
D	Degraded	Basic vegetation structure severely impacted by disturbance; scope for regeneration but not to a state approaching good (sic) condition without intensive management
C	Completely Degraded	Vegetation structure not intact; the area completely or almost completely without native species (“parkland cleared”).

Table A-8 Wetland Management Categories and Objectives Applied to the Swan Coastal Plain (Adapted from Environmental Protection Authority 2004)

Management Category	General Description	Management Objectives
Conservation	Wetlands which support a high level of attributes and functions.	Highest priority wetlands. Objective is to preserve and protect the existing conservation values of the wetlands through various mechanisms including: • reservation in national parks, Crown reserves and state owned land • protection under Environmental Protection Policies • wetland covenanting by landowners. No development or clearing is considered appropriate. These are the most valuable wetlands and any activity that may lead to further loss or degradation is inappropriate.
Resource Enhancement	Wetlands which may have been partially modified but still support substantial ecological attributes and functions	Priority wetlands Ultimate objective is to manage, restore and protect towards improving their conservation value. These wetlands have the potential to be restored to Conservation category. This can be achieved by restoring wetland function, structure and biodiversity. Protection is recommended through a number of mechanisms.
Multiple Use	Wetlands with few remaining important attributes and functions	Use, development and management should be considered in the context of ecologically sustainable development and best management practice catchment planning through land care.

Appendix B

Flora Inventory

Appendix B Flora Inventory

Family	Weed	*Species*
ARACEAE	*	*Zantedeschia aethiopica*
ASPARAGACEAE		*Sowerbaea laxiflora*
ASPHODELACEAE	*	*Trachyandra divaricata*
ASTERACEAE	*	*Arctotheca calendula*
		Cotula coronopifolia
	*	*Ursinia anthemoides*
CASUARINACEAE		*Allocasuarina fraseriana*
		Casuarina obesa
CHENOPODIACEAE	*	*Chenopodium album*
CHENOPODIACEAE		*Tecticornia ? halocnemoides*
CHENOPODIACEAE		*Tecticornia indica subsp. bidens*
CYPERACEAE		*Baumea juncea*
		Cyathochaeta avenacea
		Gahnia trifida
		Lepidosperma longitudinale
		Lepidosperma sp.
		Tetraria octandra
DASYPOGONACEAE		*Dasypogon bromelliifolius*
		Kingia australis
DILLENIACEAE		*Hibbertia hypericoides*
EUPHORBIACEAE	*	*Euphorbia terracina*
FABACEAE		*Acacia pulchella*
		Acacia saligna
		Hardenbergia comptoniana
		Jacksonia floribunda
		Jacksonia furcellata
		Jacksonia sternbergiana
HAEMODORACEAE		*Conostylis aculeata*
HEMEROCALLIDACEAE		*Corynotheca micrantha*
		Dianella revoluta
IRIDACEAE		*Patersonia occidentalis*
		Watsonia sp.

Family	Weed	*Species*
JUNCACEAE		*Juncus kraussii*
		Juncus pallidus
LAMIACEAE		*Hemiandra pungens*
LAURACEAE		*Cassytha sp.*
CAMPANULACEAE		*Lobelia anceps*
MYRTACEAE		*Agonis flexuosa*
		Astartea scoparia
		Calothamnus sp.
		Chamelaucium uncinatum
		Corymbia calophylla
		Eucalyptus gomphocephala
		Eucalyptus marginata subsp. marginata
		Eucalyptus rudis subsp. rudis
		Kunzea glabrescens
	*	*Leptospermum laevigatum*
		Melaleuca preissiana
		Melaleuca rhaphiophylla
		Regelia inops
		Taxandria linearifolia
ORCHIDACEAE		*Microtis media*
POACEAE	*	*Briza maxima*
	*	*Bromus diandrus*
	*	*Cynodon dactylon*
	*	*Ehrharta calycina*
	*	*Ehrharta longiflora*
	*	*Eragrostis curvula*
	*	*Lolium perenne*
PROTEACEAE		*Adenanthos cygnorum*
		Banksia attenuata
		Banksia grandis
		Banksia ilicifolia
		Banksia menziesii
		Grevillea vestita
RESTIONACEAE		*Leptocarpus sp.*
		Lyginia barbata
XANTHORRHOEACEAE		*Xanthorrhoea preissii*
ZAMIACEAE		*Macrozamia riedlei*

Appendix C

Black Cockatoo Habitat Tree Data

Appendix C Black Cockatoo Habitat Tree Data

Species	Alive/Dead/Hollows	Latitude	Longitude
Eucalyptus gomphocephala	Alive no hollows	-32.51077	115.760232
Eucalyptus gomphocephala	Alive no hollows	-32.51072	115.760116
Eucalyptus gomphocephala	Alive no hollows	-32.51068	115.760348
Eucalyptus gomphocephala	Alive no hollows	-32.5107	115.760518
Eucalyptus gomphocephala	Alive no hollows	-32.51077	115.760541
Eucalyptus gomphocephala	Alive no hollows	-32.51075	115.760601
Eucalyptus gomphocephala	Alive no hollows	-32.51069	115.760648
Eucalyptus gomphocephala	Alive no hollows	-32.51068	115.761203
Eucalyptus gomphocephala	Alive no hollows	-32.51063	115.761588
Eucalyptus gomphocephala	Alive no hollows	-32.50798	115.781606
Eucalyptus gomphocephala	Alive no hollows	-32.50816	115.782119
Eucalyptus gomphocephala	Alive no hollows	-32.50816	115.782414
Eucalyptus gomphocephala	Alive no hollows	-32.50824	115.782573
Eucalyptus rudis subsp. *rudis*	Alive no hollows	-32.50838	115.783577
Eucalyptus rudis subsp. *rudis*	Alive no hollows	-32.50839	115.783684
Eucalyptus rudis subsp. *rudis*	Alive no hollows	-32.50843	115.783871
Eucalyptus gomphocephala	Alive no hollows	-32.50855	115.784473
Eucalyptus rudis subsp. *rudis*	Alive no hollows	-32.50889	115.785572
Eucalyptus gomphocephala	Alive no hollows	-32.50909	115.785749
Eucalyptus gomphocephala	Alive no hollows	-32.50898	115.786082
Eucalyptus gomphocephala	Alive no hollows	-32.5091	115.786076
Eucalyptus gomphocephala	Alive no hollows	-32.50919	115.786195
Eucalyptus gomphocephala	Alive no hollows	-32.50921	115.786435
Eucalyptus gomphocephala	Alive no hollows	-32.50909	115.786529
Eucalyptus gomphocephala	Alive no hollows	-32.50917	115.786762
Eucalyptus gomphocephala	Alive no hollows	-32.50921	115.786888
Eucalyptus gomphocephala	Alive no hollows	-32.50923	115.786979
Corymbia calophylla	Alive no hollows	-32.50967	115.787892
Corymbia calophylla	Alive no hollows	-32.50967	115.787856
Corymbia calophylla	Alive no hollows	-32.50977	115.788026
Corymbia calophylla	Alive no hollows	-32.50738	115.790764
Eucalyptus marginata subsp. *marginata*	Dead with hollows	-32.50198	115.797381
Eucalyptus marginata subsp. *marginata*	Alive no hollows	-32.5013	115.797924
Eucalyptus marginata subsp. *marginata*	Alive no hollows	-32.50675	115.803786
Eucalyptus marginata subsp. *marginata*	Alive no hollows	-32.50673	115.803813

Species	Alive/Dead/Hollows	Latitude	Longitude
Eucalyptus marginata subsp. *marginata*	Alive no hollows	-32.50677	115.803854
Eucalyptus marginata subsp. *marginata*	Alive no hollows	-32.50693	115.803873
Corymbia calophylla	Alive no hollows	-32.50761	115.804221
Corymbia calophylla	Alive no hollows	-32.50765	115.804237
Corymbia calophylla	Dead no hollows	-32.50766	115.80425
Corymbia calophylla	Alive no hollows	-32.50776	115.80431
Corymbia calophylla	Alive no hollows	-32.50783	115.804357
Eucalyptus rudis subsp. *rudis*	Alive no hollows	-32.50944	115.806735
Corymbia calophylla	Alive no hollows	-32.50914	115.80622
Corymbia calophylla	Alive no hollows	-32.5091	115.806145
Corymbia calophylla	Alive no hollows	-32.50908	115.806085
Corymbia calophylla	Dead no hollows	-32.50904	115.806044
Eucalyptus rudis subsp. *rudis*	Alive no hollows	-32.54954	115.839416
Eucalyptus marginata subsp. *marginata*	Alive no hollows	-32.5333	115.832262
Eucalyptus marginata subsp. *marginata*	Dead with hollows	-32.53184	115.832094
Eucalyptus marginata subsp. *marginata*	Dead with hollows	-32.52975	115.830823
Corymbia calophylla	Dead with hollows	-32.52284	115.825998
Corymbia calophylla	Alive no hollows	-32.52276	115.826171
Corymbia calophylla	Alive no hollows	-32.52261	115.826157
Eucalyptus rudis subsp. *rudis*	Alive no hollows	-32.52265	115.826024
Eucalyptus rudis subsp. *rudis*	Alive no hollows	-32.52252	115.826006
Eucalyptus rudis subsp. *rudis*	Alive no hollows	-32.52246	115.826087
Eucalyptus rudis subsp. *rudis*	Alive no hollows	-32.52235	115.826061
Corymbia calophylla	Alive no hollows	-32.52288	115.826057
Corymbia calophylla	Alive no hollows	-32.5231	115.826056
Eucalyptus rudis subsp. *rudis*	Alive no hollows	-32.50922	115.784503
Eucalyptus rudis subsp. *rudis*	Alive no hollows	-32.50933	115.78433
Eucalyptus rudis subsp. *rudis*	Alive no hollows	-32.50938	115.783184
Eucalyptus rudis subsp. *rudis*	Alive no hollows	-32.50905	115.783363
Eucalyptus rudis subsp. *rudis*	Alive no hollows	-32.50873	115.783649
Eucalyptus rudis subsp. *rudis*	Alive no hollows	-32.5087	115.783579
Eucalyptus rudis subsp. *rudis*	Alive no hollows	-32.50969	115.784889
Eucalyptus rudis subsp. *rudis*	Alive no hollows	-32.50974	115.785099
Eucalyptus rudis subsp. *rudis*	Alive no hollows	-32.5098	115.785073
Eucalyptus rudis subsp. *rudis*	Alive no hollows	-32.50987	115.784996
Planted Non-endemic Eucalypt	Alive no hollows	-32.51002	115.784909
Planted Non-endemic Eucalypt	Alive no hollows	-32.51014	115.784774
Planted Non-endemic Eucalypt	Alive no hollows	-32.51019	115.784737
Planted Non-endemic Eucalypt	Alive no hollows	-32.51021	115.784701

RECONNAISSANCE FLORA AND VEGETATION SURVEY ADDENDUM

Peel Business Park

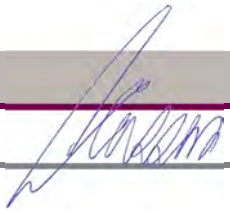
EEL11266.011
Reconnaissance flora and vegetation survey addendum
Rev 0
18 February 2020

rpsgroup.com

Document status

Version	Purpose of document	Authored by	Reviewed by	Approved by	Review date
Draft A	Draft for client review	CarGil	GilGla	NA	08/01/2020
Rev 0	Final for issue	CarGil	GilGla	GilGla	05/02/2020

Approval for issue

G. Glasson		18 February 2020

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1 INTRODUCTION

1.1 Project background

The Peel Business Park requires the delivery of trunk services infrastructure (sewer, power and water) between Gordon Road, Parklands, in the City of Mandurah to Paterson Road, Nambeelup, in the Shire of Murray to support future industrial development. The installation of underground power along Patterson Road was completed in 2019, however the installation of sewer and water infrastructure from the Water Corporation's Mandurah No 1 Wastewater Treatment Plant to Lot 600 Lakes Road, Stake Hill is still pending.

The route for the extension of the sewer and water infrastructure was subject to a Reconnaissance Flora and Vegetation Survey, inclusive of a targeted black cockatoo tree assessment, in September 2017 (RPS 2018). The proposed engineering design and construction methods for the installation of the sewer and water services were informed by the findings of the RPS 2018 ecological survey and sensitive flora and fauna values avoided.

A Purpose Clearing Permit (CPS 8037/1) was approved by the Department of Water and Environmental Regulation (DWER) in September 2018.

The Water Corporation has recently advised that alternative approaches to the siting and construction of the sewer and water infrastructure may be required, including situating the infrastructure on the opposite side of the road and changing construction methodologies from boring to trenching. The entire extent of the previously proposed sewer and water infrastructure alignment was surveyed as part of RPS (2018). However, there are additional areas within the Lakes Road reservation and to the east of the Serpentine River which have been identified as potential future locations for the sewer and water infrastructure which were not surveyed as part of RPS (2018), and are also outside of the clearing area approved under CPS 8037/1.

This reconnaissance flora and vegetation addendum has been undertaken to identify the flora and vegetation values within the additional areas (hereafter referred to as 'the addendum survey area').

1.2 Scope of works

The flora and vegetation field survey was undertaken for the addendum survey area to assist in informing potential revisions to the sewer and water infrastructure alignment. This reconnaissance flora and vegetation addendum relies on previous relatively recent desktop mapping undertaken as part of RPS (2018) to identify environmental values relating to flora and vegetation for the additional areas.

1.3 Report objectives

This reconnaissance flora and vegetation survey addendum presents the findings of the flora and vegetation field survey and black cockatoo habitat tree assessment undertaken within the addendum survey area. This reconnaissance flora and vegetation survey addendum included:

- Site visit to assess the vegetation type and condition within the addendum survey area', confirm the presence of significant features identified in the database searches, and to produce maps of the proposed alignment identifying the location of any constraints identified
- Targeted search for any Threatened Flora (TF) or Priority Flora (PF) species known from the area (as recorded in the Department of Biodiversity Conservation and Attractions (DBCA) database and NatureMap searches) in likely habitat
- Targeted tree survey to identify potential black cockatoo breeding habitat
- Assessment of the conservation significance of the vegetation and the identification of other mapped environmental constraints (e.g. wetlands and Environmentally Sensitive Areas (ESAs)).

1.4 Legislative context

Commonwealth and state legislation pertaining to the conservation of native flora, vegetation and fauna include the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act), the *Biodiversity Conservation Act 2016* (BC Act) and the *Environmental Protection Act 1986* (EP Act). The EP Act is the primary legislation that governs environmental impact assessment and protection in Western Australia. The aim of the EP Act is "to provide for an Environmental Protection Authority, for the prevention, control and abatement of pollution and environmental harm, for the conservation, preservation, protection, enhancement and management of the environment and for matters incidental to or connected with foregoing".

Section 4A of the EP Act states that the following principles, applicable to native flora and vegetation should be adhered to in order to protect the environment of Western Australia:

1. The Precautionary Principle: Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.
2. The Principle of Intergenerational Equity: The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.
3. The Principle of the Conservation of Biological Diversity and Ecological Integrity: Conservation of biological diversity and ecological integrity should be a fundamental consideration.

1.5 Conservation significant flora

Within Western Australia, Threatened, Extinct and Specially Protected fauna or flora are species which have been adequately searched for and are deemed to be, in the wild, threatened, extinct or in need of special protection, and have been gazetted under Part 2 of the BC Act. The Western Australian conservation categories for flora and fauna are defined in Appendix A, Table A-1.

Many flora and fauna species listed under the BC Act have additional protection under one of six threat categories (Extinct, Extinct in the wild, Critically Endangered, Endangered, Vulnerable or Conservation Dependent) listed in the EPBC Act. These threatened species are defined as MNES under the EPBC Act and penalties apply for any damage to individuals, populations or habitats of these species. EPBC Act conservation category codes are defined in Appendix A, Table A-2.

1.6 Conservation significant vegetation

Under the BC Act and the EP Act, Threatened Ecological Communities (TECs), classified by the DBCA in one of the TEC categories (Appendix A, Table A-3) have limited protection. Other ecological communities are classified by DBCA in the category of Priority Ecological Communities (PECs) (Appendix A, Table A-4) pending further survey and/or definition. A subset of the DBCA-listed TECs are also listed and protected as MNES under the EPBC Act. EPBC Act threat categories for TECs are defined in Appendix A, Table A-5.

2 METHODS

The reconnaissance flora and vegetation survey of the addendum survey area was undertaken in accordance with the EPA's Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016).

As stated in the guidance, a reconnaissance level survey is undertaken to provide context and gather broad information about a survey area. Generally, a reconnaissance survey is required where flora and vegetation values are well defined, the area is not likely to support significant flora or vegetation and the scale and nature of potential impacts are not likely to be significant. A reconnaissance survey is undertaken to verify the information obtained from the desktop study, characterise the flora and delineate the vegetation units present using low intensity sampling of the flora and vegetation, and identify the potential impacts of the proposed development on local flora and vegetation values particularly flora taxa of conservation significance.

In addition to delineation of vegetation units, the addendum survey area was traversed to search for conservation significant taxa that were identified in the desktop study as potentially occurring there.

2.1 Field survey

2.1.1 Reconnaissance flora and vegetation assessment

The reconnaissance survey was carried out by qualified on 19 November 2019 in accordance with the methods prescribed in EPA (2016).

The field survey involved traversing the addendum survey area by vehicle and on foot to:

- Verify the data from the desktop survey (undertaken as part of RPS (2018) at a local scale.
- Characterise the vegetation within the addendum survey area in terms of the NVIS vegetation structure classes (Appendix A, Table A-6 and Table A-7).
- Record mature remnant *Eucalyptus* spp. and *Corymbia* spp. trees within the addendum survey area that were of adequate size to provide roosting and nesting habitat for black cockatoo species.
- Identify any constraints and potential impacts of the proposed development on local flora, vegetation and fauna values, or other environmental features such as wetlands.

The total alignment was divided up into 16 sections (map units). For each portion of the addendum survey area the following was documented and mapped:

- Waypoint recorded on a hand-held GPS marking the photo-point and the point where the information was recorded
- Photographs of the vegetation
- Description of the remnant vegetation type (if any) and condition (adapted from Keighery 1994 and Trudgen 1988) within the addendum survey area (Appendix A, Table A-8)
- Identified constraints to clearing of the vegetation including vegetation in "Good" or better condition, flora or vegetation of conservation significance, mature remnant native trees, conservation significant wetlands and ESAs
- Inventory of all the flora species recorded within the addendum survey area.

2.1.2 Significant tree inventory

The significant tree inventory was undertaken concurrently with the reconnaissance flora and vegetation assessment. The survey methods were informed by Referral Guidelines for Three Threatened Black Cockatoo Species: Carnaby's Cockatoo (endangered) *Calyptorhynchus latirostris*, Baudin's Cockatoo (vulnerable) *Calyptorhynchus baudinii*, Forest Red-tailed Black Cockatoo (vulnerable) *Calyptorhynchus banksii naso* (Department of Sustainability, Environment, Water, Population and Communities (DSEWPAC) 2012).

All *Eucalyptus* spp. and *Corymbia* spp. trees (alive and dead) that occurred within the addendum survey area and had a diameter at breast height (DBH) of 500 millimetres (mm) or greater were recorded using a hand-held GPS. The tree species name, health and presence of hollows were noted.

2.1.3 Assessment of tuart woodlands and forests of the Swan Coastal Plain ecological community TEC

The *Eucalyptus gomphocephala* (tuart) remnant trees mapped within the addendum survey area and the original survey area were assessed against the key diagnostic characteristics set out in the Conservation Advice for the tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain ecological community TEC (Department of the Environment and Energy (DEE) 2019) in order to determine if any of this vegetation represented the TEC. This assessment is required for the entire sewer and water infrastructure alignment, including those areas previously surveyed by RPS (2018). A TEC assessment was not undertaken at the time of the RPS (2018) survey because the tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain ecological community TEC was only listed for protection under the EPBC Act in July 2019.

In accordance with the Conservation Advice (DEE 2019) the three steps in identifying patches of the nationally protected ecological community are:

1. Decide if the area meets the diagnostic characteristics of the ecological community.
2. Determine the size of each patch
    a. < 0.5 ha
    b. ≥ 0.5 < 5 ha
    c. ≥ 5 ha

    and consider the patch condition in the context of the patch size.
3. Consider the surrounding context of a patch that meets the size and condition thresholds.

As stated in the Conservation Advice, to qualify as a TEC record the vegetation must meet all the following diagnostic characteristics:

- Occur in the Swan Coastal Plain bioregion within the state of Western Australia and primarily occur on the Spearwood and Quindalup dune systems, but can also occur on the Bassendean dunes and Pinjarra Plain,on the banks of rivers and wetlands
- Occur (most commonly) as a woodland, or in a variety of structural forms, including closed forest, open forest, woodland, open woodland, closed mallee forest, open mallee forest, mallee woodland and open mallee woodland
- Have a dominant canopy of *Eucalyptus gomphocephala* (tuart)
- Have at least two living established *Eucalyptus gomphocephala* (tuart) trees in the uppermost canopy layer, although they may co-occur with trees of other species
- Have a gap of no more than 60 m between the outer edges of the canopies of adjacent tuart trees.

The patch size and condition thresholds used in assessing potential TEC patches are presented in Appendix A, Table A-9).

2.2 Data analysis

2.2.1 Flora and taxonomy

A vascular flora inventory was compiled from flora species recorded and collected within the addendum survey area. Flora specimens were either identified in the field, or collected and identified using the resources (keys, publications and databases) of the Western Australian Herbarium (WAH). Nomenclature was aligned with the current names in Florabase (WAHa 2019).

2.2.2 Vegetation mapping

Vegetation description and mapping was conducted using a combination of aerial photo-interpretation, regional vegetation mapping, on-ground confirmation and vegetation structure data. Each vegetation unit was defined by the dominant plant species using the vegetation structure classes established under Bush Forever (Western Australian Planning Commission 2000) (Appendix A, Table A-6 and A.7).

Vegetation condition mapping was conducted using aerial photo-interpretation and on-site confirmation. Vegetation condition was assessed using the Vegetation Condition Scale adapted from Keighery (1994) and Trudgen (1988) recommended in the EPA's Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016) (Appendix A, Table A-8).

3 RESULTS

3.1 Flora

3.1.1 Flora statistics

A total of 45 plant taxa were recorded for the addendum survey area of which 17 were exotic (weed) species. In addition to this there were numerous planted tree and shrub species which were not recorded for this survey. The list of species recorded is presented in Appendix B. It should be noted that this list is by no means exhaustive - this reconnaissance level survey involved low-level sampling of the flora, with a focus primarily on dominant and keystone species (to accurately characterise the vegetation types present), as well as species of conservation significance (including environmentally significant weeds). As such the list does not include some common pasture weeds (grasses and herbs) and native and weed microflora which were likely present at the time of the survey.

These taxa represent 37 genera from 15 families. The families represented by the greatest number of species are presented in Table 1.

Table 1: Dominant families within the addendum survey area

Family	Common name	No. of taxa
Myrtaceae	Myrtles	11
Poaceae	Grasses	10
Fabaceae	Peas	7

3.1.2 Flora of conservation significance

No TF species listed under the BC Act or under the EPBC Act were recorded within the addendum survey area.

One PF species as currently listed by the DBCA was recorded within the addendum survey area. *Jacksonia gracillima*, a Priority 3 taxon, was recorded within Lot 329 Lakelands Rd, Barragup. A total of 16 individuals were recorded at three locations within the *Melaleuca preissiana* remnant trees over a degraded understorey of naturalised alien (weed) herbs and grasses vegetation unit (Plate 1). The locations are shown in Figure B-9 and the coordinates tabulated in Appendix C. Additional information on the species is provided below.

3.1.2.1 *Jacksonia gracillima* (P3)

Jacksonia gracillima (Plate 2) is a prostrate, spreading or scrambling shrub that grows up to 1 metre (m) high. It has orange-red flowers in October and November (WAH 2020).

(Source: WAH 2020)

Plate 1: *Jacksonia gracillima* within Lot 329 Lakelands Road, Barragup

Plate 2: *Jacksonia gracillima*

3.1.3 Introduced flora (weeds)

Seventeen introduced flora taxa were recorded from the addendum survey area representing 38% of the total flora taxa recorded. Naturalised bushland weeds were recorded at high densities throughout the addendum survey area.

The Western Australian Organism List database was searched to determine the legal status of each weed recorded, and any control requirements. Of the 17 weed species recorded, none were determined to be Declared Pests under the *Biosecurity and Agricultural Management Act 2007* nor were they classified as Weeds of National Significance.

3.2 Vegetation

3.2.1 Vegetation units

RPS (2018) assessment defined and mapped eleven upland and dampland / wetland vegetation units. No new vegetation units were defined for the addendum survey area. Of the eleven units defined previously six were represented within the addendum survey area. These units represented highly modified vegetation in degraded condition no longer representative of the original floristic communities that would have occurred there.

A description of these six vegetation units follows. Vegetation unit mapping is presented in Figures B-1 to B-9.

3.2.1.1 Remnant tuart (Unit 10)

Eucalyptus gomphocephala (tuart) remnant trees over a degraded understorey of annual and perennial naturalised alien (weed) herbs and grasses. This vegetation occurred within the road reserve along sections of Lakes Road and within Lot 526 Lakes Road, in the western portion of the addendum survey area. Remnant tuart trees within the addendum survey area are shown in Figures B-1; B-2; and B-3 and Plate 3 and Plate 4.

Plate 3 and Plate 4: Remnant *Eucalyptus gomphocephala* (tuart), Lakes Road

3.2.1.2 Planted trees and shrubs (Unit 6)

Planted (non-endemic) eucalypts over emergent and planted native shrubs occurred within the southern road reserve of Gordon Road (Figure C-1 and Plate 5 and Plate 6) and are the result of historical road-side landscaping.

Plate 5 and Plate 6: Planted trees and shrubs, Lakes Road and Kwinana Freeway

3.2.1.3 Remnant marri (Unit 7)

Within the addendum survey area *Corymbia calophylla* (marri) remnant trees over a degraded understorey of naturalised alien (weed) herbs and grasses was mapped within Lot 526 Lakes Road (Figure B-3 and Plate 7). These trees were mature and generally in excellent health.

Plate 7: Remnant *Corymbia calophylla* (marri), Lot 526 Lakes Road

3.2.1.4 Remnant *Melaleuca preissiana* (Unit 8)

Melaleuca preissiana remnant trees over a degraded understorey of exotic grasses (Plate 8 and Plate 9). This vegetation occurred throughout much of the eastern portion of the addendum survey area along Lakes Road, Gull Road and Patterson Road (Figures C-5 to C-9 and C-14 to C-16. This vegetation unit is in "Completely Degraded" condition due to the absence of an intact understorey.


Plate 8 and Plate 9: Remnant *Melaleuca preissiana*, Lot 329 Lakelands Road and Gull Road

3.2.1.5 Remnant mixed trees (Unit 9)

Scattered *Eucalyptus marginata* (jarrah), *Corymbia calophylla* (marri), *Allocasuarina fraseriana* (sheoak), *Banksia* spp., *Eucalyptus rudis* and *Melaleuca preissiana* trees over a degraded understorey of naturalised alien (weed) herbs and grasses (Plate 10 and Plate 11). This vegetation was mapped for a portion of Lot 526 Lakes Road and Lot 329 Lakelands Road (Figure B-3 and B-9).


Plate 10 and Plate 11: Remnant mixed trees, Lot 526 Lakes Road, Stakehill and Lot 329 Lakelands Road, Barragup

3.2.1.6 Scrub (Unit 12)

Kunzea glabrescens / *Adenanthos cygnorum* / *Jacksonia furcellata* Closed Tall Scrub to Tall Shrubland over a degraded understorey of naturalised alien (weed) herbs and grasses (Plate 12 and Plate 13). This vegetation was mapped for a section of Lakes Road (Figure B-3).

Plate 12 and Plate 13: *Kunzea glabrescens* / *Adenanthos cygnorum* / *Jacksonia furcellata* / *Banksia* spp. scrub, Lakes Road

3.2.2 Vegetation condition

Vegetation condition ranged from Degraded to Completely Degraded throughout the addendum survey area, with most of the vegetation within the road reserve, and areas adjacent to the road reserve and within the addendum survey area, recorded as Completely Degraded. All of the vegetation within the addendum survey area had a high weed load. Vegetation condition mapping is presented in Figures C-1 to C-9.

3.2.3 Significant trees

A total of 22 trees with a DBH greater than 500 mm were recorded within the addendum survey area (Appendix D; Figures B-1 to B-9). The number of trees recorded for each species is presented in Table 2.

Table 2: Tree species recorded with a DBH >500 mm

Species	Number recorded
Eucalyptus gomphocephala (tuart)	14
Corymbia calophylla (marri)	3
Eucalyptus rudis subsp. rudis (flooded gum)	4
Eucalyptus marginata subsp. *marginata* (jarrah)	1

Eucalyptus gomphocephala (tuart), *Corymbia calophylla* (marri), *Eucalyptus rudis* subsp. *rudis* (flooded gum), and *Eucalyptus marginata* subsp. *marginata* (jarrah) are recognised by DSEWPAC (2012) to provide potential breeding and night-roosting habitat for black cockatoos.

4 DISCUSSION

4.1 Floristic diversity and representation

In assessing the conservation significance of flora within the addendum survey area, consideration is given to rarity, biodiversity, endemism and representativeness of the flora in the area.

4.1.1 Rarity

The rarity of the flora was assessed via the various categories of TF (protected under the BC Act and under the EPBC Act) and PF (listed by DBCA).

No TF were recorded within the addendum survey area for the current survey.

One Priority 3 PF species, *Jacksonia gracillima* was recorded within a portion of the addendum survey area (in Lot 329 Lakelands Road, Barragup).

The rarity of the addendum survey area flora was assessed as moderate.

4.1.2 Biodiversity

A total of 28 native taxa were recorded for the addendum survey area mostly comprising remnant trees and emergent shrubs. There was no native intact understorey recorded within the addendum survey area.

Floristic diversity was assessed as low.

4.2 Vegetation conservation significance

4.2.1 Bioregional representation

On a regional scale the addendum survey area is mapped as Vegetation Associations 968; 1000; and 1001 (Shepherd et al. 2002) and Bassendean Complex Central and South; Herdsman Complex; and Yoongarillup Complex (Heddle et al. 1980). Of these three associations the one with the least remaining is Vegetation Association 968 (Medium woodland; jarrah, marri and wandoo) which has only 6.62% (9,017.32 ha) of its original (pre-European) extent remaining in the Swan Coastal Plain IBRA bioregion, and only 1.18% protected for conservation (Government of Western Australia 2018), however, there are no records of this vegetation in Good or better condition within the addendum survey area.

4.2.2 National threatened ecological communities

The addendum survey area intersects the buffers of three EPBC listed TECs, Banksia Woodlands of the Swan Coastal Plain ecological community (Endangered), Subtropical and Temperate Coastal Saltmarsh ecological community (Vulnerable) and tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain ecological community (Critically Endangered).

These three nationally-significant communities and their representation within the addendum survey area are discussed below.

4.2.2.1 Banksia woodlands of the Swan Coastal Plain ecological community

No Banksia woodland vegetation was recorded within the addendum survey area therefore none of the vegetation described and mapped for the survey represents the Banksia Woodlands of the Swan Coastal Plain ecological community TEC.

4.2.2.2 Subtropical and Temperate Coastal Saltmarsh ecological community

No saltmarsh vegetation was recorded within the addendum survey area therefore none of the vegetation described and mapped for the survey represents the Subtropical and Temperate Coastal Saltmarsh ecological community TEC.

4.2.2.3 Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain ecological community

The *Eucalyptus gomphocephala* (tuart) remnant trees mapped within the addendum survey area in the western portion of the proposed alignment were assessed against the key diagnostic characteristics set out in the Conservation Advice for the tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain ecological community TEC (DEE 2019) to determine if this vegetation should be considered a record of the TEC.

The assessment determined that one patch of tuart woodland, which intersects the original survey area and the addendum survey area, meets all of the diagnostic characteristics, as well as the minimum patch size and condition requirements for the ecological community, and therefore is considered a record of the TEC and protected under the EPBC Act. As stated in the Conservation Advice the patch boundary extends 30 m beyond the outer canopy of the tuart trees, and trees belong to the same patch if there is < 60 m between their 30 m buffers. This patch is mapped within road reserve on Lakes Road and within Lot 526 Lakes Road (Figure D-2). This patch meets the criteria and is considered part of the EPBC Act listed TEC because although the understorey is in Degraded or Completely Degraded condition it consists of numerous mature and very large tuart trees covering an area of ≥ 5 ha.

There is also an area of tuart woodland mapped within the road reserve on Lakes Road at the western-most end of the addendum survey area (Figure D-1), which is 2.02 ha in size. The understory is in Completely Degraded condition and therefore this patch, on its own, does not meet the minimum condition and size thresholds and so is not considered part of the protected ecological community. However, aerial imagery indicates that this ‘patch’ is contiguous with a large area of intact woodland to the north, which is on private land, and is likely to comprise tuart woodland or forest vegetation which is ≥ 5 ha in size. This patch therefore represents a ‘potential’ TEC record.

4.2.3 Western Australian Threatened and Priority ecological communities

No state-listed TECs were recorded within the addendum survey area for the current survey.

The three EPBC-listed TECs discussed in Section 4.2.2 are listed at a state level as PECs.

4.3 Fauna habitat

The 22 significant trees recorded within the addendum survey area are considered potential night roosting and breeding habitat for black cockatoos and therefore conservation significant.

4.4 Other conservation significant features

The addendum survey area lies adjacent to, and in some places intersects, environmental features identified in the desktop survey such as Conservation Category Wetlands, associated with Goegrup Lake and the Serpentine River on Gordon Road.

5 REFERENCES

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FIGURES

Figure A

Location plan and map index

GDA 1994 MGA Zone 50

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Source: Cadastre - Landgate, 2019 Orthophoto - Landgate, Feb 2019

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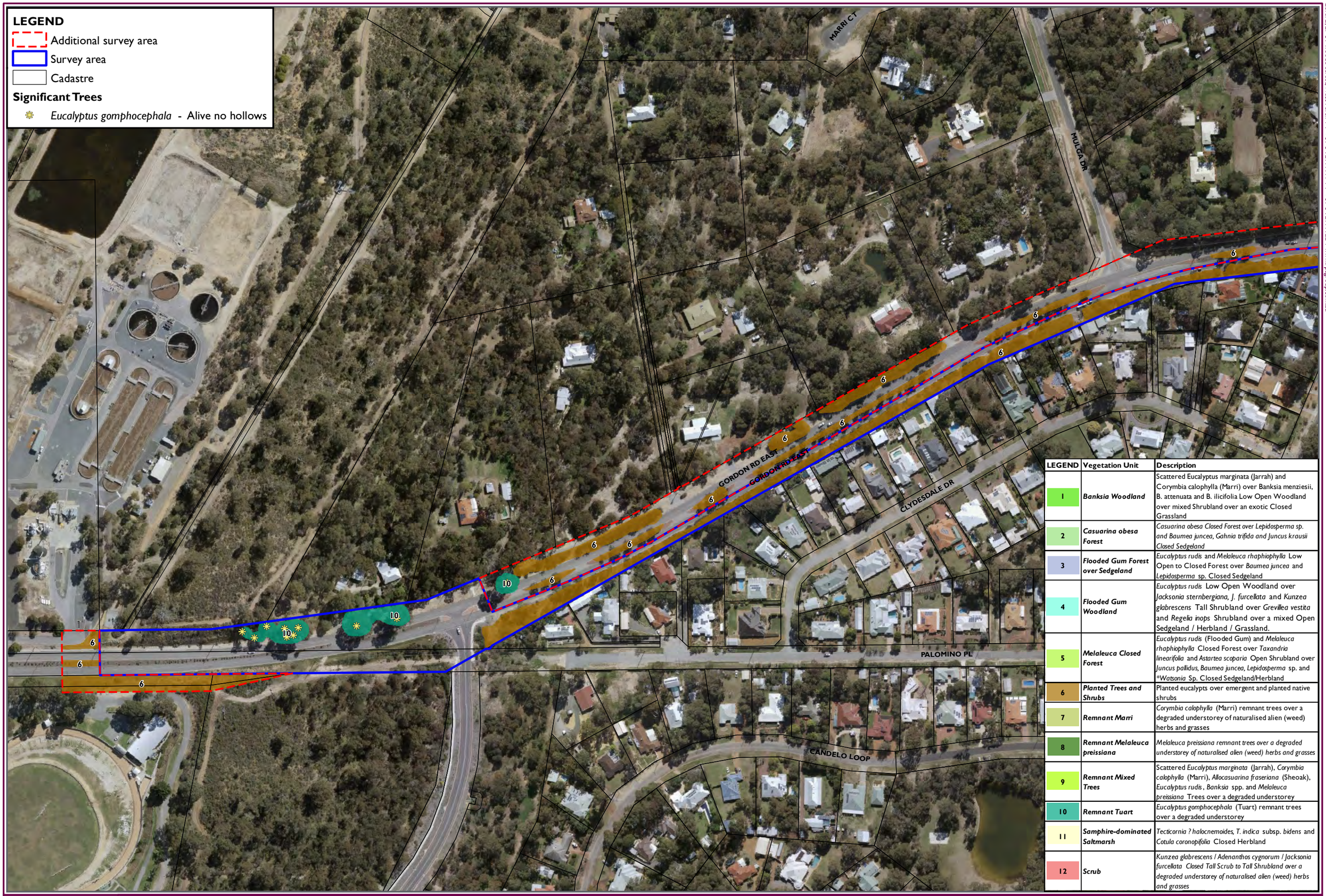

LEGEND	Vegetation Unit	Description
1	***Banksia Woodland***	Scattered Eucalyptus marginata (Jarrah) and Corymbia calophylla (Marri) over Banksia menziesii, B. attenuata and B. ilicifolia Low Open Woodland over mixed Shrubland over an exotic Closed Grassland
2	***Casuarina obesa Forest***	*Casuarina obesa Closed Forest over Lepidosperma sp. and Baumea juncea, Gahnia trifida and Juncus krausii Closed Sedgeland*
3	***Flooded Gum Forest over Sedgeland***	*Eucalyptus rudis* and *Melaleuca rhaphiophylla* Low Open to Closed Forest over *Baumea juncea* and *Lepidosperma* sp. Closed Sedgeland
4	***Flooded Gum Woodland***	*Eucalyptus rudis* Low Open Woodland over *Jacksonia sternbergiana, J. furcellata* and *Kunzea glabrescens* Tall Shrubland over *Grevillea vestita* and *Regelia inops* Shrubland over a mixed Open Sedgeland / Herbland / Grassland.
5	***Melaleuca Closed Forest***	*Eucalyptus rudis* (Flooded Gum) and *Melaleuca rhaphiophylla* Closed Forest over *Taxandria linearifolia* and *Astartea scoparia* Open Shrubland over *Juncus pallidus, Baumea juncea, Lepidosperma* sp. and **Watsonia* Sp. Closed Sedgeland/Herbland
6	***Planted Trees and Shrubs***	Planted eucalypts over emergent and planted native shrubs
7	***Remnant Marri***	*Corymbia calophylla* (Marri) remnant trees over a degraded understorey of naturalised alien (weed) herbs and grasses
8	***Remnant Melaleuca preissiana***	*Melaleuca preissiana remnant trees over a degraded understorey of naturalised alien (weed) herbs and grasses*
9	***Remnant Mixed Trees***	Scattered *Eucalyptus marginata* (Jarrah), *Corymbia calophylla* (Marri), *Allocasuarina fraseriana* (Sheoak), *Eucalyptus rudis*, *Banksia* spp. and *Melaleuca preissiana* Trees over a degraded understorey
10	***Remnant Tuart***	*Eucalyptus gomphocephala* (Tuart) remnant trees over a degraded understorey
11	***Samphire-dominated Saltmarsh***	*Tecticornia ? halocnemoides, T. indica* subsp. *bidens* and *Cotula coronopifolia* Closed Herbland
12	***Scrub***	*Kunzea glabrescens / Adenanthos cygnorum / Jacksonia furcellata Closed Tall Scrub to Tall Shrubland over a degraded understorey of naturalised alien (weed) herbs and grasses*

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Created by: MA
Source: Orthophoto - Landgate, April 2019

GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure B-1

Vegetation Units

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LEGEND	Vegetation Unit	Description
1	***Banksia Woodland***	Scattered Eucalyptus marginata (Jarrah) and Corymbia calophylla (Marri) over Banksia menziesii, B. attenuata and B. ilicifolia Low Open Woodland over mixed Shrubland over an exotic Closed Grassland
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3	***Flooded Gum Forest over Sedgeland***	*Eucalyptus rudis* and *Melaleuca rhaphiophylla* Low Open to Closed Forest over *Baumea juncea* and *Lepidosperma* sp. Closed Sedgeland
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6	***Planted Trees and Shrubs***	Planted eucalypts over emergent and planted native shrubs
7	***Remnant Marri***	*Corymbia calophylla* (Marri) remnant trees over a degraded understorey of naturalised alien (weed) herbs and grasses
8	***Remnant Melaleuca preissiana***	*Melaleuca preissiana remnant trees over a degraded understorey of naturalised alien (weed) herbs and grasses*
9	***Remnant Mixed Trees***	Scattered *Eucalyptus marginata* (Jarrah), *Corymbia calophylla* (Marri), *Allocasuarina fraseriana* (Sheoak), *Eucalyptus rudis*, *Banksia* spp. and *Melaleuca preissiana* Trees over a degraded understorey
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GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure B-2

Vegetation Units

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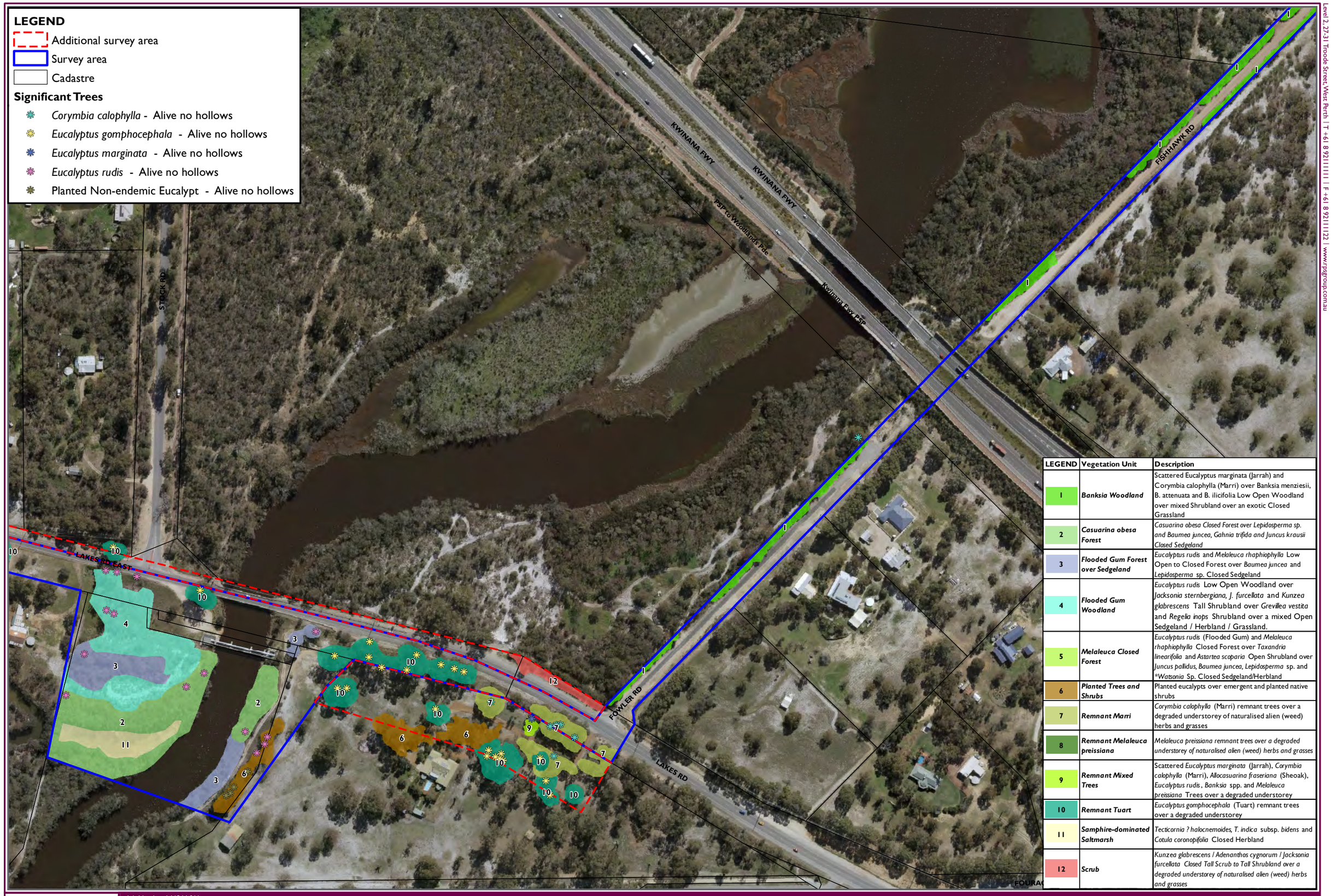

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4	*Flooded Gum Woodland*	*Eucalyptus rudis* Low Open Woodland over *Jacksonia sternbergiana, J. furcellata* and *Kunzea glabrescens* Tall Shrubland over *Grevillea vestita* and *Regelia inops* Shrubland over a mixed Open Sedgeland / Herbland / Grassland.
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7	*Remnant Marri*	*Corymbia calophylla* (Marri) remnant trees over a degraded understorey of naturalised alien (weed) herbs and grasses
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9	*Remnant Mixed Trees*	Scattered *Eucalyptus marginata* (Jarrah), *Corymbia calophylla* (Marri), *Allocasuarina fraseriana* (Sheoak), *Eucalyptus rudis*, *Banksia* spp. and *Melaleuca preissiana* Trees over a degraded understorey
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GDA 1994 MGA Zone 50

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Figure B-3

Vegetation Units

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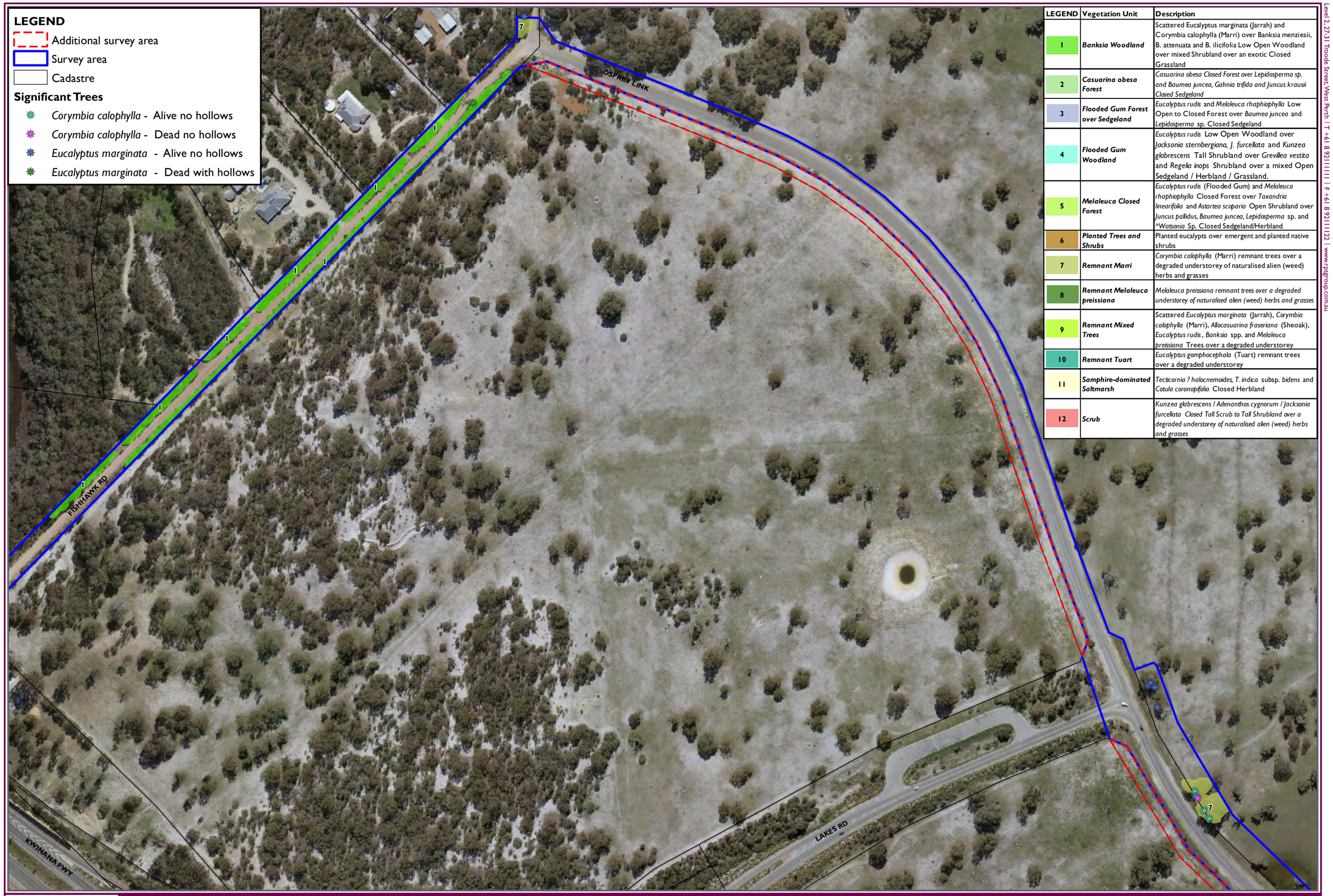

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Figure B-4

Vegetation Units

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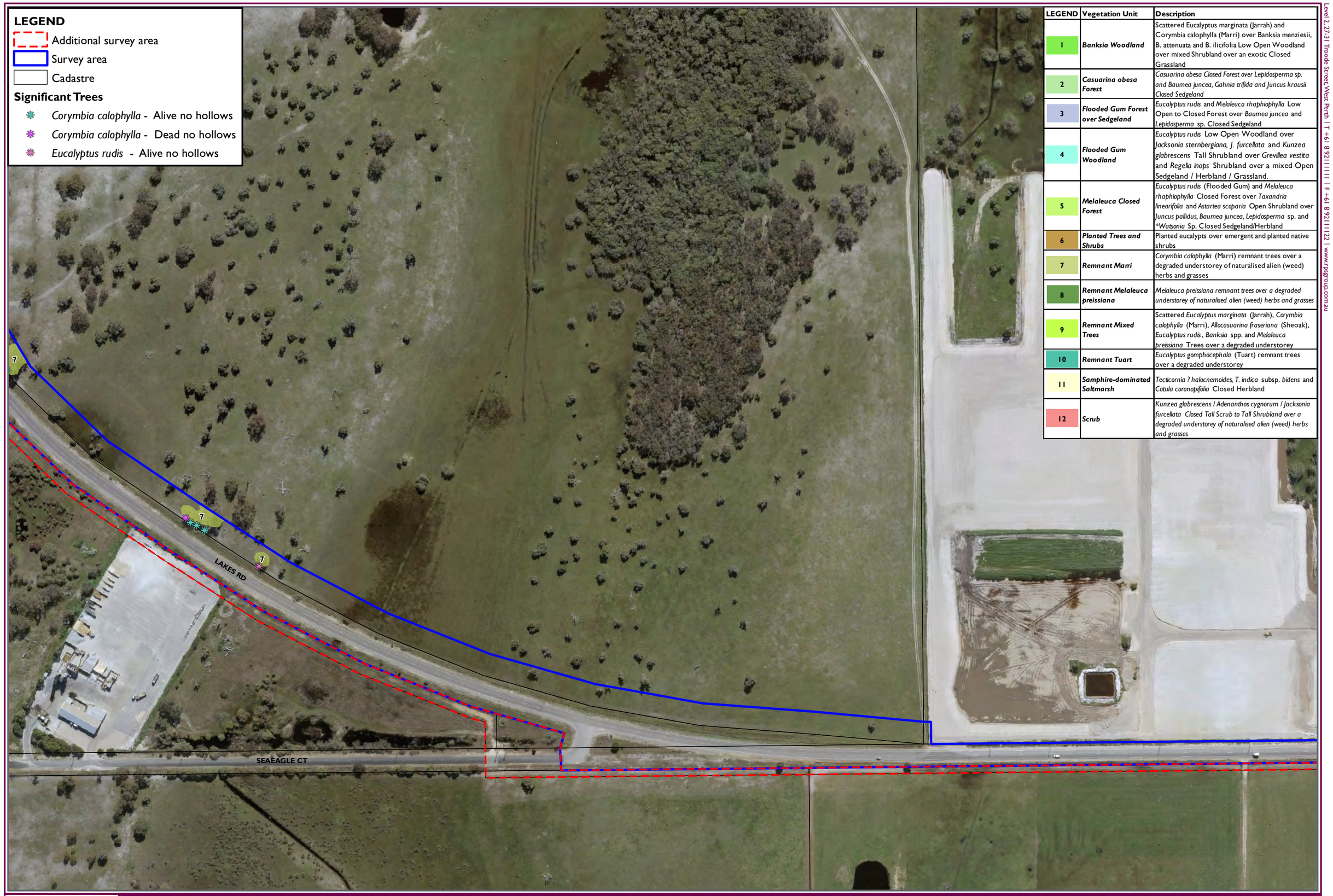

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Figure B-5

Vegetation Units

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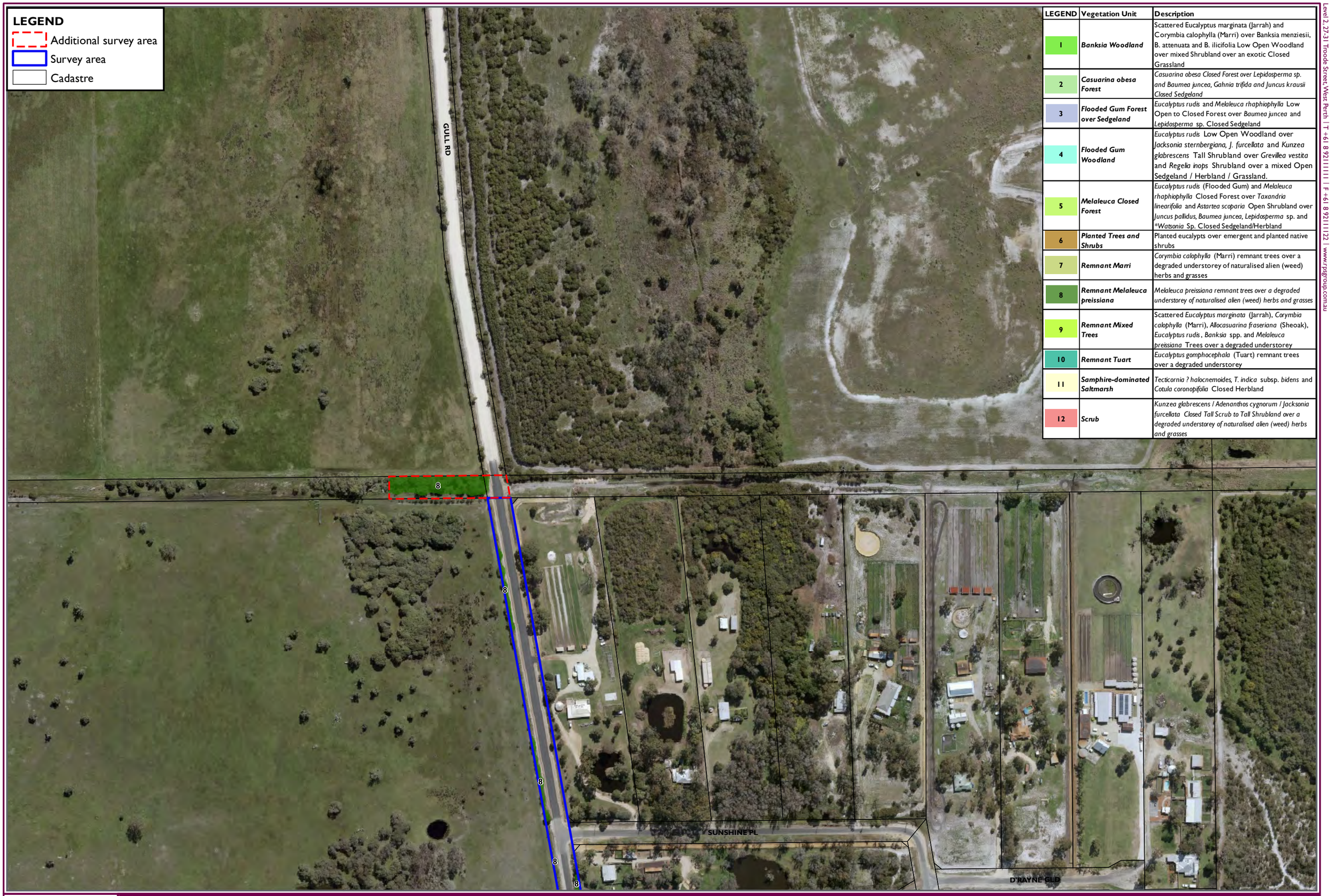

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Source: Orthophoto - Landgate, April 2019

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Figure B-6

Vegetation Units

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7	***Remnant Marri***	*Corymbia calophylla* (Marri) remnant trees over a degraded understorey of naturalised alien (weed) herbs and grasses
8	***Remnant Melaleuca preissiana***	*Melaleuca preissiana remnant trees over a degraded understorey of naturalised alien (weed) herbs and grasses*
9	***Remnant Mixed Trees***	Scattered *Eucalyptus marginata* (Jarrah), *Corymbia calophylla* (Marri), *Allocasuarina fraseriana* (Sheoak), *Eucalyptus rudis*, *Banksia* spp. and *Melaleuca preissiana* Trees over a degraded understorey
10	***Remnant Tuart***	*Eucalyptus gomphocephala* (Tuart) remnant trees over a degraded understorey
11	***Samphire-dominated Saltmarsh***	*Tecticornia ? halocnemoides, T. indica* subsp. *bidens* and *Cotula coronopifolia* Closed Herbland
12	***Scrub***	*Kunzea glabrescens / Adenanthos cygnorum / Jacksonia furcellata Closed Tall Scrub to Tall Shrubland over a degraded understorey of naturalised alien (weed) herbs and grasses*

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Figure B-7

Vegetation Units

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LEGEND	Vegetation Unit	Description
1	***Banksia Woodland***	Scattered Eucalyptus marginata (Jarrah) and Corymbia calophylla (Marri) over Banksia menziesii, B. attenuata and B. ilicifolia Low Open Woodland over mixed Shrubland over an exotic Closed Grassland
2	***Casuarina obesa Forest***	*Casuarina obesa Closed Forest over Lepidosperma sp. and Baumea juncea, Gahnia trifida and Juncus krausii Closed Sedgeland*
3	***Flooded Gum Forest over Sedgeland***	*Eucalyptus rudis* and *Melaleuca rhaphiophylla* Low Open to Closed Forest over *Baumea juncea* and *Lepidosperma* sp. Closed Sedgeland
4	***Flooded Gum Woodland***	*Eucalyptus rudis* Low Open Woodland over *Jacksonia sternbergiana, J. furcellata* and *Kunzea glabrescens* Tall Shrubland over *Grevillea vestita* and *Regelia inops* Shrubland over a mixed Open Sedgeland / Herbland / Grassland.
5	***Melaleuca Closed Forest***	*Eucalyptus rudis* (Flooded Gum) and *Melaleuca rhaphiophylla* Closed Forest over *Taxandria linearifolia* and *Astartea scoparia* Open Shrubland over *Juncus pallidus, Baumea juncea, Lepidosperma* sp. and **Watsonia* Sp. Closed Sedgeland/Herbland
6	***Planted Trees and Shrubs***	Planted eucalypts over emergent and planted native shrubs
7	***Remnant Marri***	*Corymbia calophylla* (Marri) remnant trees over a degraded understorey of naturalised alien (weed) herbs and grasses
8	***Remnant Melaleuca preissiana***	*Melaleuca preissiana remnant trees over a degraded understorey of naturalised alien (weed) herbs and grasses*
9	***Remnant Mixed Trees***	Scattered *Eucalyptus marginata* (Jarrah), *Corymbia calophylla* (Marri), *Allocasuarina fraseriana* (Sheoak), *Eucalyptus rudis*, *Banksia* spp. and *Melaleuca preissiana* Trees over a degraded understorey
10	***Remnant Tuart***	*Eucalyptus gomphocephala* (Tuart) remnant trees over a degraded understorey
11	***Samphire-dominated Saltmarsh***	*Tecticornia ? halocnemoides, T. indica* subsp. *bidens* and *Cotula coronopifolia* Closed Herbland
12	***Scrub***	*Kunzea glabrescens / Adenanthos cygnorum / Jacksonia furcellata Closed Tall Scrub to Tall Shrubland over a degraded understorey of naturalised alien (weed) herbs and grasses*

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Figure B-8

Vegetation Units

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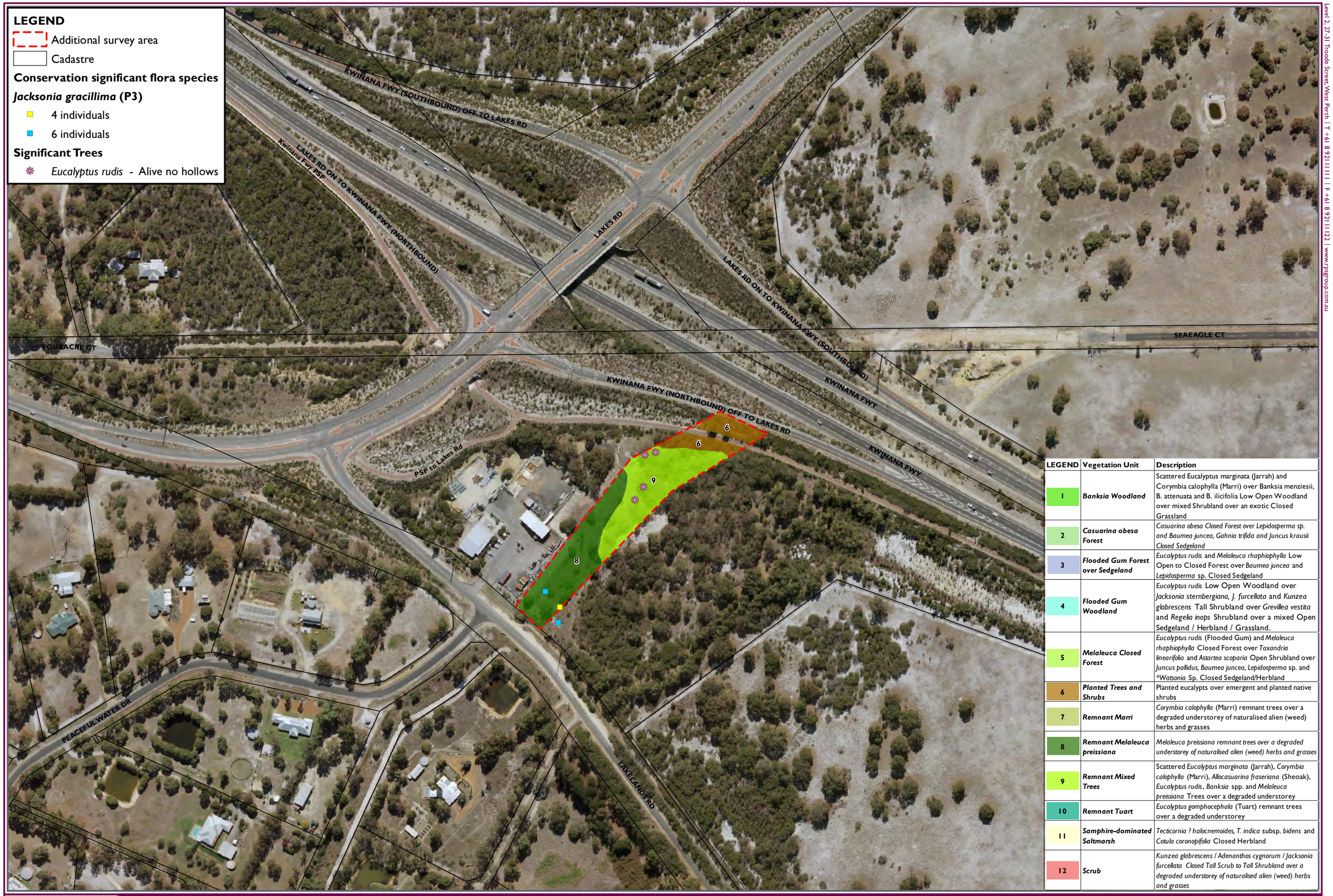

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6	***Planted Trees and Shrubs***	Planted eucalypts over emergent and planted native shrubs
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Figure B-9

Vegetation Units

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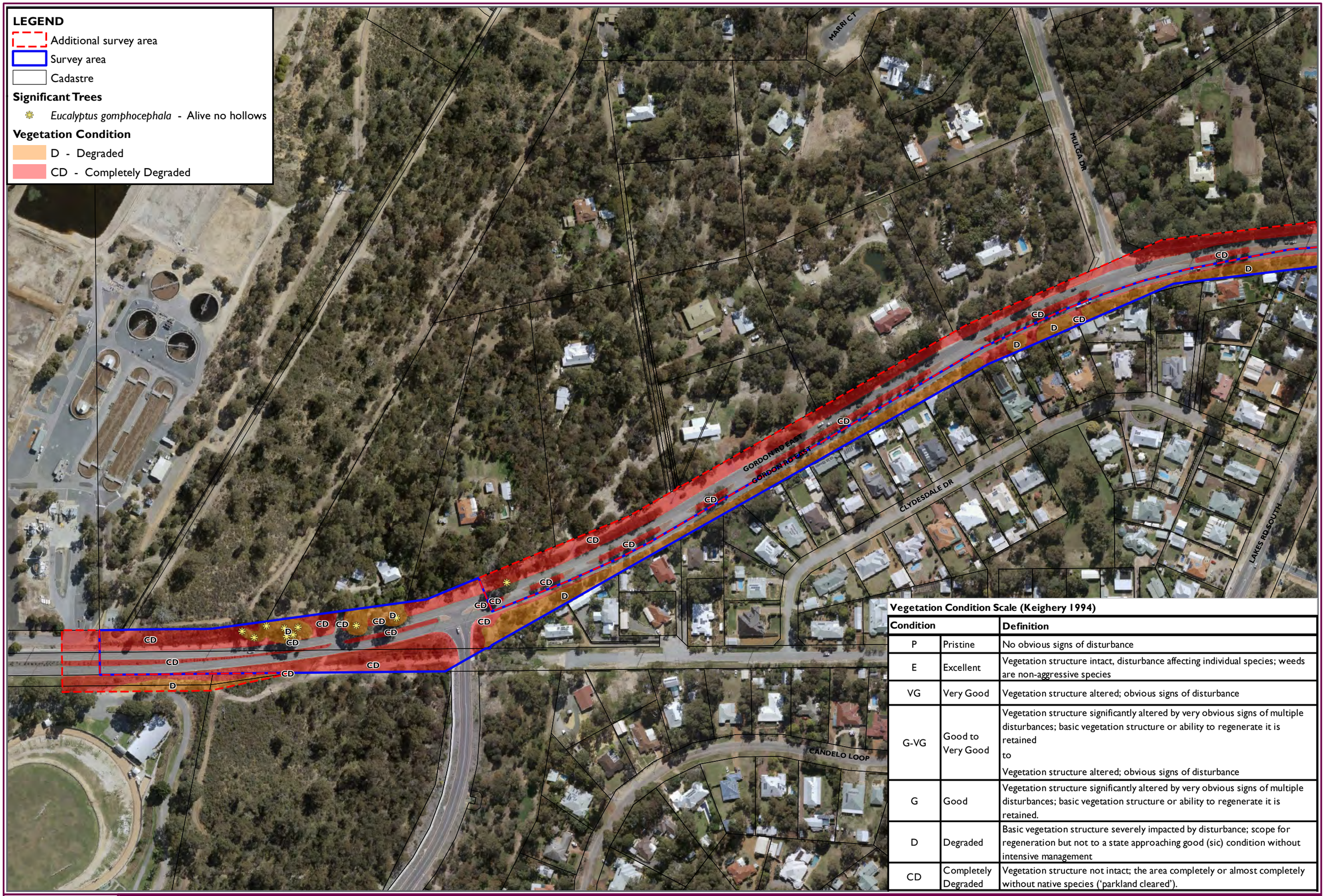

Vegetation Condition Scale (Keighery 1994)

Condition		Definition
P	Pristine	No obvious signs of disturbance
E	Excellent	Vegetation structure intact, disturbance affecting individual species; weeds are non-aggressive species
VG	Very Good	Vegetation structure altered; obvious signs of disturbance
G-VG	Good to Very Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances; basic vegetation structure or ability to regenerate it is retained to Vegetation structure altered; obvious signs of disturbance
G	Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances; basic vegetation structure or ability to regenerate it is retained.
D	Degraded	Basic vegetation structure severely impacted by disturbance; scope for regeneration but not to a state approaching good (sic) condition without intensive management
CD	Completely Degraded	Vegetation structure not intact; the area completely or almost completely without native species ('parkland cleared').

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Figure C-1

Vegetation Condition

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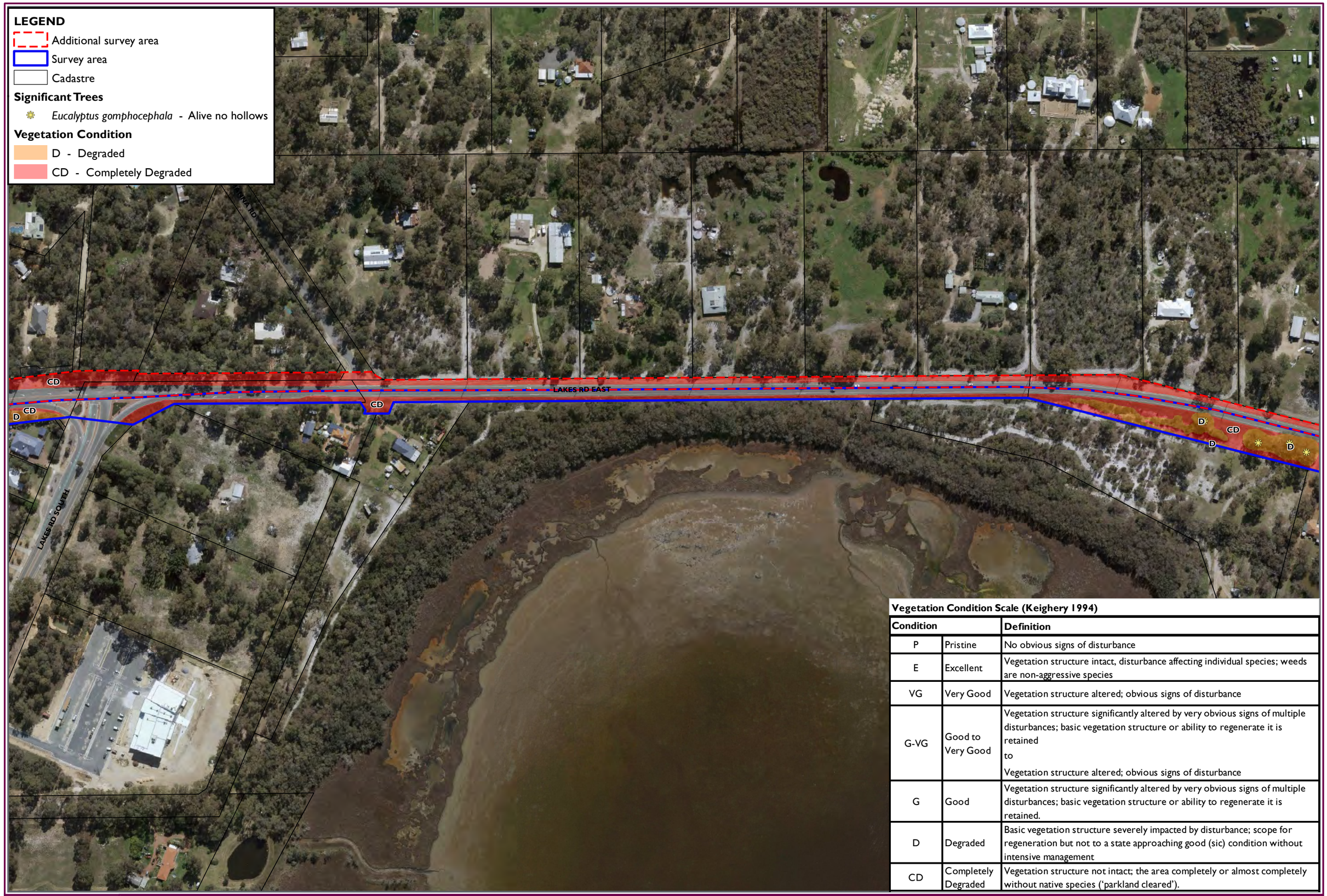

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Figure C-2

Vegetation Condition

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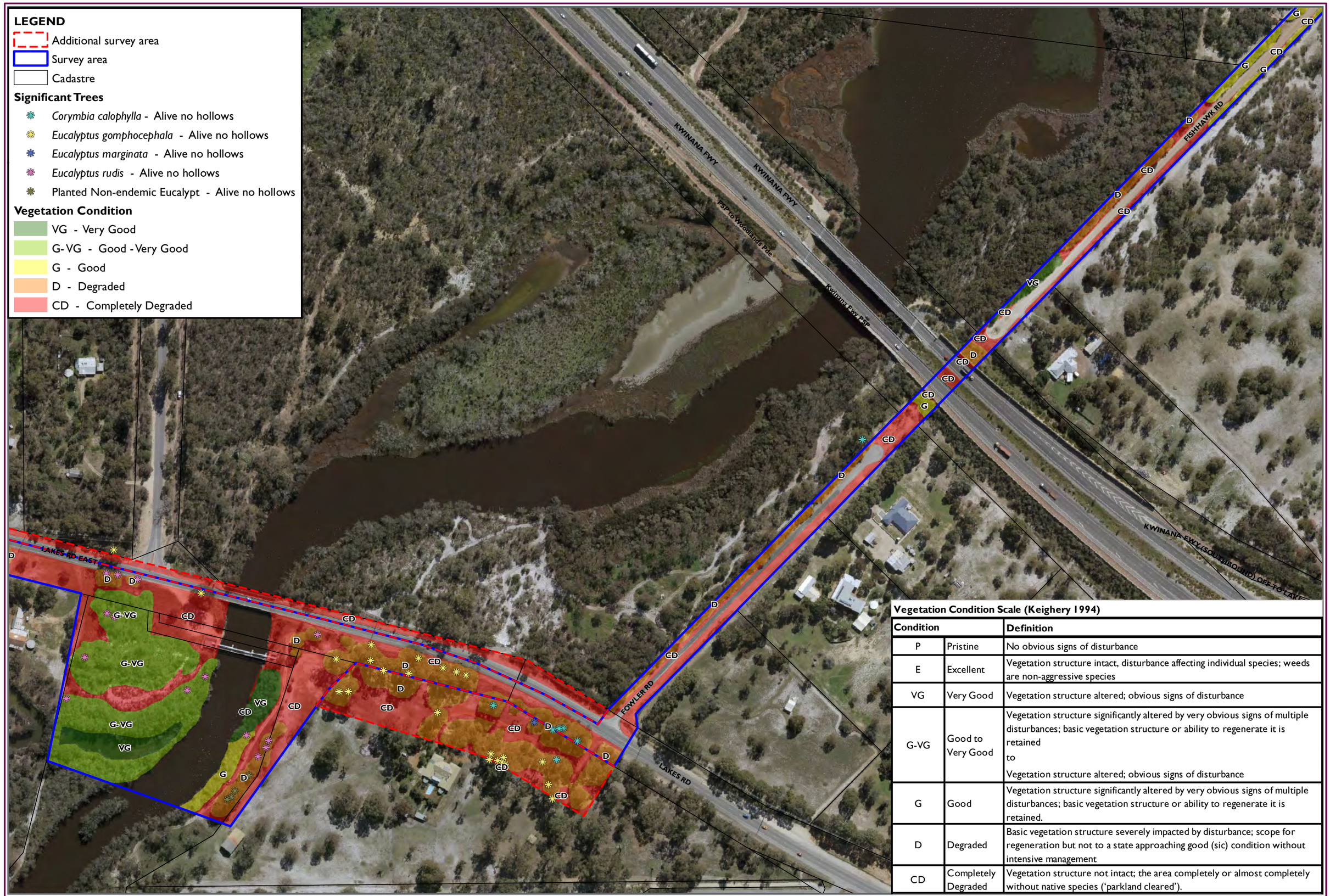

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Figure C-3

Vegetation Condition

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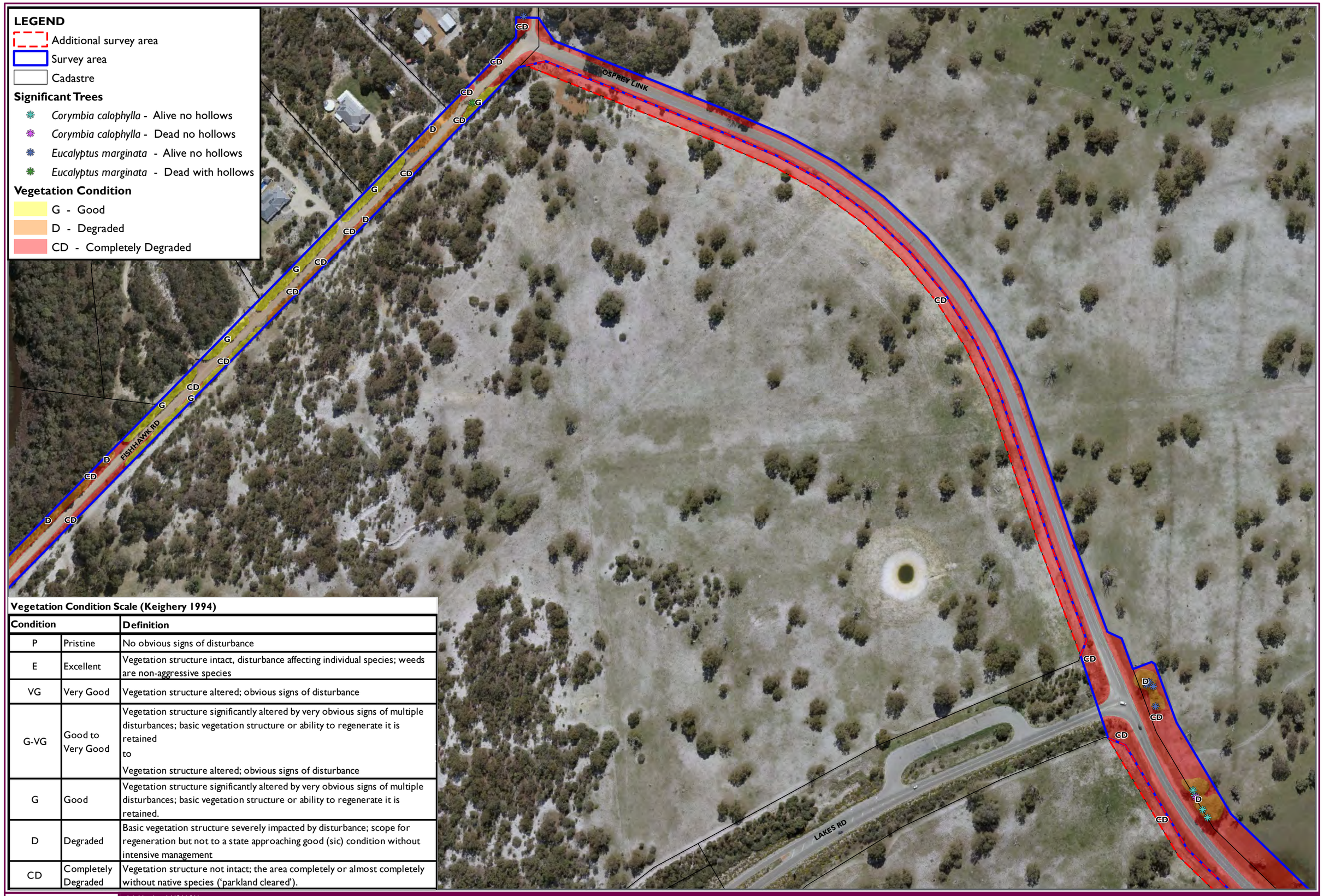

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Figure C-4

Vegetation Condition

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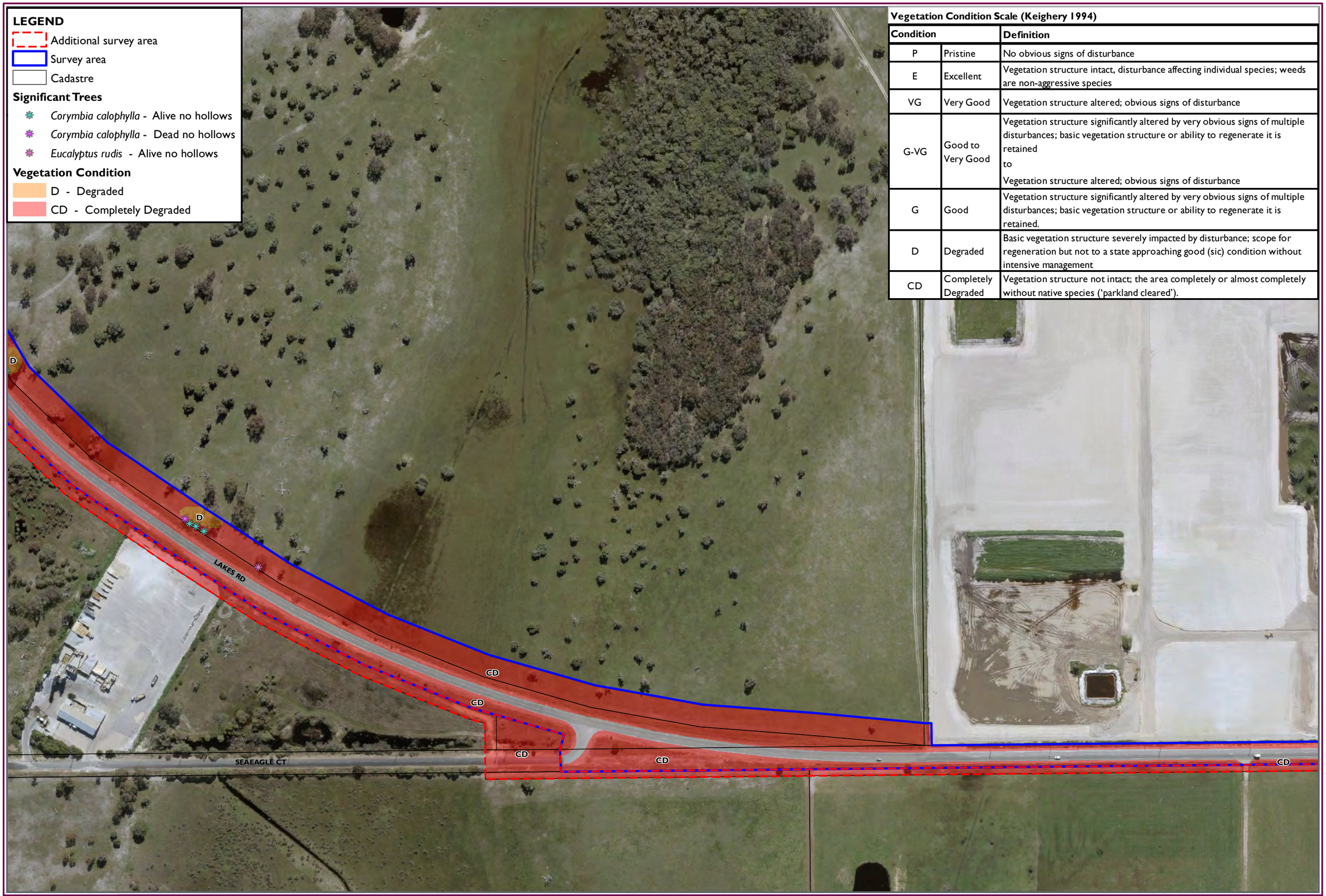

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Figure C-5

Vegetation Condition

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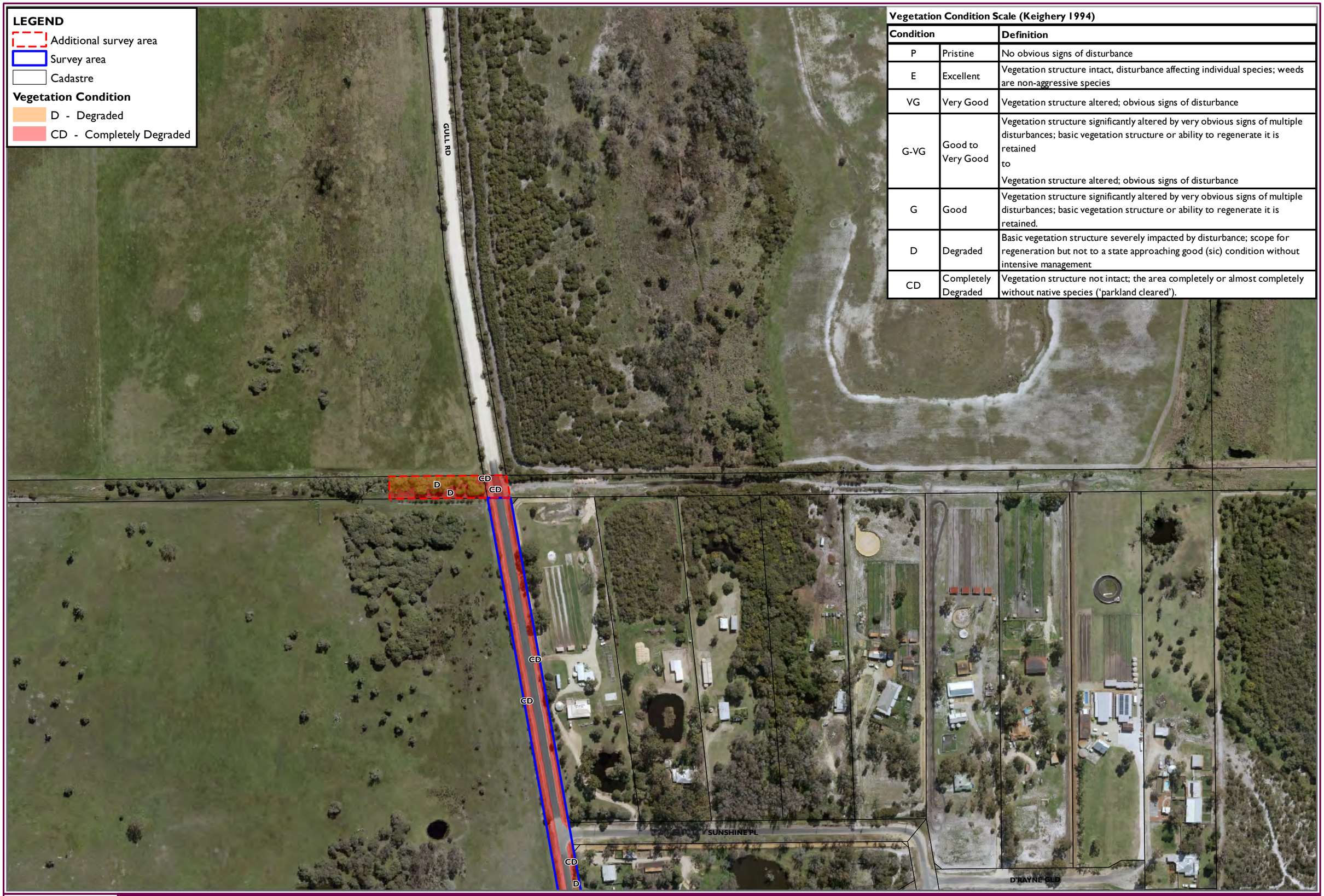

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Figure C-6

Vegetation Condition

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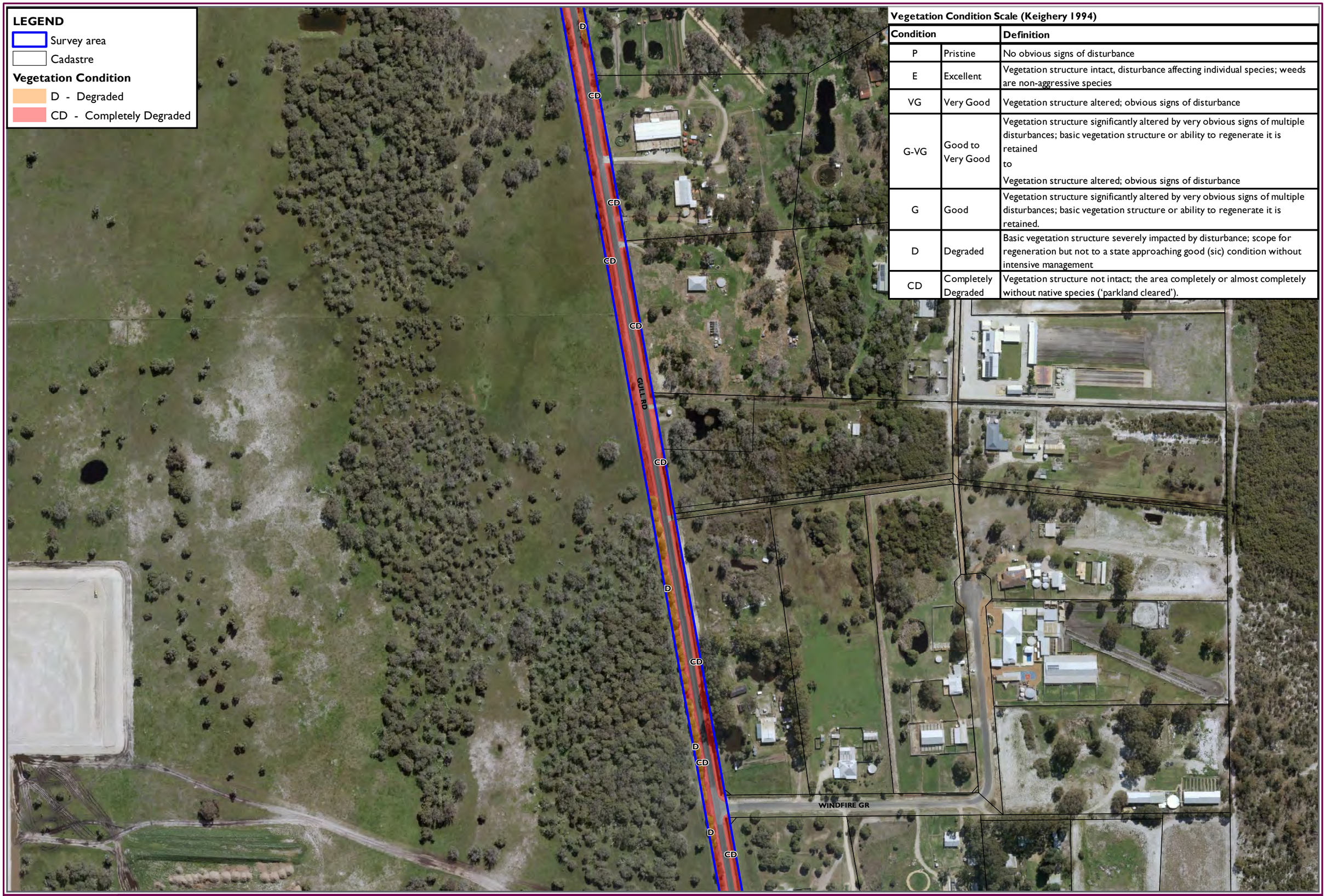

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Figure C-7

Vegetation Condition

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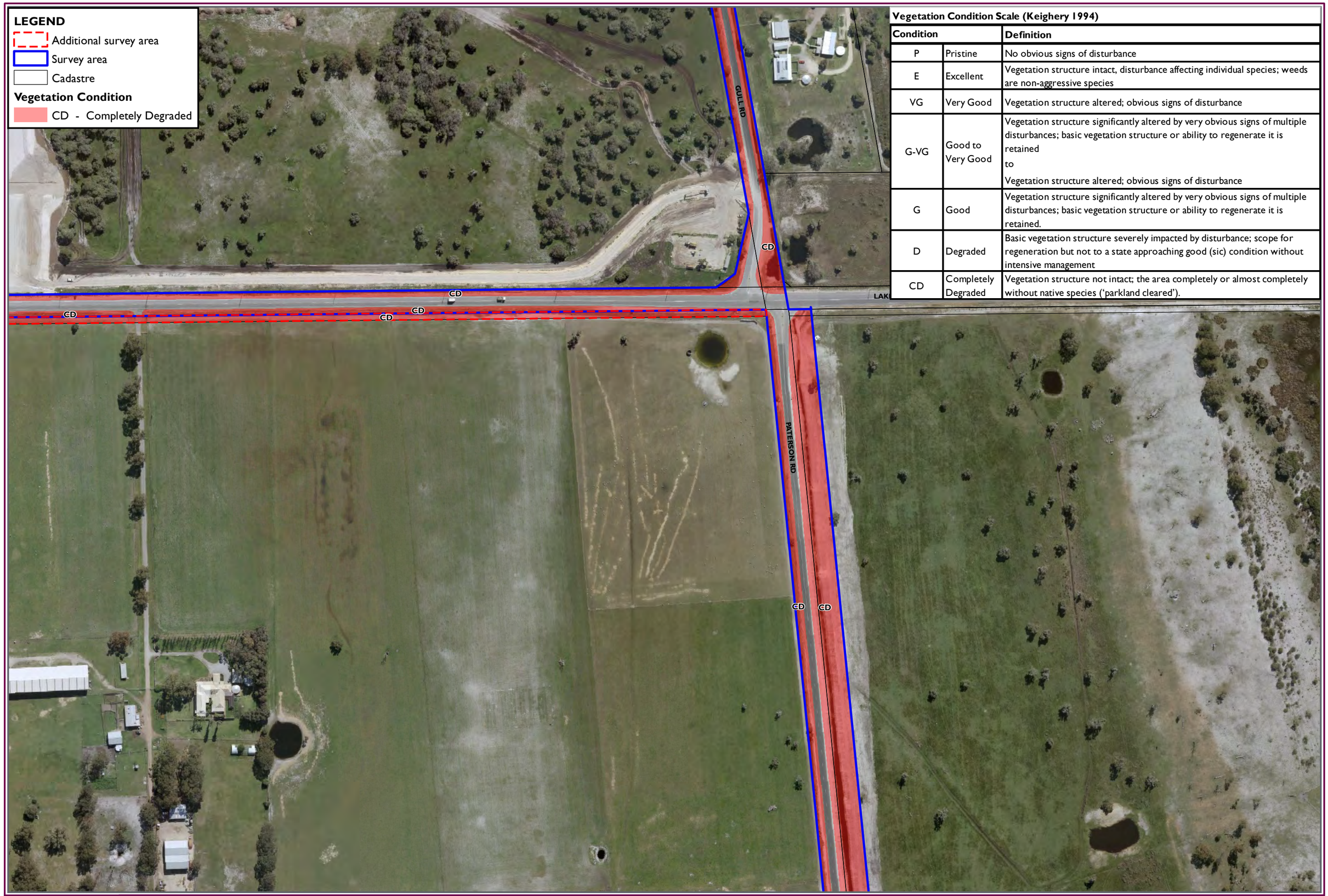

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Figure C-8

Vegetation Condition

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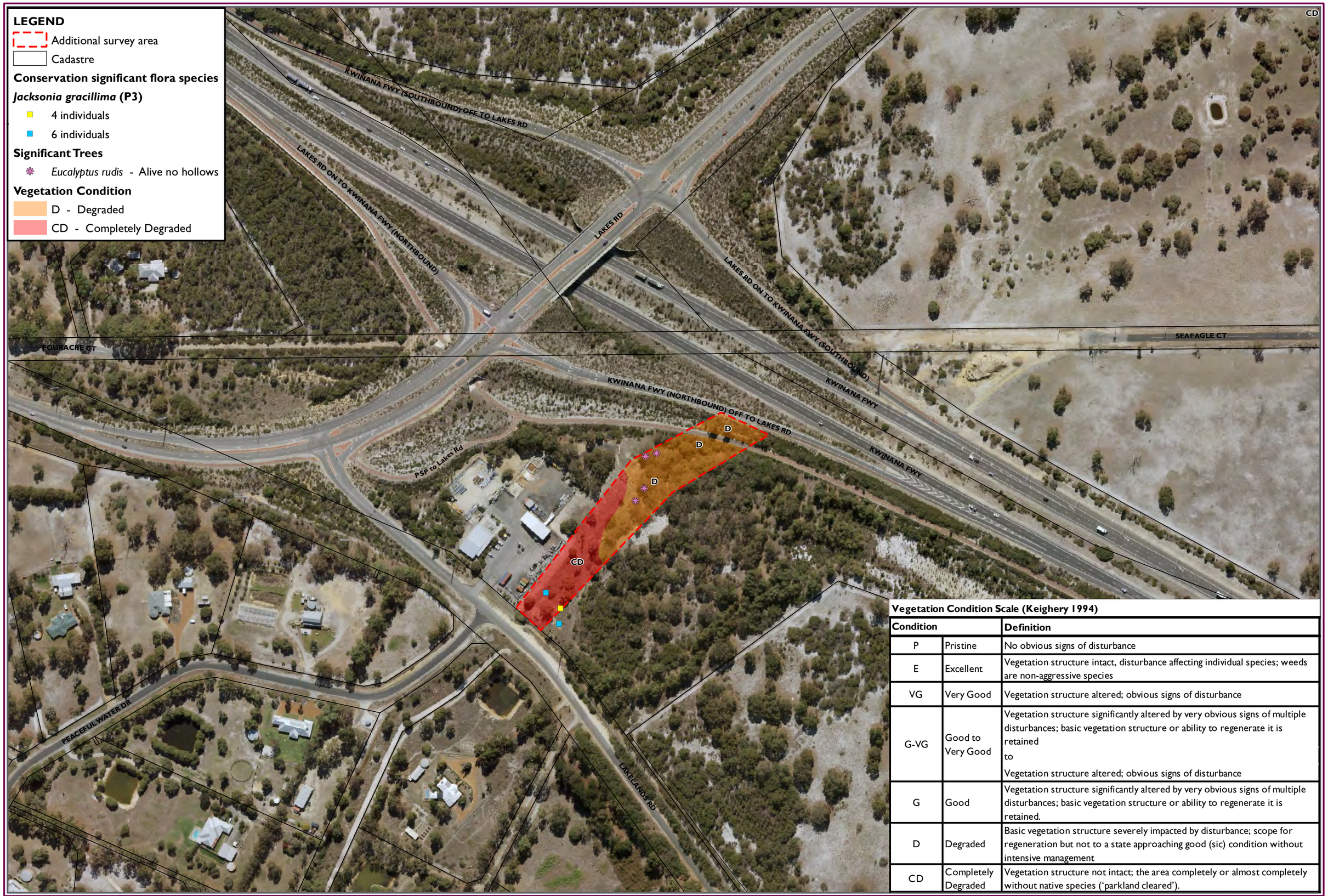

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Figure C-9

Vegetation Condition

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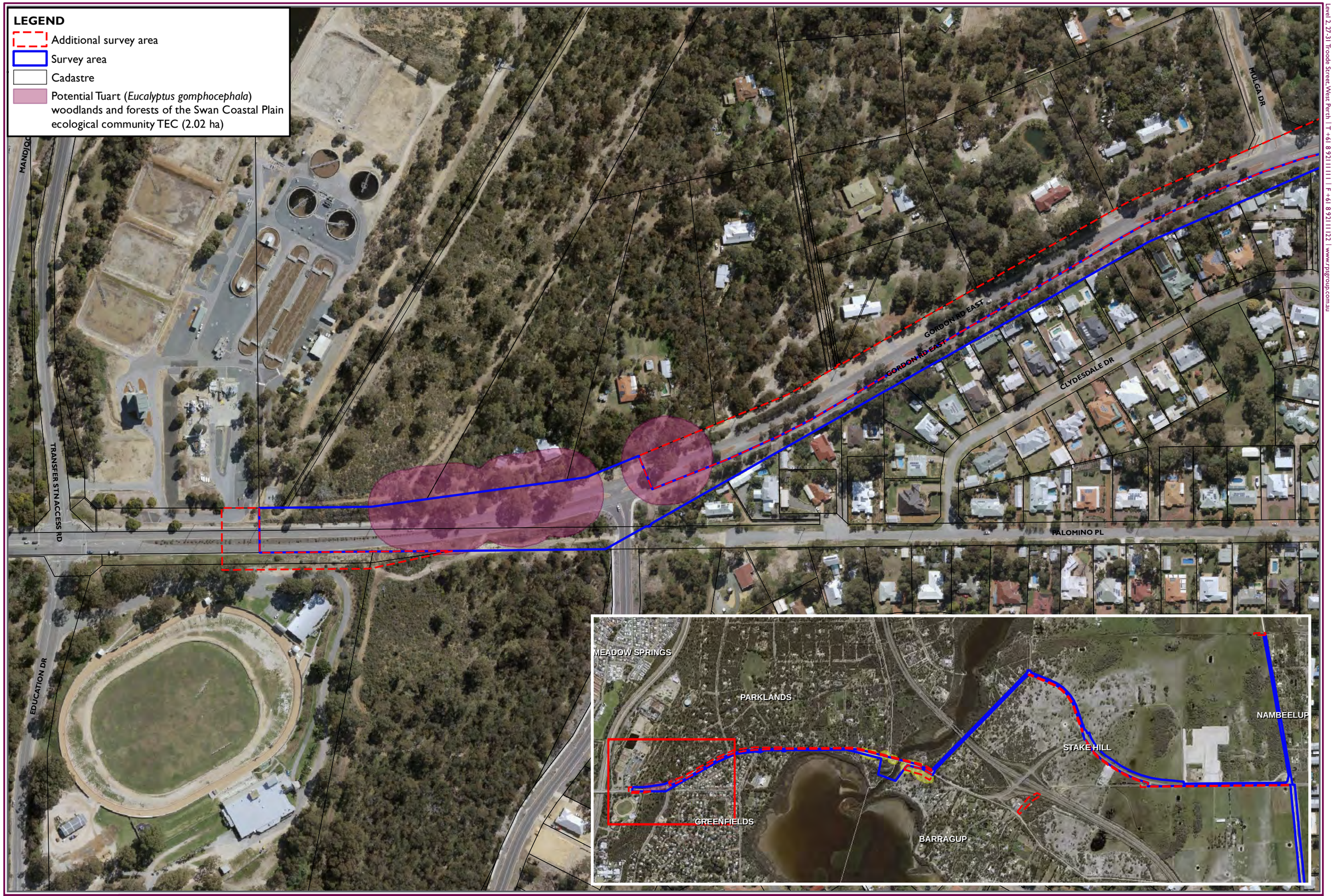

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Created by: MA
Source: Orthophoto - Landgate, Aug 2019

GDA 1994 MGA Zone 50

0 12.5 25 50 75 100 m

Figure D-1
Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain ecological community TEC

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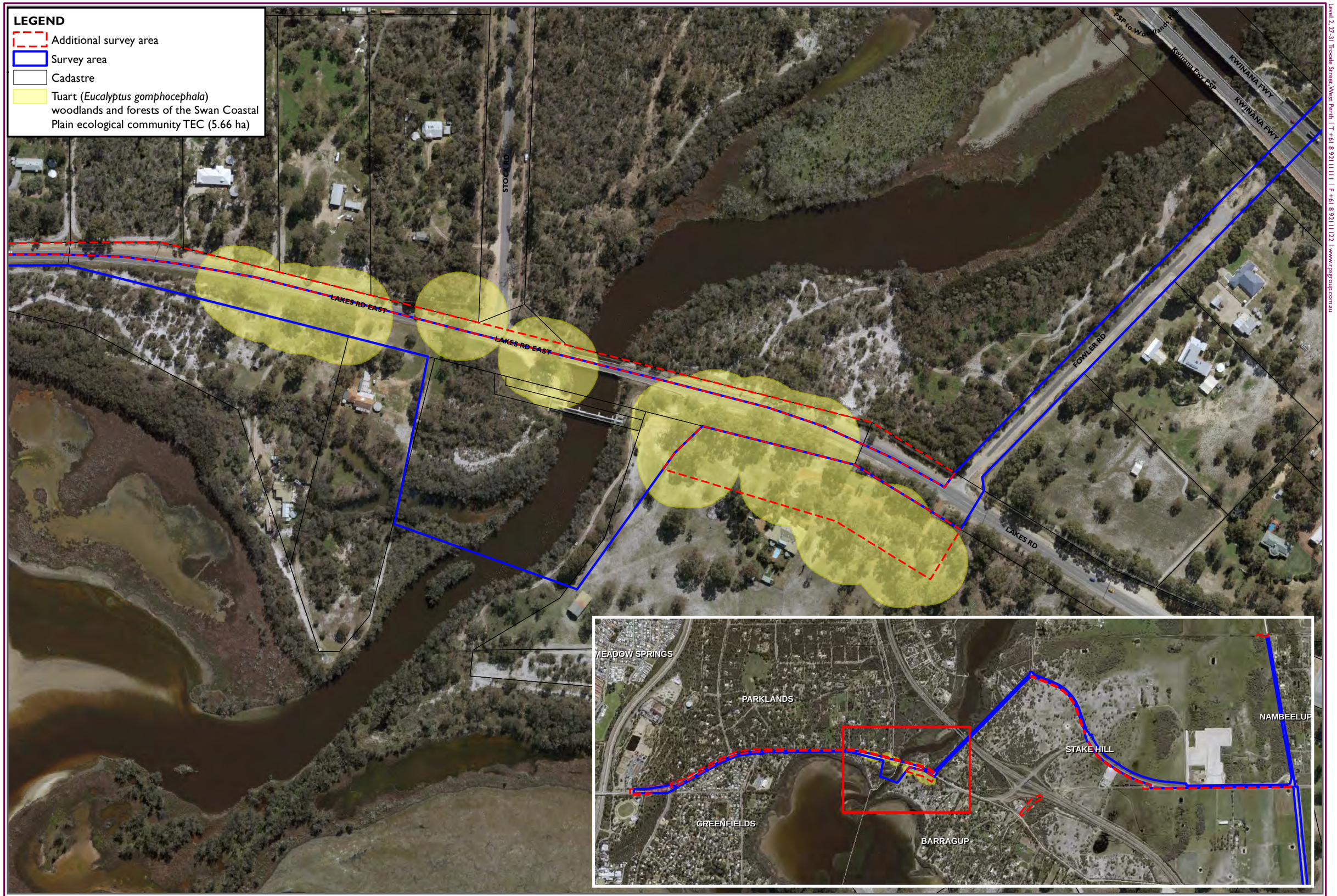

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Created by: MA
Source: Orthophoto - Landgate, Aug 2019

GDA 1994 MGA Zone 50

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Figure D-2
Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain ecological community TEC

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Appendix A

Definitions

APPENDIX A: DEFINITIONS

Table A-1: Conservation codes for Western Australian flora and fauna

Category	Definition
Threatened species	
T	**Threatened species** Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the Biodiversity Conservation Act 2016 (BC Act). **Threatened fauna** is that subset of 'Specially Protected Fauna' listed under schedules 1 to 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for Threatened Fauna. **Threatened flora** is that subset of 'Rare Flora' listed under schedules 1 to 3 of the Wildlife Conservation (Rare Flora) Notice 2018 for Threatened Flora. The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.
CR	**Critically endangered species** Threatened species considered to be "facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for critically endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for critically endangered flora.
EN	**Endangered species** Threatened species considered to be "facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for endangered flora.
VU	**Vulnerable species** Threatened species considered to be "facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for vulnerable fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for vulnerable flora.
Extinct species	
EX	**Extinct species** Species where "there is no reasonable doubt that the last member of the species has died", and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act). Published as presumed extinct under schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for extinct fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for extinct flora.
EW	**Extinct in the wild species** Species that "is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form", and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act). Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.

Category	Definition
Specially protected species	
Listed by order of the Minister as specially protected under section 13(1) of the BC Act. Meeting one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection. Species that are listed as threatened species (critically endangered, endangered or vulnerable) or extinct species under the BC Act cannot also be listed as Specially Protected species.	
M	**Migratory species** Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act). Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals, that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species. Published as migratory birds protected under an international agreement under schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.
CD	**Species of special conservation interest (conservation dependent fauna)** Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act). Published as conservation dependent fauna under schedule 6 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.
OS	**Other specially protected species** Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act). Published as other specially protected fauna under schedule 7 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.
Priority species	
P	Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened fauna or flora. Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring. Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.
P1	**Priority 1: Poorly-known species** Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
P2	**Priority 2: Poorly-known species** Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
P3	**Priority 3: Poorly-known species** Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey

Category	Definition
P4	**Priority 4: Rare, Near Threatened and other species in need of monitoring** (a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy

(Source: DBCA 2019)

Table A-2: EPBC Act conservation codes

Category	Definition
EX	**Extinct** A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual) throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
EW	**Extinct in the Wild** A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalised population (or populations) well outside the past range. A taxon is presumed Extinct in the Wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual) throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
CR	**Critically Endangered** A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered (see Section V), and it is therefore considered to be facing an extremely high risk of extinction in the wild.
EN	**Endangered** A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered (see Section V), and it is therefore considered to be facing a very high risk of extinction in the wild.
VU	**Vulnerable** A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable (see Section V), and it is therefore considered to be facing a high risk of extinction in the wild.
NT	**Near Threatened** A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.
LC	**Least Concern** A taxon is Least Concern when it has been evaluated against the criteria and it does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.
DD	**Data Deficient** A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases, great care should be exercised in choosing between DD and a threatened status. If the range of a taxon is suspected to be relatively circumscribed, and a considerable period has elapsed since the last record of the taxon, threatened status may well be justified.
NE	**Not Evaluated** A taxon is Not Evaluated when it has not yet been evaluated against the criteria.

(Source: IUCN 2019)

Table A-3: Threatened ecological communities category of threat

Category	Definition
Presumed Totally Destroyed (PD)	An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies: Records within the last 50 years have not been confirmed despite thorough searches or known or likely habitats or. All occurrences recorded within the last 50 years have since been destroyed.
Critically Endangered (CR)	An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria: The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply: Geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately five years). Modification throughout its range is continuing such that in the immediate future (within approximately five years) the community is unlikely to be capable of being substantially rehabilitated. Current distribution is limited, and one or more of the following apply (i, ii or iii): Geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes, which are likely to result in total destruction throughout its range in the immediate future (within approximately five years). There are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes. There may be many occurrences, but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes. The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately five years).
Endangered (EN)	An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C): The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 70% and either or both of the following apply (i or ii) Geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term (within approximately 10 years). Modification throughout its range is continuing such that in the short-term future (within approximately 10 years) the community is unlikely to be capable of being substantially restored or rehabilitated. Current distribution is limited, and one or more of the following apply (i, ii or iii): Geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short-term future (within approximately 10 years). There are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes. There may be many occurrences, but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes. The ecological community exists only as highly modified occurrences, which may be capable of being rehabilitated if such work begins in the short-term future (within approximately 10 years).
Vulnerable (VU)	An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction in the medium to long term future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C): The ecological community exists largely as modified occurrences, which are likely to be capable of being substantially restored or rehabilitated. The ecological community can be modified or destroyed and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations. The ecological community may still be widespread but is believed likely to move into a category of higher threat in the medium to long-term future because of existing or impending threatening processes.

Category	Definition
Data Deficient (DD)	An ecological community, which has not been adequately evaluated with respect to status or where there is currently insufficient information to assign it to a particular category. (An ecological community with poorly known distribution or biology that is suspected to belong to any of the above categories. These ecological communities have a high priority for survey and/or research).
Lower Risk (LR)	An ecological community that has been adequately surveyed and does not qualify for any of the above categories of threat and appears unlikely to be under threat of significant modification or destruction in the short to medium term future.

(Source: English and Blyth 1997)

Table A-4: Priority ecological communities category of threat

Category	Definition
P1	**Priority One: Poorly-known ecological communities** Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
P2	**Priority Two: Poorly-known ecological communities** Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, state forest, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.
P3	**Priority Three: Poorly known ecological communities** Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation, or: Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; Communities made up of large, and/or widespread occurrences that may or not be represented in the reserve system but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes. Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.
P4	**Priority Four: Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened or that have been recently removed from the threatened list** These communities require regular monitoring. Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These communities are usually represented on conservation lands. Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. Ecological communities that have been removed from the list of threatened communities during the past five years.
P5	**Priority Five: Conservation Dependent ecological communities** Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

(Source: DEC 2013)

Table A-5: EPBC Act listed threatened ecological communities category of threat

Category	Definition
CR	**Critically Endangered** If an ecological community is facing an extremely high risk of extinction in the wild in the immediate future.
EN	**Endangered** If an ecological community is not Critically Endangered but is facing a very high risk of extinction in the wild in the immediate future.
VU	**Vulnerable** If an ecological community is not Critically Endangered or Endangered but is facing a very high risk of extinction in the wild in the medium-term future.

Table A-6: NVIS vegetation structure classes

Stratum	Growth form	Height	Structural formation classes (% cover)					
			70-100	30-70	10-30	< 10	0-5	~0
U	Tree, palm	Tall; Mid; Low	Closed forest	Open forest	Woodland	Open woodland	Isolated trees	Isolated clumps of trees
	Tree mallee	Tall; Mid; Low	Closed mallee forest	Open mallee forest	Mallee woodland	Open mallee woodland	Isolated mallee trees	Isolated clumps of mallee trees
M	Shrub, cycad, grass-tree, tree-fern	Tall; Mid; Low	Closed shrubland	Shrubland	Open shrubland	Sparse shrubland	Isolated shrubs	Isolated clumps of shrubs
	Mallee shrub	Tall; Mid; Low	Closed mallee shrubland	Mallee shrubland	Open mallee shrubland	Sparse mallee shrubland	Isolated mallee shrubs	Isolated clumps of mallee shrubs
	Heath shrub	Tall; Mid; Low	Closed heathland	Heathland	Open heathland	Sparse heathland	Isolated heath shrubs	Isolated clumps of heath shrubs
	Chenopod shrub	Tall; Mid; Low	Closed chenopod shrubland	Chenopod shrubland	Open chenopod shrubland	Sparse chenopod shrubland	Isolated chenopod shrubs	Isolated clumps of chenopod shrubs
	Samphire shrub	Mid; Low	Closed samphire shrubland	Samphire shrubland	Open samphire shrubland	Sparse samphire shrubland	Isolated samphire shrubs	Isolated clumps of samphire shrubs
G	Hummock grass	Mid; Low	Closed hummock grassland	Hummock grassland	Open hummock grassland	Sparse hummock grassland	Isolated hummock grasses	Isolated clumps of hummock grasses
	Tussock grass	Mid; Low	Closed tussock grassland	Tussock grassland	Open tussock grassland	Sparse tussock grassland	Isolated tussock grasses	Isolated clumps of tussock grasses
	Other grass	Mid; Low	Closed grassland	Grassland	Open grassland	Sparse grassland	Isolated grasses	Isolated clumps of grasses
	Sedge	Mid; Low	Closed sedgeland	Sedgeland	Open sedgeland	Sparse sedgeland	Isolated sedges	Isolated clumps of sedges
	Rush	Mid; Low	Closed rushland	Rushland	Open rushland	Sparse rushland	Isolated rushes	Isolated clumps of rushes
	Forb (herb)	Mid; Low	Closed forbland	Forbland	Open forbland	Sparse forbland	Isolated forbs	Isolated clumps of forbs

(Source: ESCAVI 2003)

Table A-7: NVIS vegetation height classes

Height		Growth form			
Height class	Height range (m)	Tree, vine (m and u), palm (single-stemmed)	Shrub, heath shrub, chenopod shrub, ferns, samphire shrub, cycad, tree-fern, grass-tree, palm (multi-stemmed)	Tree mallee, mallee shrub	Tussock grass, hummock grass, other grass, sedge, rush, forbs, vine (g)
8	>30	Tall			
7	10-30	Mid		Tall	
6	<10	Low		Mid	
5				Low	
4	>2		Tall		Tall
3	1-2		Mid		Tall
2	0.5-1		Low		Mid
1	<0.5		Low		Low

(Source: ESCAVI 2003)

Table A-8: Vegetation condition scale

Condition		Definition
P	Pristine	No obvious signs of disturbance.
E	Excellent	Vegetation structure intact, disturbance affecting individual species; weeds are non-aggressive species
V	Very Good	Vegetation structure altered; obvious signs of disturbance
G	Good	Vegetation structure significantly altered by very obvious signs of multiple disturbance; basic vegetation structure or ability to regenerate it is retained
D	Degraded	Basic vegetation structure severely impacted by disturbance; scope for regeneration but not to a state approaching good (sic) condition without intensive management
C	Completely Degraded	Vegetation structure not intact; the area completely or almost completely without native species (“parkland cleared”).

(Source: adapted from Keighery 1994 and Trudgen 1988)

Table A-9: Condition categories and thresholds for patches of Tuart woodlands and forests TEC

Biotic thresholds	Patch size			
Condition	**< 0.5 ha**	**≥ 0.5 ha < 2 ha**	**≥ 2 ha < 5 ha**	**≥ 5 ha**
Very high condition ≥80 % of all understorey^ vegetation cover is native# Or At least 12 native understorey^ species per 0.01 ha (10 m x 10 m plot or equivalent sample unit)	NOT part of the protected ecological community	Smaller patches with very high condition understorey. PART OF THE PROTECTED ECOLOGICAL COMMUNITY	Medium sized patches with very high condition understorey. PART OF THE PROTECTED ECOLOGICAL COMMUNITY	PART OF THE PROTECTED ECOLOGICAL COMMUNITY
High condition ≥60 % of all understorey^ vegetation cover is native# Or At least 8 native understorey^ species per 0.01 ha (10 m x 10 m plot or equivalent sample unit)	NOT part of the protected ecological community	Smaller patches with high condition understorey. AND That either: have an important landscape role (≤100 m to native vegetation) OR have a habitat role (≥2 very large trees per 0.5 ha) OR show regeneration (≥15 seedlings and/or saplings per 0.5 ha) PART OF THE PROTECTED ECOLOGICAL COMMUNITY	Medium sized patches with high condition understorey. PART OF THE PROTECTED ECOLOGICAL COMMUNITY	PART OF THE PROTECTED ECOLOGICAL COMMUNITY
Moderate condition ≥50 % of all understorey^ vegetation cover is native# Or At least 4 native understorey^ species per 0.01 ha (10 m x 10 m plot or equivalent sample unit)	NOT part of the protected ecological community	NOT part of the protected ecological community (but may be a focus for local protection or restoration)	Medium sized patches with moderate condition understorey. AND that either have an important landscape role (≤100 m to native vegetation) OR have a habitat role (≥2 very large trees per 0.5 ha) OR show regeneration (≥15 seedlings and/or saplings per 0.5 ha) PART OF THE PROTECTED ECOLOGICAL COMMUNITY	PART OF THE PROTECTED ECOLOGICAL COMMUNITY
Poor Has minimal or no native cover and species richness. That is: <50 % of all understorey^ vegetation cover is native# And Less than 4 native understorey^ species per 0.01 ha (10 m x 10 m plot or equivalent sample unit)	NOT part of the protected ecological community	NOT part of the protected ecological community (but may be a focus for local protection or restoration)	NOT part of the protected ecological community (but may be a focus for local protection or restoration)	PART OF THE PROTECTED ECOLOGICAL COMMUNITY

(Adapted from Table 2 in Department of the Environment and Energy (2019))

#'Native' refers to species naturally occurring in southwest Western Australia.

^ Understorey vegetation cover includes annual and perennial vascular plant species of both the ground layer and the shrub layer up to 3 m in height.

Appendix B

Flora inventory

APPENDIX B: FLORA INVENTORY

Family	Weed	Species
ASPHODELACEAE	*	*Trachyandra divaricata*
ASTERACEAE	*	*Arctotheca calendula*
	*	*Ursinia anthemoides*
CASUARINACEAE		*Allocasuarina fraseriana*
CYPERACEAE		*Baumea juncea*
DASYPOGONACEAE		*Dasypogon bromeliifolius*
DILLENIACEAE		*Hibbertia hypericoides*
EUPHORBIACEAE	*	*Euphorbia terracina*
FABACEAE		*Acacia pulchella*
		Acacia saligna
		Acacia rostellifera
		Hardenbergia comptoniana
		Jacksonia furcellata
		Jacksonia gracillima (P3)
	*	*Ornithopus compressus*
HEMEROCALLIDACEAE		*Dianella revoluta*
IRIDACEAE		*Patersonia occidentalis*
		Watsonia sp.
MYRTACEAE		*Agonis flexuosa*
		Calothamnus sp.
	*	*Chamelaucium uncinatum*
		Corymbia calophylla
		Eucalyptus gomphocephala
		Eucalyptus marginata subsp. *marginata*
		Eucalyptus rudis subsp. *rudis*
		Kunzea glabrescens
	*	*Leptospermum laevigatum*
		Melaleuca preissiana
		Melaleuca rhaphiophylla
POACEAE	*	*Avena barbata*
	*	*Briza maxima*
	*	*Bromus diandrus*
	*	*Cenchrus clandestinus*
	*	*Cynodon dactylon*
	*	*Ehrharta calycina*
	*	*Ehrharta longiflora*
	*	*Eragrostis curvula*
	*	*Lagurus ovatus*
	*	*Lolium perenne*
PROTEACEAE		*Adenanthos cygnorum*
		Banksia attenuata
		Banksia menziesii
		Grevillea vestita
XANTHORRHOEACEAE		*Xanthorrhoea preissii*
ZAMIACEAE		*Macrozamia riedlei*

Appendix C

Jacksonia gracillima locations

APPENDIX C: *JACKSONIA GRACILLIMA* LOCATIONS

Species	Conservation code (state)	No. of individuals	Latitude	Longitude
Jacksonia gracillima	Priority 3	4	-32.513134	115.797098
Jacksonia gracillima	Priority 3	6	-32.513259	115.797082
Jacksonia gracillima	Priority 3	6	-32.513007	115.796961

Appendix D

Habitat tree data

APPENDIX D: HABITAT TREE DATA

Species	Latitude	Longitude	DBH > 500 mm	Hollows
Corymbia calophylla	-32.509478	115.787232	Yes	No
Corymbia calophylla	-32.509919	115.787826	Yes	No
Corymbia calophylla	-32.509681	115.787796	Yes	No
Eucalyptus gomphocephala	-32.51033	115.762569	Yes	No
Eucalyptus gomphocephala	-32.508193	115.78365	Yes	No
Eucalyptus gomphocephala	-32.509352	115.78586	Yes	No
Eucalyptus gomphocephala	-32.509351	115.785773	Yes	No
Eucalyptus gomphocephala	-32.50953	115.786706	Yes	No
Eucalyptus gomphocephala	-32.509867	115.787206	Yes	No
Eucalyptus gomphocephala	-32.509898	115.787325	Yes	No
Eucalyptus gomphocephala	-32.509951	115.787342	Yes	No
Eucalyptus gomphocephala	-32.509932	115.787307	Yes	No
Eucalyptus gomphocephala	-32.509923	115.787269	Yes	No
Eucalyptus gomphocephala	-32.509913	115.787188	Yes	No
Eucalyptus gomphocephala	-32.510119	115.787748	Yes	No
Eucalyptus gomphocephala	-32.510234	115.787785	Yes	No
Eucalyptus gomphocephala	-32.509939	115.787694	Yes	No
Eucalyptus marginata subsp. *marginata*	-32.509616	115.78762	Yes	No
Eucalyptus rudis subsp. *rudis*	-32.512275	115.797823	Yes	No
Eucalyptus rudis subsp. *rudis*	-32.512175	115.797906	Yes	No
Eucalyptus rudis subsp. *rudis*	-32.511882	115.797988	Yes	No
Eucalyptus rudis subsp. *rudis*	-32.511869	115.797943	Yes	No

Appendix D

Letters of support

From: Brett Flugge <emsd@murray.wa.gov.au>
Sent: Thursday, 27 February 2020 3:08 PM
To: Brenton Pham
Cc: Giles Glasson; John Halleen; Martin Harrop; Tom Lerner
Subject: RE: Peel Business Park - Installation of Sewer and Water Trunk Infrastructure Amendment

CAUTION: This email originated from outside of RPS.

Hi Brenton, the Shire confirms its acceptance of the proposed clearing works as a net reduction in clearing of approximately 0.112 ha and clearing of additional jarrah tree to facilitate that installation of sewer and water services as detailed in the RPS group email dated February 14, 2020.

Brett Flugge | Executive Manager Strategic Development

emsd@murray.wa.gov.au
P: +61 8 9531 7707
www.murray.wa.gov.au

PO Box 21 • Pinjarra • WA • 6208 • How are we doing?

From: Brenton Pham <Brenton.Pham@developmentwa.com.au>
Sent: Thursday, 27 February 2020 2:57 PM
To: Brett Flugge <emsd@murray.wa.gov.au>; Tom Lerner <tom.lerner@murray.wa.gov.au>
Cc: Giles Glasson (Giles.Glasson@rpsgroup.com.au) <Giles.Glasson@rpsgroup.com.au>; John Halleen <John.Halleen@rpsgroup.com.au>; Martin Harrop <meng@murray.wa.gov.au>
Subject: RE: Peel Business Park - Installation of Sewer and Water Trunk Infrastructure Amendment

Hi Brett and Tom

Given that we have now come to an agreement below, can you please confirm that the Shire as landowners/mangers accept the proposed clearing works as detailed in Giles' email dated 14 February 2020?

This acceptance is necessary for the clearing permit application to be submitted to DWER.

Thanks
Brenton

Brenton Pham
Development Manager

DevelopmentWA

40 The Esplanade, Perth WA 6000
T 08 9482 7818 M 0422 702 329 F +61 8 9481 0861
developmentwa.com.au

From: Brett Flugge <emsd@murray.wa.gov.au>
Sent: Wednesday, 26 February 2020 1:46 PM
To: Brenton Pham <Brenton.Pham@developmentwa.com.au>
Cc: Tom Lerner <tom.lerner@murray.wa.gov.au>
Subject: RE: Peel Business Park - Installation of Sewer and Water Trunk Infrastructure Amendment

Hi Brenton, I've spoken to Tom and can confirm the Shire is happy for DWA to proceed with supply and install of one nesting box. We acknowledge that the Shire would be responsible for ongoing management and maintenance of the nesting box.

Siting of the box somewhere along the Nambeelup Brook foreshore reserve is preferable with reasonable ease of access.

Brett Flugge | Executive Manager Strategic Development

emsd@murray.wa.gov.au
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PO Box 21 • Pinjarra • WA • 6208 • How are we doing?

From: Brenton Pham <Brenton.Pham@developmentwa.com.au>
Sent: Wednesday, 26 February 2020 11:05 AM
To: Brett Flugge <emsd@murray.wa.gov.au>
Subject: RE: Peel Business Park - Installation of Sewer and Water Trunk Infrastructure Amendment

Hi Brett

Thanks for the chat this morning. As discussed the project is prepared to provide and install 1 nesting box to offset the inactive hollow in the jarrah. I acknowledge that this is over and beyond what DWER would instruct, however this would be a positive outcome for the project and our relationship with the Shire.
The email from RPS had input from myself and was just asking for rationale and supporting information on the position.

FYI - My environmental consultant has advised approximate costings as below for reference.

- $500 for the plastic hollows;
- ~ $3,000 - $4,000 to install

I forgot to mention on the phone that as part of the stakeholder management, we were also planning on doing a letter drop to residents in vicinity to the jarrah advising of what we are doing, and having the support from the Shire noted in this future letter would be good.

Please have a word with Tom and let me know a location, and also who will be responsible for the supply and install. DevelopmentWA can provides funds to the Shire for you to do the works in entirety, or alternatively DevelopmentWA could do the supply and install. Please note that ongoing maintenance and management will be the responsibility of the Shire.

Look forward to your response.

Thanks
Brenton

Brenton Pham
Development Manager

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From: Tom Lerner <tom.lerner@murray.wa.gov.au>
Sent: Tuesday, 25 February 2020 10:42 AM
To: Giles Glasson <Giles.Glasson@rpsgroup.com.au>
Cc: Martin Harrop <meng@murray.wa.gov.au>; Brett Flugge <emsd@murray.wa.gov.au>; John Halleen <John.Halleen@rpsgroup.com.au>; Brenton Pham <Brenton.Pham@developmentwa.com.au>
Subject: RE: Peel Business Park - Installation of Sewer and Water Trunk Infrastructure Amendment

That's disappointing Giles, It was hoped that we could get a viable environmental outcome to compensate for the loss of such a significant hundreds year old tree with hollows especially considering that originally we tried to avoid removing it and tunnelling (mitigation) was considered too high risk.

Tom Lerner | Coordinator Environment Services

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From: Giles Glasson <Giles.Glasson@rpsgroup.com.au>
Sent: Monday, 24 February 2020 9:40 PM
To: Tom Lerner <tom.lerner@murray.wa.gov.au>
Cc: Martin Harrop <meng@murray.wa.gov.au>; Brett Flugge <emsd@murray.wa.gov.au>; John Halleen <John.Halleen@rpsgroup.com.au>; 'Brenton Pham' <Brenton.Pham@developmentwa.com.au>
Subject: RE: Peel Business Park - Installation of Sewer and Water Trunk Infrastructure Amendment

Hi Tom,

Thanks for providing the comments on the proposed amendments to the approved clearing permit (CPS 8037/1) that the Shire of Murray would like DevelopmentWA to consider, specifically in relation to the removal of the jarrah tree.

We've undertaken a brief review of recently approved clearing permits where nest boxes have been required to be provided. Please find linked two recent DWER clearing permit decisions (CPS 7869/1 was approved by DWER in 2018 and CPS 8172/1 was approved by DWER in 2019) which are similar in nature to the works proposed within the Shire's road reserves for your information. Application CPS 8172/1, was appealed by the WA Black Cockatoo Recovery Project, and I have included the Appeals Convenor's Report to demonstrate full disclosure and transparency https://filetransfer.rpsgroup.com/link/mJL8bxJB590NDh3qu8TT3x

For CPS 7869/1 and CPS 8172/1, nest boxes were required as part of the conditional approval by DWER for only those black cockatoo breeding trees with evidence of current or past breeding and at a ratio of one nest box per potential breeding tree. As per my email below, a targeted inspection of the hollows in the jarrah tree on Fishhawk Road was undertaken by Terrestrial Ecosystems on 10 December 2019 to confirm if the tree was currently in use or had previously been used by black cockatoos for nesting. None of the hollows has any evidence of existing or previous use by black cockatoos for nesting. If the two CPS scenarios are applied to the jarrah tree on Fishhawk Road, then there would be not be a requirement for nest boxes to be provided.

Acknowledging DWER as the decision making authority responsible for approving and conditioning clearing actions under the *Environment Protection Act 1986* and noting the disparity between the Shire's below request and the outcomes that have been previously conditioned by DWER, I would very respectfully request that the Shire provide the rationale and supporting evidence underpinning the Shire's request that DevelopmentWA provide an "all of the hollows offset with either cockatubes or the hollows themselves(plus cockatubes) at a ratio of at least 3 to 1".

DevelopmentWA has clearly foreshadowed their concern that the Shire's expectation is well in excess of the standards set by DWER, that all reasonable steps have been taken to determine whether the jarrah tree has been used for cockatoo breeding and that supporting the Shire's request would create competing standards within government on determining the level of environmental offsets.

Please don't hesitate to get in touch to discuss as required.

Many thanks,

Giles

Giles Glasson
Principal Scientist
RPS | Australia Asia Pacific
T +61 8 9211 1111
E giles.glasson@rpsgroup.com.au

From: Tom Lerner <tom.lerner@murray.wa.gov.au>
Sent: Thursday, 20 February 2020 2:46 PM
To: Giles Glasson <Giles.Glasson@rpsgroup.com.au>
Cc: Martin Harrop <meng@murray.wa.gov.au>; Brett Flugge <emsd@murray.wa.gov.au>
Subject: RE: Peel Business Park - Installation of Sewer and Water Trunk Infrastructure Amendment

CAUTION: This email originated from outside of RPS.

Hi Giles,

Thanks for the opportunity to comment, given the removal of the king Jarrah, we would like to see all of the hollows offset with either cockatubes or the hollows themselves(plus cockatubes) at a ratio of at least 3 to 1 and installed at a suitable spot nearby, I would recommend reserves associated with Nambeelup brook.

Tom Lerner | Coordinator Environment Services

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From: Giles Glasson <Giles.Glasson@rpsgroup.com.au>
Sent: Friday, 14 February 2020 2:47 PM
To: Tom Lerner <tom.lerner@murray.wa.gov.au>
Cc: 'Robert Fenn' <Robert.Fenn@developmentwa.com.au>; 'Brenton Pham (Brenton.Pham@developmentwa.com.au)' <Brenton.Pham@developmentwa.com.au>; Paul Standing <pauls@cosweb.com.au>
Subject: Peel Business Park - Installation of Sewer and Water Trunk Infrastructure Amendment

Good afternoon Tom,

I hope that you are keeping well.

RPS is assisting DevelopmentWA with amending an approved clearing permit to facilitate the installation and extension of trunk services infrastructure (sewer and water) to the Peel Business Park (Lot 600 Lakes Road, Stake Hill). Clearing Permit (CPS 8037/1) was approved by the DWER in September 2018 and allows for the clearing of up to 3.015 hectares (ha) of native vegetation within the proposed clearing area (attached for your general information). Thought I would get in touch with you as a first port of call as you previously provided the Shire's support for the clearing works associated with CPS 8037/1 (See below email).

The installation of underground power along Patterson Road was completed in 2019, however the installation of sewer and water infrastructure from the Water Corporation's Mandurah No 1 Wastewater Treatment Plant to Lot 600 is still pending. The Water Corporation has recently advised that alternative approaches to the siting and construction of the sewer and water infrastructure are required, including situating the infrastructure on the opposite side of the road. There were minor areas within the Lakes Road, Fowler and Fishhawk roads and Osprey Links reservations which were identified as potential future locations for the sewer and water infrastructure. The Main Roads owned Lot 329 Lakelands Road landholding was also identified as potential future locations for the sewer and water infrastructure. These areas are outside of the approved CPS 8037/1 clearing area.

A flora and vegetation field survey was undertaken by RPS in November 2019 to characterise the flora, delineate vegetation units, provide an assessment of the conservation significance of the flora and vegetation and identify any potential breeding trees for black cockatoos within the addition clearing areas. The proposed engineering design and construction methods for the installation of the sewer and water services infrastructure within the Shire's road reserves has been underpinned by the findings of the November 2019 flora and vegetation survey as well as the previous spring 2017 flora and vegetation survey. I've linked the figure set containing updated clearing area for the sewer and water alignments (i.e. blue border in the figures), Figure numbers A-5 and A-9 specifically relates to exclusion of previously required clearing (i.e. red hatch) and inclusion of additional clearing areas within the Shire managed road reservations https://filetransfer.rpsgroup.com/link/Sfd0vN9XfQceuR8pqfVEaU. The figure panes also show the approved CPS 8037/1 clearing which remains unchanged (i.e. orange border) and a Main Roads owned landholding (Figure A-32) which has also been proposed to be included.

In relation to the Shire managed road reserves, the change relates to the movement of the sewer and water infrastructure from the western side of the Fowler and Fishhawk roads reservation to the eastern side of the roads reservation. This has resulted in 0.540 ha of Banksia Woodland vegetation ranging in condition from "Very Good" to "Completely Degraded" and 0.006 ha of Remnant Marri vegetation primarily in "Very Good" condition no longer being required to be cleared on the western side of the road. This is replaced by the clearing 0.428 ha of Banksia Woodland vegetation in "Degraded" or worse condition and one jarrah tree which is dead with hollows (Figure A-8) on the eastern side of the road. No further additional native vegetation clearing is proposed within the Shire managed road reserves. This a net reduction in clearing of approximately 0.112 ha but does include an additional jarrah tree. I've linked the 2017 flora and vegetation survey as it relates to both sides of the Fowler and Fishhawk roads reservation https://filetransfer.rpsgroup.com/link/CtHUgaKgYPn5n2y0pkPA1b.

A targeted inspection of the hollows in the remnant jarrah tree was undertaken by Terrestrial Ecosystems on 10 December 2019 to confirm if the tree was currently in use or had previously been used by Black Cockatoos for nesting. None of the hollows has any evidence of existing or previous use by black cockatoos for nesting. I've

attached the Terrestrial Ecosystems report for this tree for your information, which confirms that the jarrah tree is a potential black cockatoo breeding tree only.

To inform the request to amend Clearing Permit (CPS 8037/1), DevelopmentWA requires confirmation from land owners/managers, where native vegetation clearing is proposed, that the proposed clearing works area acceptable. To achieve this outcome, could you please provide a letter or email confirming that the net reduction in clearing of approximately 0.112 ha and clearing of additional jarrah tree to facilitate that installation of sewer and water services is acceptable to the Shire.

Once you've had the opportunity to review this information please don't hesitate to give me a call to discuss as required.

Many thanks,

Giles

Giles Glasson
Principal Scientist
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From: Tom Lerner <tom.lerner@murray.wa.gov.au>
Sent: Friday, 9 March 2018 1:07 PM
To: Giles Glasson <Giles.Glasson@rpsgroup.com.au>
Cc: Rod Peake <RodP@murray.wa.gov.au>; Grant Bilton <GrantB@murray.wa.gov.au>; Chris Pretorius <mos@murray.wa.gov.au>; Alan Smith <dts@murray.wa.gov.au>
Subject: [EXT] RE: Peel Business Park - Trunk Services Infrastructure Extension Clearing

Hi Giles,

The Shire can support the clearing application but does request the following:

- We would like as-cons when the powerlines are in for potential future revegetation works.
- The Shire is currently revegetating Patterson Road, it would be appreciated if some funding could be provided for further revegetation of the road after construction to compliment Shire works being undertaken in winter.
- That Our support for boring beneath tuarts and Nambeelup Brook is noted.

Thanks for the opportunity to provide feedback.

Tom Lerner | Coordinator Environment Services

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PO Box 21 • Pinjarra • WA • 6208 •

From: Giles Glasson [mailto:itsupport@rpsgroup.com]
Sent: Tuesday, 6 March 2018 3:43 PM
To: Tom Lerner <tom.lerner@murray.wa.gov.au>
Subject: Peel Business Park - Trunk Services Infrastructure Extension Clearing

Hi Tom,

Thanks for the call.

Please find linked below the Shire of Murray Map Book which indicates the extent of our proposed clearing works along Paterson Road to facilitate the installation of the underground powerlines. My apologies that you've not previously had access to this information.

Boring has been proposed adjacent to Nambeelup Brook to avoid the vegetation in this area, but in the remaining extent of the Clearing Area we are proposing that the vegetation will be cleared.

Please don't hesitate to get in touch if you require any additional assistance.

Best regards,

Giles Glasson

Managing Scientist

Environment - Land & Infrastructure

RPS Australia Asia Pacific

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www: http://rpsgroup.com.au

Files attached to this message

Filename	Size	Checksum (SHA256)
Shire of Murray	23.4 MB	cdd241c66f0cd2ff37c1c9c83cd79aaef142c0558dd747617dc3726f13093770

Map
Book.pdf

Please click on the following link to download the attachments:
https://filetransfer.rpsgroup.com/message/JIfa8oRtum0vICIuAeuGrU

This email or download link can be forwarded to anyone.

The attachments are available until: **Tuesday, 20 March.**

Message ID: JIfa8oRtum0vICIuAeuGrU

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mainroads
WESTERN AUSTRALIA

Enquiries: Neil McCarthy 9724 5632
Our Ref: 07/5622
Your Ref:

25 February 2020

Mr Giles Glasson
RPS Group
Level 2, 27-31 Troode Street
WEST PERTH, WA, 6005

Dear Giles

PROPOSED CLEARING ON LOT 329 LAKELANDS ROAD FOR DRAINAGE WORKS

It is understood that DevelopmentWA wishes to construct drainage infrastructure through Lot 329 Lakeland Road and under Kwinana Freeway. Approval is being sought from the landowner (Main Roads) to undertake clearing to facilitate these works, with this letter being provided to DWER as part of the amendment to clearing permit CPS 8037/1.

This letter is to confirm 'in principle' agreement of Main Roads WA for DevelopmentWA to clear approximately 0.43 ha of vegetation for the construction of drainage infrastructure on Lot 329 Lakelands Road, as depicted in your Figure A-32, subject to completion and subsequent approval of *Application Form - Seeking Approval to Undertake Works within the Road Reserve* by Main Roads.

It should be noted that no clearing is to be undertaken on Lot 329 until the clearing line has been pegged on site and inspected and approved by Main Roads.

It is also noted from Figure A-5, that sewer and water infrastructure may pass under Kwinana Freeway along Fishhawk Road. It is requested that DevelopmentWA submit an *Application Form - Seeking Approval to Undertake Works within the Road Reserve for these works.*

Please do not hesitate to contact me if you require any further information or clarification regarding the above.

Yours sincerely

Robert Barnsley
DIRECTOR SOUTH WEST OPERATIONS

Appendix E

Tree assessment on Fishhawk Road, Stake Hill

2018-0098-001-gt

12 December 2019

Giles Glasson
Principal Scientist
RPS Australia Asia Pacific
Level 2, 27-31 Troode Street
West Perth, WA 6005

Re: Tree assessment on Fishhawk Road, Stakehill

Dear Giles

As requested, Terrestrial Ecosystems has assessed the hollows in a large jarrah tree on Fishhawk Road, Stakehill (-32.501983ºS, 115.797406ºE; Plates 6 and 7) for use by Black-Cockatoos as well as other vertebrate species.

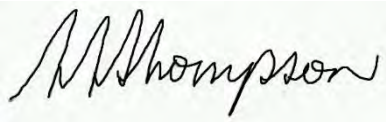
Dr Scott Thompson, using an elevated work platform (EWP), inspected all of the hollows in the tree. No hollows contained a Black-Cockatoo nest, eggs or chicks. None of the hollows contained vertebrate fauna.

The highest two hollows support a beehive, the larger hollows are mostly filled will decaying wood. No hollow had egg fragments suggesting that it had been used as a nesting site. Two of the hollows had a wide and flattened base and could have been used as an arboreal mammal diurnal retreat.

Plates 1-6 show the internal aspect of the hollows other than the two supporting a beehive.

Please do not hesitate in contacting the undersigned (0407 385 239) or Graham (0438 491 227), if you have additional questions.

Yours sincerely



Dr Scott Thompson
Partner and Principal Zoologist

10 Houston Place, Mt Claremont, Western Australia, Australia 6010
ph: 0407 385 239, email: info@terrestrialecosystems.com
www.terrestrialecosystems.com

Plate 1. Contents of a hollow

Plate 2. Contents of a hollow

Plate 3. Contents of a hollow

Plate 4. Contents of a hollow

Plate 5. Contents of a hollow

Plate 6. Contents of a hollow

Plate 7. Tree with hollows looking west

Plate 8. Tree with hollows looking east