

# Preliminary Roadside Vegetation Survey of Enabling Infrastructure Routes

National Radioactive Waste Management Facility, Napandee

20-Dec-2021  
National Radioactive Waste Management Facility

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National Radioactive Waste Management Facility, Napandee

Client: Commonwealth Department of Industry, Science, Energy and Resources

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## Quality Information

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Reviewed by Christopher White and James Rusk

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## 1.0 Introduction

### 1.1 Background

AECOM Australia Pty Ltd (AECOM) has been commissioned by the Australian Radioactive Waste Agency (ARWA), part of the Commonwealth Department of Industry, Science, Energy and Resources (the Department) to undertake site characterisation works on and nearby the National Radioactive Waste Management Facility (NRWMF) Napandee Project Area, a 210 ha parcel of freehold land (hereafter referred to as the Project Area). The Napandee Project Area is located approximately 20 km west of Kimba, in the upper Eyre Peninsula of South Australia (**Figure 1**). The Project Area is surrounded by a larger area defined as the Survey Area which includes potential routes of the enabling infrastructure including local access roads to the Eyre Highway, a dedicated water pipeline and communications cable required for the NRWMF (**Figure 1**). The preliminary roadside vegetation survey covers the local access road and service routes. Three local access roads surveyed includes:

- Option 1 – NRWMF local access road (Tola road);
- Option 2 – NRWMF local access road (Larwood, Pinkwaillinie and Buckleboo roads); and
- Option 3 – NRWMF local access road (Larwood, Pinkawillinie, Clements, Inglis and Wilcherry Roads).

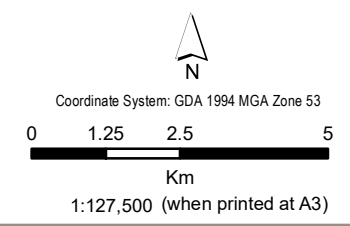
AECOM conducted a desktop flora and fauna assessment in February 2018 followed by a preliminary field survey in April 2018 to verify the findings of the desktop assessment and to develop an initial understanding of the conditions of the vegetation and habitat within the Napandee Project Area. Vegetation mapping for the Project Area was undertaken by AECOM and reported within the AECOM (2019) Technical Report Addendum – Site Characterisation, Napandee. This did not include mapping roadside vegetation along the potential routes of the enabling infrastructure.

### 1.2 Objectives

The objectives of the preliminary roadside vegetation survey along the enabling infrastructure routes were to:

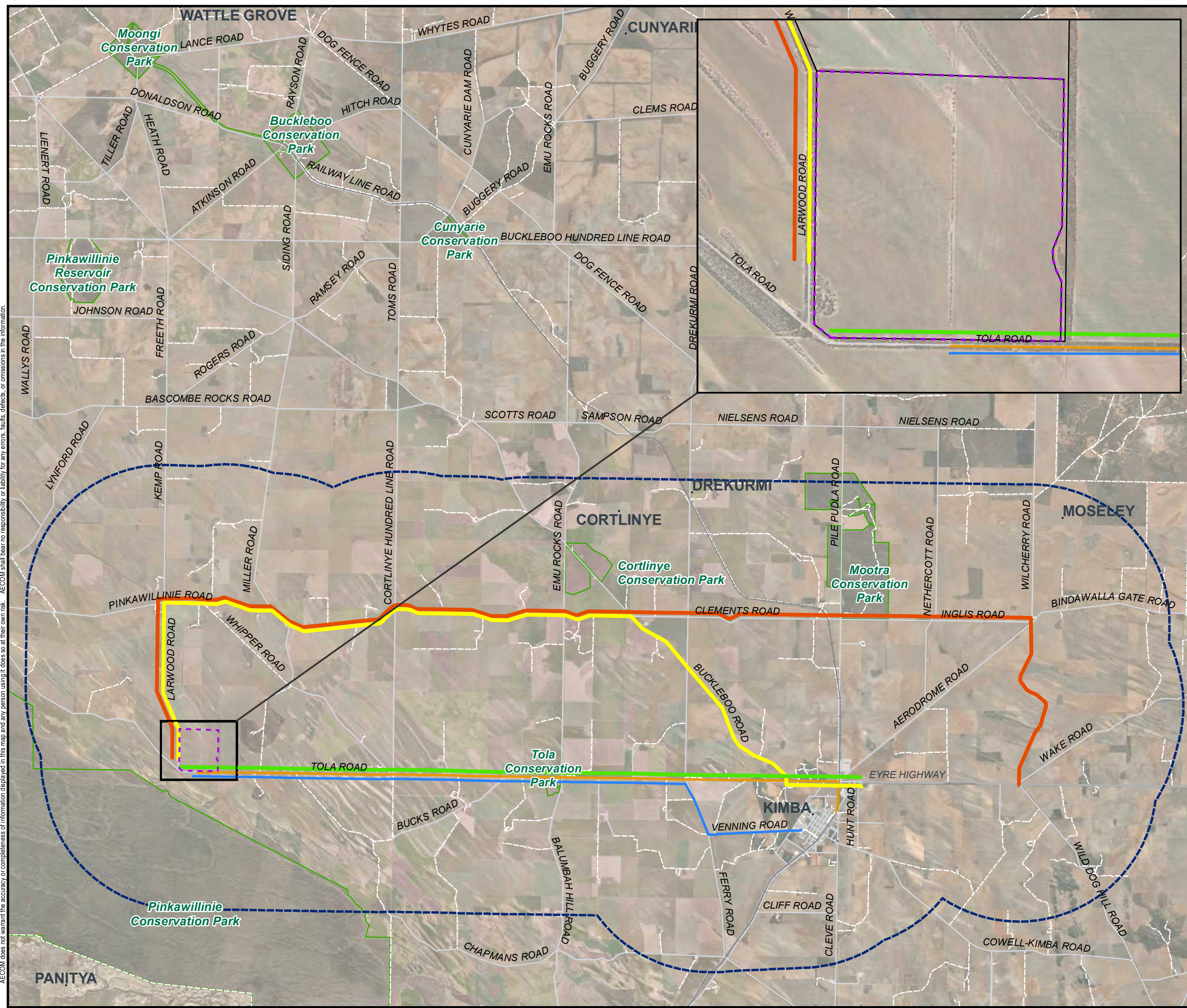
- Identify whether there are ecological values such as listed threatened ecological communities (TECs) or flora and fauna which represent Matters of National Environmental Significance (MNES) under the Commonwealth *Environment Protection and Biodiversity Act 1999* (EPBC Act) that could potentially be impacted by the clearance of roadside vegetation for upgrade local access roads and install services; and
- Map the type of vegetation communities and condition with reference to the *Guide to Roadside Vegetation Surveys Methodology in South Australia* (Department of Environment and Heritage 2006).





**LEGEND**

- Project Area (210 ha)
- Routes 5km Buffer
- Study Area**
- Road Route - Upgrade - option 1
- Road Route - Upgrade - option 2
- Road Route - Upgrade - option 3
- Water Pipework - proposed
- Communication Cable Burried Route - proposed



**Project Area and Survey Area**

Commonwealth Department of Industry, Science, Energy and Resources

National Radioactive Waste Management Facility project

Kimba, South Australia

Figure  
**1**

AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.



## 2.0 Legislation

This survey was undertaken with reference to the legislation outlined in **Table 1**.

**Table 1** Legislation Relevant to the Project

Legislation	Purpose of Legislation
<b>Commonwealth</b>	
<i>Environment Protection and Biodiversity Conservation Act 1999</i>	Provides for the protection of the environment and the conservation of biodiversity. Any action that has, will have, or is likely to have a significant impact on MNES requires referral under the EPBC Act.
<b>South Australia</b>	
<i>National Parks and Wildlife Act 1972</i>	Provides for the establishment and management of reserves for public benefit and enjoyment; to provide for the conservation of wildlife in a natural environment; and for other purposes.
<i>Native Vegetation Act 1991</i>	Provides protection for native vegetation in SA and sets out a process for applying to clear vegetation. The <i>Native Vegetation Act 1991</i> ensures that areas of high conservation value are protected, and that clearances are subject to a thorough assessment process.
<i>Landscape South Australia Act 2019</i>	Under the <i>Landscape South Australia Act 2019</i> (LSA Act) landholders have a legal responsibility to manage declared pest plants and animals and prevent land and water degradation.

## 3.0 Methodology

### 3.1 Desktop assessment

A desktop assessment was carried out to describe the existing environment, and to identify the potential occurrence of significant flora, vegetation and fauna species. The desktop assessment considered the entire Project Area and Survey Area with a 5 km buffer so that any indirect impacts could be considered in the planning phase of the Project. A Protected Matters Search Tool (PMST) with a 5 km buffer on the Survey Area was applied, which is the standard distance for bushland assessments under the SA Native Vegetation Council (NVC) Bushland Assessment Manual (July 2020).

The following databases were utilised in September 2021 prior to the survey to inform the desktop assessment:

- The Department of Agriculture, Water and the Environment (DAWE) Protected Matters Search Tool (PMST) was used to identify Commonwealth protected flora and fauna species with potential to occur on or within 5 km of the Survey Area, accessed at <http://www.environment.gov.au/webgis-framework/apps/pmst/pmst.jsf>.
- The Department for Environment and Water (DEW) Biological Databases of SA (BDBSA) via NatureMaps was used to identify all species recorded within 5 km of the Survey Area and obtain information about their conservation status, accessed at: <http://spatialwebapps.environment.sa.gov.au/naturemaps/?locale=en-us&viewer=naturemaps>; and
- NatureMaps vegetation administered by DEW, accessed at <http://spatialwebapps.environment.sa.gov.au/naturemaps/?locale=en-us&viewer=naturemaps>.

Previous desktop assessment information pertaining to the Napandee Project Area and surrounds was reviewed from AECOM (2019) Technical Report Addendum – Site Characterisation, Napandee.

A likelihood of occurrence assessment was undertaken for flora, vegetation and fauna species identified in the desktop assessment. The likelihood assessment considered the presence of suitable habitat, number of records, date of records, and proximity of known records in relation to the Survey Area. The year of and number of records were also taken into account to verify the accuracy of location data and the commonality of the species.

Five likelihood categories were used for the assessment, including:

- **Unlikely:** No preferred/suitable habitat present. Species unlikely to be present in the Survey Area at any time or during any season. No records of species/community in the Survey Area.
- **Low:** Potentially suitable habitat present lacking condition, specific floristic or complexity data. Species may visit or flyover however habitat is unlikely to be considered critical to the survival of the species. No recent records of species/community in the Survey Area.
- **Moderate:** Preferred habitat (or parts thereof) present and is of size suitable for supporting species (individual or population). One or more recent records of species/community in the Survey Area.
- **High:** Suitable habitat is present. Several recent records of species/community in the Survey Area.
- **Present:** Species known to be present, confirmed records in the Survey Area.

#### **Desktop Assessment Limitations**

The content of the desktop assessment was derived from existing datasets and references from a range of sources. Flora and fauna records were sourced from the BDBSA via NatureMaps. The BDBSA only includes verified flora and fauna records submitted to DEW or partner organisations. It is recognised that drawing conclusions can be unreliable within areas that have been underrepresented in terms of biological studies. It is possible, therefore, that significant species occur within the Survey Area that are not reflected by database records.

### 3.2 Preliminary Vegetation Survey and Assessment

AECOM undertook a preliminary vegetation survey between 28 to 30 September 2021 with SA Native Vegetation Council accredited sub-consultant BlackOak Environmental Pty Ltd.

The survey footprint encompassed and all vegetation immediately adjacent the road edge to the property fence lines. The survey was conducted in accordance with the *Guide to Roadside Vegetation Surveys Methodology in South Australia* (Department of Environment and Heritage 2006).

To address the objective of the works detailed in Section **Error! Reference source not found.**, the following tasks were undertaken during the preliminary vegetation survey and assessment:

- A “drive-by” roadside vegetation survey to briefly describe and map all the vegetation present on selected roadsides. Broad mapping of vegetation communities was undertaken to determine whether there are any listed threatened ecological communities (TECs) or specific habitat that relates to flora or fauna of national conservation significance;
- An analysis of the “drive-by” information was undertaken to assign a category of overall importance (quality, or condition), to each vegetation segment (**Table 2**);
- A detailed botanical survey that re-visited high quality areas identified during the “drive-by”, to collect detailed floristic and structural data describing the vegetation associations and prepare a representative species list for associations identified during the rapid assessment.

Analysis of the results of the desktop assessment and preliminary vegetation survey were used to provide an assessment of the likelihood of occurrence of State and Commonwealth listed species.

Each vegetation community present was assigned a vegetation ‘association’ which describes the dominant overstorey species and lifeform. Associations are useful for describing the habitat type associated with specific species assemblages. Species with nationally threatened conservation listings are generally habitat specific and inferences as to the likelihood of presence are closely aligned to habitat availability. Mapping was undertaken utilising a handheld GPS. Species lists and representative photographs for each habitat type were collected.

**Table 2** Definition of vegetation condition categories

Value	Condition	Description
1	Excellent	Very little or no sign of alien vegetation in the understorey; close resemblance to probable pre-European condition
2	Good	High proportion of native species and native cover in the understorey; reasonable representation of probable pre-European vegetation
3	Moderate	Substantial invasion of aliens, but native understorey persists; for example, may be a low proportion of native species and high native cover, or high proportion of native species and low native cover
4	Poor	The understorey consists predominantly of alien species, although a small number of natives persist
5	Very poor	The understorey consists only of alien species

#### Vegetation Assessment Limitations

The compiled list of observations does not represent all species expected to occur within the Survey Area. Being a high level and opportunistic only survey, the likelihood of detection of many species is largely reduced with many species being either nocturnal, or active for small periods of the day, limiting the ability to assess their occurrence. Despite this, habitat assessment through vegetation association mapping combined with historical records allows for reasonable determination of the likelihood of presence of threatened species.

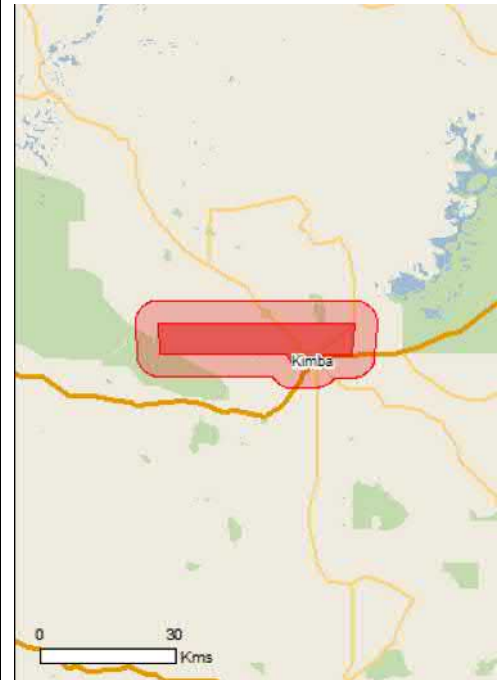
Vegetation along the road reserve was digitised at a scale of 1:2000. The road reserve boundary was estimated using aerial photography, property boundary accuracy for this region varies, land parcels were used as a guide to estimate the road reserve extent, therefore vegetation extent accuracy within the road reserve varies and is an approximate only.

## 4.0 Matters of National Environmental Significance

There is a requirement to consider potential impacts of the NRWMF on MNES through Significant Impact Guidelines 1.1 – Matters of National Environmental Significance (DEWHA 2013).

A summary of the PMST is in **Table 3** with relevant MNES discussed in the sections below. The PMST is attached in **Appendix A**.

**Table 3 EPBC Protected Matters Search Tool Results Summary**

Survey Area and 5 km buffer	MNES Under the EPBC Act	Identified within 5 km of the Survey Area
	<b>World heritage properties</b>	None
	<b>National heritage properties</b>	None
	<b>Wetlands of international importance</b>	None
	<b>Listed threatened ecological communities</b>	None
	<b>Listed threatened species</b>	17
	<b>Listed migratory species</b>	10
	<b>The Great Barrier Reef Marine Park</b>	Not applicable
	<b>Nuclear Action</b>	Note: The NRWMF is a nuclear action
	<b>Commonwealth Marine Area</b>	Not applicable
	<b>Water Resources, in relation to coal seam gas/coal mining development</b>	Not applicable

### 4.1 Threatened Ecological Communities

No TECs listed under the EPBC Act, nor the NPW Act were identified from the PMST or BDBSA as potentially occurring within 5 km of the Survey Area (see **Appendix A**).

No TECs listed under the EPBC Act, nor the NPW Act were identified during a review of existing vegetation mapping on NatureMaps or during the vegetation assessment.

### 4.2 Threatened Flora

Six flora species listed under the EPBC Act were identified from the PMST as potentially occurring or having suitable habitat within 5 km of the Survey Area (**Appendix A**). Two flora species listed under the NPW Act were identified from the BDBSA as having historic records within the Survey Area (See **Appendix B** and **Figure 2**).

One NPW Act listed flora species *Grevillea anethifolia* (a medium sized shrub) was recorded along Pinkawillinie Rd, within a section which is part of two route options (see **Plate 1** and **Figure 3**).

EPBC Act listed species *Swainsona pyrophila* (Yellow Swainson Pea, a small short-lived shrub) and NPW Act listed species *Eremophila praecox* (a small shrub) were not recorded however both were assessed as having a moderate likelihood of occurrence within roadside vegetation of the potential enabling infrastructure routes (**Appendix B**).





Plate 1 *Grevillea anethifolia*

### 4.3 Threatened Fauna

Ten fauna species listed under the EPBC Act were identified in the PMST as potentially occurring or having suitable habitat within 5 km of the Survey Area (see **Appendix A**). Four fauna species listed under the NPW Act were identified from the BDBSA as having historic records within the Survey Area (See **Appendix B** and **Figure 2**).

One NPW Act listed bird species White Winged Chough (*Corcorax melanorhamphos*) was recorded along Pinkawillinie Rd (within Option 2 and Option 3 road routes) and at a second location 500 m south of Buckleboo Rd (south of Option 1) (see **Figure 3**).

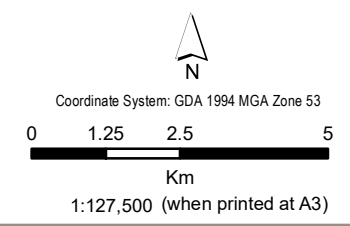
EPBC Act listed bird species Grey Falcon (*Falco hypoleucos*) and NPW Act listed bird species Black Falcon (*Falco subniger*) were not recorded however both were assessed as having a moderate likelihood of occurrence along all potential enabling infrastructure routes as a flyover species (see **Appendix B**).

### 4.4 Commonwealth Listed Migratory Species

Ten migratory bird species listed under the EPBC Act were identified in the PMST as potentially occurring or having suitable habitat within 5 km of the Survey Area (see **Appendix A**). No migratory species identified from the BDBSA as having historic records within the Survey Area (See **Appendix B**).

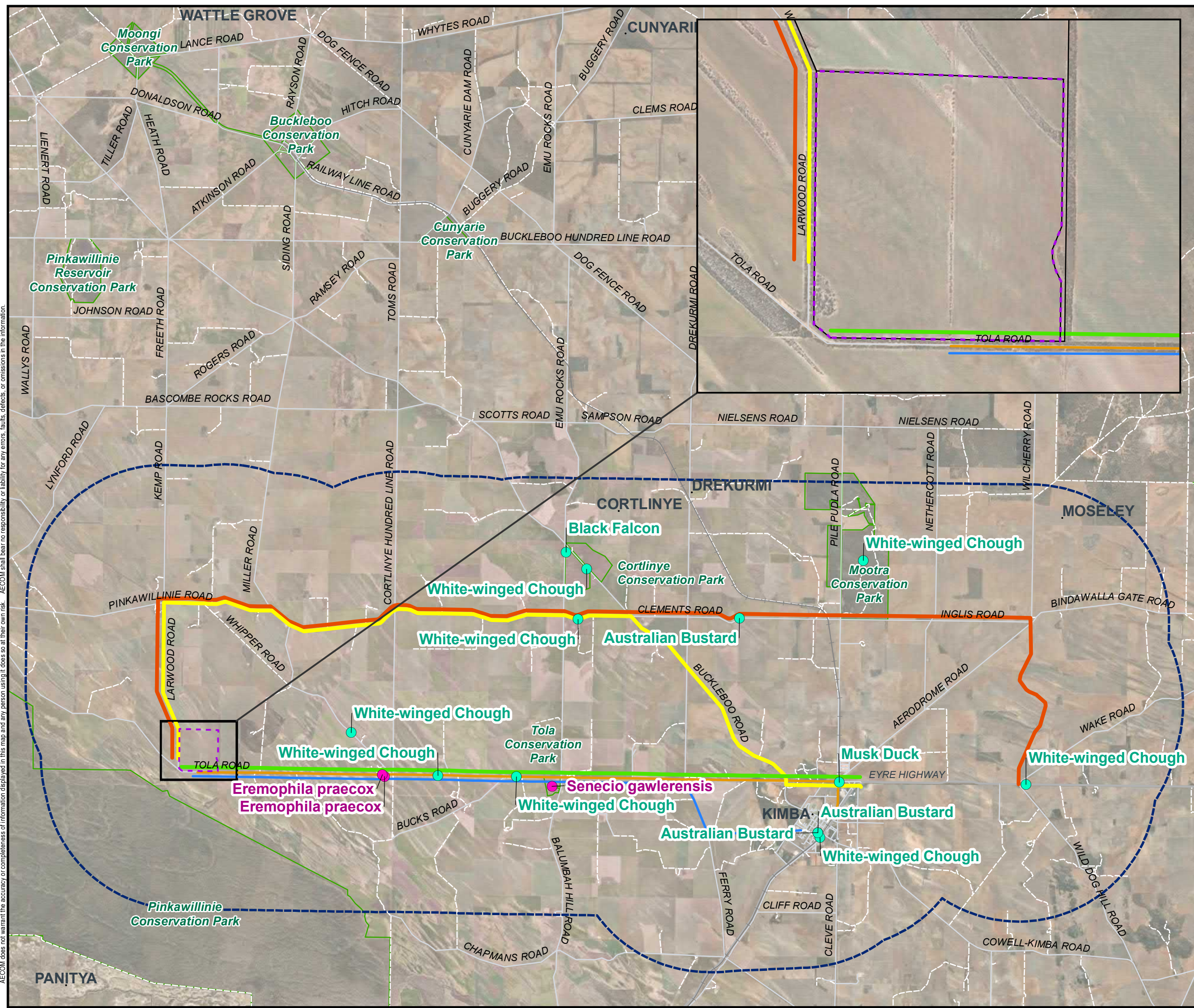
No EPBC Act migratory species were considered as having a moderate or higher likelihood of occurrence based on potential habitat present within the vicinity of the Survey Area (see **Appendix B**).





**LEGEND**

- Project Area (210 ha)
- Routes 5km Buffer
- Study Area**
- Road Route - Upgrade - option 1
- Road Route - Upgrade - option 2
- Road Route - Upgrade - option 3
- Water Pipework - proposed
- Communication Cable Burried Route - proposed



**Napandee Desktop Threatened Species**

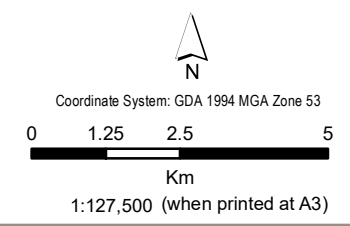
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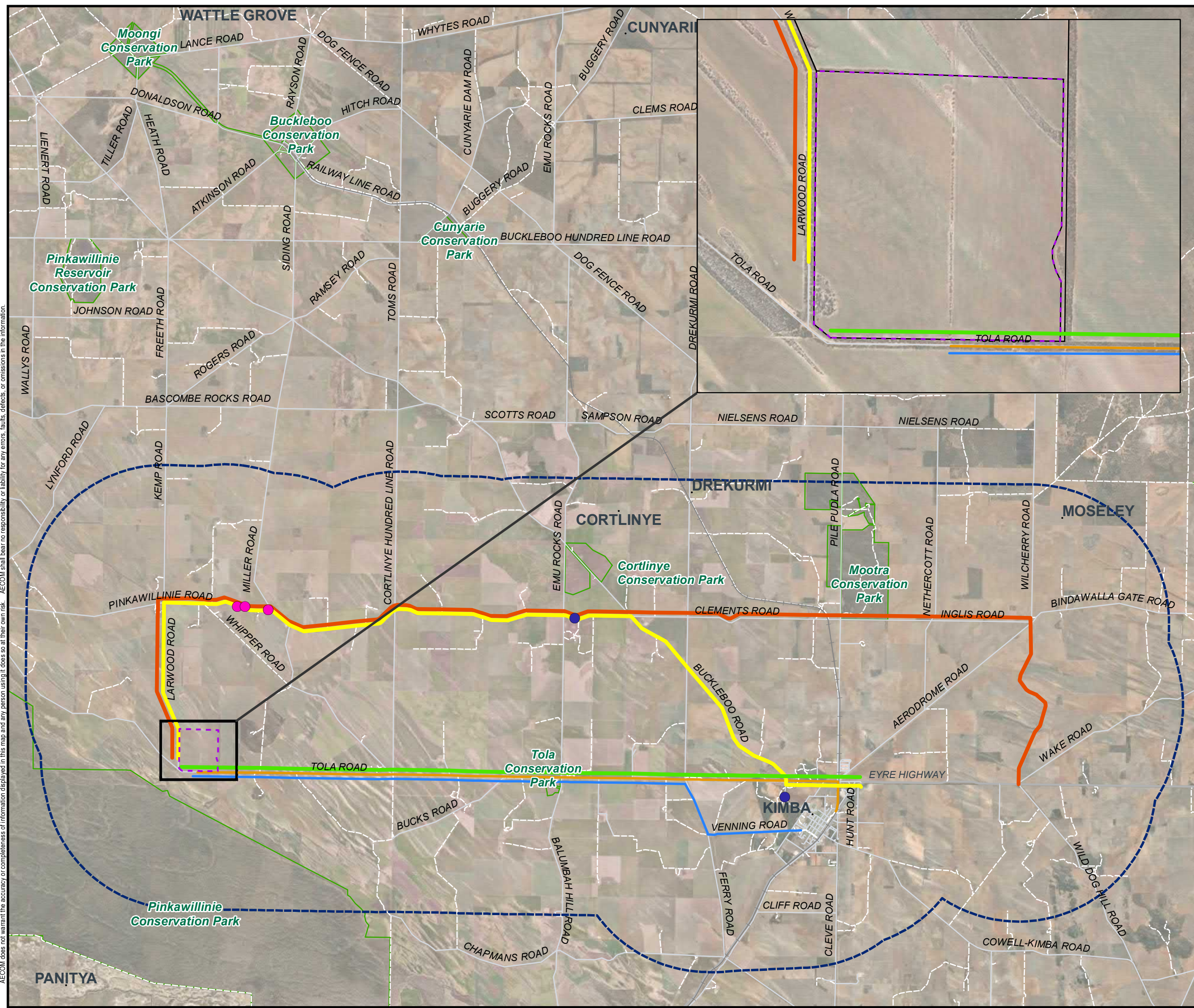
Figure  
**2**





**LEGEND**

- Project Area (210 ha)
- 5km Buffer
- White-winged Cough (Corcorax melanorhamphos)
- Grevillea anethifolia
- Study Area**
- Road Route - Upgrade - option 1
- Road Route - Upgrade - option 2
- Road Route - Upgrade - option 3
- Water Pipework - proposed
- Communication Cable Burried Route - proposed



**Napandee Field Threatened Species**

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Figure  
**3**



## 5.0 Preliminary Vegetation Survey and Assessment

### 5.1 Vegetation Associations

There were ten broad vegetation associations recorded within the Survey Area varying in condition rated from excellent (1) to very poor (5) (**Table 4**). A total of 89 species flora species were recorded which included 70 native species and 19 introduced species (**Appendix C**).

Vegetation Associations 1, 5 and 10 had the highest species richness. These contained 69 (58 native species), 26 (17 native species) and 28 (25 native species) species, respectively.

The 19 introduced flora species recorded included *Asparagus asparagoides f. asparagoides* (Bridal Creeper) which is listed as a Declared Plant under the LSA Act and a Weed of National Significance (WoNS), and *Marrubium vulgare* (Horehound) and *Echium plantagineum* (Salvation Jane) which are listed as Declared Plants under the LSA Act.

Refer to **Appendix D** for a representative photo of each vegetation association and **Appendix E** for vegetation mapping and condition figures.

**Table 4** Vegetation associations recorded within the Project Area.

Assoc #	Description	Area (ha)
1	<i>Eucalyptus oleosa ssp. ampliata</i> , <i>Eucalyptus gracilis</i> , <i>Eucalyptus calycogona ssp. calycogona</i> , <i>Eucalyptus socialis ssp.</i> , <i>Eucalyptus calcareana</i> , <i>Eucalyptus incrassata</i> Mixed Mallee	245.82
2	<i>Melaleuca uncinata</i> Shrubland	1.80
3	<i>Casuarina pauper</i> Low Woodland	3.61
4	<i>Callitris gracilis</i> Low Woodland	2.63
5	<i>Senna artemisioides ssp. X coriacea</i> Shrubland	11.17
6	<i>Avena barbata</i> , <i>Hordeum glaucum</i> , <i>Asphodelus fistulosus</i> Exotic Grassland +/- <i>Eucalyptus oleosa ssp. ampliata</i>	11.92
7	<i>Austrostipa nitida</i> , <i>Austrostipa acrociliata</i> Tussock Grassland	1.92
8	<i>Eucalyptus porosa</i> Open Woodland	0.33
9	<i>Eucalyptus oleosa ssp. ampliata</i> Very Open Mallee over <i>Atriplex stipitata</i> and introduced species <i>Avena barbata</i> , <i>Hordeum glaucum</i> , <i>Asphodelus fistulosus</i>	2.28
10	<i>Senna artemisioides ssp.</i> , <i>Pittosporum angustifolium</i> , <i>Acacia ligulata</i> , <i>Acacia sclerophylla var. sclerophylla</i> Mixed Open Shrubland	3.83
<b>Total</b>		<b>285.31</b>

Occurrences of *Casuarina pauper* Low Woodland and *Callitris gracilis* Low Woodland may be of potential Aboriginal cultural significance. The potential cultural significance of these two tree species to traditional owners should be assessed as part of the Aboriginal Cultural Heritage Assessment. A summary of the occurrence of these vegetation associations is provided in **Table 5**.

Table 5 *Casuarina pauper* Low Woodland and *Callitris gracilis* Low Woodland summary

Vegetation Association	Length (km)
<b>Option 1 – NRWMF local access road</b>	
<i>Casuarina pauper</i> Low Woodland (2 Good)	0.73
<i>Callitris gracilis</i> Low Woodland (2 Good)	0.53
<b>Total</b>	<b>1.26</b>
<b>Option 2 - NRWMF local access road</b>	
<i>Casuarina pauper</i> Low Woodland (2 Good)	0.28
<i>Casuarina pauper</i> Low Woodland (3 Moderate)	2.45
<i>Callitris gracilis</i> Low Woodland (2 Good)	0.69
<i>Callitris gracilis</i> Low Woodland (3 Moderate)	0.43
<b>Total</b>	<b>3.85</b>
<b>Option 3 - NRWMF local access road</b>	
<i>Casuarina pauper</i> Low Woodland (2 Good)	0.28
<i>Casuarina pauper</i> Low Woodland (3 Moderate)	2.45
<i>Callitris gracilis</i> Low Woodland (2 Good)	0.69
<b>Total</b>	<b>3.42</b>
<b>Preferred Service Route (incorporating Option 1 – NRWMF local access road)</b>	
<i>Casuarina pauper</i> Low Woodland (2 Good)	0.73
<i>Callitris gracilis</i> Low Woodland (2 Good)	0.53
<i>Callitris gracilis</i> Low Woodland (3 Moderate)	0.42
<b>Total</b>	<b>1.68</b>

## 5.2 Summary of Options

### 5.2.1 Option 1 – NRWMF local access road – Tola Road

Option 1 is approximately 26 km in length containing 125 ha of vegetation in roadside reserves. The route contains eight vegetation associations in three vegetation condition categories, 2 (good), 3 (moderate) and 4 (poor) (**Table 6**).

**Table 6** Vegetation condition categories for Option 1 – NRWMF local access road

Condition	Area (ha)	Percentage (%)
2 (Good)	90	72
3 (Moderate)	25	20
4 (Poor)	10	8
<b>Total</b>	<b>125</b>	<b>100</b>

### 5.2.2 Option 2 – NRWMF local access road – Buckleboo Road / Pinkawilline Road

Option 2 is approximately 34 km in length containing 110 ha of vegetation in roadside reserves. The route contains nine vegetation associations in four condition categories, 2 (good), 3 (moderate), 4 (poor) and 5 (very poor) (**Table 7**). *Grevillea anethifolia* which is listed as Rare under the NPW Act was recorded at three locations within roadside vegetation on Pinkawilline Road.

**Table 7** Vegetation condition categories for Option 2 – NRWMF local access road

Condition	Area (ha)	Percentage (%)
2 (Good)	75	68
3 (Moderate)	31	28
4 (Poor)	3	3
5 (Very poor)	1	1
<b>Total</b>	<b>110</b>	<b>100</b>

### 5.2.3 Option 3 – NRWMF local access road – Wilcherry Road / Pinkawilline Road

Option 3 is approximately 44 km in length containing 90 ha of vegetation in roadside reserves. The route contains eight vegetation associations in four condition categories, 1 (Excellent), 2 (good), 3 (moderate) and 4 (poor) (**Table 8**). *Grevillea anethifolia* which is listed as Rare under the NPW Act was recorded at three locations within roadside vegetation on Pinkawilline Road.

**Table 8** Vegetation condition categories for Option 3 – NRWMF local access road

Condition	Area (ha)	Percentage (%)
1 (Excellent)	4	5
2 (Good)	55	61
3 (Moderate)	28	31
4 (Poor)	3	3
<b>Total</b>	<b>90</b>	<b>100</b>

### 5.2.4 Preferred Service Route (including Option 1 – NRWMF local access road)

The preferred service route is approximately 33 km in length containing 310 ha of vegetation in roadside reserves. There is an additional 7 km and 187 ha added on to Option 1 – NRWMF local access road (Tola Road). The route contains eight vegetation associations, in four condition categories, 2 (good), 3 (moderate), 4 (poor) and 5 (very poor) (**Table 9**).

**Table 9** Vegetation condition categories for Preferred Service Route (including Option 1 – NRWMF local access road)

Condition	Area (ha)	Percentage (%)
2 (Good)	128	42
3 (Moderate)	162	52
4 (Poor)	10	3
5 (Very poor)	10	3
<b>Total</b>	<b>310</b>	<b>100</b>

### 5.3 Comparison of Options

The summary provided in **Section 5.2** details the vegetation contained within the entire road reserve, including all vegetation immediately adjacent from the roads edge to the fence lines. For clearance required for road and enabling infrastructure upgrades the following assumptions are made:

- The designed road width is 26 m, based on 30% road design cross sections including a full clear zone of 5 m on either side of the road for construction;
- The existing road width is 12 m, and upgrades require an additional 14 m of clearance;
- It is assumed clearing is required along the whole length of alignment; and
- Enabling infrastructure requires 5 m clearance for trenching, shared trenching could be utilised to reduce clearance requirements.

A comparison of the approximate clearance required for options is detailed in **Table 10**. Details of the clearance requirements calculations is in **Appendix A**.

**Table 10** Comparison of clearance requirements for each option (approximate)^

	Length (km)	Amount of roadside vegetation (ha)	Clearance (ha)	Clearance (ha) incl. services
<b>Option 1</b>	26	125	50	55
<b>Option 2</b>	34	110	65	80
<b>Option 3</b>	44	90	85	100 *
<b>Preferred Service Route</b>	32	310	15	-

\* It is noted that the area of clearance exceeds the amount of roadside vegetation mapped during the field survey, this is due to the assumption that clearing is required along the whole length of alignment (i.e some areas may not contain vegetation and therefore the clearance amount would be lower).

If Option 1 is chosen, shared trenching for the water and communication services could be utilised reducing the clearance requirements to approximately 55 ha in total in comparison with 80 ha or 100 ha for Option 2 and 3 respectively. Option 1 also contains less *Casuarina pauper* Low Woodland and *Callitris gracilis* Low Woodland vegetation, noted in **Section 5.1** to potentially be of Aboriginal Heritage significance.

A detailed survey of the roadside vegetation shall be undertaken along the selected enabling infrastructure routes in order to assess the ecological values and thus identify potential impacts and design, construction or operational mitigations that could be employed, and to enable requirements for native vegetation clearance to be determined.

## 6.0 Summary of Assessment

A desktop assessment and preliminary roadside vegetation survey has been undertaken to inform our understanding of ecological values which represent Matters of National Environmental Significance (MNES) under the EPBC Act along the potential enabling infrastructure routes. The outcome can be summarised as follows:

- No Threatened Ecological Communities listed under the EPBC Act, nor the NPW Act were identified during a review of existing vegetation mapping on NatureMaps or during the vegetation assessment.
- EPBC Act listed species *Swainsona pyrophila* (Yellow Swainson Pea, a small short-lived shrub) was not recorded however was assessed with a moderate likelihood of occurrence along all enabling infrastructure and service routes.
- EPBC Act listed bird species Grey Falcon (*Falco hypoleucos*) was not recorded however was assessed with a moderate likelihood of occurrence as a flyover species due to suitable habitat present along or nearby all enabling infrastructure routes.
- The assessment of ecological values undertaken to date along the potential enabling infrastructure routes has not identified any matters considered likely to constrain development that would involve vegetation clearance, road widening and upgrades, and the installation of an underground water pipeline and communications cable.

There were ten broad vegetation associations recorded along the potential enabling infrastructure routes (Survey Area). The most common association was *Eucalyptus oleosa ssp. ampliata*, *Eucalyptus gracilis*, *Eucalyptus calycogona ssp. calycogona*, *Eucalyptus socialis ssp.*, *Eucalyptus calcareana*, *Eucalyptus incrassata* Mixed Mallee (86% of the total vegetation mapped). The vegetation varied in condition ratings from excellent to very poor. The majority of the roadside vegetation along the local road access route and preferred service routes is in good condition with a lesser amount in moderate condition.

A comparison of the approximate amount of vegetation clearance required for the potential enabling infrastructure route options was undertaken. The amount of vegetation clearance required increases with the length of the potential local access route between Napandee and the Eyre Highway. The shortest local access road route between Napandee and the Eyre Highway, via Tola Road, also incorporates the preferred route for installation of an underground water pipeline and communications cable between Napandee and connection points in Kimba.

If local access road route Option 1 (Tola Road) is chosen, trenching for the water and communication services could be undertaken side by side which will reduce the clearance requirements to approximately 55 ha in total in comparison with 80 ha or 100 ha for Option 2 (Larwood, Pinkwillinie and Buckleboo Roads) and Option 3 (Larwood, Pinkwillinie, Clements, Inglis and Wilcherry Roads) respectively. Option 1 also contains less *Casuarina pauper* Low Woodland and *Callitris gracilis* Low Woodland vegetation, which may be of Aboriginal Heritage significance.

A detailed survey of the roadside vegetation shall be undertaken along the selected enabling infrastructure routes in order to assess the ecological values and thus identify potential impacts and design, construction or operational mitigations that could be employed, and to enable requirements for native vegetation clearance to be determined.

## 7.0 References

AECOM (2019) Technical Report Addendum – Site Characterisation, Napandee.

Atlas of Living Australia (2021) Species Records accessed at: <https://www.ala.org.au/>.

Commonwealth Department of Agriculture, Water and the Environment (2021) Protected Matters Search Tool accessed at: <http://www.environment.gov.au/webgis-framework/apps/pmst/pmst.jsf>.

Department for Environment and Water (2021) Biological Databases of South Australia via NatureMaps accessed at: <https://data.environment.sa.gov.au/NatureMaps/Pages/default.aspx>.

Department of Environment and Heritage (2006) Guide to Roadside Vegetation Surveys Methodology in South Australia accessed at: <https://data.environment.sa.gov.au/Content/Publications/roadside-veg-survey-guide.pdf>.

Native Vegetation Council (NVC) (2020) Bushland Assessment Manual accessed at: [https://www.environment.sa.gov.au/files/sharedassets/public/native\\_veg/accredited\\_consultant\\_documents/bushland\\_assessment\\_manual\\_1\\_july\\_2020.pdf](https://www.environment.sa.gov.au/files/sharedassets/public/native_veg/accredited_consultant_documents/bushland_assessment_manual_1_july_2020.pdf).

# Appendix A

## Protected Matters Search Tool (PMST) Report





# EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 09/11/21 09:38:21

[Summary](#)

[Details](#)

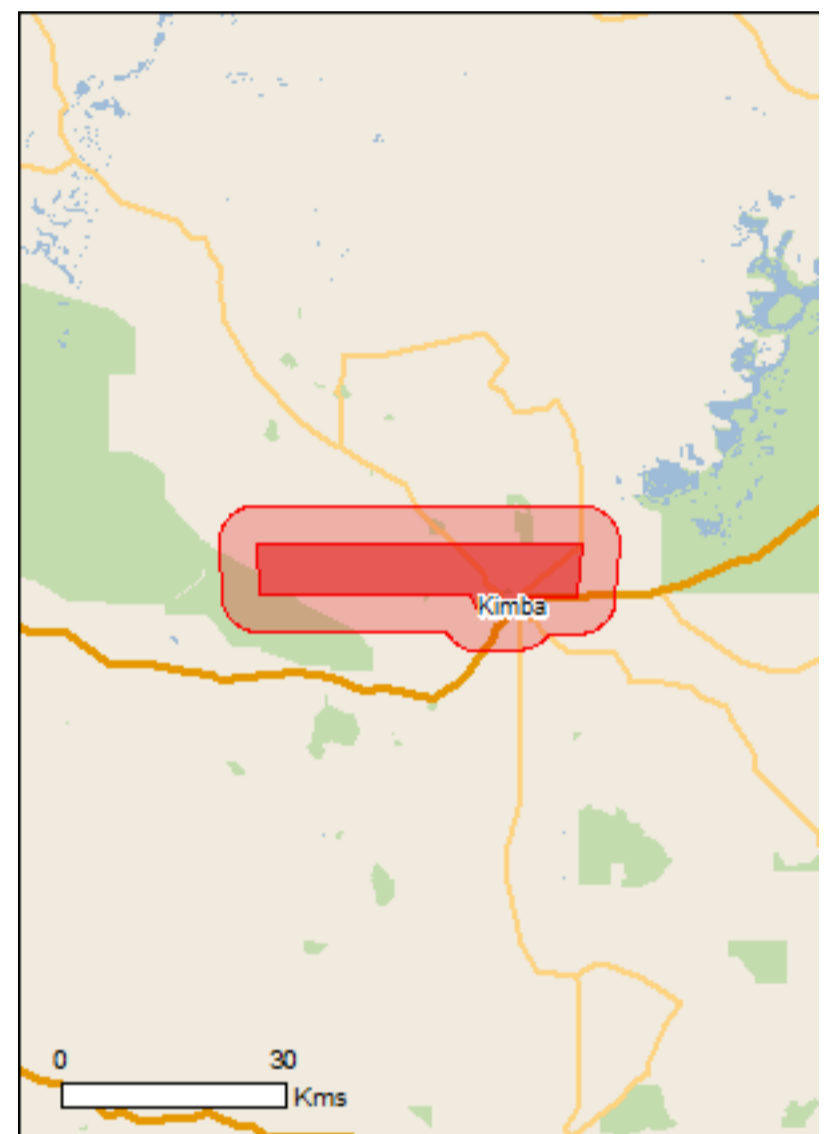
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

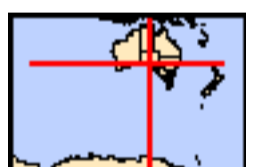
[Acknowledgements](#)



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2015

[Coordinates](#)

Buffer: 5.0Km



# Summary

## Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

<a href="#">World Heritage Properties:</a>	None
<a href="#">National Heritage Places:</a>	None
<a href="#">Wetlands of International Importance:</a>	None
<a href="#">Great Barrier Reef Marine Park:</a>	None
<a href="#">Commonwealth Marine Area:</a>	None
<a href="#">Listed Threatened Ecological Communities:</a>	None
<a href="#">Listed Threatened Species:</a>	17
<a href="#">Listed Migratory Species:</a>	10

## Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

<a href="#">Commonwealth Land:</a>	None
<a href="#">Commonwealth Heritage Places:</a>	None
<a href="#">Listed Marine Species:</a>	16
<a href="#">Whales and Other Cetaceans:</a>	None
<a href="#">Critical Habitats:</a>	None
<a href="#">Commonwealth Reserves Terrestrial:</a>	None
<a href="#">Australian Marine Parks:</a>	None

## Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

<a href="#">State and Territory Reserves:</a>	7
<a href="#">Regional Forest Agreements:</a>	None
<a href="#">Invasive Species:</a>	17
<a href="#">Nationally Important Wetlands:</a>	None
<a href="#">Key Ecological Features (Marine)</a>	None

# Details

## Matters of National Environmental Significance

Listed Threatened Species		[ Resource Information ]
Name	Status	Type of Presence
<b>Birds</b>		
<a href="#">Amytornis textilis myall</a> Western Grasswren (Gawler Ranges) [64454]	Vulnerable	Species or species habitat may occur within area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Falco hypoleucos</a> Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Grantiella picta</a> Painted Honeyeater [470]	Vulnerable	Species or species habitat may occur within area
<a href="#">Leipoa ocellata</a> Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Pedionomus torquatus</a> Plains-wanderer [906]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Pezoporus occidentalis</a> Night Parrot [59350]	Endangered	Extinct within area
<a href="#">Rostratula australis</a> Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
<b>Mammals</b>		
<a href="#">Sminthopsis psammophila</a> Sandhill Dunnart [291]	Endangered	Species or species habitat likely to occur within area
<b>Plants</b>		
<a href="#">Acacia enterocarpa</a> Jumping-jack Wattle [17615]	Endangered	Species or species habitat may occur within area
<a href="#">Acacia rhetinocarpa</a> Neat Wattle, Resin Wattle (SA) [11282]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Caladenia tensa</a> Greencomb Spider-orchid, Rigid Spider-orchid	Endangered	Species or species

Name	Status	Type of Presence
[24390]		habitat known to occur within area
<a href="#">Hibbertia crispula</a> Ooldea Guinea-flower [15222]	Vulnerable	Species or species habitat may occur within area
<a href="#">Olearia pannosa subsp. pannosa</a> Silver Daisy-bush, Silver-leaved Daisy, Velvet Daisy-bush [12348]	Vulnerable	Species or species habitat may occur within area
<a href="#">Pterostylis mirabilis</a> Nodding Rufoushood [86228]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Swainsona pyrophila</a> Yellow Swainson-pea [56344]	Vulnerable	Species or species habitat likely to occur within area

### Listed Migratory Species [ [Resource Information](#) ]

\* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
<b>Migratory Marine Birds</b>		
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area
<b>Migratory Terrestrial Species</b>		
<a href="#">Motacilla cinerea</a> Grey Wagtail [642]		Species or species habitat may occur within area
<a href="#">Motacilla flava</a> Yellow Wagtail [644]		Species or species habitat may occur within area
<b>Migratory Wetlands Species</b>		
<a href="#">Actitis hypoleucos</a> Common Sandpiper [59309]		Species or species habitat may occur within area
<a href="#">Calidris acuminata</a> Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Calidris melanotos</a> Pectoral Sandpiper [858]		Species or species habitat may occur within area
<a href="#">Charadrius veredus</a> Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
<a href="#">Gallinago hardwickii</a> Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area

## Other Matters Protected by the EPBC Act

### Listed Marine Species [ [Resource Information](#) ]

\* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
<b>Birds</b>		
<a href="#">Actitis hypoleucos</a>		
Common Sandpiper [59309]		Species or species habitat may occur within area
<a href="#">Apus pacificus</a>		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
<a href="#">Ardea ibis</a>		
Cattle Egret [59542]		Species or species habitat may occur within area
<a href="#">Calidris acuminata</a>		
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
<a href="#">Calidris ferruginea</a>		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Calidris melanotos</a>		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
<a href="#">Charadrius veredus</a>		
Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
<a href="#">Chrysococcyx osculans</a>		
Black-eared Cuckoo [705]		Species or species habitat likely to occur within area
<a href="#">Gallinago hardwickii</a>		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
<a href="#">Haliaeetus leucogaster</a>		
White-bellied Sea-Eagle [943]		Species or species habitat may occur within area
<a href="#">Merops ornatus</a>		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
<a href="#">Motacilla cinerea</a>		
Grey Wagtail [642]		Species or species habitat may occur within area
<a href="#">Motacilla flava</a>		
Yellow Wagtail [644]		Species or species habitat may occur within area
<a href="#">Neophema chrysostoma</a>		
Blue-winged Parrot [726]		Species or species habitat likely to occur within area
<a href="#">Numenius madagascariensis</a>		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Rostratula benghalensis (sensu lato)</a>		
Painted Snipe [889]	Endangered*	Species or species habitat may occur within



Name	Threatened	Type of Presence area
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## Extra Information

### State and Territory Reserves [\[ Resource Information \]](#)

Name	State
Cortlinye	SA
Mootra	SA
Pinkawillinie	SA
Tola	SA
Unnamed (No.HA32)	SA
Unnamed (No.HA472)	SA
Unnamed (No.HA86)	SA

### Invasive Species [\[ Resource Information \]](#)

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resources Audit, 2001.

Name	Status	Type of Presence
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#### Birds

Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area

#### Mammals

Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area

## Plants

Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Carrichtera annua Ward's Weed [9511]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area

# Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

# Coordinates

-33.12555 136.496906,-33.125262 136.427554,-33.141362 136.425838,-33.143662 136.378116,-33.124975 136.36713,-33.123825 136.113414,-33.071479 136.110667,-33.072342 136.501712,-33.12555 136.496906



# Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Department of Land and Resource Management, Northern Territory](#)
- [-Department of Environmental and Heritage Protection, Queensland](#)
- [-Department of Parks and Wildlife, Western Australia](#)
- [-Environment and Planning Directorate, ACT](#)
- [-Birdlife Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
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- [-Natural history museums of Australia](#)
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-South Australian Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
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- [-State Herbarium of South Australia](#)
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- [-CSIRO](#)
- [-Australian Tropical Herbarium, Cairns](#)
- [-eBird Australia](#)
- [-Australian Government – Australian Antarctic Data Centre](#)
- [-Museum and Art Gallery of the Northern Territory](#)
- [-Australian Government National Environmental Science Program](#)
- [-Australian Institute of Marine Science](#)
- [-Reef Life Survey Australia](#)
- [-American Museum of Natural History](#)
- [-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [-Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- [-Other groups and individuals](#)

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact Us](#) page.

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# Appendix B

## Likelihood of Occurrence Assessment

## Appendix B Likelihood of Occurrence Assessment

Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Conservation Codes: CE = Critically Endangered, E = Endangered, V = Vulnerable, , Mi = Migratory, Ma = Marine

SA *National Parks and Wildlife Act 1972* (NPW Act) Conservation Codes: En = Endangered, Vu = Vulnerable, R = Rare

Scientific name	Common name	Listing		Habitat	Source	Likelihood
		EPBC	NPW			
<b>Aves</b>						
<i>Actitis hypoleucos</i>	Common Sandpiper	Mi, Ma	R	Edges of saltwater to fresh waterbodies and wetlands, including estuaries, lakes, drainage lines, tidal watercourses and mudflats.	PMST	Unlikely
<i>Amytornis textilis myall</i>	Western Grasswren (Gawler Ranges)	V	V	Occurs in open chenopod shrublands, often where dense stands of Dead Finish <i>Acacia tetragonophylla</i> or Blackbush <i>Maireana pyramidata</i> surround drainage lines. It also occurs in saltbush <i>Atriplex</i> spp. and bluebush <i>Maireana</i> spp. shrublands with a sparse or open overstorey of low trees or shrubs.	PMST	Unlikely
<i>Apus pacificus</i>	Fork-tailed Swift	Mi, Ma	-	Mostly occur over inland plains but sometimes above foothills or in coastal areas.	PMST	Unlikely
<i>Ardeotis australis</i>	Australian Bustard	-	V	Range from tropical to semi-arid and temperate tussock grasslands, open-shrublands and grassy woodlands. In settled areas they visit pasture and crops. Bustards may roost in clumps of trees or on the ground, usually in an elevated position.	BDBSA 2 (2002)	Unlikely
<i>Biziura lobata menziesi</i>	Musk Duck	-	R	Deep permanent water or open lakes with dense vegetation.	BDBSA 1 (2018)	Unlikely
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	Mi, Ma	-	Prefers the grassy edges of shallow inland freshwater wetlands. It is also found around sewage farms, flooded fields, mudflats, mangroves, rocky shores and beaches.	PMST	Unlikely
<i>Calidris ferruginea</i>	Curlew Sandpiper	CE, Mi, Ma	E	Coastal estuaries, bays and shallow wetlands, tidal mudflats and sandflats; mainly spring-summer non-breeding migrant.	PMST	Unlikely
<i>Calidris melanotos</i>	Pectoral Sandpiper	Mi, Ma	R	Shallow freshwater or brackish wetlands, including swamps, flooded grasslands, sewage ponds, occasionally tidal flats and saltmarshes	PMST	Unlikely
<i>Charadrius veredus</i>	Oriental Plover, Oriental Dotterel	Mi, Ma	-	Coastal habitats such as estuarine mudflats and sandbanks, on sandy or rocky ocean beaches or nearby reefs, or in near-coastal grasslands, before dispersing further inland.	PMST	Unlikely

Scientific name	Common name	Listing		Habitat	Source	Likelihood
		EPBC	NPW			
<i>Corcorax melanorhamphos</i>	White-winged Chough	-	R	Dry woodlands near permanent water, such as streams or dams.	BDBSA 5 (2018) 2021 Survey	Present
<i>Falco hypoleucos</i>	Grey Falcon	V	R	Frequents timbered lowland plains, particularly acacia shrublands that are crossed by tree-lined water courses. Observed hunting in treeless areas, tussock grassland and open woodland, especially in winter.	PMST	Moderate (as flyover)
<i>Falco subniger</i>	Black Falcon	-	R	Inhabits woodland, shrubland and grassland in the arid and semi-arid zones, especially wooded (eucalypt- dominated) watercourses; it also uses agricultural land with scattered remnant trees. Often associated with streams or wetlands, visiting them in search of prey.	BDBSA 1 (2002)	Moderate (as flyover)
<i>Gallinago hardwickii</i>	Latham's Snipe, Japanese Snipe	Mi, Ma	R	Occurs in permanent and ephemeral wetlands up to 2000m altitude. They inhabit open, freshwater wetlands with low, dense vegetation.	PMST	Unlikely
<i>Grantiella picta</i>	Painted Honeyeater	V	R	Open box-ironbark forests, eucalypt and casuarina woodlands and well vegetated watercourses, particularly where trees are infested with mistletoe; mainly spring-summer migrant to south-eastern Australia.	PMST	Unlikely
<i>Leipoa ocellata</i>	Malleefowl	V	V	Mallee woodlands, scrubland and heathlands, often with sandy substrate. Breed in areas with good leaf litter layer. Occasional forage in open areas, including farmland and clearing amongst mallee.	PMST	Unlikely
<i>Motacilla cinerea</i>	Grey Wagtail	Mi, Ma	-	Fast-flowing mountain streams and rivers with riffles and exposed rocks or shoals, often in forested areas.	PMST	Unlikely
<i>Motacilla flava</i>	Yellow Wagtail	Mi, Ma	-	Occurs in a variety of damp or wet habitats with low vegetation, from rushy pastures, meadows, hay fields and marshes to damp steppe and grassy tundra.	PMST	Unlikely
<i>Numenius madagascariensis</i>	Eastern Curlew, Far Eastern Curlew	CE, Mi	E	Coastal lakes, estuaries, tidal mudflats and sandflats, mangroves and saltmarshes; occasionally fresh or brackish lakes near coast.	PMST	Unlikely
<i>Pedionomus torquatus</i>	Plains-wanderer	CE	E	Low, open native grasslands, typically with sward less than 1m high, with extensive inter-tussock spaces and high diversity of small herbs; sometimes in unimproved pastures or crops.	PMST	Unlikely
<i>Pezoporus occidentalis</i>	Night Parrot	E	E	Extinct in south-eastern Australia; historical records from arid and semi-arid chenopod shrublands, spinifex ( <i>Triodia</i> ) on stony rises, flats around salt lakes and flooded claypans.	PMST	Unlikely

Scientific name	Common name	Listing		Habitat	Source	Likelihood
		EPBC	NPW			
<i>Rostratula australis</i>	Australian Painted Snipe	E	E	Shallow freshwater wetlands. Occasionally inhabits brackish wetlands, saltmarsh or claypans.	PMST	Unlikely
<b>Mammals</b>						
<i>Sminthopsis psammophila</i>	Sandhill Dunnart	E	V	On the Eyre Peninsula, the sandhill dunnart occupies sand ridges covered by hummock grassland and mallee-broombush shrub.	PMST	Unlikely
<b>Plants</b>						
<i>Acacia enterocarpa</i>	Jumping-jack Wattle	E	E	Occurring in woodland to open forest on sandy alkaline and hard neutral yellow duplex soils, red shallow porous loam and grey cracking and self-mulching clays with an annual rainfall of 300-500 mm	PMST	Unlikely
<i>Acacia rheticarpa</i>	Neat Wattle, Resin Wattle (SA)	V	V	Usually grows in open scrub on calcareous sand, sandy loam, red shallow porous loam or grey-brown calcareous loamy earths.	PMST	Unlikely
<i>Caladenia tensa</i>	Greencomb Spider-orchid, Rigid Spider-orchid	E		Grows in Cypress-pine/Yellow Gum Woodland, Heathy Woodland and Mallee on sands and sandy loams derived from aeolian sand deposits	PMST	Unlikely
<i>Eremophila praecox</i>		-	R	Grows in red-brown sandy loam with other <i>Eremophila</i> species	BDBSA 2 (2015)	Moderate
<i>Grevillia anethifolia</i>		-	R	Grows in shrubland and mallee, in sandy soils, sometimes along creeks	2021 Survey	Present
<i>Hibbertia crispula</i>	Ooldea Guinea-flower	V	V	Most of the population occurs on the sand dunes north of the Ooldea Railway Siding.	PMST	Unlikely
<i>Olearia pannosa subsp. pannosa</i>	Silver Daisy-bush, Velvet Daisy-bush	V	V	Occurs mainly in dry open forest, on shallow rocky soils where the mean annual rainfall ranges from 450 to 650 millimetres.	-	Unlikely
<i>Pterostylis mirabilis</i>	Nodding Rufoushood	V	V	Grows mostly in stony brown loam soils, among rocks on hilly slopes in scrublands of <i>Melaleuca uncinata</i> .	PMST	Unlikely
<i>Senecio gawlerensis</i>	Gawler Ranges Groundsel	-	R	Among rocky outcrops, usually toward the summit of hills, occasional on the lower slopes among rocks or near watercourses.	BDBSA 1 (1998)	Unlikely
<i>Swainsona pyrophila</i>	Yellow Swainson-pea	V	R	Grows in mallee scrub on sandy or loamy soil, usually found only after fire.	PMST	Moderate

# Appendix C

## List of Flora Species Recorded in Vegetation Associations

## Appendix C List of Flora Species Recorded in Vegetation Associations, Preliminary Survey

Species	Common	Conservation status		Vegetation association									
		EPBC Act	NPW Act	1	2	3	4	5	6	7	8	9	10
<i>Acacia hakeoides</i>	Hakea Wattle	-	-	1				1					1
<i>Acacia ligulata</i>	Umbrella Bush	-	-			1	1			1			1
<i>Acacia merrallii</i>	Merrall's Wattle	-	-	1									
<i>Acacia notabilis</i>	Notable Wattle	-	-	1		1	1				1		
<i>Acacia nyssophylla</i>	Spine Bush	-	-							1			
<i>Acacia oswaldii</i>	Umbrella Wattle	-	-	1					1		1		1
<i>Acacia sclerophylla</i> var. <i>sclerophylla</i>	Hard-leaf Wattle	-	-	1									1
* <i>Aeonium haworthii</i>	Pinwheel	-	-	1									
<i>Alyxia buxifolia</i>	Sea Box	-	-	1		1							
* <i>Arctotheca calendula</i>	Cape Weed	-	-		1					1	1		
# <i>Asparagus asparagoides</i> f. <i>asparagoides</i>	Bridal Creeper	-	-		1	1							
* <i>Asphodelus fistulosus</i>	Onion Weed	-	-	1		1	1	1	1	1		1	1
<i>Atriplex semibaccata</i>	Berry Saltbush	-	-	1									
<i>Atriplex stipitata</i>	Bitter Saltbush	-	-	1		1	1	1	1		1	1	1
<i>Austrostipa acrociliata</i>	Graceful Spear-grass	-	-							1	1	1	1
<i>Austrostipa elegantissima</i>	Feather Spear-grass	-	-	1		1							
<i>Austrostipa nitida</i>	Balcarra Spear-grass	-	-		1	1	1	1	1	1	1	1	1
<i>Austrostipa platychaeta</i>	Flat-awn Spear-grass	-	-	1						1			
* <i>Avena barbata</i>	Bearded Oat	-	-	1	1		1	1	1	1		1	1
<i>Brachyscome ciliaris</i> var.	Variable Daisy	-	-					1		1			
* <i>Brassica tournefortii</i>	Wild Turnip	-	-	1				1	1			1	
* <i>Bromus diandrus</i>	Great Brome	-	-		1			1					
* <i>Bromus rubens</i>	Red Brome	-	-							1			
<i>Callitris gracilis</i>	Southern Cypress Pine	-	-	1		1	1	1					1
<i>Cassytha melantha</i>	Coarse Dodder-laurel	-	-	1									
<i>Casuarina pauper</i>	Black Oak	-	-	1		1							1

Species	Common	Conservation status		Vegetation association									
		EPBC Act	NPW Act	1	2	3	4	5	6	7	8	9	10
<i>*Carrichtera annua</i>	Ward's Weed	-	-	1		1	1		1	1	1	1	1
<i>*Carthamus lanatus</i>	Saffron Thistle	-	-									1	
<i>Comesperma volubile</i>	Love Creeper	-	-	1				1					
<i>Cratystylis conocephala</i>	Bluebush Daisy	-	-	1									
<i>Dampiera rosmarinifolia</i>	Rosemary Dampiera	-	-	1	1								1
<i>Dianella revoluta</i> var.		-	-	1		1							
<i>Dodonaea viscosa</i> ssp.	Sticky Hop-bush	-	-										1
<i>#Echium plantagineum</i>	Salvation Jane	-	-									1	
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	Ruby Saltbush	-	-	1		1		1	1	1	1		1
<i>Eremophila glabra</i> ssp. <i>glabra</i>	Tar Bush	-	-	1		1		1					
<i>Eremophila scoparia</i>	Broom Emubush	-	-	1								1	
<i>Eucalyptus calcareana</i>	Nundroo Mallee	-	-	1									
<i>Eucalyptus calycogona</i> ssp. <i>calycogona</i>	Square-fruit Mallee	-	-	1									
<i>Eucalyptus gracilis</i>	Yorrell	-	-	1									
<i>Eucalyptus incrassata</i>	Ridge-fruited Mallee	-	-	1									
<i>Eucalyptus oleosa</i> ssp. <i>ampliata</i>	Red Mallee	-	-	1				1	1		1	1	1
<i>Eucalyptus porosa</i>	Mallee Box	-	-					1			1		
<i>Eucalyptus socialis</i> ssp.	Beaked Red Mallee	-	-	1									
<i>Exocarpos aphyllus</i>	Leafless Cherry	-	-	1		1					1		
<i>Geijera linearifolia</i>	Sheep Bush	-	-	1		1	1				1		1
<i>Grevillea anethifolia</i>		-	R		1								
<i>Grevillea huegelii</i>	Comb Grevillea	-	-	1									1
<i>Hibbertia virgata</i>	Twiggy Guinea-flower	-	-	1									
<i>*Hordeum glaucum</i>	Blue Barley-grass	-	-	1	1	1		1	1	1	1	1	1
<i>Lomandra effusa</i>	Scented Mat-rush	-	-	1		1					1		
<i>Maireana brevifolia</i>	Short-leaf Bluebush	-	-	1	1				1			1	1
<i>Maireana erioclada</i>	Rosy Bluebush	-	-	1		1	1						
<i>Maireana pentatropis</i>	Erect Mallee Bluebush	-	-	1									



Species	Common	Conservation status		Vegetation association										
		EPBC Act	NPW Act	1	2	3	4	5	6	7	8	9	10	
<i>Maireana sedifolia</i>	Bluebush	-	-	1										
<i>Maireana trichoptera</i>	Hairy-fruit Bluebush	-	-	1										
<i>#Marrubium vulgare</i>	Horehound	-	-						1					
<i>Melaleuca lanceolata</i>	Dryland Tea-tree	-	-	1										
<i>Melaleuca uncinata</i>	Broombush	-	-	1	1									
<i>Minuria leptophylla</i>	Minnie Daisy	-	-	1				1		1				
<i>*Moraea setifolia</i>	Thread Iris	-	-	1				1	1	1	1			
<i>Myoporum platycarpum ssp.</i>	False Sandalwood	-	-	1										1
<i>Olearia muelleri</i>	Mueller's Daisy-bush	-	-	1										
<i>Olearia ramulosa</i>	Twiggy Daisy-bush	-	-								1			
<i>*Papaver hybridum</i>	Rough Poppy	-	-	1										
<i>Pimelea microcephala ssp. microcephala</i>	Shrubby Riceflower	-	-	1	1	1				1				
<i>Pittosporum angustifolium</i>	Native Apricot	-	-	1		1	1	1			1	1	1	
<i>*Reichardia tingitana</i>	False Sowthistle	-	-	1				1	1			1		
<i>Rhagodia crassifolia</i>	Fleshy Saltbush	-	-	1										
<i>Rhagodia parabolica</i>	Mealy Saltbush	-	-								1			
<i>Rhagodia preissii ssp. preissii</i>	Mallee Saltbush	-	-	1							1			
<i>Roepora glauca</i>	Pale Twinleaf	-	-	1										
<i>Roepora ovata</i>	Dwarf Twinleaf	-	-	1										
<i>Rytidosperma caespitosum</i>	Common Wallaby-grass	-	-								1			1
<i>Salsola australis</i>	Buckbush	-	-	1				1			1			
<i>*Salvia verbenaca var. verbenaca</i>	Wild Sage	-	-	1			1	1	1	1	1			
<i>Santalum acuminatum</i>	Quandong	-	-	1	1		1							
<i>Sarcozona praecox</i>	Sarcozona	-	-	1										
<i>Scaevola spinescens</i>	Spiny Fanflower	-	-	1		1		1						1
<i>Sclerolaena diacantha</i>	Grey Bindyi	-	-	1										1
<i>Sclerolaena uniflora</i>	Small-spine Bindyi	-	-	1										

Species	Common	Conservation status		Vegetation association									
		EPBC Act	NPW Act	1	2	3	4	5	6	7	8	9	10
<i>Senna artemisioides</i> ssp. <i>artemisioides</i> x ssp. <i>filifolia</i>	Desert Senna	-	-	1				1					
<i>Senna artemisioides</i> ssp. <i>petiolaris</i>		-	-	1				1					
<i>Senna artemisioides</i> ssp. <i>X coriacea</i>	Broad-leaf Desert Senna	-	-	1	1		1	1	1	1	1	1	1
* <i>Sisymbrium erysimoides</i>	Smooth Mustard	-	-	1				1				1	
* <i>Sonchus oleraceus</i>	Common Sow-thistle	-	-						1				
<i>Velleia arguta</i>	Toothed Velleia	-	-							1			
<i>Vittadinia gracilis</i>	Woolly New Holland Daisy	-	-	1						1			1
<i>Zygophyllum aurantiacum/eremaeum</i>	Shrubby Twinleaf	-	-	1	1								1
<b>Total flora species</b>				<b>69</b>	<b>14</b>	<b>22</b>	<b>14</b>	<b>26</b>	<b>18</b>	<b>20</b>	<b>22</b>	<b>17</b>	<b>28</b>
<b>Total native flora species</b>				<b>58</b>	<b>9</b>	<b>18</b>	<b>10</b>	<b>17</b>	<b>8</b>	<b>12</b>	<b>17</b>	<b>8</b>	<b>25</b>
<b>Total introduced species</b>				<b>11</b>	<b>5</b>	<b>4</b>	<b>4</b>	<b>9</b>	<b>10</b>	<b>8</b>	<b>5</b>	<b>9</b>	<b>3</b>

\* = Introduced species.

# = Declared weed listed under the LSA Act.

#### Conservation codes

CE: Critically Endangered. E: Endangered. V: Vulnerable. R: Rare.

# Appendix D

Representative  
Photographs of  
Vegetation Associations

## Appendix D Representative Photographs of Vegetation Associations



**Vegetation Association 1.** *Eucalyptus oleosa* ssp. *ampliata*, *Eucalyptus gracilis*, *Eucalyptus calycogona* ssp. *calycogona*, *Eucalyptus socialis* ssp., *Eucalyptus calcareana*, *Eucalyptus incrassata*  
Mixed Mallee.



**Vegetation Association 2.** *Melaleuca uncinata* Shrubland.





**Vegetation Association 3. *Casuarina pauper* Low Woodland.**

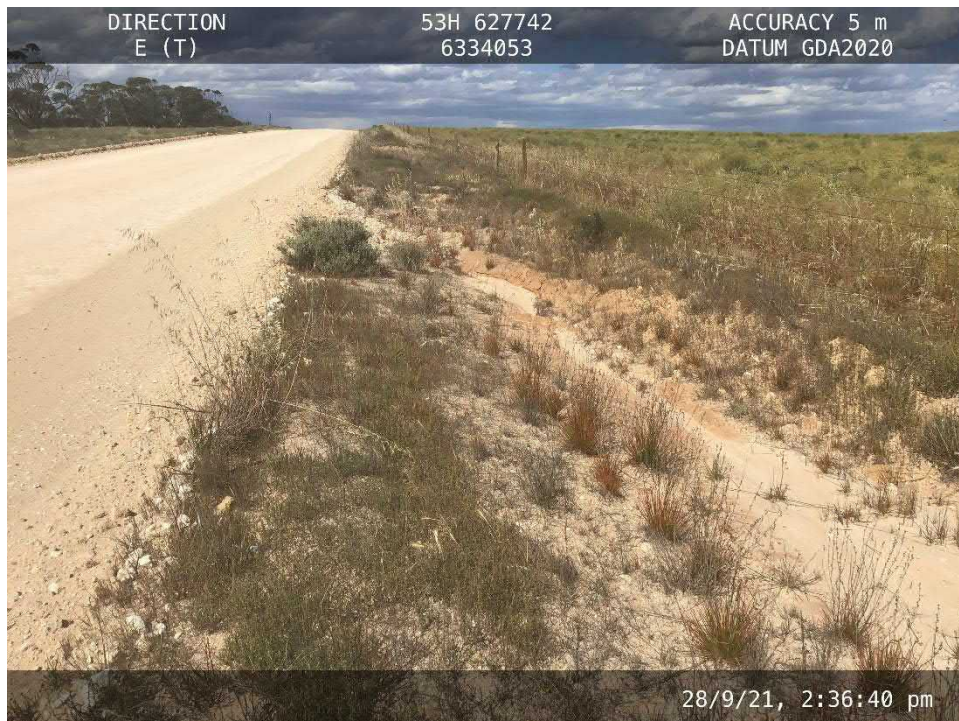


**Vegetation Association 4. *Callitris gracilis* Low Woodland.**





**Vegetation Association 5.** *Senna artemisioides* ssp. *X coriacea* Shrubland.



**Vegetation Association 6.** *Avena barbata*, *Hordeum glaucum*, *Asphodelus fistulosus* Exotic Grassland +/- *Eucalyptus oleosa* ssp. *Ampliata*.





**Vegetation Association 7.** *Austrostipa nitida*, *Austrostipa acrociliata* Tussock Grassland.



**Vegetation Association 8.** *Eucalyptus porosa* Open Woodland.





**Vegetation Association 9.** *Eucalyptus oleosa* ssp. *ampliata* Very Open Mallee over *Atriplex stipitata* and introduced species *Avena barbata*, *Hordeum glaucum*, *Asphodelus fistulosus*.



**Vegetation Association 10.** *Senna artemisioides* ssp., *Pittosporum angustifolium*, *Acacia ligulata*, *Acacia sclerophylla* var. *sclerophylla* Mixed Open Shrubland.



# Appendix E

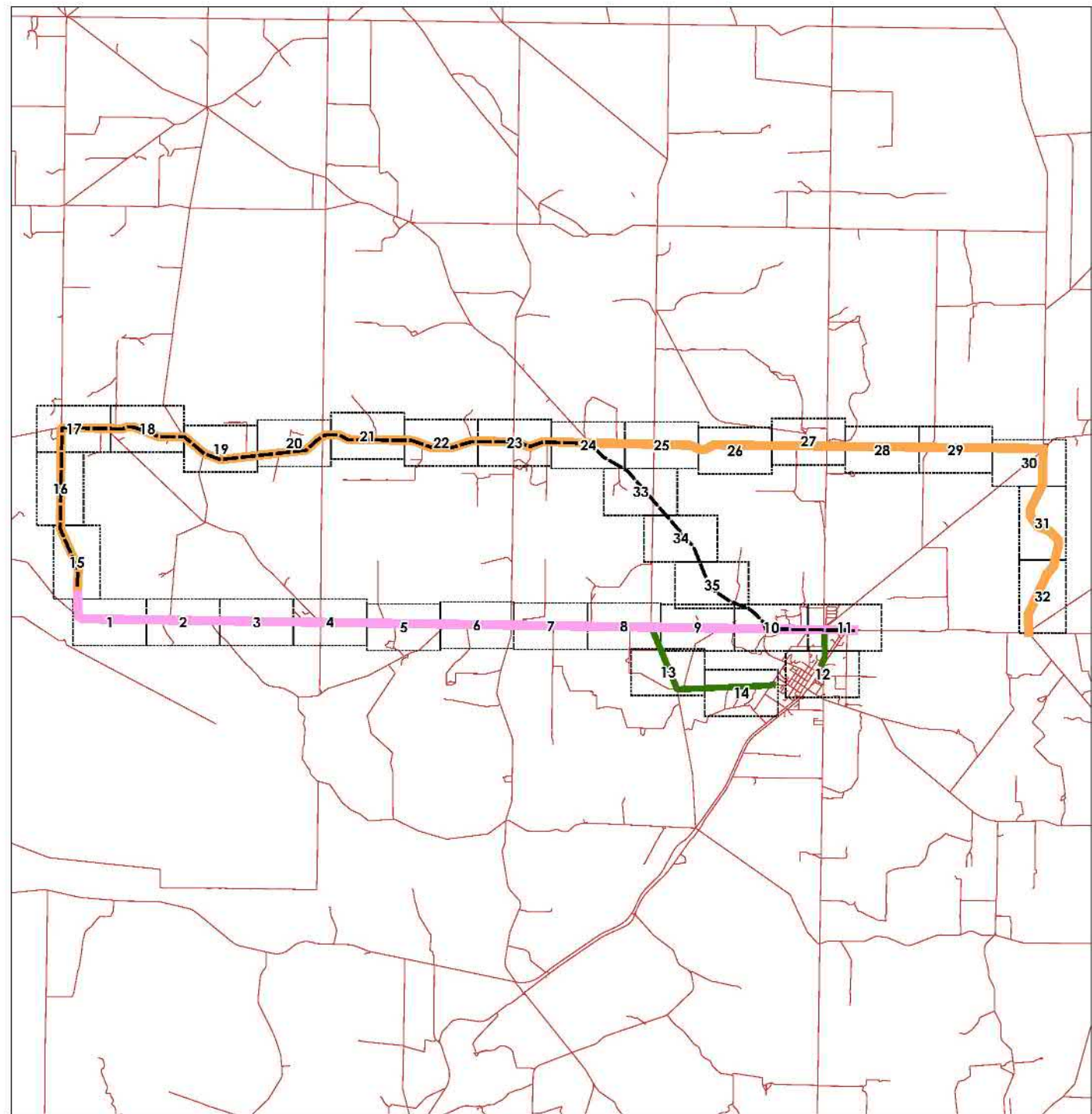
Figures of Vegetation  
Associations and  
Condition

# Kimba vegetation associations

## Vegetation association

Number denotes Veg type, Number in ( ) denotes condition

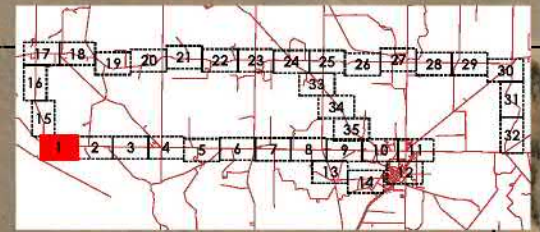
- 1. *Eucalyptus oleosa* ssp. *ampliata*, *Eucalyptus gracilis*, *Eucalyptus calycogona* ssp. *calycogona*, *Eucalyptus socialis* ssp., *Eucalyptus calcareana*, *Eucalyptus incrassata* Mixed Mallee
- 2. *Melaleuca uncinata* Shrubland
- 3. *Casuarina pauper* Low Woodland
- 4. *Callitris gracilis* Low Woodland
- 5. *Senna artemisioides* ssp. *X coriacea* Shrubland
- 6. *Avena barbata*, *Hordeum glaucum*, *Asphodelus fistulosus* Exotic Grassland +/- *Eucalyptus oleosa* ssp. *ampliata*
- 7. *Austrostipa nitida*, *Austrostipa acroclilata* Tussock Grassland
- 8. *Eucalyptus porosa* Open Woodland
- 9. *Eucalyptus oleosa* ssp. *ampliata* Very Open Mallee over *Atriplex stipitata* and introduced species *Avena barbata*, *Hordeum glaucum*, *Asphodelus fistulosus*
- 10. *Senna artemisioides* ssp., *Pittosporum angustifolium*, *Acacia ligulata*, *Acacia sclerophylla* var. *sclerophylla* Mixed Open Shrubland
- Option 1 – NRWFM local access road
- Option 2 – NRWFM local access road
- Option 3 – NRWFM local access road
- Preferred service route (incorporating Option 1 – NRWFM local access road)
- Road
- Page extent



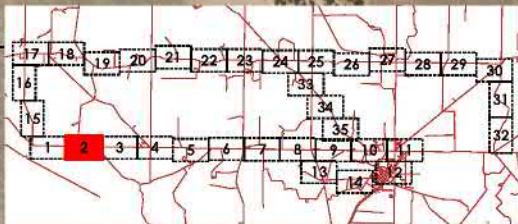
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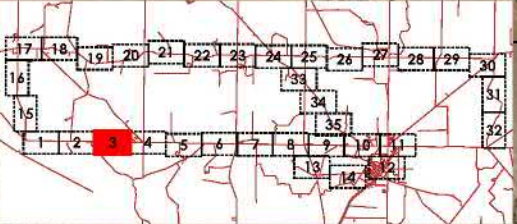
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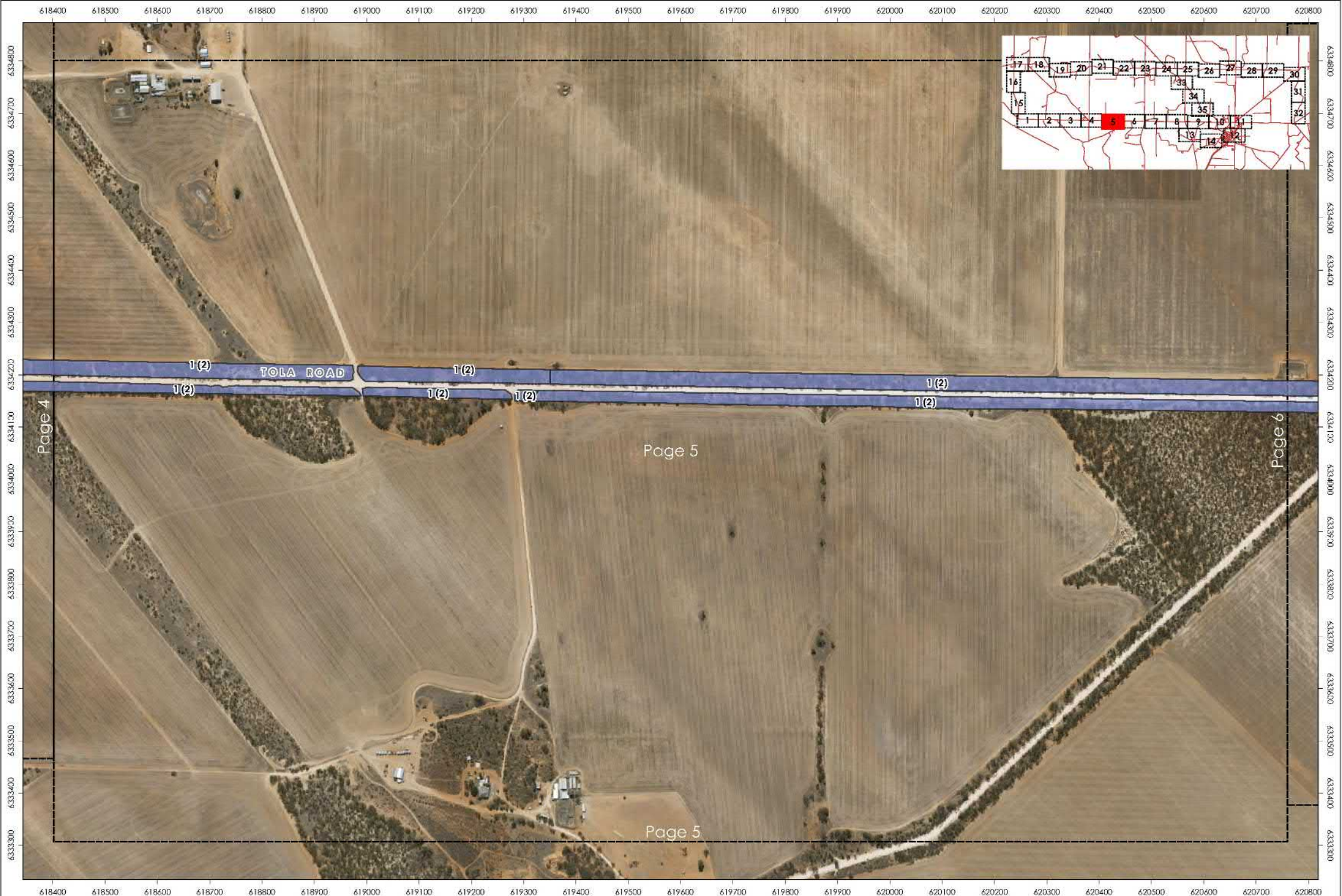
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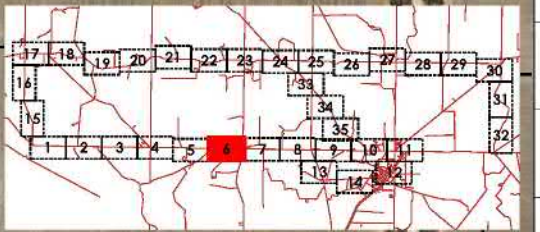
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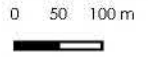
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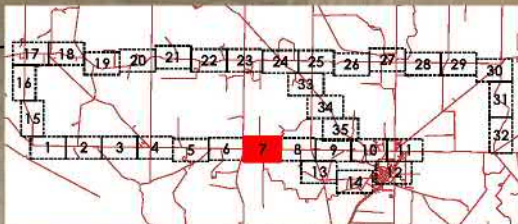
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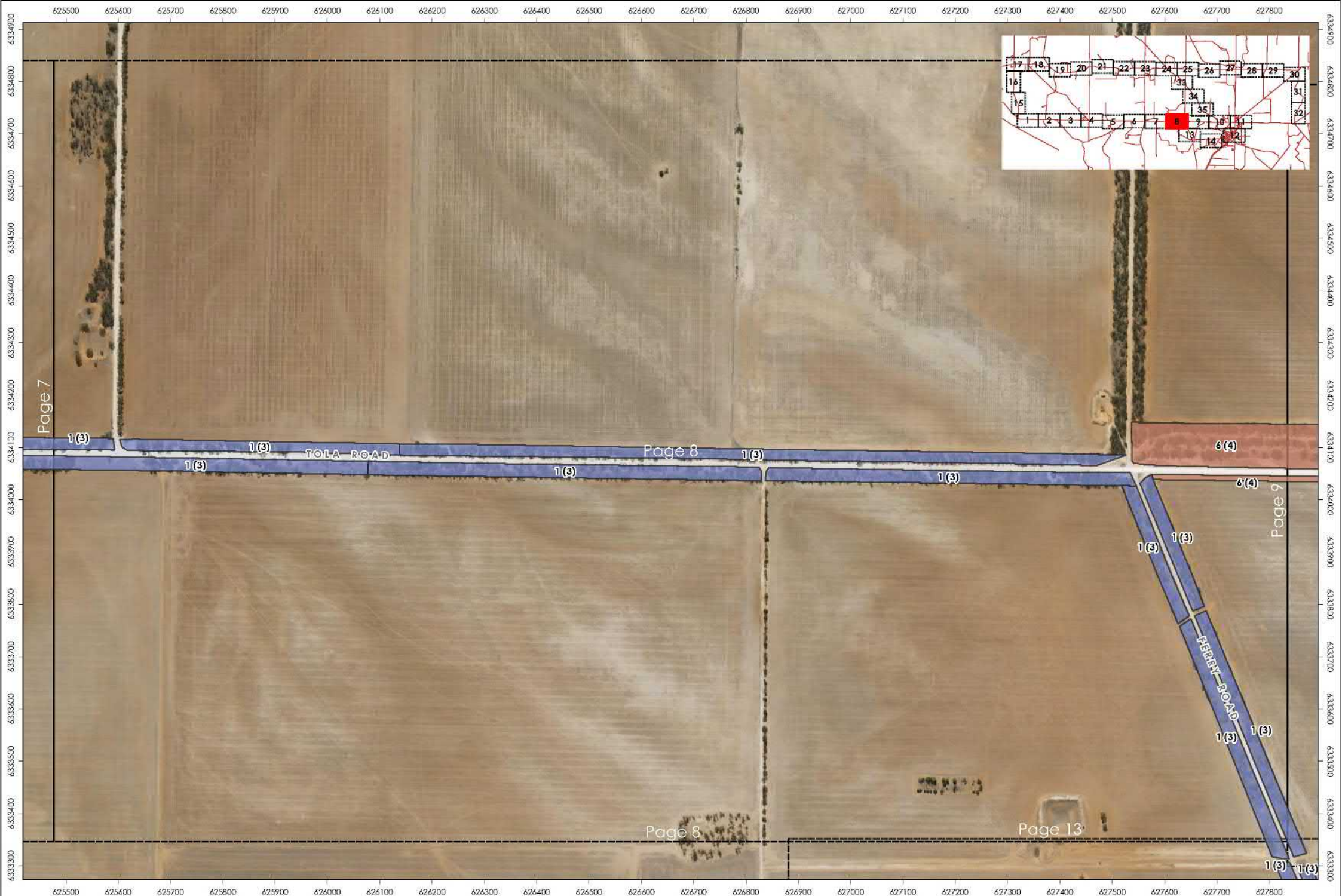
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TOLA ROAD







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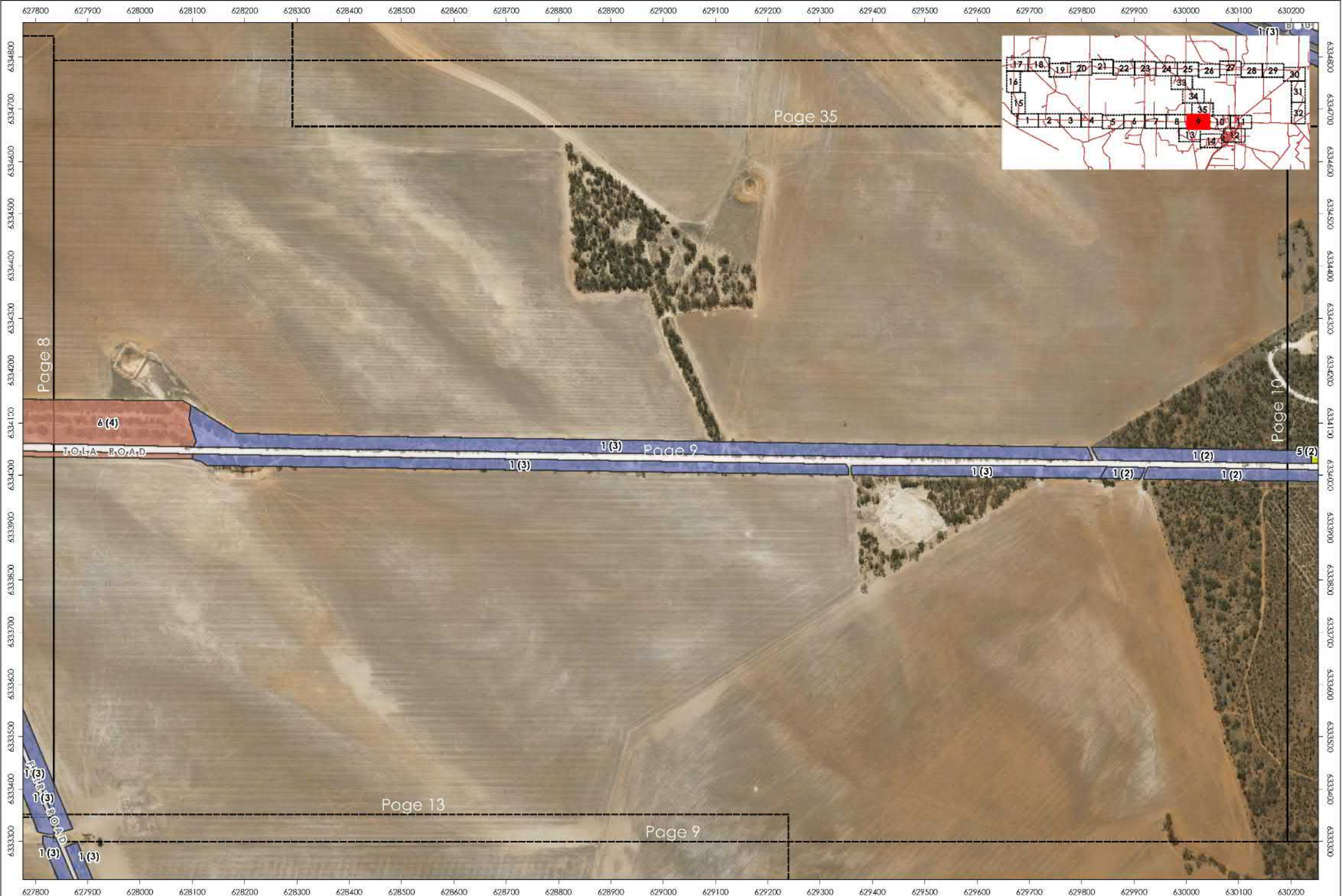
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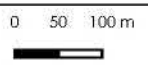


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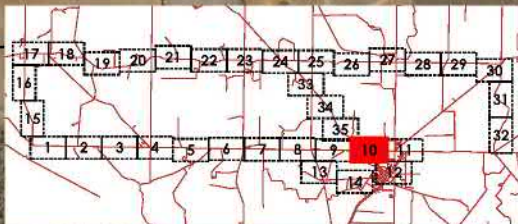
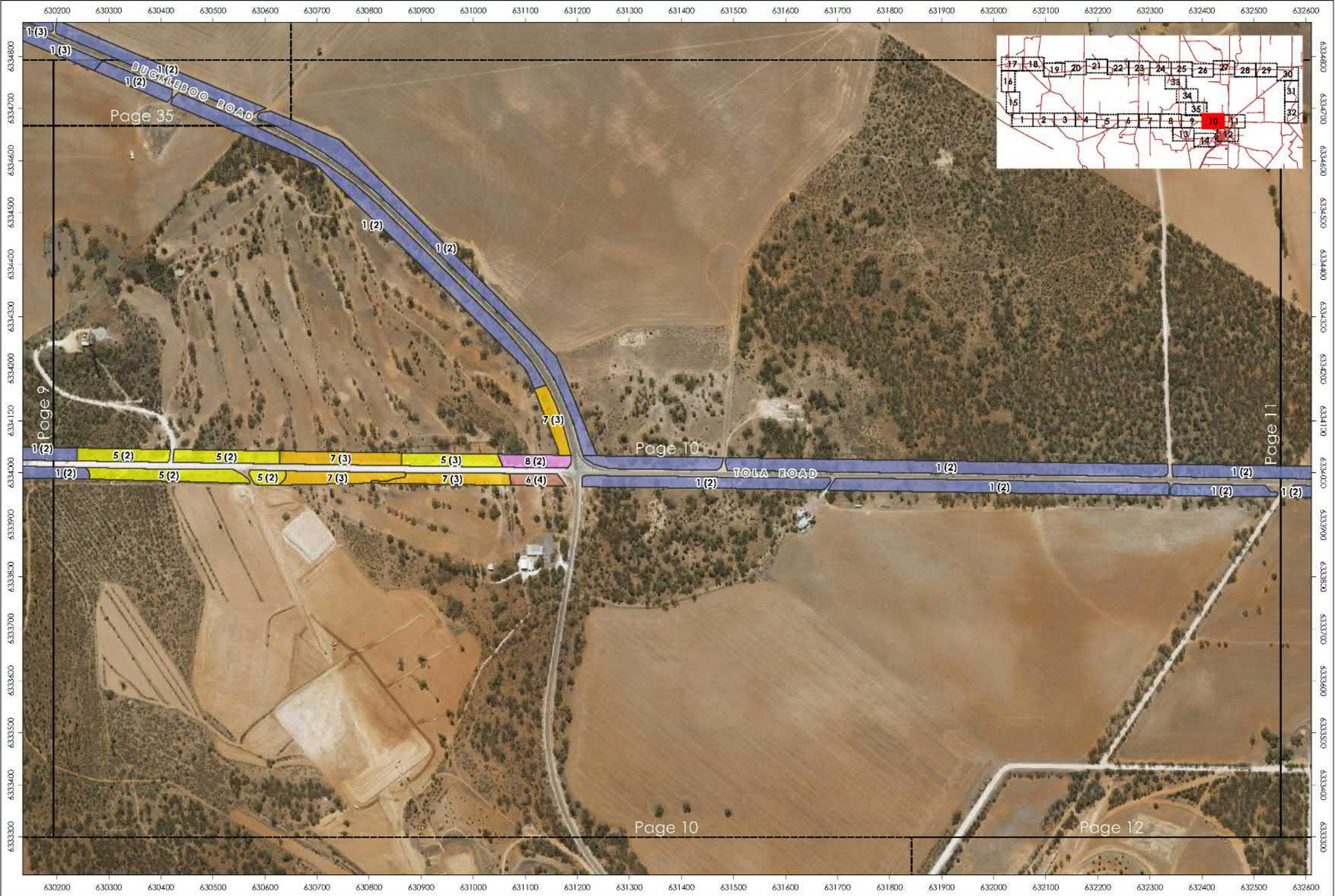
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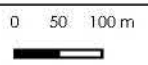
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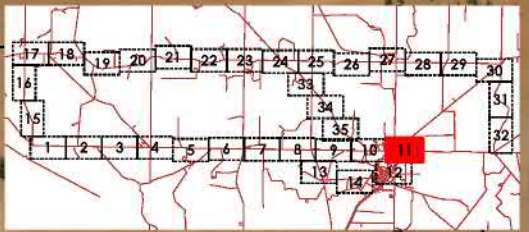
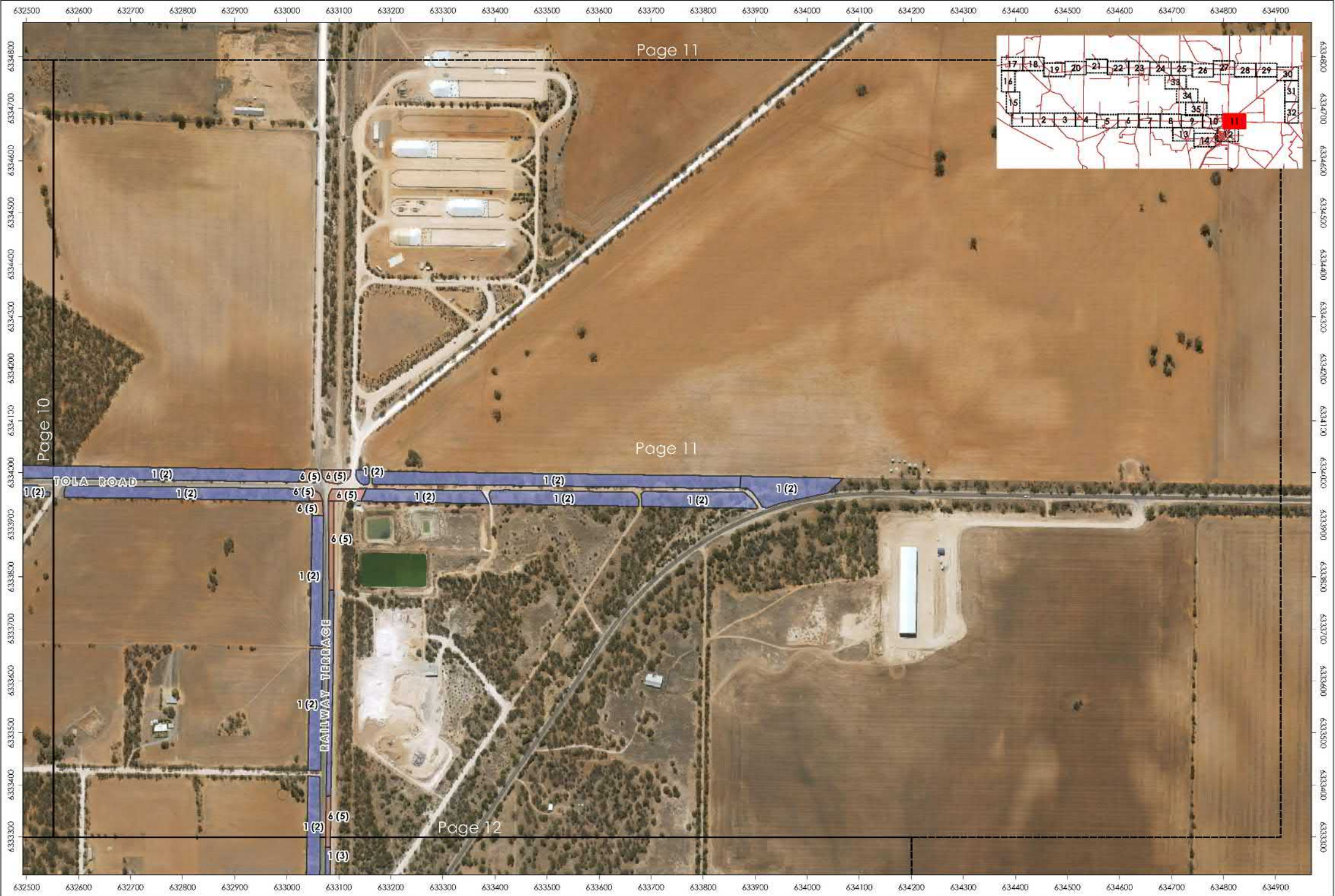
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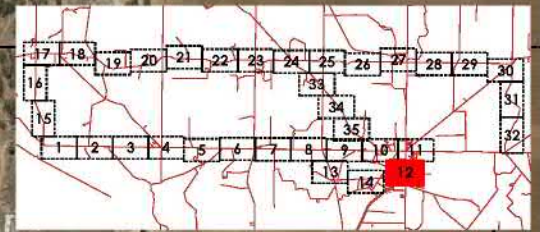


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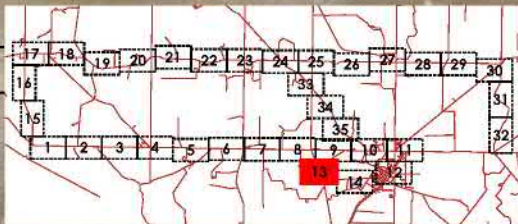
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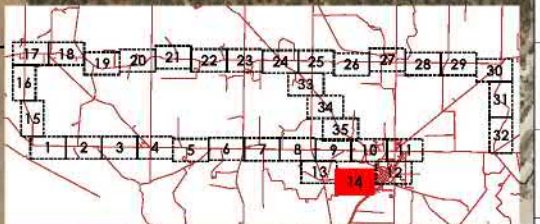
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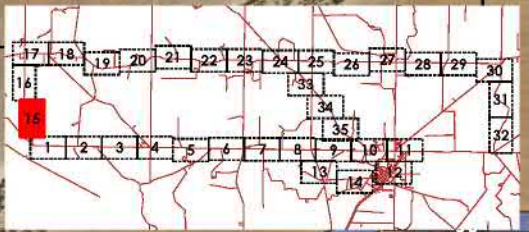








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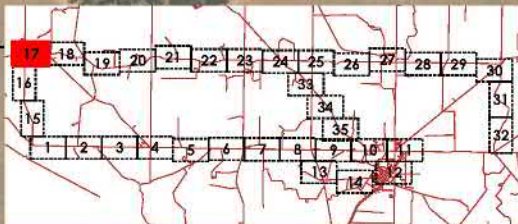
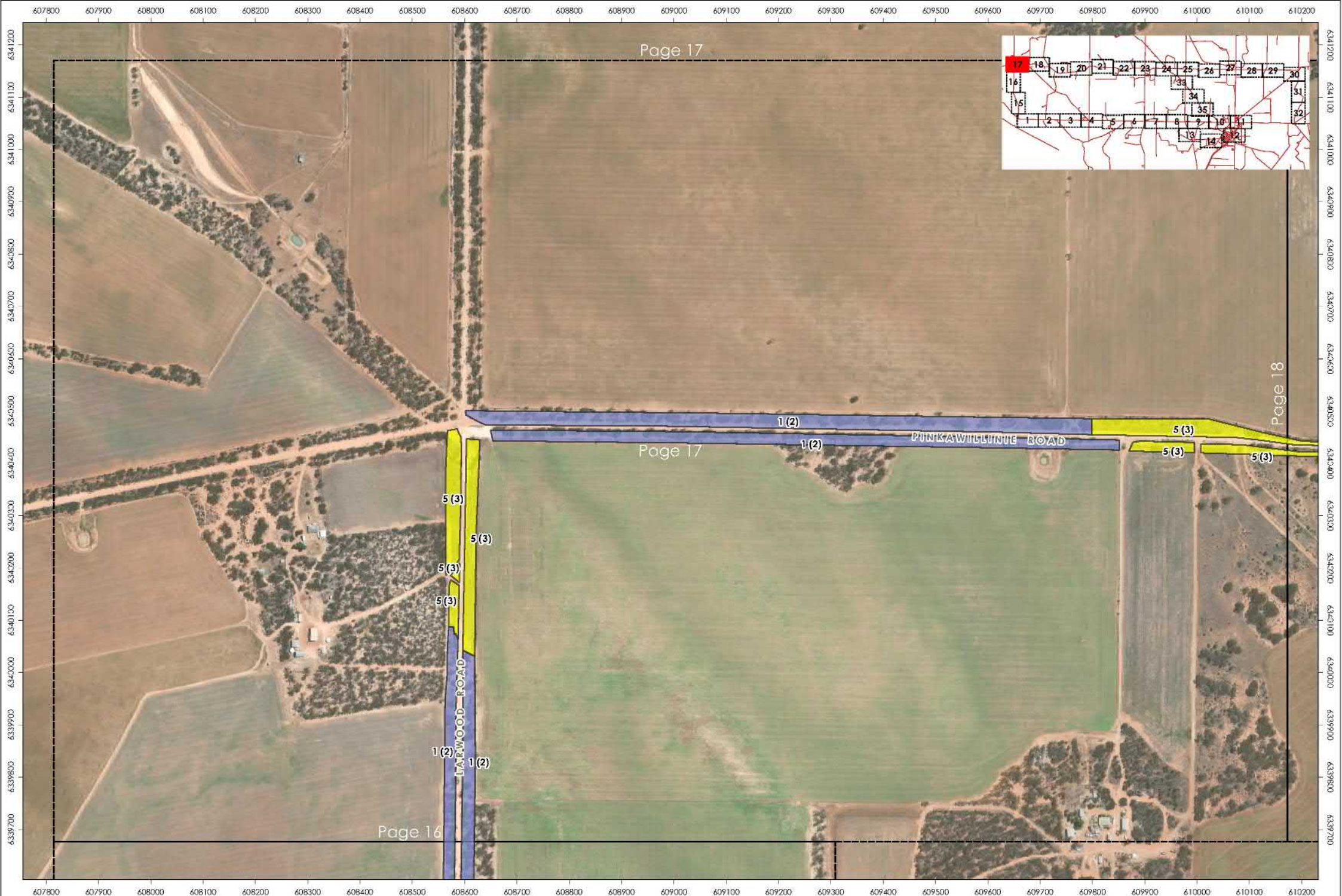
LARWOOD ROAD

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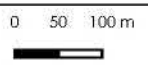






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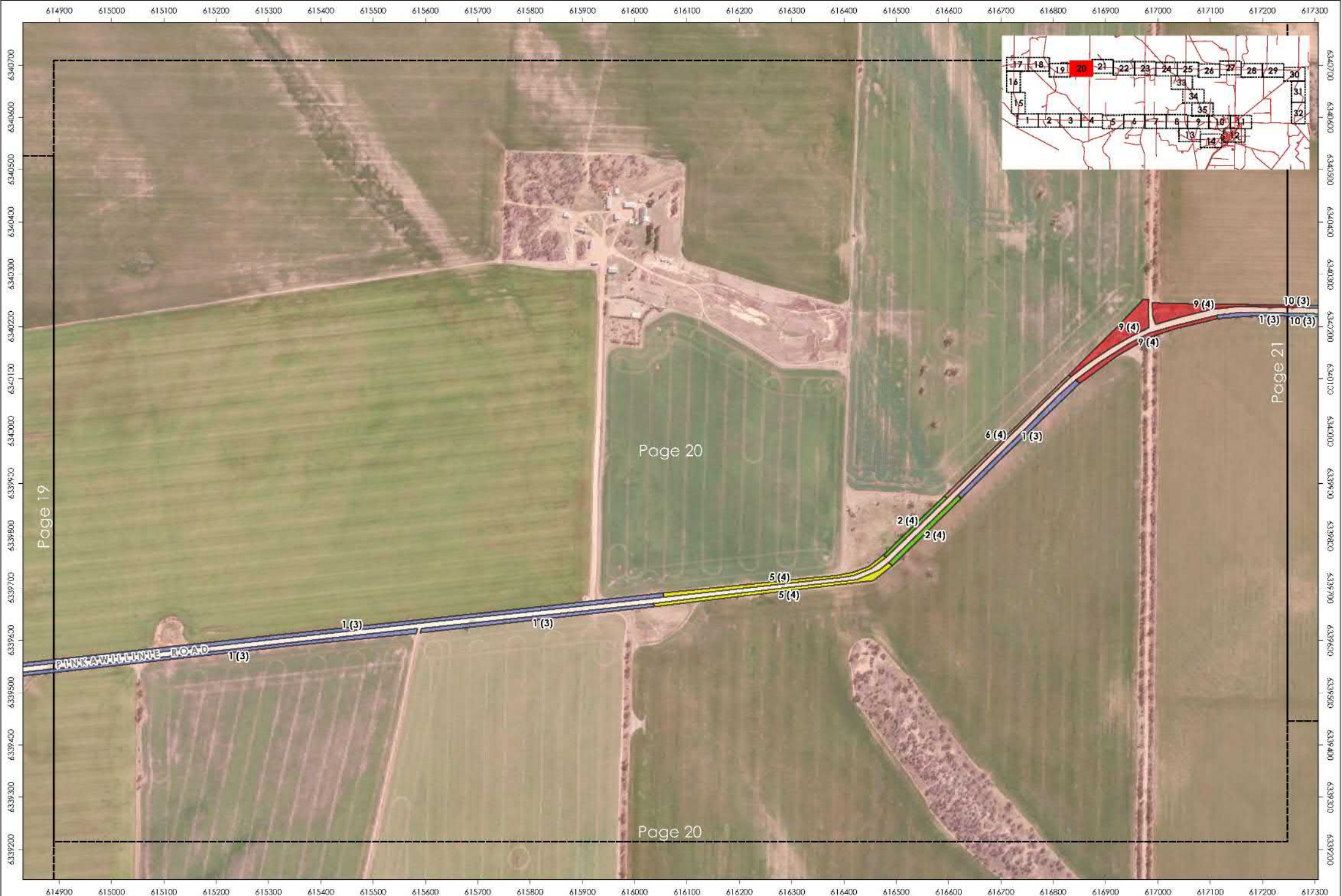




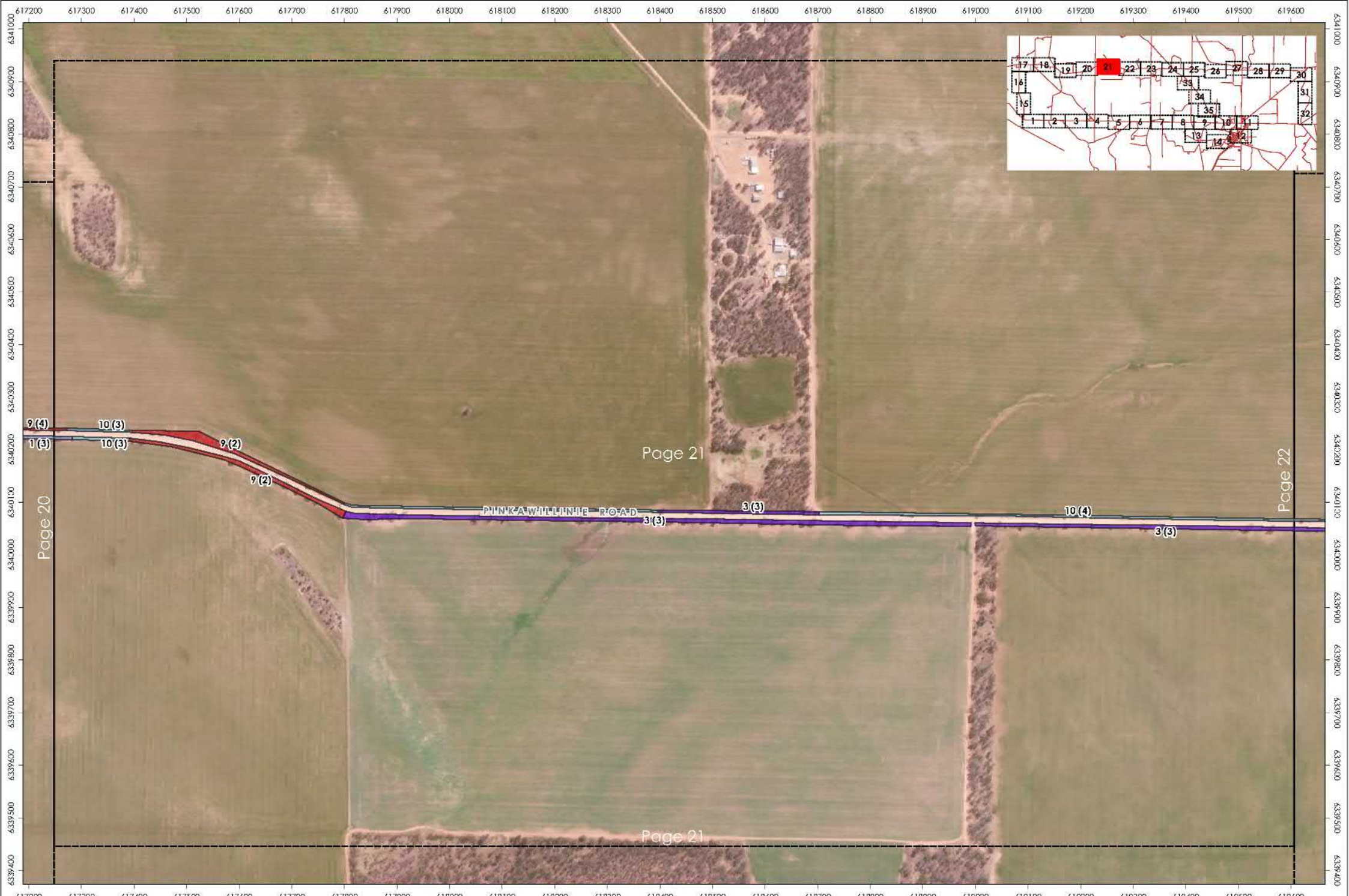
















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PINKAWILLIHE ROAD

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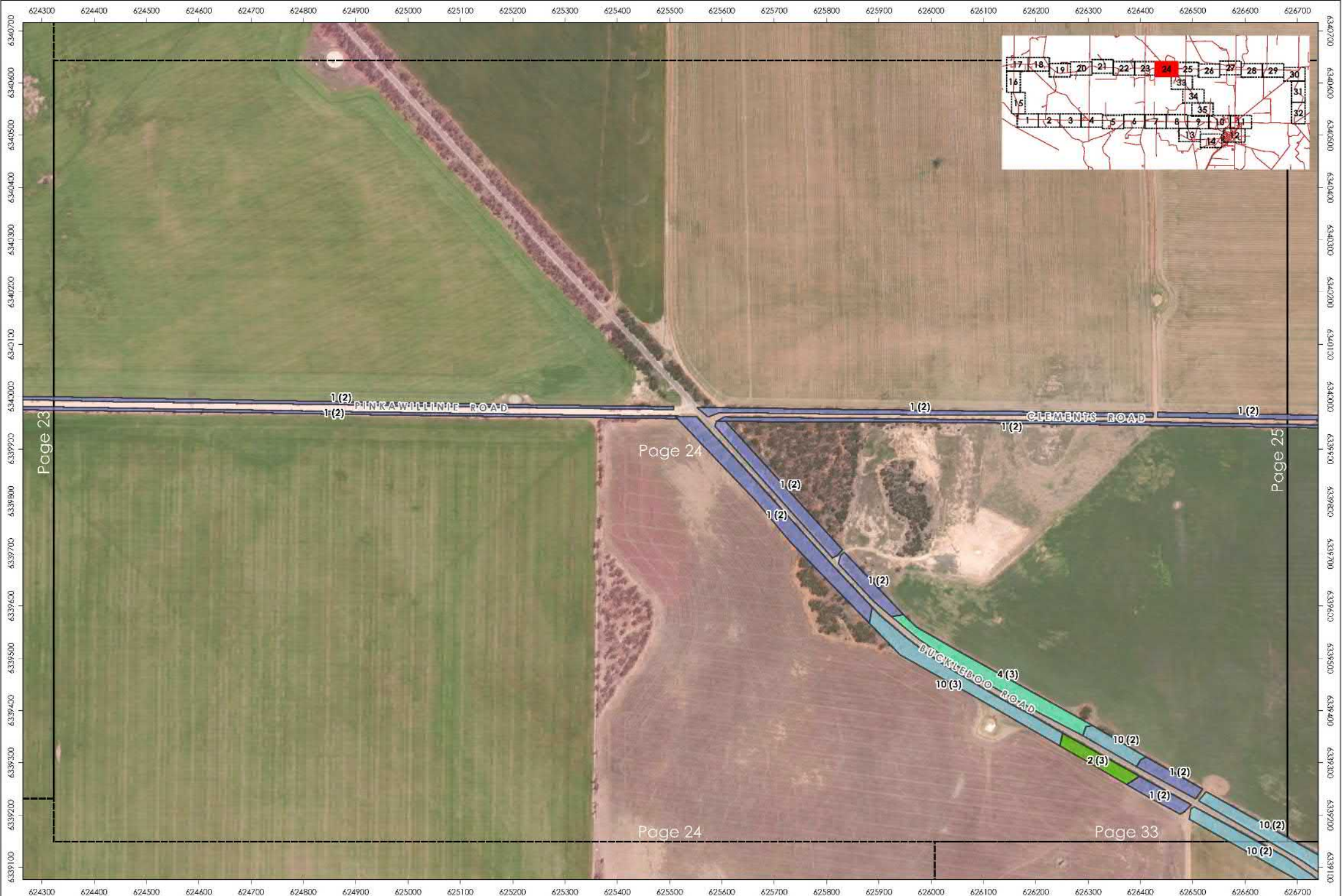
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BUCKLEBOO ROAD

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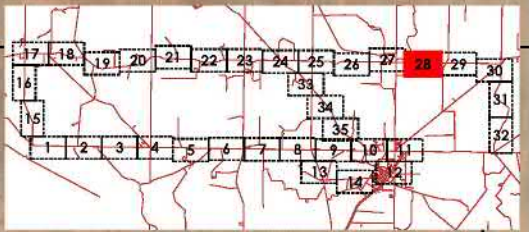
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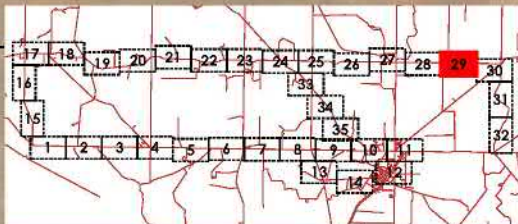
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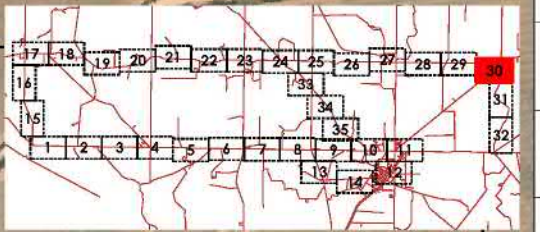
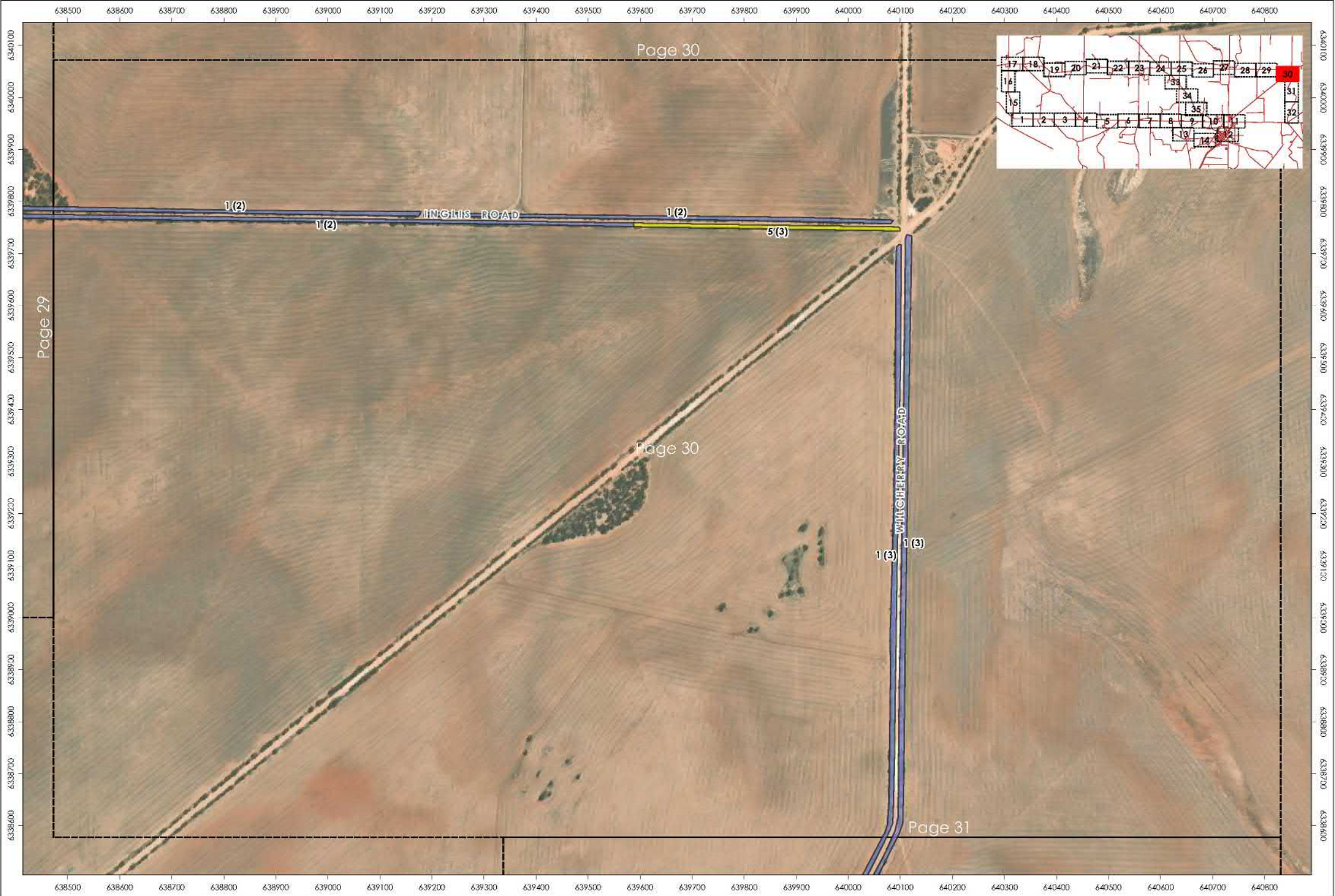
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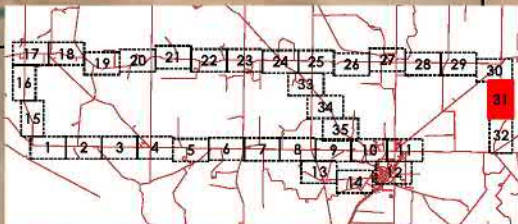








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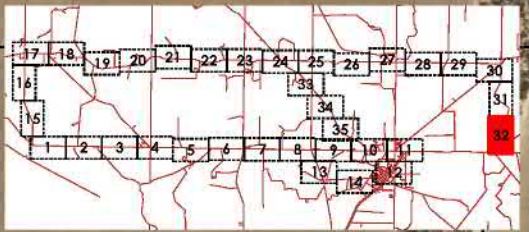
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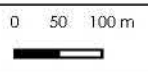
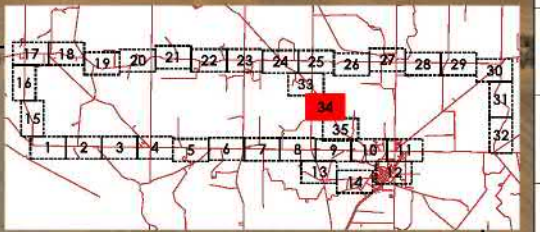






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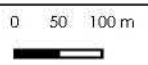
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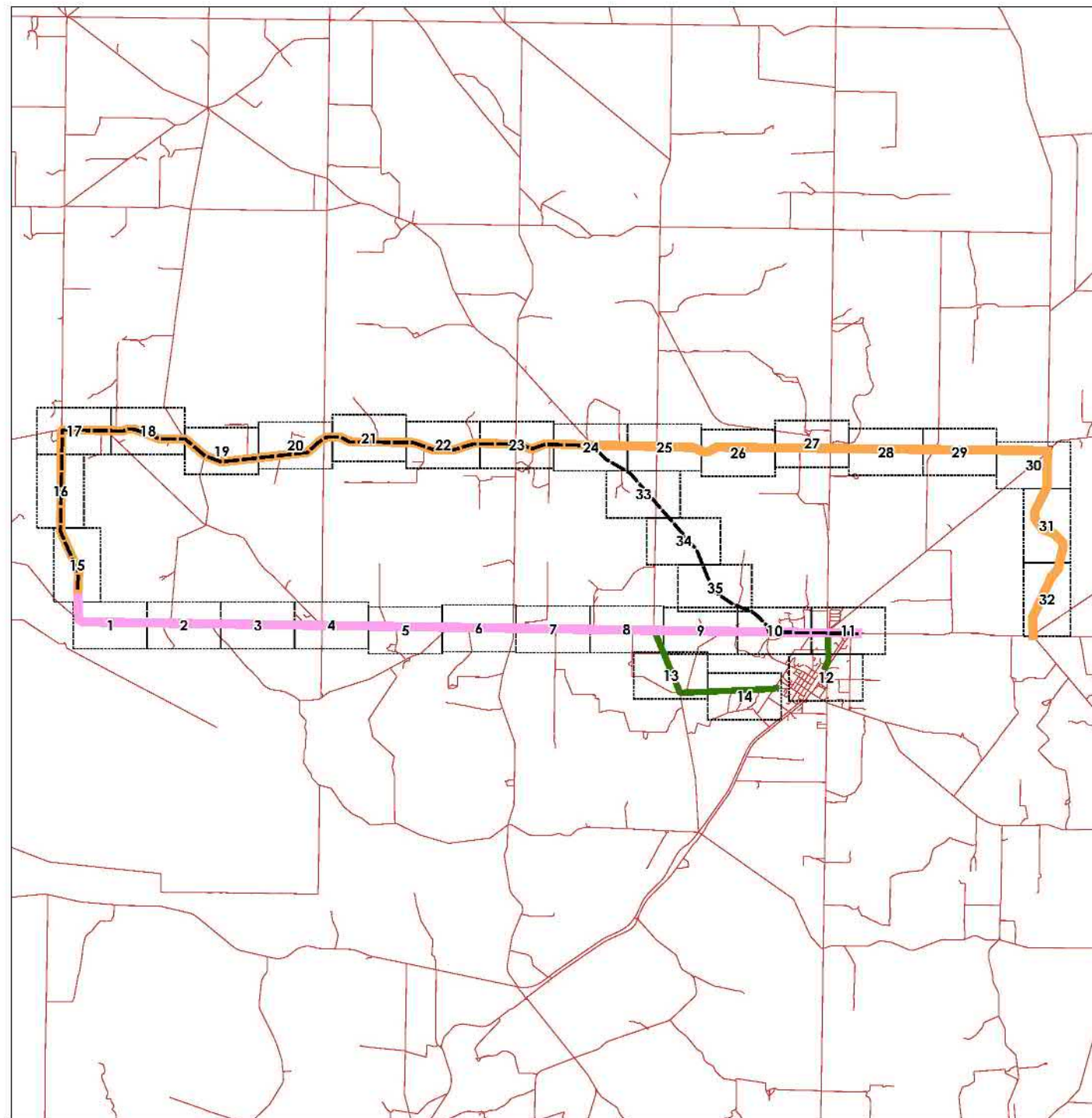


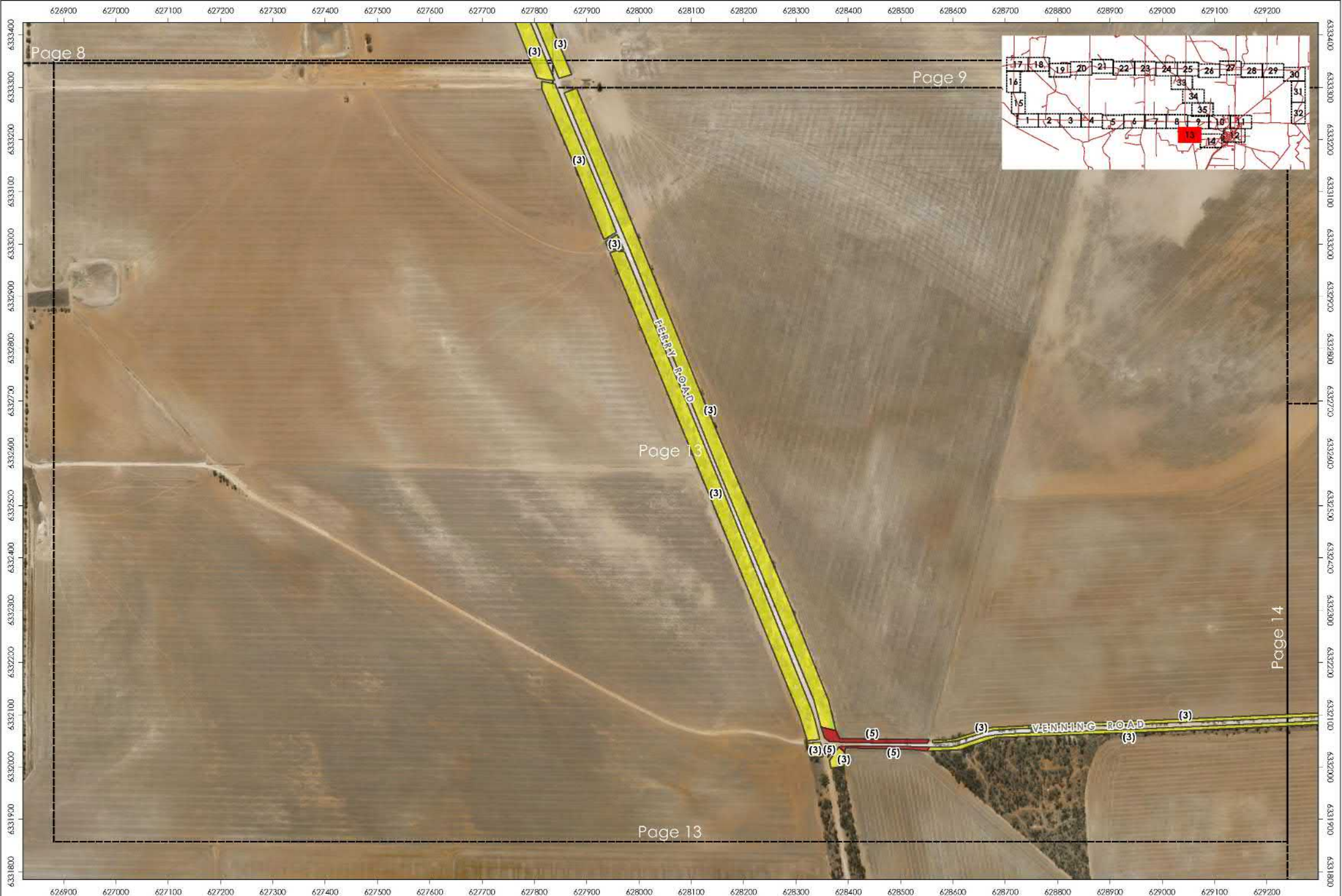


# Kimba vegetation condition

Vegetation condition  
Number in ( ) denotes condition

- 1. Excellent
- 2. Good
- 3. Moderate
- 4. Poor
- 5. Very poor
- Option 1 – NRWMF local access road
- Option 2 – NRWMF local access road
- Option 3 – NRWMF local access road
- Preferred service route (incorporating Option 1 – NRWMF local access road)
- Road
- Page extent





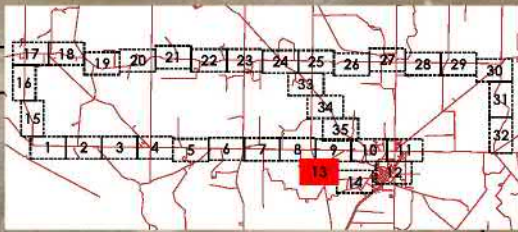
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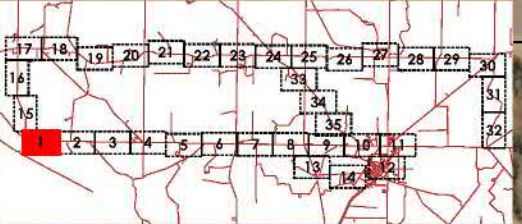
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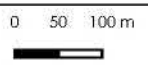
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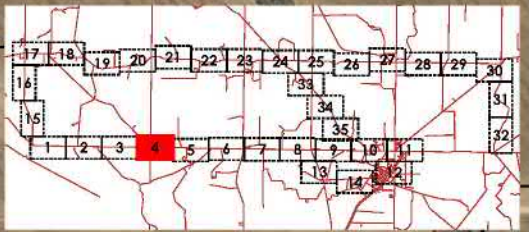
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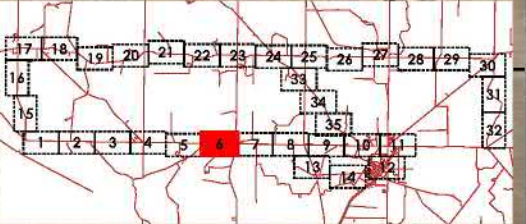
TOLA ROAD











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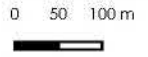
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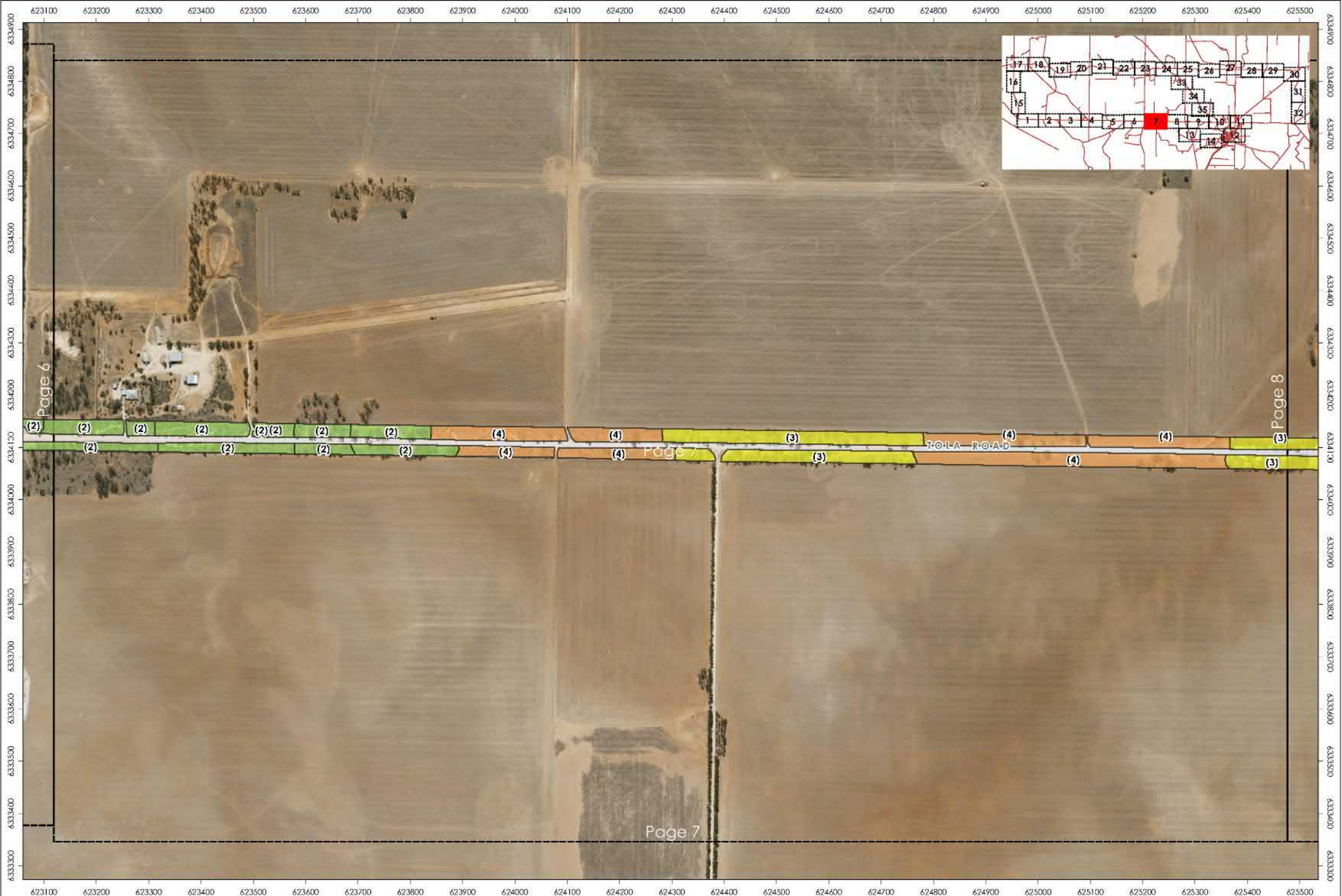
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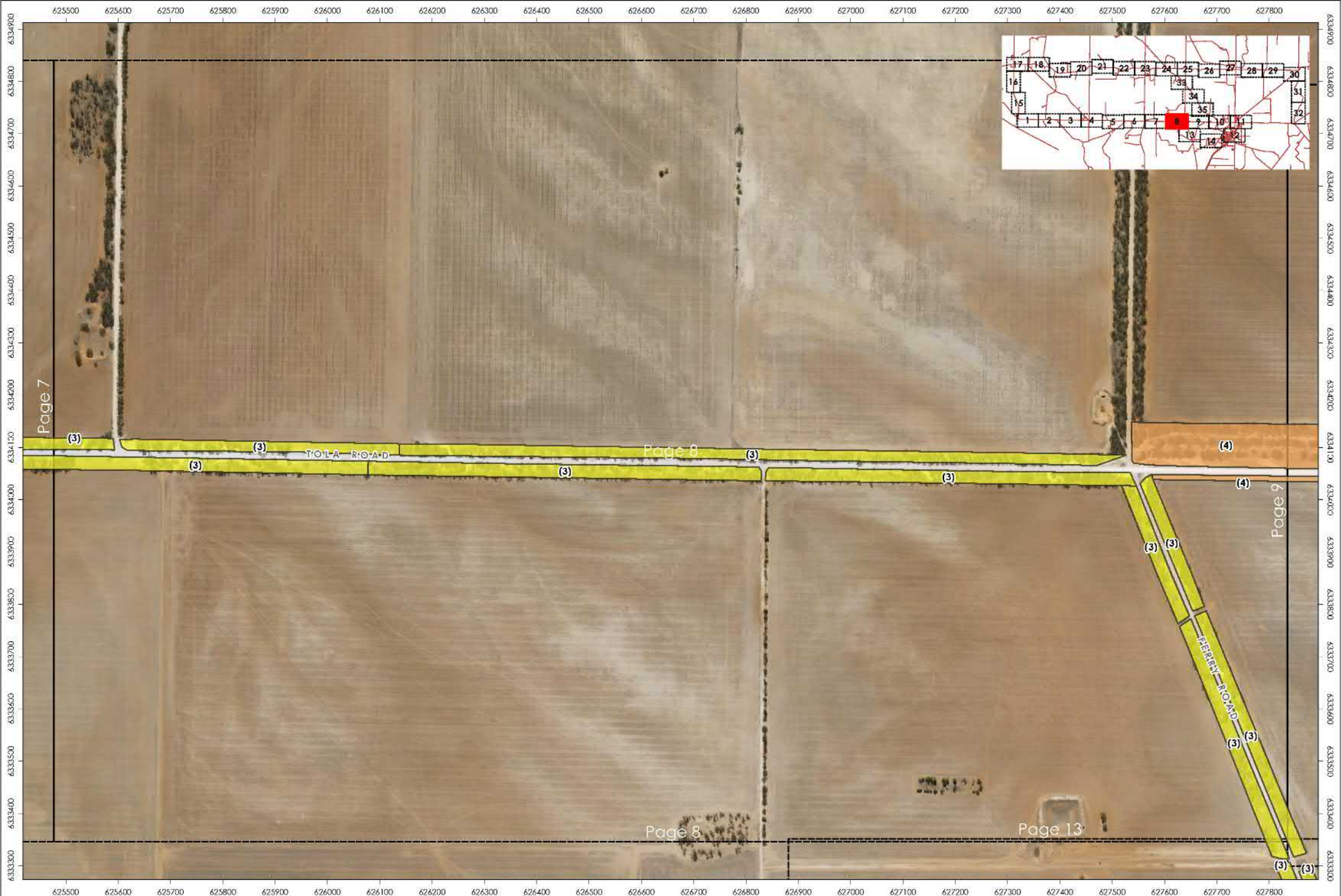
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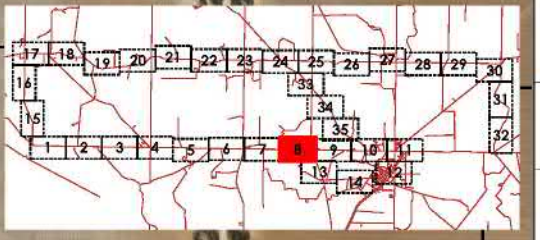




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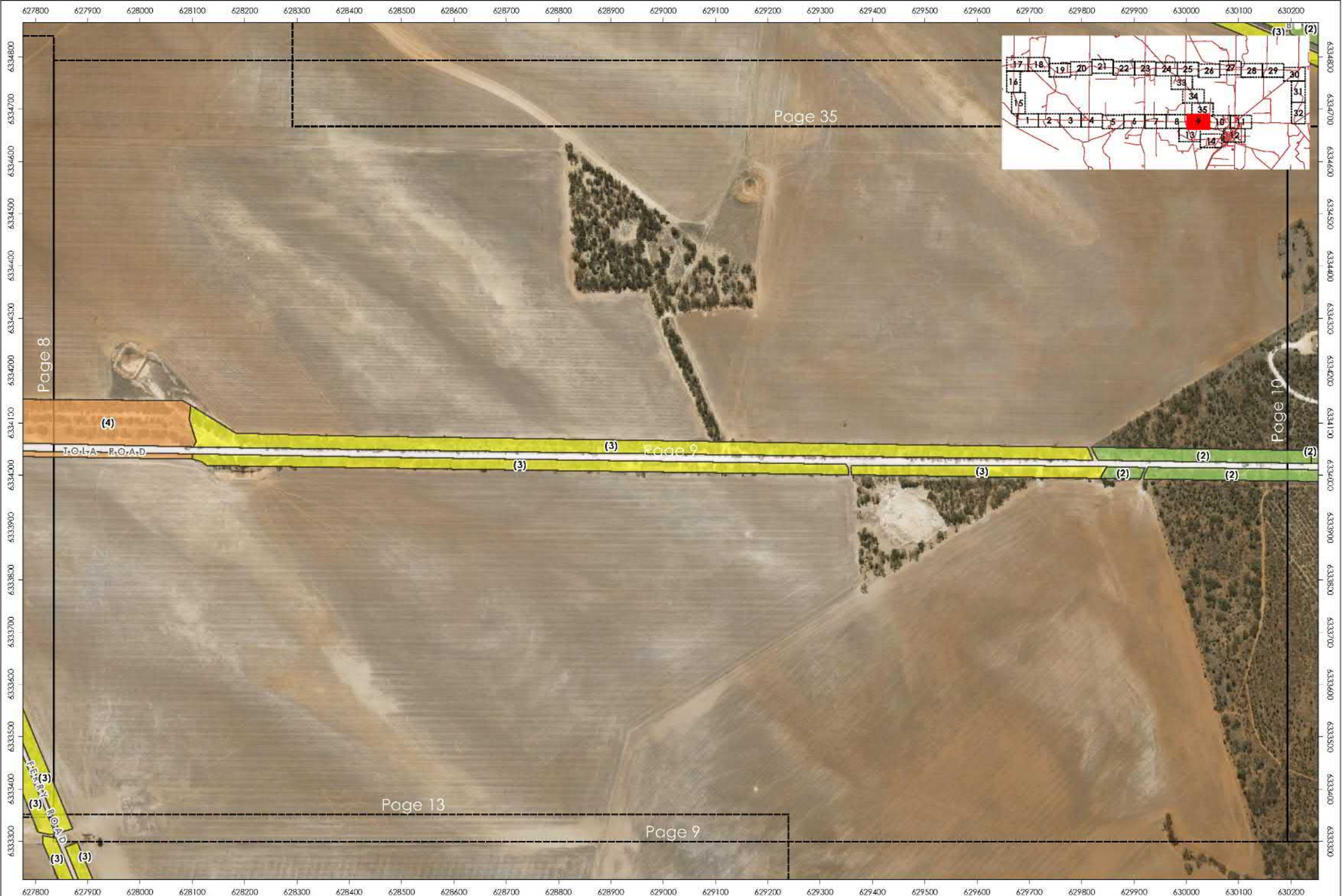
FERRY ROAD

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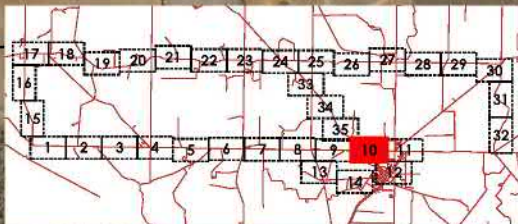
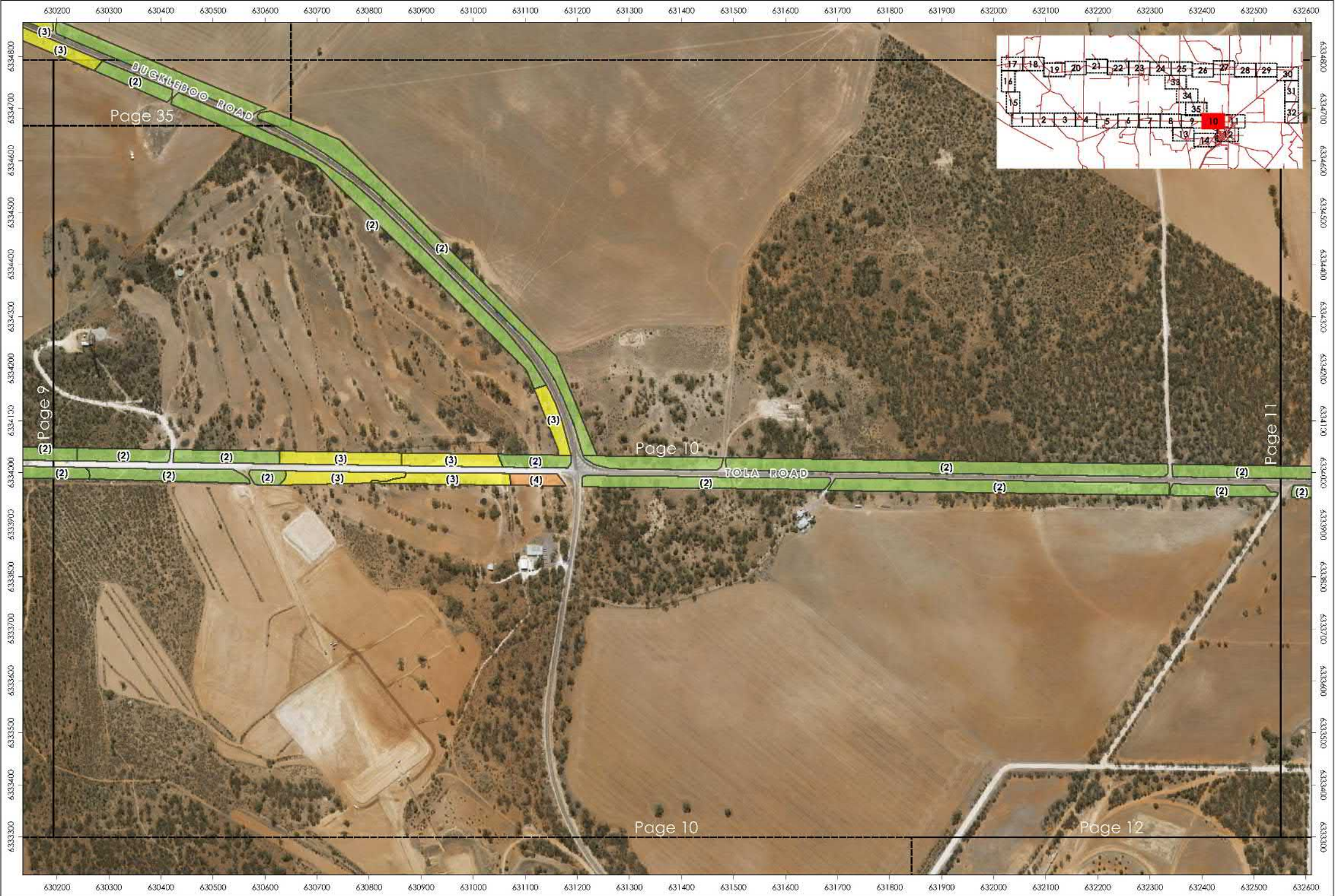
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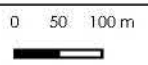
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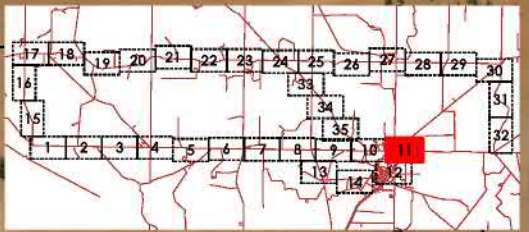
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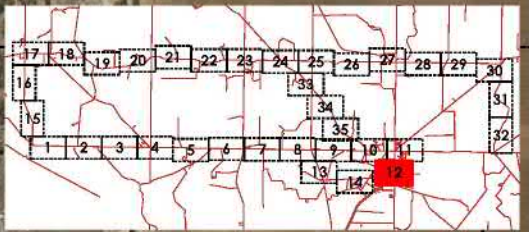
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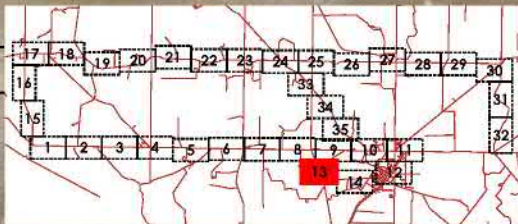
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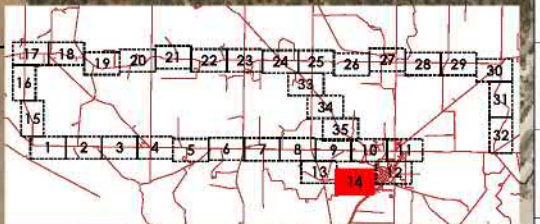




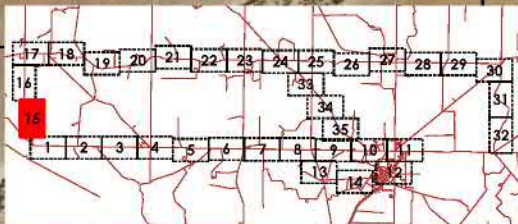
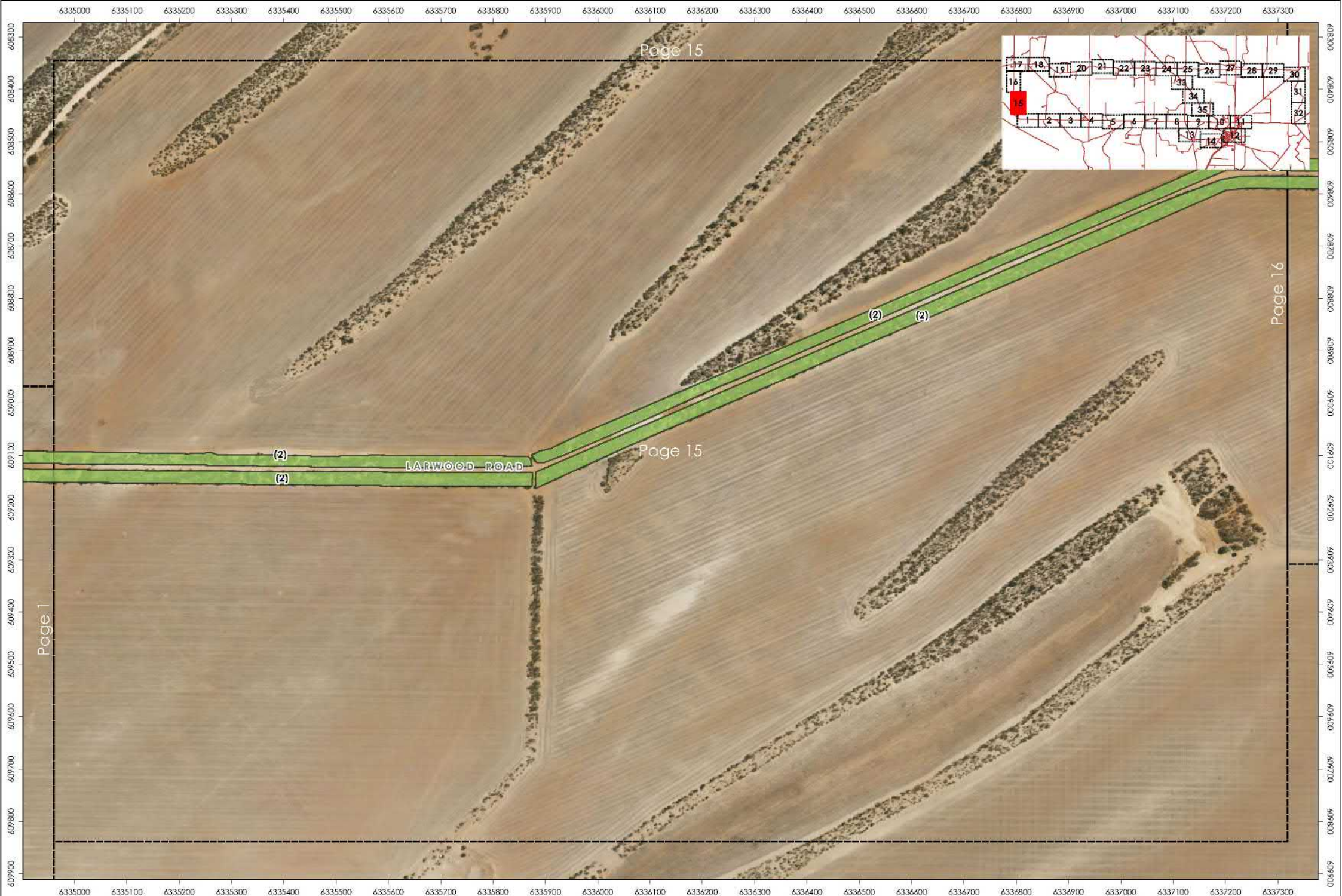
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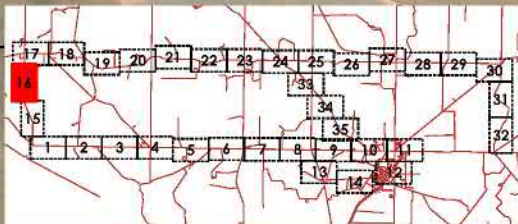








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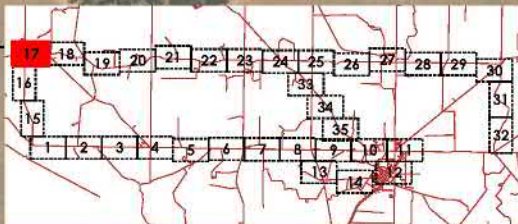
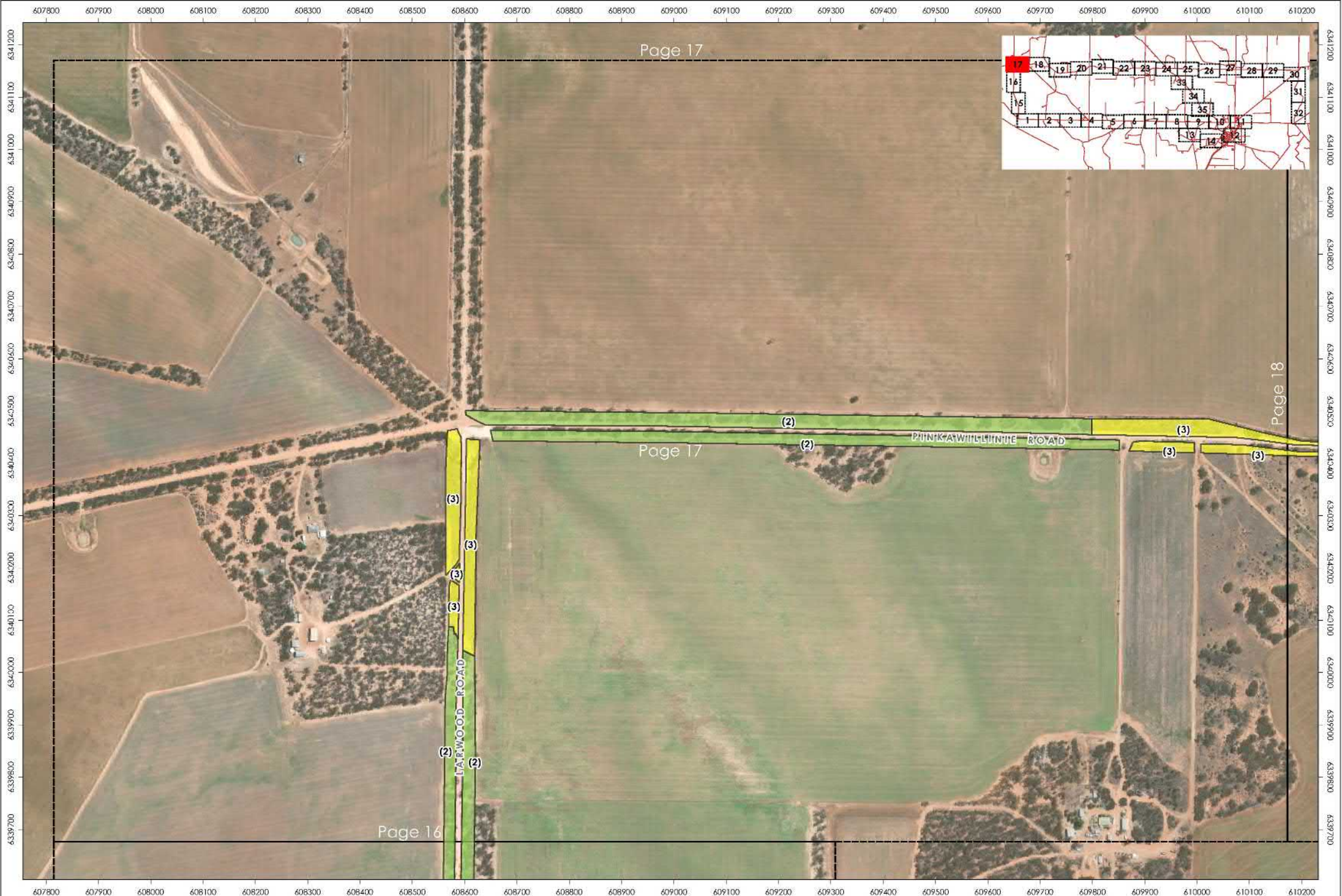
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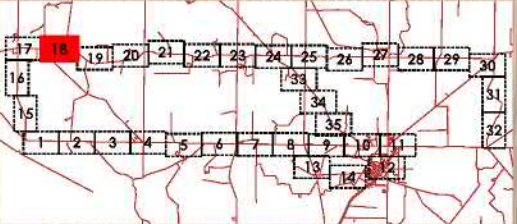
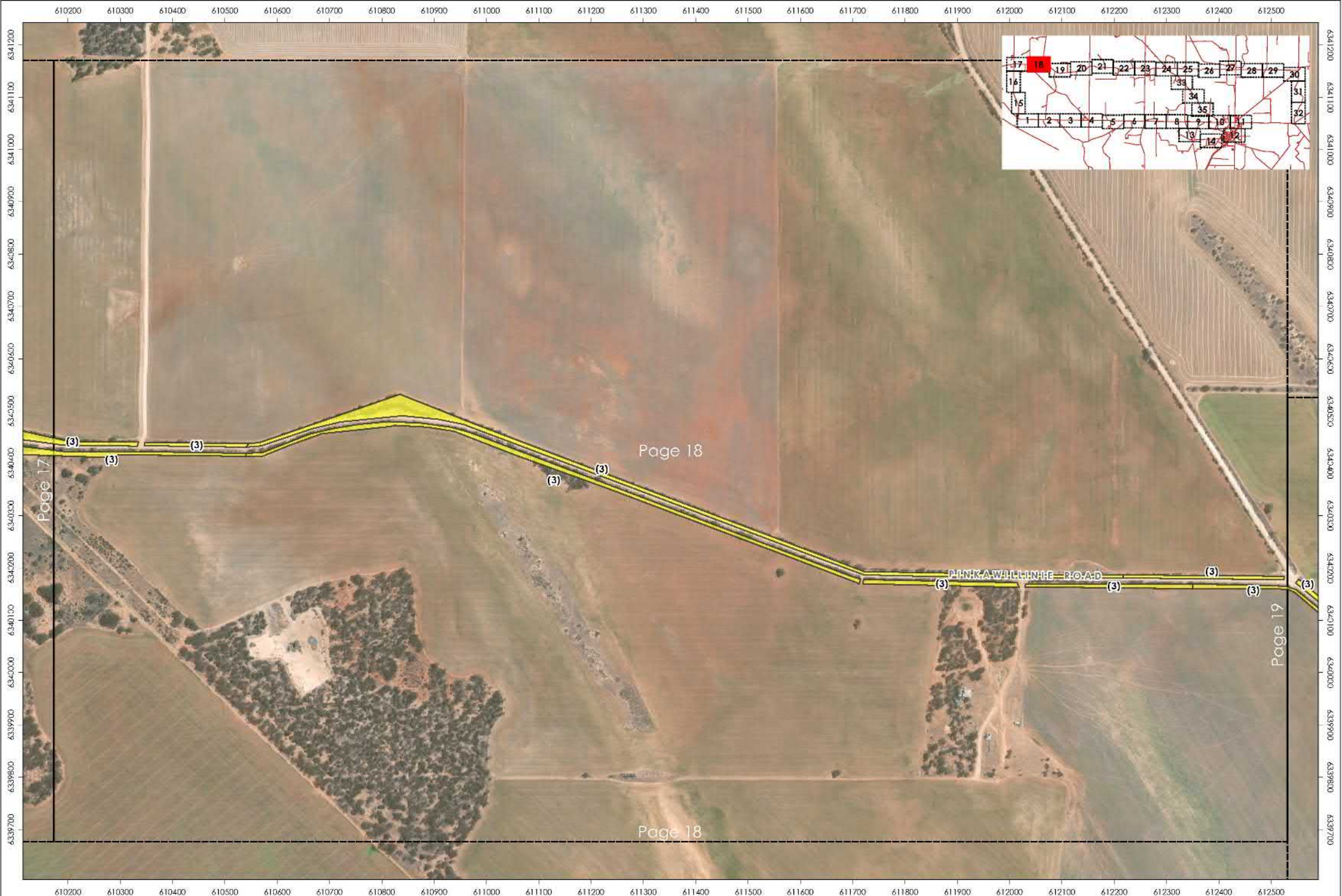
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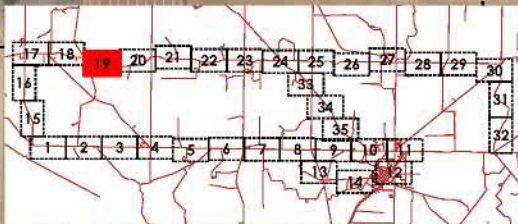












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PINKA-WHILNHE ROAD

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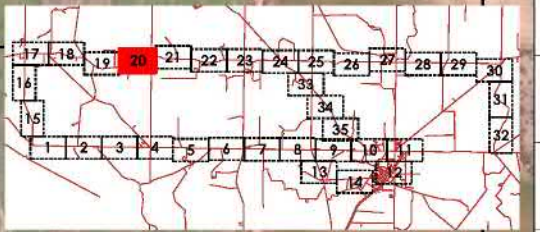




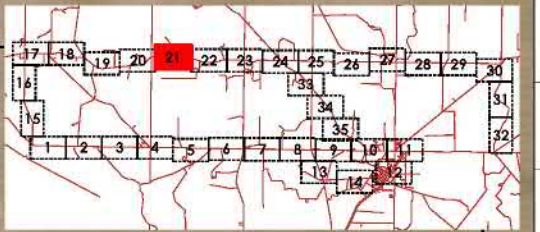
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PINKAWILLINIE ROAD











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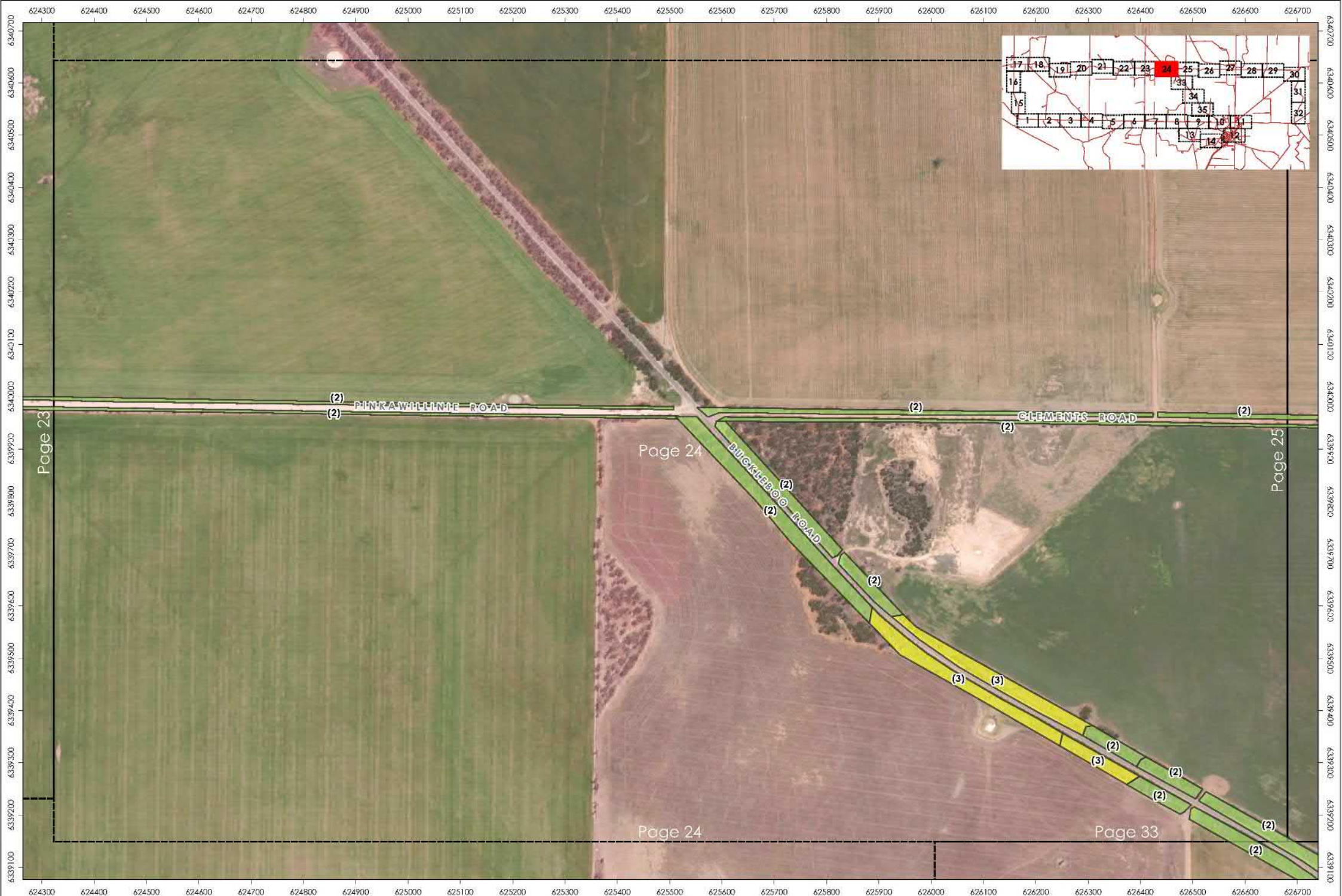
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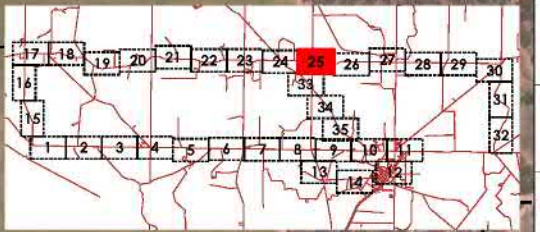
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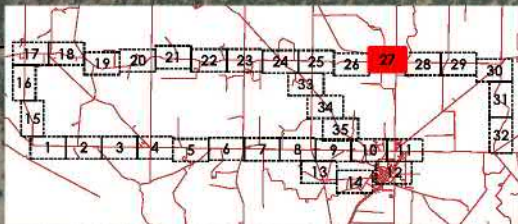
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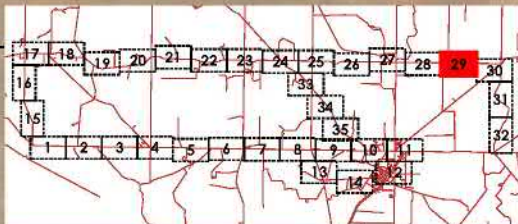
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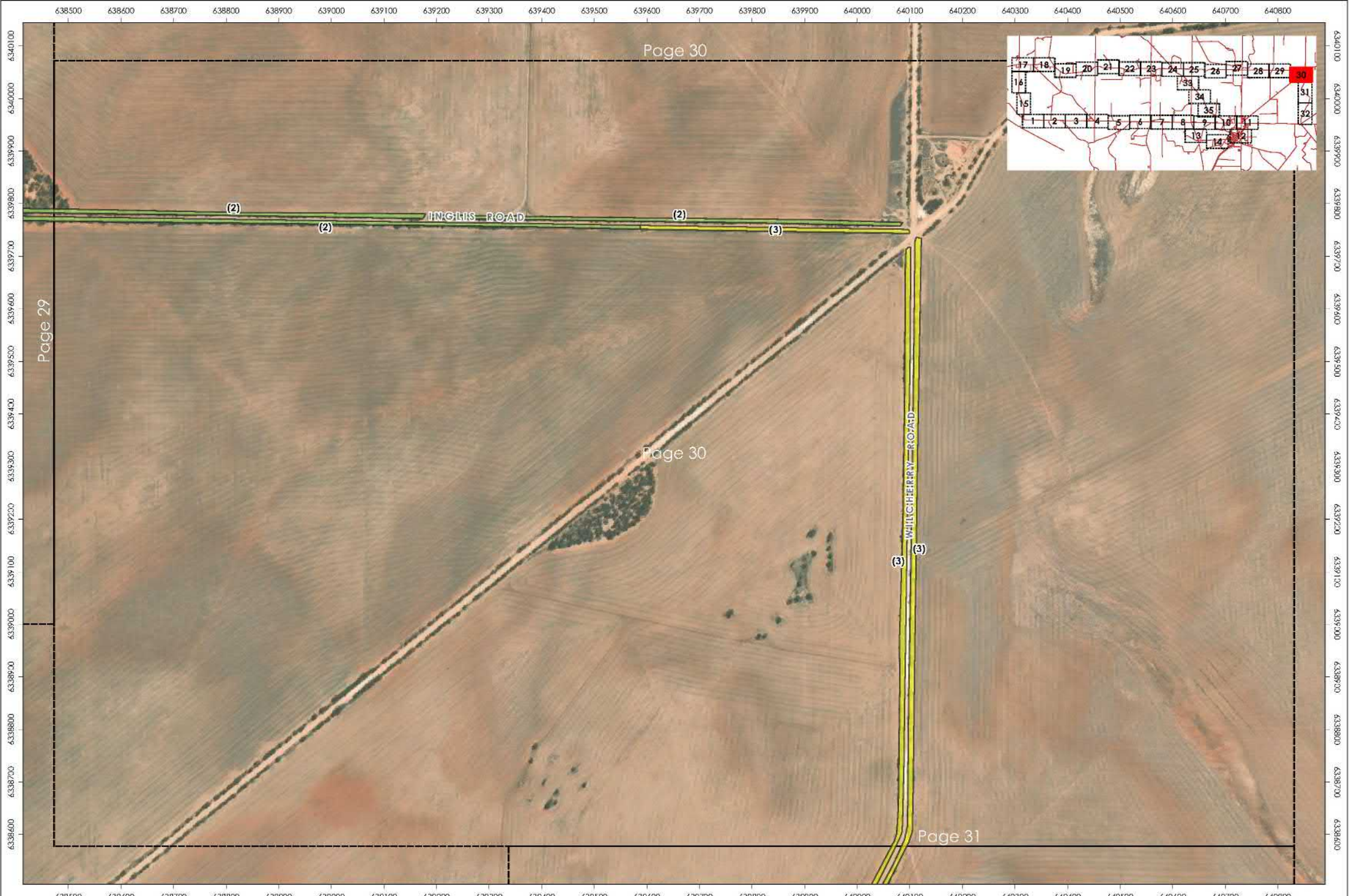
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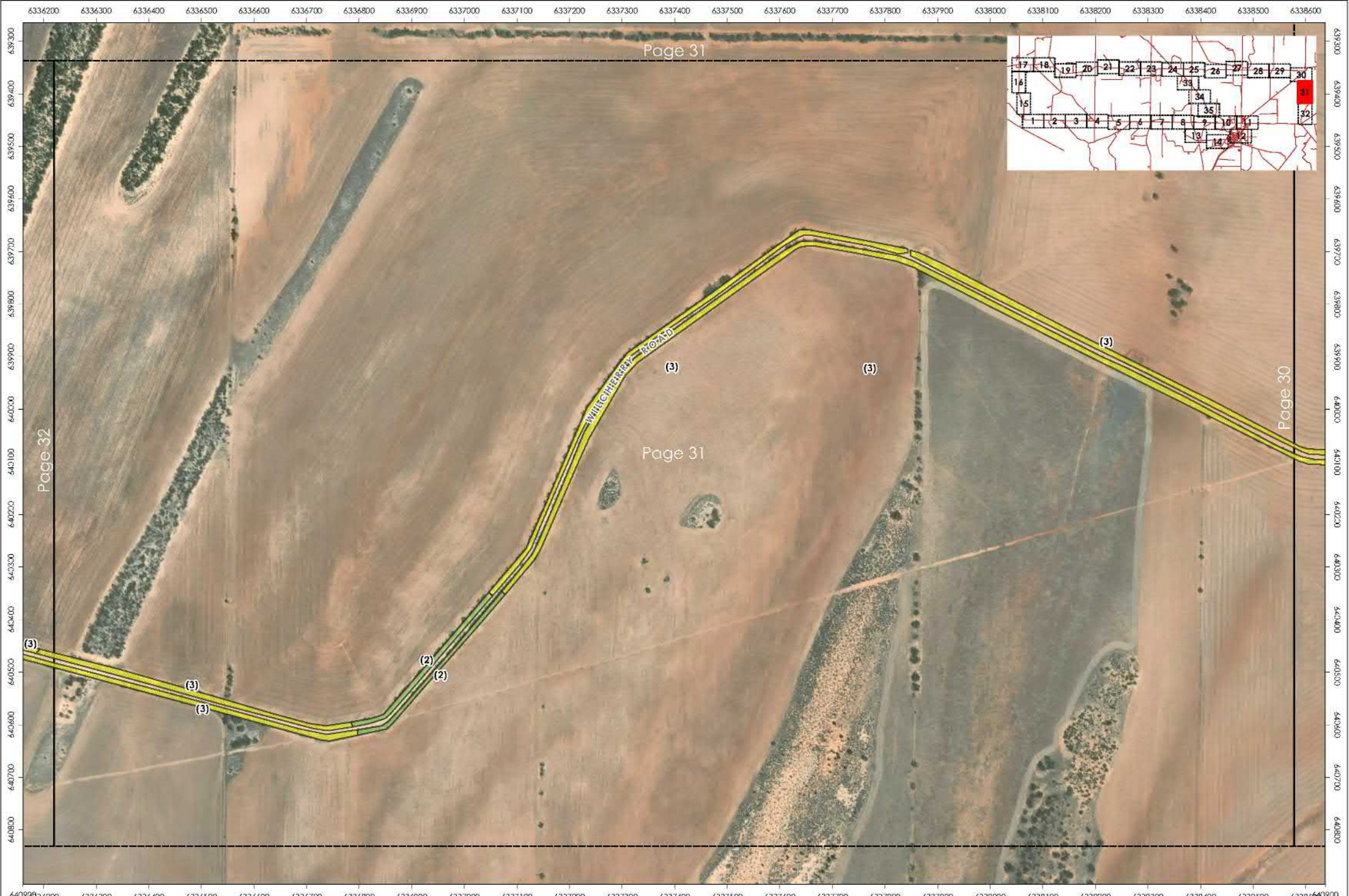
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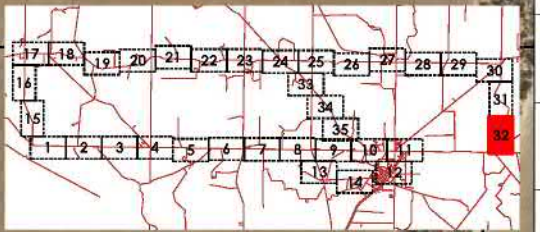
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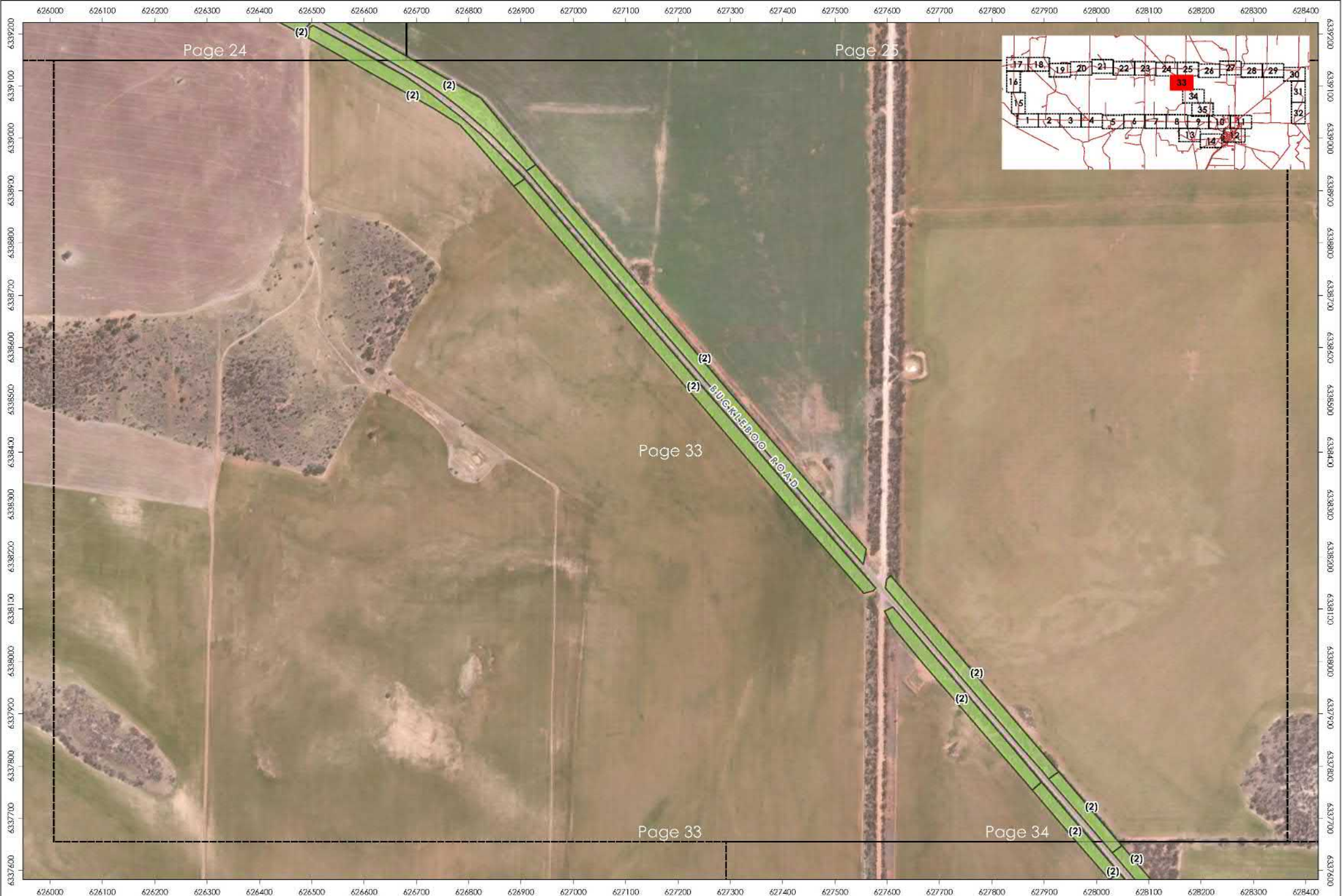




WILCHERRY ROAD







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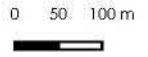
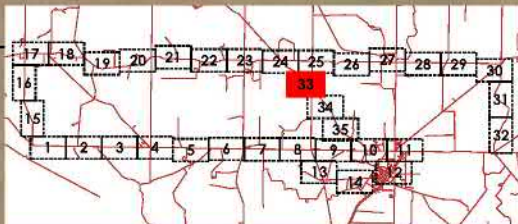
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BUCKLEBOO ROAD





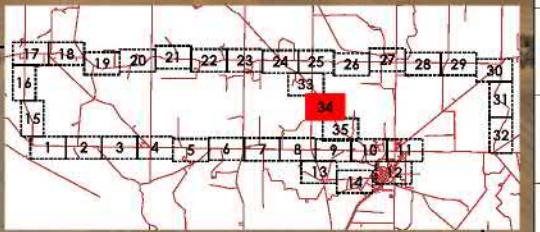


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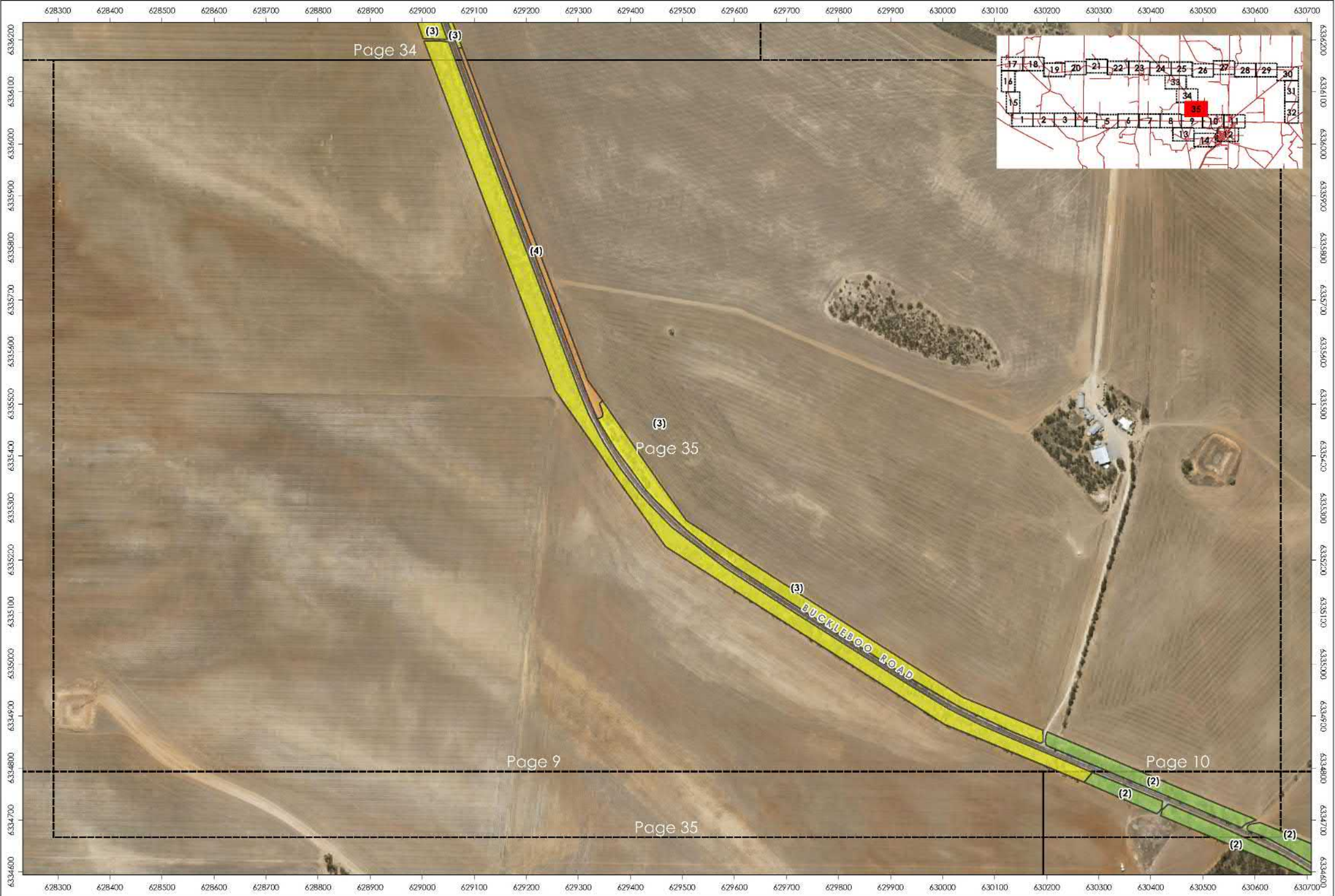
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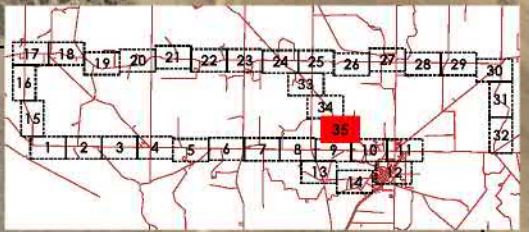
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BUCKLEBOO ROAD





# Appendix F

## Vegetation Clearing Estimate Calculations



## Appendix F Vegetation Clearing Estimate Calculations

### Road widths

Road Cross Section	1	2	3	4	Average
<b>Tola Road</b>					
Fence to fence (m)	60	60	70	60	62.5
Road edge to edge (m)	12	12	12	12	12
Vegetation width (m)	48	48	58	48	50.5
<b>Pinkawillinie Road</b>					
Fence to fence (m)	20	55	26	20	30.25
Road edge to edge (m)	10	12	12	10	11
Vegetation width (m)	10	43	14	10	19.25
<b>Larwood Road</b>					
Fence to fence (m)	60	60	60	60	60
Road edge to edge (m)	10	15	13	13	12.75
Vegetation width (m)	50	45	47	47	47.25
<b>Buckleboo Road</b>					
Fence to fence (m)	60	60	60	60	60
Road edge to edge (m)	10	14	14	10	12
Vegetation width (m)	50	46	46	50	48
<b>Wilcherry Road</b>					
Fence to fence (m)	30	35	20	25	27.5
Road edge to edge (m)	10	14	10	10	11
Vegetation width (m)	20	21	10	15	16.5

Note: four representative cross sections were measured to determine the average cross section for the length of the road.

Route Options	Section 1	Section 2	Section 3	Section 4	Average
<b>Option 1 - Tola Road</b>					
Fence to fence (m)	62.5				62.5
Road edge to edge (m)	12				12.0
Vegetation width (m)	50.5				50.5
<b>Option 2 - Buckleboo/Pinkawillinie</b>					
Fence to fence (m)	60	30.25	60		50.1
Road edge to edge (m)	12	11	12.75		11.9
Vegetation width (m)	48	19.25	47.25		38.2
<b>Option 1 - Wilcherry/Pinkawillinie</b>					
Fence to fence (m)	27.5	30.25	60		39.3
Road edge to edge (m)	11	11	12.75		11.6
Vegetation width (m)	16.5	19.25	47.25		27.7



## Vegetation clearance areas

Option	1	2	3	Comment
<b>Road</b>	<b>Tola</b>	<b>Buckleboo / Pinkawillinie</b>	<b>Wilcherry / Pinkawillinie</b>	
Designed road width (m)	26	26	26	Based on 30% design road cross section and including the full clear zone of 5m on either side
Existing road reserve width (m)	63	50	39	Based on an average of 4 cross sections along the route
Existing road width (m)	12	12	12	
Clearing width (m)	14	14	14	Proposed road width - existing road width
Construction allowance (m)	5	5	5	Assumed to be 5m
Length (m)	26,000	34,000	44,000	Assumed clearing required along whole length of alignment. Measured from 5% drawings. Rounded to the nearest 1,000 m.
Access point (m <sup>2</sup> )	2,400	2,400	2,400	Based on turn path for semi-trailer produced for 5% design - 2x access points, excluding existing road area
<b>Total Area (m<sup>2</sup>)</b>	<b>496,400</b>	<b>651,233</b>	<b>856,733</b>	
<b>Water</b>	<b>Shared with Option 1 Road</b>			
Corridor width (m)	5	5	5	Assumed to be 5m for whole corridor, including trench, construction allowance and offsets
Length (m)	6,000	24,000	24,000	Assumed clearing required along whole length of alignment. Measured from 5% drawings. Rounded to the nearest 1,000 m.
<b>Total Area (m<sup>2</sup>)</b>	<b>30,000</b>	<b>120,000</b>	<b>120,000</b>	
<b>Communications</b>	<b>Shared with Option 1 Road</b>	<b>Shared with Water</b>	<b>Shared with Water</b>	
Corridor width (m)	5	5	5	Assumed to be 5m for whole corridor, including trench, construction allowance and offsets
Length (m)	1,000	7,000	7,000	Assumed clearing required along whole length of alignment. Measured from 5% drawings. Rounded to the nearest 1,000 m.
<b>Total Area (m<sup>2</sup>)</b>	<b>5,000</b>	<b>35,000</b>	<b>35,000</b>	