

Main Roads Western Australia  
Tonkin Highway Extension

Preliminary Documentation (EPBC 2019/8608) –  
s95A Additional Information

2 June 2021

Rev I

JBS&G Australia Pty Ltd T/A Strategen-JBS&G

## EXECUTIVE SUMMARY

Main Roads Western Australia (Main Roads) is proposing to extend the existing Tonkin Highway from Thomas Road in Oakford to South Western Highway in Mundijong, Western Australia (the Proposed Action). The Proposed Action will occur within an area of approximately 233.6 hectares (ha), comprising approximately 20.82 ha of native vegetation, 15.23 ha of planted vegetation, and 197.55 ha of cleared/disturbed lands.

In December 2019, Main Roads (2019a) submitted a Referral of the Proposed Action in accordance with Section 68 of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (C'th) (EPBC Act) due to potential impacts on Matters of National Environmental Significance (MNES). In April 2020, the Commonwealth Department of Agriculture, Water and the Environment (DAWE) (on behalf of the Commonwealth Minister for the Environment) determined the Proposed Action to be a 'Controlled Action' which required assessment and approval under the EPBC Act, with the assessment to be undertaken at the level of 'Preliminary Documentation' (EPBC 2019/8608). The DAWE requested Main Roads to provide additional information in accordance with Section 95A of the EPBC Act to further inform its environmental assessment.

The environmental assessment information provided in this Preliminary Documentation Report has been prepared to meet the additional information requirements under s95A of the EPBC Act. The Proposed Action has potential impacts on a number of ecological communities, flora species and fauna species listed and protected under the EPBC Act, namely:

- Threatened Ecological Communities:
  - Clay Pans of the Swan Coastal Plain Threatened Ecological Community (Critically Endangered);
  - *Corymbia calophylla* – *Kingia australis* woodlands on heavy soils, Swan Coastal Plain Threatened Ecological Community (Endangered); and
  - *Corymbia calophylla* - *Xanthorrhoea preissii* woodlands and shrublands of the Swan Coastal Plain (Endangered);
- Threatened Species:
  - *Synaphea* sp. Serpentine (Critically Endangered);
  - *Synaphea* sp. Pinjarra Plain (Endangered);
  - *Tetraria australiensis* (Vulnerable);
  - Carnaby's Cockatoo *Calyptorhynchus latirostris* (Endangered);
  - Baudin's Cockatoo *Calyptorhynchus baudinii* (Endangered); and
  - Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso* (Vulnerable).

Main Roads has sought to avoid identified locations of the above ecological communities, species and species habitat, and where avoidance of locations has not been possible, the potential impact to these species and communities has been minimised as far as practicable. This process principally occurred through minor adjustments to the infrastructure positioning and structure, resulting in a reduction to the impacts to these species and communities.

Main Roads proposes an offset to counterbalance the potential significant residual impacts to the above species and ecological communities where those impacts may be considered significant.

The Environmental Offset Strategy identifies proposed offset actions comprising land acquisition, land rehabilitation, research and plant translocations. The proposed environmental offsets will be fully funded and implemented by Main Roads (with the assistance of external technical experts,

where appropriate), with the implementation of the environmental offsets to be reported on under the provisions of the EPBC Act.

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## Appendices

- Appendix A DAWE (2020b) s95A Request for Additional Information EPBC 2019/8608
- Appendix B Concept Plan
- Appendix C Flora and Vegetation Survey (Woodman 2020)
- Appendix D Black Cockatoo Breeding Habitat Survey (Kirkby 2020)
- Appendix E Black Cockatoo Habitat Quality Assessment
- Appendix F Dieback Assessment (Glevan 2020)
- Appendix G Biological Survey Adequacy and Limitations
- Appendix H Environmental Offset Strategy
- Appendix I Action Management Plan
- Appendix J *Tetraria australiensis* Fire Management Plan

## 1. Introduction

### 1.1 Background

The Commissioner of Main Roads Western Australia (Main Roads) is proposing to extend the existing Tonkin Highway from Thomas Road in Oakford to the South Western Highway in Mundijong, Western Australia (hereafter referred to as the Tonkin Highway Extension Project or Proposed Action). The Proposed Action area refers to the maximum extent of works to be undertaken, covering 314.9 ha. The Proposed Construction Footprint is described as the area that will be impacted by the Proposed Action, which sits within the Development Envelope and covers 233.60 ha. This area is comprised of approximately 20.82 ha of intact native vegetation, 15.23 ha of planted vegetation (partially revegetation) and 197.55 ha of cleared/disturbed lands. Some of the highly disturbed areas support isolated trees and therefore can comprise fauna habitat.

The south-east corridor is an important and fast-growing area faced with increased congestion, higher travel times for freight vehicles and reduced safety outcomes on the existing road network. Population projections show that by 2031, sustained growth in the south-east sub-region will result in a population increase of approximately 35 per cent (from the 2008 base level). This additional population will put significant pressure on the existing road network with volumes exceeding recommended capacity.

The Proposed Action will extend Tonkin Highway from Thomas Road to South Western Highway including at grade separations at Thomas Road, Orton Road, Bishop Road, Mundijong Road and South Western Highway.

Key components of the Proposed Action include:

- Approximately 14 kilometres of four lane dual carriageway road from Thomas Road to South Western Highway;
- Construction/upgrades of intersections at Thomas Road, Orton Road, Mundijong Road and South Western Highway;
- A grade separated interchange at Bishop Road catering for the Perth to Bunbury rail line and freight line;
- A principal shared path along the corridor; and
- Installation of associated road infrastructure, such as lighting, noise and retaining walls, safety barriers, stopping bays and traffic monitoring devices

The Proposed Action forms the second portion of the project '*Construction and use of the Tonkin Highway Extension from Mills Road West, Gosnells to South Western Highway, Mundijong*', which was approved under Ministerial Statement 595 in June 2002 under the State *Environmental Protection Act 1986 (WA)* following assessment by the State Environmental Protection Authority (EPA). The construction of Tonkin Highway between Mills Road West and Thomas Road was referred to the Commonwealth in 2001 and was determined '*Not a Controlled Action*'.

The Proposed Action is located within the Shire of Serpentine-Jarrahdale Local Government Area (LGA) on the Swan Coastal Plain in Western Australia (Figure 1; Figure 2). The Proposed Action is approximately 30 km south-east of the Perth Central Business District and approximately 3.5 km west of Byford. The Proposed Action spans approximately 14 km in length.

The Proposed Action was referred to the Commonwealth Department of Agriculture, Water and the Environment (DAWE) in December 2019 due to potential impacts to Matters of National Environmental Significance. In April 2020, a delegate of the Commonwealth Minister for the Environment determined that the Proposed Action be a Controlled Action to be assessed by

Preliminary Documentation for the potential impacts to Listed Threatened Species and Communities (Sections 18 and 18A of the EPBC Act), namely:

- Clay Pans of the Swan Coastal Plain Threatened Ecological Community (Critically Endangered);
- *Corymbia calophylla* – *Kingia australis* woodlands on heavy soils, Swan Coastal Plain Threatened Ecological Community (Endangered);
- *Synaphea* sp. Serpentine (Critically Endangered);
- *Synaphea* sp. Pinjarra Plain (Endangered);
- *Tetraria australiensis* (Vulnerable);
- Carnaby’s Cockatoo *Calyptorhynchus latirostris* (Endangered);
- Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso* (Vulnerable); and
- Baudin’s Cockatoo *Calyptorhynchus baudinii* (Endangered).

In April 2020, in accordance with Section 95A of the EPBC Act, the DAWE (2020b, Appendix A) requested Main Roads provide additional information to inform the environmental assessment of the Proposed Action on the potential impacts to the ‘Listed Threatened Species and Communities’ identified above. Since the Proposed Action was referred, an addition MNES was identified through the biological surveys conducted for the project (Woodman 2020) – *Corymbia calophylla* – *Xanthorrhoea preissii* woodlands and shrublands of the Swan Coastal Plain (Endangered). Potential impacts to this community are also addressed in this Preliminary Documentation.

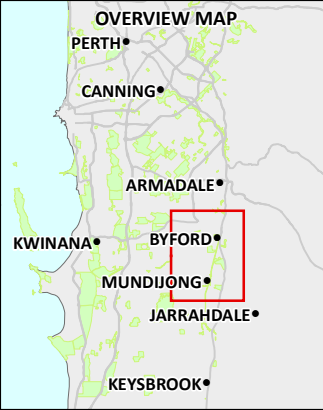
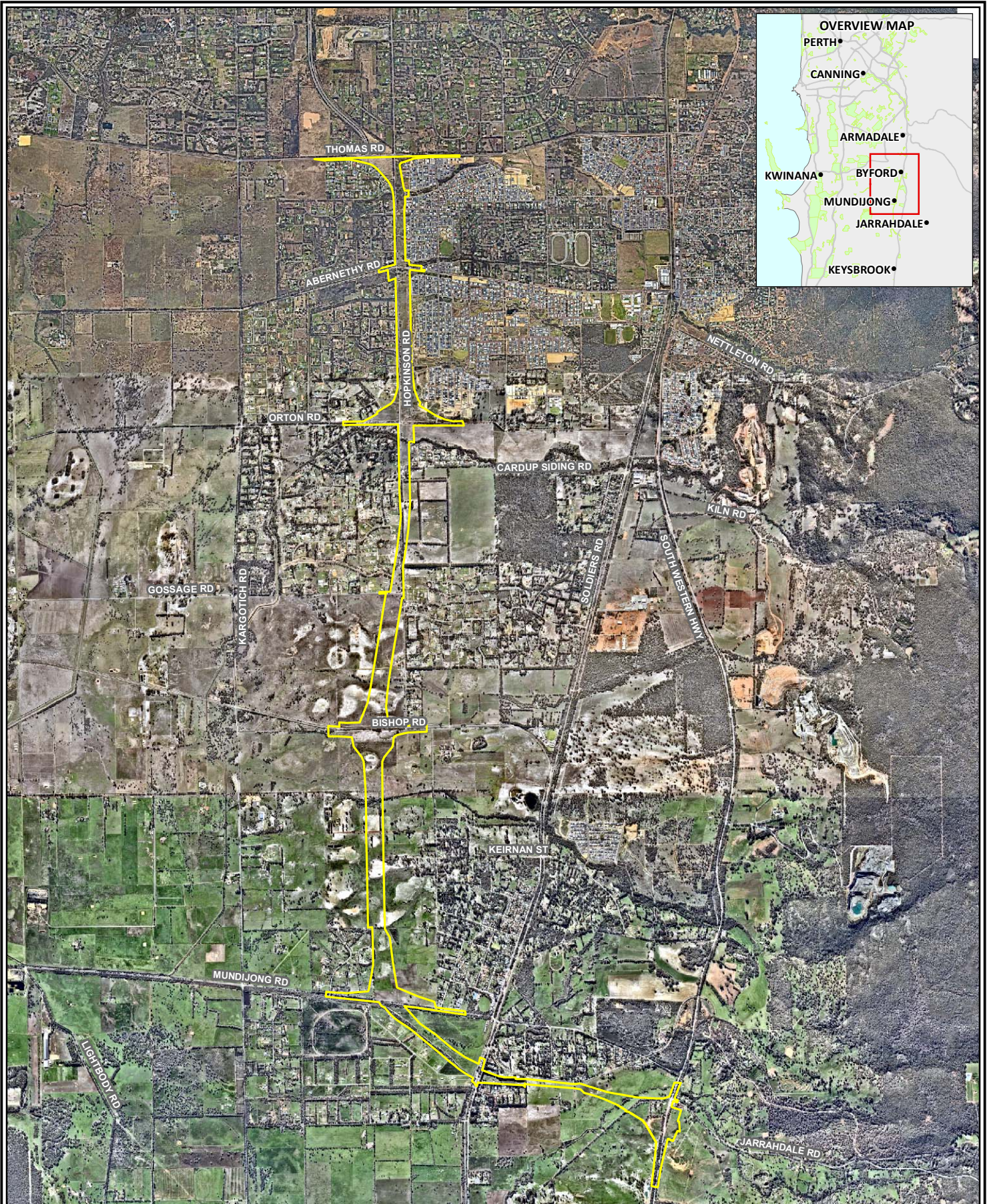
## 1.2 Purpose of this Report

This Report provides responses to the Additional Information Request issued by DAWE (2020b, Appendix A). The format of this Report follows that outlined by DAWE (2020b) to ensure that the request for additional information has been adequately addressed.

A summary of the information requested as part of the Preliminary Documentation and the corresponding section in this Report is provided below in Table 1.1.

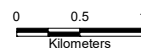
**Table 1.1: Preliminary Documentation Requirements**

No.	Information Requested	Section of Report
1	Description of the Action	Section 2
2	Description of the Environment and Matters of National Environmental Significance	Section 3 and Section 4
3	Assessment of Impacts	Section 5
4	Avoidance and Mitigation Measures	Section 6
5	Offsets	Section 7
6	Economic and Social Matters	Section 8
7	Information Sources	Section 9
8	Person taking the Action and Designated Proponent	Section 12
9	Environmental Record of the Person proposing to take the Action	Section 12
10	Ecologically Sustainable Development	Section 13
11	Other Approvals and Conditions	Section 12
12	Relevant Policies and Publications	Section 10



**Legend**  
 Proposed Action

Scale 1:60,000 at A4



Coord. Sys. GDA 1994 MGA Zone 50



Job No: 58910

Client: Main Roads Western Australia

Version: A

Date: 20-Jan-2021

Drawn By: hsullivan

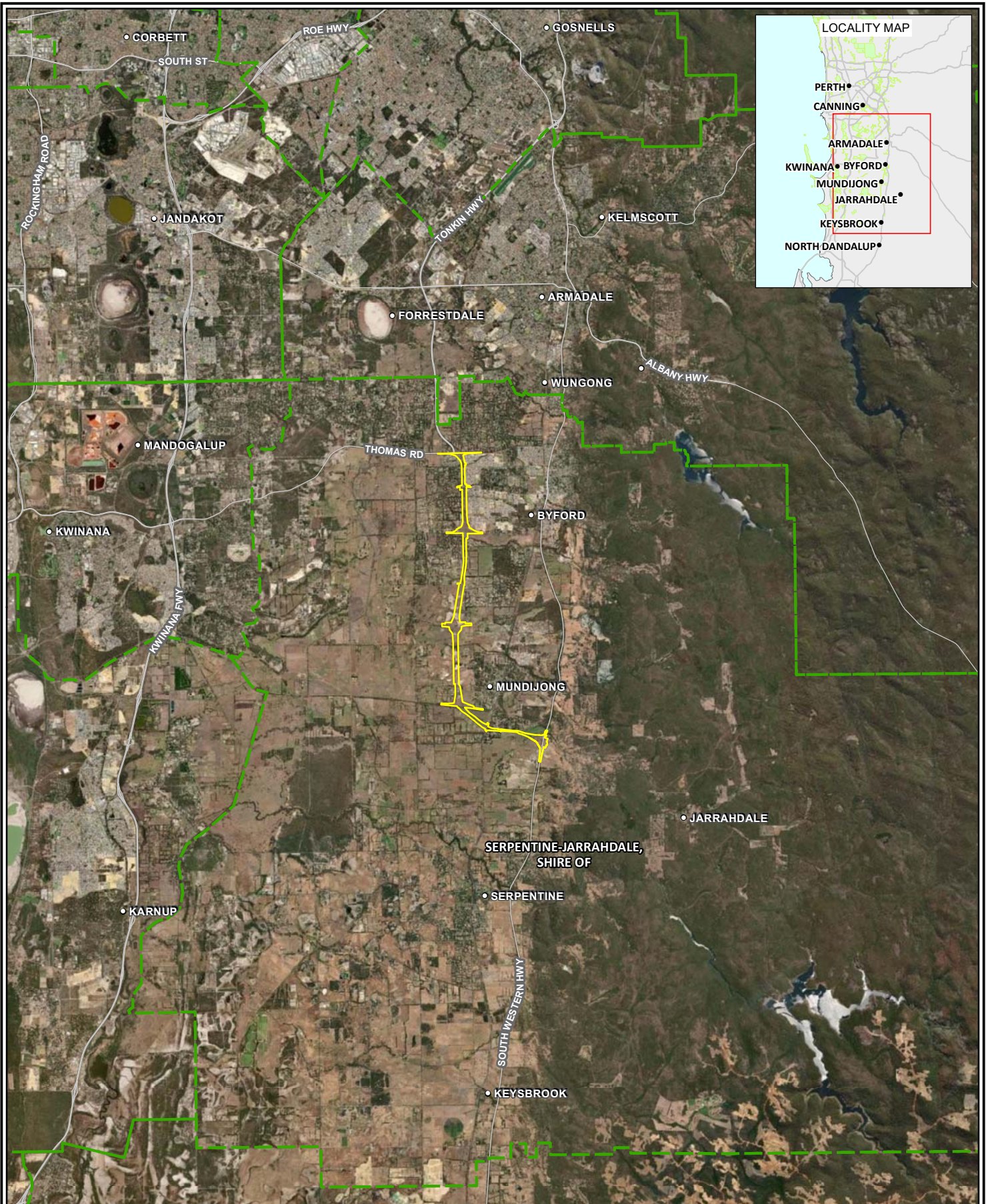
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**Tonkin Highway Extension  
WA**

**PROPOSED ACTION AREA**

**FIGURE 1**





<b>Legend</b> Proposed Action Local Government Area Local and regional roads Towns	Scale 1:200,000 at A4		<b>Tonkin Highway Extension WA</b>
	Coord. Sys. GDA 1994 MGA Zone 50		<b>REGIONAL LOCATION</b>
	Job No: 58910		<b>FIGURE 2</b> 
	Client: Main Roads Western Australia		
	Version: A	Date: 20-Jan-2021	
Drawn By: hsullivan	Checked By: DN		

File Name: W:\Projects\1)\Open\Main Roads\58910 Tonkin Extension PD\GIS\Maps\VR01\_Rev\_A\58910\_02\_RegLoc.mxd  
 Image Reference: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

## 2. Description of the Proposed Action

### 2.1 Summary of the Proposed Action

Main Roads are proposing to extend the existing Tonkin Highway from Thomas Road in Oakford to South Western Highway in Mundijong, Western Australia (the Proposed Action). The Proposed Action is shown in Figure 1.

The Proposed Action will improve freight efficiency, connectivity and travel time within the existing road network by relieving congestion pressure and improve road safety for all users.

The Proposed Action includes:

- Approximately 14 kilometres of four lane dual carriageway from Thomas Road to South Western Highway;
- Construction/upgrades and grade separation to intersections at Thomas Road, Orton Road, Mundijong Road and South Western Highway; and
- A grade separated interchange at Bishop Road catering for the Perth to Bunbury rail line and the freight rail line.

The Proposed Action represents the overall 'Development Envelope' (314.9 ha) for the Tonkin Highway Extension Project; the maximum extent of works (Figure 1). The assessment of the environmental impacts has been considered based on the area of the Proposed Construction Footprint which is located within the Proposed Action area, and represents the maximum area of impact (233.60 ha).

### 2.2 Description of activities of Proposed Action

The Proposed Action will necessitate clearing of native vegetation for construction of a new four lane road that will incorporate the following ancillary road infrastructure:

- All road pavements;
- Drainage basins;
- Drains;
- Medians;
- 'At grade' intersections;
- 'Grade separated' interchanges;
- Bulk earth works;
- Pedestrian and Cycling Paths (principal shared paths);
- Bridges;
- Culverts;
- Lighting and noise barriers;
- Safety barriers;
- Road signs;
- Under passes;
- Over passes; and
- Landscaping and rehabilitation work.

To inform design and environmental assessment, technical biological surveys were undertaken over an area larger than the Proposed Action Area. The Survey Area is shown in Figure 3.

### **2.3 Location of the Proposed Action**

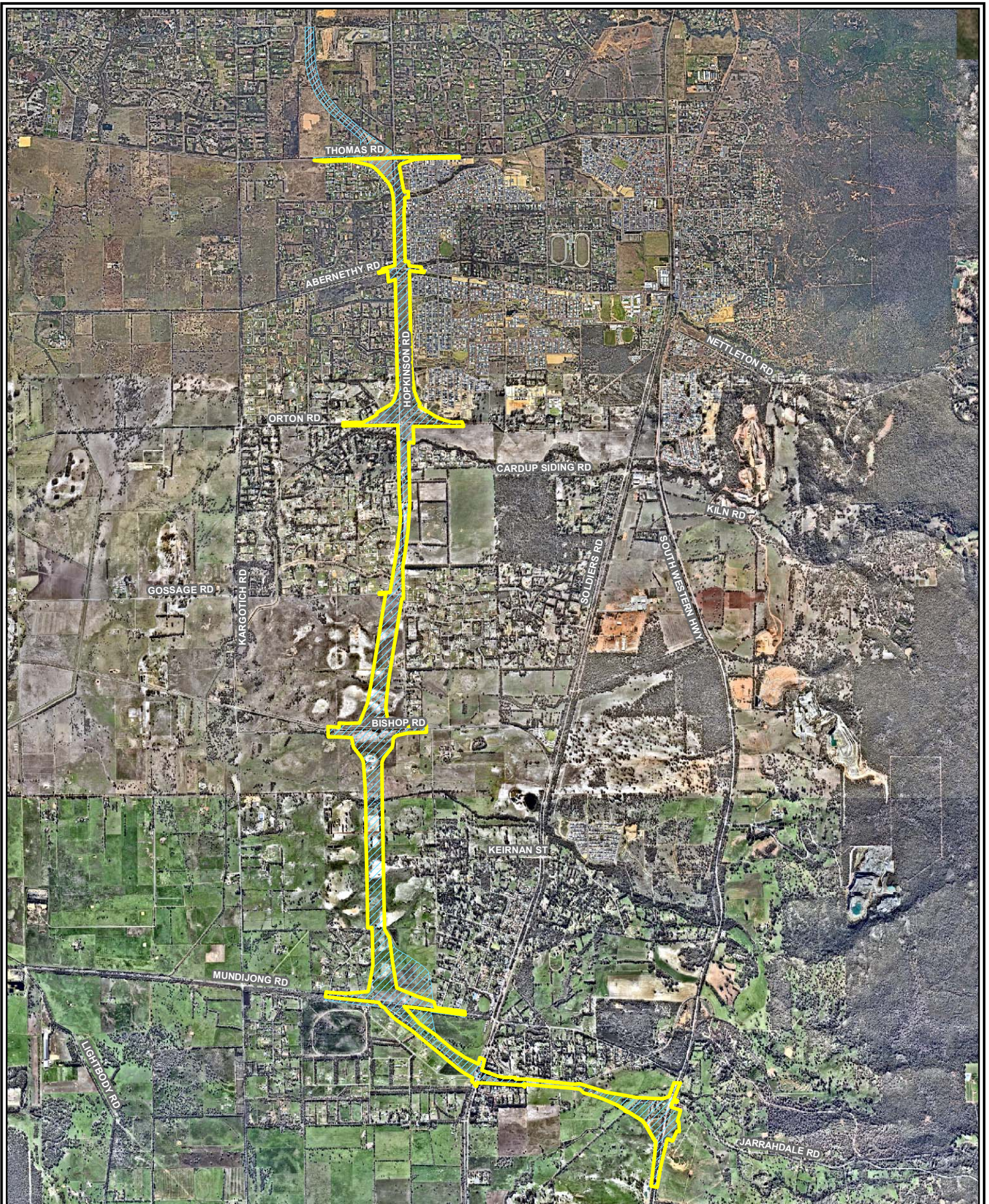
The Proposed Action is situated approximately 30 km south east of Perth and 4.3 km west of the existing South Western Highway, within the Shire of Serpentine-Jarrahdale (Figure 1). The Proposed Action spans approximately 14 km in length and 314.9 ha in area (Figure 2).

The Proposed Action is located largely within the existing road reserve. Land use adjacent to the Proposed Action includes:

- Predominately urban land uses to the east, with Mundijong town site and Mundijong train station situated east, adjacent to the southern portion of the Proposed Action; and
- Predominately rural land to the north, west and south, with a section of industrial land to the east in the southern portion of the Proposed Action.

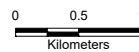
Land use type within and surrounding the Proposed Action is shown in Figure 4.





- Legend**
- Proposed Action
  - Survey area

Scale 1:60,000 at A4



Coord. Sys. GDA 1994 MGA Zone 50



Job No: 58910

Client: Main Roads Western Australia

Version: A

Date: 20-Jan-2021

Drawn By: hsullivan

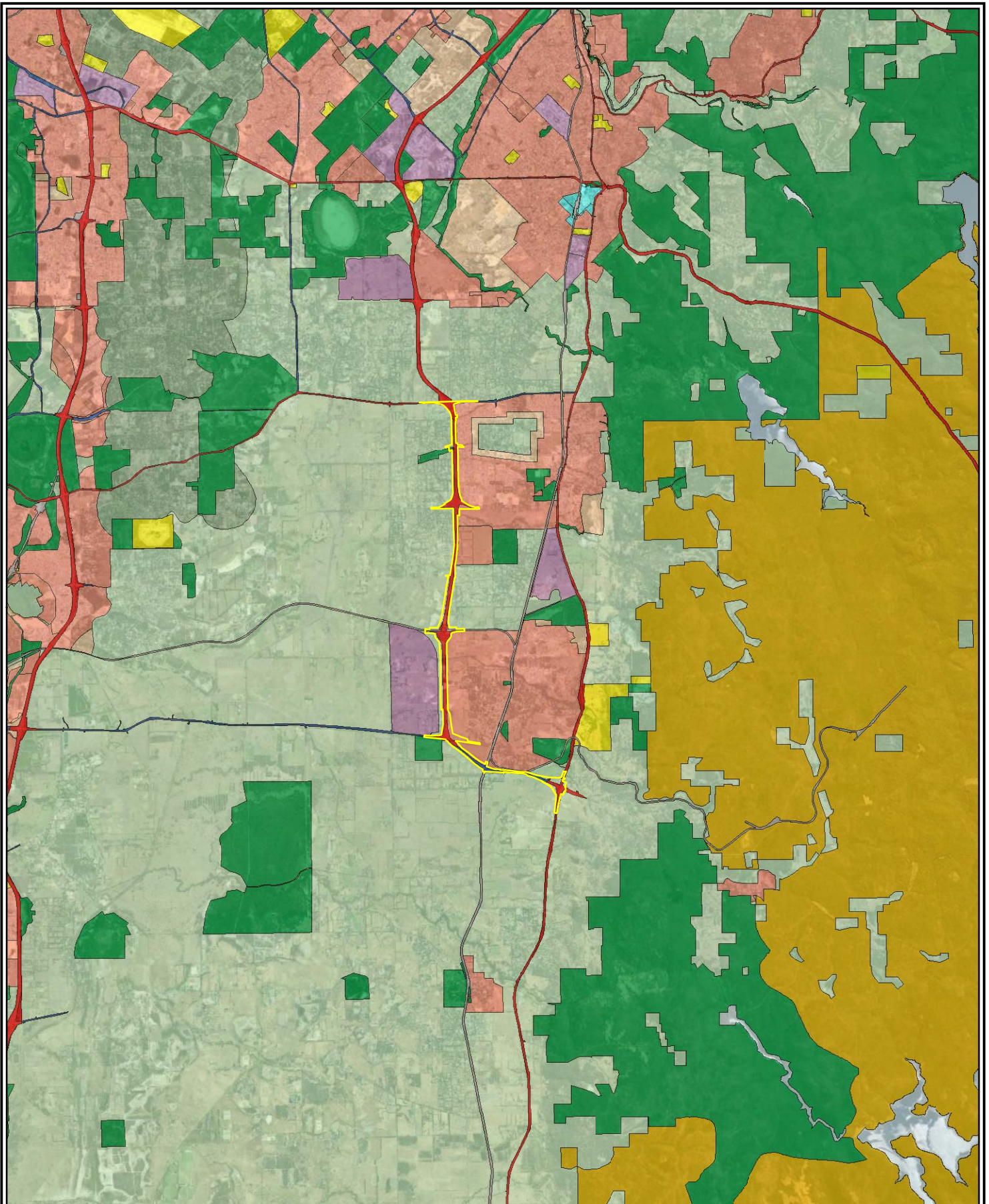
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**Tonkin Highway Extension  
WA**

**SURVEY AREA**

**FIGURE 3**

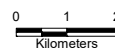




**Legend**

- |                        |                          |
|------------------------|--------------------------|
| Proposed Action        | Public purposes          |
| Central city area      | Railways                 |
| Industrial             | Rural                    |
| Other regional roads   | Rural - water protection |
| Parks and recreation   | State forests            |
| Primary regional roads | Urban                    |
| Private recreation     | Urban deferred           |
|                        | Waterways                |

Scale 1:150,000 at A4



Coord. Sys. GDA 1994 MGA Zone 50



Job No: 58910

Client: Main Roads Western Australia

Version: A

Date: 20-Jan-2021

Drawn By: hsullivan

Checked By: DN

**Tonkin Highway Extension WA**

**SURROUNDING LAND USE**

**FIGURE 4**



## 2.4 Timing and Duration

The following information presents the current scope, timing and duration of both construction and operational components of the Proposed Action.

### Construction Phase (2022 – 2024)

Construction of the Proposed Action is proposed to commence in the first quarter of 2022 for a two-year period.

Bridges are likely to consist of pre-cast concrete or steel, supported on piled foundations or spread footings with mechanically stabilised earth (MSE) walls at the abutments.

Construction of the road will be undertaken using traditional earth-moving, equipment and construction techniques. The majority of the length of the road will be primarily infill. This material will be imported to the site.

### Operations & Maintenance (2024+)

Tonkin Highway will operate as a controlled access highway with access to the highway restricted to the grade separated interchange locations. Traffic will generally be free flowing on the four-lane dual carriageway (two lanes each direction). Daily volumes along the alignment are likely to ultimately range from 30,000 to 70,000 vehicles. Traffic volumes are expected to be the highest between Thomas Road and Orton Road.

Tonkin Highway will be subject to normal routine, recurrent and periodic maintenance during operation. The maintenance operations will be confined to the road corridor and the road itself, typically including vegetation, drainage, lighting, road markings, signs and resurfacing the road pavement.

## 2.5 Description of Rehabilitation

Revegetation along the Proposed Action area will comply with MRWA Vegetation Placement within the Road Reserve Doc. No. 6707/022 (MRWA, 2013). This guide defines the recommended setbacks and clearance requirements that apply to all revegetation or landscaping associated with new road construction. Revegetation would utilise local native species that are suitable for the site conditions within three years after the rehabilitation works are completed.

Revegetation will not include species of foraging habitat for black cockatoos within 10 m of the constructed road carriageway, including but not limited to, *Banksia* spp., *Hakea* spp., *Grevillea* spp. and *Eucalyptus* spp.

Placement of vegetation near road infrastructure is restricted to maintain road safety. These requirements minimise ongoing maintenance and maintain a standard amenity level for road users. Revegetation will incorporate these restrictions when undertaking planting, in particular the need for roadside maintenance and clear zones.

## 2.6 Request to Vary Proposed Action

Through the ongoing development of the road design, a review had identified the ability to reduce the size of the Development Envelope. On 29 March 2021, Main Roads Western Australia requested to vary the proposed action to reduce the Development Envelope. This involves a reduction of 94.1 ha of land. The variation has the potential to result in a reduction of clearing a number of MNES within the Development Envelope. Reductions in impacts to the MNES are outlined in Section 2.7. On April 2021 DAWE approved the request to vary the proposal.

## 2.7 Alternatives Considered

### 2.7.1 Planning history

A reservation for the Tonkin Highway Extension has been included within the Metropolitan Planning Scheme (MRS) for a number of years. Planning in the Perth Metropolitan Region occurs at a number of levels. The main planning tools relevant to the proposal include the State Planning Strategy, Metroplan, Corridor Plans, MRS, Metropolitan Transport Strategy, Structure Plans, Outline Development Plans and Local Government Town Planning Schemes.

This transport route has been considered through the South East Corridor Plan, South East Corridor Transport Study and various amendments to the MRS. All MRS amendments included formal public consultation and Parliamentary review and approval. The South East Corridor Plan involved public, industry and government consultation. The EPA provided strategic advice in 1995, pursuant to Section 16 of the *Environmental Protection Act*, on the South East Corridor Plan and MRS amendment 966/33 in 1995.

### 2.7.2 Mundijong Road intersection refinement

The Mundijong Road intersection concept design as referred was informed by the results of the environmental, heritage and other constraints.

Since the referral in December 2019, Main Roads has considered a number of design options for the construction phase and ultimate design of Tonkin Highway. Main Roads objective was to minimise the impacts to:

- Threatened Ecological Communities:
  - Clay Pans of the Swan Coastal Plain Threatened Ecological Community (Critically Endangered);
  - *Corymbia calophylla* – *Kingia australis* woodlands on heavy soils, Swan Coastal Plain Threatened Ecological Community (Endangered); and
  - *Corymbia calophylla* - *Xanthorrhoea preissii* woodlands and shrublands of the Swan Coastal Plain (Endangered);
- Threatened Species:
  - *Synaphea* sp. Serpentine (Critically Endangered);
  - *Synaphea* sp. Pinjarra Plain (Endangered);
  - *Tetraria australiensis* (Vulnerable);
  - Carnaby's Cockatoo - *Calyptorhynchus latirostris* (Endangered);
  - Baudin's Cockatoo - *Calyptorhynchus baudinii* (Endangered); and
  - Forest Red-tailed Black Cockatoo - *Calyptorhynchus banksii naso* (Vulnerable).

The vegetation in the Mundijong Road reserve contains several environmental values and hence further work has been completed on the design considering the minimisation of environmental and heritage impacts while incorporating safety and construction standards.

A high level of review was undertaken of the options at the Mundijong Road intersection with the future Tonkin Highway. Alignments were evaluated based on safety, environment, economic constraints, Network performance and impacts to land use planning. The referral footprint involved clearing all of the vegetation in the road reserve. An interchange was deemed necessary to be constructed at the intersection to enable access to Mundijong Road from both the north and

southbound carriageways. This was determined due to traffic modelling and heavy haulage freight routes.

The proposal is currently at Concept Design phase. The concept design has been revised following submission of the referral for the Mundijong road grade separate interchange. The crossing for the interchange has shifted further to the east to minimise the impacts to Threatened flora and completely avoid Clay Pan TEC. The median width of the road has also been reduced adjacent to significant vegetation to narrow the footprint of the project. Furthermore, increased batter slope (gradients) and retaining walls will be incorporated in the Mundijong road area to reduce the area of clearing required. Further refinement of the alignment within the Proposed Action area will be undertaken to minimise impacts to MNES and other environmental values during the detailed design process.

The extent to which design changes result in reduction to impacts for significant species and communities is summarised in Table 2.1. Accordingly, the total clearing of native vegetation for the proposed action will be reduced to 20.6 ha.

**Table 2.1: Detailed design changes to avoid impacts to threatened fauna, ecological communities and flora.**

Aspect	Original Proposal as referred	Revised Proposal at Concept Design	Reduction in impact
Clay Pans of the Swan Coastal Plain Threatened Ecological Community (Critically Endangered)	0.05 ha	0 ha	0.05 ha
<i>Corymbia calophylla</i> – <i>Kingia australis</i> woodlands on heavy soils, Swan Coastal Plain Threatened Ecological Community (Endangered)	1.3 ha	0.13 ha	1.2 ha
<i>Corymbia calophylla</i> - <i>Xanthorrhoea preissii</i> woodlands and shrublands of the Swan Coastal Plain (Endangered)	5.3 ha	3.94ha	1.36 ha
<i>Synaphea</i> sp. Serpentine (Critically Endangered)	538	3	535
<i>Synaphea</i> sp. Pinjarra Plain (Endangered)	6	0	6
<i>Tetraria australiensis</i> (Vulnerable)	1,131	165	966
Carnaby's Cockatoo <i>Calyptorhynchus latirostris</i> (Endangered); Habitat extent (ha)	35.82 ha	34.09 ha	1.73 ha
Baudin's Cockatoo <i>Calyptorhynchus baudinii</i> (Endangered). Suitable DBH trees without a Suitable Nest Hollow	35.8 ha	34.09 ha	1.71 ha
Forest Red-tailed Black Cockatoo <i>Calyptorhynchus banksii naso</i> (Vulnerable); Habitat extent (ha)	35.8 ha	34.09 ha	1.71 ha
All three Black Cockatoo Species Suitable DBH trees without a Suitable Nest Hollow	347 trees	346 trees	1 tree

Aspect	Original Proposal as referred	Revised Proposal at Concept Design	Reduction in impact
All three Black Cockatoo Species Suitable DBH trees with a Suitable Nest Hollow	2 trees	2 trees	No change

### 3. Description of the Environment and Matters of National Environmental Significance

#### 3.1 Protected Matters within the proposed action area

The following protected matters are, or have the potential to be, in the Proposed Action area and surrounds:

- Clay Pans of the Swan Coastal Plain Threatened Ecological Community (Critically Endangered);
- *Corymbia calophylla* – *Kingia australis* woodlands on heavy soils, Swan Coastal Plain Threatened Ecological Community (Endangered);
- *Corymbia calophylla* - *Xanthorrhoea preissii* woodlands and shrublands of the Swan Coastal Plain (Endangered);
- *Synaphea* sp. Serpentine (Critically Endangered);
- *Synaphea* sp. Pinjarra Plain (Endangered);
- *Tetraria australiensis* (Vulnerable);
- Carnaby's Cockatoo *Calyptorhynchus latirostris* (Endangered);
- Forest Red-tailed Black Cockatoo *C. banksii naso* (Vulnerable); and
- Baudin's Cockatoo *C. baudinii* (Endangered).

#### 3.2 Existing Environment

##### 3.2.1 Current Land Use

The land has been used for pastoral and dairying activity for over 100 years, and 84.6 % (197.35 ha) of the 233.60 ha area to be impacted by the Proposed Action has already been cleared. Agricultural activities are ongoing in the area.

##### 3.2.2 Topography

The land gradient within the Proposed Action ranges from approximately 14 metres Australian height datum (mAHD) to 24 mAHD. The Proposed Action may result in some localised changes to the existing gradient to facilitate the creation of new road infrastructure, including road embankments.

##### 3.2.3 Soils and Geology

The Proposed Action is located in the Swan Coastal Plain subregion as defined by Beard (1981; 1990); which is equivalent to the Swan Coastal Plain Interim Biogeographic Regionalisation for Australia (IBRA) region and SWA-2 IBRA subregion (Commonwealth of Australia 2012).

The Swan Coastal Plain subregion consists of a coastal plain of low-lying, often swampy areas and sandhills (generally referred to as the Swan Coastal Plain) with soils consisting of sands or swamp deposits as well as dissected country rising to the duricrusted Dandaragan Plateau on Mesozoics consisting of mainly yellow sandy soils. The geology of the region comprises Mesozoic to recent sediments of the Perth Basin (Beard 1990).

The Proposed Action occurs within the Bassendean and the Pinjarra Soil-Landscape Zones of the Swan Province. The Bassendean Zone is described as consisting of Mid-Pleistocene Bassendean sand and fixed dunes inland from the coastal dune zone, with non-calcareous sands and podsolised soils with low-lying wet areas. The Pinjarra Zone is characterised by alluvial deposits (early Pleistocene to

Recent) between the Bassendean Dunes Zone and the Darling Scarp with colluvial and shelf deposits adjacent to the Darling Scarp in clayey to sandy alluvial soils with wet areas (Purdie et al. 2004).

### **3.2.4 Acid sulphate soils**

The Australian Soil Resource Information System (ASRIS) database indicates that the Project area intersects areas of potential acid sulfate soils (PASS) with a 'moderate to low' risk of acid sulfate soil (ASS) occurring within 3 m of natural soil surface (ASRIS, 2019).

Site investigations have not been undertaken however field investigations will be required prior to dewatering and excavating activities in order to inform management measures.

### **3.2.5 Contamination**

Project activities are located within the road reserve and no known previous land use activities on or adjacent to the Project area have had the potential to create contamination. A search of ArcGIS shapefiles and DWER's contaminated sites database indicates there are no identified contaminated sites within the Project area.

### **3.2.6 Groundwater**

Three layers of aquifer occur beneath the Proposed Action. The unconfined (or superficial) aquifer is the topmost layer and is usually accessed for groundwater abstraction. Beneath the superficial aquifer lies the semi-confined Leederville aquifer. Below the Leederville aquifer lies the confined Yarragadee North aquifer.

The superficial aquifer receives direct recharge from groundwater infiltration and surface water. There is limited interaction between the various aquifers, in terms of water exchange. Both the Yarragadee and the Leederville aquifer receive direct recharge where these formations outcrop (not within the Proposed Action). Groundwater movement and recharge is very slow in these confined aquifers.

Depth to groundwater levels range from 2.0 m to 4.8 m below surface level (approximately 24m Australian Height Datum (AHD)) across the Proposed Action area. The depth of the bottom of the superficial aquifer in the area of the Proposed Action is approximately 15 m below ground level.

### **3.2.7 Surface Water and Waterways**

The Proposed Action is located within both the Swan-Canning Catchment (Lower Canning and Southern River sub-catchments) and the upper Peel-Harvey Catchment. At the local scale, the Project area is within the Birriga Main Drain catchment. The drain, which is 7 km west of the Project area, is fed by several tributaries which intersect the Project area, including the Mandejal, Cardup and Beenyup Brooks and the Oaklands Creek. The Birriga Main Drain feeds into the Serpentine River (Figure 4).

The Mandejal Brook is a perennial stream approximately 11.2 km in length, and initiates from Langford Park, flowing through Whitby Falls and the Mandejal Brook Reserve and discharges into Oaklands drain to the east, ultimately terminating within the Peel-Yalgorup system.

The Proposed Action intersects seven wetlands mapped by the Geomorphic Wetlands of the Swan Coastal Plain dataset (Figure 5) including:

- Multiple Use Wetland 'Armadale Palusplain' (UFI 15797), palusplain;
- Multiple Use Wetland (UFI 16021), palusplain;
- Conservation Category Wetland 'Abernethy Road Bushland' (UFI 14495), palusplain;
- Resource Enhancement Wetland (UFI 14540), creek;
- Conservation Category Wetland (UFI 14945), palusplain;



- Conservation Category Wetland (UFI 14817), palusplain; and
- Conservation Category Wetland (UFI 14985), palusplain.

The Project area will directly impact 182.04 ha of mapped geomorphic wetlands, comprising of:

- 3.40 ha of Conservation Category Wetlands (CCW);
- 178.37 ha of Multiple Use Wetlands; and
- 0.27 ha of Resource Enhanced Wetlands.

The CCWs within the Proposed Action area have all been subject to some disturbance due to the long history of agriculture in the region. They may retain high ecological values. Resource Enhancement Wetlands are partly modified but still support substantial functions and attributes (EPA, 2008), and Multiple Use Wetlands are considered to have few attributes which still provide important wetland functions.

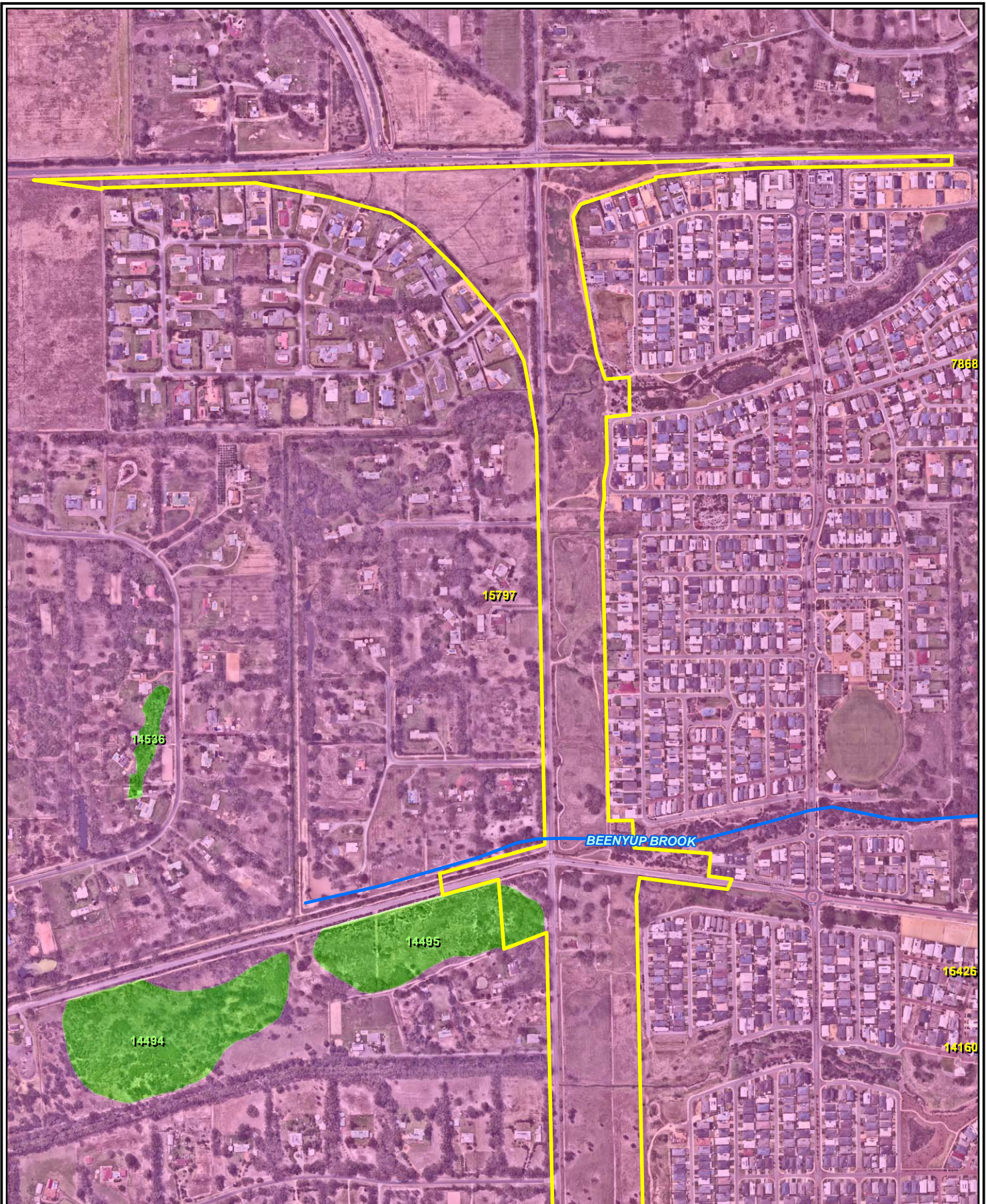
The wetland vegetation types are reflected in the vegetation mapping (Figure 8

No other listed or CCWs occur within 1 km of the Project area.

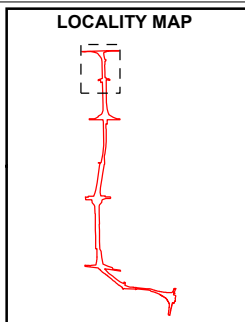
Two Wetlands of International Importance were identified from the PMST Report:

- Forrestdale and Thomsons Lakes - together these lakes are a Ramsar wetland site; and
- Peel-Yalgorup system.

Forrestdale Lake and Thomsons Lake are located approximately 5 km and 13 km north-west of the Proposed Action Area respectively, and the Peel-Yalgorup system is 36 km to the south of the Proposed Action area.



- Legend**
- Proposed Action
  - Geomorphic Wetlands (DBCA)
    - Conservation
    - Multiple Use
  - Watercourses

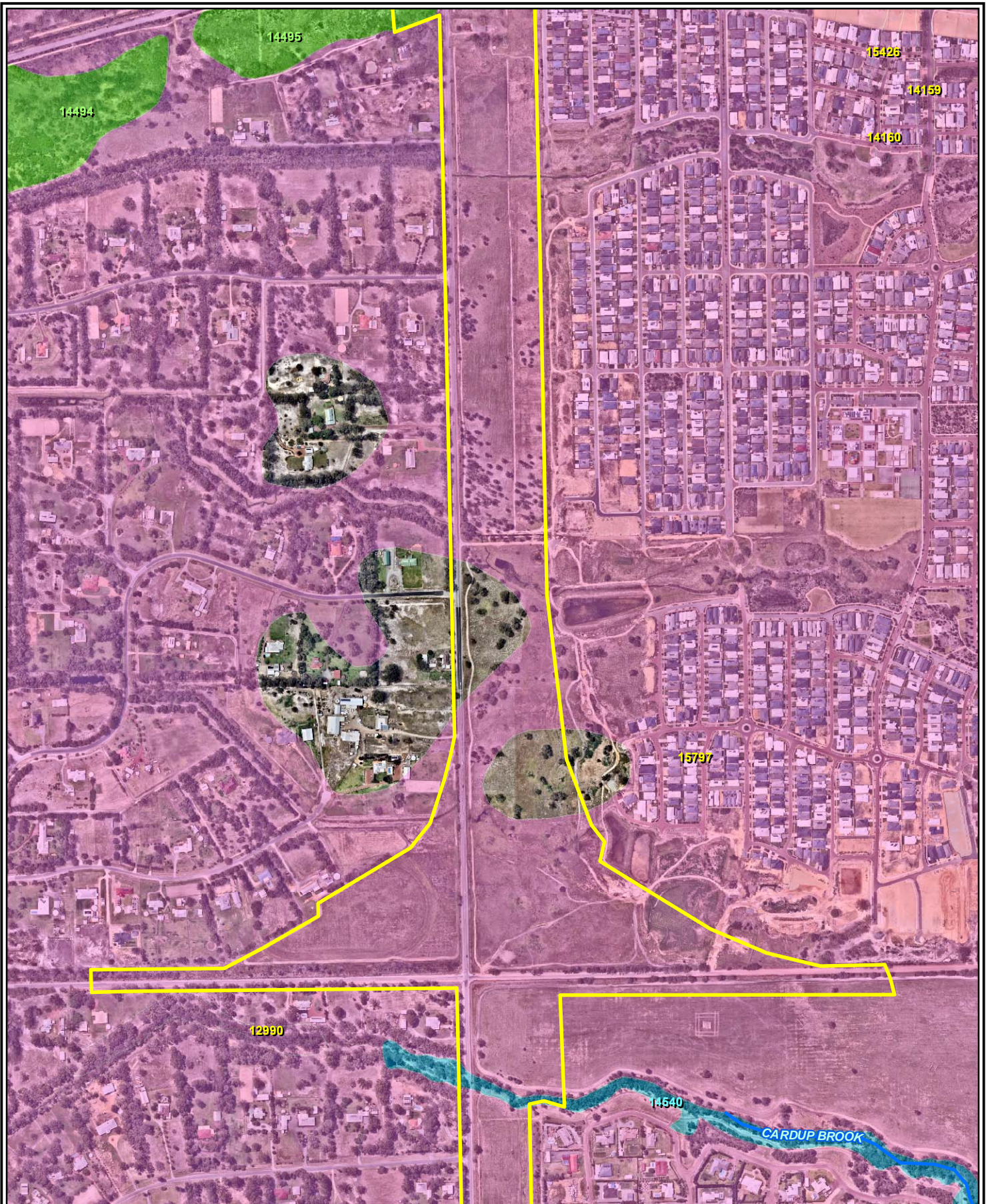


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Client: Main Roads Western Australia		
Version: A	Date: 27-Jan-2021	
Drawn By: hsullivan	Checked By: DN	

**Tonkin Highway Extension WA**

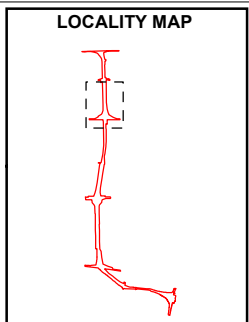
**WETLANDS AND WATERCOURSES**

**FIGURE 5** **PAGE 1**



**Legend**

- Proposed Action
- Geomorphic Wetlands (DBCA) Conservation
- Resource Enhancement
- Multiple Use
- Watercourses



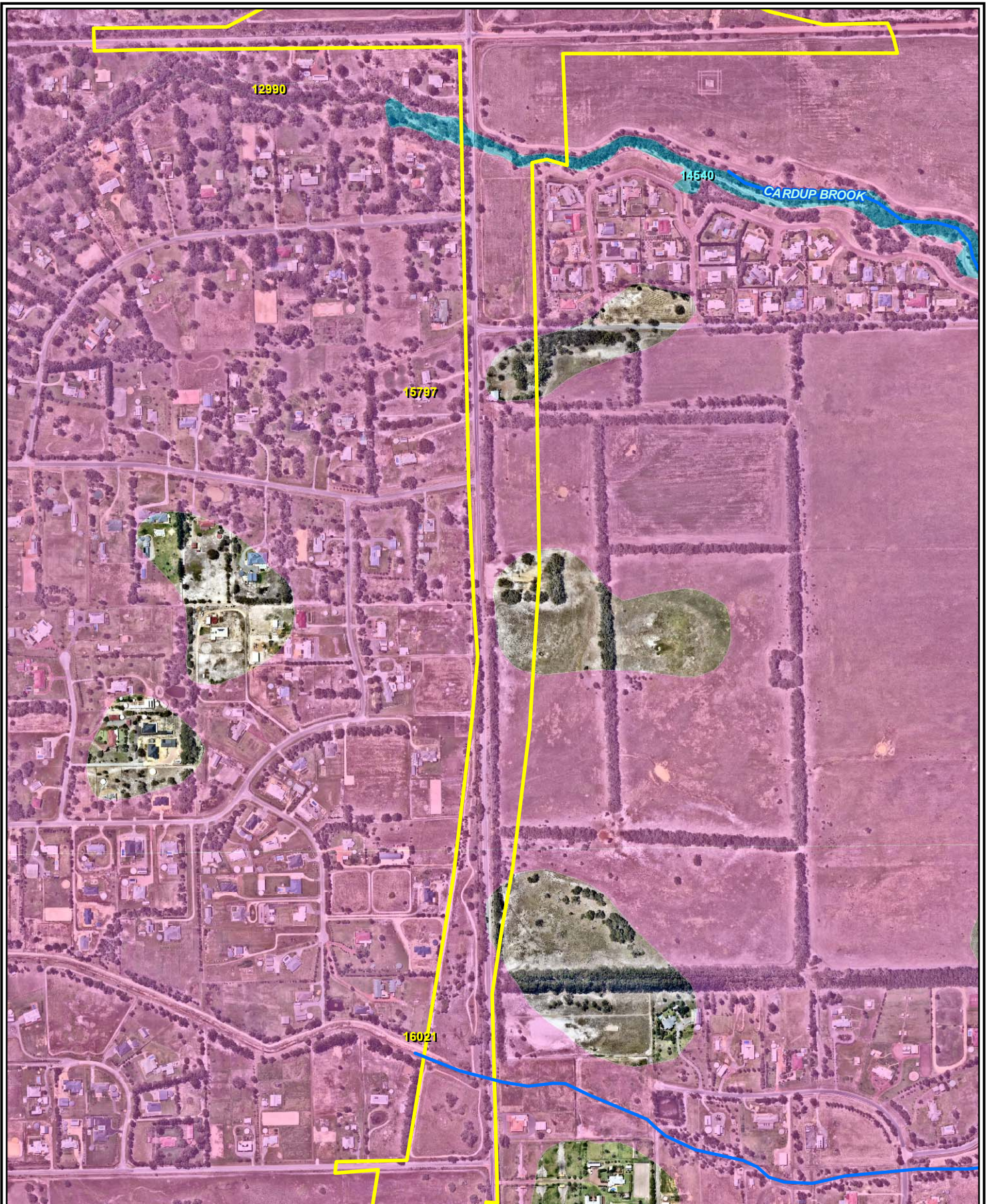
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Client: Main Roads Western Australia		
Version: A	Date: 27-Jan-2021	
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**Tonkin Highway Extension  
WA**

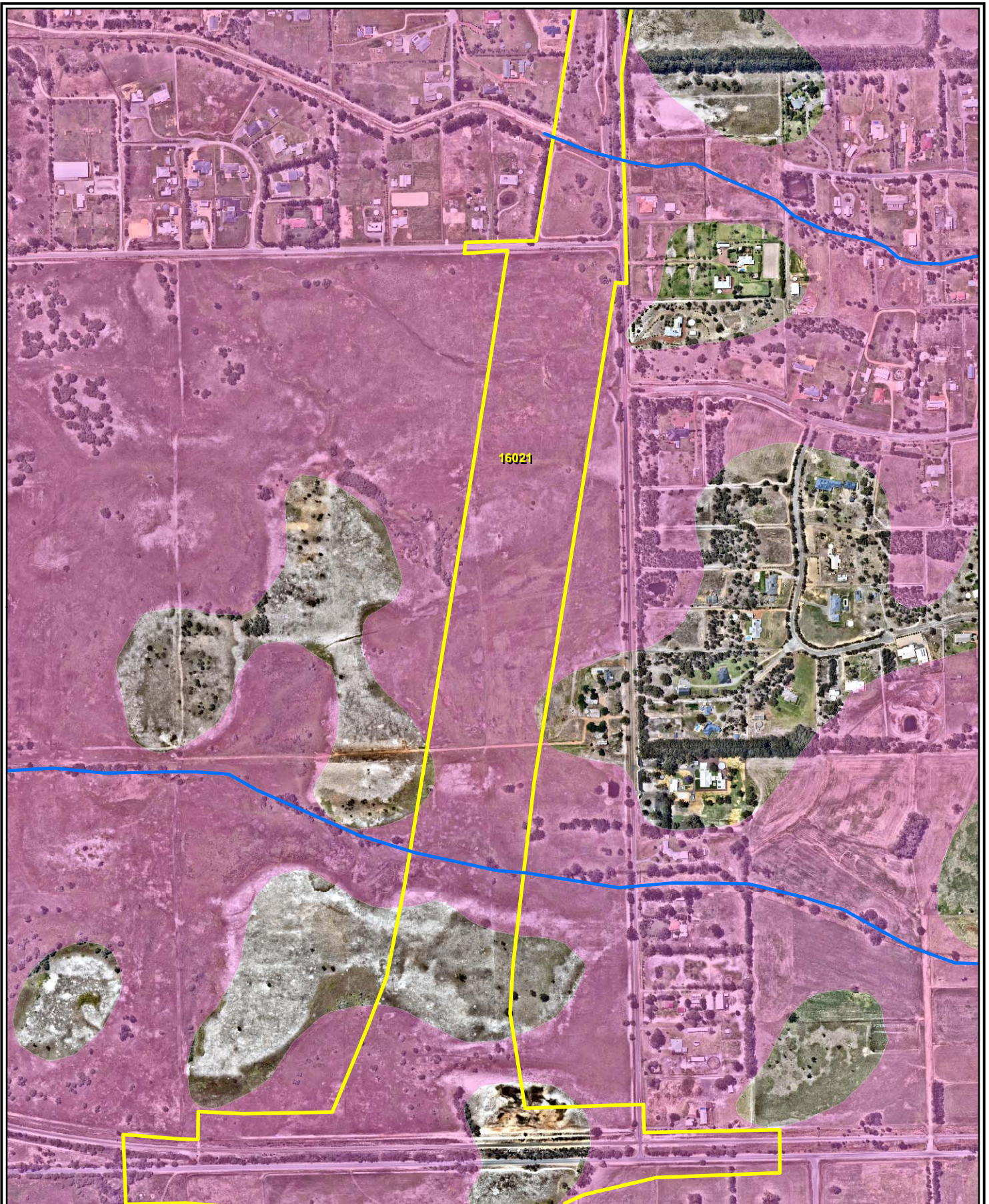
**WETLANDS AND WATERCOURSES**

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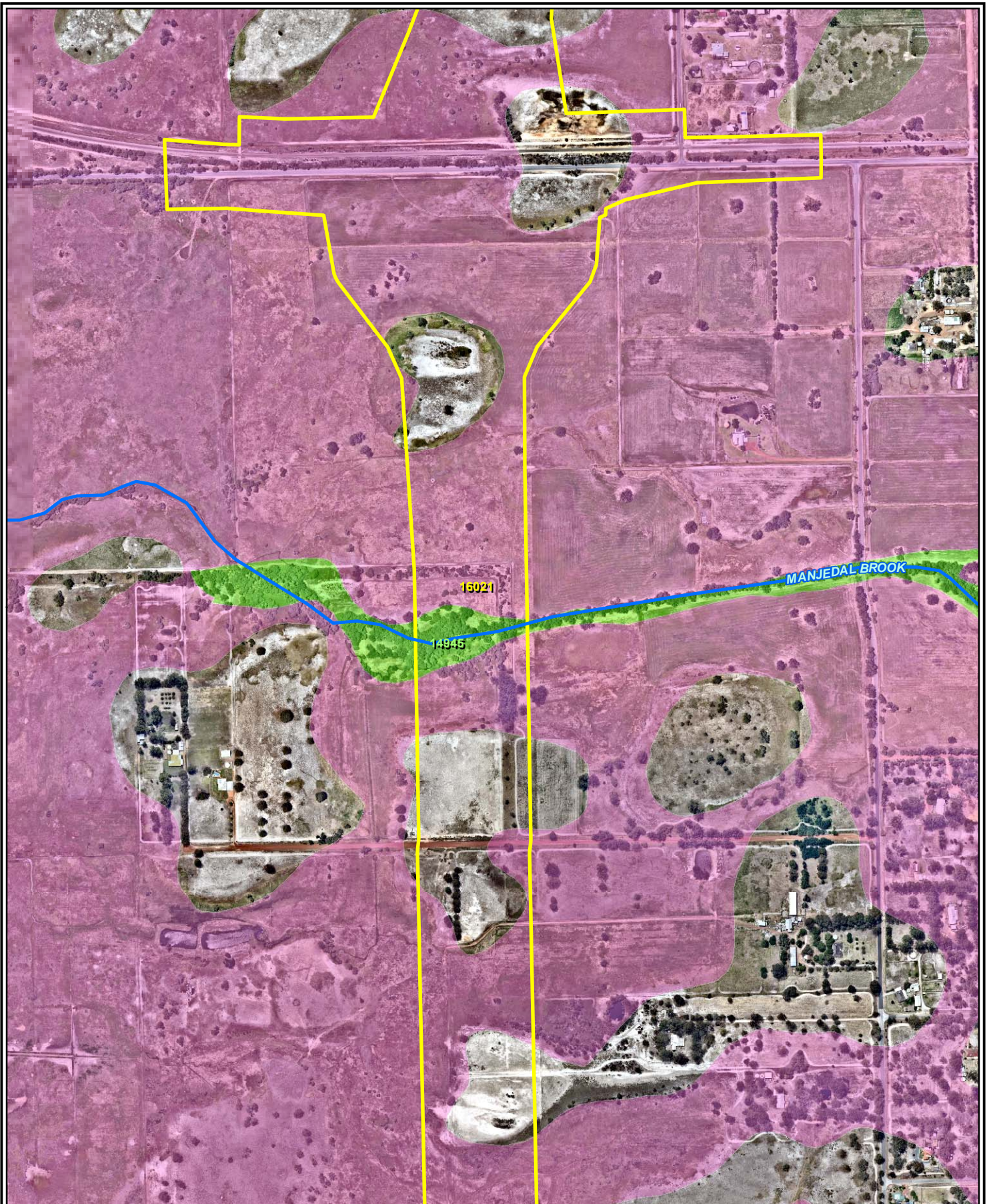
**FIGURE 5** **PAGE 2**



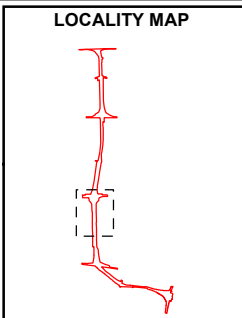
<b>Legend</b> Proposed Action Geomorphic Wetlands (DBCA) Resource Enhancement Multiple Use Watercourses	<b>LOCALITY MAP</b> 	Scale 1:9,000 at A4		<b>Tonkin Highway Extension WA</b>  <b>WETLANDS AND WATERCOURSES</b>  <b>FIGURE 5</b> <span style="float: right;"><b>PAGE 3</b></span>
		Coord. Sys. GDA 1994 MGA Zone 50		
		Job No: 58910		
		Client: Main Roads Western Australia		
Version: A	Date: 27-Jan-2021			
Drawn By: hsullivan	Checked By: DN			



<b>Legend</b> Proposed Action Geomorphic Wetlands (DBCA) Multiple Use Watercourses	<b>LOCALITY MAP</b> 	Scale 1:9,000 at A4		<b>Tonkin Highway Extension WA</b>  <b>WETLANDS AND WATERCOURSES</b>
		Coord. Sys. GDA 1994 MGA Zone 50		
		Job No: 58910		<b>FIGURE 5</b> <span style="float: right;"><b>PAGE 4</b></span>
		Client: Main Roads Western Australia	Version: A	
Drawn By: hsullivan	Checked By: DN			



- Legend**
- Proposed Action
  - Geomorphic Wetlands (DBCA)
    - Conservation
    - Multiple Use
  - Watercourses

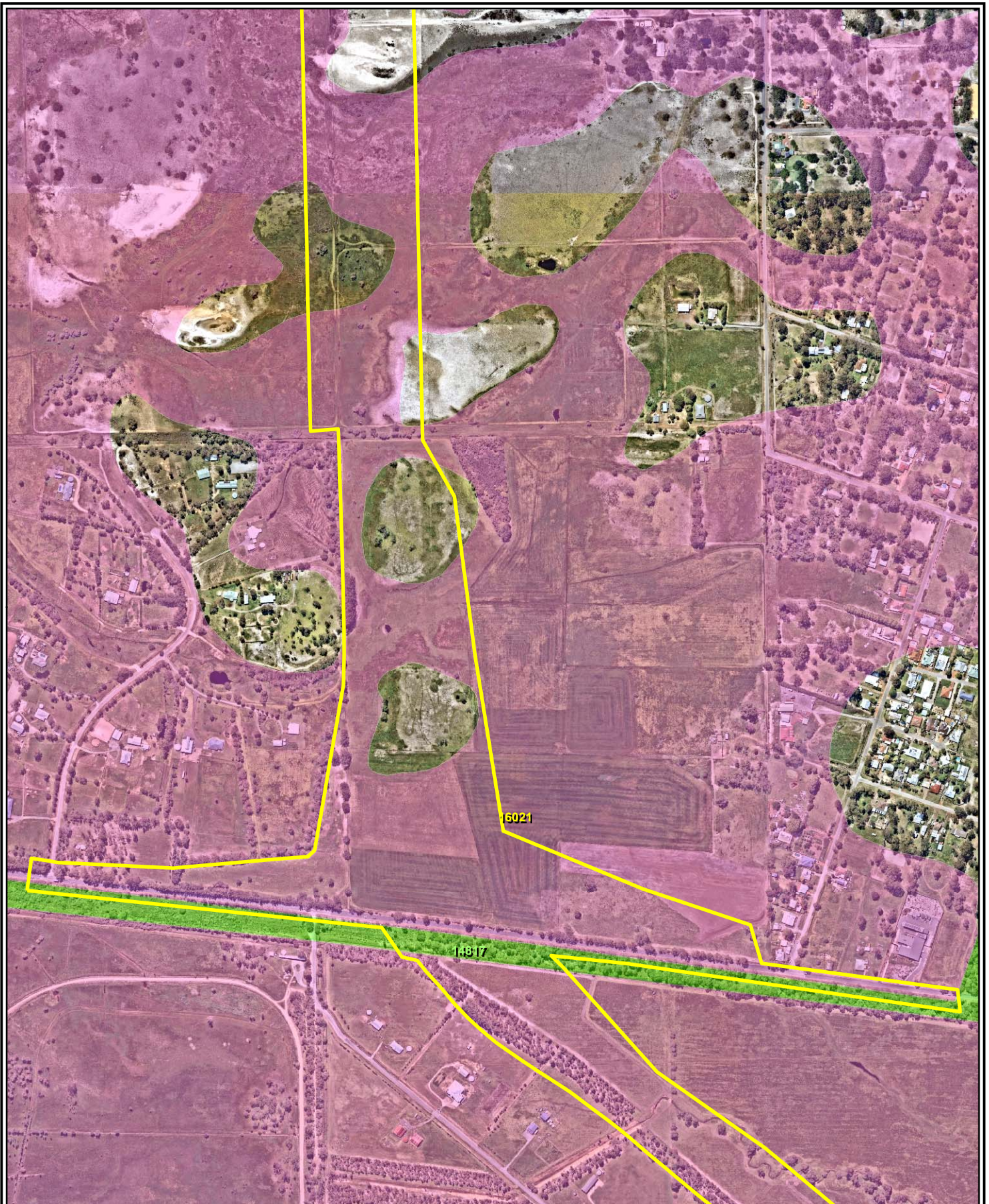


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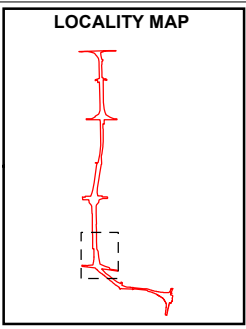
**Tonkin Highway Extension WA**

**WETLANDS AND WATERCOURSES**

**FIGURE 5** **PAGE 5**



- Legend**
- Proposed Action
  - Geomorphic Wetlands (DBCA)
    - Conservation
    - Multiple Use

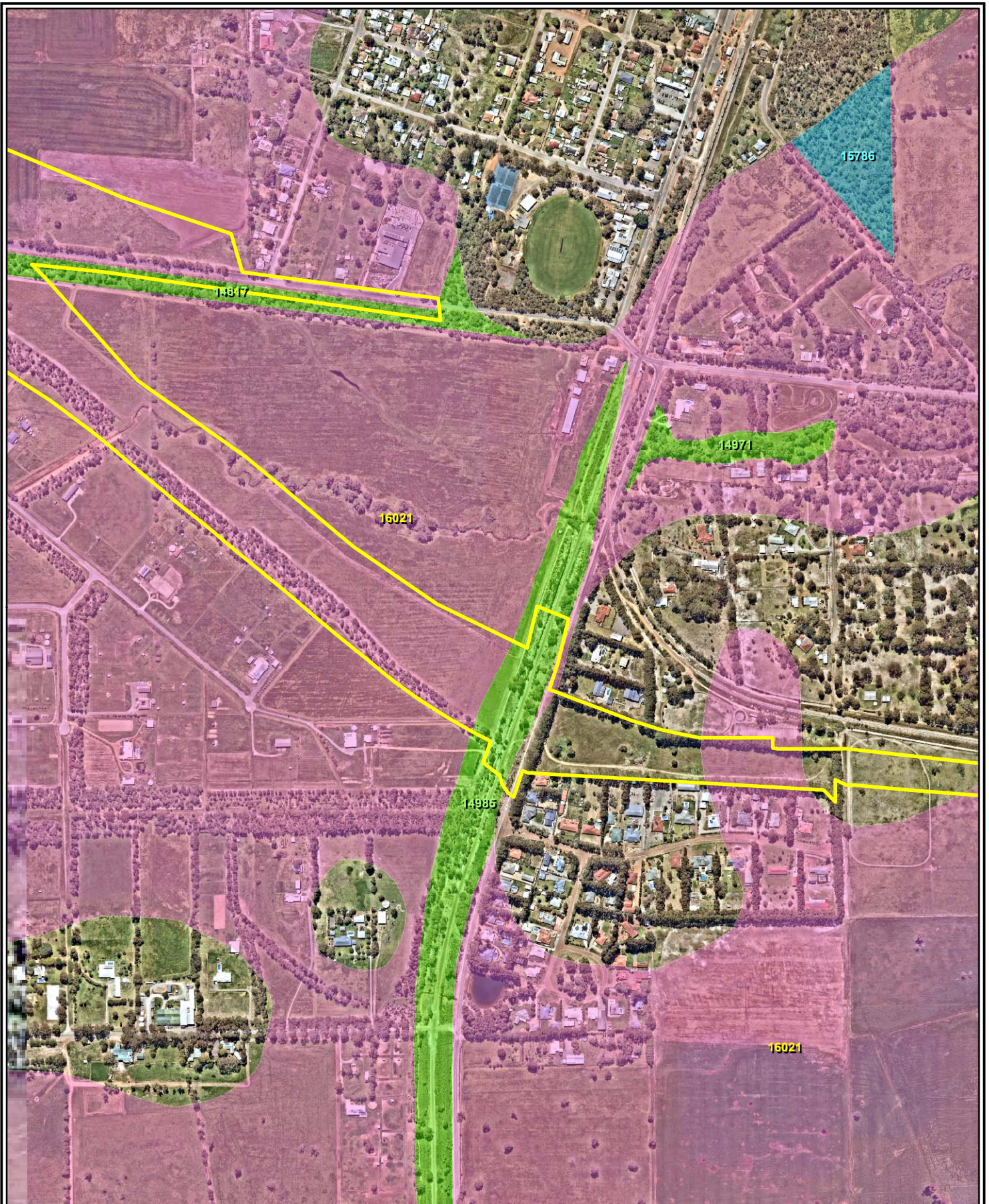


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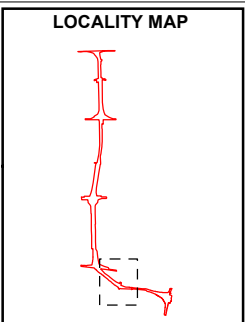
**Tonkin Highway Extension WA**

**WETLANDS AND WATERCOURSES**

**FIGURE 5** **PAGE 6**



- Legend**
- Proposed Action
  - Geomorphic Wetlands (DBCAs)
    - Conservation
    - Resource Enhancement
    - Multiple Use



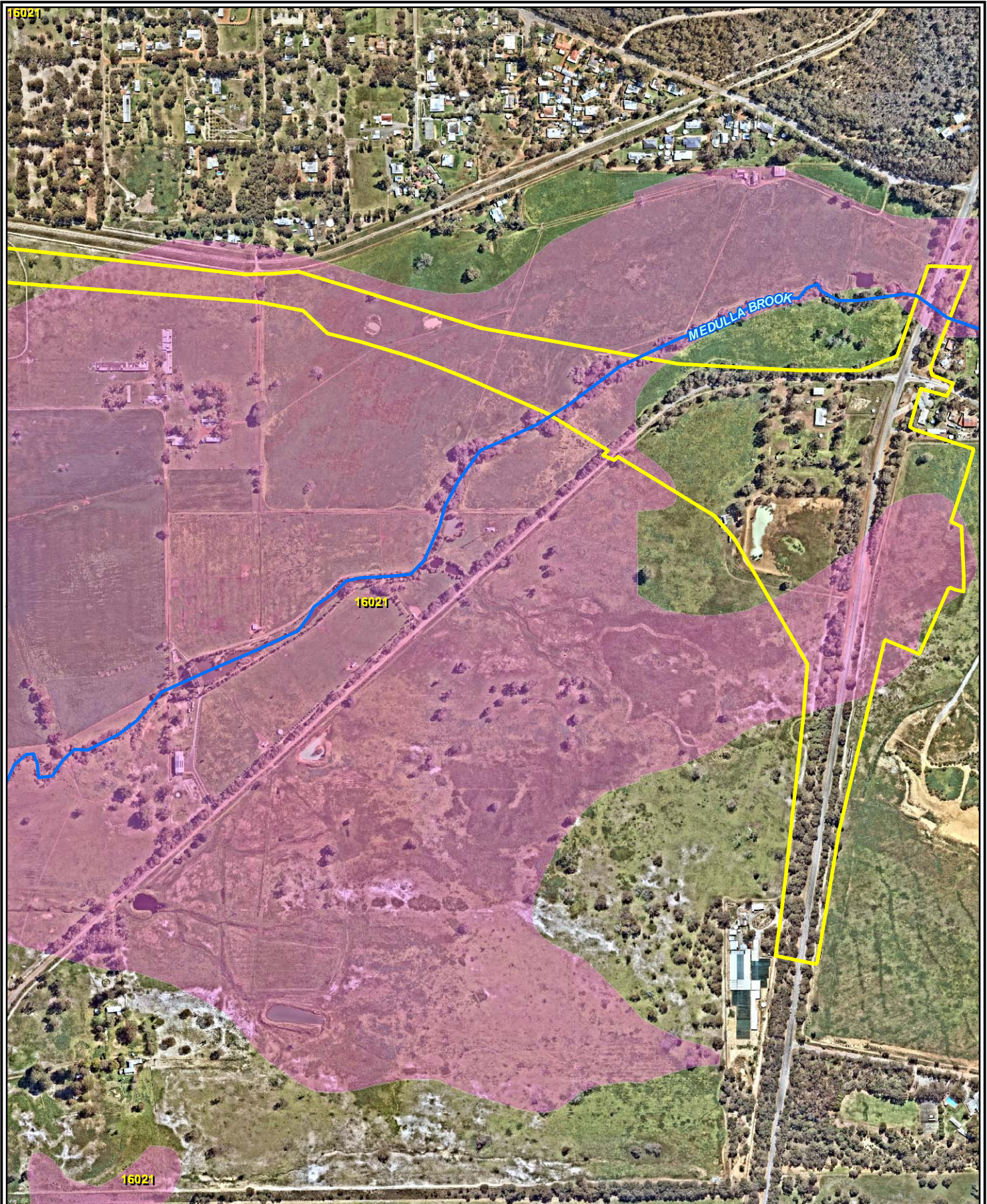
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Client: Main Roads Western Australia		
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**Tonkin Highway Extension WA**

**WETLANDS AND WATERCOURSES**

**FIGURE 5** **PAGE 7**





<b>Legend</b> Proposed Action Geomorphic Wetlands (DBCA) Multiple Use Watercourses	<b>LOCALITY MAP</b> 		Scale 1:9,000 at A4 		<b>Tonkin Highway Extension WA</b>  <b>WETLANDS AND WATERCOURSES</b>	
			Coord. Sys. GDA 1994 MGA Zone 50 			
			Job No: 58910 Client: Main Roads Western Australia		<b>FIGURE 5</b>	<b>PAGE 8</b>
			Version: A Date: 27-Jan-2021 Drawn By: hsullivan Checked By: DN			

### 3.2.8 Vegetation, Flora and Fauna

#### 3.2.8.1 Broad Vegetation

Vegetation within the area of the Proposed Action is situated primarily within the Pinjarra 968 association and has been broadly characterised by Beard (1990) as medium woodland of Jarrah (*Eucalyptus marginata*), Marri (*Corymbia calophylla*) and Wandoo (*Eucalyptus wandoo*). The southern portion of the Proposed Action is situated within the Pinjarra 3 and West Darling 4 associations, which are described as ‘Medium forest; Jarrah-Marri’ and ‘Medium woodland; Marri and Wandoo’. Vegetation complexes as described by Heddle et al. (1980) within the Proposed Action area comprise:

- Beermullah Complex – Mixture of low open forest of *Casuarina obesa* and open woodland of *Eucalyptus calophylla* – *E. wandoo* – *E. marginata*. Minor components include closed scrub of *Melaleuca* spp. and occurrence of *Actinostrobilus pyramidalis*
- Guildford Complex – A mixture of open forest to tall open forest of *Eucalyptus calophylla* – *E. wandoo* – *E. marginata* and woodland of *E. wandoo* (with rare occurrences of *E. lane-poolei*). Minor components include *E. rudis* – *Melaleuca raphiophylla*
- Forrestfield Complex – Vegetation ranges from open forest of *Eucalyptus calophylla* – *E. wandoo* – *E. marginata* to open forest of *E. marginata* – *E. calophylla* – *Allocasuarina fraseriana* – *Banksia* spp. Fringing woodland of *E. rudis* in the gullies that dissect this landform.

The remaining pre-European extents of the Beermullah, Guildford and Forrestfield Complexes are approximately 7% and 5% and 12% respectively (GoWA 2019) being either near to, or below the 10% target for the retention of vegetation complexes within constrained areas of the Swan Coastal Plain (EPA 2000). The extent of native vegetation remaining within a 12 km radius of the Proposed Action is identified by Figure 6.

#### 3.2.8.2 Flora

Woodman (2020) recorded a total of 256 discrete vascular flora taxa in the Study Area (broader than the Proposed Action area), representing 50 families and 147 genera. The most well-represented families are Myrtaceae (32 taxa), Proteaceae (28 taxa), Fabaceae (24 taxa) and Cyperaceae (23 taxa). Forty-seven taxa are annual taxa. Fifty of the total taxa recorded are introduced taxa.

Given the very small area of intact vegetation in the Survey Area and history of disturbance of this vegetation (most areas are in narrow road reserves), the floristic diversity is considered to be relatively high.

A total of nine significant flora taxa were recorded, including three Threatened taxa and five Priority flora taxa.

The three threatened flora species are listed under the EPBC Act:

- *Synaphea* sp. Serpentine (Critically Endangered);
- *Synaphea* sp. Pinjarra Plain (Endangered);
- *Tetraria australiensis* (Vulnerable)

The locations of these threatened flora species within 5 km of the Proposed Action is provided in Figure 7.

#### 3.2.8.3 Introduced and Invasive Species

Fifty introduced taxa were recorded within the Survey Area during the Woodman 2019 survey. Five of the recorded taxa are Declared Pests under the Biosecurity and Agriculture Management Act 2007.

One Weed of National Significance, \**Asparagus asparagoides* (Bridal Creeper) was recorded within the Survey Area, outside of the area to be impacted by the Proposed Action.

#### **3.2.8.4 Vegetation Types**

The flora and vegetation survey conducted by Woodman Environmental (2020) identified 11 vegetation types (VTs) as intact vegetation (Figure 8 and Table 3.1). These 11 VTs occur within the Proposed Action area and, of those, nine will be impacted.

**Table 3.1: Vegetation Types Mapped in the Proposed Action Area**

ID	Vegetation Type	Vegetation Type Description	Extent Within the Proposed Action Area	Condition
VT 1	Floristic Community Type 8  SCP08 - Herb rich shrublands in clay pans (WA); Clay Pans of the Swan Coastal Plain (Vulnerable))	Mid sparse shrubland dominated by <i>Xanthorrhoea preissii</i> and <i>Kingia australis</i> over low open shrubland dominated by <i>Verticordia densiflora</i> var. <i>densiflora</i> over low sparse sedgeland and grassland of mixed species dominated by <i>Schoenus rigens</i> , <i>Mesomelaena tetragona</i> , <i>Cyathochaeta avenacea</i> , * <i>Ehrharta calycina</i> and <i>Neurachne alopecuroidea</i> over low sparse forbland of mixed species including <i>Drosera menziesii</i> , <i>Drosera heterophylla</i> , <i>Thelymitra antennifera</i> , <i>Burchardia multiflora</i> and <i>Stylidium pulchellum</i> on brown sandy clay with occasional laterite pebbles on seasonally inundated flats.	0.23 ha	Very Good – 0.05 ha Degraded – 0.17 ha
VT 2	Floristic Community Type 3a  <i>Corymbia calophylla</i> - <i>Kingia australis</i> woodlands on heavy soils, Swan Coastal Plain (WA) (Critically Endangered)	Tall sparse shrubland dominated by <i>Jacksonia sternbergiana</i> , <i>Kingia australis</i> and <i>Xanthorrhoea preissii</i> over low sparse shrubland dominated by <i>Hypocalymma angustifolium</i> subsp. Swan Coastal Plain (G.J. Keighery 16777), <i>Stirlingia latifolia</i> and <i>Hakea prostrata</i> over low open sedgeland and grassland of mixed species including <i>Cyathochaeta avenacea</i> , <i>Amphipogon turbinatus</i> , <i>Tetraria australiensis</i> , <i>Mesomelaena tetragona</i> and <i>Tetraria octandra</i> over low sparse shrubland of mixed species including <i>Dampiera linearis</i> and <i>Banksia dallanneyi</i> subsp. <i>dallanneyi</i> var. <i>dallanneyi</i> on brown sandy loam on seasonally moist flats.	0.51 ha	Very Good – 0.36 ha Degraded – 0.15 ha
VT 3	Floristic Community Type 3a  <i>Corymbia calophylla</i> - <i>Kingia australis</i> woodlands on heavy soils, Swan Coastal Plain (WA) (Critically Endangered)	Tall to mid sparse shrubland dominated by <i>Jacksonia sternbergiana</i> , <i>Kingia australis</i> and <i>Xanthorrhoea preissii</i> over mid sparse shrubland of mixed species dominated by <i>Hakea varia</i> over shrubland to open shrubland of mixed species including <i>Hypocalymma angustifolium</i> subsp. Swan Coastal Plain (G.J. Keighery 16777), <i>Hakea incrassata</i> , <i>Allocasuarina microstachya</i> , <i>Grevillea pilulifera</i> and <i>Kunzea micrantha</i> subsp. <i>micrantha</i> over low open rushland and sedgeland of mixed species including <i>Desmocladius lateriflorus</i> , <i>Mesomelaena tetragona</i> , <i>Tetraria octandra</i> and <i>Schoenus subflavus</i> subsp. <i>subflavus</i> on brown sandy clay on seasonally moist flats.	1.57 ha	Very Good – 0.96 ha Degraded – 0.61 ha
VT 4	Floristic Community Type 3c  <i>Corymbia calophylla</i> - <i>Xanthorrhoea preissii</i> woodlands and shrublands, Swan Coastal Plain (WA); (Critically Endangered)	Mid open forest of <i>Corymbia calophylla</i> over tall to mid sparse shrubland dominated by <i>Xanthorrhoea preissii</i> and <i>Kingia australis</i> over low sedgeland to open sedgeland dominated by <i>Cyathochaeta avenacea</i> , <i>Tetraria octandra</i> , <i>Lepidosperma</i> cf. <i>oldhamii</i> and <i>Mesomelaena tetragona</i> over low sparse forbland of mixed species dominated by <i>Dasyogon bromeliifolius</i> , <i>Sowerbaea laxiflora</i> , <i>Conostylis aculeata</i> subsp. <i>preissii</i> , <i>Caesia micrantha</i> and <i>Burchardia congesta</i> on grey or brown sand or sandy loam on dry flats.	8.21 ha	Very Good – 2.10 ha Good – 1.99 ha Degraded - 3.66 ha Completely Degraded – 0.46 ha

ID	Vegetation Type	Vegetation Type Description	Extent Within the Proposed Action Area	Condition
VT 5	Affinity with SCP 3b/3c however results of FCT analysis inconclusive. Potentially undescribed (Woodman 2020).	Mid open forest dominated by <i>Eucalyptus marginata</i> subsp. <i>marginata</i> , <i>Allocasuarina fraseriana</i> and occasionally <i>Corymbia calophylla</i> over tall sparse shrubland dominated by <i>Xanthorrhoea preissii</i> and occasionally <i>Banksia grandis</i> over low open shrubland of mixed species including <i>Labichea punctata</i> , <i>Phyllanthus calycinus</i> , <i>Hakea stenocarpa</i> , <i>Hakea lissocarpa</i> and <i>Babingtonia camphorosmae</i> over low open sedgeland of mixed species including <i>Tetraria</i> sp. Jarrah Forest (R. Davis 7391), <i>Mesomelaena pseudostygia</i> and <i>Tetraria octandra</i> on grey-brown sand on foothills.	0.82 ha	Very Good – 0.18 ha Degraded – 0.64 ha
VT 6	Floristic Community Type 3c  <i>Corymbia calophylla</i> - <i>Xanthorrhoea preissii</i> woodlands and shrublands, Swan Coastal Plain (WA); (Critically Endangered)	Mid open forest of <i>Corymbia calophylla</i> over mid sparse shrubland of <i>Xanthorrhoea preissii</i> and <i>Kingia australis</i> over low sparse shrubland of mixed species including <i>Hypocalymma angustifolium</i> , <i>Hakea lissocarpa</i> and <i>Hibbertia hypericoides</i> over low open sedgeland of mixed species including <i>Cyathochaeta avenacea</i> , <i>Lepidosperma apricola</i> , <i>Tetraria octandra</i> and <i>Mesomelaena tetragona</i> over low open introduced grassland of mixed species including <i>*Ehrharta calycina</i> , <i>*Ehrharta longiflora</i> , <i>*Avena barbata</i> and <i>*Briza maxima</i> over low open shrubland and forbland of mixed species including <i>Dampiera linearis</i> , <i>Lechenaultia biloba</i> , <i>Tricoryne elatior</i> , <i>Caesia micrantha</i> and <i>Watsonia meriana</i> var. <i>bulbillifera</i> on brown sandy loam on mid to lower slopes of foothills.	0.73 ha	Degraded – 0.36 ha Completely Degraded – 0.37 ha
VT 7	Inconclusive – considered to not resemble natural vegetation type given level of disturbance	Tall shrubland of mixed species dominated by <i>Melaleuca osullivanii</i> , <i>Melaleuca viminea</i> subsp. <i>viminea</i> , and occasionally <i>Hakea varia</i> and <i>Acacia saligna</i> subsp. <i>saligna</i> over mid sparse shrubland to isolated shrubs of mixed species including <i>Calothamnus hirsutus</i> , <i>Kingia australis</i> and <i>Xanthorrhoea preissii</i> over low sparse sedgeland and rushland to isolated sedges and rushes of mixed species including <i>Lepidosperma longitudinale</i> , <i>Leptocarpus canus</i> and <i>Schoenus rigens</i> over low introduced grassland of mixed species dominated by <i>*Ehrharta calycina</i> , <i>*Ehrharta longiflora</i> , <i>*Briza maxima</i> and <i>*Briza minima</i> over open forbland of mixed species (primarily introduced) including <i>*Oxalis purpurea</i> , <i>*Hypochaeris glabra</i> , <i>*Sparaxis bulbifera</i> , <i>*Moraea flaccida</i> and <i>*Aphelia cyperoides</i> on brown sandy clay on flats.	1.20 ha	Good – 1.20 ha
VT 8	Floristic Community Type 11  Wet forests and woodlands	Mid open to closed forest of <i>Eucalyptus rudis</i> , <i>Melaleuca raphiophylla</i> and <i>Melaleuca preissiana</i> over isolated mid shrubs of mixed species including <i>Xanthorrhoea preissii</i> over low grassland and forbland of introduced species including <i>*Ehrharta longiflora</i> , <i>*Watsonia meriana</i> var. <i>bulbillifera</i> , <i>*Oxalis pes-caprae</i> , <i>*Juncus usitatus</i> and <i>*Zantedeschia aethiopica</i> on brown loam in drainage lines and on adjacent floodplains.	3.50 ha	Degraded- 2.86 ha Completely Degraded – 0.64

ID	Vegetation Type	Vegetation Type Description	Extent Within the Proposed Action Area	Condition
VT 9	Floristic Community Type 11  Wet forests and woodlands dominated by <i>Eucalyptus. rudis</i> , <i>Allocasuarina. fascicularis</i> and <i>Lepidosperma longitudinal</i>	Tall open shrubland of mixed species including <i>Melaleuca viminea</i> subsp. <i>viminea</i> , <i>Melaleuca preissiana</i> , <i>Melaleuca raphiophylla</i> and <i>Acacia saligna</i> subsp. <i>saligna</i> over low grassland and forbland of introduced species including <i>*Ehrharta calycina</i> , <i>*Ehrharta longiflora</i> , <i>*Eragrostis curvula</i> and <i>*Lolium perenne</i> and <i>*Moraea flaccida</i> on brown sandy loam on flats.	0.81 ha	Degraded – 0.81 ha
VT 10	Floristic Community Type 23a  Central <i>Banksia attenuata</i> – <i>Banksia menziesii</i> woodlands	Low open woodland of <i>Banksia attenuata</i> and <i>Banksia menziesii</i> over tall sparse shrubland of <i>Jacksonia furcellata</i> and <i>Kunzea glabrescens</i> over low sparse shrubland of mixed species including <i>Eremaea pauciflora</i> var. <i>pauciflora</i> , <i>Melaleuca trichophylla</i> , <i>Melaleuca seriata</i> , <i>Hypocalymma robustum</i> and <i>Hibbertia hypericoides</i> subsp. <i>hypericoides</i> over low sparse rushland, shrubland and forbland of mixed species including <i>Conostylis aculeate</i> subsp. <i>preissii</i> , <i>Dasypogon bromeliifolius</i> , <i>Lyginia imberbis</i> , <i>Banksia dallanneyi</i> subsp. <i>dallanneyi</i> var. <i>dallanneyi</i> and <i>Desmocladius flexuosus</i> over low open grassland of introduced species dominated by <i>*Ehrharta calycina</i> , <i>*Ehrharta longiflora</i> and <i>*Bromus diandrus</i> on grey sand on low dunes.	0.35 ha	Degraded - 0.35 ha
VT 11	Floristic Community Type 5	Isolated low trees of <i>Melaleuca preissiana</i> over isolated tall shrubs of <i>Viminaria juncea</i> and <i>Callitris pyramidalis</i> over mid to low shrubland to low shrubland of mixed species dominated by <i>Regelia ciliata</i> , <i>Hakea varia</i> , <i>Pericalymma ellipticum</i> , <i>Calothamnus lateralis</i> var. <i>lateralis</i> and occasionally <i>Verticordia densiflora</i> over low sparse rushland and forbland of mixed species including <i>Hypolaena pubescens</i> , <i>Conostylis aculeata</i> subsp. <i>preissii</i> and <i>Cytogonidium leptocarpoides</i> over low open grassland of introduced species dominated by <i>*Eragrostis curvula</i> and <i>*Ehrharta calycina</i> on brown sandy loam on flats.	0.84 ha	Good – 0.61 ha Degraded – 0.23 ha

A further 21 vegetation types were identified comprising highly disturbed vegetation or isolated remnant trees, including six vegetation associations of planted vegetation (some with native species). The extent of each recorded vegetation types is identified in Figure 8.

Areas where natural vegetation have been completely removed, with no native taxa remaining, have been mapped as 'Cleared' (C). This includes roads (and associated infrastructure including culverts), tracks and areas cleared for farming activities. A total of 301.5 ha of 'Cleared' land was mapped, representing 83.2 % of the Survey Area.

Because of the long history of disturbance, there are many areas that still possess trees or large shrub taxa, but are highly modified otherwise, with understoreys usually completely comprised of introduced taxa. In many cases the trees or large shrubs are native species and are probably remnant, however, in other cases these taxa have likely colonised the area following disturbance (e.g. in drains). Occasionally, some areas contained a mixture of native trees and non-native trees that have presumably been planted or have escaped from nearby plantings. All of the above-described areas were therefore mapped as 'Highly Modified Areas', and no attempt has been made to align any such areas with VTs (Table 3.2).

A total of 15.6 ha of 'Highly Modified Areas' were mapped, representing 4.3 % of the Survey Area.

The Proposed Action area comprises of approximately 33.20 ha of native vegetation which ranges in condition from 'Completely Degraded' to 'Very Good' in accordance with the scale identified by Keighery (1994) (Figure 9).

**Table 3.2: Highly Modified Areas Mapped in the Survey Area**

Code	Description
AS	Individual or stands of <i>Acacia saligna</i> over pasture weeds on grey sands on cleared palusplains
BI	Individual or stands of <i>Banksia ilicifolia</i> over pasture weeds on grey sandy soils on low rises
CC	Individual or stands of <i>Corymbia calophylla</i> over pasture weeds on various soils and topographical positions
CO	Individual or stands of <i>Casuarina obesa</i> over pasture weeds on grey sands on cleared palusplains and in roadside drains
EG	Individual or stands of planted <i>Eucalyptus gomphocephala</i> over pasture weeds on grey sands on cleared palusplains and in roadside drains
EM	Individual or stands of <i>Eucalyptus marginata</i> over pasture weeds on grey sandy soils on low rises
ER	Individual or stands of <i>Eucalyptus rudis</i> over pasture weeds on grey sands on cleared palusplains and in roadside drains
ER/CC	Mixed stand of <i>Eucalyptus rudis</i> and <i>Corymbia calophylla</i> over pasture weeds on grey sands on cleared palusplains and in roadside drains
ER/EC	Mixed stand of <i>Eucalyptus rudis</i> and planted <i>E. camaldulensis</i> over pasture weeds on grey sands on cleared palusplains and in roadside drains
ER/MP	Mixed stand of <i>Eucalyptus rudis</i> and <i>Melaleuca preissiana</i> over pasture weeds on grey sands on cleared palusplains and in roadside drains
ER/MR	Mixed stand of <i>Eucalyptus rudis</i> and <i>Melaleuca raphiophylla</i> over pasture weeds on grey sands on cleared palusplains and in roadside drains
ER/CO/MP/MR	Mixed stand of <i>Eucalyptus rudis</i> , <i>Casuarina obesa</i> , <i>Melaleuca preissiana</i> and <i>Melaleuca raphiophylla</i> over pasture weeds on grey sands on cleared palusplains and in roadside drains
EW	Individual or stands of <i>Eucalyptus wandoo</i> over pasture weeds on grey sands on cleared land
MP	Individual or stands of <i>Melaleuca preissiana</i> over pasture weeds on grey sands on cleared palusplains and in roadside drains
TO	Dense rushland of * <i>Typha orientalis</i> growing in a minor creek

Additionally, there are several areas where tree and shrub species have clearly been planted for the purposes of revegetation. This includes a number of sections of roadside revegetation along Tonkin Highway. These areas often possessed native taxa however, these taxa had clearly been planted, and

the resulting taxon combinations did not resemble remnant vegetation. However, in some cases, the majority of taxa present were not native to the area.

These areas were mapped as 'Revegetated Areas' (Table 3.3). A total of 26.3 ha of 'Revegetated Areas' were mapped, representing 7.3 % of the Survey Area.

**Table 3.3: Description of Revegetated Areas Mapped in the Survey Area**

Code	Description
IE:	Areas planted with Non-indigenous <i>Eucalyptus</i> species over pasture weeds
RV1:	Revegetated road reserve with <i>Casuarina obesa</i> , introduced <i>Eucalyptus</i> species and the occasional <i>Corymbia calophylla</i> and <i>Eucalyptus rudis</i> over <i>Melaleuca raphiophylla</i> and <i>M. teretifolia</i> over pasture weeds
RV2:	Revegetated land with <i>Corymbia calophylla</i> and <i>Eucalyptus rudis</i> over <i>Melaleuca raphiophylla</i> and mixed shrub species over pasture weeds
RV3:	Revegetated road reserve dominated by <i>Corymbia calophylla</i> with occasional <i>Eucalyptus marginata</i> , <i>E. wandoo</i> , <i>E. rudis</i> , <i>E. accedens</i> and <i>E. lane poolei</i> over <i>Acacia saligna</i> , <i>A. pulchella</i> , <i>Xanthorrhoea preissii</i> and various indigenous and non-indigenous shrub species over pasture weeds
Mixed Plantation:	Shelter belt plantings composed of introduced <i>Eucalyptus</i> species along with <i>E. rudis</i> , <i>E. gomphocephala</i> , <i>E. wandoo</i> , <i>Corymbia calophylla</i> , <i>Melaleuca raphiophylla</i> , <i>M. preissiana</i> , <i>M. teretifolia</i> , <i>Allocasuarina fraseriana</i> , <i>Acacia saligna</i> and <i>Callistemon phoeniceus</i> .
PR?:	Individual or stands of <i>Pinus ?radiata</i> over pasture weeds on grey sands on cleared land

### 3.2.8.5 Threatened Ecological Communities

Eco Logical (2019) identified two threatened Ecological Communities (TEC) as potentially occurring in the Proposed Action area:

- Clay Pans of the Swan Coastal Plain Threatened Ecological Community (Critically Endangered); and
- *Corymbia calophylla* – *Kingia australis* woodlands on heavy soils, Swan Coastal Plain Threatened Ecological Community (Endangered).

This survey did not cover the entire Proposed Action area. Later, Woodman (2020) was engaged to survey the entire Proposed Action area. The survey confirmed the presence of the two TEC's above and the addition of another TEC:

- *Corymbia calophylla* - *Xanthorrhoea preissii* woodlands and shrublands of the Swan Coastal Plain (Endangered).

### 3.2.8.6 Fauna

The Level 1 fauna assessment undertaken by Bamford Consulting Ecologists (2019) is the primary source of information for the summary of fauna species occurring or likely to occur within the Proposed Action area.

Three Vegetation and Substrate Associations (VSAs) were identified in the Survey Area

- VSA 1 (open farmland with scattered trees) – low lying areas in VSA 1 may support aquatic species and waterbirds when they are flooded
- VSA 2 (remnant and re-planted native vegetation) – occurs along roads and rail and is of most importance for fauna; and
- VSA 3 (creeklines with native vegetation) – may support aquatic species and waterbirds

The desktop study identified 212 vertebrate fauna species as potentially occurring in the survey area: 9 frogs, 41 reptiles, 5 fish, 135 birds, and 22 mammals. The fauna assemblage is incomplete due to habitat degradation and loss in the general area. Much of the predicted assemblage is associated with small patches of native vegetation along road and rail verges throughout the project area. Species



present are typical of rural landscapes on the Swan Coastal Plain with some species visiting seasonally to forage in flooded areas.

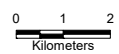
The assemblage includes 106 species of significance, including seven invertebrate species. Most of the significant species expected are of local significance as they are sensitive to urbanisation and/or their habitat is declining across the Plain. Waterways and flooded areas may support significant species on a seasonal basis. Three species of conservation significance of particular note, the Forest Red-tailed, Carnaby's and Baudin's Cockatoos, are likely to utilise the Survey Area and Proposed Action area. Kirkby (2019) recorded evidence of foraging for Baudin's Cockatoos within the southern extent of the Proposed Action area. Calls of Forest Red-tailed Black Cockatoos were heard along Shanley Road just outside of the Proposed Action area (Kirkby 2019).



**Legend**

- Proposed Action
- 12 km radius of Proposed Action
- Native vegetation (12 km radius, 31,621.47 ha)

Scale 1:160,000 at A4



Coord. Sys. GDA 1994 MGA Zone 50



Job No: 58910

Client: Main Roads Western Australia

Version: A

Date: 20-Jan-2021

Drawn By: hsullivan

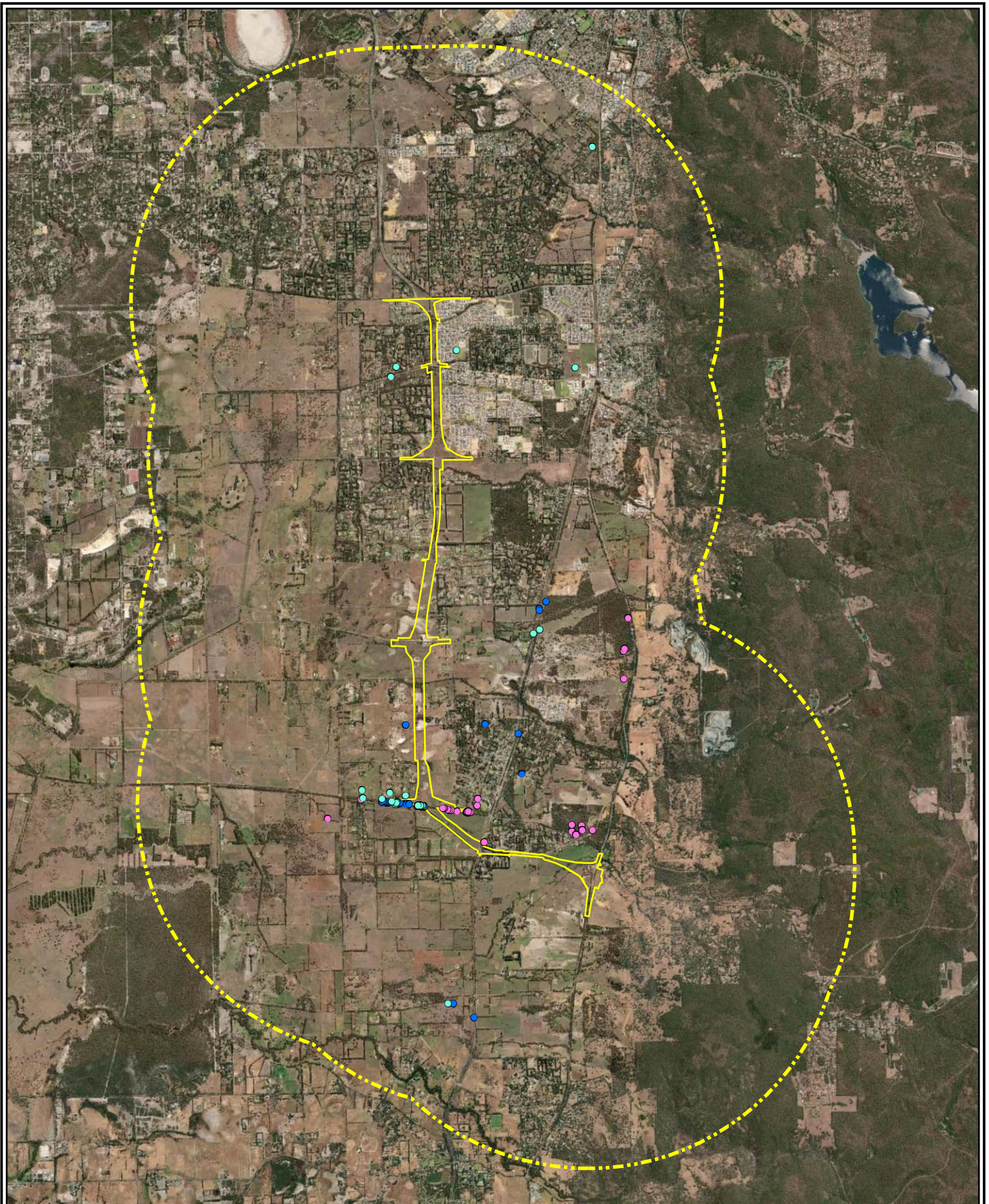
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**Tonkin Highway Extension  
WA**






**NATIVE VEGETATION REMAINING -  
REGIONAL (12 KM)**

**FIGURE 6**

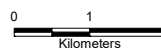




**Legend**

-  Proposed Action
-  5 km radius of Proposed
-  *Synaphea* sp. Pinjarra Plain (E) locations
-  *Synaphea* sp. Serpentine (CE) locations
-  *Tetraria australiensis* (V) locations

Scale 1:100,000 at A4



Coord. Sys. GDA 1994 MGA Zone 50



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**Tonkin Highway Extension  
WA**

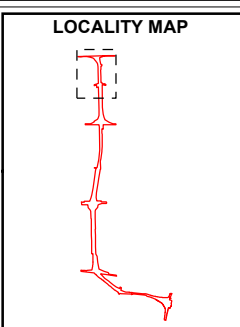
**KNOWN THREATENED FLORA  
LOCATIONS WITHIN 5 KM**


**FIGURE 7**





**Legend**  
 Proposed Action  
 Local and regional roads  
  
 Vegetation legend on separate page




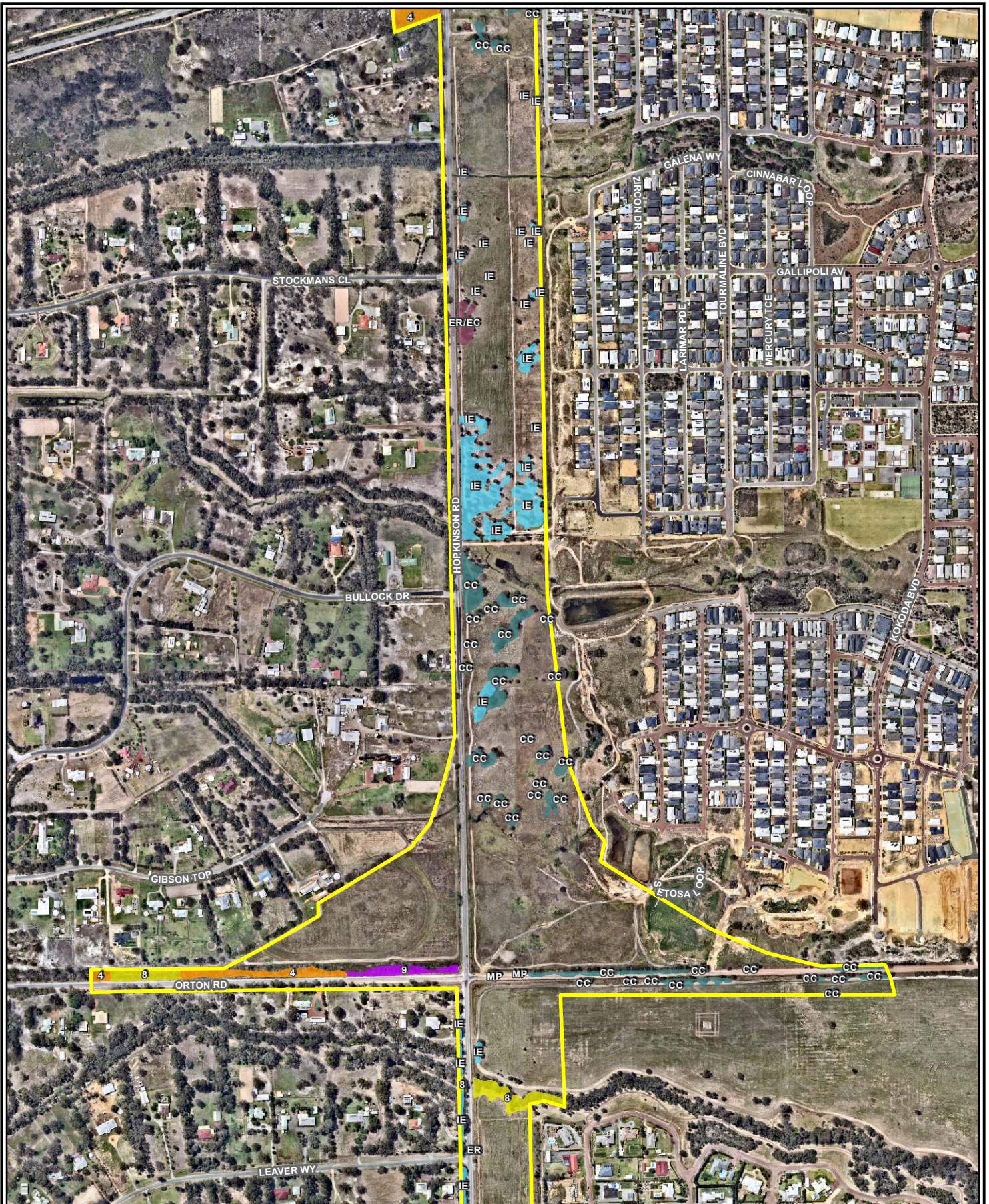
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Version: A	Date: 20-Jan-2021	
Drawn By: hsullivan	Checked By: DN	



**Tonkin Highway Extension WA**

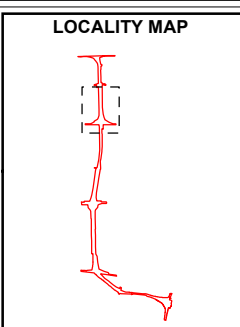
**VEGETATION TYPES**


**FIGURE 8** **PAGE 1**





**Legend**  
 Proposed Action  
 Local and regional roads  
 Vegetation legend on separate page




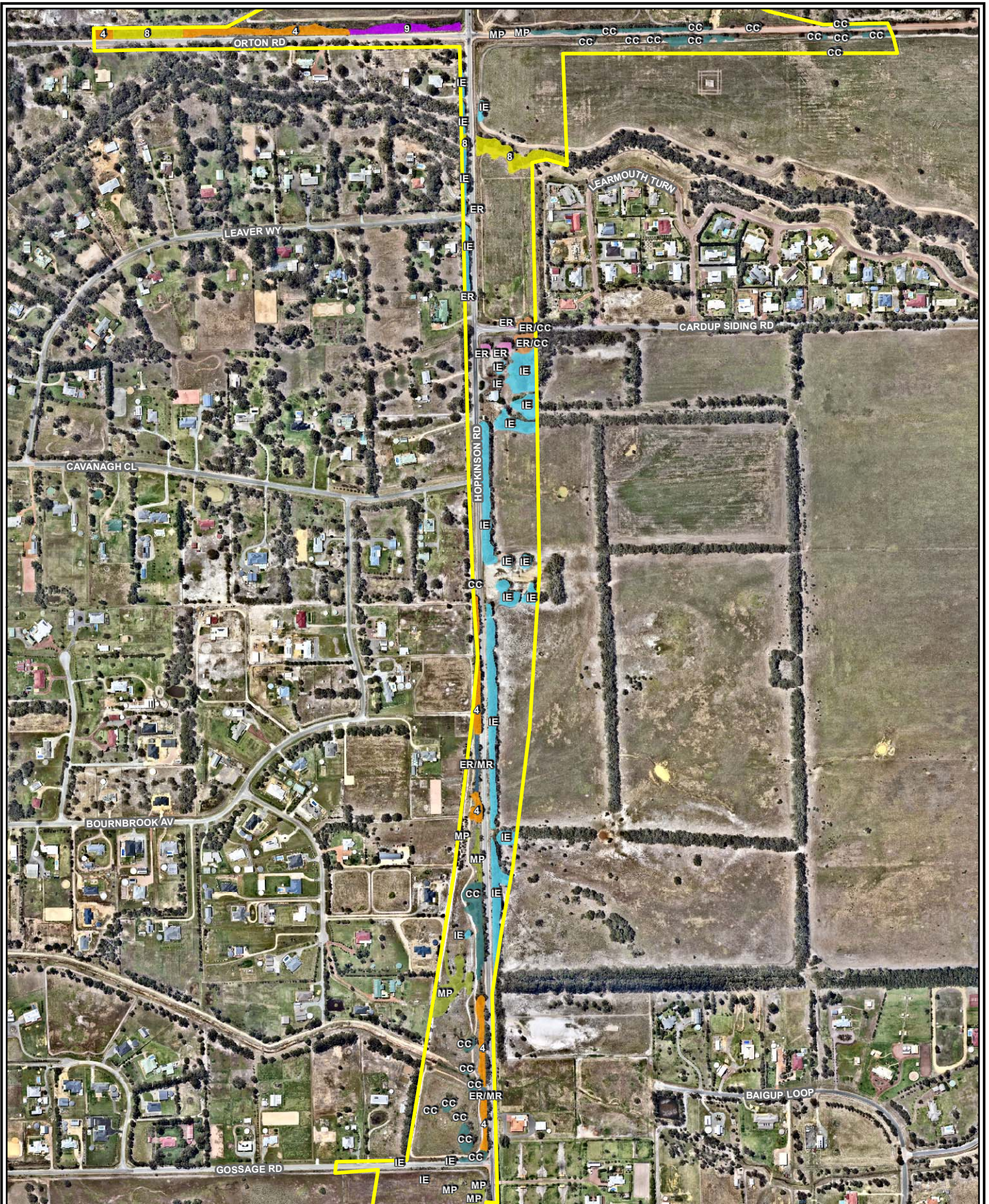
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Version: A	Date: 20-Jan-2021		
Drawn By: hsullivan	Checked By: DN		



**Tonkin Highway Extension WA**

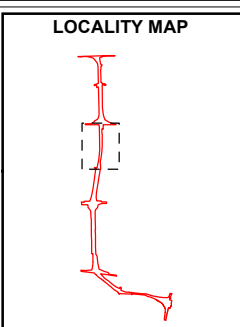
**VEGETATION TYPES**


**FIGURE 8 PAGE 2**





**Legend**  
 Proposed Action  
 Local and regional roads  
  
 Vegetation legend on separate page




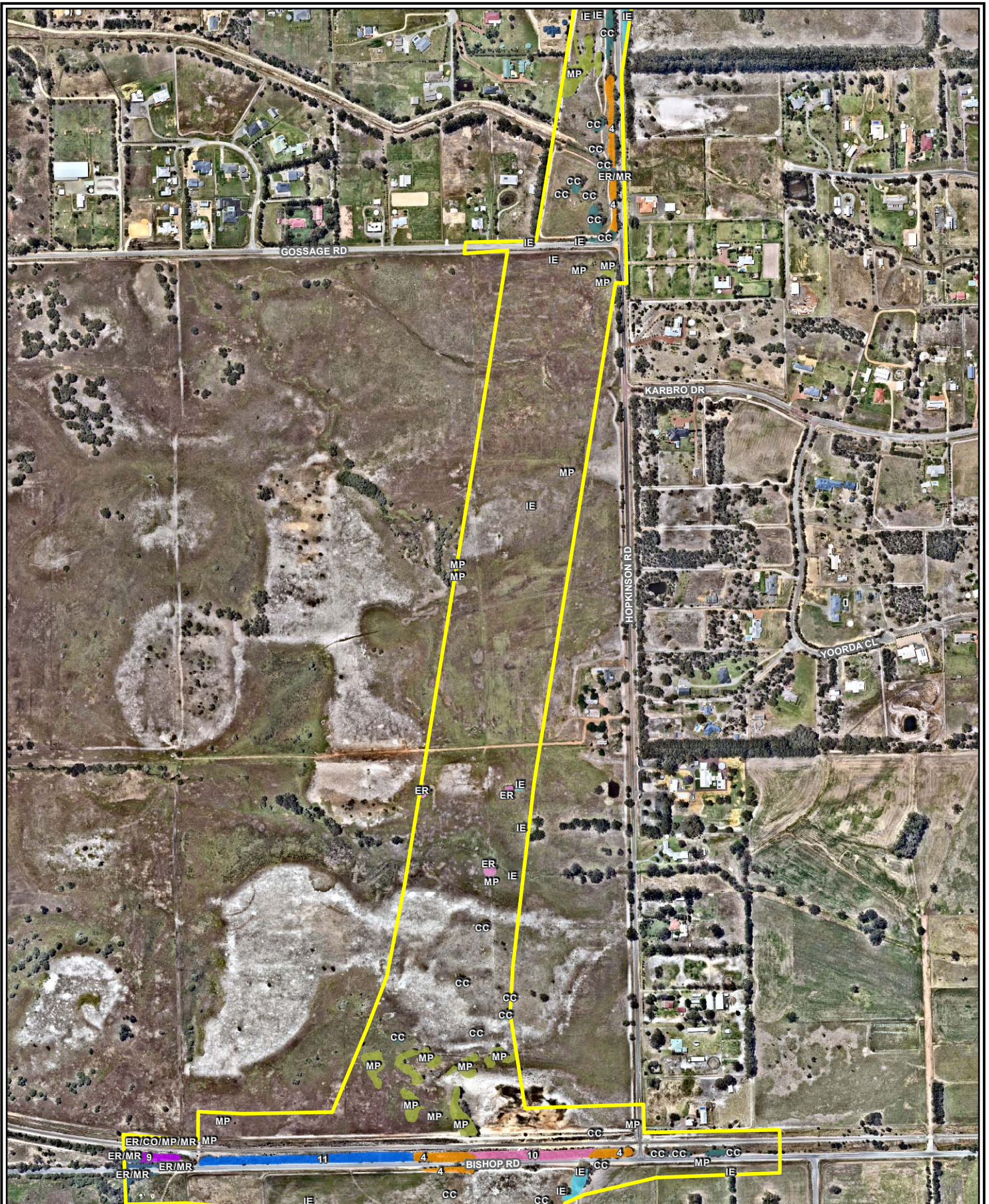
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Job No: 58910	
Client: Main Roads Western Australia	
Version: A	Date: 20-Jan-2021
Drawn By: hsullivan	Checked By: DN



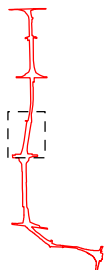


**Tonkin Highway Extension WA**

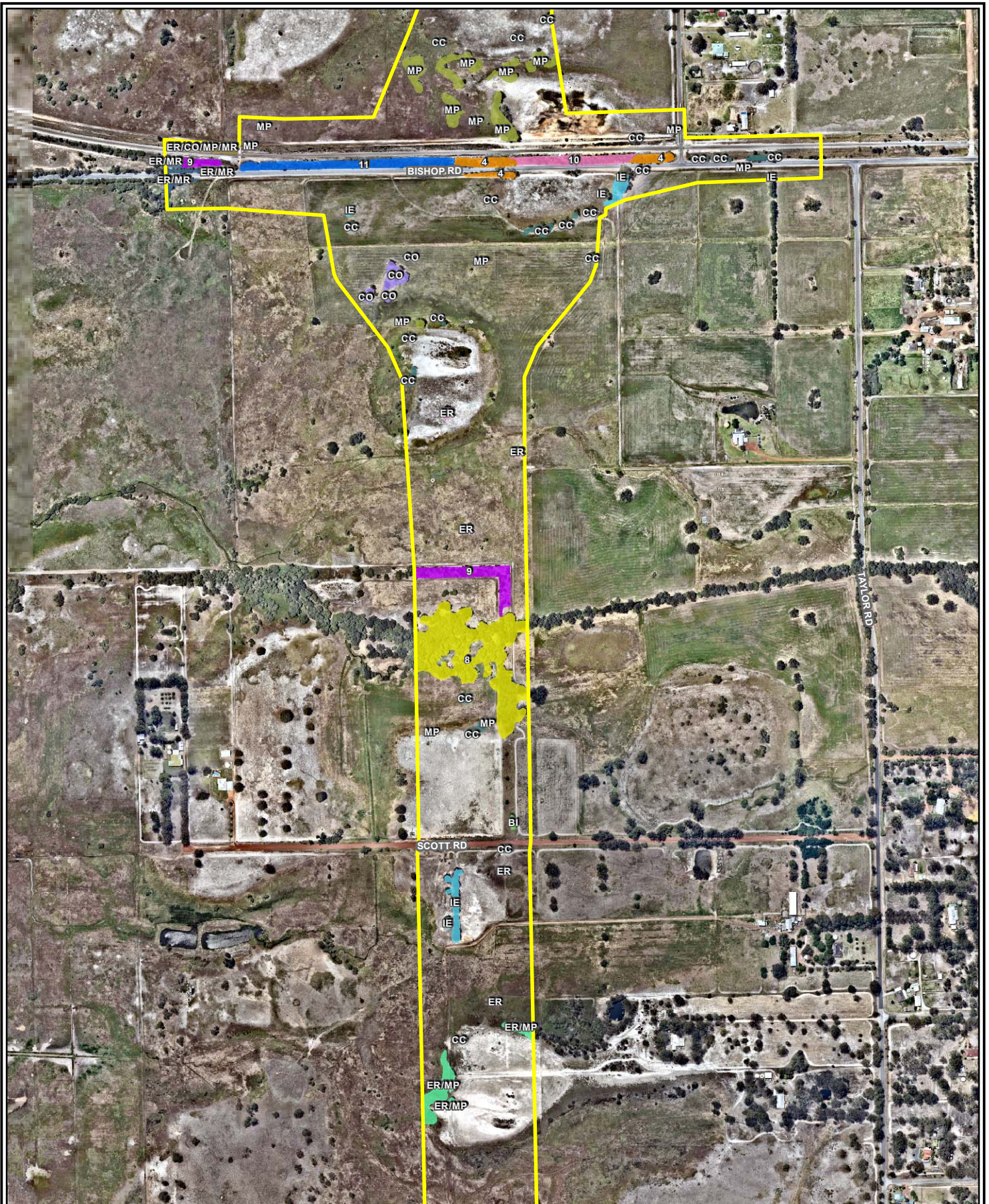
**VEGETATION TYPES**

**FIGURE 8 PAGE 3**



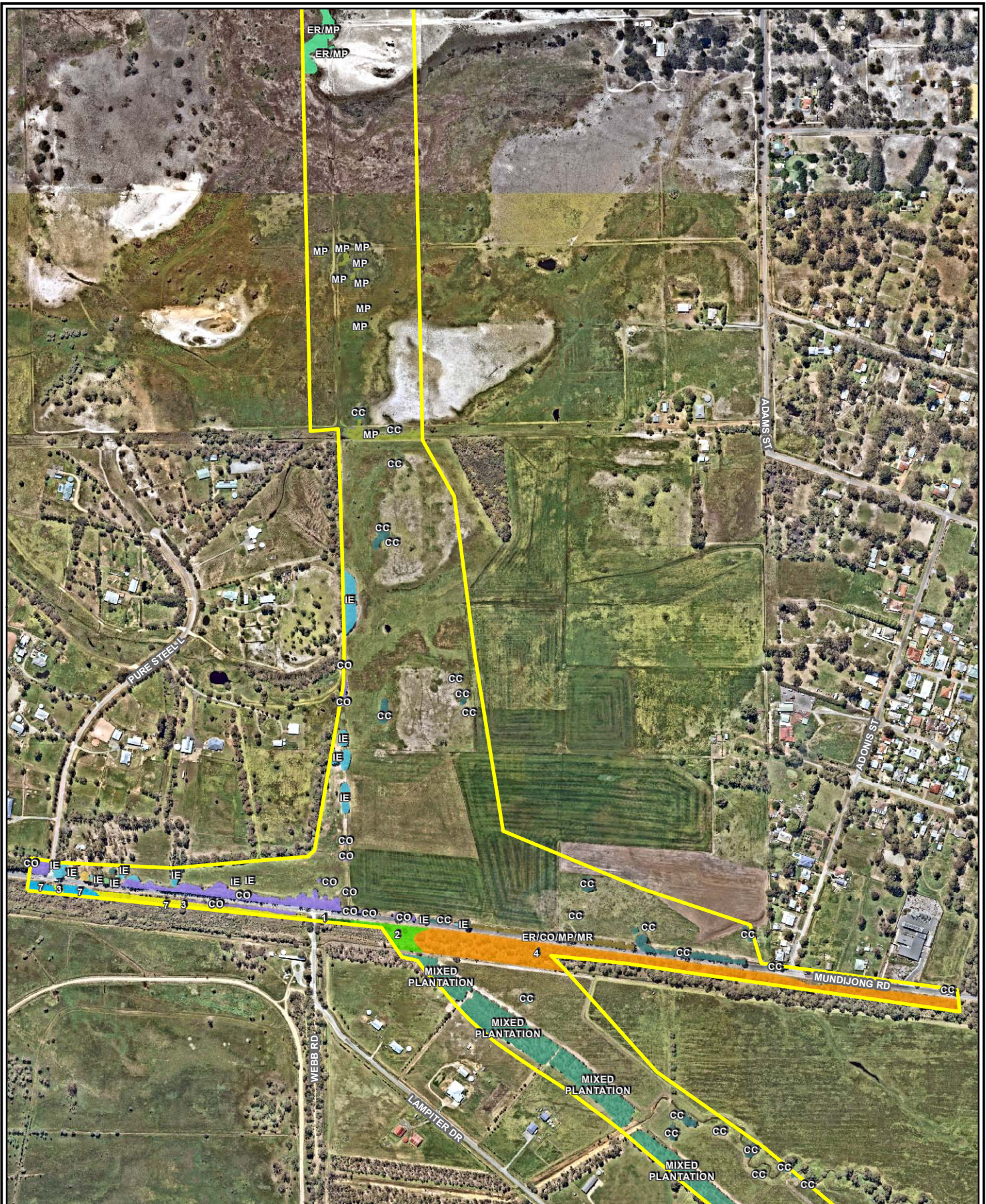


<b>Legend</b>  Proposed Action  Local and regional roads  Vegetation legend on separate page	<b>LOCALITY MAP</b> 	Scale 1:9,000 at A4 <span style="float: right;">0 100 200 Meters</span>		<b>Tonkin Highway Extension WA</b>
		Coord. Sys. GDA 1994 MGA Zone 50 <span style="float: right;"></span>		<b>VEGETATION TYPES</b>
Job No: 58910		Client: Main Roads Western Australia		<b>FIGURE 8</b> <span style="float: right;"><b>PAGE 4</b></span>
Version: A		Date: 20-Jan-2021		
Drawn By: hsullivan		Checked By: DN		

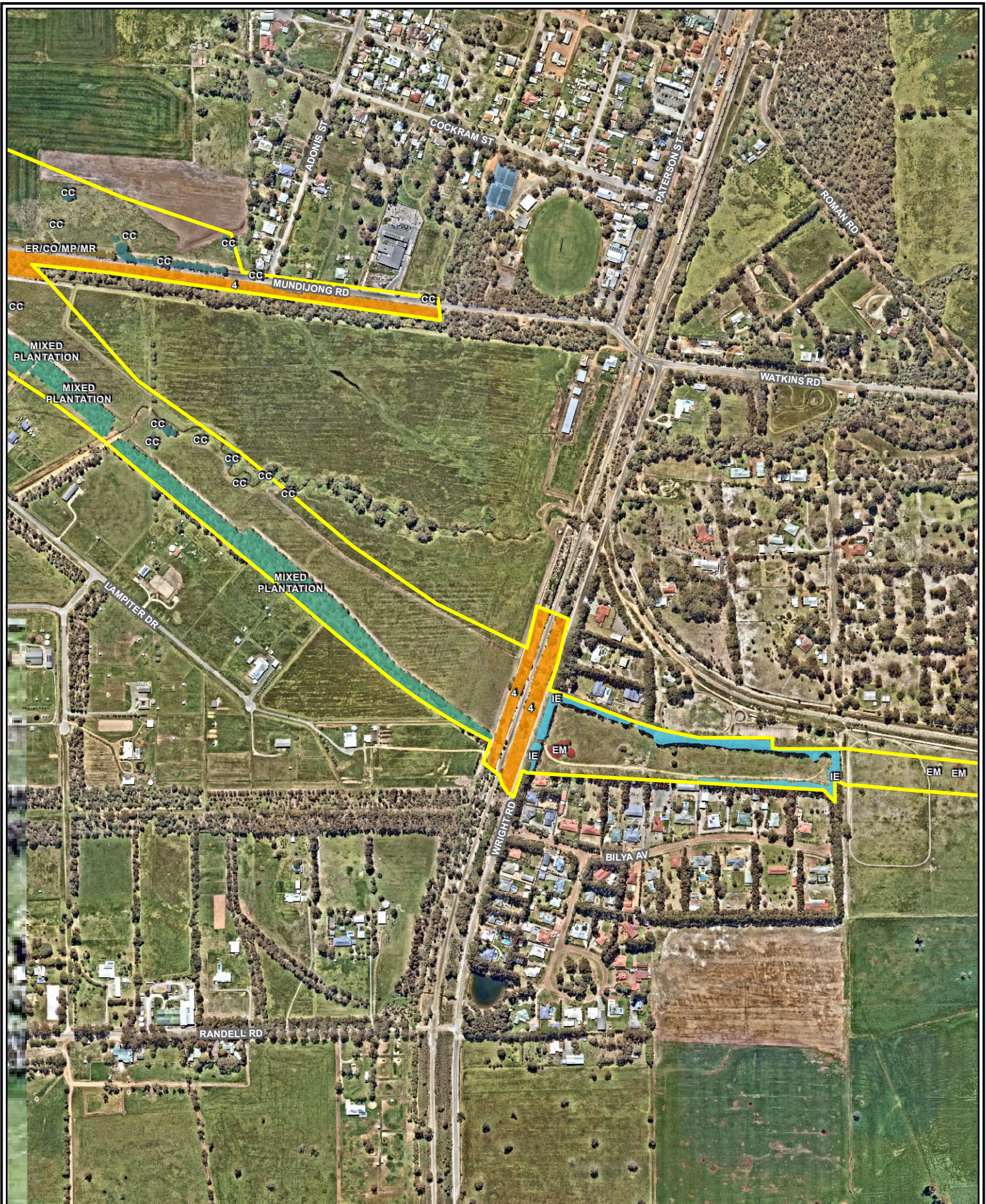


<b>Legend</b> Proposed Action Local and regional roads  Vegetation legend on separate page	<b>LOCALITY MAP</b> 	Scale 1:9,000 at A4 0 100 200 	<b>Tonkin Highway Extension WA</b>
		Coord. Sys. GDA 1994 MGA Zone 50 	<b>VEGETATION TYPES</b>
Job No: 58910 Client: Main Roads Western Australia		Version: A Date: 20-Jan-2021	<b>FIGURE 8</b> <span style="float: right;"><b>PAGE 5</b></span>
Drawn By: hsullivan Checked By: DN			

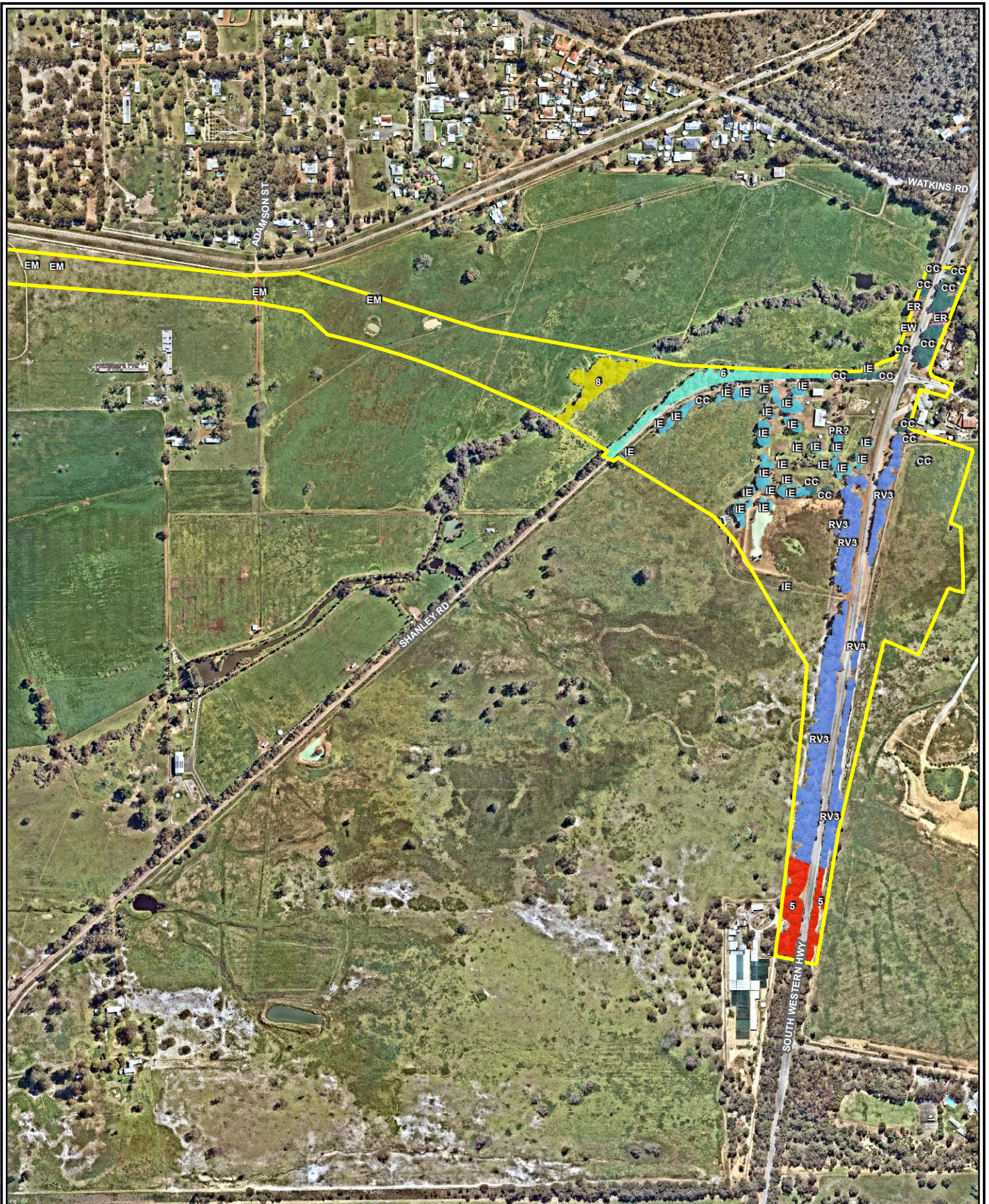




<b>Legend</b> Proposed Action Local and regional roads  Vegetation legend on separate page	<b>LOCALITY MAP</b> 	Scale 1:9,000 at A4	<b>Tonkin Highway Extension WA</b>
		Coord. Sys. GDA 1994 MGA Zone 50	<b>VEGETATION TYPES</b>
Job No: 58910		Client: Main Roads Western Australia	<b>FIGURE 8</b>
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<b>Legend</b> Proposed Action Local and regional roads  Vegetation legend on separate page	<b>LOCALITY MAP</b> 	Scale 1:9,000 at A4		<b>Tonkin Highway Extension WA</b>
		Coord. Sys. GDA 1994 MGA Zone 50		<b>VEGETATION TYPES</b>
Job No: 58910		Client: Main Roads Western Australia		<b>FIGURE 8</b>
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Drawn By: hsullivan		Checked By: DN		





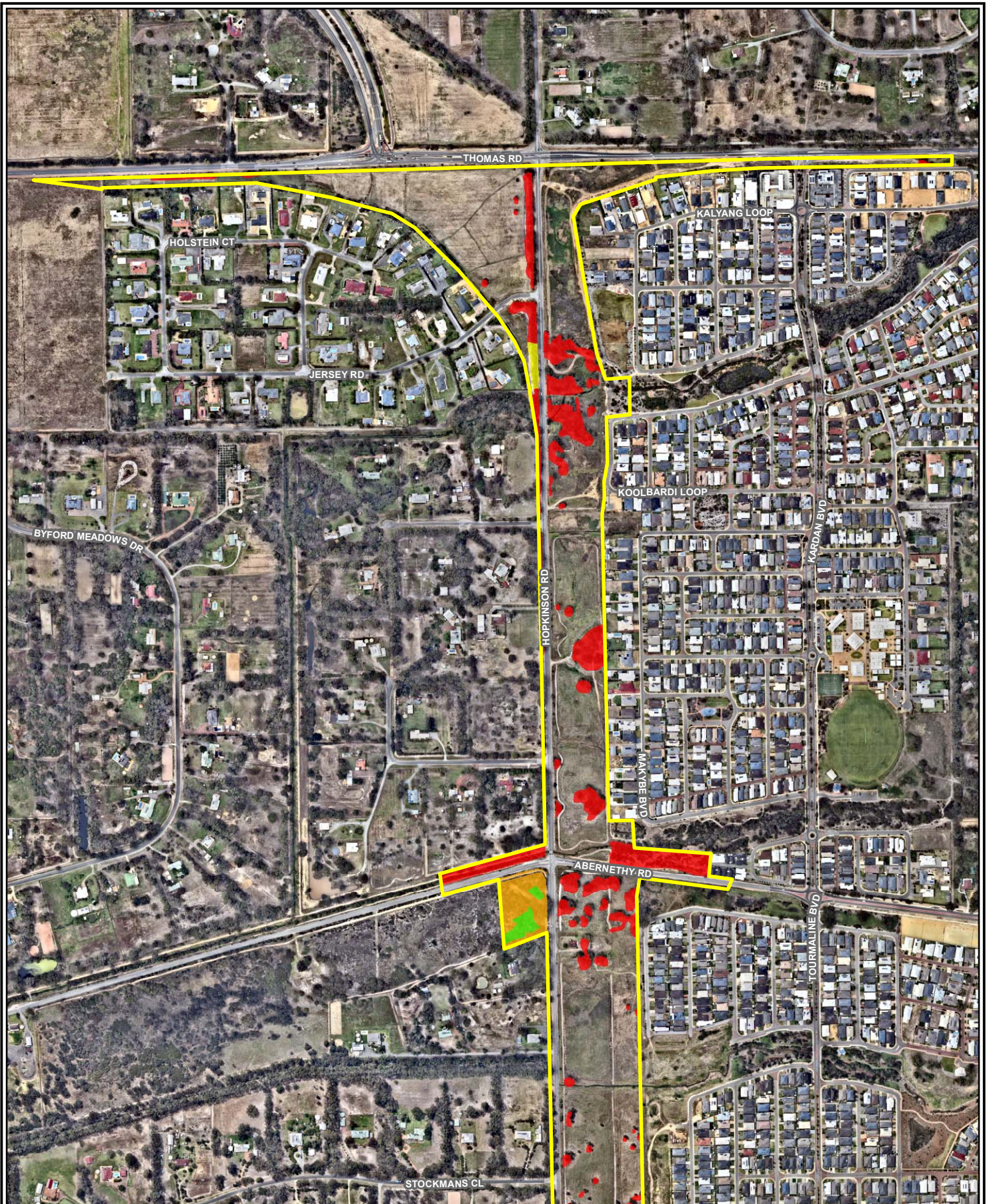
<b>Legend</b> Proposed Action Local and regional roads  Vegetation legend on separate page	<b>LOCALITY MAP</b> 	Scale 1:9,000 at A4 <div style="float: right;"> </div>	<b>Tonkin Highway Extension WA</b>
		Coord. Sys. GDA 1994 MGA Zone 50 <div style="float: right;"> </div>	<b>VEGETATION TYPES</b>
Job No: 58910		Client: Main Roads Western Australia	<b>FIGURE 8</b> <span style="float: right;"><b>PAGE 8</b></span>
Version: A	Date: 20-Jan-2021	Drawn By: hsullivan	
		Checked By: DN	

**Legend**

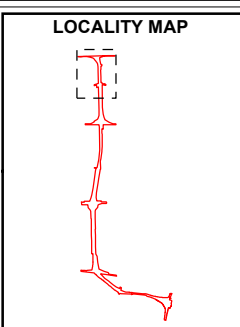
Vegetation type

	1	Mid sparse shrubland dominated by <i>Xanthorrhoea preissii</i> and <i>Kingia australis</i> over low open shrubland dominated by <i>Verticordia densiflora</i> var. <i>densiflora</i> over low sparse sedgeland and grassland of mixed species dominated by <i>Schoenus rigens</i> , <i>Mesomelaena tetragona</i> , <i>Cyathochaeta avenacea</i> , <i>Ehrharta calycina</i> and <i>Neurachne alopecuroidea</i> over low sparse forbland of mixed species including <i>Drosera menziesii</i> , <i>Drosera heterophylla</i> , <i>Thelymitra antennifera</i> , <i>Burchardia multiflora</i> and <i>Stylidium pulchellum</i> on brown sandy clay with occasional laterite pebbles on seasonally inundated flats.
	2	Tall sparse shrubland dominated by <i>Jacksonia sternbergiana</i> , <i>Kingia australis</i> and <i>Xanthorrhoea preissii</i> over low sparse shrubland dominated by <i>Hypocalymma angustifolium</i> subsp. Swan Coastal Plain (G.J. Keighery 16777), <i>Stirlingia latifolia</i> and <i>Hakea prostrata</i> over low open sedgeland and grassland of mixed species including <i>Cyathochaeta avenacea</i> , <i>Amphipogon turbinatus</i> , <i>Tetralia australiensis</i> , <i>Mesomelaena tetragona</i> and <i>Tetralia octandra</i> over low sparse shrubland of mixed species including <i>Dampiera linearis</i> and <i>Banksia dallanneyi</i> subsp. <i>dallanneyi</i> var. <i>dallanneyi</i> on brown sandy loam on seasonally moist flats.
	3	Tall to mid sparse shrubland dominated by <i>Jacksonia sternbergiana</i> , <i>Kingia australis</i> and <i>Xanthorrhoea preissii</i> over mid sparse shrubland of mixed species dominated by <i>Hakea varia</i> over shrubland to open shrubland of mixed species including <i>Hypocalymma angustifolium</i> subsp. Swan Coastal Plain (G.J. Keighery 16777), <i>Hakea incrassata</i> , <i>Allocasuarina microstachya</i> , <i>Grevillea pilulifera</i> and <i>Kunzea micrantha</i> subsp. <i>micrantha</i> over low open rushland and sedgeland of mixed species including <i>Desmocladius lateriflorus</i> , <i>Mesomelaena tetragona</i> , <i>Tetralia octandra</i> and <i>Schoenus subflavus</i> subsp. <i>subflavus</i> on brown sandy clay on seasonally moist flats.
	4	Mid open forest of <i>Corymbia calophylla</i> over tall to mid sparse shrubland dominated by <i>Xanthorrhoea preissii</i> and <i>Kingia australis</i> over low sedgeland to open sedgeland dominated by <i>Cyathochaeta avenacea</i> , <i>Tetralia octandra</i> , <i>Lepidosperma cf. oldhamii</i> and <i>Mesomelaena tetragona</i> over low sparse forbland of mixed species dominated by <i>Dasyopogon bromeliifolius</i> , <i>Sowerbaea laxiflora</i> , <i>Conostylis aculeata</i> subsp. <i>preissii</i> , <i>Caesia micrantha</i> and <i>Burchardia congesta</i> on grey or brown sand or sand loam on dry flats.
	5	Mid open forest dominated by <i>Eucalyptus marginata</i> subsp. <i>marginata</i> , <i>Allocasuarina fraseriana</i> and occasionally <i>Corymbia calophylla</i> over tall sparse shrubland dominated by <i>Xanthorrhoea preissii</i> and occasionally <i>Banksia grandis</i> over low open shrubland of mixed species including <i>Labichea punctata</i> , <i>Phyllanthus calycinus</i> , <i>Hakea stenocarpa</i> , <i>Hakea lissocarpha</i> and <i>Babingtonia camphorosma</i> over low open sedgeland of mixed species including <i>Tetralia</i> sp. Jarrah Forest (R. Davis 7391), <i>Mesomelaena pseudostygia</i> and <i>Tetralia octandra</i> on grey □ brown sand on foothills.
	6	Mid open forest of <i>Corymbia calophylla</i> over mid sparse shrubland of <i>Xanthorrhoea preissii</i> and <i>Kingia australis</i> over low sparse shrubland of mixed species including <i>Hypocalymma angustifolium</i> , <i>Hakea lissocarpha</i> and <i>Hibbertia hypericoides</i> over low open sedgeland of mixed species including <i>Cyathochaeta avenacea</i> , <i>Lepidosperma apricola</i> , <i>Tetralia octandra</i> and <i>Mesomelaena tetragona</i> over low open introduced grassland of mixed species including <i>Ehrharta calycina</i> , <i>Ehrharta longiflora</i> , <i>Avena barbata</i> and <i>Briza maxima</i> over low open shrubland and forbland of mixed species including <i>Dampiera linearis</i> , <i>Lechenaultia biloba</i> , <i>Tricoryne elatior</i> , <i>Caesia micrantha</i> and <i>*Watsonia meriana</i> var. <i>bulbillifera</i> on brown sandy loam on mid to lower slopes of foothills.
	7	Tall shrubland of mixed species dominated by <i>Melaleuca osullivanii</i> , <i>Melaleuca viminea</i> subsp. <i>viminea</i> , and occasionally <i>Hakea varia</i> and <i>Acacia saligna</i> subsp. <i>saligna</i> ms over mid sparse shrubland to isolated shrubs of mixed species including <i>Calothamnus hirsutus</i> , <i>Kingia australis</i> and <i>Xanthorrhoea preissii</i> over low sparse sedgeland and rushland to isolated sedges and rushes of mixed species including <i>Lepidosperma longitudinale</i> , <i>Leptocarpus canus</i> and <i>Schoenus rigens</i> over low introduced grassland of mixed species dominated by <i>Ehrharta calycina</i> , <i>Ehrharta longiflora</i> , <i>Briza maxima</i> and <i>Briza minima</i> over open forbland of mixed species (primarily introduced) including <i>*Oxalis purpurea</i> , <i>*Hypochoeris glabra</i> , <i>*Sparaxis bulbifera</i> , <i>*Moraea flaccida</i> and <i>*Aphelia cyperoides</i> on brown sandy clay on flats.
	8	Mid open to closed forest of <i>Eucalyptus rudis</i> , <i>Melaleuca raphiophylla</i> and <i>Melaleuca preissiana</i> over isolated mid shrubs of mixed species including <i>Xanthorrhoea preissii</i> over low grassland and forbland of introduced species including <i>Ehrharta longiflora</i> , <i>*Watsonia meriana</i> var. <i>bulbillifera</i> , <i>*Oxalis pes □ caprae</i> , <i>*Juncus usitatus</i> and <i>*Zantedeschia aethiopica</i> on brown loam in drainage lines and on adjacent floodplains.
	9	Tall open shrubland of mixed species including <i>Melaleuca viminea</i> subsp. <i>viminea</i> , <i>Melaleuca preissiana</i> , <i>Melaleuca raphiophylla</i> and <i>Acacia saligna</i> subsp. <i>saligna</i> ms over low grassland and forbland of introduced species including <i>Ehrharta calycina</i> , <i>Ehrharta longiflora</i> , <i>*Eragrostis curvula</i> and <i>*Lolium perenne</i> and <i>*Moraea flaccida</i> on brown sandy loam on flats.
	10	Low open woodland of <i>Banksia attenuata</i> and <i>Banksia menziesii</i> over tall sparse shrubland of <i>Jacksonia furcellata</i> and <i>Kunzea glabrescens</i> over low sparse shrubland of mixed species including <i>Eremaea pauciflora</i> var. <i>pauciflora</i> , <i>Melaleuca trichophylla</i> , <i>Melaleuca seriata</i> , <i>Hypocalymma robustum</i> and <i>Hibbertia hypericoides</i> subsp. <i>hypericoides</i> over low sparse rushland, shrubland and forbland of mixed species including <i>Conostylis aculeata</i> subsp. <i>preissii</i> , <i>Dasyopogon bromeliifolius</i> , <i>Lyginia imberbis</i> , <i>Banksia dallanneyi</i> subsp. <i>dallanneyi</i> var. <i>dallanneyi</i> and <i>Desmocladius flexuosus</i> over low open grassland of introduced species dominated by <i>Ehrharta calycina</i> , <i>Ehrharta longiflora</i> and <i>*Bromus diandrus</i> on grey sand on low dunes.
	11	Isolated low trees of <i>Melaleuca preissiana</i> over isolated tall shrubs of <i>Viminaria juncea</i> and <i>Callitris pyramidalis</i> over mid to low shrubland to low shrubland of mixed species dominated by <i>Regelia ciliata</i> , <i>Hakea varia</i> , <i>Pericalymma ellipticum</i> , <i>Calothamnus lateralis</i> var. <i>lateralis</i> and occasionally <i>Verticordia densiflora</i> over low sparse rushland and forbland of mixed species including <i>Hypolaena pubescens</i> , <i>Conostylis aculeata</i> subsp. <i>preissii</i> and <i>Cytopogonidium leptocarpoides</i> over low open grassland of introduced species dominated by <i>*Eragrostis curvula</i> and <i>*Ehrharta calycina</i> on brown sandy loam on flats.
<b>Highly modified vegetation</b>		
	AS	Individual or stands of <i>Acacia saligna</i> over pasture weeds on grey sands on cleared palusplains
	BI	Individual or stands of <i>Banksia ilicifolia</i> over pasture weeds on grey sandy soils on low rises
	CC	Individual or stands of <i>Corymbia calophylla</i> over pasture weeds on various soils and topographical positions
	CO	Individual or stands of <i>Casuarina obesa</i> over pasture weeds on grey sands on cleared palusplains and in roadside drains
	EG	Individual or stands of planted <i>Eucalyptus gomphocephala</i> over pasture weeds on grey sands on cleared palusplains and in roadside drains
	EM	Individual or stands of <i>Eucalyptus marginata</i> over pasture weeds on grey sandy soils on low rises
	ER	Individual or stands of <i>Eucalyptus rudis</i> over pasture weeds on grey sands on cleared palusplains and in roadside drains
	ER/CC	Mixed stand of <i>Eucalyptus rudis</i> and <i>Corymbia calophylla</i> over pasture weeds on grey sands on cleared palusplains and in roadside drains
	ER/CO/MP/MR	Mixed stand of <i>Eucalyptus rudis</i> , <i>Casuarina obesa</i> , <i>Melaleuca preissiana</i> and <i>Melaleuca raphiophylla</i> over pasture weeds on grey sands on cleared palusplains and in roadside drains
	ER/EC	Mixed stand of <i>Eucalyptus rudis</i> and planted <i>E. camaldulensis</i> over pasture weeds on grey sands on cleared palusplains and in roadside drains
	ER/MP	Mixed stand of <i>Eucalyptus rudis</i> and <i>Melaleuca preissiana</i> over pasture weeds on grey sands on cleared palusplains and in roadside drains
	ER/MR	Mixed stand of <i>Eucalyptus rudis</i> and <i>Melaleuca raphiophylla</i> over pasture weeds on grey sands on cleared palusplains and in roadside drains
	EW	Individual or stands of <i>Eucalyptus wandoo</i> over pasture weeds on grey sands on cleared land
	IE	Areas planted with Non-indigenous <i>Eucalyptus</i> species over pasture weeds
	MP	Individual or stands of <i>Melaleuca preissiana</i> over pasture weeds on grey sands on cleared palusplains and in roadside drains
	Mixed Plantation	Shelter belt plantings composed of introduced <i>Eucalyptus</i> species along with <i>E. rudis</i> , <i>E. gomphocephala</i> , <i>E. wandoo</i> , <i>Corymbia calophylla</i> , <i>Melaleuca raphiophylla</i> , <i>M. preissiana</i> , <i>M. teretifolia</i> , <i>Allocasuarina fraseriana</i> , <i>Acacia saligna</i> and <i>Callistemon phoen</i>
	PR?	Individual or stands of <i>Pinus?radiata</i> over pasture weeds on grey sands on cleared land
	RV2	Revegetated land with <i>Corymbia calophylla</i> and <i>Eucalyptus rudis</i> over <i>Melaleuca raphiophylla</i> and mixed shrub species over pasture weeds
	RV3	Revegetated road reserve dominated by <i>Corymbia calophylla</i> with occasional <i>Eucalyptus marginata</i> , <i>E. wandoo</i> , <i>E. rudis</i> , <i>E. accedens</i> and <i>E. lane poollei</i> over <i>Acacia saligna</i> , <i>A. pulchella</i> , <i>Xanthorrhoea preissii</i> and various indigenous and non-indigenous shrub s
	TO	Dense rushland of <i>*Typha orientalis</i> growing in a minor creek

Scale 1: N/A			<b>Tonkin Highway Extension WA</b>
Coord. Sys. N/A			<b>VEGETATION LEGEND</b>
Job No: 58910			
Client: Main Roads Western Australia		<b>FIGURE 8</b>	
Version: A	Date: 20-Jan-2021		
Drawn By: hsullivan	Checked By: DN		



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

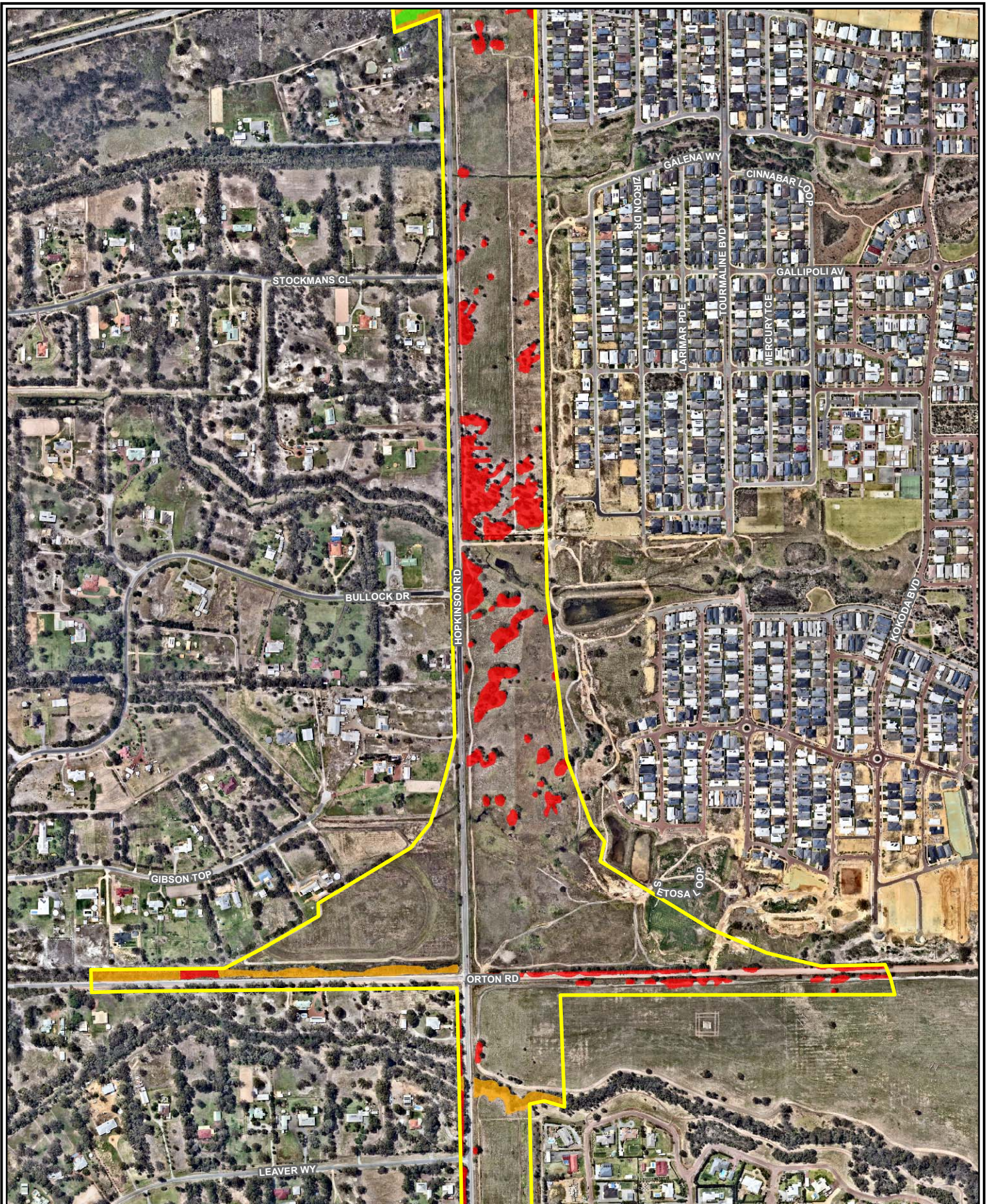


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Job No: 58910			
Client: Main Roads Western Australia			
Version: A	Date: 20-Jan-2021		
Drawn By: hsullivan	Checked By: DN		

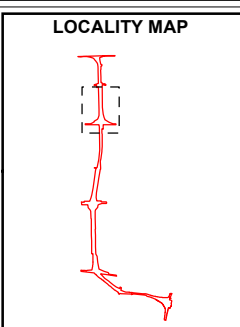
**Tonkin Highway Extension WA**

**VEGETATION CONDITION**

**FIGURE 9 PAGE 1**



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

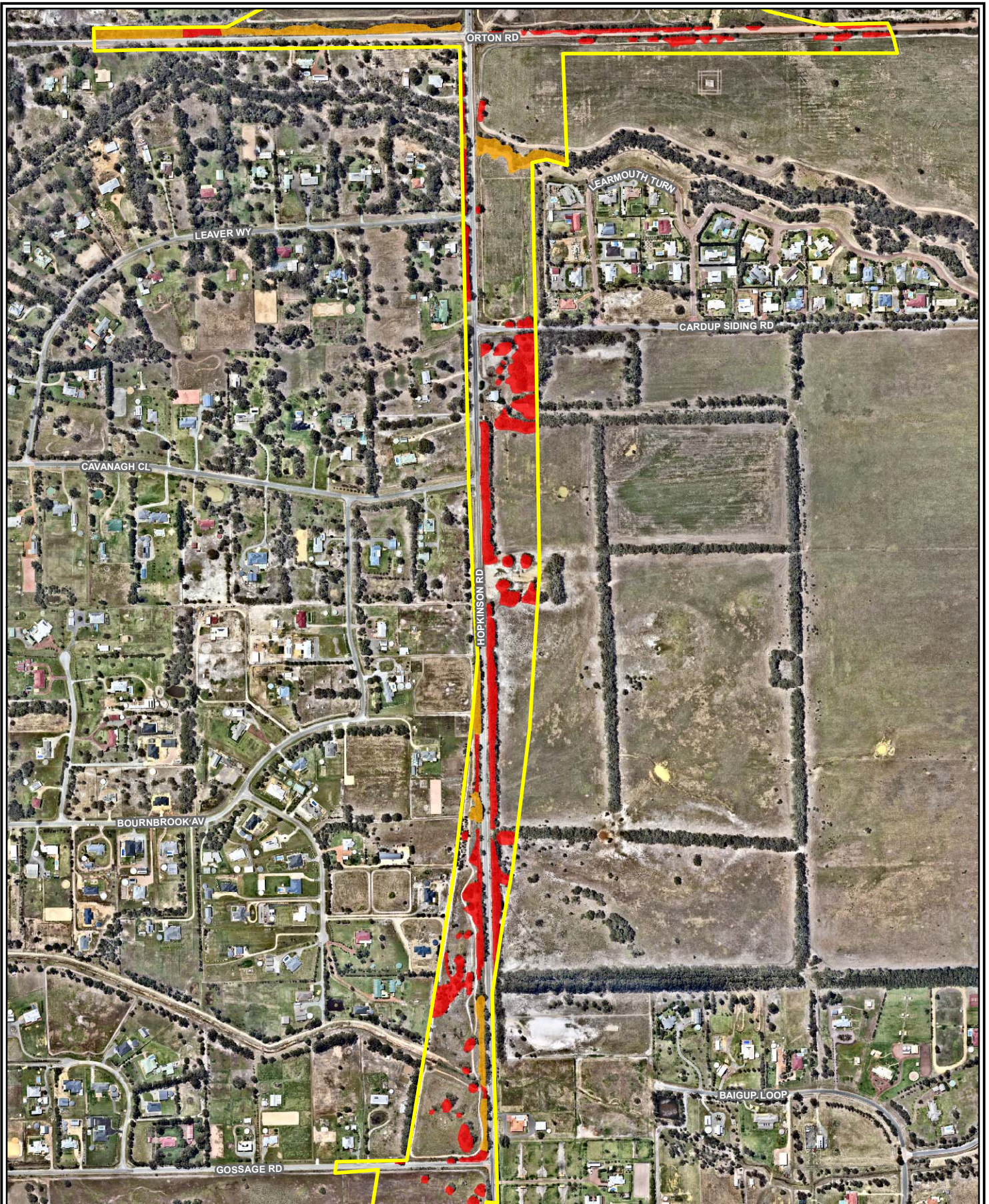


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Client: Main Roads Western Australia			
Version: A	Date: 20-Jan-2021		
Drawn By: hsullivan	Checked By: DN		

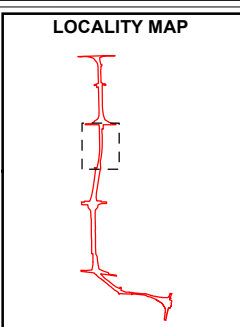
**Tonkin Highway Extension WA**

**VEGETATION CONDITION**

**FIGURE 9 PAGE 2**



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

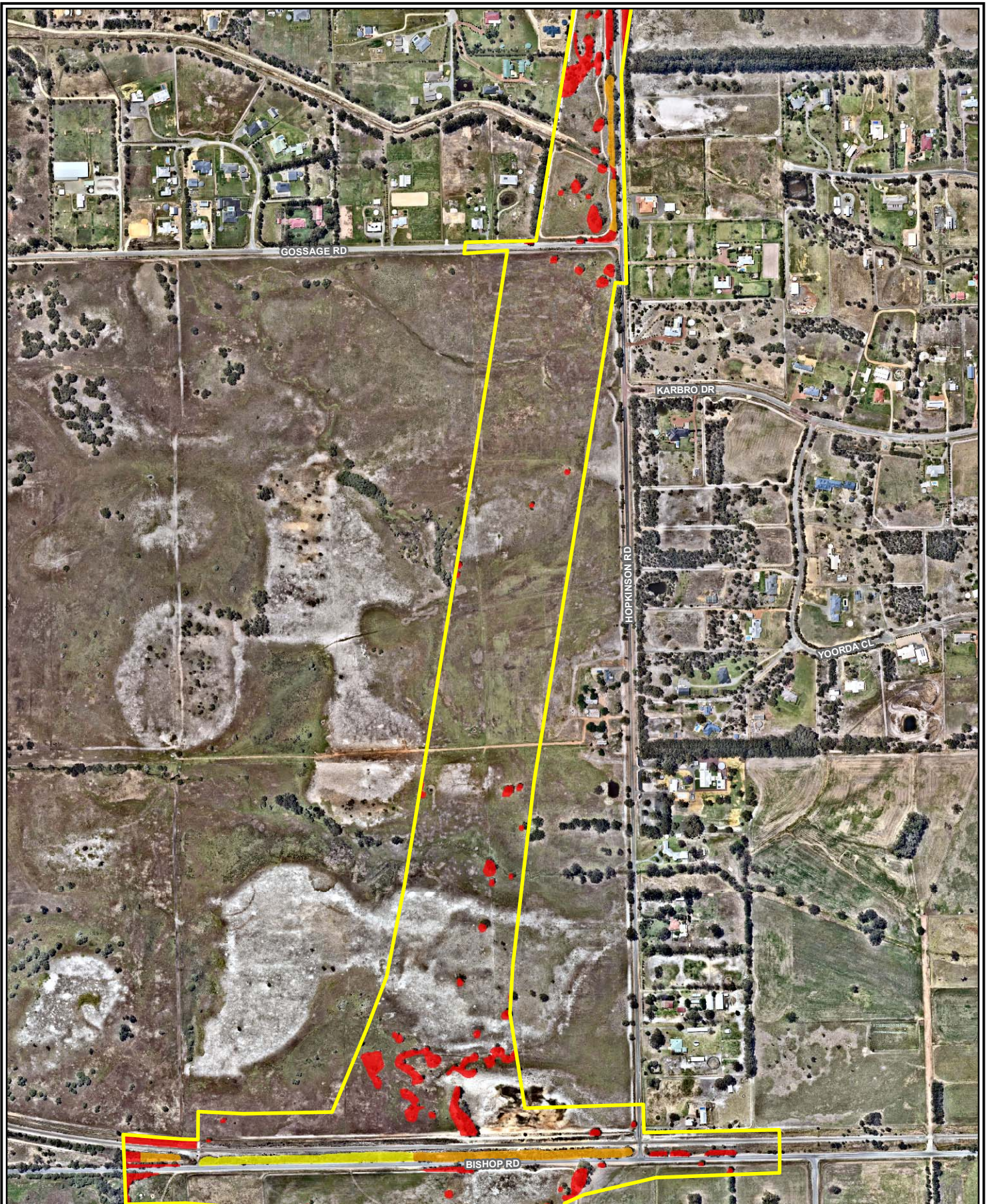


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Client: Main Roads Western Australia			
Version: A	Date: 20-Jan-2021		
Drawn By: hsullivan	Checked By: DN		

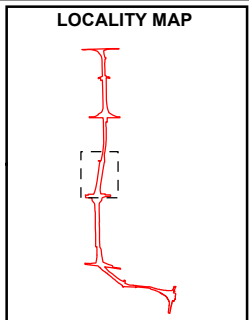
**Tonkin Highway Extension WA**

**VEGETATION CONDITION**

**FIGURE 9** **PAGE 3**



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



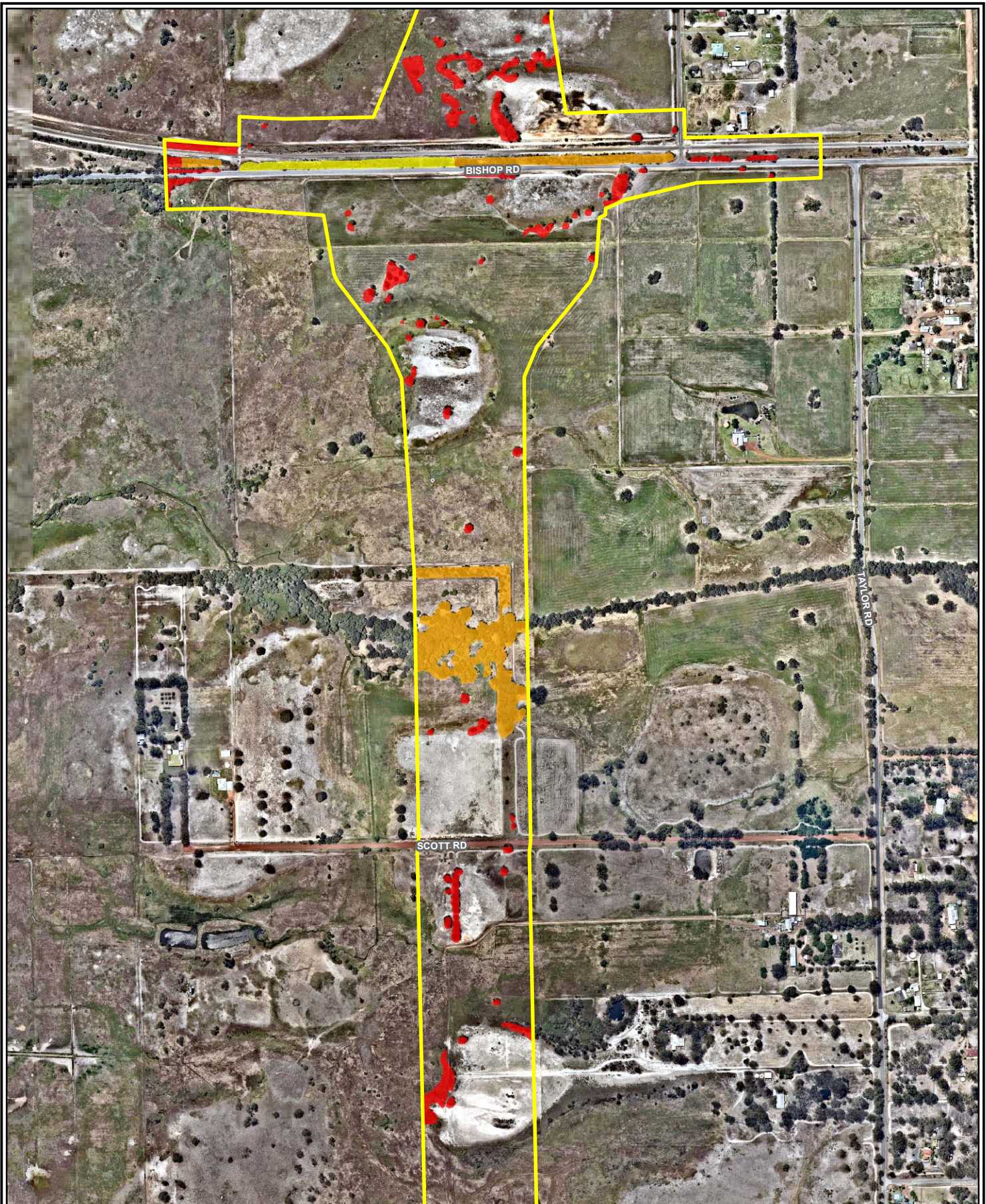
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Coord. Sys. GDA 1994 MGA Zone 50		↑
Job No: 58910		
Client: Main Roads Western Australia		
Version: A	Date: 20-Jan-2021	
Drawn By: hsullivan	Checked By: DN	

**Tonkin Highway Extension WA**

**VEGETATION CONDITION**

**FIGURE 9 PAGE 4**





<b>Legend</b> Proposed Action <b>Vegetation condition</b> Good Degraded Completely degraded Local and regional roads	<b>LOCALITY MAP</b> 	Scale 1:9,000 at A4 	<b>Tonkin Highway Extension WA</b>
		Coord. Sys. GDA 1994 MGA Zone 50 	<b>VEGETATION CONDITION</b>
Job No: 58910 Client: Main Roads Western Australia		<b>FIGURE 9</b> <span style="float: right;"><b>PAGE 5</b></span>	
Version: A Drawn By: hsullivan	Date: 20-Jan-2021 Checked By: DN		