

# Environmental Review Document

## Mulga Downs Iron Ore Mine

## 9 Flora and Vegetation

### 9.1 EPA Objective

The EPA's objective for the environmental factor Flora and Vegetation is:

“To protect flora and vegetation so that biological diversity and ecological integrity are maintained” (EPA 2016a; EPA 2021d).

### 9.2 Policy and Guidance

In addition to the policy and guidance outlined in **Section 4.1**, specific policy and guidance relevant to key environmental factor Flora and Vegetation which have informed the planning for the Proposal are listed in **Table 9-1**.

HPPL has specifically considered these guidance documents in the following ways:

- Surveys and analyses undertaken to describe the receiving environment and its significance;
- Identification of activities which may lead to impacts to flora and vegetation; and
- Application of the mitigation hierarchy in elements of Proposal design.

Table 9-1: Flora and Vegetation Policy and Guidance

Reference	Title	How Policy has been considered
EPA 2016c	Environmental Factor Guideline: Flora and Vegetation	The information provided in this chapter addresses the 'considerations for environmental impact assessment' listed in this document.
EPA 2016d	Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment	This document guides flora and vegetation surveys and data to be used in EIA. All studies conducted for the Proposal are in accordance with this guidance document.
GoWA 2011	WA Environmental Offsets Policy	The offset policy and guidelines have been considered in relation to the definition of significant residual impacts and the proposed offset strategy.
GoWA 2014	WA Environmental Offsets Guidelines	

Specific additional work required for assessment of the Proposal, relating to Flora and Vegetation, was provided in the ESD which was approved by the EPA on the 24 August 2022. These additional requirements (as outlined in **Table ES 4**) are considered in this section.

### 9.3 Receiving Environment

The following sections describe the key features of the receiving environment in relation to Flora and Vegetation, including details of the surveys and studies undertaken to support the Proposal.

#### 9.3.1 Relevant Studies

A summary of the flora and vegetation studies undertaken for the Proposal and surrounding area is provided in **Table 9-2**. The assessment of potential impacts on flora and vegetation as a result of the Proposal draws on

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information from these reports. The flora and vegetation surveys completed to inform the Proposal have been conducted in accordance with the *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016d) and *Environmental Factor Guideline: Flora and Vegetation* (EPA 2016c).

Since 2012, numerous flora and vegetation assessments have been completed for the Mulga Downs Iron Ore Mine. A total of 271 quadrats have been assessed both within and outside of the Development Envelope (Survey Area) by Maia Consulting Ecologists (Maia) (**Figure 9-1**). The combined results of these surveys have been consolidated into one document: *Mulga Downs Iron Ore Project, Mine and Borefield Study Area Detailed Flora and Vegetation Assessment 2019-2022* (Maia 2022).

A separate survey was undertaken by Maia (2023) across the Solar Farm and expansion of a haul road along the northern boundary of the Development Envelope<sup>1</sup>. The results of this survey as they relate to the Development Envelope are incorporated into this ERD. The survey report is provided in **Appendix 10**.

The outcomes from additional surveys completed to support the ongoing Programme of Works applications to DEMIRS have also been incorporated into this ERD where relevant.

All supporting surveys for this ERD are provided in **Appendix 10**. The extent of the surveys undertaken for the Proposal are presented in **Table 9-2**.

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<sup>1</sup> The Spectrum (2023) survey also included a proposed pipeline route realignment which is no longer within the Development Envelope.

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Table 9-2: Flora and Vegetation Surveys

Reference	Report	Description		Guidance
		Survey Type & Area	Survey Month	
Maia (2022)  (Appendix 10a.1)	Mulga Downs Project Preliminary Vegetation and Flora Impact Assessment  Total survey extent is collectively known as the Survey Area in this section of the ERD.	Level 2 flora and vegetation survey (Phase 1)  Within Development Envelope (refer to <b>Figure 9-1</b> ): <b>Area 1:</b> Mulga East (R47/12-I, M 47/1621 and L45/380) and Mulga Well (E47/2117-I).  Outside Development Envelope: <b>Area 3:</b> Hester Peak South-east (L45/316). <b>Area 6:</b> Hester Peak (E47/2044-I).	<b>Area 1:</b> 2021 Winter (Jun, Jul). <b>Area 3:</b> 2012 Winter (Aug). <b>Area 6:</b> 2012 Winter (Aug).	Environmental Factor Guideline: Flora and Vegetation (EPA 2016a).  Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016d).  Matters of National Environmental Significance Significant Impact Guidelines 1.1 (DoE 2013).
	Mulga Downs Iron Ore Project, Mine and Borefield Study Area Detailed Flora and Vegetation Assessment 2019-2022	Baseline flora and vegetation (multi-Phase) Within Development Envelope (refer to <b>Figure 9-1</b> ): <b>Area 1:</b> Mulga East (R47/12-I, M 47/1621 and L45/380) and Mulga Well (E47/2117-I). <b>Area 5:</b> Two Mile Well (E47/4264). <b>Area 6:</b> Hester Peak (E47/2044-I). <b>Area 7:</b> Hester Peak East (L45/384 and E47/2044-I) (see also JBS&G 2023 below).  Outside Development Envelope: <b>Area 2:</b> Mulga West (E47/1315-I). <b>Area 3:</b> Hester Peak South-east (L45/316). <b>Area 4:</b> Mulga West to Mulga East linking corridor.	<b>Area 1:</b> 2019 Winter (Aug), Spring (Sep), Autumn (May), and 2021 Winter (Jul), Autumn (May), Spring (Sep). <b>Area 2:</b> 2022 Autumn (Mar). <b>Area 3:</b> 2022 Autumn (Mar). <b>Area 4:</b> 2022 Autumn (Mar). <b>Area 5:</b> 2022 Autumn (Mar). <b>Area 6:</b> 2022 Autumn (Mar). <b>Area 7:</b> Assessed in this report via desktop study (field surveys undertaken over this area are discussed in JBS&G 2023).  The above multi-phase surveys resulted in 249 quadrats across the entire survey area.	
	Mulga Downs West Flora and Vegetation Desktop Study	Outside Development Envelope:	2012 to 2015: targeted flora surveys over an area of 538 ha;	

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Reference	Report	Description		Guidance
		Survey Type & Area	Survey Month	
		Phase 1 (E47/1315-I)Mulga West Borefield. Targeted flora surveys to support exploration activity	2018 to 2020: targeted flora surveys over an area of 3,245 ha. Vegetation mapping: 2021	
Spectrum (2024) <b>(Appendix 10a.2)</b>	Memo: Data reconciliation. S. Hitchcock to HaRoy.18March2024	Memo to address the discrepancies between Maia 2022 and IBSA data package for 2019 – 2022 survey (Maia 2022)	Not applicable.	Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016d).
JBS&G (2023) <b>(Appendix 10c)</b>	Memorandum: Mulga Downs Rail and Hub – Flora and Vegetation Surveys – Supplementary memorandum to Attexo (2022a,b). JBS&G 65318: 153,027.	Supplement to Attexo (2022a; b) reports. Detailed Survey (Quadrats and Targeted searches)  Discusses surveys undertaken over <b>Area 7: L45/384 and E47/2044-I</b> which is inside the Development Envelope and common to the Mulga Downs Hub and Rail Proposal.	Phase 1 and 2 Detailed: 18 March 2022 (Autumn) 21 July 2022 (Winter)	Environmental Factor Guideline: Flora and Vegetation (EPA 2016a). Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016d). Matters of National Environmental Significance Significant Impact Guidelines 1.1 (DoE 2013).
Maia (2023) <b>(Appendix 10b)</b>	Strategen-JBS&G: Mulga Downs Iron Ore Mine, Additional Survey Areas, Flora and Vegetation Assessment, February 2023	Detailed flora and vegetation assessment Targeted Flora and Vegetation Survey over a 241.6 ha survey area. Within Development Envelope (refer to <b>Figure 9-1</b> ): (E 47/2044-I) Solar Farm, Road Deviation Area Outside Development Envelope: Re-aligned water pipeline route (E47/1315-1 to Mulga East)	Detailed flora and vegetation assessment and targeted flora survey Summer - Autumn (Mar 2023).	Environmental Factor Guideline: Flora and Vegetation (EPA 2016a). Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016d).
AQ2 (2025) <b>(Appendix 5)</b>	Mulga Downs Groundwater, Surface Water &	Ecohydrological assessment across Mulga East (R47/12, E47/2117)	Two site reconnaissance visits: <b>Mulga East:</b> 2019 (March) <b>Mulga West:</b> 2021 (October)	Not applicable.

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Reference	Report	Description		Guidance
		Survey Type & Area	Survey Month	
	Ecohydrological studies – Baseline Assessment (171X_492b)	Also includes assessment across Mulga West (E47/1315) which is outside the Development Envelope.	Four field work campaigns: <ul style="list-style-type: none"> <li>• <b>Wet Season:</b> 2019 (May)</li> <li>• <b>Dry Season:</b> 2019 (October)</li> <li>• <b>Dry Season:</b> 2021 (October)</li> <li>• <b>Dry Season:</b> 2022 (October)</li> </ul>	
Spectrum (2024c) <b>(Appendix 10d)</b>	Memo - Targeted flora and vegetation survey – portion of the Northern Haul Road.	Targeted flora and vegetation survey across a 55 km length within the Northern Haul Road within the Development Envelope.	A dry season survey targeting conservation significant flora and ecological communities	The survey was conducted in accordance with the relevant State and Commonwealth legislative, regulatory and survey guidance

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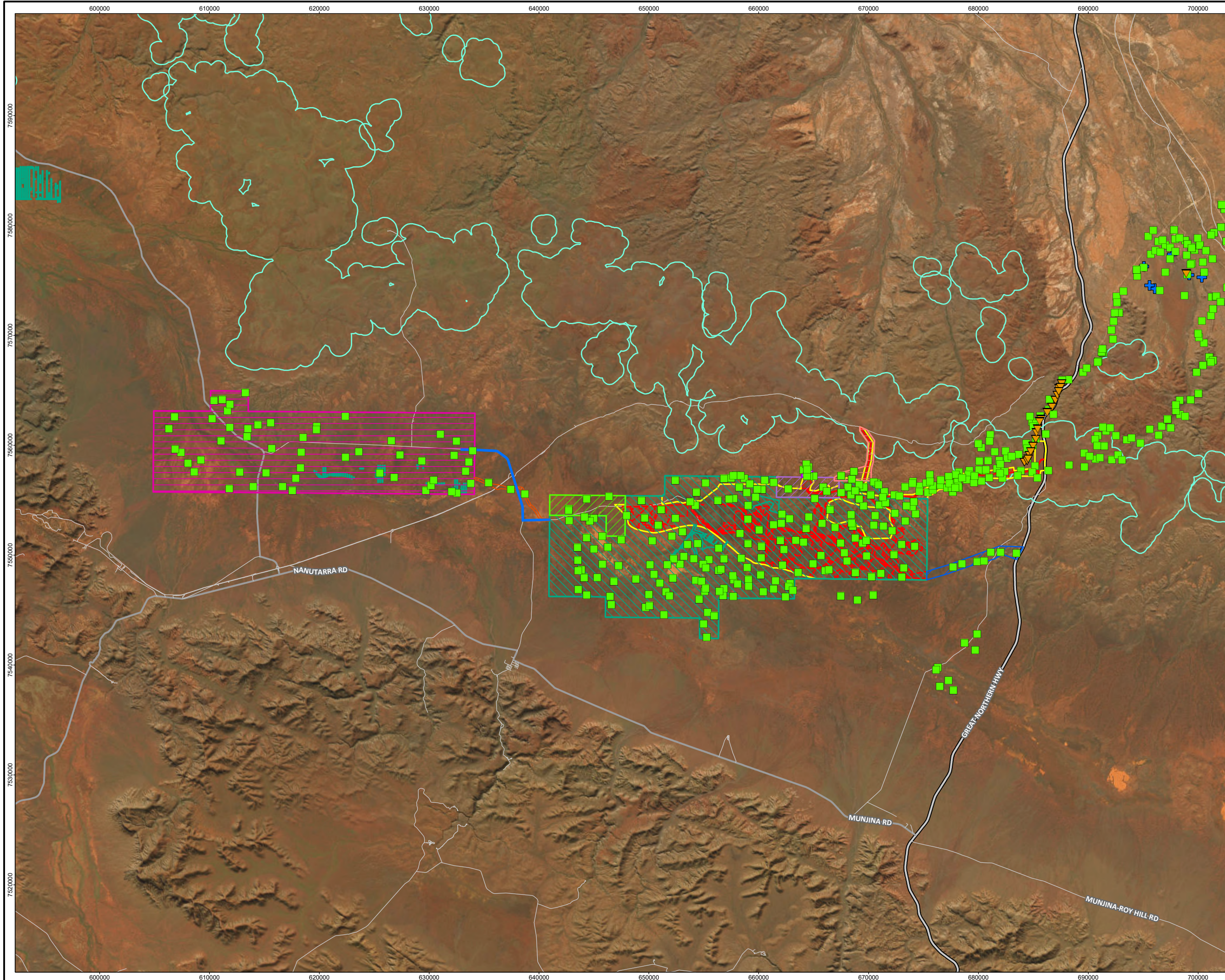
## Mulga Downs Iron Ore Mine

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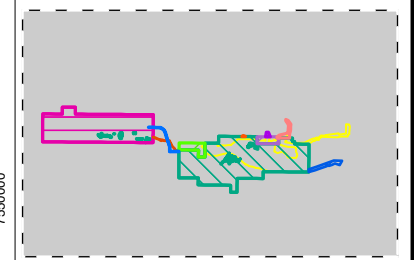
Figure 9-1: Flora and Vegetation Surveys Effort

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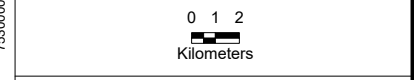


- Legend**
- Development Envelope
  - Indicative Footprint
  - Four plant assemblages of the Wona Landsystem
- Survey areas**
- Area 1 (Mulga East and Malay Well)
  - Area 2 (Mulga West)
  - Area 3 (Hester Peak SE)
  - Area 4 (Mulga West - Mulga East Linking Corridor)
  - Area 5 (Two Mile Well)
  - Area 6 (Hester Peak)
  - Area 7 (Hester Peak East)
- Proposed haul road diversion single phase detailed survey
  - Proposed solar farm single phase detailed survey (Maia, 2023)
  - Water supply pipeline single phase targeted survey (Maia, 2023)
- Site Type**
- + Groundwater Dependent Vegetation Notes
  - Quadrat
  - ▼ Relevé
  - Highway
  - Major road
  - Minor Road



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Client: Hancock Prospecting Pty Ltd	
Version: A	Date: 23-Oct-2024
Drawn By: droberts	Checked By: VC

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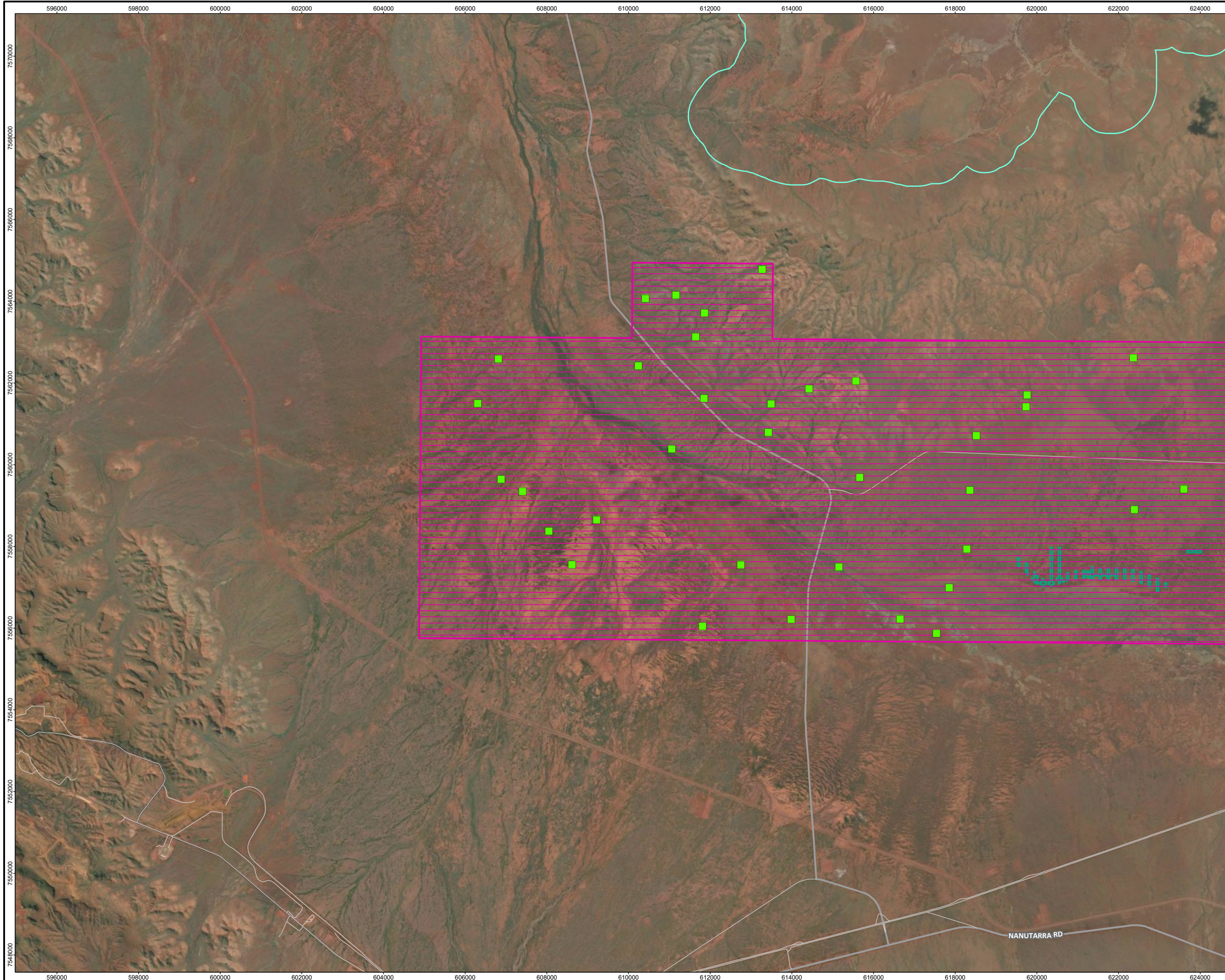
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Central Pilbara, Western Australia

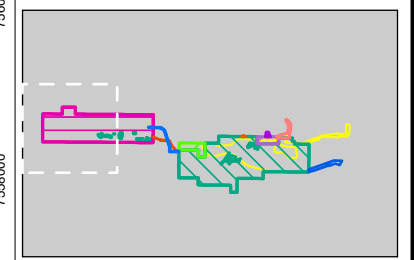
**FLORA AND VEGETATION**  
SURVEYS EFFORT

**FIGURE 9.1 Map 1 of 6**

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- Legend**
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  - Area 2 (Mulga West)
  - Site Type**
  - Quadrat
  - Major road
  - Minor Road



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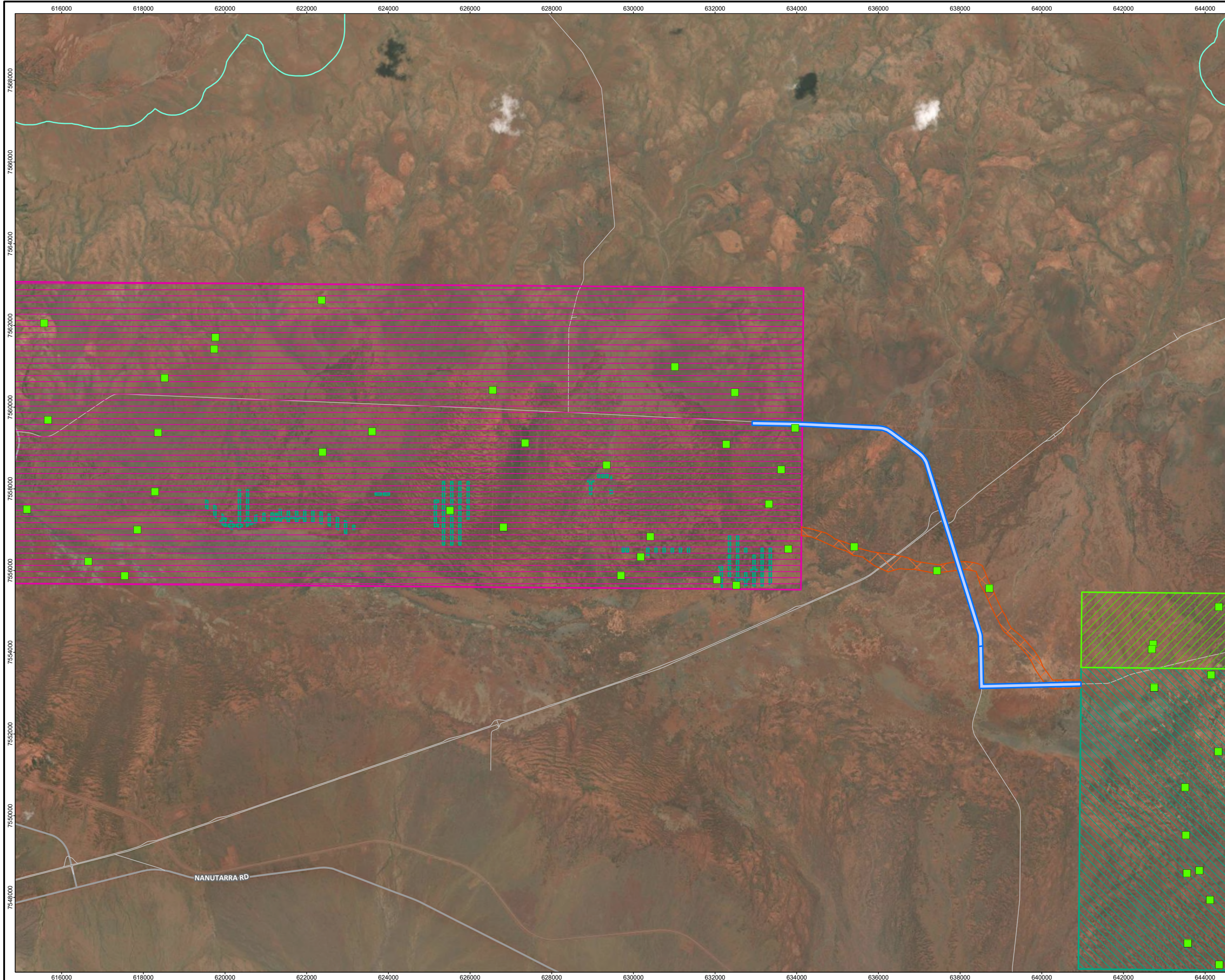
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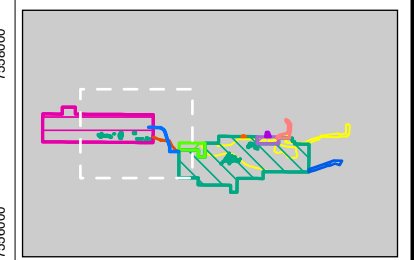
**Mulga Downs Iron Ore Mine  
 Central Pilbara, Western Australia**

**FLORA AND VEGETATION  
 SURVEYS EFFORT**

**FIGURE 9.1 Map 2 of 6**



- Legend**
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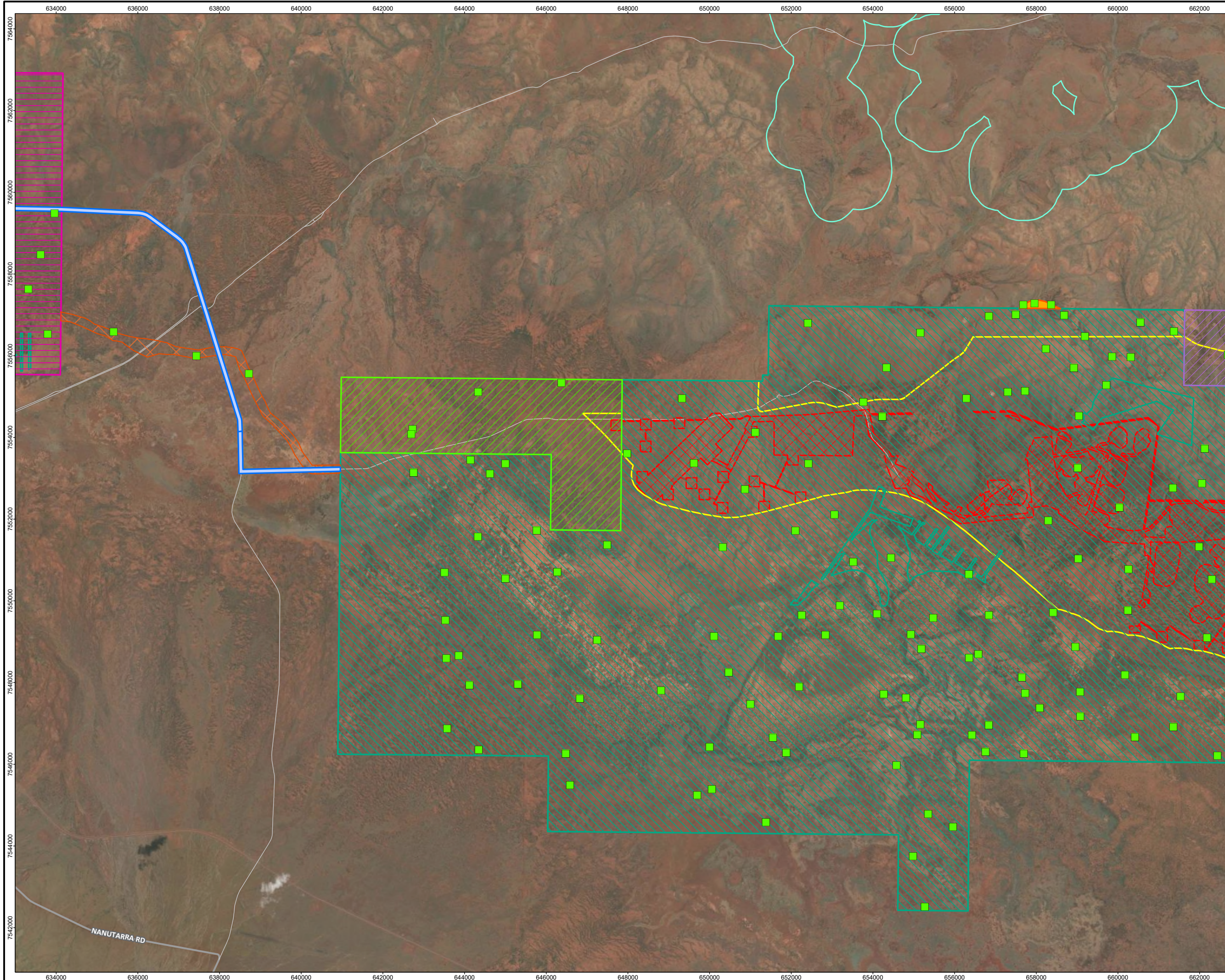
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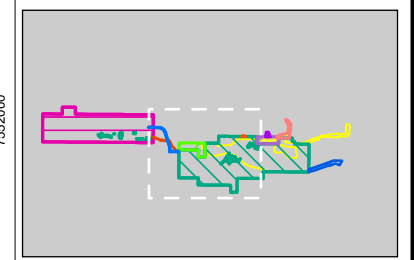
**FLORA AND VEGETATION  
 SURVEYS EFFORT**

**FIGURE 9.1 Map 3 of 6**

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  - single phase detailed survey
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- Site Type**
- Quadrat
  - Major road
  - Minor Road



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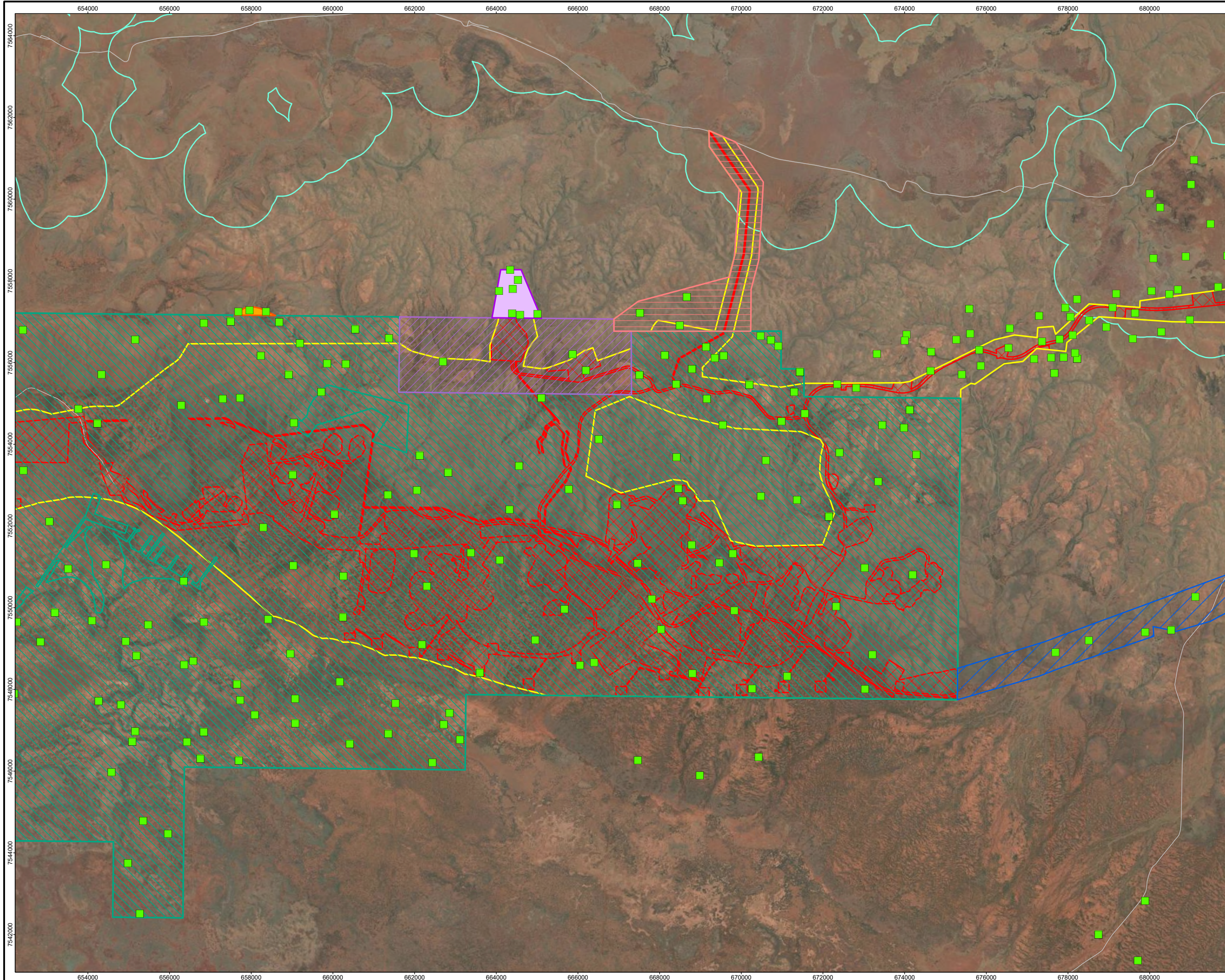
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**Mulga Downs Iron Ore Mine  
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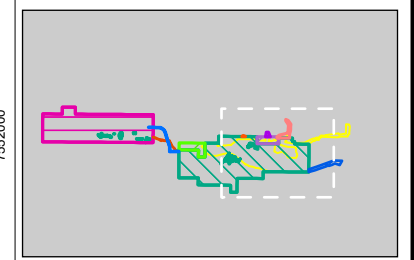
**FLORA AND VEGETATION  
SURVEYS EFFORT**

**FIGURE 9.1 Map 4 of 6**

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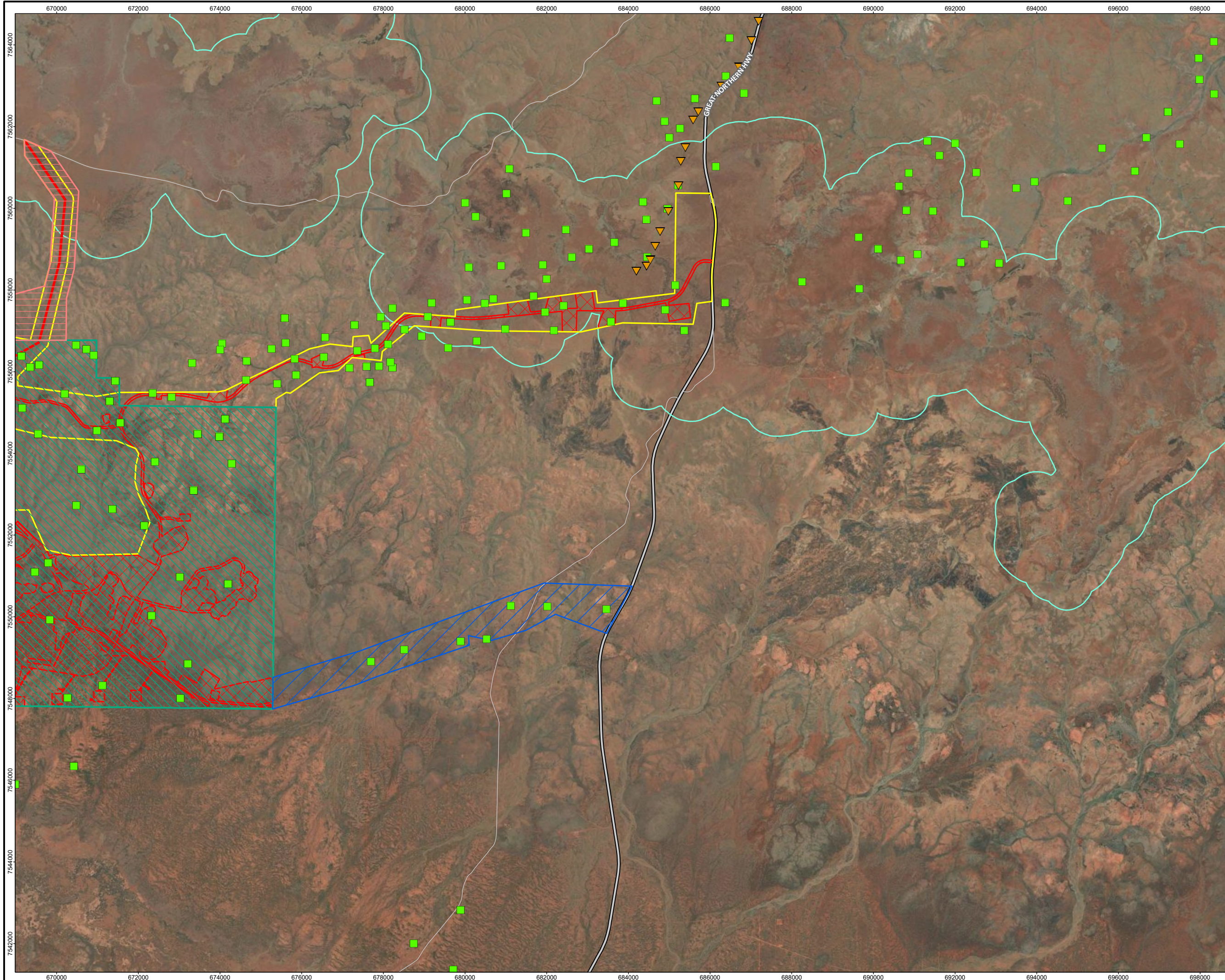
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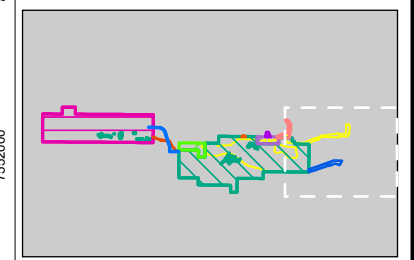
**FLORA AND VEGETATION  
 SURVEYS EFFORT**

**FIGURE 9.1 Map 5 of 6**

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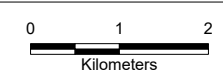


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**FLORA AND VEGETATION  
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**FIGURE 9.1 Map 6 of 6**

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## Mulga Downs Iron Ore Mine

### 9.3.2 Pre-European Vegetation Associations

Vegetation at a regional scale has been described by Beard (1975). These vegetation units (vegetation associations) are broad scale and are aligned with landform, soil and topography. The Development Envelope comprises four broad Beard structural vegetation associations (Beard 1975) as outlined in **Section 3.2**.

Currently, more than 99.8% of the four vegetation associations remain in the Pilbara bioregion and the relevant subregions (Maia, 2022).

### 9.3.3 Vegetation Types

A total of 15 vegetation types have been mapped within the Development Envelope during surveys undertaken for the Proposal (**Figure 9-2; Table 9-3**). Six of the 15 vegetation types were considered by Maia (2022) as locally significant (shown in bold in **Figure 9-3** and discussed in **Section 9.3.5**). With the exception of AWL (1) (33.56% of the Development Envelope), each locally significant vegetation type is a small percentage of the Development Envelope (less than 8.18%).

Table 9-3: Vegetation Types within the Development Envelope

Vegetation Type	Vegetation Description	Total Mapped Survey extent (Table 9.2)*	Extent within the Development Envelope	
			Area (ha)	Proportion (%)
AaAxSL	Tall Sparse Shrubland of <i>Acacia aneura</i> (alliance) and <i>A. xiphophylla</i> with a Low Sparse Shrubland of <i>Eremaea cuneifolia</i> and a Sparse Hummock Grassland of <i>Triodia epactia</i> and/or <i>T. basedowii</i> . Potential sheet-flow dependent vegetation.	3,628.68	814.09	4.83
<b>AdEvWL</b>	<b>Low Open Woodland to Low Woodland of <i>Acacia distans</i> and <i>Eucalyptus victrix</i> sometimes with a Tall Sparse Shrubland of <i>Acacia stenophylla</i> or <i>A. tetragonophylla</i> and a Shrubland to a Sparse Shrubland of <i>Duma florulenta</i>.</b>	<b>12,051.30</b>	<b>4.96</b>	<b>0.03</b>
ASL (1)	Tall Sparse to Open mixed Shrubland mainly of <i>Acacia synchronicia</i> , <i>A. tetragonophylla</i> , <i>A. xiphophylla</i> with a mixed Sparse Chenopod Shrubland mainly of <i>Sclerolaena densiflora</i> , <i>S. cuneata</i> and <i>S. costata</i> and Isolated mixed Tussock Grasses mainly of <i>Sporobolus australasicus</i> , <i>Enneapogon polyphyllus</i> and <i>Dactyloctenium radulans</i> .	1,854.75	359.51	2.13
<b>ASL (2)</b>	<b>Mixed Tall Acacia Shrubland mainly of <i>Acacia tumida</i> var. <i>pilbarensis</i>, <i>A. pyrifolia</i> and <i>A. maitlandii</i> with a Sparse Tussock Grassland of <i>Themeda triandra</i> and Low Isolated Trees of <i>Corymbia hamersleyana</i> and / or <i>Eucalyptus victrix</i>.</b>	<b>4,283.22</b>	<b>1,378.13</b>	<b>8.18</b>
<b>AWL (1)</b>	<b>Low Woodland / Tall Shrubland to Low Isolated Trees / Shrubs of <i>Acacia aneura</i> (complex) with a mixed Low Sparse Shrubland mainly of <i>Dodonaea petiolaris</i>, <i>Eremophila forrestii</i> and <i>Abutilon otocarpum</i> and Isolated Low Trees of <i>A. pruinocarpa</i>.</b>	<b>14,111.52</b>	<b>5,654.28</b>	<b>33.56</b>

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Vegetation Type	Vegetation Description	Total Mapped Survey extent (Table 9.2)*	Extent within the Development Envelope	
			Area (ha)	Proportion (%)
AWL (2)	Low Woodland / Tall Shrubland to Low Isolated Trees / Tall Shrubs of <i>Acacia aneura</i> (complex) A. <i>synchronicia</i> and A. <i>tetragonophylla</i> with a mixed Low Sparse Shrubland mainly of <i>Solanum lasiophyllum</i> , <i>Abutilon otocarpum</i> and <i>Sida platycalyx</i> and a Sparse Tussock Grassland to Isolated Tussock Grasses mainly of <i>Sporobolus australasicus</i> , <i>Enneapogon cylindricus</i> and <i>Aristida contorta</i> .	7,240.06	105.67	0.63
AWL (3)	Low Woodland of <i>Acacia aneura</i> (complex) mainly <i>Acacia aptaneura</i> , A. <i>aneura</i> and A. <i>incurvaneura</i> with a mixed Tall Shrubland mainly of A. <i>synchronicia</i> , A. <i>tetragonophylla</i> and <i>Hakea lorea subsp. lorea</i> with a Sparse Tussock Grassland to Isolated Tussock Grasses mainly of <i>Sporobolus australasicus</i> , <i>Enneapogon cylindricus</i> and <i>Aristida contorta</i> .	4,066.26	32.12	0.19
AxAsSL	Tall Sparse Shrubland of <i>Acacia xiphophylla</i> and / or A. <i>synchronicia</i> with a mixed Sparse Chenopod Shrubland mainly of <i>Sclerolaena cuneata</i> , S. <i>bicornis</i> , S. <i>cornishiana</i> and a Sparse Tussock Grassland of <i>Eragrostis xerophila</i> .	9,779.72	1,381.93	8.20
MSW	Mixed Shrublands and Woodland of Drainage Lines. Shrublands and woodlands of <i>Eucalyptus spp.</i> , <i>Atalaya hemiglauca</i> , <i>Melaleuca</i> and <i>Acacia</i> species associated with drainage lines. Potential Groundwater Dependent Vegetation.	2,433.38	141.97	0.84
MTG (1)	Mixed Tussock Grassland mainly of <i>Eragrostis xerophila</i> , <i>Eulalia aurea</i> and * <i>Cenchrus setiger</i> with a mixed Tall Sparse Shrubland mainly of <i>Acacia coriacea subsp. pendens</i> , A. <i>tetragonophylla</i> and A. <i>synchronicia</i> with a Low mixed Sparse Shrubland mainly of <i>Pluchea rubelliflora</i> , <i>Pterocaulon sphacelatum</i> and <i>Salsola australis</i> .	576.38	241.96	1.44
MTGW	Tussock grasslands and shrublands of the 'Four plant assemblages of the Wona Land System' P1 (PEC) Mixed tussock grasslands of <i>Eragrostis xerophila</i> , <i>Aristida latifolia</i> and <i>Astrelba pectinate</i> , with patches of <i>Triodia spp.</i> and sparse mixed shrubs.	3,162.29	403.50	2.39
THG (1)	Mixed Hummock Grassland mainly of <i>Triodia basedowii</i> , <i>Triodia brizoides</i> and T. <i>vanleeuwenii</i> with a Tall Sparse Shrubland of mixed <i>Acacia</i> species mainly <i>Acacia atkinsiana</i> , A. <i>maitlandii</i> , A. <i>ancistrocarpa</i> with Low Isolated Trees of <i>Eucalyptus leucophloia</i> .	21,015.77	5,236.74	31.08
THG (2)	Mixed Hummock Grassland mainly of <i>Triodia basedowii</i> , <i>Triodia brizoides</i> and T. <i>vanleeuwenii</i> with a Tall Sparse Shrubland of mixed <i>Acacia</i> species mainly <i>Acacia atkinsiana</i> , A. <i>maitlandii</i> , A. <i>ancistrocarpa</i> with Low Isolated Trees of <i>Eucalyptus leucophloia</i> .	5,732.79	707.14	4.20

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## Mulga Downs Iron Ore Mine

Vegetation Type	Vegetation Description	Total Mapped Survey extent (Table 9.2)*	Extent within the Development Envelope	
			Area (ha)	Proportion (%)
THGB	<i>Triodia</i> Hummock Grassland on Basaltic Terrain <i>Triodia epactia</i> and <i>T. brizoides</i> hummock grassland with sparse <i>Acacia inaequilatera</i> and <i>Grevillea pyramidalis</i> subsp. <i>leucadendron</i>	4,697.16	197.03	1.17
TvHG	<b>Hummock Grassland of <i>Triodia veniciae</i> with Isolated Shrubs of <i>Acacia marramamba</i> and <i>A. atkinsiana</i>.</b>	<b>122.15</b>	<b>24.85</b>	<b>0.15</b>
Cleared / Disturbed		1,412.89	164.63	0.98
<b>Total</b>		<b>96,168.32</b>	<b>16,848.53</b>	<b>100</b>

\*Note: area calculations are based on multiple surveys with some overlap and as a result some figures may be an overestimate.

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## Mulga Downs Iron Ore Mine

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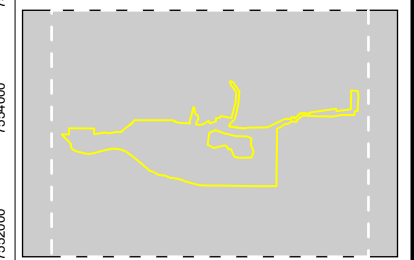
Figure 9-2: Mapped Vegetation Types within the Development Envelope

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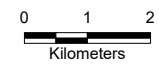


- Legend**
- Development Envelope
  - Indicative Footprint
  - Priority Ecological Communities (DBCA)
    - Four plant assemblages of the Wona Landsystem (Priority 1)
  - Vegetation type
    - AaAxSL
    - AdEvWL
    - ASL (1)
    - ASL (2)
    - AWL (1)
    - AWL (2)
    - AWL (3)
    - AxAsSL
    - MSW
    - MTG (1)
    - MTGW
    - THG (1)
    - THG (2)
    - THGB
    - TvHG
    - Cleared/Disturbed
  - Roads (LGATE-195)
    - Highway
    - Minor Road



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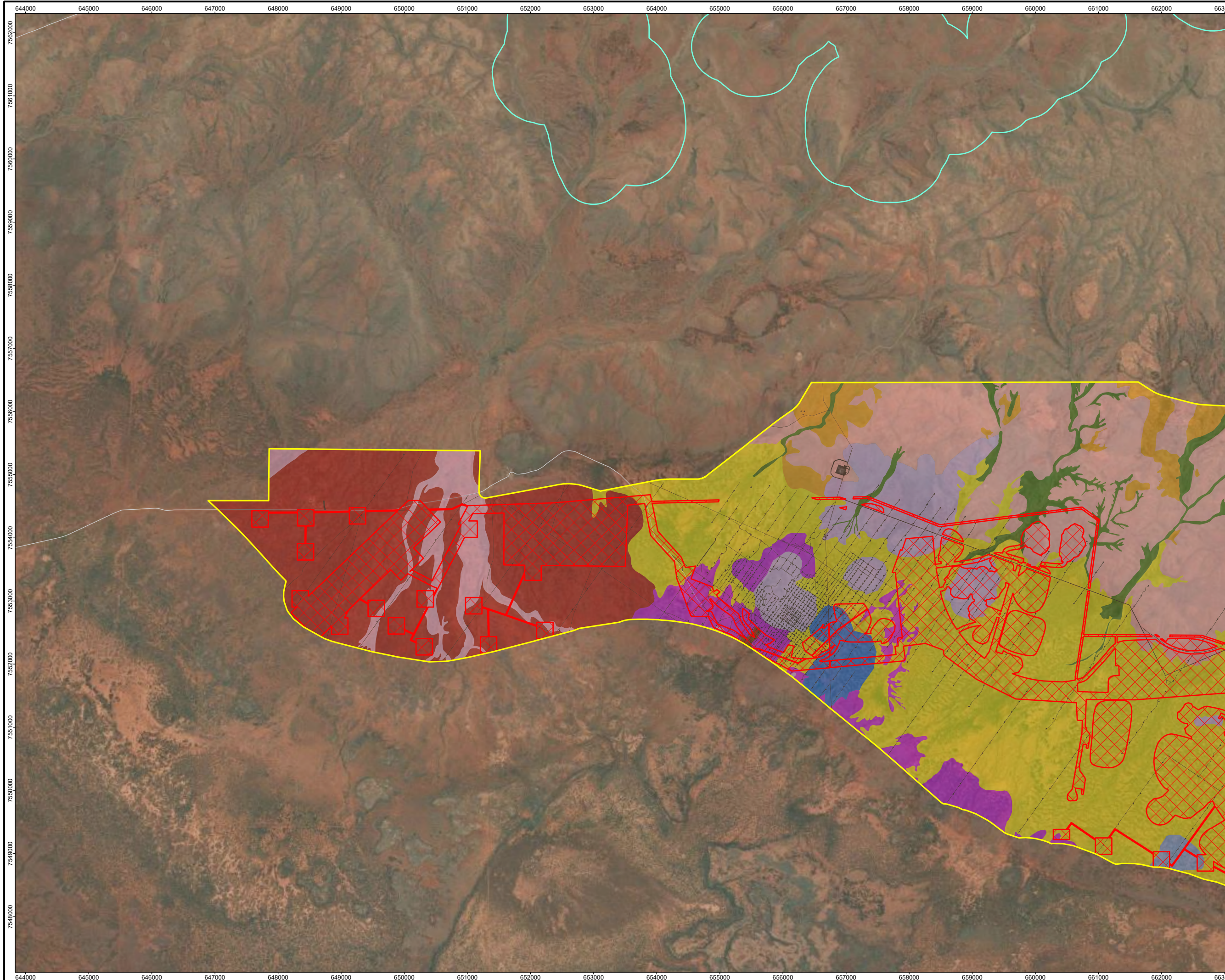
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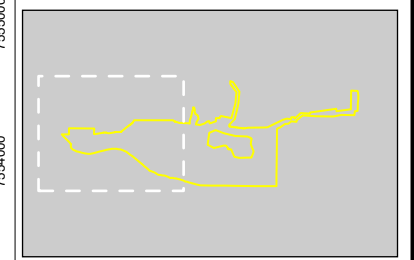
**MAPPED VEGETATION TYPES  
 WITHIN THE DEVELOPMENT ENVELOPE**

**FIGURE 9.2 Map 1 of 4**

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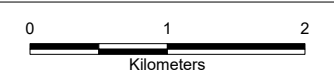


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  - AWL (2)
  - AWL (3)
  - AxAsSL
  - MTG (1)
  - THG (1)
  - THG (2)
  - Cleared/Disturbed
  - Roads (LGATE-195)
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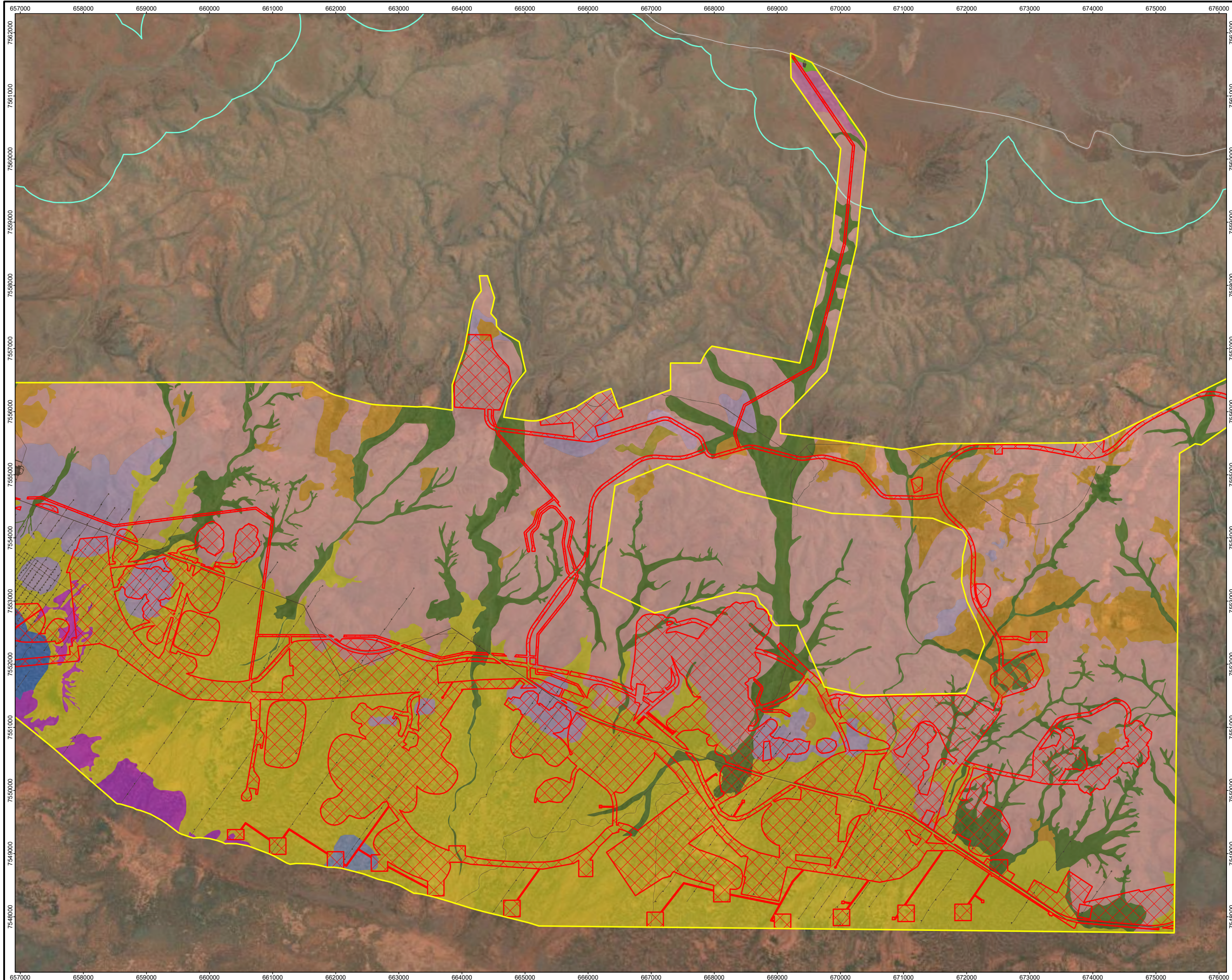
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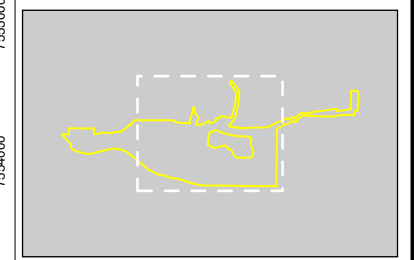
**MAPPED VEGETATION TYPES  
 WITHIN THE DEVELOPMENT ENVELOPE**

**FIGURE 9.2 Map 2 of 4**

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  - ASL (2)
  - AWL (1)
  - AWL (2)
  - AWL (3)
  - AxAsSL
  - MSW
  - MTGW
  - THG (1)
  - THG (2)
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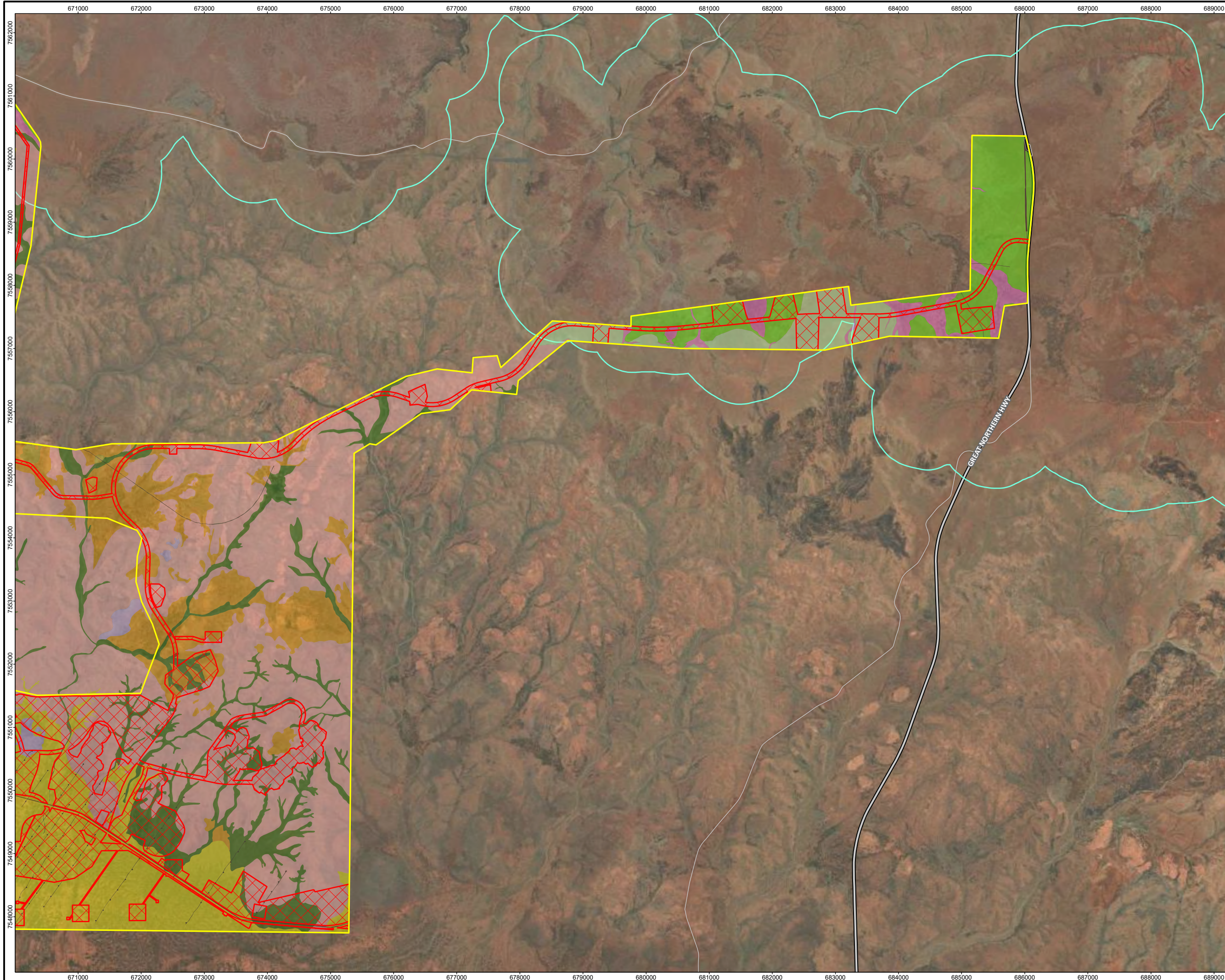
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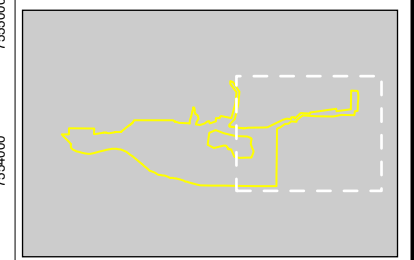
**MAPPED VEGETATION TYPES  
 WITHIN THE DEVELOPMENT ENVELOPE**

**FIGURE 9.2 Map 3 of 4**

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  - Vegetation type
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  - ASL (2)
  - AWL (1)
  - MSW
  - MTGW
  - THG (1)
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**Mulga Downs Iron Ore Mine  
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**MAPPED VEGETATION TYPES  
 WITHIN THE DEVELOPMENT ENVELOPE**

**FIGURE 9.2 Map 4 of 4**

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## Mulga Downs Iron Ore Mine

### 9.3.4 Vegetation Condition

The condition of each vegetation type was assessed using the vegetation condition scale for the Eremaean and Northern Botanical Provinces recommended in EPA (2016d). The majority (99.01%) of vegetation in the Development Envelope is considered to be in 'Good' to 'Excellent' condition based on Keighery's (1994) vegetation condition scale (**Figure 9-3; Table 9-4**). Areas cleared for drill lines, access tracks, fence lines and existing infrastructure were mapped as 'Cleared, Completely Degraded or Disturbed' (Maia, 2022).

Vegetation mapped as 'Excellent' condition showed little to no disturbance from exploration or cattle grazing. Vegetation mapped as 'Very Good' condition showed impacts from current and historical grazing pressures and exploration activities, with numerous weed populations throughout. Vegetation mapped as 'Good' condition was mostly confined to an area close to the homestead and cattle yards and contained large numbers of weeds present with little to no understorey plants. Vegetation mapped as 'Degraded' is associated with areas cleared for exploration and small borrow areas (Maia, 2022). It should be noted that HPPL maintains an active exploration programme across the Mulga tenements. These activities are excluded from the current Proposal and are approved under relevant approval processes by DEMIRS under the Mining Act (e.g. programme of works) as noted in **Section 2.2.5**. Station tracks and some of clearing for exploration drilling have been digitised (Maia (2022)); however, numerous drill lines have since been cleared. The area mapped as Degraded (**Figure 9-3; Table 9-4**) is therefore an underestimate of these areas. The nature of these exploration activities are low impact and temporary, with rehabilitation of the impacted areas required within six to twelve months depending on permit conditions.

Evidence of fire was noted in some areas, mainly on the low rolling hills and plains adjacent to Roebourne – Wittenoom Road. The condition of the vegetation within the floodplains is mostly rated as 'Very Good' to 'Good', as large numbers of cattle tend to graze in these areas. A number of weed species (*\*Malvastrum americanum*, *\*Cenchrus ciliaris*, *\*C. setiger* and *\*Vachellia farnesiana*) have been recorded in high numbers in vegetation types associated with the Fortescue River including its smaller tributaries and adjacent floodplains.

Table 9-4: Vegetation Condition within the Development Envelope (Maia, 2022).

Vegetation Condition	Extent in Development Envelope (ha)	Proportion of Development Envelope (%)
Excellent	6337.25	37.61
Very Good	8,363.23	49.64
Good	1,981.71	11.76
<i>Sub-Total (Good to Excellent)</i>	<i>16,682.19</i>	<i>99.01</i>
Degraded	158.91	0.94
Completely Degraded	7.43	0.04
<b>Total</b>	<b>16,848.53</b>	<b>100</b>

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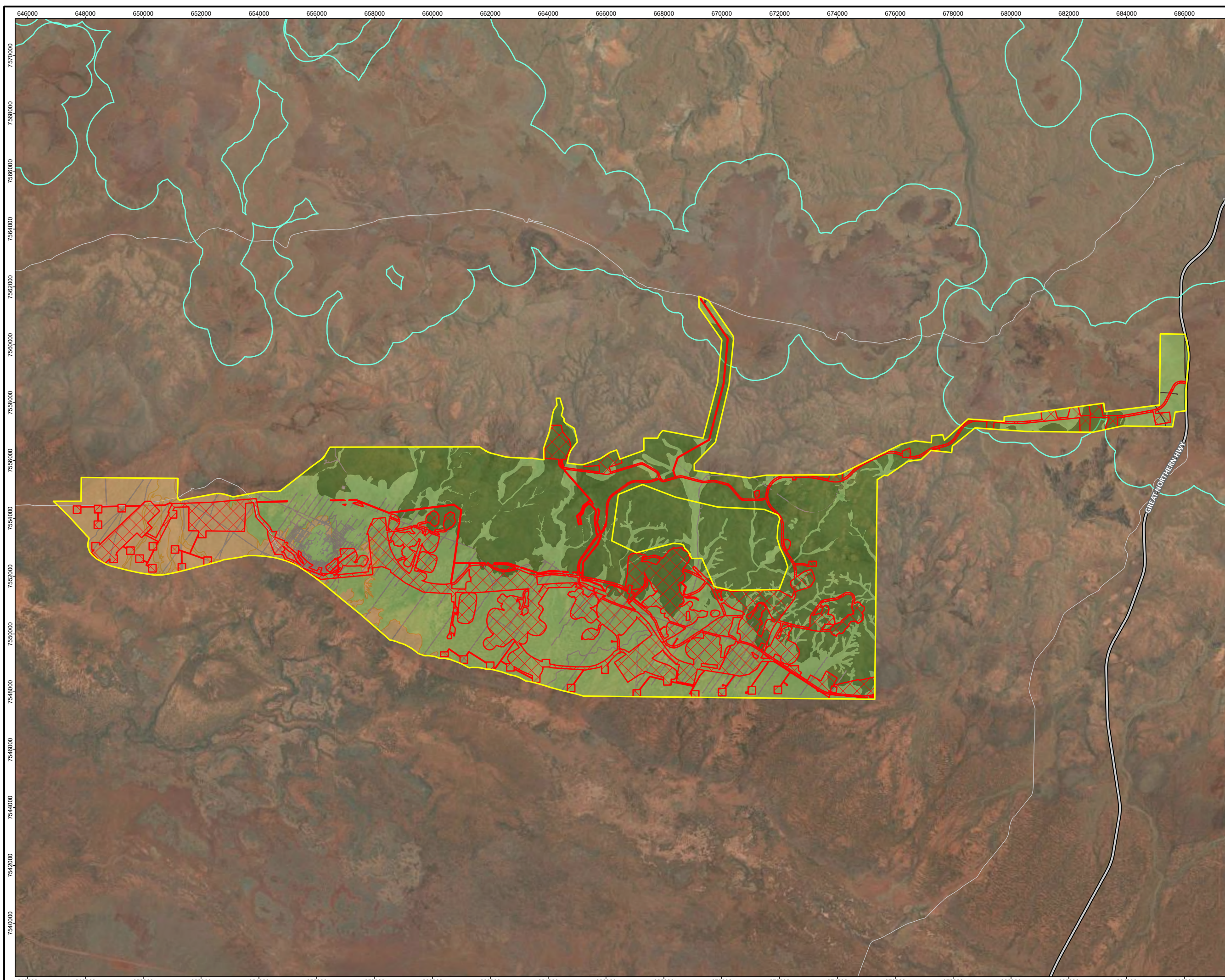
## Mulga Downs Iron Ore Mine

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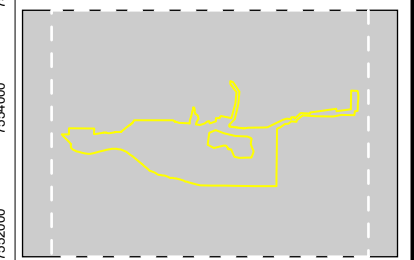
Figure 9-3: Vegetation Condition Mapped within the Development Envelope (Maia, 2022)

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- Legend**
- Development Envelope
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- Excellent
  - Very Good
  - Good
  - Degraded
  - Completely Degraded
- Roads (LGATE-195)**
- Highway
  - Minor Road

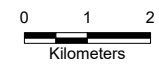


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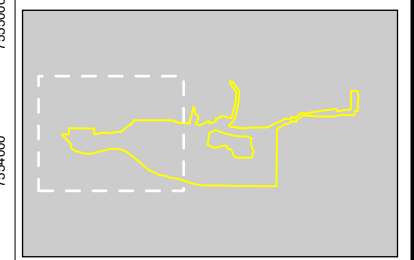
**VEGETATION CONDITION MAPPED  
WITHIN THE DEVELOPMENT ENVELOPE**

**FIGURE 9.3 Map 1 of 4**

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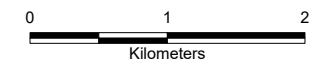


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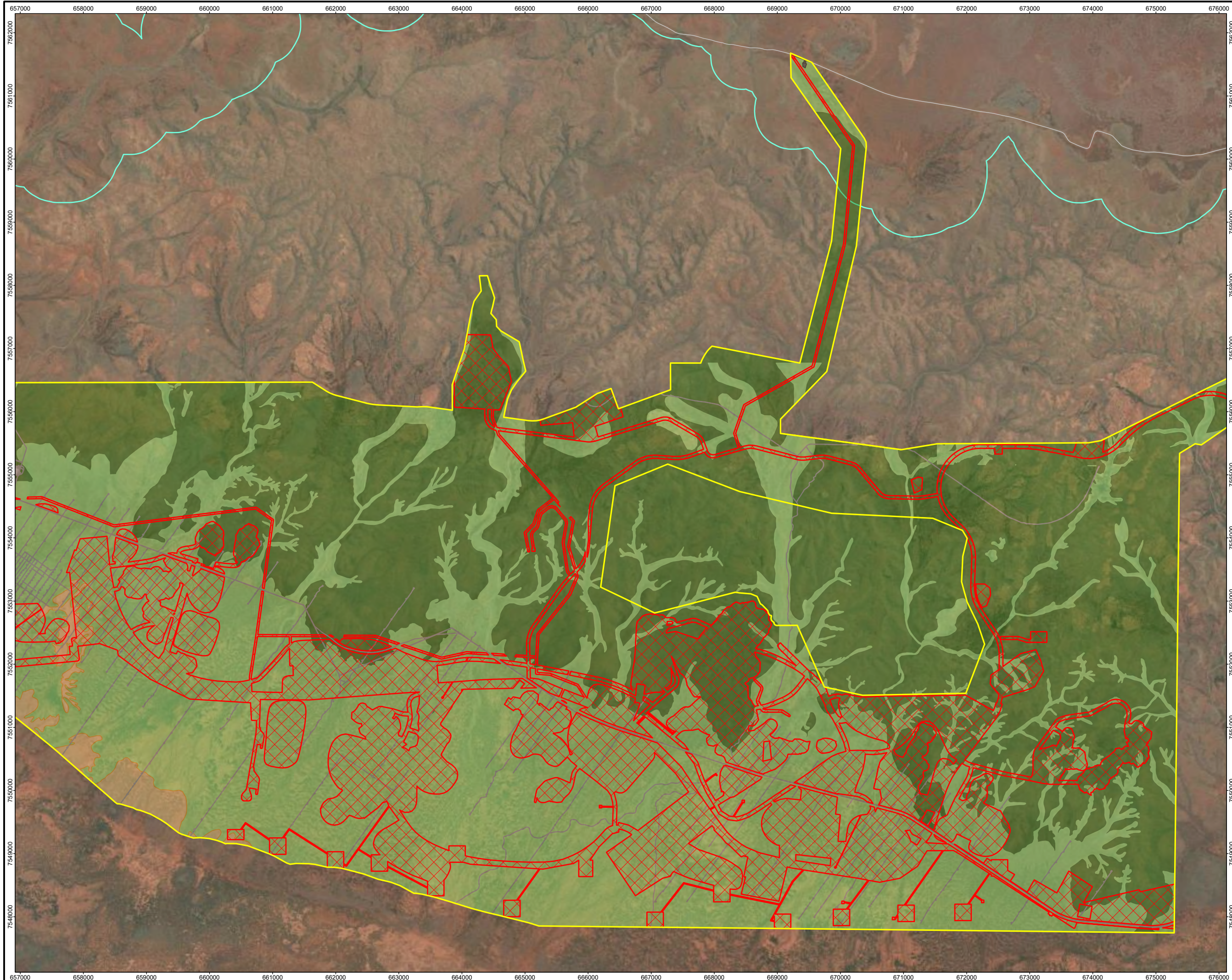
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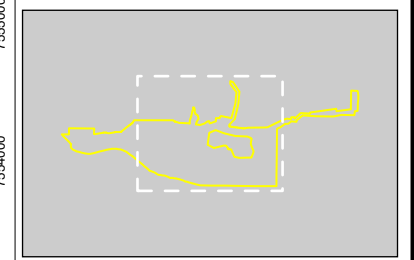
**VEGETATION CONDITION MAPPED  
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**FIGURE 9.3 Map 2 of 4**

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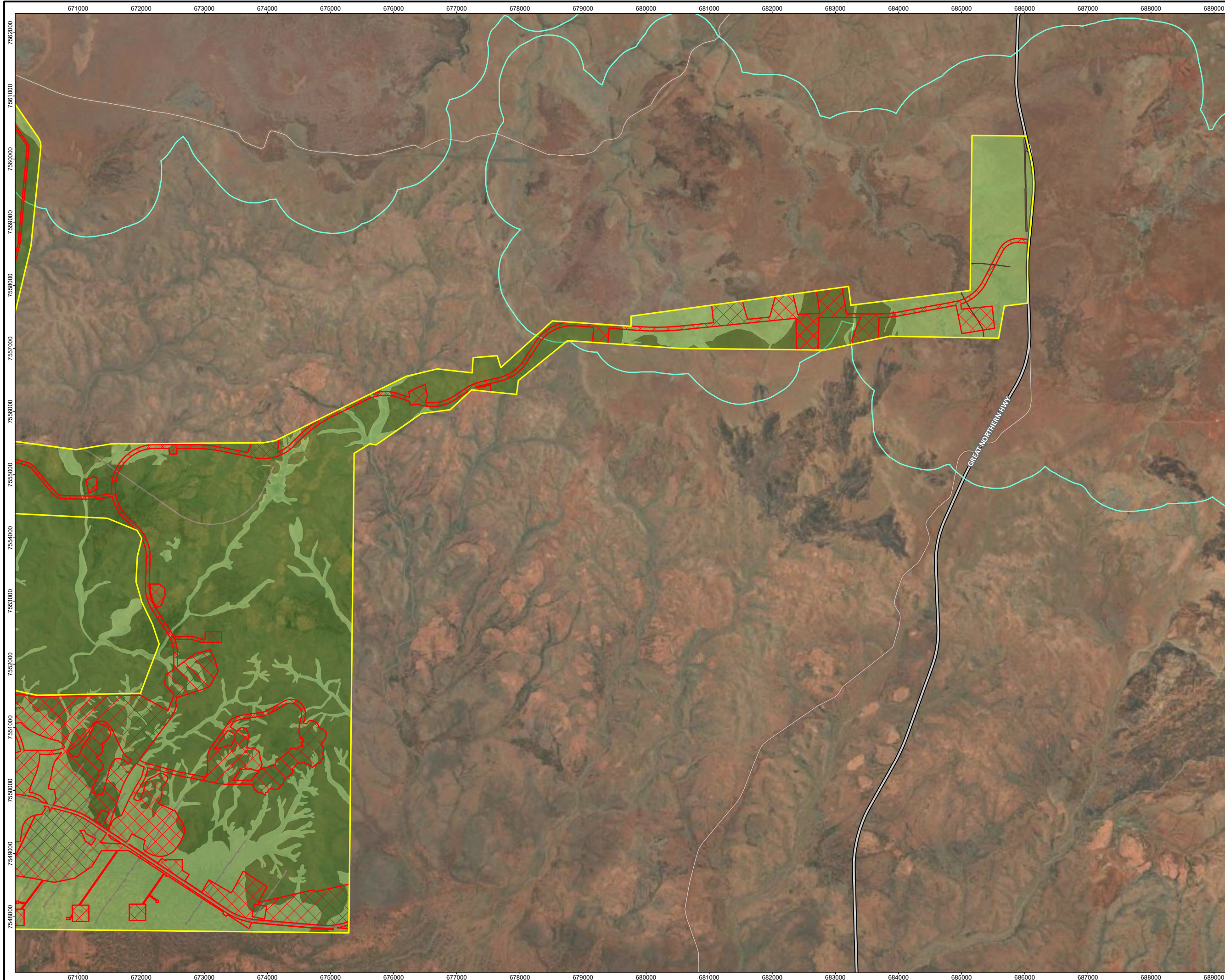
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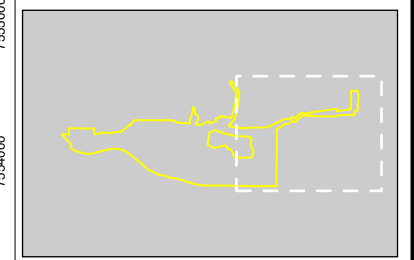
**VEGETATION CONDITION MAPPED  
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**FIGURE 9.3 Map 3 of 4**

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**Mulga Downs Iron Ore Mine  
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**VEGETATION CONDITION MAPPED  
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**FIGURE 9.3 Map 4 of 4**

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## Mulga Downs Iron Ore Mine

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### 9.3.5 Significant Vegetation

For the purpose of EIA, significant vegetation is defined as vegetation which:

- Is identified as a threatened or priority ecological communities (TEC; or PEC);
- Has a restricted distribution;
- Has a degree of historical impact from threatening processes;
- Has a role as a refuge; or
- Provides an important function which is required to maintain ecological integrity of a significant ecosystem (EPA, 2016d).

The remaining extent of the pre-European vegetation associations within the Development Envelope and within the Pilbara bioregion is greater than 99% (refer to **Section 9.3.2**). Based on the remaining extent, the regional significance of the pre-European vegetation associations present is considered low.

#### 9.3.5.1 Threatened Ecological Communities

There are no TECs listed under the BC Act within the Development Envelope or within 20 km of the Development Envelope

#### 9.3.5.2 Priority Ecological Communities

##### Freshwater Claypans of the Fortescue Valley (Priority 1)

The Freshwater claypans of the Fortescue Valley PEC (Priority 1) includes a series of claypans in the Fortescue Valley and include the Gnalka Gnoona Claypan and the Koodjeepindarranna Claypans.

The Development Envelope does not intersect the DBCA designated buffer of the 'Freshwater Claypans of the Fortescue Valley' Priority 1 PEC (**Figure 9-4**). While the Proposal will not result in direct impacts to this PEC, potential indirect impacts have been considered and are discussed in **Section 9.4.2**.

##### Four plant assemblages of the Wona Land System (Priority 1-Priority 3)

Within the Development Envelope the vegetation type MTGW has been mapped and described as Mixed Tussock Grasslands of *Eragrostis xerophila*, *Aristida latifolia* and *Astrebala pectinate*, with patches of *Triodia spp.* and sparse mixed shrublands (Maia 2022). This habitat/vegetation type lacks shrubs and has very little vegetative cover during the dry season. During the wet season, an array of ephemeral/annuals and short-lived perennials emerge, many of which are poorly known and range-end taxa (DBCA, 2021b). A total of 403.50 ha of MTGW occurs within the Development Envelope and is mapped as the 'Four plant assemblages of the Wona Land System' PEC (**Figure 9-4**). Of this, 69.98 ha occurs within the Indicative Footprint.

Vegetation type ASL(2) shares similar species to MTGW and may also be associated with the PEC so has been conservatively considered for the purpose of this assessment. A total of 4.00 ha of ASL (2) is mapped within the 'Four plant assemblages of the Wona Land System' PEC buffer (**Figure 9-4**). Of this, 0.33 ha occurs within the Indicative Footprint.

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## Mulga Downs Iron Ore Mine

This system was previously known as the 'Cracking clays of the Chichester and Mungaroona Range' PEC. This PEC is a system of basalt upland gilgai plains with tussock grasslands which occurs throughout the Chichester Range into the Chichester-Millstream National Park and the Mungaroona Range Nature Reserve. There are a series of community types identified within the Wona Land System gilgai plains which are considered susceptible to known threats such as grazing or have constituent rare/restricted species.

Table 9-5: Four plant assemblages of the Wona Land System PEC

Vegetation Type	Extent in Development Envelope (ha)	Extent in Indicative Footprint
MTGW	403.50	69.98
ASL(2)	4.00	0.33
<b>Total</b>	<b>407.50</b>	<b>70.31</b>

### Coolibah-lignum flats: *Eucalyptus victrix* over lignum community in the Pilbara (P1-P3)

One vegetation community mapped within the Development Envelope AdEvWL (4.96 ha occurs within the Development Envelope) appears to have affinities with the PEC, 'Coolibah-lignum flats: *Eucalyptus victrix* over lignum community in the Pilbara' PEC (Priority 1 or Priority 3 depending on location; Maia 2022). Quadrat data from within this mapped area was sent to DBCA (Species and Communities Branch) for comparison and analysis against reference quadrats from known PEC occurrences. Based on the analysis, the presence of two different *Acacia* species (*Acacia distans* and *A. stenophylla*) signifies different communities from the sub-types described for the PEC (pers. comm. Jill Pryde A/Senior Ecologist, DBCA Species and Communities Branch, November, 2012). The nearest mapped location of this PEC is approximately 45 km south-southwest of the Development Envelope within Karijini National Park. This PEC is therefore not considered to be present within the Development Envelope. DBCA has advised that it is likely that the vegetation type is still not considered part of the Coolibah lignum flats of the Pilbara Region PEC (pers comms Robyn Luu 2/9/24).

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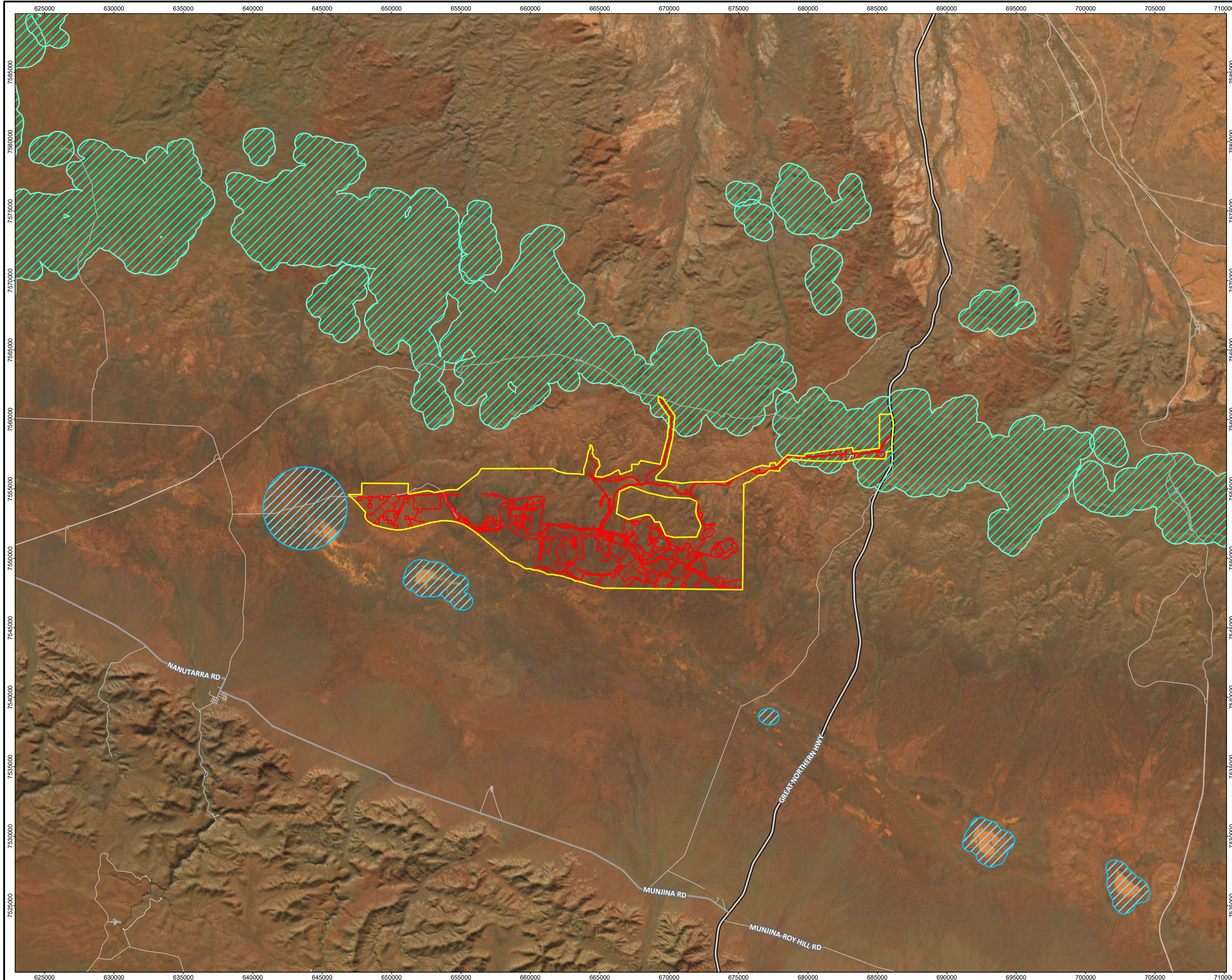
## Mulga Downs Iron Ore Mine

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Figure 9-4: Conservation Significant Ecological Communities based on DBCA designated buffers

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- Legend**
- Development Envelope
  - Indicative Footprint
  - Priority Ecological Communities (DBCA-038)
  - Four plant assemblages of the Wona Landsystem PEC buffer (P1)
  - Freshwater claypans downstream of the Fortescue Marsh PEC buffer (P1)
  - Highway
  - Major road
  - Minor Road



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**Mulga Downs Iron Ore Mine  
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**CONSERVATION SIGNIFICANT  
 ECOLOGICAL COMMUNITIES BASED  
 ON DBCA DESIGNATED BUFFERS**

**FIGURE 9.4**

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## Mulga Downs Iron Ore Mine

Vegetation with a restricted distribution, with a history of historical impact, a role as a refuge, and with important ecological functions

According to Maia (2022) six of the 15 vegetation types mapped within the Development Envelope may be locally significant due to being restricted locally, associated with significant ecological processes and landforms, and supporting conservation-significant species as outlined in (Table 9-6).

Table 9-6: Key attributes of locally significant vegetation within the Development Envelope (Maia, 2022)

Locally Significant Vegetation Type	Reason
ASL (2)	Drainage lines associated with ASL (2) harvest water from the surrounding hills and feed it to Mulga and other vegetation downslope; therefore, any changes to water flow into these drainage lines may affect the health of vegetation types dependent on water shedding off the hills.
AWL (1) AWL (2) AWL (3)	These vegetation types contain areas of banded and non-banded mulga and are likely to be susceptible to changes in surface water flow.
TvHG	Vegetation type TvHG occurs in the Jeerinah Formation stratigraphic unit which contains the geological characters of shale. The Priority 1 species <i>Triodia venciae</i> is the dominant and indicator species of this vegetation type.
AdEvWL	This riparian vegetation type is habitat specific as it is restricted to the Fortescue River and associated habitats.

### 9.3.5.3 Sheetflow Dependant Vegetation

Vegetation potentially dependent on sheet flow (overland/surface water flow) is present within the Development Envelope.

*Acacia aneura* and closely related co-occurring species are commonly referred to as Mulga vegetation (Mulga) (Page and Grierson, 2010). Mulga has been found to be highly dependent on sheet flow (Winkworth, 1973; Tongway and Hindley, 2004; Saco et al., 2010) and sensitive to any changes to sheet flow. The changes can be natural, such as following rainfall events where the natural fluvial channels may be altered from erosional processes.

Across the Pilbara, sheetflow vegetation typically comprises banded Mulga and non-banded Mulga that is most commonly associated with the Jamindie land system.

Vegetation types listed in Table 9-7 which may represent sheetflow dependent vegetation types have been mapped within and surrounding the Development Envelope. They are identified as potential sheetflow vegetation solely due to the dominant presence of Mulga species, such as *Acacia aneura*, within these vegetation types (Maia 2022). Soil type and gradient has not been considered in the identification of these potential sheetflow dependent communities.

A total of 44,964.20 ha of these vegetation types have been mapped during surveys associated with the Proposal (refer to Table 9-3) of which 9,725.43 ha occurs within the Development Envelope and 2,973.51 ha occurs within the Indicative Footprint (Figure 9-5).

Table 9-7: Potential Sheet Flow Vegetation

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## Mulga Downs Iron Ore Mine

Potential Sheetflow Vegetation	Known mapped Extent (refer to Figure 9-3)*	Extent in Development Envelope (ha)	Extent in Indicative Footprint (ha)
AaAxSL - tall sparse shrubland of <i>Acacia aneura</i> (alliance)	3,628.68	814.09	68.53
ASL (1) - <i>Acacia</i> tall shrubland	1,854.75	359.51	64.95
ASL (2) - <i>Acacia</i> tall shrubland	4,283.22	1378.13	253.47
AWL (1) - <i>Acacia</i> low woodland or tall shrubland	14,111.52	5654.28	2087.41
AWL (2) - <i>Acacia</i> low woodland or tall shrubland	7,240.06	105.67	35.98
AWL (3) - <i>Acacia</i> low woodland or tall shrubland	4,066.26	32.12	8.83
AxAsSL - <i>Acacia</i> tall sparse shrubland	9,779.72	1381.63	454.33
<b>Total</b>	<b>44,964.21</b>	<b>9,725.43</b>	<b>2,973.51</b>

\*Note: area calculations are based on multiple surveys with some overlap and as a result some figures may be an overestimate.

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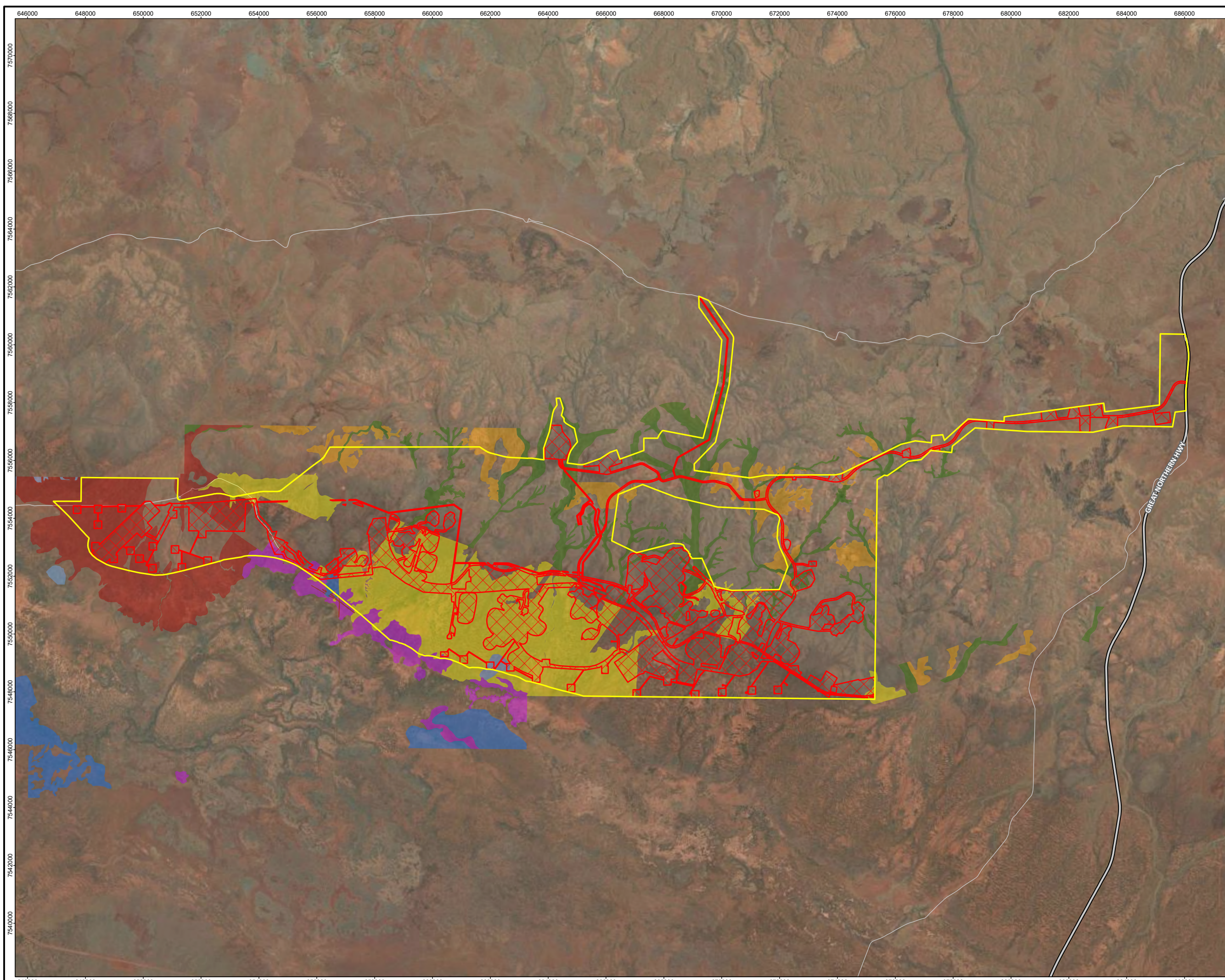
## Mulga Downs Iron Ore Mine

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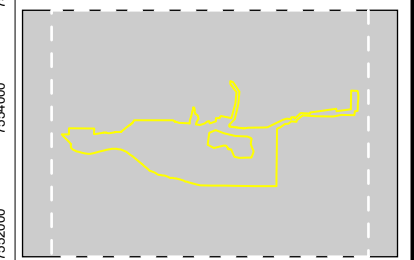
Figure 9-5: Potential Sheetflow Dependent Vegetation within the Development Envelope (Maia, 2022)

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- Legend**
- Development Envelope
  - Indicative Footprint
- Sheetflow vegetation type
- AaAxSL
  - ASL (1)
  - ASL (2)
  - AWL (1)
  - AWL (2)
  - AWL (3)
  - AxAxSL
- Roads (LGATE-195)
- Highway
  - Minor Road

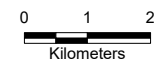


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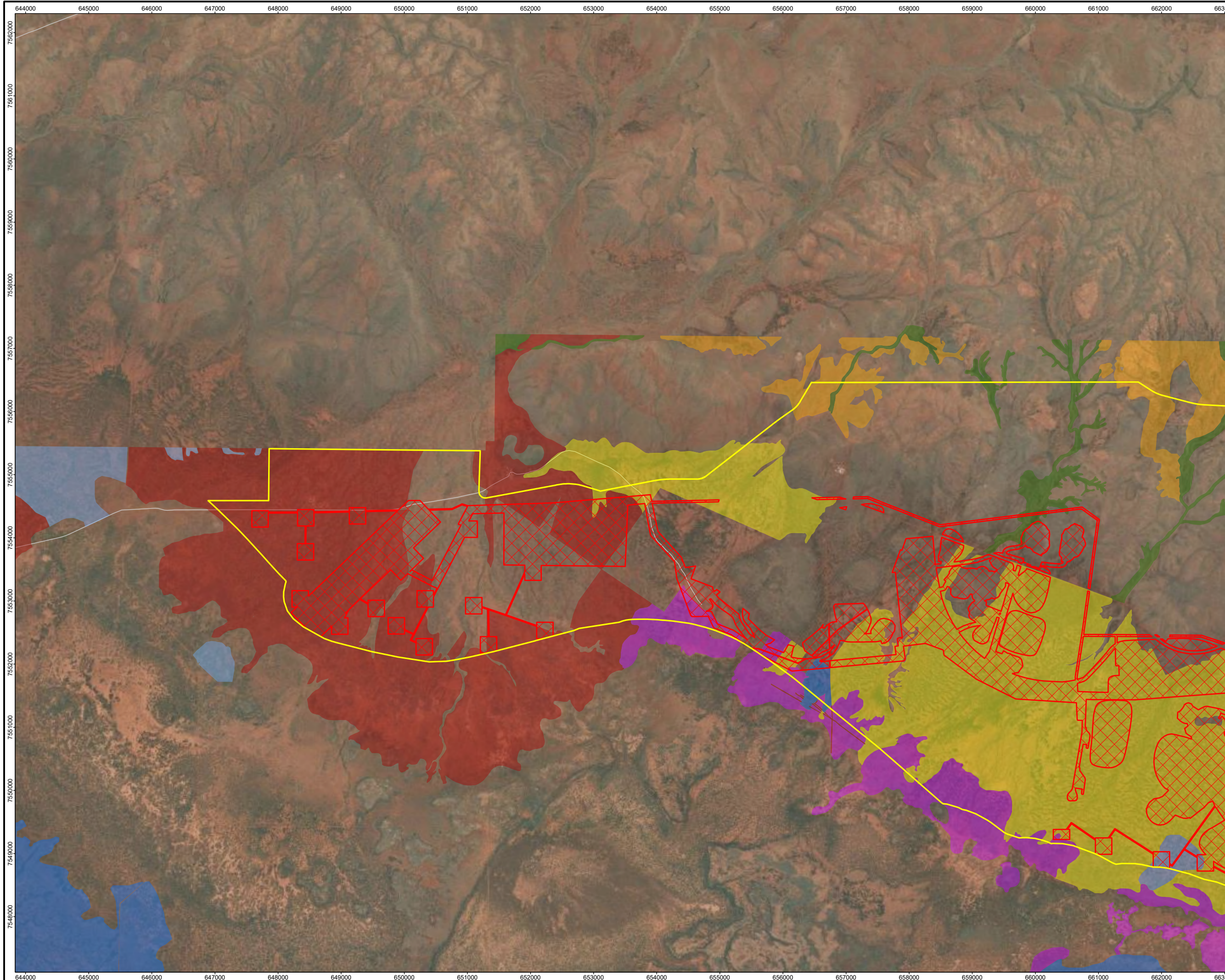
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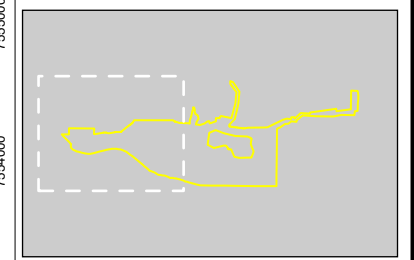
**POTENTIAL SHEETFLOW VEGETATION  
WITHIN THE DEVELOPMENT ENVELOPE**

**FIGURE 9.5 Map 1 of 4**

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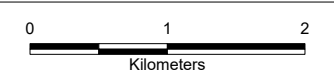


- Legend**
- Development Envelope
  - Indicative Footprint
  - Sheetflow vegetation type
    - AaAxSL
    - ASL (1)
    - ASL (2)
    - AWL (1)
    - AWL (2)
    - AWL (3)
    - AxAsSL
  - Roads (LGATE-195)
    - Minor Road



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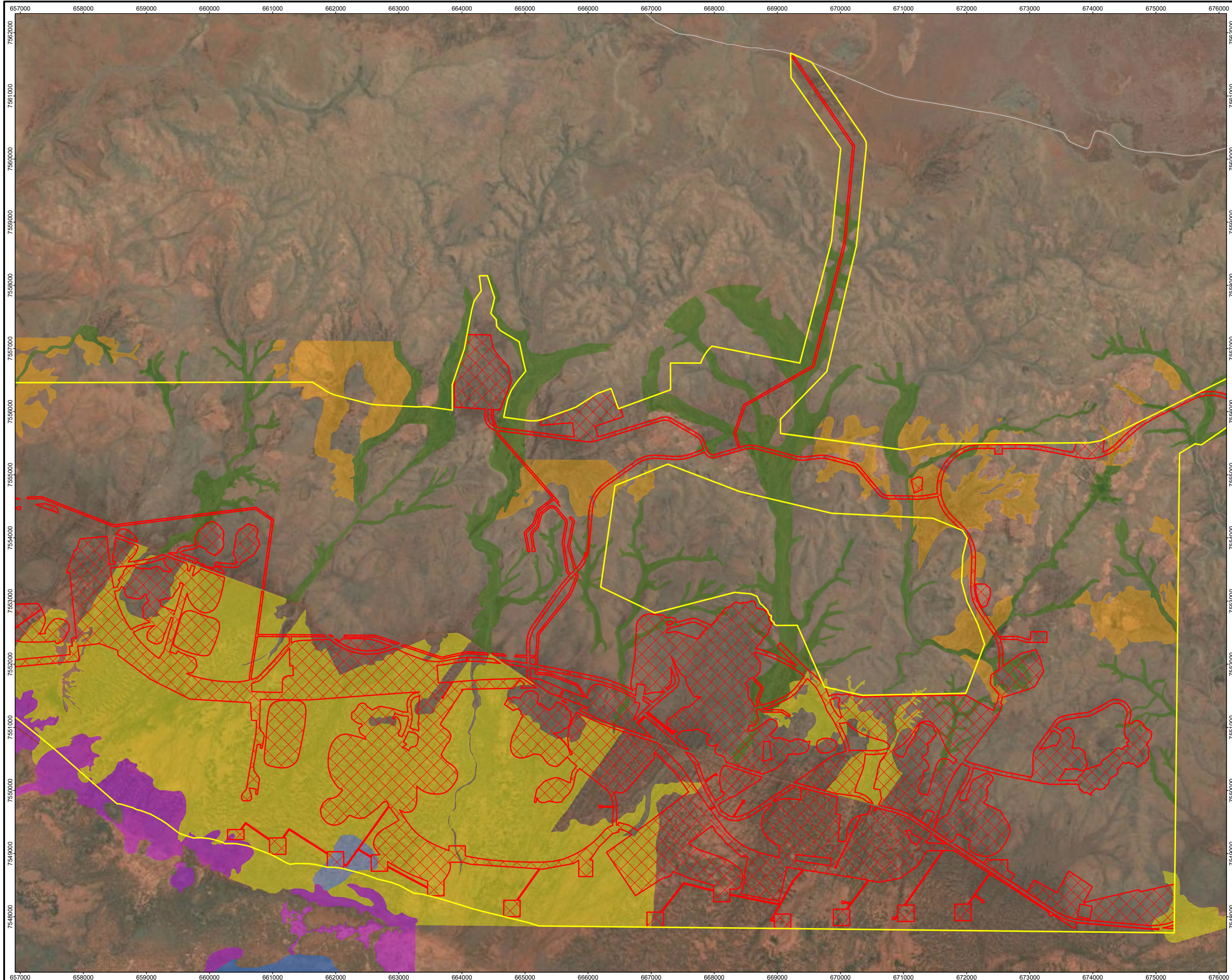
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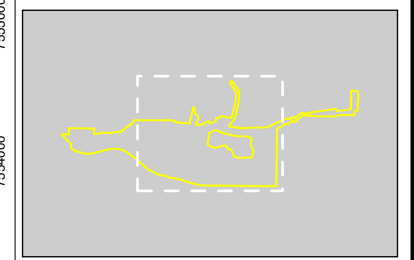
**POTENTIAL SHEETFLOW VEGETATION  
 WITHIN THE DEVELOPMENT ENVELOPE**

**FIGURE 9.5 Map 2 of 4**

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- Legend**
- Development Envelope
  - Indicative Footprint
  - Sheetflow vegetation type
  - AaAxSL
  - ASL (1)
  - ASL (2)
  - AWL (1)
  - AWL (2)
  - AWL (3)
  - AxAsSL
  - Roads (LGATE-195)
  - Minor Road



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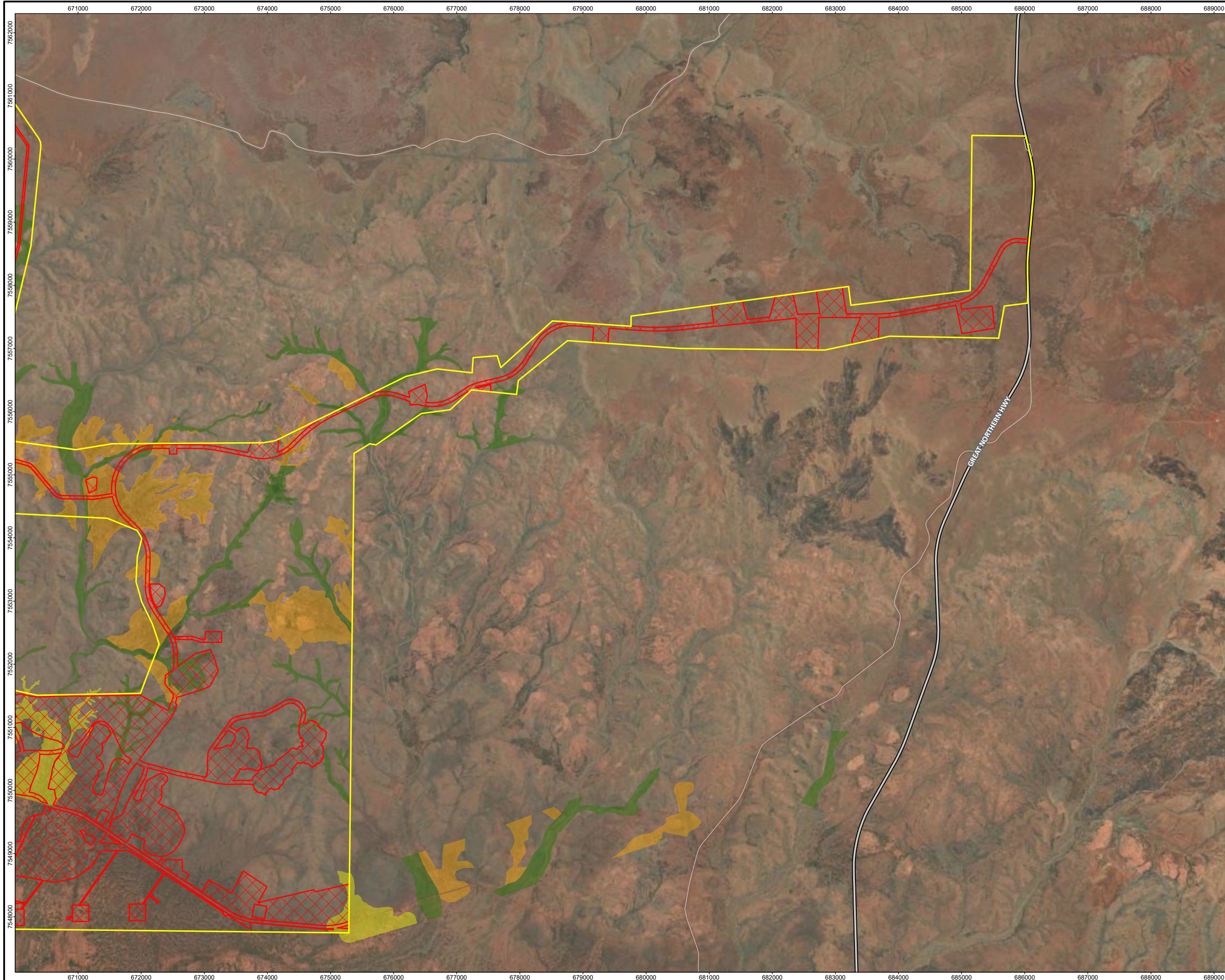
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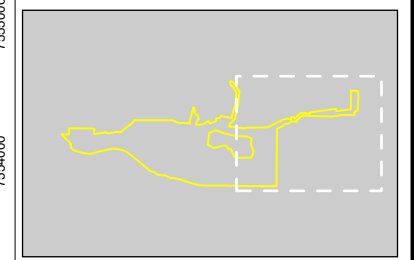
**POTENTIAL SHEETFLOW VEGETATION  
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**FIGURE 9.5 Map 3 of 4**

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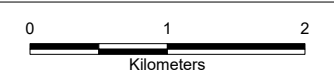


- Legend**
- Development Envelope
  - Indicative Footprint
  - Sheetflow vegetation type
  - AaAxSL
  - ASL (2)
  - AWL (1)
  - Roads (LGATE-195)
  - Highway
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**POTENTIAL SHEETFLOW VEGETATION  
 WITHIN THE DEVELOPMENT ENVELOPE**

**FIGURE 9.5 Map 4 of 4**

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## Mulga Downs Iron Ore Mine

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### 9.3.5.4 Groundwater Dependant Vegetation

Based on the detailed assessment of vegetation using remote sensing methods and other ecophysiological studies completed by AQ2 it is considered highly unlikely that groundwater dependent vegetation occurs within or in proximity to the Development Envelope (AQ2 2025).

Riparian species in the Pilbara represent the mesic or wet-end of an ecological gradient of decreasing water availability. Although vegetation higher in the ecological gradient may draw upon groundwater at times, riparian vegetation is considered the main groundwater-dependent vegetation of the Pilbara. It is also likely to be the most sensitive and least tolerant to decreased water availability (Loomes 2010a). Dominant riparian Pilbara species are often widespread and common to other Pilbara systems (e.g. floodplains, springs, river pools) (Maia 2022).

Groundwater Dependent Ecosystems (GDE) and the related Groundwater Dependent Vegetation (GDV) may be separated into the following phreatophytes (a plant with deep root systems that draws its water supply from near the water table) types:

- Obligate - obtains all of its water from the water table; and
- Facultative - able to source water from other sources than groundwater, for example surface water (i.e. rainfall).

The following dominant Pilbara riparian tree and shrub species have been identified in an assessment of water level ranges of Pilbara riparian species (Loomes 2010 cited in Maia 2021):

- *Eucalyptus camaldulensis*;
- *Melaleuca argentea*;
- *Eucalyptus victrix*;
- *Sesbania Formosa*;
- *Atalaya hemiglauca*;
- *Melaleuca glomerata*;
- *M. bracteate*;
- *Livistona alfredii*;
- *Lysiphyllum cunninghamii*;
- *Ficus opposita*;
- *Hakea lorea*; and
- *Acacia ampliceps*.

Of these, the desktop flora and vegetation survey undertaken by Maia (2022) identified that the following species have the potential to occur within the Development Envelope and across associated areas of riparian vegetation and known drainage lines:

- *Eucalyptus victrix*;
- *Melaleuca glomerata*;

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- *Ficus braccypoda*;
- *Atalaya hemiglauca*; and
- *Hakea lorea*.

To date, biological field surveys indicate no records of *Melaleuca argentea* or *Eucalyptus camaldulensis* (both obligate phreatophytes) occur within the Development Envelope. The dominant eucalypt species recorded by the biological field surveys was *Eucalyptus victrix*, a facultative phreatophyte (Maia, 2018 and 2020).

*Eucalyptus victrix* is considered a potential GDE indicator species (Maia 2022) and was recorded in four vegetation types mapped within the Development Envelope, including AdEvWL, ASL (2), AWL (2) and MTG (1). The most notable aspects of these vegetation types are:

- *E. victrix* occurs in low, open woodland to low woodland formations in vegetation types AdEvWL. In all other vegetation types, *E. victrix* occurs as scattered or isolated trees. These trees may be regarded as outliers from the core woodland populations, with recruitment presumably facilitated by a combination of specific hydrological regimes (e.g., major floods providing seed dispersal) and micro niche habitat characteristics.
- The Acacia woodland/shrubland vegetation types (i.e. ASL (2) and AWL (2)), and tussock grass dominate types (i.e. MTG (1)) are all upgradient of the *E. victrix* woodland units.

The mapped vegetation types within the Development Envelope and their ecohydrological characteristics are listed in **Table 9-8**.

Table 9-8: Mapped Vegetation Types in the Development Envelope and their Ecohydrological Characteristics (AQ2 2024a)

Vegetation Community	Key Ecohydrological Characteristics
AaAxSL	Occurs in upland areas. Dominant species include members of the <i>Acacia aneura</i> (complex) and <i>A. xiphophylla</i> , with Low Sparse Shrubland of <i>Eremophila cuneifolia</i> and a Sparse Hummock Grassland of <i>Triodia epactia</i> and/or <i>T. basedowii</i> . These are generally regarded as shallow rooted, drought tolerant species.
AdEvWL	Occurs in valley areas adjacent to claypans where surface water inflows accumulate. <i>Eucalyptus victrix</i> open woodland to woodland formations, with little to no understorey to a dense overstorey of <i>Acacia distans</i> . Other notable shrub species can include <i>A. stenophylla</i> , <i>A. tetragonophylla</i> and <i>Duma florulenta</i> . Maia (2022) noted that in some areas the understorey is impacted by current and historical grazing.
ASL (1)	Associated with Jamindie Land System, at the base of alluvial fans on hardpan plains dissected by throughflow drainages. Water sources include direct rainfall and redistributed runoff. Tall sparse to open mixed Shrubland mainly of <i>Acacia synchronicia</i> , <i>A. tetragonophylla</i> , <i>A. xiphophylla</i> with a mixed Sparse Chenopod Shrubland and occasional patched of mixed Tussock Grasses. These are generally regarded as shallow rooted, drought tolerant species.
ASL (2)	Associated with creek banks, minor drainage channels and floodplains. <i>E. victrix</i> is present as scattered trees (low density). Other notable species include <i>Corymbia hamersleyana</i> , <i>A. tumida</i> var. <i>pilbarensis</i> , <i>A. pyrifolia</i> and <i>A. maitlandii</i> and the understorey tussock grass <i>Themeda triandra</i> . Drainage inflows augment rainfall with soil water storage controlled by alluvium depth.

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Vegetation Community	Key Ecohydrological Characteristics
AWL (1)	A spatially extensive vegetation types that occurs on stony, washout flats with indistinct drainage on the northern side of the Fortescue Valley. Distinct banded vegetation formations supported by localised surface water redistribution processes. Dominated by <i>Acacia aneura</i> (complex) – shallow rooted, drought tolerant species.
AWL (2)	Similar to AWL (1), but mostly occurs on the southern side of the Fortescue Valley on better developed alluvial fans. Vegetation banding is evident but less distinct than AWL (1). Major species include <i>Acacia aneura</i> (complex), <i>Acacia synchronicia</i> and <i>A. tetragonophylla</i> , <i>E. victrix</i> present as scattered trees (low density).
AWL (3)	Functionally similar to AWL (1) and AWL (2). Occurs on broad drainage lines, drainage basins and hardpan and stony plains.
AxAsSL	Principally associated with the Hooley Land System (west of the proposed mining areas), occurs mainly on hardpan and stony plains. Characterised by fine textured (clayey) soil types. Water sources include direct rainfall and redistributed runoff. Tall Sparse Shrubland of <i>A. xiphophylla</i> and / or <i>A. synchronicia</i> with a mixed Sparse Chenopod Shrubland. These are generally regarded as shallow rooted, drought tolerant species.
MSW	Mixed shrublands and woodlands of drainage lines, contained the following species which have the potential to be groundwater dependent species: <ul style="list-style-type: none"> <li>• <i>Eucalyptus camaldulensis</i>; and</li> <li>• <i>Eucalyptus victrix</i> or <i>Melaleuca argentea</i>.</li> </ul>
MTG (1)	Occur in alluvial plains adjacent to major drainages feeding into the Fortescue Valley. Characterised by the fine textured soils. <i>E. victrix</i> present as scattered trees (low density) in MTG (1) and MTG (2).
MTGW	Four plant assemblages of the Wona Land System PEC
THG (1)	Occur on hillslopes in the Chichester Range, Rainfed, shallow rooted vegetation growing on stony soils.
THG (2)	
TvHG	Has restricted distribution on low rolling hills and undulating stony plains with a surface layer of shale in the Chichester Range. Rainfed, shallow rooted vegetation growing on stony soils.
THGB	Scattered spinifex hummock grasslands which occur in interfluvial areas, characteristic of skeletal soils and xerophytic conditions.

An ecohydrological study (AQ2 2025; **Appendix 4**) was completed to investigate the claypan flats and associated stands of mesic trees comprising *Eucalyptus victrix* with a midstorey and understorey of predominately *Acacia* sp. and *Meuhlenbeckia florulenta*.

An ecohydrological water model (EWB) was developed and predicted groundwater did not contribute to tree water demand at any of the measured sites (AQ2 2025). The model included several climatic scenarios. The objective of the model was to determine the frequency and magnitude of drought stress on the woodland trees over extended periods. The information from the assessment provides a basis for evaluating the necessity of

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groundwater to augment rainfall at key times over the different climatic periods (i.e. after prolonged soil-drying). The EWB evaluated water transfer in *E. victrix* woodlands that are representative of the on-ground tree measurement locations in the Development Envelope.

No GDEs were identified within the Development Envelope during the ecohydrology assessment. The study area also considered the areas proximal to the Proposal including the Goodiadarrie Swamp. The focus areas for the assessment included the Koodjeepindarranna and Gnalka Goona Claypans, which are also outside of the Development Envelope.

The ecohydrological assessment concluded that groundwater dependent vegetation is unlikely to occur within and in the area surrounding the Proposal, based on the following evidence:

- Groundwater underlying the Fortescue Valley environs is generally brackish/saline and therefore does not constitute a favourable water source for the vegetation.
- In most areas, plant roots cannot readily access groundwater as there is calcrete or dense impermeable clay beneath the soil, and above the groundwater table, which plants roots cannot easily penetrate.
- There are no areas of persistently high greenness as measured by time series NDVI imagery in the relevant area. Greenness reflects photosynthetic activity, which relies on water availability. In order to maintain persistently high greenness, vegetation would likely need a persistent water source even during dry seasons, such as groundwater.
- Time series pre-dawn leaf water potentials indicate the tree-root zones are in unsaturated media. Also taking into consideration the potential influence of brackish groundwater, this precludes the roots being in groundwater or at the capillary fringe.
- Water balance modelling supported by on-ground vegetation measurements, used to estimate tree water use relative to water availability estimated that surface water inputs are sufficient to support the density of trees occurring in the Fortescue Valley *E. victrix* woodland communities. The denser woodland stands are associated with better structured soils with relatively higher plant-available water storage capacity. This provides further support to the conclusion that the vegetation is unlikely to be reliant on groundwater.

### 9.3.5.5 Riparian Vegetation

One mapped riparian vegetation type (AdEvWL) (**Figure 9-7**) was identified within the Development Envelope which is restricted to the Fortescue River and associated habitats (Maia 2022). Vegetation type AdEvWL supports species that only occur in seasonally inundated habitats (Maia 2022). AdEvWL was mapped within 4.96 ha (0.03 %) of the Development Envelope (**Table 9-3**).

### 9.3.6 Flora

#### 9.3.6.1 Desktop Assessment

Maia (2022) completed a desktop assessment over an area approximately 235 km by 112 km referred to as the desktop study area. Searches were requested of DBCA's Threatened and Priority Flora List (TPFL) and WA Herbarium (WAH) databases in 2018 and 2020 (DBCA search references #31-0818FL, #55-0820FL and #41-1120FL) to gather information on conservation significant flora species that could potentially occur in the desktop study area.

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### 9.3.6.2 Threatened Flora

Threatened flora is the species of flora that are listed under the BC Act as critically endangered, endangered or vulnerable threatened species (DBCA 2023).

Four Threatened flora species under the BC Act which currently have records in the Pilbara bioregion (WAH, 1998-):

- *Aluta quadrata* (Endangered); found in three geographically separated locations in the Hamersley Range, approximately 225 km south west of the Proposal;
- *Quoya zonalis* (Endangered) previously known as *Pityrodia sp. Marble Bar* (G. Woodman & D. Coultas GWDC Opp 4). Found in Chichester subregion approximately 130 km north west;
- *Thryptomene wittweri* (Vulnerable, BC Act). Records are from the Hamersley;
- *Synostemon hamersleyensis* (Endangered). This species was listed as Priority species (DBCA) at the time of referral of this Proposal in 2021). It was delisted in October 2023 and upgraded to Endangered under the BC Act. This species is restricted to the Hamersley subregion (Telford and Naaykens, 2015).

All four species occur some distance from the Proposal with very different habitat preferences to those were mapped in the Development Envelope. With the exception of *Q. zonalis*, with records in the Chichester, the other three taxa occur within the Hamersley subregion. Searches in extensive surveys did not yield any records of these taxa (Maia 2022).

### 9.3.6.3 Priority Flora

Priority 1 species are known from one or a few locations (generally five or less) and are species which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, for example, agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements for threatened listing and appear to be under immediate threat from known threatening processes (DBCA 2023).

Priority 2 (poorly-known species) are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes (DBCA 2023).

Priority 3 (poorly-known species) are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them (DBCA 2023).

Species that are adequately known, meet criteria for near threatened, or are rare but not threatened, or that have been recently removed from the threatened species list or conservation dependent or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4 (DBCA 2023).

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The desktop assessment identified 108 Priority (classified by DBCA) flora species in the desktop study area. This includes 21 Priority 1 (P1), 19 Priority 2 (P2), 59 Priority 3 (P3) species and 9 Priority 4 (P4) species (See Table A3.3 of Maia 2022 for full species list; **Appendix 10a.1**).

Of these, 16 Priority flora species were previously recorded by surveys within the desktop study area:

- *Calotis squamigera* (Priority 1);
- *Helichrysum oligochaetum* (Priority 1);
- *Josephinia* sp. Woodstock (A.A. Mitchell PRP 989) (Priority 1);
- *Rhodanthe ascendens* (Priority 1);
- *Triodia veniciae* (Priority 1);
- *Teucrium pilbaranum* (Priority 2);
- *Eragrostis crateriformis* (Priority 3);
- Eragrostis sp. Erect spikelets (P.K. Latz 2122) (Priority 3);
- *Euphorbia australis* var. *glabra* (Priority 3);
- *Glycine falcata* (Priority 3);
- *Goodenia* sp. East Pilbara (A.A. Mitchell PRP 727) (Priority 3);
- *Lotasperma sessilifolium* (Priority 3);
- *Rostellularia adscendens* var. *latifolia* (Priority 3);
- *Themeda* sp. Hamersley Station (M.E. Trudgen 11431) (Priority 3);
- *Triodia basitricha* (Priority 3); and
- *Bulbostylis burbidgeae* (Priority 4).

One queried Priority flora species has also been recorded: *Rostellularia adscendens* ? var. *latifolia* (potential P3), along with one other potential Priority flora species, *Bulbostylis burbidgeae* – atypical form (? P4).

At the time of referral *Goodenia nuda* was listed as Priority 4. This species was downgraded and no longer listed under DBCA or BC Act.

### 9.3.6.4 Field Surveys

A total of 749 taxa from 60 families and 206 genera were recorded during field surveys by Maia (2022). Maia (2022) recorded 88% of the estimated flora taxa within the Survey Area as determined by species accumulation analysis. This is greater than most other studies recorded within the local area (Maia 2022) and highlights the large survey effort undertaken by Maia. This demonstrates that an adequate level of survey has been undertaken throughout the Development Envelope with respect to flora species detection.

The plant families most frequently recorded were:

- Fabaceae: 130 taxa;
- Poaceae: 127 taxa;
- Malvaceae: 81 taxa;

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- Asteraceae: 53 taxa; and
- Amaranthaceae: 35 taxa.

The findings are generally consistent with the flora assemblages expected for the Chichester and Fortescue Plains subregions (DBCA, 2022).

Following completion of the Maia (2022) survey, two additional survey areas (ASA) within the Development Envelope were identified, being the Road Deviation Area (RDA), the Solar Farm and the Water Pipeline (WP) covering a total area of 241.6 ha (**Figure 9-1**). A targeted flora and vegetation assessment of the ASA was subsequently undertaken by Maia in February 2023 (Maia 2023; **Appendix 10b**).

In total, 79 taxa from 45 genera and 22 families were recorded from the ASA; comprising 97% perennial taxa and 3% annual taxa. The families with the highest number of tax recorded were, similar to the Maia (2022) Survey Area:

- Fabaceae: 29 taxa;
- Poaceae: 10 taxa; and
- Malvaceae: 9 taxa.

### 9.3.6.5 Conservation Significant Flora

Conservation significant flora are species listed under the BC Act or Threatened or Priority species identified by DBCA as requiring further protection as described in **Section 9.3.6.2** and **9.3.6.3**, respectively.

No Threatened flora species listed under the BC Act have been recorded within the Development Envelope (Maia 2022; 2023).

Nine confirmed 'Priority' flora species have been identified in the Development Envelope (**Table 9-9; Figure 9-6**). Of these, two species were initially considered unresolved, *Hibiscus* sp.? Nov. and *Bulbostylis burbridgeae*-like (atypical form); however, subsequent taxonomic identification has determined these species to be; *Hibiscus* sp. Mulga Downs (S. Hitchcock SH 638) (now Priority 1); and an atypical form of *Bulbostylis burbridgeae*-(Priority 4).



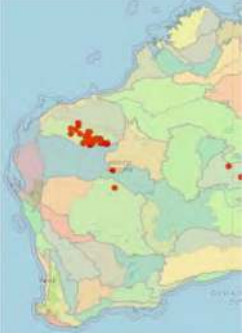
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Table 9-9: Conservation Significant Flora Recorded in the Development Envelope

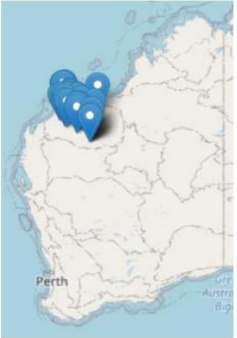

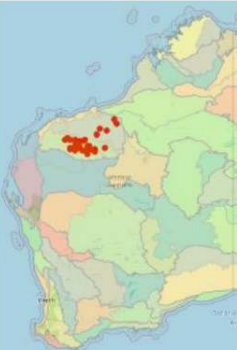

Species	Description/Habitat/Known Range and Extent (Maia 2022; WAH 1998-)	Distribution (from Maia 2022; WAH 1998-)	Vegetation Types	Total Extent of Potential Habitat in Development Envelope (ha)	Total Extent of Potential Habitat in Indicative Footprint (ha)	Total number of individuals mapped during surveys (Table 9-2)	No. of known individuals in the Development Envelope	No. of known Individuals in the Indicative Footprint
<b>Priority 1</b>								
<i>Hibiscus</i> sp. Mulga Downs (S. Hitchcock SH 638) (includes resolved records)	<i>Hibiscus</i> sp. Mulga Downs (S. Hitchcock SH 638) is a sub-shrub, that has been recorded growing from 12 cm to 20cm in height, with purple flowers and grows on stony plain with red clay-load over ironstone (Western Australian Herbarium 1998-). Records associated with surveys undertaken in connection with this Proposal are the only records of this species. AWL (1) and AWL (2) are also the primary vegetation types in which this taxon has been recorded. Both vegetation types are sheetflow dependent. Currently, 229 of 311 <i>Hibiscus</i> sp. Mulga Downs waypoints / records (within the Survey Area) are in vegetation type AWL (1) (74% of the Survey Area records), and 77 records (25%) are in AWL (2); the remaining five are in ASL (1).		AWL (1) AWL (2)	5,759.95	2,123.39	1,741	1,427	622
<i>Triodia veniciae</i>	Spinifex species located on shale slopes and tops of low hills. <i>T. veniciae</i> has 26 records on Florabase and 22 records on ALA. The ALA records appear to be mostly in the Fortescue subregion, with one record in the Chichester subregion of the Pilbara bioregion. This species has been recorded across the broader MDIOM and Hub and Rail Spur.		AaAxSL THG (1) THG (2) TvHG	6,782.81	1,192.97	2,359	1,099	544
<b>Priority 3</b>								
<i>Aristida jerichoensis</i> var. <i>subspinulifera</i>	<i>A. jerichoensis</i> var. <i>subspinulifera</i> has 42 records on Florabase and 36 records ALA in WA (2,105 records for all of Australia). The ALA records are in the Gascoyne, Murchison and Pilbara bioregions and five subregions – Hamersley, Fortescue, Augustus, Carnegie and Eastern Murchison.		ASL (2) AWL (1) THG (2)	7,739.54	2,525.78	14	5	0

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Species	Description/Habitat/Known Range and Extent (Maia 2022; WAH 1998-)	Distribution (from Maia 2022; WAH 1998-)	Vegetation Types	Total Extent of Potential Habitat in Development Envelope (ha)	Total Extent of Potential Habitat in Indicative Footprint (ha)	Total number of individuals mapped during surveys (Table 9-2)	No. of known individuals in the Development Envelope	No. of known Individuals in the Indicative Footprint
<i>Dolichocarpa sp.</i> Hamersley Station (A.A. Mitchell PRP 1479) (includes <i>Oldenlandia sp.</i> Hamersley Station (A.A. Mitchell PRP 1479))	Prostrate annual herb, growing up to 0.01 m tall. Blue-mauve flowers. Gentle slope, plains, in claypan, red-brown sandy clay. <i>D. sp.</i> Hamersley Station (A.A. Mitchell PRP 1479) has 38 2 records on Florabase. The Florabase records are all in the Pilbara bioregion (in the four subregions) but it is restricted to heavy clay soils.		AWL (1) THG (1)	10,891.02	3,026.64	180,169	17	2
<i>Euphorbia australis var. glabra</i>	Prostrate annual herb. Typically occurs on cracking clay and clay plains. Flowers in April to September. It is distributed widely in the central Pilbara. <i>E. australis var. glabra</i> has 23 records on Florabase and 25 records on ALA, with records are in the Pilbara bioregion and in the Chichester, Fortescue and Hamersley subregions.		AdEvWL	4.95	4.31	3,346	1	0
<i>Rostellularia adscendens var. latifolia</i>	Herb or shrub to 0.3 m high. Creeks, rocky hills. Flowers are blue-purple-violet in April to May. <i>Rostellularia adscendens var. latifolia</i> is an erect, perennial herb to 0.3 m high, which occurs near creeks or on rocky hills (Western Australian Herbarium 1998-). This taxon occurs over a range of approximately 420 km in Western Australia, from Warrawagine Station in the north-east, to near Hamersley Station in the south-west (DBCA 2007-). It also occurs in the Northern Territory, South Australia, Queensland and New South Wales (Council of Heads of Australasian Herbaria 2016). <i>R. adscendens var. latifolia</i> has 47 records on Florabase and 49 records on ALA in WA. The WA records are only in the Pilbara bioregion in three of the four subregions – Hamersley, Fortescue and Chichester.		AdEvWL	814.09	4.31	2,841	4	0
<i>Themeda sp.</i> Hamersley Station (M.E. Trudgen 11431)	<i>Themeda sp.</i> Hamersley Station (M.E. Trudgen 11431) has 55 records on Florabase and 55 records on ALA. Almost all of the records are in the Pilbara bioregion, in all 4 subregions, while one record is in the Trainor subregion of the Little Sandy Desert bioregion.		AaAxSL MTG (1)	1,056.06	109.14	522	0	0

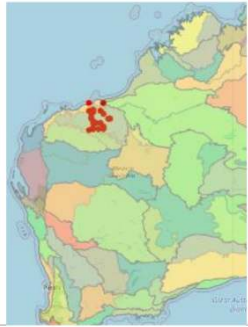

Priority 4

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Species	Description/Habitat/Known Range and Extent (Maia 2022; WAH 1998-)	Distribution (from Maia 2022; WAH 1998-)	Vegetation Types	Total Extent of Potential Habitat in Development Envelope (ha)	Total Extent of Potential Habitat in Indicative Footprint (ha)	Total number of individuals mapped during surveys (Table 9-2)	No. of known individuals in the Development Envelope	No. of known Individuals in the Indicative Footprint
<i>Bulbostylis burbridgeae</i> (includes count of 'atypical' taxa)	A tufted, erect to spreading annual, grass like or herb (sedge) growing 0.03-0.25m high, with brown flowers (March or June to August), on granitic soils, granite outcrops and cliff bases. The WA records of <i>Bulbostylis burbridgeae</i> are only in the Pilbara bioregion in three of the four subregions - Chichester, Fortescue, Roebourne. (WAH 1998-). The atypical form was recorded within the DE from 4 records (20 individuals each).		TGH (1)	5,236.74	939.23	80	20	0
<i>Rhynchosia bungarensis</i>	<i>R. bungarensis</i> has 87 records on Florabase and 91 records on ALA. While they are in the Carnarvon, Gascoyne and Pilbara bioregions most records are in the Pilbara. The records are in 5 subregions including the Chichester, Hamersley and Roebourne in the Pilbara. ALA shows one record in the Dampierland bioregion, Pindanland subregion, which is not on Florabase		ASL (1)	359.51	64.95	1	1	0

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### 9.3.6.6 Other Significant Flora

According to EPA guidance (EPA, 2016f), flora species may be considered significant if they are considered possible new species, have atypical characteristics or are range extensions.

Using a distance of 100 km as the minimum distance from an existing record to define range extension, nine range extension species have been collected within the Survey Area:

- *Acacia doreta*;
- *Aristida anthoxanthoides*;
- *Abildgaardia oxystachya*;
- *Goodenia occidentalis*;
- *Maireana aphylla*;
- *Olearia muelleri*;
- *Roepera iodocarpa*;
- *Stemodia linophylla*; and
- *Vittadinia ertici*.

Two *Acacia sp. nov* individuals were collected from an *Acacia* with miniritchie bark growing in shaley areas. The shrubs were sterile when the surveys were carried out; however, one specimen was submitted to the WA Herbarium for identification, and it was indicated to be a potential new species (Maia 2022; **Appendix 10a.1**). The specimen did not clearly fit any currently recognised taxon or hybrid. More specimens were collected during a follow-up targeted flora survey in 2021, and they were submitted to the WA Herbarium for identification. The sample was subsequently determined likely to be *Acacia doreta*, with the WA Herbarium reasonably confident with the identification, and was noted that it would be good to see fruiting material to confirm. This is a northerly range extension for the species. *A. doreta* is not listed as conservation significant.

Species have a typical range which is indicated by their known distribution records. Sometimes species are recorded during a survey and their distribution records show that they have not been located in the area previously. The new records can either extend the range of a species out from its known distribution or fill a gap in the distribution records. The new distribution records can be a result of few surveys having been carried out in an area; of the degree of coverage achieved previously and of the habitats surveyed; or the time of year of survey with respect to season and rainfall. However, range extensions and gap fillers can also reflect a lack of submission of flora records to the WA Herbarium, as relatively common species or those not classified as significant are not often submitted.

An additional flora of significance, Sandalwood (*Santalum spicatum*) has also been recorded in the Survey Area but occurs outside the Development Envelope. This species is defined and controlled as a native species by the BC Act and *Biodiversity Regulations 2018*. It cannot be taken from private land or from Crown land without a license (flora taking (sandalwood license) (GoWA, 2018a), unless an exemption applies. It may also be lawfully taken (or cleared) in Western Australia under Parts IV and V of the EP Act and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*. Three individual *S. spicatum* trees were identified within the Study Area (**Figure 9-6**).

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Some of these species could have been dispersed into the area by cattle if transported to the Survey Area from other regions. None of the range extension / range gap filling species is listed as conservation significant (Maia 2022). None of these other significant flora occur in the Development Envelope and are not considered further.

### 9.3.7 Introduced Flora

A total of 19 introduced flora taxa (weeds) have been recorded during surveys (Maia 2022; **Appendix 10a.1**) of which 13 are present within the Development Envelope. None of the introduced flora taxa are listed as Weeds of National Significance (WoNS). Eight of the introduced flora taxa recorded within the Development Envelope are listed as environmental weeds (**bold text**):

- *Aerva javanica* (Kapok Bush)
- *Bidens bipinnata* (Bipinnate Begger's Tick)
- *Cenchrus ciliaris* (Buffel Grass)
- *Cenchrus setiger* (Birdwood Grass)
- *Chloris virgata* (Feathertop Rhodes Grass)
- *Citrullus amarus* (Pie Melon)
- *Citrullus colocynthis* (Colocynth)
- *Flaveria trinervia* (Speedy Weed)
- *Malvastrum americanum* (Spiked Malvastrum).
- *Rumex vesicarius* (Ruby Dock)
- *Setaria verticillata* (Whorled Pigeon Grass).
- *Tribulus terrestris* (Caltrop)
- *Vachellia farnesiana* (Mimosa Bush).

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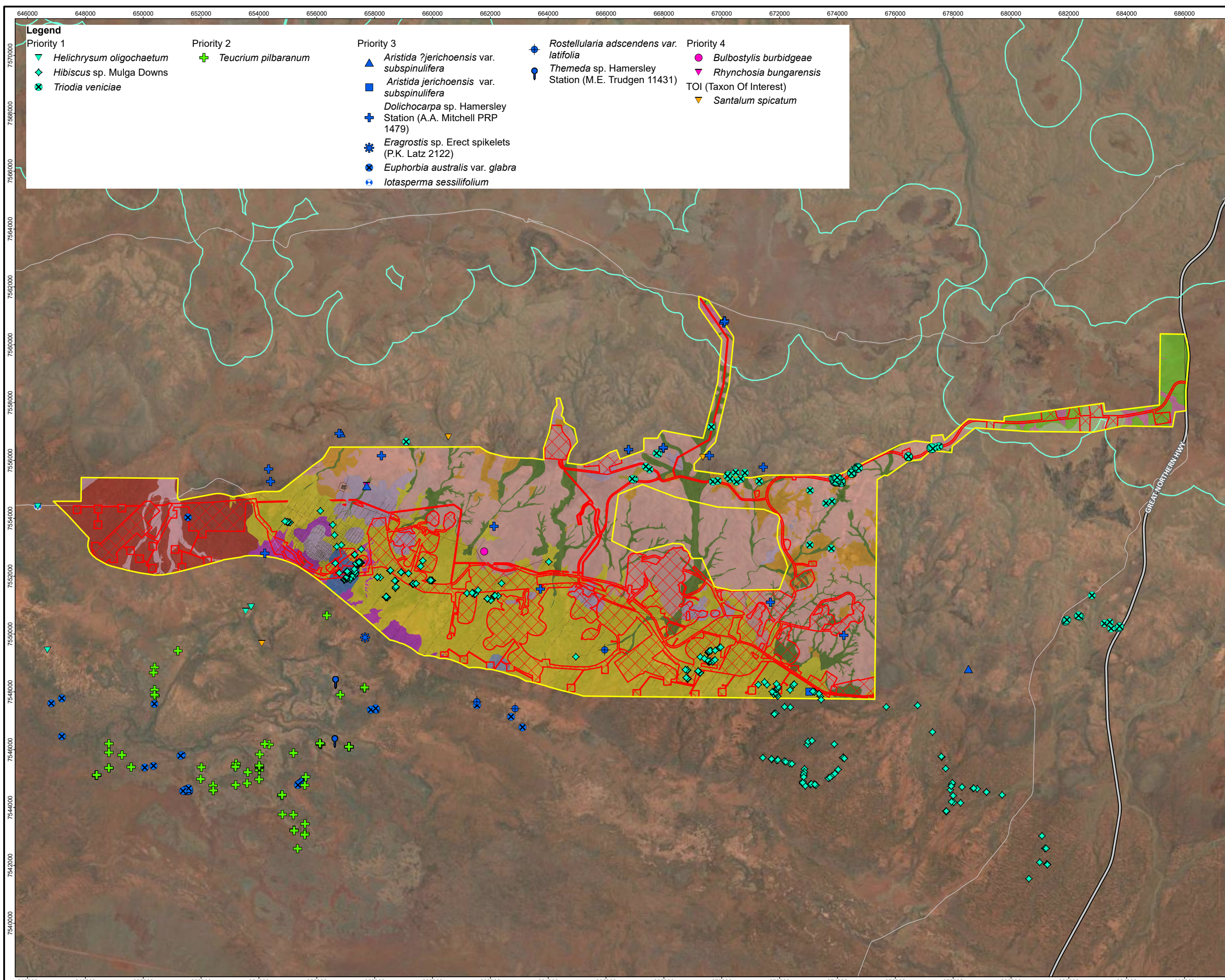
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Figure 9-6: Conservation Significant Flora in relation to the Proposal

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**Legend**

<b>Priority 1</b>	<b>Priority 2</b>	<b>Priority 3</b>	<b>Priority 4</b>
<ul style="list-style-type: none"> <li>▼ <i>Helichrysum oligochaetum</i></li> <li>◆ <i>Hibiscus</i> sp. Mulga Downs</li> <li>⊗ <i>Triodia veniciae</i></li> </ul>	<ul style="list-style-type: none"> <li>⊕ <i>Teucrium pilbaranum</i></li> </ul>	<ul style="list-style-type: none"> <li>▲ <i>Aristida ?jerichoensis</i> var. <i>subspinulifera</i></li> <li>▲ <i>Aristida jerichoensis</i> var. <i>subspinulifera</i></li> <li>■ <i>Dolichocarpa</i> sp. Hamersley Station (A.A. Mitchell PRP 1479)</li> <li>⊕ <i>Eragrostis</i> sp. Erect spikelets (P.K. Latz 2122)</li> <li>⊗ <i>Euphorbia australis</i> var. <i>glabra</i></li> <li>⊕ <i>Iotasperma sessilifolium</i></li> </ul>	<ul style="list-style-type: none"> <li>◆ <i>Rostellularia adscendens</i> var. <i>latifolia</i></li> <li>● <i>Themeda</i> sp. Hamersley Station (M.E. Trudgen 11431)</li> <li>● <i>Bulbostylis burbidgeae</i></li> <li>▼ <i>Rhynchosia bungarensis</i></li> <li>▼ <i>Santalum spicatum</i></li> </ul>

**Legend**

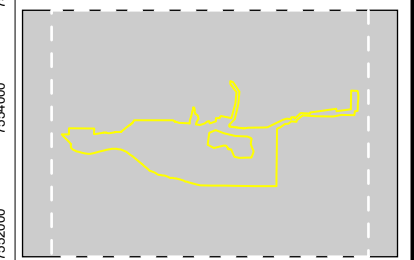
- Development Envelope
- Indicative Footprint
- Four plant assemblages of the Wona Landsystem

**Vegetation type**

- AaAxSL
- AdEvWL
- ASL (1)
- ASL (2)
- AWL (1)
- AWL (2)
- AWL (3)
- AxAsSL
- MSW
- MTG (1)
- MTGW
- THG (1)
- THG (2)
- THGB
- TvHG
- Cleared/Disturbed

**Roads (LGATE-195)**

- Highway
- Minor Road



Job No: 67751

Client: Hancock Prospecting Pty Ltd

Version: A	Date: 27-Mar-2025
Drawn By: dmills	Checked By: VC

Scale 1:120,000 at A3

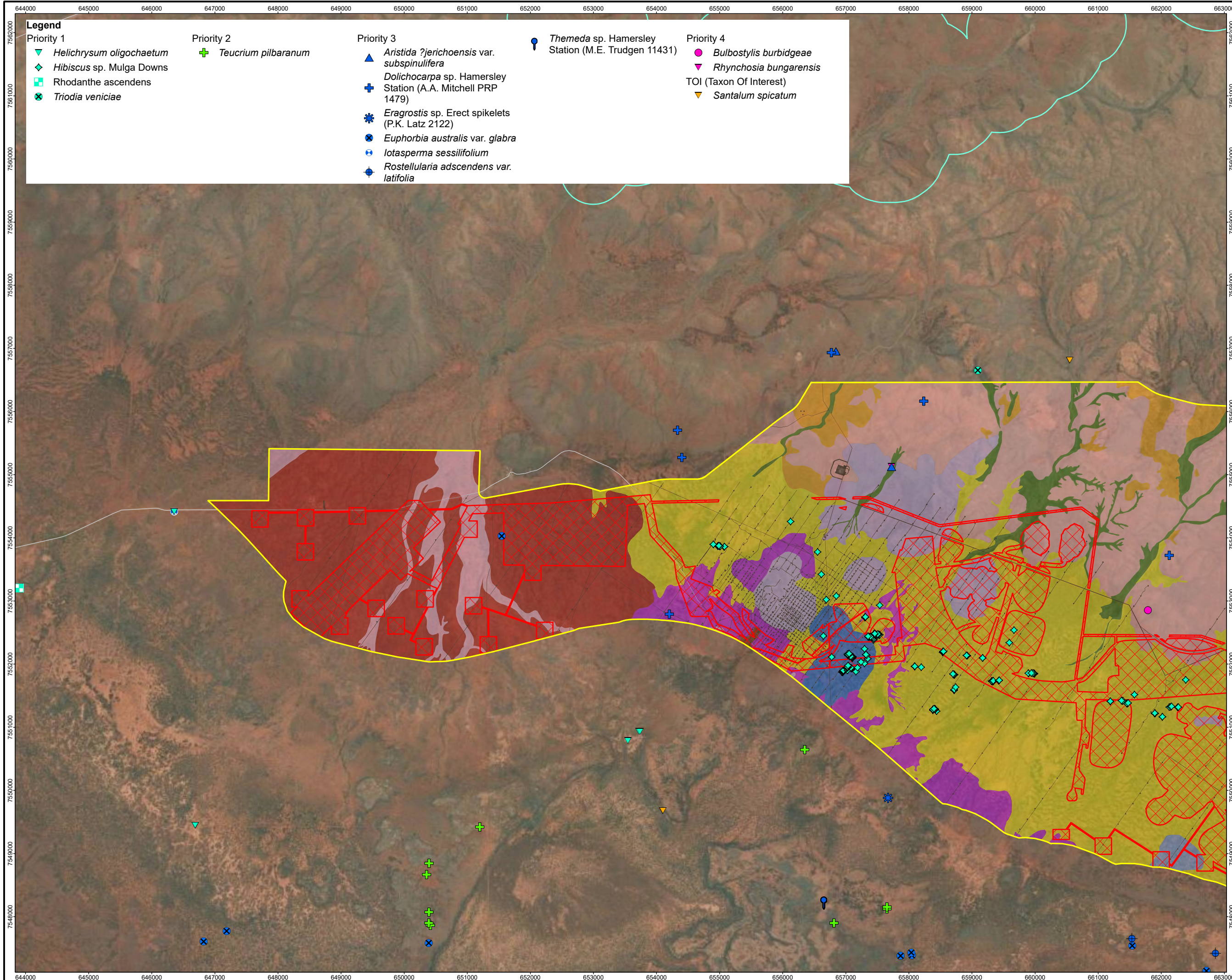
Coord. Sys. GDA2020 MGA Zone 50

**Mulga Downs Iron Ore Mine  
Central Pilbara, Western Australia**

**CONSERVATION SIGNIFICANT FLORA  
IN RELATION TO THE PROPOSAL**

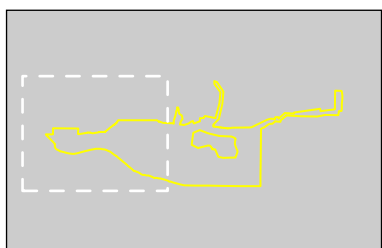
**FIGURE 9.6 Map 1 of 4**

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Image Reference: World Imagery: Earthstar Geographics



- Legend**
- |   |  |  |   |
|---|--|--|---|
| <b>Priority 1</b>   | <b>Priority 2</b>  | <b>Priority 3</b>  | <b>Priority 4</b>   |
| <ul style="list-style-type: none"> <li>▼ <i>Helichrysum oligochaetum</i></li> <li>◆ <i>Hibiscus</i> sp. Mulga Downs</li> <li>■ <i>Rhodanthe ascendens</i></li> <li>⊗ <i>Triodia veniciae</i></li> </ul> | <ul style="list-style-type: none"> <li>⊕ <i>Teucrium pilbaranum</i></li> </ul> | <ul style="list-style-type: none"> <li>▲ <i>Aristida ?jerichoensis</i> var. <i>subspinulifera</i></li> <li>⊕ <i>Dolichocarpa</i> sp. Hamersley Station (A.A. Mitchell PRP 1479)</li> <li>✱ <i>Eragrostis</i> sp. Erect spikelets (P.K. Latz 2122)</li> <li>⊗ <i>Euphorbia australis</i> var. <i>glabra</i></li> <li>⊕ <i>Iotasperma sessilifolium</i></li> <li>⊕ <i>Rostellularia ascendens</i> var. <i>latifolia</i></li> </ul> | <ul style="list-style-type: none"> <li>● <i>Themeda</i> sp. Hamersley Station (M.E. Trudgen 11431)</li> <li>● <i>Bulbostylis burbidgeae</i></li> <li>▼ <i>Rhynchosia bungarensis</i></li> <li>▼ <i>Santalum spicatum</i></li> </ul> |
- TOI (Taxon Of Interest)

- Legend**
- Development Envelope
  - Indicative Footprint
  - Four plant assemblages of the Wona Landsystem
- Vegetation type**
- AaAxSL
  - AdEvWL
  - ASL (1)
  - ASL (2)
  - AWL (1)
  - AWL (2)
  - AWL (3)
  - AxAsSL
  - MTG (1)
  - THG (1)
  - THG (2)
  - Cleared/Disturbed
- Roads (LGATE-195)**
- Minor Road



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 Drawn By: dmills Checked By: VC

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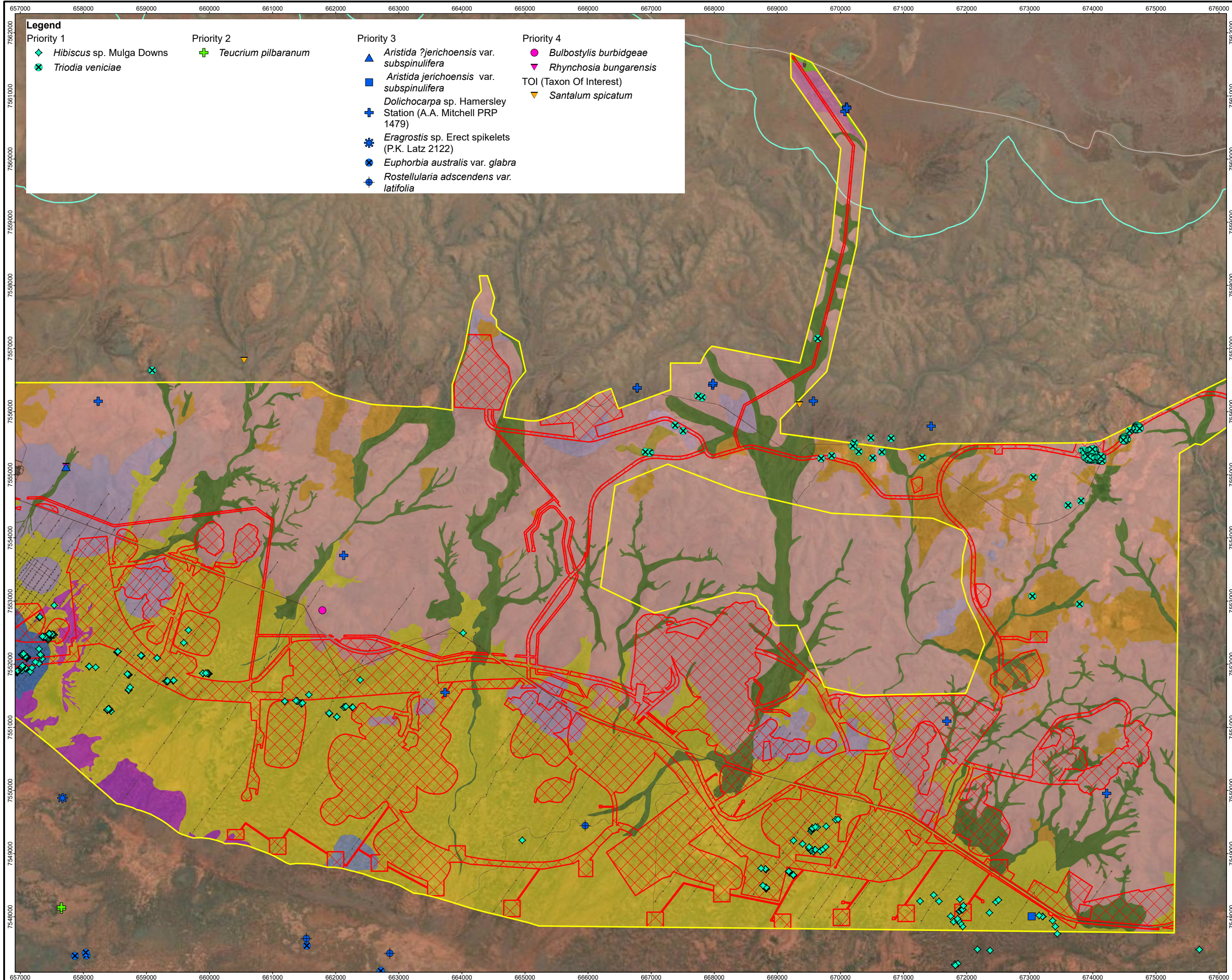
Coord. Sys. GDA2020 MGA Zone 50

**Mulga Downs Iron Ore Mine  
 Central Pilbara, Western Australia**

**CONSERVATION SIGNIFICANT FLORA  
 IN RELATION TO THE PROPOSAL**

**FIGURE 9.6 Map 2 of 4**

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 Image Reference: World Imagery: Earthstar Geographics



**Legend**

<b>Priority 1</b>	<b>Priority 2</b>	<b>Priority 3</b>	<b>Priority 4</b>
◆ <i>Hibiscus</i> sp. Mulga Downs	✚ <i>Teucrium pilbaranum</i>	▲ <i>Aristida ?jerichoensis</i> var. <i>subspinulifera</i>	● <i>Bulbostylis burbidgeae</i>
✖ <i>Triodia veniciae</i>		■ <i>Aristida jerichoensis</i> var. <i>subspinulifera</i>	▼ <i>Rhynchosia bungarensis</i>
		■ <i>Dolichocarpa</i> sp. Hamersley Station (A.A. Mitchell PRP 1479)	TOI (Taxon Of Interest)
		✚ <i>Eragrostis</i> sp. Erect spikelets (P.K. Latz 2122)	▼ <i>Santalum spicatum</i>
		✚ <i>Euphorbia australis</i> var. <i>glabra</i>	
		✚ <i>Rostellularia adscendens</i> var. <i>latifolia</i>	

**Legend**

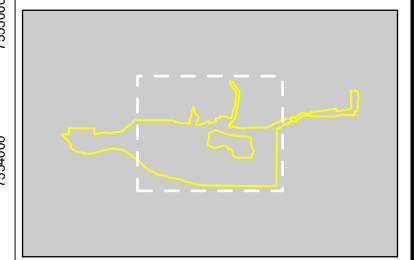
- Development Envelope
- Indicative Footprint
- Four plant assemblages of the Wona Landsystem

**Vegetation type**

- AaAxSL
- ASL (1)
- ASL (2)
- AWL (1)
- AWL (2)
- AWL (3)
- AxAsSL
- MSW
- MTGW
- THG (1)
- THG (2)
- TvHG
- Cleared/Disturbed

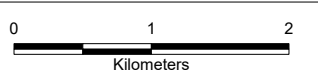
**Roads (LGATE-195)**

- Minor Road



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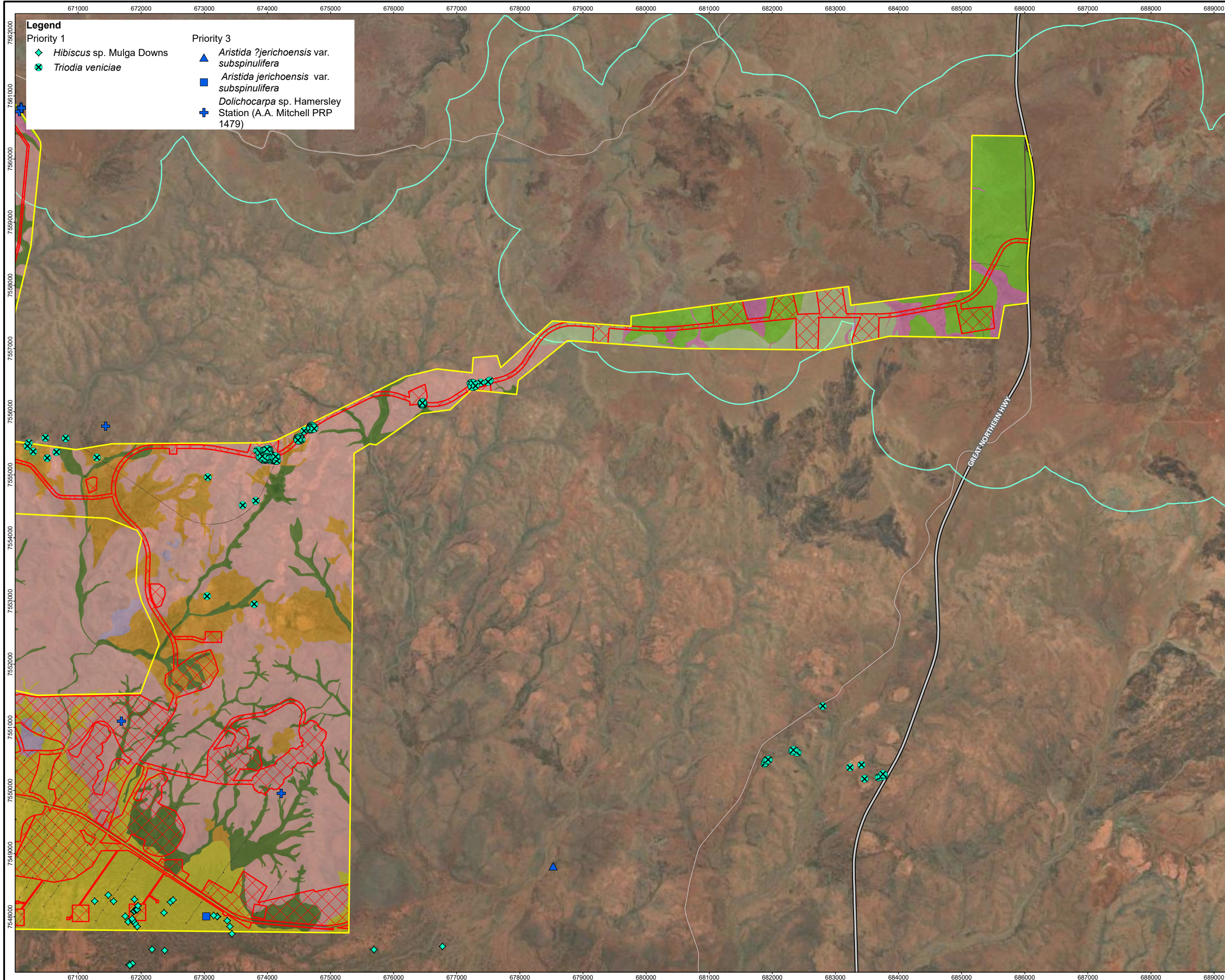


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**Mulga Downs Iron Ore Mine  
 Central Pilbara, Western Australia**

**CONSERVATION SIGNIFICANT FLORA  
 IN RELATION TO THE PROPOSAL**

**FIGURE 9.6 Map 3 of 4**



**Legend**

**Priority 1**

- ◆ *Hibiscus* sp. Mulga Downs
- ✕ *Triodia veniciae*

**Priority 3**

- ▲ *Aristida ?jerichoensis* var. *subspinulifera*
- *Aristida jerichoensis* var. *subspinulifera*
- + *Dolichocarpa* sp. Hamersley Station (A.A. Mitchell PRP 1479)

**Legend**

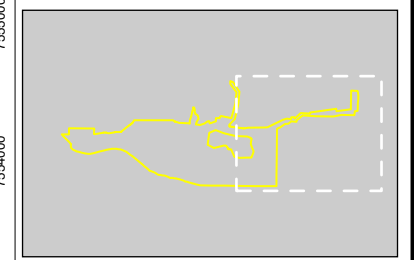
- Development Envelope
- Indicative Footprint
- Four plant assemblages of the Wona Landsystem

**Vegetation type**

- AaAxSL
- ASL (2)
- AWL (1)
- MSW
- MTGW
- THG (1)
- THG (2)
- THGB
- TvHG
- Cleared/Disturbed

**Roads (LGATE-195)**

- Highway
- Minor Road



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**CONSERVATION SIGNIFICANT FLORA  
IN RELATION TO THE PROPOSAL**

**FIGURE 9.6 Map 4 of 4**

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## Mulga Downs Iron Ore Mine

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Figure 9-7: Mapped Riparian vegetation Types within the Development Envelope

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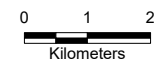


- Legend**
- Development Envelope
  - Indicative Footprint
  - Priority Ecological Communities (DBCA)
  - Four plant assemblages of the Wona Landsystem (Priority 1)
  - Riparian vegetation
  - AdEvWL
  - Roads (LGATE-195)
  - Highway
  - Minor Road



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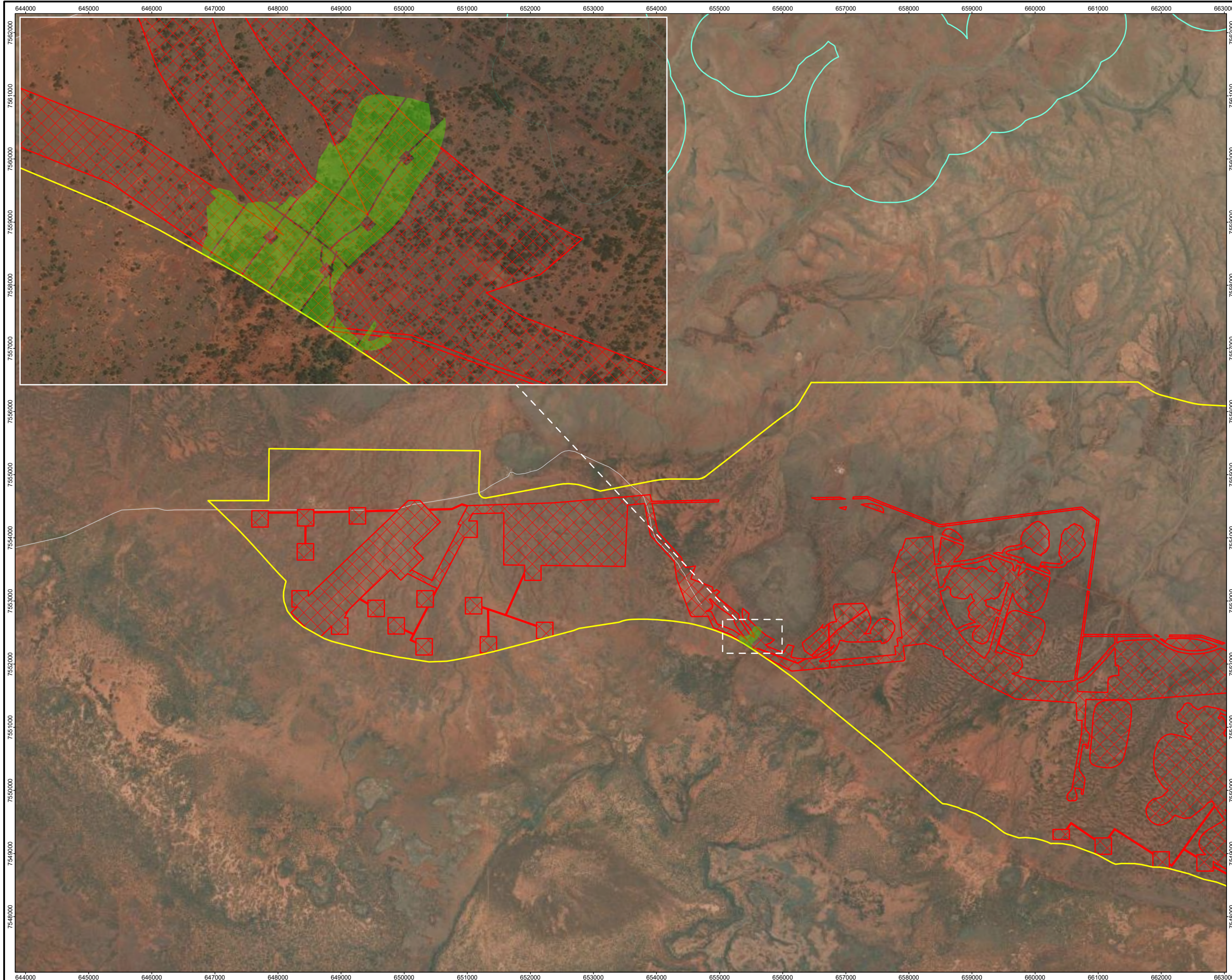
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**Mulga Downs Iron Ore Mine  
 Central Pilbara, Western Australia**

**MAPPED RIPARIAN VEGETATION TYPES  
 WITHIN THE DEVELOPMENT ENVELOPE**

**FIGURE 9.7 Map 1 of 4**

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 Image Reference: World Imagery: Earthstar Geographics  
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- Legend**
- Development Envelope
  - Indicative Footprint
  - Priority Ecological Communities (DBCAs)
  - Four plant assemblages of the Wona Landsystem (Priority 1)
  - Riparian vegetation
  - AdEvWL
  - Roads (LGATE-195)
  - Minor Road



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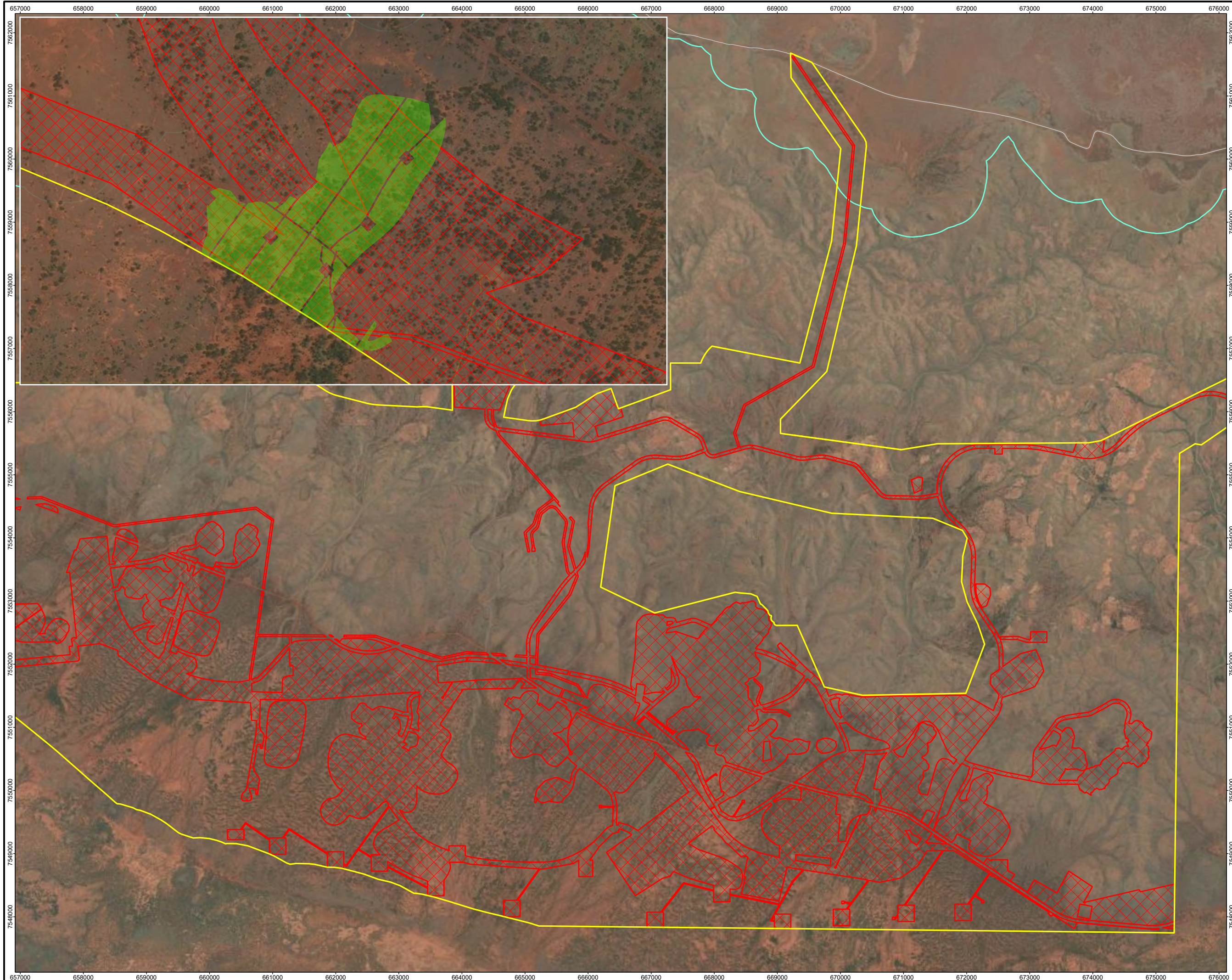
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**Mulga Downs Iron Ore Mine  
 Central Pilbara, Western Australia**

**MAPPED RIPARIAN VEGETATION TYPES  
 WITHIN THE DEVELOPMENT ENVELOPE**

**FIGURE 9.17 Map 2 of 4**

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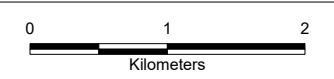


- Legend**
- Development Envelope
  - Indicative Footprint
  - Priority Ecological Communities (DBCA)
  - Four plant assemblages of the Wona Landsystem (Priority 1)
  - Roads (LGATE-195)
  - Minor Road



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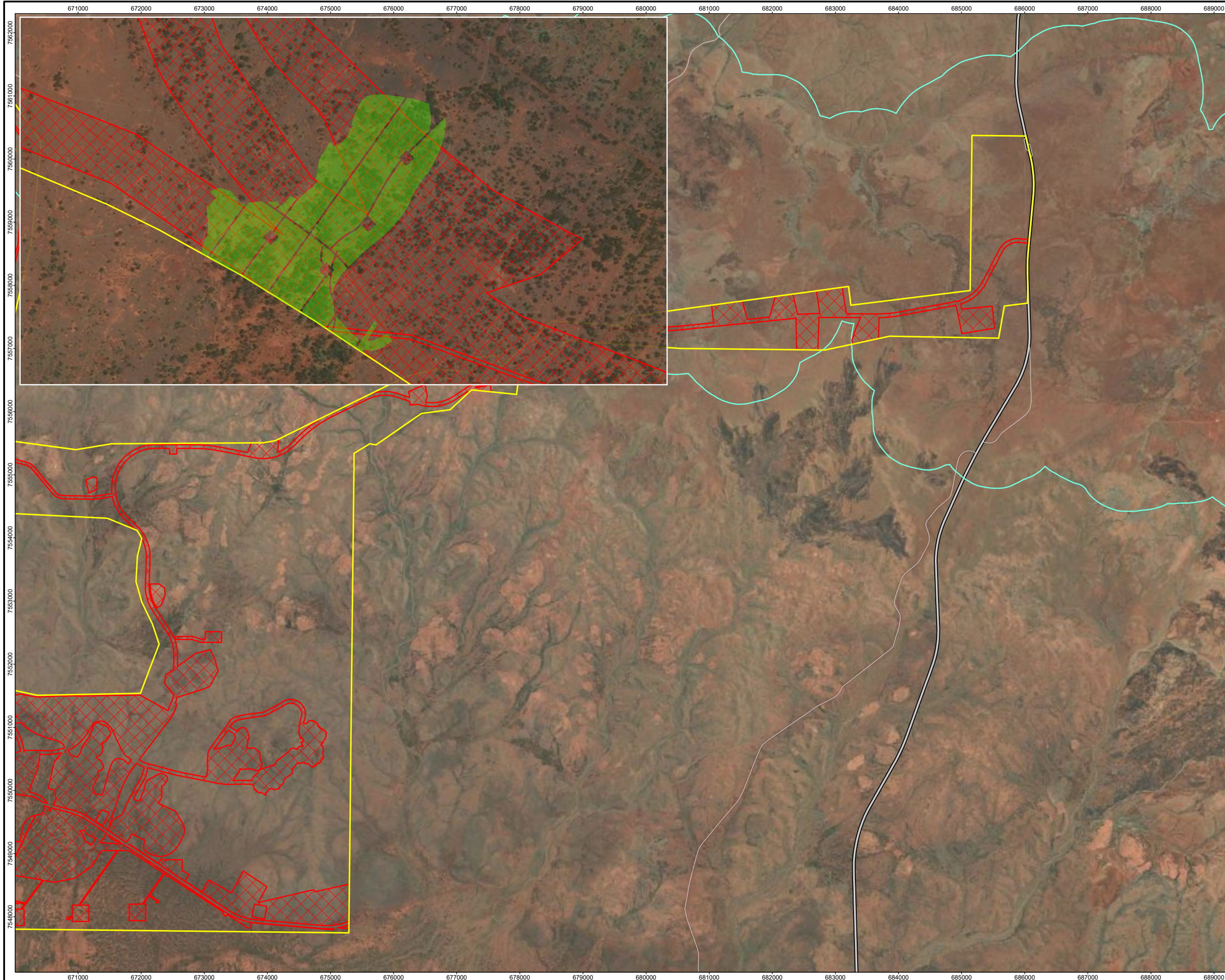
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**Mulga Downs Iron Ore Mine  
 Central Pilbara, Western Australia**

**MAPPED RIPARIAN VEGETATION TYPES  
 WITHIN THE DEVELOPMENT ENVELOPE**

**FIGURE 9.17 Map 3 of 4**

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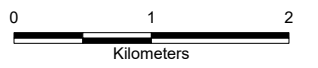


- Legend**
- Development Envelope
  - Indicative Footprint
  - Priority Ecological Communities (DBCA)
  - Four plant assemblages of the Wona Landsystem (Priority 1)
  - Roads (LGATE-195)
  - Highway
  - Minor Road



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**Mulga Downs Iron Ore Mine  
 Central Pilbara, Western Australia**

**MAPPED RIPARIAN VEGETATION TYPES  
 WITHIN THE DEVELOPMENT ENVELOPE**

**FIGURE 9.7 Map 4 of 4**

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## Mulga Downs Iron Ore Mine

### 9.4 Potential Impacts

#### 9.4.1 Direct Impacts

The direct impact to flora and vegetation from the Proposal will be from clearing. The impacts include the:

- Loss of native vegetation;
- Loss of conservation significant vegetation communities; and
- Loss of conservation significant flora.

##### 9.4.1.1 Loss of Native Vegetation

This section presents the indicative loss of vegetation based on the Indicative Footprint; however, the final location of Proposal elements within the Development Envelope may change through the detailed design phase.

The maximum amount of native vegetation clearing as a result of the Proposal will not exceed 4,339.16 ha within the 16,848.53 ha Development Envelope. The majority (16,682.19 ha) of the vegetation in the Development Envelope is in 'Good to Excellent' condition. There are four vegetation associations within the Development Envelope. All are found within the Indicative Footprint and therefore are expected to be impacted (**Table 9-10**).

Less than 1% of the Pilbara extent of any of the vegetation associations mapped within the Indicative Footprint will be cleared.

Table 9-10: Loss of Pre-European Vegetation Associations

Vegetation Association	Description	Extent in Pilbara Bioregion (ha)	Extent in Development Envelope (ha)	Pre-European Vegetation within the Development Envelope (%)	Extent within Indicative Footprint (ha)	Pre-European Vegetation impacted by the Indicative Footprint (%)
29	Low woodland, open low woodland or sparse woodland. Mulga <i>Acacia aneura</i> and associated species.	1,131,712.01	9,194.77	0.81	3,195.44	0.28
173	Shrub-steppe. Flora: Hummock grassland with scattered shrubs or mallee <i>Triodia</i> spp. <i>Acacia</i> spp., <i>Grevillea</i> spp. <i>Eucalyptus</i> spp.	1,747,677.63	1,220.52	0.07	183.15	0.01
175	Grasslands, short bunch-grass savanna. Flora: Annual grasses <i>Enneapogon</i> spp. <i>Aristida</i> spp. etc on dry plains and saltwater grasses <i>Sporobolus virginicus</i> on the coast	507,466.80	466.42	0.09	57.77	0.01
562	Low tree-steppe. Flora: Hummock grassland with scattered bloodwoods &	103,606.82	5,966.82	5.76	902.80	0.87

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## Mulga Downs Iron Ore Mine

Vegetation Association	Description	Extent in Pilbara Bioregion (ha)	Extent in Development Envelope (ha)	Pre-European Vegetation within the Development Envelope (%)	Extent within Indicative Footprint (ha)	Pre-European Vegetation impacted by the Indicative Footprint (%)
	snappy gum <i>Triodia</i> spp., <i>Corymbia dichromophloia</i> and <i>Eucalyptus leucophloia</i>					
<b>TOTAL</b>			<b>16,848.53</b>		<b>4,339.16</b>	

At a local scale, 15 vegetation types have been mapped within the Development Envelope and the Indicative Footprint (**Table 9-11; Figure 9-2**). The known extent of each community mapped through the surveys undertaken in relation to the Proposal (as outlined in **Table 9-2**) is also presented in **Table 9-11** to provide additional local context.

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## Mulga Downs Iron Ore Mine

Table 9-11: Impacts to Vegetation Types (shaded cells represent locally significant vegetation types).

Vegetation Type	Total Mapped Extent of Surveys (Table 9-2)	Extent within the Development Envelope (ha)	Extent within Indicative Footprint (ha)	Approximate % impact within Development Envelope	Remaining extent in Development Envelope (%)	Impact on total Mapped Extent of Surveys (Table 9.2) (%)
AaAxSL	3,682.68	814.09	68.53	8.42	91.58	1.89
AdEvWL	12,051.30	4.96	4.31	86.90	13.13	0.04
ASL (1)	1,854.75	359.51	64.95	18.07	81.93	3.50
ASL (2)	4,283.22	1,378.13	253.47	18.39	81.61	5.92
AWL (1)	14,111.52	5,654.28	2087.41	36.92	63.08	14.79
AWL (2)	7,240.06	105.67	35.98	34.05	65.95	0.50
AWL (3)	4,066.26	32.12	8.83	27.49	72.51	0.22
AxAsSL	9,779.72	1,381.93	454.33	32.88	67.12	4.65
MSW	2433.38	141.97	12.96	9.13	90.87	0.53
MTG (1)	576.38	241.96	40.61	16.78	83.22	7.05
MTGW	3,162.29	403.50	69.98	17.34	82.66	2.21
THG (1)	21,015.77	5,236.74	939.23	17.94	82.06	4.47
THG (2)	5,732.79	707.14	184.90	26.15	73.85	3.23
THGB	4697.16	197.03	71.13	36.10	69.90	1.51
TvHG	122.15	24.85	0.31	1.25	98.76	0.25
Cleared/Degraded	1,412.89	164.63	42.23	25.65	74.35	2.99
<b>Total</b>	<b>96,222.32</b>	<b>16,848.53</b>	<b>4,339.16</b>	-	-	-

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## Mulga Downs Iron Ore Mine

Vegetation within the Indicative Footprint is considered to be in predominantly 'Good' or better condition, the majority of which occurs in the Fortescue IBRA subregion (**Table 9-12; Figure 9-3**). Of the vegetation to be removed, the majority (99.01%) is classified as being in a 'Good' or better condition.

Table 9-12: The extent of proposed vegetation clearing per IBRA subregion within the Development Envelope and Indicative Footprint

Vegetation Condition	Extent within Development Envelope (ha)			Extent within Indicative Footprint (ha)			Impact (% vegetation of this condition lost)
	Chichester Subregion	Fortescue Subregion	Total	Chichester Subregion	Fortescue Subregion	Total Cleared (ha)	
Good	0.00	1,981.22	1,981.71	0.00	559.89	559.89	28.25
Very Good	639.98	7,723.26	8,363.23	90.20	2,563.26	2,653.46	31.73
Excellent	1,054.60	5,282.65	6,337.25	152.92	930.66	1,083.57	17.10
<i>Sub-total (Good to Excellent)</i>	<i>1,694.58</i>	<i>14,987.13</i>	<i>16,682.19</i>	<i>243.12</i>	<i>4,053.80</i>	<i>4,296.93</i>	
Degraded	0.99	157.92	158.91	0.02	41.84	41.87	26.35
Completely Degraded	7.43	0.00	7.43	0.36	0.00	0.36	4.85
<b>TOTAL</b>	<b>1,703.00</b>	<b>15,145.04</b>	<b>16,848.53</b>	<b>243.51</b>	<b>4095.65</b>	<b>4,339.16</b>	

### 9.4.1.2 Loss of Conservation Significant Vegetation Communities

Implementation of the Proposal will result in the loss of conservation significant vegetation including:

- Four Plant Assemblages of the Wona Land System' Priority 1 PEC;
- Sheetflow dependent vegetation communities; and
- Riparian vegetation.

As noted in **Section 9.3.5.2**, 407.50 ha of the Four Plant Assemblages of the Wona Land System' Priority 1 PEC occurs within the Development Envelope, of which 70.31 ha (i.e. 17.25% of the mapped extent in the Development Envelope) will be impacted by the Proposal through clearing.

The impacts of clearing on potential sheetflow dependent vegetation communities and riparian vegetation within the Development Envelope are outlined in **Table 9-13**. The known extent of each community mapped through the surveys undertaken in relation to the Proposal (as outlined in **Table 9-3**) is also presented to provide additional local context. Only the mapped extent of MTGW and ASL (2) within the boundary of the Four Plant Assemblages of the Wona Land System' Priority 1 PEC are considered part of the PEC. Both vegetation types are also mapped outside the PEC boundary. The significant residual impacts of native vegetation clearing on significant vegetation communities is assessed in **Section 9.4.1.2**.

Table 9-13: Loss of Conservation Significant Vegetation within the Development Envelope

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## Mulga Downs Iron Ore Mine

Conservation Significant Vegetation	Total Mapped Extent of Surveys (Table 9-3)	Extent within Development Envelope (ha)	Extent within Indicative Footprint (ha)	% Impact within the Development Envelope	% Impact of mapped extent of surveys
<b>Sheetflow dependent vegetation communities</b>					
AaAxSL	3,628.68	814.09	68.53	8.42	1.89
ASL (1)	1,854.75	359.51	64.95	18.07	3.50
ASL (2)	4,283.22	1,378.13	253.47	18.39	5.92
AWL (1)	14,111.52	5654.28	2,087.41	36.92	14.79
AWL (2)	7,240.06	105.67	35.98	34.05	0.50
AWL (3)	4,066.26	32.12	8.83	27.49	0.22
AxAsSL	9,779.72	1,381.93	454.33	32.88	4.65
<i>Sub Total</i>	<i>44,964.21</i>	<i>9725.73</i>	<i>2973.50</i>	<i>30.57</i>	<i>6.61</i>
<b>Riparian</b>					
AdEvWL	12,051.30	4.96	4.31	86.90	0.04
<b>TOTAL (Conservation Significant Vegetation)</b>	<b>57,015.51</b>	<b>9,730.69</b>	<b>2,977.81</b>	<b>30.60</b>	<b>5.22</b>

### 9.4.1.3 Loss of Conservation Significant Flora and Habitat

No Threatened flora species will be impacted by the Proposal.

Of the nine Priority flora taxa recorded within the Development Envelope, three taxa occur within the Indicative Footprint (shaded orange) in **Table 9-14**.

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## Mulga Downs Iron Ore Mine

Table 9-14: Impacts to Conservation Significant Species and their Habitat (coloured cells = taxa in Indicative Footprint)

Species	Vegetation Types	Total Extent of Potential Habitat in Development Envelope (ha)	Total Extent of Habitat in Indicative Footprint (ha)	% impact of Indicative Footprint on known habitat within Development Envelope	Total mapped individuals from survey effort	No. of known individuals in the Development Envelope	No. of known Individuals in the Indicative Footprint	% Impact (loss of individuals in Indicative Footprint compared to Development Envelope)
<b>Priority 1</b>								
<i>Hibiscus</i> sp. Mulga Downs (S. Hitchcock SH 638)	AWL (1)	5,759.95	2,123.39	36.86	1741	1427	622	43.59
	AWL (2)							
<i>Triodia veniciae</i>	AaAxSL	6,782.81	1,192.97	17.59	2359	1099	544	49.50
	THG (1)							
	THG (2)							
	TvHG							
<b>Priority 3</b>								
<i>Aristida jerichoensis</i> var. <i>subspinulifera</i>	ASL(2)	7,739.54	2,525.78	32.63	14	5	0	0
	AWL (1)							
	THG (2)							
<i>Dolichocarpa</i> sp. Hamersley Station (A.A. Mitchell PRP 1479)	AWL (1)	10,891.02	3,026.64	27.79	180,169	17	2	11.76
	THG (1)							
<i>Euphorbia australis</i> var. <i>abragl</i>	AdEvWL	712.10	4.31	0.61	3346	1	0	0
	MSL (2)							
	MTG (2)							
<i>Rostellularia adscendens</i> var. <i>latifolia</i>	AdEvWL	814.09	4.31	0.53	2841	4	0	0
<i>Themeda</i> sp. Hamersley Station (M.E. Trudgen 11431)	AaAxSL	1,056.06	109.14	10.33	522	0	0	0
	MTG (1)							
<b>Priority 4</b>								

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Species	Vegetation Types	Total Extent of Potential Habitat in Development Envelope (ha)	Total Extent of Habitat in Indicative Footprint (ha)	% impact of Indicative Footprint on known habitat within Development Envelope	Total mapped individuals from survey effort	No. of known individuals in the Development Envelope	No. of known Individuals in the Indicative Footprint	% Impact (loss of individuals in Indicative Footprint compared to Development Envelope)
<i>Bulbostylis burbidgeae</i>	TGH (1)	5,236.74	939.23	17.94	80	20	0	0
<i>Rhynchosia bungarensis</i>	ASL (1)	359.51	64.95	18.07	1	1	0	0

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## Mulga Downs Iron Ore Mine

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### 9.4.1.4 Loss of Other Significant Flora and Habitat

As discussed in **Section 9.3.6.6**, nine taxa with previously known ranges greater than 100 km from their recorded location were collected within the Survey Area (Maia 2022), however none of these occur within the Development Envelope.

As described in **Section 9.3.6.6**, three individual *Santalum. spicatum* trees (Sandalwood) were identified within the Study Area; however, these records are located outside the Development Envelope and will not be directly impacted by the Proposal (**Figure 9-6**).

### 9.4.2 Indirect Impacts

Indirect impacts which will result in the decline of vegetation health are:

- Altered fire regimes and increased risk of fire;
- Dust deposition and management with saline water;
- Introduction and spread of weed species;
- Altered hydrological regimes; and
- Fragmentation and/or isolation of populations/occurrences.

#### 9.4.2.1 Altered Fire Regimes and Increased Fire Risk

The Proposal has the potential to increase the risk of fires with the introduction of ignition sources such as machinery, vehicles and equipment. Altered fire regimes can result in the loss of species during critical seeding phases or during recruitment. Fires too early in the year can prevent the establishment of resilient seed banks which are resistant to periods of fire, characteristic of the Pilbara and other arid zones. Fires out of season can also remove the ability of a species to set seed, reducing the successive generations of a population. Frequent fires also lead to an increase of some weeds species, which can result in the vegetation becoming more bushfire prone.

#### 9.4.2.2 Dust and Use of Saline Water for Dust Suppression

The Proposal has the potential to impact on the health of flora and vegetation resulting from generation of dust and deposition onto the surfaces of leaves. This includes the clearing of vegetation, construction of roads, vehicle movement and the transport and handling of ore during operation. There is also the potential of impacts to flora and vegetation from the use of saline water for dust suppression during the construction and operation of the Proposal. Although unlikely to result in vegetation mortality, an increase in soil salinity can lead to a decline in vegetation /flora health.

#### 9.4.2.3 Introduced Weeds

Clearing, and vehicle and machinery movements have the potential to increase the spread and/or introduce weed species. Weeds are often able to rapidly invade locations due to disturbance, land clearing and/or altered hydrological regimes resulting in degradation of vegetation condition and competition with native flora species. There is a risk that weeds will be spread into environmentally sensitive areas in the Development Envelope. These areas include the Four Plant assemblages of the Wona Land System PEC.

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As noted in **Section 9.3.7**, a total of 19 introduced flora taxa (weeds) have been recorded during surveys (Maia 2022) of which 13 are present within the Development Envelope. None of the introduced flora taxa are listed as Weeds of National Significance (WoNS). Eight of the introduced flora taxa recorded within the Development Envelope are listed as environmental weeds.

### 9.4.2.4 Altered Hydrological Regimes

Diversion of surface water flows, abstraction of groundwater and the reinjection of mine dewater via MAR will result in changes to the natural hydrological regime. Relevant mechanisms which will cause these changes are:

- Surface catchment modifications, in particular reduced or redirected inflows and increased sedimentation to portions of the valley environment.
- Modifications which impede or disrupt surface flow to sheetflow dependent vegetation outside the Development Envelope.
- Groundwater drawdown from mine dewatering.
- Groundwater mounding from management of surplus mine dewater via MAR.

### Surface Water

The presence of water within the drainage lines in the Pilbara is characteristically temporary and flows only in response to rainfall events. Surface water flows can be diverted/disrupted as a result of mine pits, waste rock dumps, borrow pits, airport, haul and access roads, pipelines, and other infrastructure associated with the Proposal. This can have impacts both immediately downstream of disturbance area footprints and surface water diversions, and further downstream as an accumulation of impacts from multiple disturbance areas. These changes can be detrimental to the vegetation downstream. The receptors which may potentially be impacted by the Proposal are local vegetation (in particular, sheetflow vegetation which is reliant on a particular pattern) and watercourses, plus the Fortescue Valley, including the claypans, swamp and persistent pools.

The Proposal will cause a reduction in surface water flows to the environment on the downstream side of the Proposal, particularly around the Fridge Hill mining area, due to a reduction in contributing catchment areas. This particularly applies to the development of the pits, waste rock dumps, borrow pits and stockpiles as they are proposed to extend across large areas draining towards the Fortescue Valley and will therefore prevent surface water from draining through those areas. Additionally, where mine development areas block drainage paths, there is a risk of increased inundation on the upstream side of the development area. The increased inundation may lead to vegetation death due to water logging and changes to vegetation composition with more water tolerant vegetation species (including weeds) potentially taking over in these areas (AQ2 2025).

Mulga (*Acacia aneura*) and other closely related co-occurring species, is sensitive to changes to sheet flow (Maia 2020). Six vegetation types within the Development Envelope were mapped as potential sheetflow dependent vegetation communities. These communities are:

- AaAxSL – tall sparse shrubland of *Acacia aneura* (alliance);
- ASL (1 and 2)– Acacia tall shrubland; and
- AWL (1, 2 and 3) - Acacia low woodland or tall shrubland.

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A total of 44,964.20 ha of these vegetation types have been mapped during surveys associated with the Proposal (refer to **Table 9-3**) of which 9,725.43 ha occurs within the Development Envelope and 2,973.51 ha occurs within the Indicative Footprint and will therefore be impacted through clearing. Potential surface water dependent vegetation extends beyond the Development Envelope. Changes to sheetflow can cause a shadow effect down gradient of the Proposal and result in indirect impacts to vegetation downstream of disturbance areas.

In addition, there are five conservation significant flora within the surface water dependent vegetation types present in the Development Envelope:

- *Triodia veniciae* (Priority 1) occurring within AaAxSL;
- *Hibiscus* sp. Mulga Downs (Priority 1) - occurring within AWL (1) and (2);
- *Aristida jerichoensis* var. *subspinulifera* (Priority 3) – occurring within ASL (2); and
- *Dolichocarpa* sp. Hamersley Station (A.A. Mitchell PRP 1479) (Priority 3)- occurring within AWL (1).

While individually these taxa are not necessarily surface water dependant, they may indirectly impacted by degradation / loss of habitat that supports them. Freshwater claypans of the Fortescue Valley PEC (Priority 1) includes the Gnalka Gnoona Claypan and the Koodjeepindarranna Claypan, both of which are located south of the Development Envelope. The key characteristics of the claypans which may be impacted are changes to the inundation depths, ponding duration (hydroperiod) and water quality (TDS) of ponded water as a result of changes in water availability and quality downstream of the Proposal.

### Groundwater

Given that the vegetation is inferred to be disconnected from the groundwater system under baseline conditions, a reduction in groundwater levels is not predicted to impact the terrestrial environment, inclusive of vegetation (AQ2 2025). An ecohydrological assessment found no GDV within the Development Envelope and surrounds or in the valley to the south.

The principal change risk is groundwater mounding as a result of MAR. As dewatering exceeds water demands, excess water will be disposed of by MAR within the Development Envelope. MAR is proposed on the slopes of the valley (i.e. in and around the proposed mining areas). Initially, MAR is proposed via reinjection bores, with the potential for using repurposed dewatering bores and / or in-pit infiltration, once mining of a pit is complete. Without management practices in place, there is the potential for detrimental environmental impacts resulting from changes to groundwater levels and / or quality as a result of MAR.

Mounding of groundwater can result in the following impacts (AQ2 2025):

- Tree roots that become inundated for more than a few weeks to months will senesce, due to oxygen deficiency, effectively pruning the deeper roots. If sustained over long periods, this could result in vegetation leaf area index adjustments (either increased or decreased) based on the net effect of interactions between climate (droughts or floods) and soil water replenishment processes. In the extreme case of prolonged saturation of the entire root system, tree deaths could occur.
- Waterlogging associated with flood events may be more spatially extensive and of longer duration, causing increased exposure of vegetation to this stress agent relative to baseline conditions.
- Salt may accumulate in the upper soil profile resulting from the combined effects of increased evaporative concentration and/or reduced salt leaching into the deeper profile. If sustained over

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long periods, this could have adverse impacts on vegetation health by reducing soil water extractability.

- Claypan water quality could also be affected by increased salt loads.

### 9.4.2.5 Fragmentation

Fragmentation of vegetation occurs when pockets of vegetation become isolated through clearing for mining and associated infrastructure, creating islands of vegetation. These areas of vegetation are at increased risk of degradation as a result of 'edge effect' where cleared areas become vectors for weeds and changes to surface drainage.

Where there is sufficient isolation of islands of vegetation, there may be a reduction of corridors for pollinators to travel between these areas, with resultant reduction in flora reproduction and genetic diversity.

### 9.4.3 Cumulative Impacts

The Proposal and other projects in the region including the Mulga Downs Hub and Rail Spur and Murray's Hill, will have a cumulative impact on flora and vegetation at a regional scale through:

- The loss and fragmentation of native vegetation from clearing; and
- The loss of conservation significant species and communities as a result of clearing.

The cumulative impacts associated with the construction and operation of the Proposal and other projects are discussed in more detail in the Cumulative Impact Assessment in **Section 17**.

## 9.5 Mitigation

The Proponent has applied the mitigation hierarchy (avoid, minimise and rehabilitate) during Proposal design to reduce the potential direct and indirect impacts to flora and vegetation.

The design of the Proposal has been planned to avoid direct impacts and minimise indirect impacts to key environmental values identified within the Development Envelope where possible since its referral in 2021. Three applications to amend the Proposal (under s43A of the EP Act) have been submitted by HPPL, each change resulting in a reduction in the potential environmental impacts of the Proposal on flora and vegetation. Overall, there has been a total reduction in the Development Envelope and Indicative Footprint of 23,804.97 ha and 5,288.84 ha respectively. In addition, impacts to the following have also been avoided or reduced:

- Impacts to the 'Freshwater Claypans of the Fortescue Valley' Priority 1 PEC are avoided;
- Impacts to DBCA Priority (P) listed species have been avoided / reduced;
- Impacts to seven vegetation types, including riparian vegetation, are avoided and / or reduced;
- Impacts to five vegetation types that support *Eucalyptus victrix* are avoided and / or reduced;
- The extent of impacts to vegetation within the Fortescue IBRA subregion are significantly reduced; and
- The extent of direct impacts to mapped potential sheetflow vegetation is reduced.

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A summary of mitigation measures applied to address the key potential impacts on flora and vegetation are provided in **Table 9-15**.

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Table 9-15: Mitigation Measures for Flora and Vegetation

Mitigation			
Potential Impacts	Avoid	Minimise	Rehabilitate / Monitor
<b>Direct Impacts</b>			
Loss of native vegetation	<ul style="list-style-type: none"> <li>Establishment of a Fauna Habitat Exclusion Zone (FHEZ) which avoids impact to 1,320.82 ha of native vegetation and a FHEZ corridor which avoids impacts within an additional 991.45 ha area.</li> <li>Impacts to the 'Freshwater Claypans of the Fortescue Valley' Priority 1 PEC are avoided.</li> </ul>	<ul style="list-style-type: none"> <li>The Development Envelope and Indicative Footprint has been revised and reduced through iterative mine planning to reduce the extent of clearing required where possible resulting in a 5,288.84 ha reduction in impacts to native vegetation.</li> <li>Utilise areas of existing disturbance before clearing of new ground where possible.</li> <li>Proposal elements have been located to minimise impacts on environmental factors.</li> <li>Phase the works to enable progressive clearing and where possible progressive rehabilitation.</li> <li>Implement programs for induction and education of the workforce with respect to flora and vegetation protection and management.</li> <li>Ensure clearing only occurs in approved ground disturbance areas (in accordance with an internal Ground Disturbance Permit (GDP)).</li> </ul>	<ul style="list-style-type: none"> <li>Construction areas no longer required for operations will be rehabilitated upon completion of construction.</li> <li>Progressive rehabilitation of operational areas no longer required, throughout life of mine.</li> <li>Decommissioning and rehabilitation of disturbed areas at the end of LoM.</li> <li>Topsoil will be collected in windrows and stored for rehabilitation of temporary construction areas.</li> <li>Topsoil will be recovered and stockpiled to a maximum height of 2 m to preserve the soil physical/chemical properties and seed bank for use over temporary construction areas or for future rehabilitation.</li> <li>Topsoil will be progressively re-spread over temporary construction areas or utilised for future rehabilitation.</li> <li>Rehabilitation will occur with vegetation comprised of native species of provenance local to the Chichester and Fortescue bioregions in accordance with a DEMIRS approved MCP.</li> </ul>

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Mitigation			
Potential Impacts	Avoid	Minimise	Rehabilitate / Monitor
Loss of conservation significant flora and communities from clearing	<ul style="list-style-type: none"> <li>Establishment of a Fauna Habitat Exclusion Zone (FHEZ) which avoids impact to 1,320.82 ha of native vegetation which and a FHEZ Corridor which contains an additional 991.45 ha area..</li> <li>Impacts to the 'Freshwater Claypans of the Fortescue Valley' Priority 1 PEC are avoided.</li> </ul>	<ul style="list-style-type: none"> <li>Located Proposal elements to minimise impacts to Priority flora species.</li> <li>Located Proposal elements to minimise impacts on locally significant vegetation communities.</li> <li>Implement induction and education of the workforce with respect to flora and vegetation protection and management.</li> <li>HPPL will ensure clearing only occurs in approved ground disturbance areas (in accordance with an internal GDP.</li> </ul>	<ul style="list-style-type: none"> <li>Consultation with Banjima to inform the seed mix so that it includes culturally significant species.</li> <li>Construction areas no longer required for operations will be rehabilitated upon completion of construction.</li> <li>Progressive rehabilitation of operational areas no longer required, throughout life of mine.</li> <li>Decommissioning and rehabilitating of Development Envelope at end of life of mine. Topsoil will be recovered and stockpiled to a maximum height of 2 m to preserve the soil physical/chemical properties and seed bank for use over temporary construction areas or for future rehabilitation.</li> <li>Rehabilitation will occur with vegetation comprised of native species of provenance local to the Chichester and Fortescue bioregions in accordance with a DEMIRS approved MCP.</li> <li>.</li> <li>Consultation with Banjima to inform the seed mix so that it includes culturally significant species..</li> </ul>
Indirect Impacts			
Altered fire regimes and increase of risk of fires.	Minimisation measures are considered to be the key mitigation for this impact.	<ul style="list-style-type: none"> <li>An emergency management plan shall be developed and implemented and shall include methods for managing major</li> </ul>	If saline water (> 5000 mg/L TDS) is required for firefighting purposes, then potential impacts to vegetation will be monitored and managed through

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Mitigation			
Potential Impacts	Avoid	Minimise	Rehabilitate / Monitor
		<p>environmental incidents, including but not limited to fire.</p> <ul style="list-style-type: none"> <li>• Ensure compliance with the <i>Bushfire Act 1954</i>.</li> <li>• Compliance with internal Hot Works Procedures.</li> <li>• Fire-control equipment shall be available in fire-risk areas including but not limited to hazardous material storage areas, hot works job sites, service trucks.</li> <li>• An adequate number of personnel shall be trained in basic fire awareness, fire response and use of fire suppression equipment.</li> </ul>	<p>the implementation of the Water Management Plan (<b>Appendix 6</b>).</p>
<p>Deposition of dust during clearing and operational activities and use of saline water for dust suppression.</p>	<p>Minimisation measures are considered to be the key mitigation for this impact as complete avoidance of dust is not possible.</p>	<ul style="list-style-type: none"> <li>• Dust management measures will be utilised to minimise dust emissions and subsequent deposition on retained native vegetation in proximity to disturbance.</li> <li>• Dust control measures will be implemented throughout the life of the Proposal and may include:</li> <li>• Saline water (&gt; 5000 mg/L TDS) shall not be used for dust suppression unless approved by the Environmental Manager and where approved, dribble bars shall be used to control overspray onto adjacent vegetation;</li> <li>• Dust suppression techniques (e.g. water trucks) shall be used on unsealed roads</li> </ul>	<ul style="list-style-type: none"> <li>• Progressive rehabilitation will be undertaken as areas become available.</li> <li>• Topsoil stockpiles will not exceed 2 m in height.</li> </ul>

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Mitigation			
Potential Impacts	Avoid	Minimise	Rehabilitate / Monitor
		<p>and access tracks, cleared areas and at locations of high dust risk;</p> <ul style="list-style-type: none"> <li>• Vehicle speeds on haul roads, work and camp sites shall be reduced where necessary to minimise dust emissions;</li> <li>• Vegetation clearing and earthworks during high winds (&gt;50 km/hr) shall be avoided; and</li> <li>• Zones for saline water use will be in place. This includes, for instance, using saline water on heavy vehicle roads that do not cross a drainage line or creek crossing, whilst not allowing saline water to be used on roads that cross drainage lines without an appropriately sized windrow, not using saline water on topsoil stockpiles etc.</li> </ul>	
Introduction and spread of weed species.	Minimisation measures are considered to be the key mitigation for this impact as complete avoidance of weeds is not possible.	<ul style="list-style-type: none"> <li>• Implement and comply with internal hygiene and weed management measures to prevent the spread or introduction of weeds as a result of Proposal activities.</li> <li>• Weed controls will be implemented including:</li> <li>• All machinery and vehicles shall be cleaned down of all soil and vegetation material prior to arriving or entering on site. Any soil and vegetation removed from machinery or vehicles during clean down upon arrival, but prior to entry on</li> </ul>	<ul style="list-style-type: none"> <li>• Ongoing monitoring and management of weeds within the Development Envelope.</li> <li>• The MCP will detail specific weed management measures in rehabilitation areas.</li> </ul>

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Mitigation			
Potential Impacts	Avoid	Minimise	Rehabilitate / Monitor
		<p>site shall be collected and disposed of offsite;</p> <ul style="list-style-type: none"> <li>All vehicles and machinery mobilised to site shall be inspected prior to entry to site and issued with a Weed &amp; Soil Hygiene Certificates;</li> <li>Imported fill or other potential weed mediums to be certified by the supplier as being free from weed free sources prior to arrival on site;</li> <li>Areas of known weed-infestation will be identified and managed separately to weed free areas;</li> <li>Where areas of weed-infestation are to be disturbed or cleared, material will be stockpiled/placed in windrows separately from weed-free material; and</li> <li>Targeted control of infestations.</li> </ul>	
Altered hydrological regimes.	Minimisation measures are considered to be the key mitigation for this impact, as complete avoidance of altered hydrological regimes is not possible for the Proposal.	<ul style="list-style-type: none"> <li>The Proposal has been designed to minimise interactions with, and disturbance to, watercourses, riparian vegetation and flood plains.</li> <li>Implementation of the Water Management Plan (<b>Appendix 6</b>).</li> <li>Adherence to permit requirements under the RiWI Act (i.e. 5C water abstraction and Bed and Banks Permits).</li> </ul>	<ul style="list-style-type: none"> <li>Impacts to vegetation as a result of altered hydrological regimes will be managed through the implementation of the Water Management Plan (<b>Appendix 6</b>).</li> </ul>

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Mitigation			
Potential Impacts	Avoid	Minimise	Rehabilitate / Monitor
Fragmentation	Establishment of a Fauna Habitat Exclusion Zone (FHEZ) which avoids impact to 1,320.82 ha of native vegetation and a FHEZ corridor which avoids impacts within an additional 991.45 ha area, both of which include drainage lines to avoid fragmentation in that area of the Development Envelope.	<ul style="list-style-type: none"> <li>Implement weed hygiene measures (refer above) to minimise introduction of weeds caused by edge effects</li> <li>Phase the works to enable progressive clearing and where possible progressive rehabilitation.</li> </ul>	<ul style="list-style-type: none"> <li>Conduct rehabilitation in accordance with the DEMIRS approved MCP.</li> <li>Weed monitoring.</li> </ul>

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### 9.6 Assessment and Significance of Residual Impacts

#### 9.6.1 Direct Impacts

##### 9.6.1.1 Loss of Native Vegetation

As discussed in **Section 9.5**, the Proposal's Development Envelope and Indicative Footprint have been significantly reduced following updates to the mine design, an increasing understanding of the existing environmental values gained from recent surveys and studies, and continuing efforts to apply the mitigation hierarchy and reduce potential environmental impacts from the Proposal.

The Proposal will result in the clearing of up to 4,339.16 ha of native vegetation. This represents approximately 25.75% of the total amount of native vegetation mapped within the Development Envelope. Most of this clearing area, 4,296.93 ha, is in 'Good' or better condition made up of, 559.89 ha of vegetation in 'Good' condition, 2,653.46 ha in 'Very Good' condition and 1,083.57 ha 'Excellent' condition. The remaining area (42.23 ha) is in 'Degraded to Completely Degraded' condition.

Fifteen vegetation types have been mapped within the Development Envelope, six of which are considered locally significant. With the exception of AdEvWL, more than 63% of the mapped extent of each vegetation type will be retained within the Development Envelope. Each vegetation type is also known to extend outside of the Development Envelope. The Proposal will impact 0.04% of the total known extent of vegetation type AdEvWL mapped in the Survey Area (both within and outside the Development Envelope).

At a regional scale, the Development Envelope contains four mapped Pre-European vegetation associations. At present, the Pilbara bioregion, the relevant subregions (Chichester and Fortescue IBRA), and the Shire of Ashburton all retain more than 99.8% of Pre-European extents of those vegetation associations. The Indicative Footprint will impact a small proportion of each of the vegetation associations; three are impacted by less than 0.8%, and one will lose 5.76%.

In terms of vegetation of the IBRA subregions, the Proposal will result in the loss of 243.12 ha of Chichester IBRA subregion vegetation in 'Very Good' to 'Excellent'. Of the vegetation which lies within the Fortescue IBRA subregion, 4,053.80 ha of 'Good' to 'Excellent' condition vegetation will be cleared.

Based on the above, the impacts to native vegetation from the Proposal are not considered significant on their own. However, the EPA recognises the cumulative loss of native vegetation in the Pilbara bioregion is a significant residual impact. Consistent with the Western Australian offset framework, any clearing of native vegetation in 'Good' to 'Excellent' condition in the Fortescue and Chichester subregions (**Figure 3-1**) associated with the Proposal will be offset in accordance with EPA requirements (refer to **Section 16**).

##### 9.6.1.2 Loss of Conservation Significant Vegetation

###### Freshwater Claypans of the Fortescue Valley (Priority 1)

As a result of revised mine design and continual efforts to apply the mitigation hierarchy, the Proposal will have no direct impact on the DBCA designated buffer of the 'Freshwater claypan of the Fortescue Valley' (Priority 1) PEC'. While the PEC extends across the Fortescue Valley in the vicinity of the Proposal, it is no longer intersected

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by the Development Envelope. Potential indirect impacts arising from altered hydrological regimes are discussed in **Section 9.6.2**.

### **‘Four Plant Assemblages of the Wona Land System’ Priority 1 PEC**

A total of 407.5 ha of the ‘Four Plant Assemblages of the Wona Land System’ Priority 1 PEC occurs within the Development Envelope, of which 83% will be retained. Up to 70.31 ha of the PEC is present within the Indicative Footprint. This PEC is extensive and occurs across the Chichester Ranges as shown in **Figure 9-4**. There are approximately 127,050 ha of this PEC within the Pilbara, therefore the Proposal is not expected to significantly impact the PEC on a regional scale, with a loss of 0.05% of the Pilbara extent. However, given its conservation status, the direct loss of 70.31 ha of this PEC is considered a significant residual impact and is further considered in **Section 16** (Offsets) and will be offset.

### **Sheetflow Dependent Vegetation**

Up to 2,973.51 ha of seven vegetation types representing potential sheet flow dependent communities (ASL (1) (2), AWL (1) (2) (3), AxAsSL and AaAxSL) may be impacted. This equates to 30.57% of the known mapped extent of potential sheet flow dependent vegetation types within the Development Envelope. A total of 44,964.20 ha has been mapped during surveys associated with the Proposal. The Proposal impacts 6.6% of this total mapped extent. The direct loss of sheetflow vegetation is considered a significant residual impact and is further considered in **Section 16** (Offsets).

### **Loss of Riparian Vegetation**

One mapped riparian vegetation type was identified within the Development Envelope; AdEvWL. A total of 4.96 ha of this vegetation type has been mapped within the Development Envelope of which 4.31 ha occurs within the Indicative Footprint. A total of 12,051.30 ha has been mapped during surveys associated with the Proposal, of which the Proposal will impact 0.04%. The direct loss of riparian vegetation is considered a significant residual impact and is further considered in **Section 16** (Offsets).

### **Loss of Conservation Significant Flora**

Based on the Indicative Footprint, the Proposal will directly impact three DBCA-listed Priority listed species as outlined in **Table 9-14**. An assessment of residual impacts on each of those species is provided below.

#### ***Hibiscus* sp. Mulga Downs (Priority 1)**

An undescribed *Hibiscus* sp. ?nov. specimen was collected from the Survey Area (Area 1, Mulga East) in 2012. While appropriate areas were searched by botanists during subsequent years, it was not located again. However, in 2021 targeted flora surveys recorded the taxon at multiple locations in May, July and September 2021. Specimens were submitted to the WA Herbarium for determination, and they were identified as a new species and were given the phrase name of *Hibiscus* sp. Mulga Downs (S. Hitchcock SH 638). Current records associated with surveys undertaken for this Proposal are the only records of this species; however, surveys have recorded individuals outside the Development Envelope within the banded mulga formations which continue to the south east of the Development Envelope. This taxon is a Priority 1 listed flora species (DBCA 2024).

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A total of 1,741 individuals have been recorded during surveys undertaken for the Proposal, of which 1,427 occur within the Development Envelope (**Table 9-3**).

Based on the Indicative Footprint, the Proposal will result in the loss of 622 individuals. The loss of individuals resulting from the Proposal represents 35% of the mapped extent (both within and outside the Development Envelope) and 43.59% of the mapped extent within the Development Envelope.

This taxa is known from two vegetation types (AWL(1); AWL(2)) within the Development Envelope of which 3,521.89 ha (61.24%) of the mapped habitat will remain. **Figure 9-8** shows that the banded mulga formation extends well outside the Development Envelope (approximately 21,351.58 ha has been mapped through surveys undertaken in the local area) and this species has been recorded along these areas. The Proposal will directly impact 9.9% of the total surveyed extent of potential habitat for this species. Potential indirect impacts to this species from altered hydrological regimes are discussed further in **Section 9.6.2.4**.

Table 9-16: Loss of habitat for *Hibiscus* sp. Mulga Downs (Priority 1)

Vegetation Type	Total Mapped Extent of Surveys (Table 9-3)	Extent within Development Envelope (ha)	Extent within Indicative Footprint (ha)	% Impact within the Development Envelope	% Impact of mapped extent of surveys
AWL (1)	14,111.52	5,654.28	2087.41	36.92	14.79
AWL (2)	7,240.06	105.67	35.98	34.05	0.50
<b>Total</b>	<b>21,351.58</b>	<b>5,759.95</b>	<b>2,123.39</b>	<b>38.86</b>	<b>9.90</b>

Given this species is associated with sheet flow vegetation, management measures that ensure that sheetflow is maintained will minimise potential impacts on this species. Ongoing monitoring of vegetation health and condition, including mapped records of this species, will be undertaken as outlined in the WMP (**Appendix 6**).

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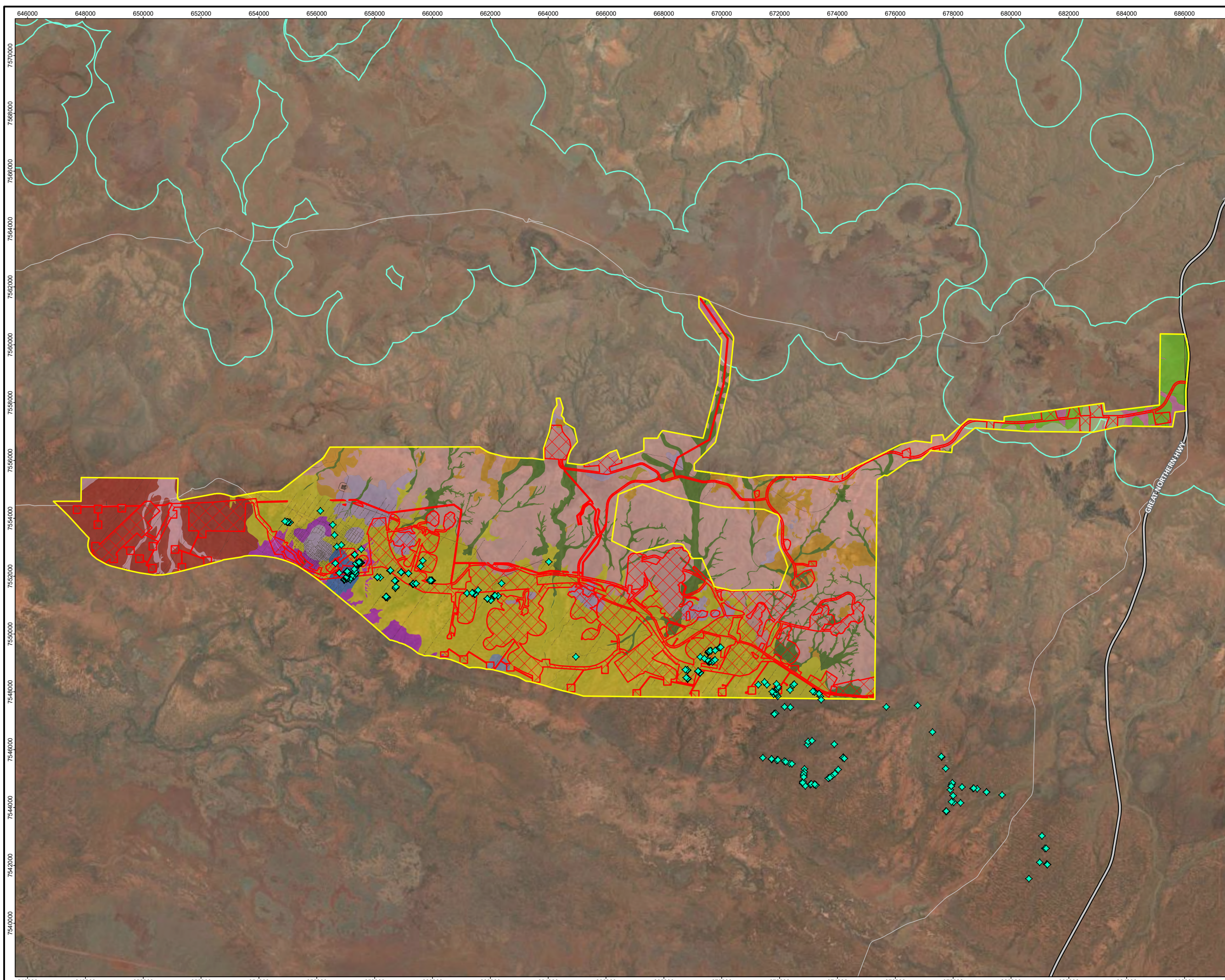
## Mulga Downs Iron Ore Mine

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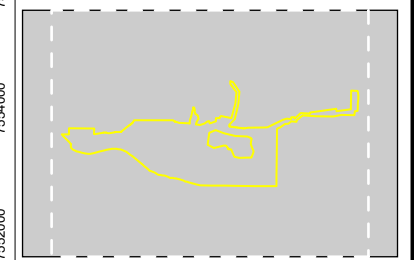
Figure 9-8: Records of *Hibiscus* sp. Mulga Downs

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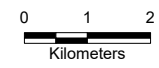


- Legend**
- Development Envelope
  - Indicative Footprint
  - Four plant assemblages of the Wona Landsystem
- Vegetation type**
- AaAxSL
  - AdEvWL
  - ASL (1)
  - ASL (2)
  - AWL (1)
  - AWL (2)
  - AWL (3)
  - AxAsSL
  - MSW
  - MTG (1)
  - MTGW
  - THG (1)
  - THG (2)
  - THGB
  - TvHG
  - Cleared/Disturbed
- Priority 1**
- ◆ *Hibiscus* sp. Mulga Downs
- Roads (LGATE-195)**
- Highway
  - Minor Road



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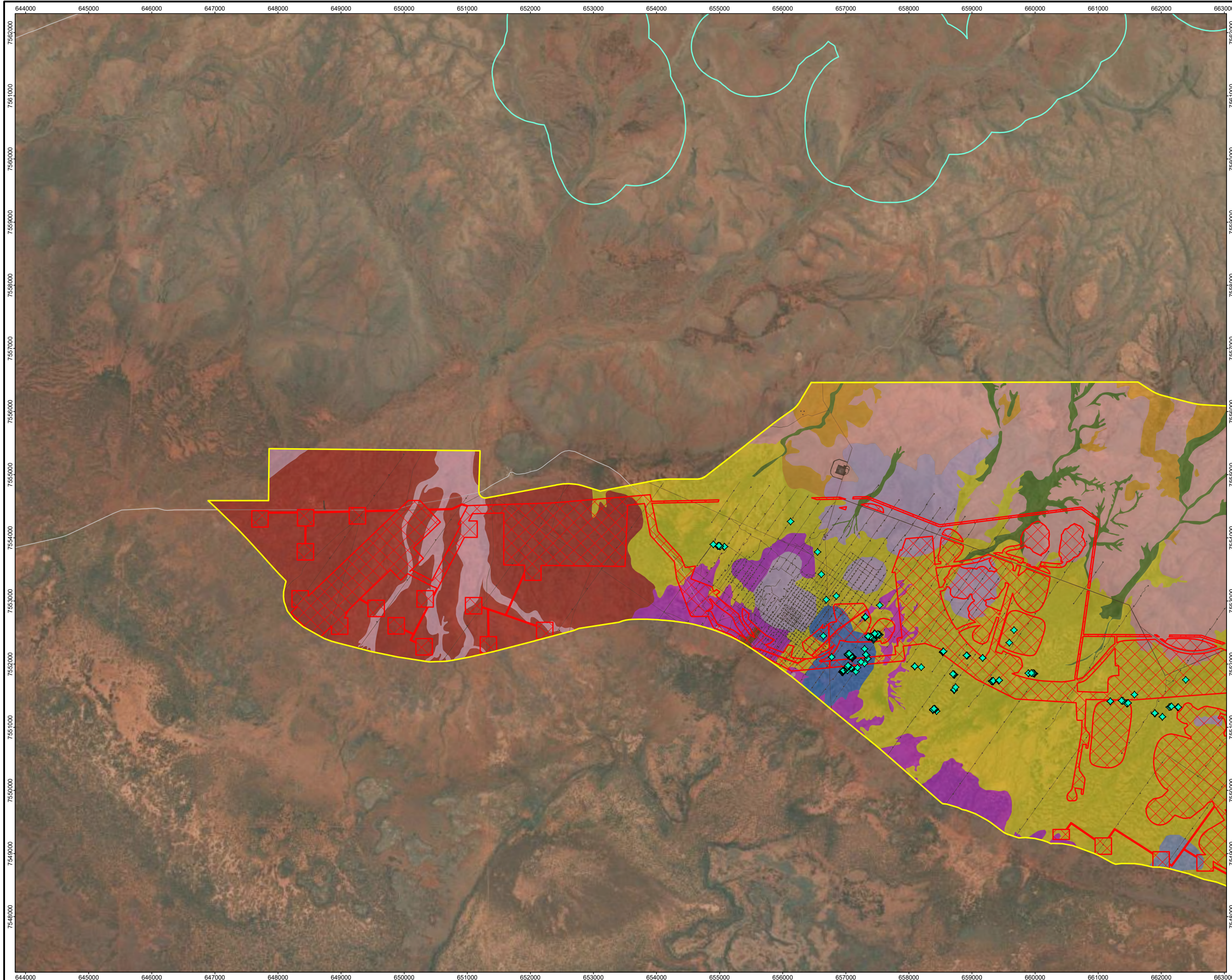
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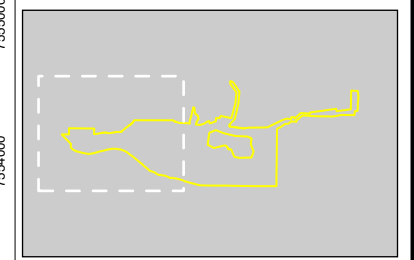
**RECORDS OF HIBISCUS SP.  
 MULGA DOWNS**

**FIGURE 9.8 Map 1 of 4**

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- Legend**
- Development Envelope
  - Indicative Footprint
  - Four plant assemblages of the Wona Landsystem
- Vegetation type**
- AaAxSL
  - AdEvWL
  - ASL (1)
  - ASL (2)
  - AWL (1)
  - AWL (2)
  - AWL (3)
  - AxAsSL
  - MTG (1)
  - THG (1)
  - THG (2)
  - Cleared/Disturbed
- Priority 1**
- Hibiscus* sp. Mulga Downs
- Roads (LGATE-195)**
- Minor Road



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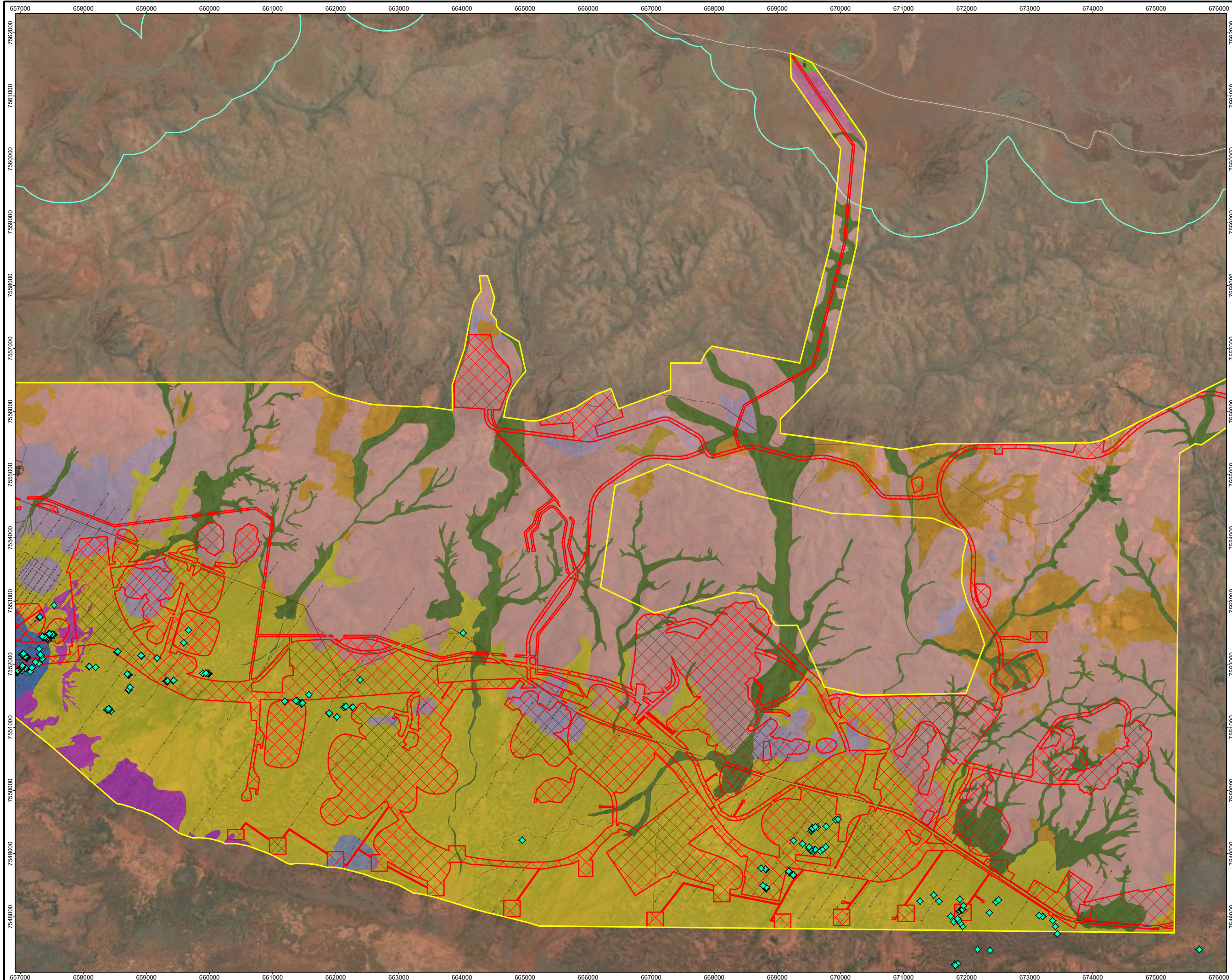
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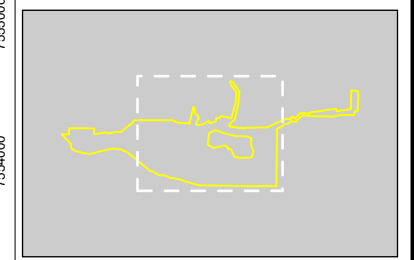
**RECORDS OF HIBISCUS SP.  
 MULGA DOWNS**

**FIGURE 9.8 Map 2 of 4**

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- Legend**
- Development Envelope
  - Indicative Footprint
  - Four plant assemblages of the Wona Landsystem
- Vegetation type**
- AaAxSL
  - ASL (1)
  - ASL (2)
  - AWL (1)
  - AWL (2)
  - AWL (3)
  - AxAsSL
  - MSW
  - MTGW
  - THG (1)
  - THG (2)
  - TvHG
  - Cleared/Disturbed
- Priority 1**
- ◆ Hibiscus sp. Mulga Downs
- Roads (LGATE-195)**
- Minor Road



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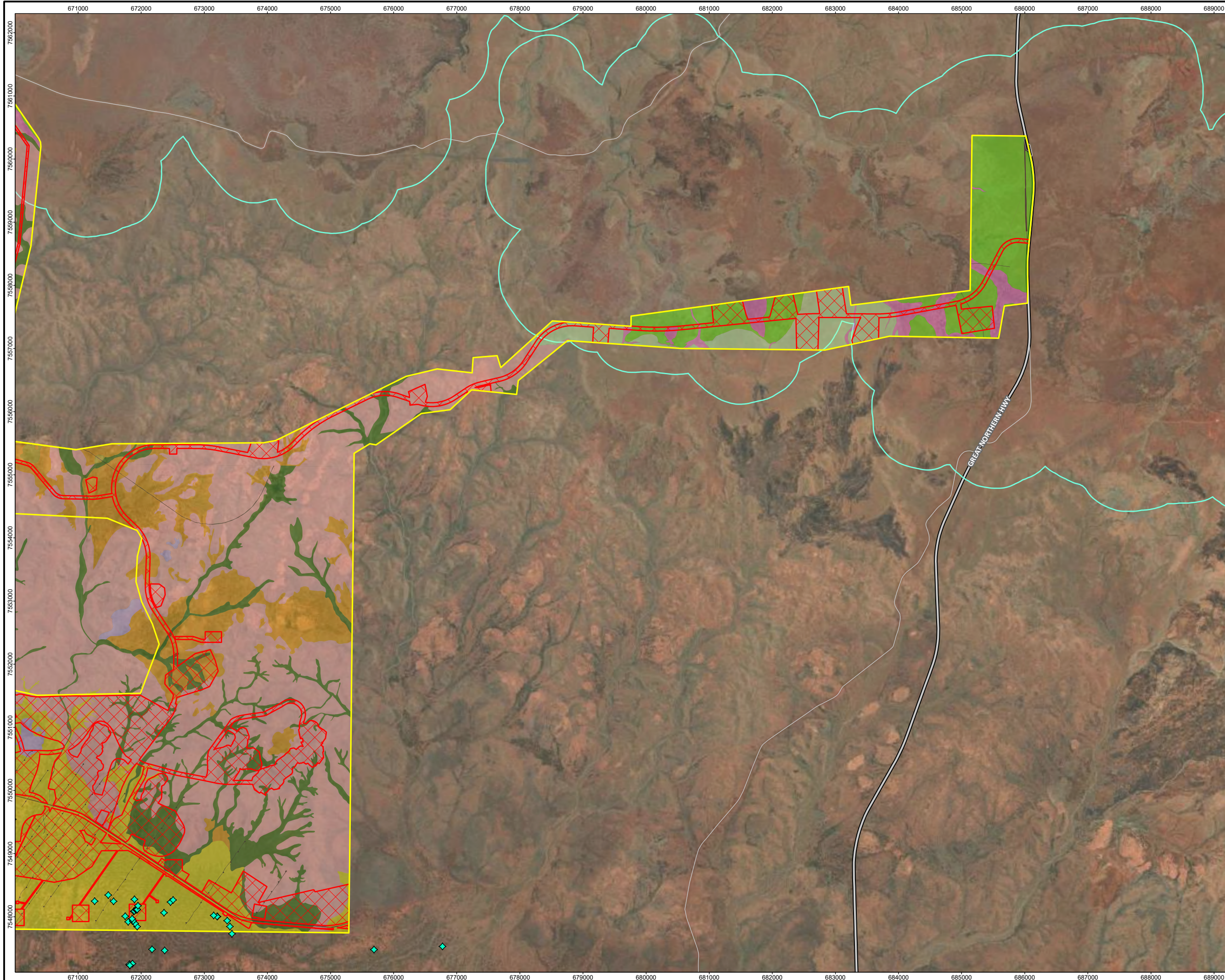
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**Mulga Downs Iron Ore Mine  
Central Pilbara, Western Australia**

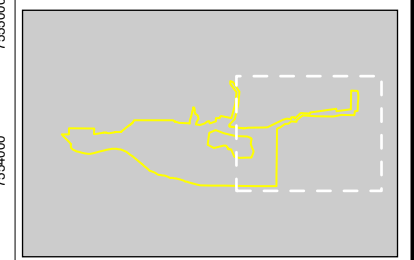
**RECORDS OF HIBISCUS SP.  
MULGA DOWNS**

**FIGURE 9.8 Map 3 of 4**

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- Legend**
- Development Envelope
  - Indicative Footprint
  - Four plant assemblages of the Wona Landsystem
- Vegetation type**
- AaAxSL
  - ASL (2)
  - AWL (1)
  - MSW
  - MTGW
  - THG (1)
  - THG (2)
  - THGB
  - TvHG
  - Cleared/Disturbed
- Priority 1**
- ◆ *Hibiscus* sp. Mulga Downs
- Roads (LGATE-195)**
- Highway
  - Minor Road



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**Mulga Downs Iron Ore Mine  
 Central Pilbara, Western Australia**

**RECORDS OF HIBISCUS SP.  
 MULGA DOWNS**

**FIGURE 9.8 Map 4 of 4**

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## Mulga Downs Iron Ore Mine

### *Triodia veniciae* (Priority 1)

This Spinifex species located on shale slopes and tops of low hills. *T. veniciae* has 26 records on Florabase and 21 records on ALA. The ALA records appear to be mostly in the Fortescue subregion, with one record in the Chichester subregion of the Pilbara bioregion. This species has been recorded across the broader MDIOM and Hub & Rail Spur (Figure 9-9).

This species is known from four vegetation types (AaAxSL; THG(1); THG(2); TvHG). Within the Development Envelope, 1,192.97 ha (3.9%) of the mapped potential habitat will falls within the Indicative Footprint (Table 9-17). The Proposal will not impact 96.1% of the total surveyed extent of potential habitat for this species.

Table 9-17: Loss of habitat for *Triodia veniciae* (Priority 1)

Vegetation Type	Total Mapped Extent of Surveys (Table 9-3)	Extent within Development Envelope (ha)	Extent within Indicative Footprint (ha)	% Impact within the Development Envelope	% Impact of mapped extent of surveys
AaAxSL	3,628.68	814.09	68.53	8.41	1.89
THG (1)	21,015.77	5,236.74	939.23	17.94	4.47
THG (2)	5,732.79	707.14	184.90	26.15	3.23
TvHG	122.15	24.85	0.31	1.25	0.25
<b>Total</b>	<b>30,499.39</b>	<b>6,782.82</b>	<b>1,192.97</b>	<b>17.59</b>	<b>3.9</b>

A total of 2,359 individuals have been recorded during surveys undertaken for the Proposal, of which 1,099 individuals occur within the Development Envelope.

Based on the Indicative Footprint, the Proposal will result in the loss of 544 individuals recorded within the Development Envelope, representing a loss of 49.50% of the extent within the Development Envelope and 23.07% of the local mapped extent.

A loss of 23.07% of the local population is not considered likely to significantly impact the taxon given its known extent and the area of potential habitat remaining within the Development Envelope.

### *Dolichocarpa sp.* Hamersley Station (A.A. Mitchell PRP 1479) (Priority 3)

A total of 180,169 individuals have been recorded during surveys undertaken for the Proposal, of which 17 occur within the Development Envelope (Figure 9-10).

Based on the Indicative Footprint, the Proposal will result in the loss of 2 individuals representing a loss of 11.7% of the extent within the Development Envelope and 0.001% of the local mapped extent. This taxa is known from two vegetation types (AWL(1); THG(1)) within the Development Envelope of which 7,864.38 ha (72%) of the mapped habitat within the Development Envelope will remain (Table 9-18). The Proposal will impact 0.09% of the total surveyed extent of potential habitat for this species.

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## Mulga Downs Iron Ore Mine

Table 9-18: Loss of habitat for *Dolichocarpa* sp. Hamersley Station (A.A. Mitchell PRP 1479) (Priority 3)

Vegetation Type	Total Mapped Extent of Surveys (Table 9-3)	Extent within Development Envelope (ha)	Extent within Indicative Footprint (ha)	% Impact within the Development Envelope	% Impact of mapped extent of surveys
AWL (1)	14,111.52	5,654.28	2,087.41	36.92	14.79
THG (1)	21,015.77	5,236.74	939.23	17.93	4.47
<b>Total</b>	<b>35,127.29</b>	<b>10,891.02</b>	<b>3,026.64</b>	<b>27.79</b>	<b>8.62</b>

The WAH has 38 records distributed across the Pilbara region (WAH, 1988-). This species is broadly distributed across the Pilbara, from the Chichester, Hamersley, Fortescue and Roebourne subregions, but it is restricted to heavy clay soils. *Dolichocarpa* sp. Hamersley Station has been recorded in Millstream-Chichester National Park, Karijini National Park, Hamersley Range and Caoolawanyah Station (State of Western Australia, 2022; WAH, 2023).

A loss of 0.001% of the local population is not considered likely to significantly impact the taxon given its broad distribution and the protection of populations in Millstream-Chichester National Park and Karijini National Park and area of potential habitat remaining within the Development Envelope.

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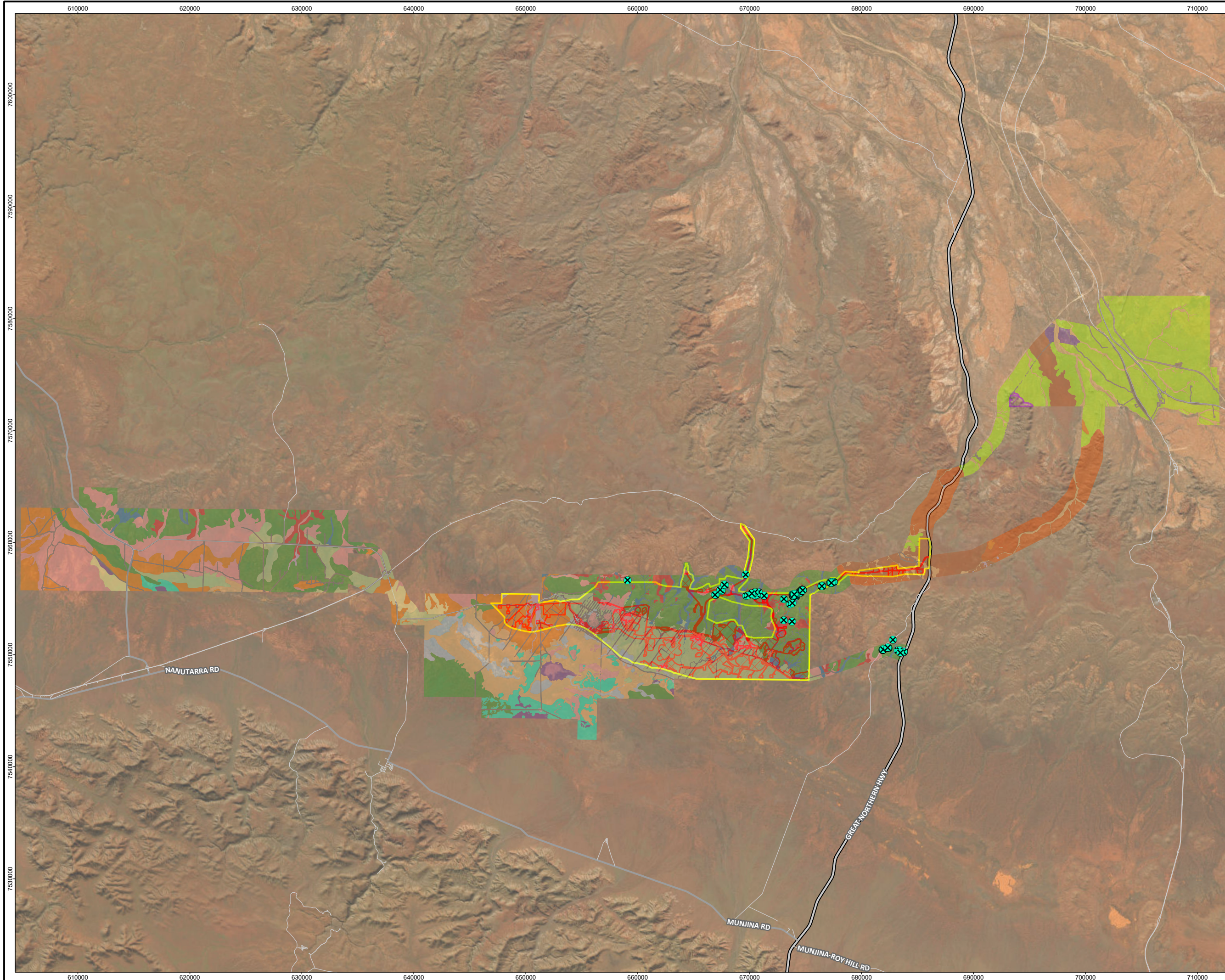
## Mulga Downs Iron Ore Mine

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Figure 9-9: Records of *Triodia veniciae*

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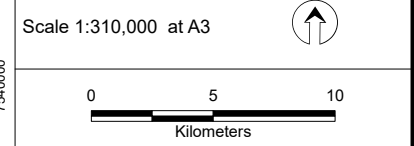
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- Legend**
- Development Envelope
  - Indicative Footprint
  - Vegetation type**
  - ASL (1)
  - ASL (2)
  - AWL (1)
  - AWL (2)
  - AWL (3)
  - AaAxSL
  - AdEvWL
  - AxAAsSL
  - AxS
  - BpoFL
  - EfEbTG
  - EvWL
  - MSL (1)
  - MSL (2)
  - MSW
  - MTG
  - MTG (1)
  - MTG (2)
  - MTG (3)
  - MTGW
  - Mosaic of AdEvWL / \*
  - THG (1)
  - THG (2)
  - THGB
  - THGG
  - TbHG
  - TvHG
  - TwHG
  - Restricted (Heritage)
  - Cleared/Disturbed area
  - Priority 1**
  - X *Triodia veniciae*
  - Roads (LGATE-195)**
  - Highway
  - Major road
  - Minor Road



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**Mulga Downs Iron Ore Mine  
 Central Pilbara, Western Australia**

**CUMULATIVE IMPACTS ON  
 TRIODIA VENICIAE**

**FIGURE 9.9**

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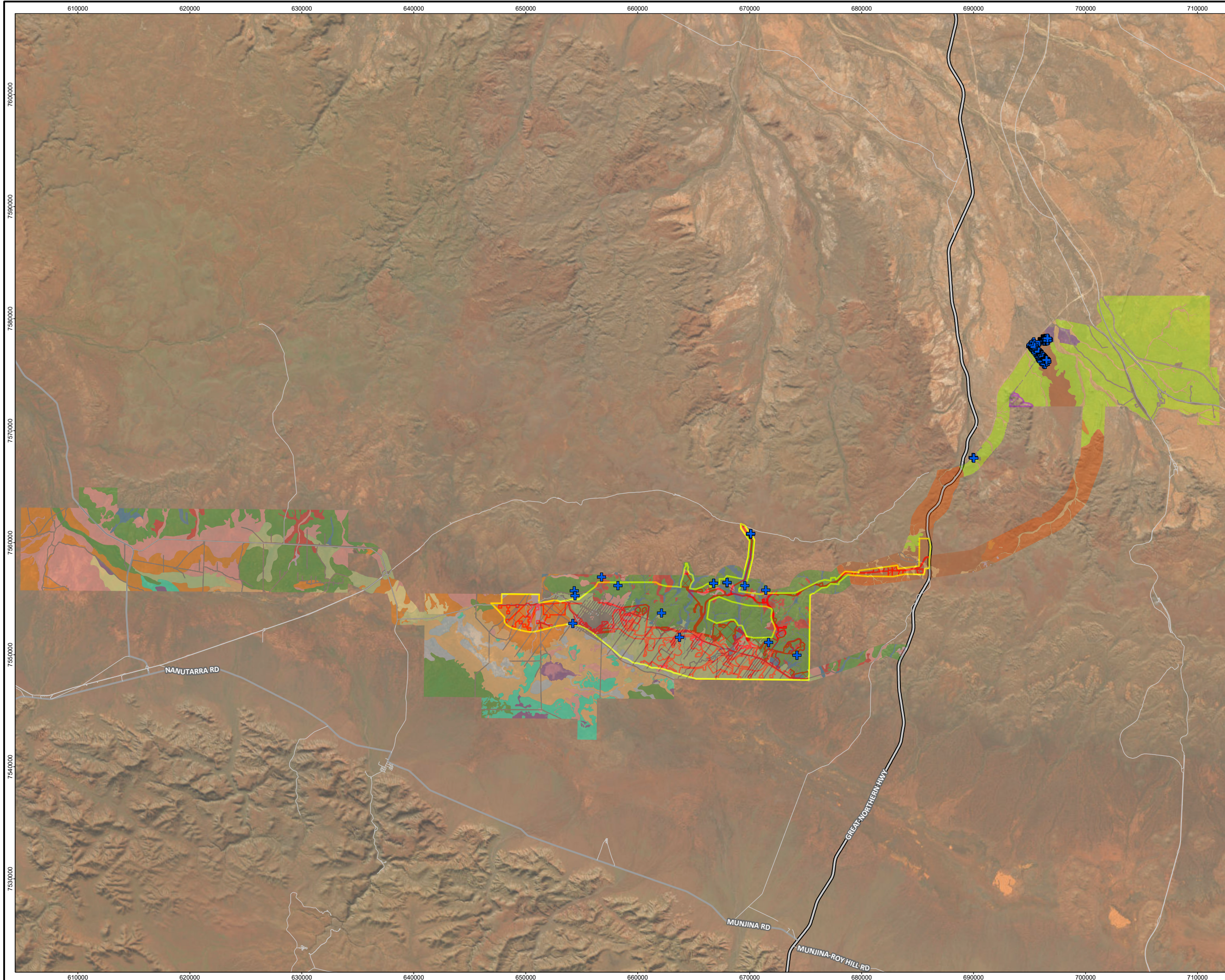
## Mulga Downs Iron Ore Mine

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Figure 9-10: Records of *Dolichocarpa sp.* Hamersley Station (A.A. Mitchell PRP 1479)

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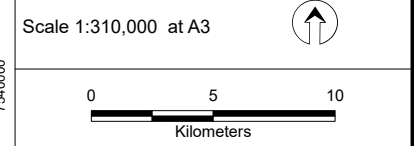
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- Legend**
- Development Envelope
  - Indicative Footprint
  - Vegetation type**
  - ASL (1)
  - ASL (2)
  - AWL (1)
  - AWL (2)
  - AWL (3)
  - AaAxSL
  - AdEvWL
  - AxAsSL
  - AxS
  - BpoFL
  - EfEbTG
  - EvWL
  - MSL (1)
  - MSL (2)
  - MSW
  - MTG
  - MTG (1)
  - MTG (2)
  - MTG (3)
  - MTGW
  - Mosaic of AdEvWL / \*
  - THG (1)
  - THG (2)
  - THGB
  - THGG
  - TbHG
  - TwHG
  - TwHG
  - Restricted (Heritage)
  - Cleared/Disturbed area
- Priority 3**
- Dolichocarpa* sp. Hamersley Station (A.A. Mitchell PRP 1479)
- Roads (LGATE-195)**
- Highway
  - Major road
  - Minor Road



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 Client: Hancock Prospecting Pty Ltd  
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**Mulg Downs Iron Ore Mine  
 Central Pilbara, Western Australia**

**CUMULATIVE IMPACTS ON  
 DOLICHOCARPA SP. HAMERSLEY  
 STATION (A.A. MITCHELL PRP 1479)**

**FIGURE 9.10**

# Environmental Review Document

## Mulga Downs Iron Ore Mine

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### 9.6.1.3 Loss of Other Significant Flora and Habitat

As discussed in **Section 9.4.1.4** of the nine taxa with range extension collected within the Survey Area (Maia 2022), none of these occur within the Development Envelope.

The mapped *Santalum. spicatum* trees (Sandalwood) were also recorded outside the Development Envelope and will not be directly impacted by the Proposal (**Figure 9-6**).

### 9.6.2 Indirect Impacts

#### 9.6.2.1 Altered Fire Regimes and Increased Fire Risk

Fire prevention and control measures will be in place during construction and operation of the Proposal. This will also provide additional fire management in the wider area through implementation of fire-fighting equipment, trained personnel and fire access. If a fire does occur, fire response procedures and equipment will ensure that the fire outbreak is kept to a minimum and effectively controlled. Therefore, the Proposal is not considered likely to increase fire regimes. Several mitigation measures will be implemented in relation to minimising bushfire risk (**Table 9-15**), which are expected to effectively mitigate fire risks during construction and operation of the Proposal.

#### 9.6.2.2 Dust and Use of Water for Dust Suppression

The Proposal will result in dust emissions from vegetation clearing required for construction and operation of the Proposal, topsoil stripping, waste material movement, processing and other ancillary activities. In addition, dust emissions may result from the movement of vehicles and machinery along unsealed roads. Matsuki et al. (2016) conducted a study examining the impacts of dust on plant health in semi-arid environments. The results of the study indicated no evidence of negative impacts on plant health as a result of dust deposition. Plants in semi-arid environments are exposed to dust within the natural environment and are less likely to suffer from short-term impacts of dust.

HPPL will implement dust management measures to reduce dust emissions and subsequent deposition, throughout the Development Envelope and throughout the life of mine using well-established industry practices (such as water based dust suppression). The Proposal may result in a minor, temporary increase in localised dust deposition on vegetation but this is not expected to significantly impact vegetation, noting that the Pilbara is a naturally dusty environment.

Dust emissions will also be regulated under Part V of the EP Act (works approval and licence). As noted in **Table 4-3**, conditions are applied to works approvals and licences that are considered to be necessary or convenient for the prevention, control, abatement or mitigation of pollution or environmental harm. DWER will set conditions to give effect to determined regulatory controls in accordance with its regulatory guidance. It is expected that DWER will regulate dust emissions associated with construction and operation of the Proposal.

In addition, a Mining Proposal is required under the Mining Act. The Mining Proposal is required to include the main environmental threats that are relevant to the mining Proposal (e.g. dieback, pathogens, weeds, feral animals, wildfires) and relevant baseline data for those threats that are relevant to the environmental risk assessment. Where dust, noise or other atmospheric emissions will impact on environmental factors (biodiversity, water resources, land and soils and/or rehabilitation and mine closure), and the impacts not

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## Mulga Downs Iron Ore Mine

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directly regulated under the EP Act, such impacts are required to be considered in the environmental risk assessment, mitigation measures and environmental outcomes.

Dewatered mine water will be used to suppress dust. The water will be a blend of brackish water from dewatering bores. This water may be saline (TDS of >5,000) and therefore has the potential to impact on vegetation. Saline water (> 5000 mg/L TDS) will be limited to use in mine areas where vegetation has been cleared and therefore, the risk of vegetation health being impacted from use of saline water is low.

Ongoing monitoring and management of dust and the use of saline water for dust suppression will be implemented. In addition, one of the objectives of the WMP (**Appendix 6**) is to allow for the identification and management of impacts to vegetation health and vegetation resulting from the use of saline water for dust suppression associated with implementation of the Proposal.

On this basis, the Proposal is considered unlikely to significantly impact the condition of native vegetation through dust deposition and dust suppression activities. Any impacts are predicted to be localised to disturbed areas. Vegetation health and condition will be monitored annually in accordance with the WMP to ensure the environmental impacts to flora and vegetation values continue to be managed to within the acceptable levels. As a result, no significant residual impacts on vegetation condition is anticipated as a result of fugitive dust emissions.

### 9.6.2.3 Introduced Weeds

HPPL has a number of established weed and hygiene management measures to reduce the risk of existing weeds being spread or new weeds being introduced into the Development Envelope including:

- Environmental Compliance Standard (HNR-0000-EN-STD-0001\_A (1));
- Significant Fauna, Flora and Weed Identification Manual (HNR-0000-EN-MAN-0001\_0);
- Imported Materials Weed Hygiene Inspection Form (HNR-0000-EN-TEM-0004\_0);
- Vehicle & Mobile Equipment Weed Hygiene Inspection Form (HNR-0000-EN-TEM-0014\_0).

Weed control measures are outlined in the CSFMP (**Appendix 12**) and include:

- Targeted weed control (including in areas around the clearing front and in retained native vegetation adjacent to cleared areas); and
- Progressive clearing and rehabilitation to minimise the opportunity for weeds to become established.

On this basis, the Proposal is considered unlikely to significantly impact the condition of native vegetation through the spread or introduction of weed species. Any impacts are predicted to be localised to disturbed areas and vegetation will be monitored annually to ensure the environmental impacts to flora and vegetation values continue to be controlled to within triggers and thresholds established in the WMP.

As a result, no significant residual impacts on vegetation condition from spread of weeds are anticipated.

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## Mulga Downs Iron Ore Mine

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### 9.6.2.4 Altered Hydrological and Hydrogeological Regimes

#### Groundwater

Based on the ecohydrological conceptual model and measured baseline conditions, the threshold groundwater depth above which interaction with vegetation may occur is estimated to be 2.0 mbgl (i.e. to within 2 m below ground). If water levels rise above this threshold for prolonged periods, vegetation stress is predicted.

The maximum extents of groundwater mounding have been predicted using the numerical groundwater model over the life of the Proposal. These model outputs, together with the regional depth to groundwater data, have been used to identify areas where there is a risk of maximum groundwater levels mounding to within 2.0 m of the ground surface (i.e., 2 mbgl). These areas occur down gradient from the Fridge / Horseshoe South MAR Borefield and the Murray's Hill / Anticline Hill MAR area, coinciding with the break of slope. With the recession of water table associated with decreased MAR, surviving tree root systems (i.e., above zone of prolonged saturation) would be expected to gradually recolonise the desaturated zone down to root impeding layers and salt flushing processes would be reinstated (AQ2 2024b).

In overall terms, potential impacts to from groundwater mounding are likely to be spatially restricted and transient over the life of the Proposal. However, given the level of uncertainty associated with predictive modelling of groundwater levels, and noting that the tolerance of vegetation to groundwater level change is site specific and not easily determined, a program of ongoing monitoring of groundwater levels and vegetation health and adaptive management will be undertaken. A detailed discussion of the proposed management and monitoring measures is provided in the Water Management Plan (**Appendix 6**). The key management measures are:

- Surplus water will be managed via MAR to:
  - limit the extent of drawdown from the immediate mining area (accepting recirculation of groundwater) and
  - limit the potential for the saline interface to rise as a result of hydrostatic changes in the broader cone of depression.
- Comprehensive baseline and operational monitoring of groundwater levels and groundwater quality will be undertaken to monitor impacts relating to dewatering and MAR; inclusive of on-going monitoring outside of the area of impact to provide further baseline data, thereby allowing differentiation between seasonal and mining-related changes. As the tolerance of vegetation to groundwater level change is site specific and not easily determined, baseline and operational monitoring of both groundwater levels and vegetation health is of particular importance for the areas identified as being at risk of exposure to shallow groundwater levels.
- Operation of multiple MAR areas to allow flexibility of injection and periods of recovery (i.e., reduced injection in one area and increased in another) if required due to groundwater level or groundwater quality triggers being observed.
- Review of dewatering rates if groundwater level or groundwater quality triggers are observed and cannot be managed by modifying the distribution of MAR.
- Backfilling of the pits at closure to allow groundwater levels to return to near pre-development conditions and eliminate further changes to groundwater salinity resulting from evaporation from pit lakes. The modelling indicates a rapid recovery of groundwater levels post-mining, with

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predicted groundwater levels reported to recover to within 0.1 m of pre-mining levels within 10 years of the cessation of mining, at all mining areas, MAR areas and regional simulated observation points.

In addition to the above management measures, monitoring data will be regularly compared to model predictions and, as necessary, the numerical model can be re-calibrated to recorded responses and used to re-assess integrated groundwater management and mining scenarios.

As such there is a low likelihood of vegetation impacts resulting from groundwater mounding.

Groundwater salinity will also change as a result of dewatering and MAR activities. The TDS of the combined dewatering discharge for all dewatering bores over LoM is predicted to range between 1,800 and 3,000 mg/L. The modelling indicates that changes in groundwater quality resulting from the proposed dewatering and MAR activities is anticipated to be fairly localised (i.e., <2 km in extent). Predicted groundwater salinity beneath the claypan areas shows only minor fluctuations (<500 mg/L TDS) throughout the LoM. As the intent is to avoid any water logging of the root zones, the salinity of the mounded groundwater and the tolerance of vegetation to salinity changes does not require further consideration.

The backfilling of the pits at the completion of mining eliminates any post-mining increases in groundwater salinity caused by evaporation from the pit lake surfaces, however, modelling of post-mining groundwater quality has not been conducted to date.

### Surface water

To reduce the impact of the mine development on the hydrological regime of the downstream environment, surface water diversions are proposed to divert water around mine development areas and reduce the likelihood of ponding and contamination of runoff (i.e., surface water that has come in contact with pollutants such as chemicals or waste materials associated with the Proposal). Flood modelling undertaken for the Proposal predicts that the diversions convey the majority of flows around infrastructure footprints and minimise the upstream ponding that may be present otherwise. Where water is predicted to build up behind development areas the ponding is typically only temporary, with the model predicting ponds to recede as water drains to the south. In downstream locations where water level reductions are predicted, this is due to a reduction in catchment area as runoff is contained within the Surface Water Containment Areas. In some cases, the diversion of catchments upstream of the Surface Water Containment Areas is diverted into alternate catchments which also results in a reduction of flow (AQ2 2025).

Based on the water balance assessment of Fortescue Valley woodland vegetation communities completed by AQ2 (2025), the amount of time between effective rainfall events is the most important factor determining vegetation water supply, rather than the magnitude of these events. This also means that the vegetation communities are periodically exposed to drought and waterlogging stress under baseline conditions and have adaptations to cope with this (AQ2 2025). Importantly, the hydrological impact assessment identifies that all baseline hydrological processes will be maintained. The predicted hydrological change primarily relates to the magnitude and duration of flooding events AQ2 2025).

A total area of approximately 25 ha is predicted by the 2D flood model to be subject to increased flood levels (>5 cm increase maximum flood height) for a 63% AEP rainfall event (i.e., ~1 year average recurrence interval).

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Affected areas comprise a mix of Mulga dominated vegetation at the base of the alluvial fans and *Eucalyptus victrix* woodlands proximal to an area of outcropping basement near the valley fringe. The magnitude of predicted change however is modest. In the majority of cases, the dominant species in these vegetation types are well adapted to periodic flooding and drying and are unlikely to be significantly affected by the predicted hydrological change of increased surface water inputs. Vegetation types dominated by *Acacia aneura* complex are susceptible to increased waterlogging, which could cause a decline in tree health. Such areas are relatively small (circa tens of hectares) in the overall affected area. Although this area has also been identified as being at risk of exposure to shallow groundwater levels (from MAR), as mentioned above, prolonged periods of groundwater mounding can be avoided with a programme of ongoing monitoring and adaptive management (AQ2 2025). Monitoring and management is outlined within the WMP (**Appendix 6**). Given this, it is considered unlikely that significant impacts to vegetation will occur as a result of increased flood levels, however, these areas will be monitored to ensure any changes are detected and managed.

The 2D flood modelling predicts the containment of runoff within the mine development areas will cause a reduction in flood levels within the Fortescue Valley to the south of the Development Envelope. In particular, the areas of ponding within the Goodiadarrie Swamp immediately to the south of Anticline South, Fridge West, Fridge Central and Horseshoe South pits are predicted to have a reduction in flood levels of 0.2 m following a 63% AEP rainfall event. Water shadowing downstream of linear infrastructure (i.e., roads and the rail line) is minimal due to the preliminary locations selected for the proposed culverts as captured in the model, which allow flows to continue downstream of the infrastructure. The modelling predicts only localised impacts on surface water inundation depths upstream and downstream of roads.

Mulga (*Acacia aneura*) (and other closely related co-occurring species), is sensitive to changes to sheet flow (Maia 2020). Seven vegetation types within the Development Envelope were mapped as sheetflow dependent vegetation communities. These communities are:

- AaAxSL – tall sparse shrubland of *Acacia aneura* (alliance);
- ASL (1 and 2)– *Acacia* tall shrubland;
- AWL (1, 2 and 3) - *Acacia* low woodland or tall shrubland; and
- AxAsSL - *Acacia* tall sparse shrubland.

A total of 44,964.20 ha of these vegetation types have been mapped during surveys associated with the Proposal (refer to **Table 9-3**) of which 9,725.43 ha occurs within the Development Envelope and 2,973.51 ha occurs within the Indicative Footprint. Potential surface water dependent vegetation extends beyond the Development Envelope. Changes to sheet flow cause a shadow effect down gradient of the Proposal and result in indirect impacts to vegetation downstream of disturbance areas.

An area of approximately 310 ha is predicted to be subject to decreased flood levels (>5 cm decrease maximum flood height) for a 63% AEP rainfall event. These areas largely are blanketed in fine depositional sediments with patchy vegetation dominated Mulga and scattered *Eucalyptus victrix* in southern portions that transition into the Loamy Flats. The magnitude of predicted change is modest. Typically, vegetation types that support Mulga and scattered *Eucalyptus victrix* include AWL (1), (2) and (3) and AdEvWL. The dominant species in these vegetation types are well adapted to periodic flooding and drying and are unlikely to be significantly affected by the predicted hydrological change of decreased flood levels. Denser patches with high percentage cover of

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*Eucalyptus victrix* (vegetation types AdEvWL and EvWL), have the greatest potential to experience soil water depletion and drought stress during prolonged interfloods. Although a channel pool is located within the area of predicted flood depth reduction, the LoM flood modelling for a 63% AEP rainfall event predicts that surface water flow to the pool is not interrupted (i.e., the pool will continue to be supported by surface water) (AQ2, 2024b).

There are six conservation significant flora within the surface water dependent vegetation types present in the Development Envelope:

- *Triodia veniciae* (Priority 1) occurring within AaAxSL;
- *Hibiscus* sp. Mulga Downs (Priority 1) - occurring within AWL (1) and (2);
- *Aristida jerichoensis* var. *subspinulifera* (Priority 3) – occurring within ASL (2);
- *Dolichocarpa* sp. Hamersley Station (A.A. Mitchell PRP 1479) (Priority 3)- occurring within AWL (1);
- *Themeda* sp. Hamersley Station (M.E. Trudgen 11431) (Priority 3) – occurring within AaAxSL; and
- *Rhynchosia bungarensis* (Priority 4) – occurring within ASL (1).

While individually these taxa are not necessarily surface water dependant, they may also be indirectly impacted by degradation / loss of habitat that supports them. Current survey extent does not extend to areas south of the Development Envelope, however, baseline monitoring will be undertaken across these areas prior to implementation of the Proposal and a program of monitoring will be implemented during operation. Monitoring and management is outlined within the WMP (**Appendix 6**).

Freshwater claypans of the Fortescue Valley PEC (Priority 1) includes a series of claypans in the Fortescue Valley, distributed over a distance of about 70 km from near the western end of the Fortescue Marsh to the Roebourne – Wittenoom Rd. The two westernmost claypans, known as the Gnalka Gnoona Claypan and the Koodjeepindarranna Claypan, are located south of the Development Envelope. The key characteristics of the claypans which may be impacted by the proposed development are changes to the inundation depths, ponding duration (hydroperiod) and water quality (TDS) of ponded water. Changes to inundation depth, ponding duration and water quality has the potential to impact fringing vegetation of the claypans associated with the Freshwater Claypans of the Fortescue Valley' Priority 1 PEC and fringing *Eucalyptus victrix*.

As discussed in Section 7.5, a water balance model for the claypans was created to quantify the impact due to the potential loss in catchment related to the proposed mine development. The proposed mine development represents a loss of surface water catchment of 21 km<sup>2</sup> which is a 10% reduction to the Gnalka Gnoona catchment and a 2% reduction to the combined claypan catchment areas. The catchment reduction estimated for Koodjeepindarranna is insignificant compared to Baseline (<0.5%) (AQ2 2025).

The claypan water balance assessment concluded the following (AQ2 2025):

- The loss of catchment has nil to minor impact on the ponded water levels. The changes to the water levels in the claypans should therefore not impact on their hydrological function.
- The reduction in the duration of water ponding within the claypans due to the loss of catchment associated with the proposed mine development is negligible for small inundation events (where total event duration approximately 2 weeks), and is in the order of days for medium to large inundation events (total event duration is between three months and a year). It is unlikely these

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reductions to ponding duration will have a significant impact on the hydrological ecosystem function provided by the claypans.

- A salt balance was completed in conjunction with the water balance model completed for Gnalka Gnoona and Koojjeepindarranna claypans to assess the potential impact of the Proposal on the water quality of the claypans. The results indicate the salinity will vary marginally between the Pre-Development and LoM model scenarios.
- Standard local runoff management practices will be deployed within plant and mining areas to reduce the risk of contaminated water being released to the downstream environment where it has the potential to impact on local waterways and the downstream Fortescue Valley and claypans. These measures are further discussed in the WMP.

The predicted changes to inundation depths, ponding duration (hydroperiod) and water quality (TDS) of ponded water associated with the claypans are therefore anticipated to be marginal (AQ2 2025). These changes would be within the range of tolerance of vegetation fringing the claypans and are therefore unlikely to have a significant impact.

The WMP aims to avoid and minimise impacts to vegetation through a monitoring program targeted at detecting adverse changes, and the implementation of clear response actions if such changes are detected. The monitoring approach is informed by the results of baseline surveys, hydrological models, and the Proposal parameters. Additionally, the WMP considers management measures to avoid and minimise impacts associated with potentially contaminated surface water. Details of proposed monitoring, mitigation and contingency actions are outlined in the WMP (**Appendix 6**).

### 9.6.2.5 Fragmentation

There may be fragments of vegetation created within the Development Envelope during construction and operation of the Proposal and a proportion of these fragments are likely to be small and may not continue to be representative of their original community structure.

It is not possible to quantify indirect impacts to flora and vegetation from fragmentation as, fragmentation by itself does not prevent native vegetation from existing. Fragmentation can however lead to secondary impacts such as the introduction and spread of weeds, reduced seed dispersal and dust.

As discussed in **Section 9.6.2.3**, HPPL has a number of established weed and hygiene management measures to reduce the risk of existing weeds being spread or new weeds being introduced into the Development Envelope.

Dust impacts will also be managed as outlined in **Section 9.6.2.2**. HPPL will implement dust management measures to reduce dust emissions and subsequent deposition, throughout the Development Envelope and throughout the life of mine using well-established industry practices (such as the sealing of roads and the use of water based dust suppression). Remnant vegetation around mine areas will likely experience some levels of degradation from edge effects, however with the implementation of management measures to minimise impacts from those secondary impacts and implementation of mine closure activities, ecological linkage to some areas will be restored, mitigating the impacts of fragmentation on vegetation. Impacts from fragmentation are likely to be localised and not regionally significant.

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### 9.7 Significant Residual Impact

The significant residual impact of the Proposal to Flora and Vegetation, after the application of the mitigation hierarchy, is:

- Clearing of up to 4,296.93 ha of native vegetation in Good to Excellent condition;
- Loss of up to 2,973.51 ha of potential sheet flow dependent vegetation;
- Loss of up to 4.31 ha of riparian vegetation; and
- Loss of up to 70.31 ha of the 'Four Plant Assemblages of the Wona Land System' Priority 1 PEC.

Environmental offsets are proposed to mitigate the significant residual impacts of the Proposal and are discussed in **Section 16**. HPPL therefore considers the Proposal can be managed to meet the EPA's objective to protect flora and vegetation so that biological diversity and ecological integrity are maintained.

### 9.8 Environmental Outcome

Based on the studies and investigations undertaken to date, the outcomes of the assessment of potential impacts and proposed mitigation measures to protect environmental values associated with flora and vegetation meet the EPA's objective for this factor. The predicted environmental outcomes for flora and vegetation are summarised in **Table 9-19**.

Table 9-19: Flora and Vegetation Environmental Outcomes

Potential impact	Environmental Outcome
<b>Direct impacts</b>	
Loss of native vegetation	Loss of no more than 4,296.93 ha of native vegetation in Good to Excellent condition of which: <ul style="list-style-type: none"> <li>• 243.12 ha occurs within the Chichester IBRA subregion.</li> <li>• 4,053.80 ha occurs within the Fortescue IBRA subregion.</li> <li>• Loss of native vegetation across 15 vegetation types, including five locally significant vegetation types.</li> </ul>
Loss of Conservation Significant Vegetation	<ul style="list-style-type: none"> <li>• Loss of up to 2,973.51 ha of potential sheet flow dependent vegetation.</li> <li>• Loss of up to 70.31 ha of the 'Four Plant Assemblages of the Wona Land System' Priority 1 PEC.</li> <li>• Loss of up to 4.31 ha of Riparian vegetation.</li> </ul>
Loss of Conservation Significant Flora	No impact to Threatened Flora listed under the BC Act. <ul style="list-style-type: none"> <li>• Clearing of three DBCA-listed Priority flora species (based on the Indicative Footprint):</li> <li>• Up to 622 known Hibiscus sp. Mulga Downs (S. Hitchcock SH 638) (P1)) individuals of the 1,427 recorded in the Development Envelope. 1,741 individuals were recorded in total during the survey effort for the Proposal.</li> <li>• Up to 544 known Triodia veniciae (P1) individuals, of the 2,359 recorded in the Development Envelope. 2,359 individuals were recorded in total during the survey effort for the Proposal.</li> <li>• Up to 2 known Dolichocarpa sp. Hamersley Station (A.A. Mitchell PRP 1479) (P3) individuals of the 17 recorded in the Development Envelope. 180,169 individuals were recorded in total during the survey effort for the Proposal.</li> </ul>
<b>Indirect impacts</b>	

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Potential impact	Environmental Outcome
Altered fire regimes and increased fire risk	No significant damage to vegetation and flora as a result of fires caused by the Proposal.
Dust and use of saline water for dust suppression	No significant decline in vegetation and flora health as a result of dust deposition and the use of saline water for dust suppression required for the Proposal.
Introduced weeds	No introduction of new environmental weed species within the Development Envelope as a result of Proposal activities.
Altered hydrological regime	No significant decline in health of potential sheet flow dependant vegetation or Freshwater claypans of the Fortescue Valley P1 Priority Ecological Community (Fortescue claypans) PEC as a result of altered hydrological regimes resulting from Proposal activities as determined through monitoring and adaptive management in accordance with the Water Management Plan ( <b>Appendix 6</b> ).

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