

## 5. Flora and vegetation

### 5.1 EPA objective

To protect flora and vegetation so that biological diversity and ecological integrity are maintained.

For the purposes of the EIA, the EPA defines flora as native vascular plants and vegetation as groupings of different flora patterned across the landscape.

### 5.2 Policy and guidance

#### **EPA Policy and Guidance**

- *Instructions on how to prepare an Environmental Review Document* (EPA 2018a)
- *Statement of Environmental Principles, Factors and Objectives* (EPA 2018b)
- *Environmental Factor Guideline: Flora and Vegetation* (EPA 2016b)
- *Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016c)

#### **Other policy and guidance**

- DBCA (2006) *Recommended Interim Protocol for Flora Surveys of Banded Ironstone Formations of the Yilgarn Craton*. Unpublished. Department of Environment and Conservation, Perth, Western Australia.
- WA Environmental Offsets Policy (Government of Western Australia [GoWA] 2011)
- WA Environmental Offsets Guidelines (GoWA 2014)
- Environmental Offsets Policy, (Department of Sustainability, Environment, Water, Population and Communities [DSEWPC] 2012).
- Relevant recovery plans, conservation advices and/or threat abatement plans for conservation significant species that are known to occur, or a likely to occur within vicinity of the Proposal.

### 5.3 Required work

The required work for the flora and vegetation factor as stipulated in the approved ESD and its location within this ERD is documented in Table 5-1.

Table 5-1 Required work for Flora and Vegetation

Task No	Required work	Section
<b>Yogi Mine Project</b>		
1	Historical reports and government databases will be reviewed to identify the environmental values and potential issues that may be present to refine survey design.	Section 5.4.1
2	Flora and vegetation will be identified and characterised in accordance with the standards of <i>Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment</i> (EPA 2016c). The detailed survey will take into account areas that are likely to be directly or indirectly impacted as a result of the Proposal. Survey will include:	Section 5.4.1

Task No	Required work	Section
2a	Desktop assessment of relevant databases. If the desktop study indicates there is inadequate local and regional context, a detailed survey may be necessary beyond the proposal area	Section 5.4.1
2b	Targeted significant flora searches within the Development Envelope	Section 5.4.1 and 5.4.2.2
2c	Delineation of vegetation units	Section 5.4.2.1
2d	Assessment of significant flora habitat and significant ecological communities	Section 5.4.2.1
2e	Assessment of vegetation condition	Section 5.4.2.1
2f	Opportunistic searches for introduced flora	Section 5.4.2.2
2g	Mapping vegetation units, condition and significant flora, landforms, introduced flora species.	Figures Figure 5-1, Figure 5-2, Figure 5-3 (Section 5.4.1)
3	Figure (s) will be provided showing the extent of flora and vegetation in relation to the Proposal and distribution of flora and vegetation.	Figure 5-1 (Section 5.4.1)
4	The extent of potential direct, indirect and cumulative risks and impacts as a result of implementation of the Proposal will be described, quantified and assessed during both construction, operations and closure to flora and vegetation, taking into consideration the significance of flora and habitat. This will include noting whether these impacts are unknown, unpredictable or irreversible, or combination or contrary to that thereof. Tables will be provided quantifying direct, indirect and cumulative impacts, including relative proportion of the local and regional occurrence of significant flora and vegetation. Reporting of significant species should include quantum of individuals and populations	Section 5.6
5	The residual impacts of the Proposal on flora and vegetation will be quantified after considering and applying avoidance and minimisation, and through applying the Residual Impact Significance Model and WA Offset Template in the WA Environmental Offsets Guidelines (GoWA 2014), and the Environmental Offsets Policy (DSEWPC 2012) as appropriate	Section 5.7
6	An environmental management plan will be provided to address significant residual impacts to flora and vegetation. The following will be addressed in the plan (6a to 6d)	GHD 2020d, Appendix C
6a	Invasive species control - control of weeds, in particular through construction of infrastructure, transport and/or entry and exit points, riparian and GDE areas, vegetation units considered to have high local significance (e.g. locally rare units, habitat for conservation significant species) and in areas identified as in 'Excellent condition'.	Section 2.1 of GHD 2020d, Appendix C
6b	Monitoring program - to monitor the significant flora and vegetation communities identified	Section 2.1 of GHD 2020d, Appendix C

Task No	Required work	Section
6c	Management program - develop adaptive management actions to be triggered should monitoring show a decline as a result of implementing the Proposal	Section 2.1 and Section 3 of GHD 2020d, Appendix C
6d	Management of offset (if applicable).	GHD 2020d, Appendix C
7	Determine the extent and degree of any significant residual impacts on the identified environmental values by applying the Residual Impact Significance Model (page 11) and WA Offset Template (Appendix 1) in the WA Environmental Offsets Guidelines (GoWA 2014). Spatial data will be provided defining the area of significant residual impacts	Section 5.8
8	Where significant residual impacts remain, an appropriate offsets package will be proposed, consistent with the WA Environmental Offsets Policy and Guidelines and where residual impacts relate to EPBC Act-listed threatened species and Communities the Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy and Commonwealth Assessment guide. Spatial data will be provided defining the area of significant residual impacts.	Section 5.8.3
9	Prepare a mine closure plan consistent with the Department of Mines, Industrial Regulation and Safety (DMIRS) and EPA Guidelines.	GHD 2019c, Appendix D
10	The ERD will demonstrate and document how the EPA's objective for this factor can be met and how proposed offsets are consistent with the EPBC Act.	Section 5.8.2
<b>Pipeline corridor</b>		
11	Historical reports and government databases will be reviewed to identify the environmental values and potential issues that may be present to refine survey design.	Sections 5.4.1
12	Conduct a targeted reconnaissance flora and vegetation survey in accordance with EPA Technical guidance - Flora and Vegetation Survey (EPA 2016c).	Sections 5.4.1
13	Figure (s) will be provided showing the extent of flora and vegetation in relation to the Proposal and distribution of flora and vegetation.	Figure 5-5, Figure 5-6, Figure 5-7, Figure 5-8, Figure 5-9 (Section 5.4.3)
14	The extent of potential direct, indirect and cumulative risk and impacts as a result of implementation of the Proposal will be described and assessed during both construction, operations and closure to flora and vegetation, taking into consideration the significance of flora and habitat. This will include noting whether these impacts are unknown, unpredictable or irreversible, or combination or contrary to that thereof.	Section 5.6
15	The residual impacts from the Proposal will be predicted on flora and vegetation after considering and applying avoidance and minimisation actions.	Section 5.7
16	The extent and degree of any significant residual impacts will be determined on the identified	Section 5.8

Task No	Required work	Section
	environmental values by applying the Residual Impact Significance Model (page 11) and WA Offset Template (Appendix 1) in the WA Environmental Offsets Guidelines (GoWA 2014). Spatial data will be provided defining the area of significant residual impacts.	
17	Where significant residual impacts remain, an appropriate offsets package will be proposed, consistent with the WA Environmental Offsets Policy and Guidelines and where residual impacts relate to EPBC Act-listed threatened species and Communities the EPBC Act Environmental Offsets Policy. Spatial data will be provided defining the area of significant residual impacts.	Section 5.8.3
18	Management measures for the Proposal will be identified to ensure residual impacts to flora and vegetation are not greater than predicted.	Section 5.7
19	An environmental management and rehabilitation plan will be prepared for the pipeline corridor to address significant residual impacts to flora and vegetation. The following will be addressed in the plan (19a and 19b).	GHD 2020e, Appendix C
19a	Invasive species control - control of weeds, in particular through construction of infrastructure, transport and/or entry and exit points, riparian and GDE areas, vegetation units considered to have high local significance (e.g. rare units, habitat for conservation significant species) and in areas identified as in 'Excellent condition'.	Section 3.4 of GHD 2020e, Appendix C
19b	Management of offset (if applicable).	GHD 2020e, Appendix C
20	The ERD will demonstrate and document how the EPA's objective for this factor can be met and how proposed offsets are consistent with the EPBC Act.	Section 5.8.2

## 5.4 Receiving Environment

This section has been prepared in alignment with the requirements of *Environmental Factor Guideline: Flora and vegetation* (EPA 2016b). The flora and vegetation receiving environment of the pipeline and the mine area will be described separately to provide clarity, which is a reflection of the different nature, size and arrangement of each area.

### 5.4.1 Supporting flora and vegetation technical studies

A number of flora and vegetation surveys have previously been undertaken in the Yalgoo area and in the vicinity of the proposal. The results of these studies have contributed to developing an understanding of the vegetation and flora within the Yalgoo region and proposal areas. Key vegetation and flora surveys relevant to the proposal are outlined in Table 5-2.

The most recent surveys that cover the MDE and PDE were completed by GHD (2020, 2019b; 2019c) (Appendix B). The survey methodology employed by GHD was undertaken with reference to the Environmental Protection Authority (EPA) *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016c).

The outcomes of recent reconnaissance flora and vegetation surveys and desktop assessment of the pipeline corridor (GHD 2020a & 2020c) are considered sufficient for the purpose of the assessment as there is some flexibility in the location of the pipeline, and the final design will be

confirmed taking into account identified 'avoidance areas' (refer to Figure 5-10 and *Western Pipeline Flora and Fauna Desktop Assessment* (GHD 2020) provided in Appendix B). Upon finalisation of the pipeline route selection and prior to clearing additional targeted surveys of the pipeline corridor will be undertaken.

Table 5-2 Summary of supporting flora and vegetation studies

Report Title Author (Month Year)	Location	Date	Summary	Survey area relevance to Proposal
<i>Western Pipeline Flora and Fauna Desktop Assessment</i> , GHD 2020a (Appendix B)	The desktop review covered the western portion of the pipeline development envelope, extending from the Geraldton port eastwards to the locality of Pindar.	February 2020	The desktop assessment reviewed publically available information (government databases) to determine the previously recorded flora and vegetation values in the western portion of the PDE. The study area included a 40 km buffer of the western portion of the PDE. No wetlands (RAMSAR or of National importance, DBCA managed lands, ESAs, TECs/PECs) intersect the western portion of the PDE. Nine 'avoidance areas' have been identified based on the prevalence of conservation significant flora and fauna and the priority status within certain areas of the western PDE.	Intersects with the western portion of the PDE.
<i>Flora and Vegetation Assessment</i> , GHD 2019b (Appendix B)	The GHD survey area intersects Carlaminda and Wagga Wagga Pastoral Stations and includes mining tenements M59/740, M59/637, P59/2133 and L59/156, and covered 8,230 ha.	August to October 2018	The assessment included both desktop and field components. The desktop assessment reviewed publically available information (government databases) and relevant historical reports (as provided by FIJV) to determine the flora and vegetation values of the survey area. Detailed and targeted vegetation and flora surveys were completed on 6- 14 August and 9-13 October 2018. The purpose of the surveys were to verify the desktop assessment, identify and describe the dominant vegetation units, assess vegetation condition and identify and record vascular flora present. Targeted searches for conservation significant vegetation and flora taxa were also completed. Fifty five non-permanent quadrats and five transects were described throughout the survey area. Targeted survey efforts focused on the Wadgingarra Hill area. Traverses spaced approximately 50 m apart were walked with more detailed searches conducted where conservation significant flora were found.	The GHD survey area aligns with the MDE.
<i>Pipeline Corridor Flora and Fauna Assessment</i> ,	Approximately 80 km of the pipeline corridor, extending from the MDE to east of Mullewa. The survey area assessed was	November 2018 and January 2020	The assessment included both desktop and field components. A desktop assessment of publically available information and databases was completed to determine the flora values of the survey area. A reconnaissance vegetation	The GHD pipeline survey area covers the

Report Title Author (Month Year)	Location	Date	Summary	Survey area relevance to Proposal
GHD 2020c (Appendix B)	approximately 500 m wide and covered 4,654.86 ha.		and flora survey was completed from 26-30 November 2018. The purpose of the survey was to verify the desktop assessment, identify and describe the dominant vegetation types, assess vegetation condition and identify and record vascular flora present. Opportunistic searches for conservation significant vegetation and flora taxa were also completed. Thirty-five relevés were conducted throughout the survey area, supplemented by photo reference sites and traversing areas by vehicle and foot.	eastern portion of the PDE.
Maia Environmental Consultancy (2011, as cited in GHD 2019b)	The Maia survey area included three polygons (Area 1, Area 2 and Laydown Area) within E59/1097 and E59/740.	November 2011	Targeted flora survey completed between 2 - 7 November 2011. Transects at 100 m spacing both along and across the polygons were walked. Transects at 50 m spacing (i.e. between wider transects) were walked in areas where conservation significant flora were found.	Area 1 intersect the western part of the MDE.
Coffey Environments (2010), as cited in GHD 2019b)	The Coffey survey area includes four separate areas (1, 2, 3 and 4) within E59/1097, E59/740 and E59/1348.	August to September 2007	Targeted flora survey completed from 29 August to 1 September 2007. Survey methodology consistent with EPA Guidance Statement No. 51 (2004). Survey included sampling within 19 relevés located in vegetation types and intensive traverses of other areas. MDE traversed by vehicle and foot.	Coffey area 2 is within the MDE.
Ecoscope (2008)	The Ecoscope survey area includes an area within E59/1097.	October 2008	Level 1 Survey and targeted flora survey completed from 6-9 October 2008. The survey included selective, low intensity sampling of flora and vegetation. Targeted searching for conservation significant flora was also completed.	The north-east part of the Ecoscope survey area intersects the western part of the MDE.
Markey and Dillon (2008)	The Yalgoo survey area extends over Muralgarra, Badja, Bunnawarra, Wagga Wagga and Carlaminda Stations.	August and September 2007	Level 2 Flora and Vegetation survey conducted during August and September 2007. 55 permanent quadrats were established over the MDE and strategically placed across the topological profile of ranges. Of the 55 quadrats, eight are located with the current MDE.	The MDE intersects Wagga Wagga and Carlaminda Stations.

Report Title Author (Month Year)	Location	Date	Summary	Survey area relevance to Proposal
ATA Environmental (2007)	The ATA survey area included E59/642, P59/1397 and P59/1508.	September 2006	Level 2 Flora and Vegetation survey conducted from 6-9 September 2006. Survey methodology consistent with EPA Guidance Statement No. 51 (2004). Survey included re-visiting 14 permanent quadrats and traversing area on foot to search for conservation significant flora.	The northern part of the ATA survey area intersects the south-west part of the MDE.
ATA Environmental (2006)	The ATA survey area included E59/642, P59/1397 and P59/1508.	May and June 2006	Initial flora and vegetation survey conducted between 29 May and 2 June 2006. Survey methodology consistent with EPA Guidance Statement No. 51 (2004). Survey included establishing 15 permanent quadrats and traversing area on foot to describe and map major vegetation types.	The northern part of the ATA survey area intersects the south-west part of the MDE.



## 5.4.2 Mine Development Envelope

### 5.4.2.1 Vegetation

#### Regional vegetation mapping

Broad scale (1:1,000,000) pre-European vegetation mapping of the Murchison region was completed by Beard (1976) at an association level. The mapping indicates there are two vegetation associations present within the MDE:

- Low woodland; mulga (*Acacia aneura*) (association 18)
- Shrublands; bowgada & jam scrub (association 420).

#### Vegetation types

Nine vegetation types as well as cleared areas were identified and described for the MDE. The vegetation types included five types associated with upland areas (BIF range, granite outcrops and low rises), three types associated with drainage areas and one type associated with gentle undulating floodplains. The most dominant vegetation type was mixed *Acacia* shrublands on floodplains (APoEc) which covered approximately 68% of MDE. The most restricted vegetation type was AiMsSa, which was recorded from a single laterite rise in the eastern part of the MDE. The vegetation types recorded within the MDE are described in Table 5-3 and mapped in Figure 5-1.

Table 5-3 Vegetation types recorded within the mine development envelope (GHD 2019b)

Vegetation type	Description and landform	Extent (ha)
ArrTdHc	<i>Acacia ramulosa</i> var. <i>ramulosa</i> , <i>A. umbraculiformis</i> tall sparse shrubland over <i>Thryptomene decussata</i> , <i>Philothea brucei</i> subsp. <i>brucei</i> , <i>Aluta aspera</i> subsp. <i>hesperia</i> mid sparse to open shrubland over <i>Helipterum craspedioides</i> , <i>Erodium cygnorum</i> , <i>Wurmbea densiflora</i> isolated herbs. Landform: Upper slopes and crests of BIF	65.72
AtEgCd	<i>Acacia tetragonophylla</i> , <i>A. ramulosa</i> var. <i>ramulosa</i> , <i>A. pteraneura</i> mid to tall sparse shrubland over <i>Eremophila galeata</i> , <i>Ptilotus obovatus</i> , <i>Maireana carnososa</i> , <i>Solanum lasiophyllum</i> low sparse shrubland over <i>Cephalopterum drummondii</i> , <i>Roebuckiella ciliocarpa</i> , <i>Helipterum craspedioides</i> isolated herbs. Landform: lower and mid slopes, low crests and hills of BIF	833.66
AEgRc	<i>Acacia</i> spp. mid to tall sparse shrubland over <i>Eremophila galeata</i> , <i>Ptilotus obovatus</i> , <i>Maireana carnososa</i> low sparse shrubland over, <i>Roebuckiella ciliocarpa</i> , <i>Lemooria burkittii</i> , <i>Helipterum craspedioides</i> sparse herbland. Landform: low slopes, colluvial flats around BIF ranges	141.70
APoEc	<i>Acacia</i> spp. ( <i>A. tetragonophylla</i> , <i>A. burkittii</i> , <i>A. ramulosa</i> var. <i>ramulosa</i> , <i>A. pteraneura</i> , <i>A. caesaneura</i> ), <i>Hakea recurva</i> subsp. <i>recurva</i> mid to tall open shrubland over <i>Eremophila forrestii</i> subsp. <i>forrestii</i> , <i>Ptilotus obovatus</i> , <i>Solanum lasiophyllum</i> , <i>Sida</i> sp. dark green fruits (S. van Leeuwin 2260), <i>Maireana planifolia</i> low sparse shrubland over <i>Erodium cygnorum</i> , <i>Chthonocephalus pseudevax</i> , <i>Helipterum craspedioides</i> sparse herbland. Landform: flood plains	5,587.38

Vegetation type	Description and landform	Extent (ha)
Mosaic between APoEc and AeFsEd	APoEc and AeFsEd formed a mosaic in areas adjacent to one of the major drainage lines. This has been mapped as Mosaic between APoEc and AeFsEd (3). Landform: floodplains and seasonal inundated areas	93.48
AeFsEd	<i>Acacia ermaea</i> mid to tall sparse shrubland over <i>Frankenia setosa</i> , <i>Maireana tomentosa</i> , <i>Ptilotus obovatus</i> low open shrubland over <i>Eragrostis dielsii</i> , <i>Helipterum craspedioides</i> , <i>Chthonocephalus pseudevax</i> isolated grasses and herbs. Landform: floodplains and seasonal inundated areas	391.26
AtSePd	<i>Acacia tetragonophylla</i> mid to tall sparse shrubland over <i>Sida ectogama</i> , <i>Solanum lasiophyllum</i> , <i>Eremophila galeata</i> low sparse shrubs over <i>Cymbopogon ambiguus</i> mid isolated tussock grasses over <i>Pluchea dentex</i> , <i>Roebuckiella ciliocarpa</i> , <i>Helipterum craspedioides</i> isolated herbs. Landform: minor drainage lines and gullies	99.77
AbCaPd	<i>Acacia burkittii</i> , <i>A. tetragonophylla</i> mid to tall open shrubland over <i>Ptilotus obovatus</i> , <i>Solanum lasiophyllum</i> low sparse shrubs over <i>Cymbopogon ambiguus</i> mid isolated tussock grasses over <i>Pluchea dentex</i> , <i>Lysimachia arvensis</i> , <i>Cyperus ?alterniflorus</i> , <i>Euphorbia drummondii</i> isolated herbs and sedges. Landform: major drainage lines	157.48
AuEeBs	<i>Acacia umbraculiformis</i> , <i>A. tetragonophylla</i> , <i>A. ramulosa</i> var. <i>linophylla</i> tall to mid-sparse shrubland over <i>Eremophila exilifolia</i> , <i>E. forrestii</i> subsp. <i>forrestii</i> mid- isolated shrubs over <i>Borya sphaerocephala</i> , <i>Ptilotus obovatus</i> , <i>Solanum lasiophyllum</i> low isolated shrubs over <i>Hyalosperma glutinosum</i> subsp. <i>venustum</i> , <i>Pogonolepis muelleriana</i> isolated herbs. Landform: granite outcrops with shallow soils.	824.44
AiMsSa	<i>Acacia incognita</i> mid isolated shrubs over <i>Micromyrtus sulphurea</i> , <i>Ptilotus obovatus</i> , <i>Eremophila latrobei</i> subsp. warty leaves (M. Officer 230) low isolated shrubs over <i>Stenopetalum anfractum</i> , <i>Gnephosis brevifolia</i> , <i>Goodenia ?pinnatifida</i> isolated herbs. Landform: low lateritic rise	1.04
Cleared	Cleared areas including the Yalgoo – Mt Magnet Road	33.57

### Vegetation condition

The vegetation condition within the MDE was rated from Excellent to Very Good, with cleared areas (i.e. Yalgoo-Mt Magnet Road) (0.41%) not rated. The majority (93.70%) of vegetation throughout the MDE was rated as Excellent. Whilst current grazing occurs over most of the MDE, it was concentrated in vegetation type AeFsEd which supported low shrubland dominated by chenopods on sandy soils. These areas (5.89%) were rated Very Good due to the increase in grazing impacts observed. The extents of the vegetation condition ratings mapped within the MDE are detailed in Table 5-4 with vegetation condition mapping shown on Figure 5-6.

Table 5-4 Vegetation condition rating extents within the mine development envelope

Vegetation condition ratings	Extent (ha)
Excellent	7,711.20
Very Good	484.74
Not rated	33.57

## Conservation significant ecological communities

Desktop searches identified eight Priority Ecological Communities (PECs) and/or their buffers occurring within a 40 km buffer of the MDE (Table 5-5). Five of these PECs represent unique assemblages of invertebrates associated with groundwater calcretes. One PEC intersects the MDE, the Yalgoo (Gnows Nest/Wolla Wolla and Woolgah-Wadgingarra) vegetation complexes (banded ironstone formation) PEC.

Table 5-5 PECs identified in the desktop searches of the mine development envelope

Community	Status	Location
Yalgoo (Gnows Nest/Wolla Wolla and Woolgah-Wadgingarra) vegetation complexes (banded ironstone formation)	DBCA: Priority 1 PEC	Intersects western portion of MDE
Wagga Wagga and Yalgoo calcrete groundwater assemblage type on Yalgoo palaeodrainage on Wagga Wagga Station and Moore Palaeodrainage on Yoweragabbie Stations	DBCA: Priority 1 PEC	Located 14 km south-west of MDE
Gabyon calcrete groundwater assemblage type on Moore palaeodrainage on Gabyon Station	DBCA: Priority 1 PEC	Located 26 km north of MDE
Gullewa vegetation complexes (banded ironstone formation)	DBCA: Priority 1 PEC	Located 38 km south-west of MDE
Muralgarra calcrete groundwater assemblage type on Murchison palaeodrainage on Muralgarra Station	DBCA: Priority 1 PEC	Located 36 km south-west of the MDE
Bunnawarra calcrete groundwater assemblage type on Moore palaeodrainage on Bunnawarra Station	DBCA: Priority 1 PEC	Located 37 km south-west of the MDE
Minjar and Chulaar Hills vegetation complexes (banded ironstone formation)	DBCA: Priority 1 PEC	Located 39 km south-west of the MDE
Badja calcrete groundwater assemblage type on Moore palaeodrainage on Badja Station	DBCA: Priority 1 PEC	Located 36 km south of the MDE

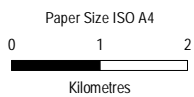
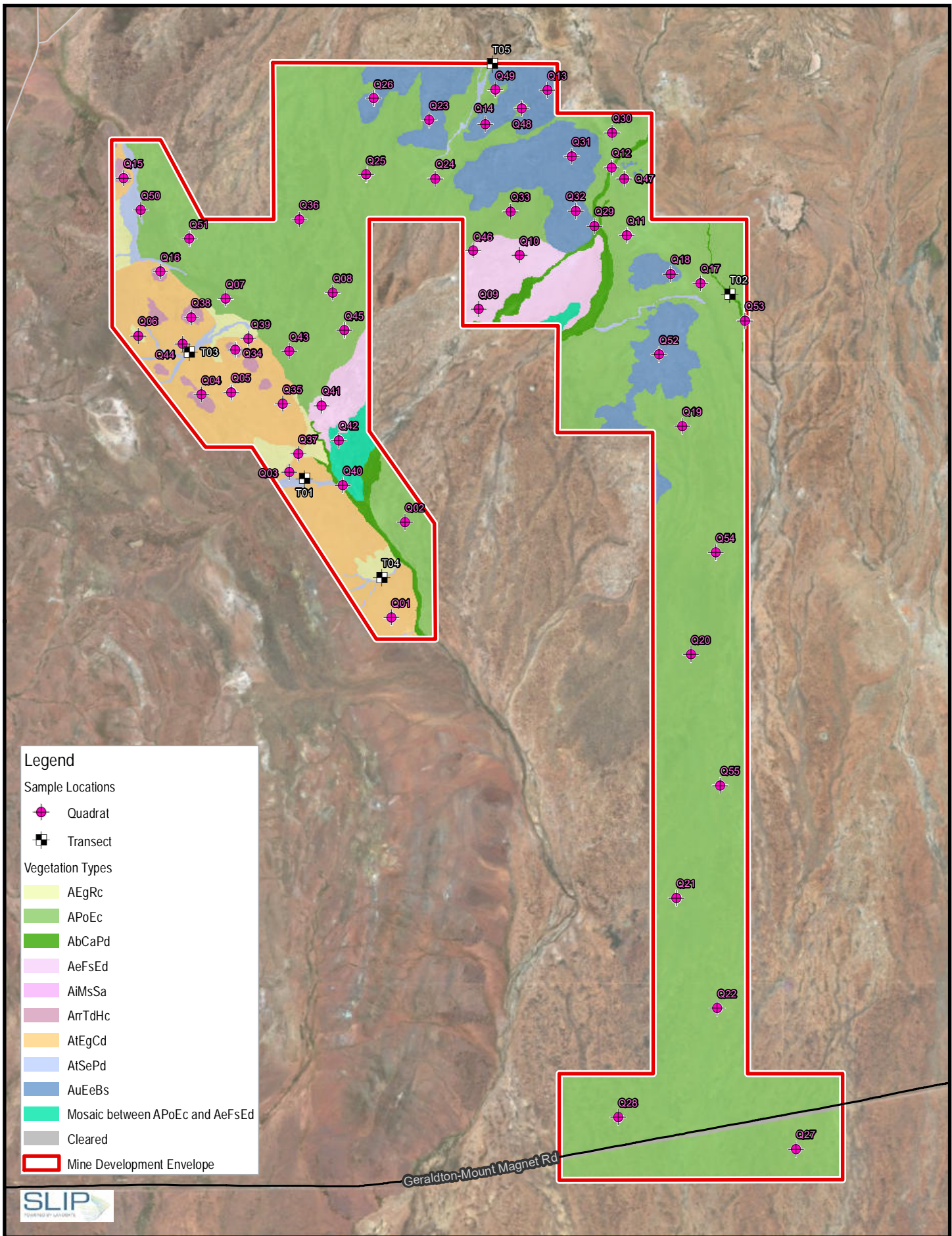
One PEC was identified within the MDE during the field survey, the Yalgoo (Gnows Nest/Wolla Wolla and Woolgah-Wadgingarra) vegetation complexes (banded ironstone formation) listed as Priority 1 by DBCA. This community was listed following surveys conducted by Markey and Dillon (2008) in the Yalgoo area (as part of flora and vegetation surveys of BIF of the Yilgarn Craton). Markey and Dillon (2008) noted that although the Yalgoo area did not have as many restricted communities and endemic and uncommon taxa as other areas (e.g. Central Talling Land system) the area still supports taxa of conservation significance and distinctive floristic communities.

Vegetation communities mapped within the MDE occurring on the BIF range include ArrTdHc on upper slope and crests, AtEgCd on mid to lower slopes and hills, and AEGrC on lower slopes and colluvial flats. These three vegetation types are considered representation of the Yalgoo vegetation complexes PEC (GHD 2019b). There is 1,041.09 ha (12.65%) of the Yalgoo vegetation complexes PEC within the MDE; a breakdown of the PEC by vegetation type is provided in Table 5-6 with the PEC spatial extent shown in Figure 5-3.

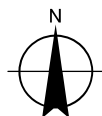
Table 5-6 Extent of Yalgoo vegetation complexes PEC within the mine development envelope

Vegetation type	Condition rating	Extent in the MDE (ha)
ArrTdHc	Excellent	65.72
AtEgCd	Excellent	833.66
AEgRc	Excellent	141.70





Map Projection: Transverse Mercator  
Horizontal Datum: GDA 1994  
Grid: GDA 1994 MGA Zone 50



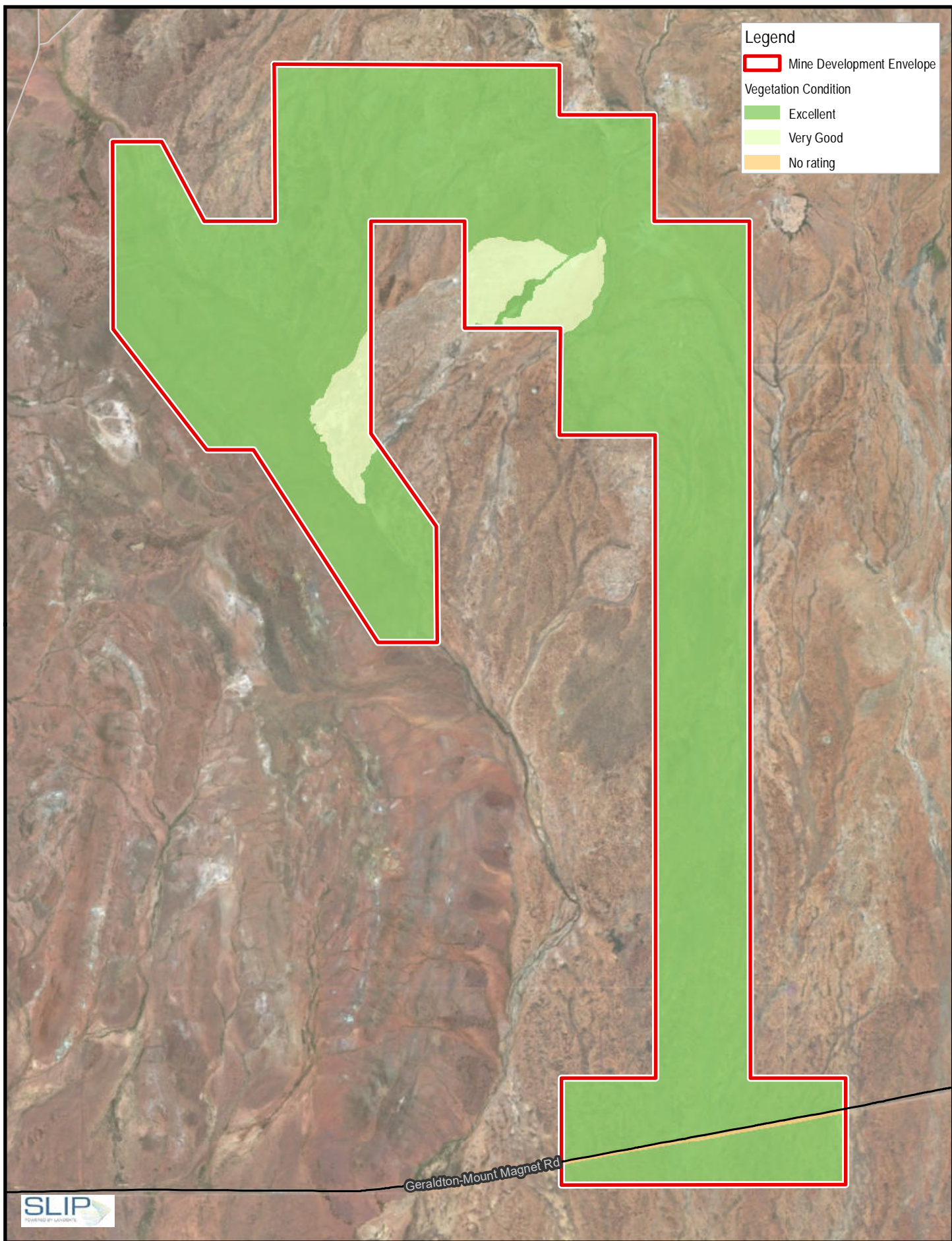
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Revision No. 0  
Date 12 Jul 2019

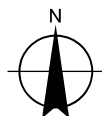
### Vegetation Types in the Mine Development Envelope

FIGURE 5-1





Paper Size ISO A4  
0 1 2  
Kilometres



Map Projection: Transverse Mercator  
Horizontal Datum: GDA 1994  
Grid: GDA 1994 MGA Zone 50



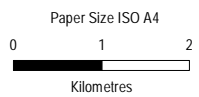
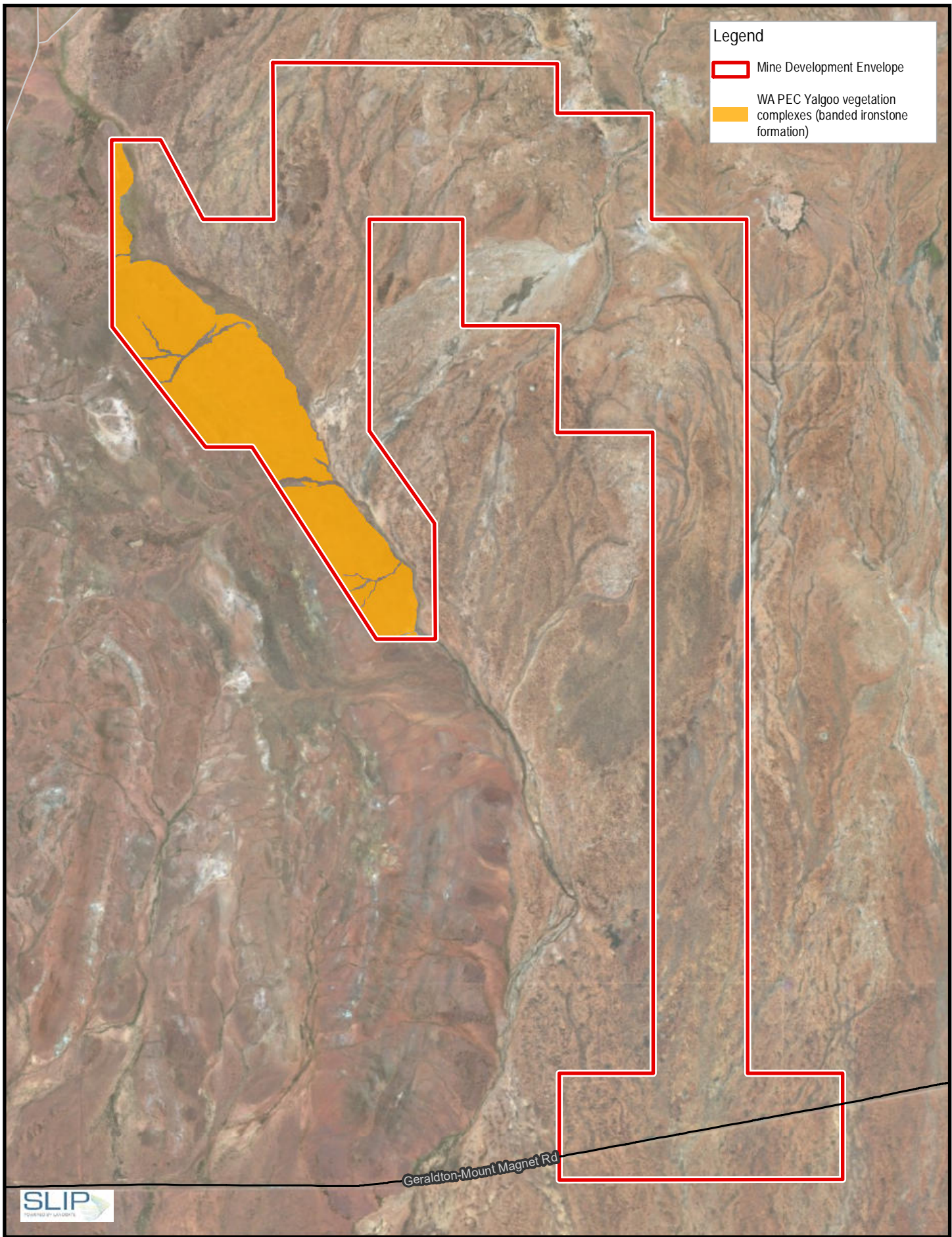
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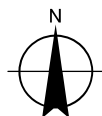
Vegetation Condition in the  
Mine Development Envelope

FIGURE 5-2





Map Projection: Transverse Mercator  
Horizontal Datum: GDA 1994  
Grid: GDA 1994 MGA Zone 50



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Conservation Ecological Communities  
in the Mine Development Envelope

FIGURE 5-3

### 5.4.2.2 Flora

#### Flora diversity

Two hundred and thirty three flora taxa (including subspecies and varieties) representing 50 families and 122 genera were recorded from the MDE during the GHD field survey (2019b). This total comprised 224 native taxa and nine introduced flora taxa. Dominant families recorded from the MDE included Fabaceae (44 taxa), Asteraceae (26 taxa), Chenopodiaceae (19 taxa) and Scrophulariaceae (18 taxa).

A species accumulation curve generated to assess the adequacy of sampling effort across the MDE. The resulting curve and bootstrap estimator of species richness indicates adequate survey effort. The MDE is considered representative of the floristic diversity in the area (GHD 2019b).

#### Conservation significant flora

Desktop searches of the EPBC Act PMST, *NatureMap*, DBCA TPFL and WAHERB databases identified the presence/potential presence of 14 conservation significant flora taxa within a 40 km buffer of the MDE. Three DBCA Priority-listed flora species were recorded within the MDE during the GHD field survey, *Acacia subsessilis* (Priority 3), *A. speckii* (Priority 4) and *Dodonaea amplisemina* (Priority 4) (GHD 2019b). These species have also been recorded in previous surveys within and in the vicinity of the MDE (Maia 2011, Coffey 2010, Ecoscape 2008, Markey and Dillon 2008, ATA 2006, 2007).

*Acacia subsessilis*, *A. speckii* and *Dodonaea amplisemina* were all restricted to the BIF range, with the exception of *A. speckii* which was also sporadically recorded in vegetation type AuEeBs occurring on granite outcrops. Approximately 450 individuals of *A. subsessilis*, 1,185 individuals of *A. speckii* and 53 individuals of *Dodonaea amplisemina* have been recorded in the MDE (GHD 2019b, Maia 2011). Based on field observations and other studies *A. subsessilis* and *A. speckii* extend beyond and occur outside of the MDE, with *A. speckii* recorded in large numbers on neighbouring BIF rises (GHD 2019b, Maia 2011).

A likelihood of occurrence assessment was conducted for all conservation significant flora taxa identified in the desktop assessment. This assessment took into account previous records, habitat requirements, efficacy and intensity of the surveys, flowering times and the cryptic nature of species. The likelihood of occurrence assessment concluded that three species are known to occur, five taxa may possibly occur and the remaining ten taxa are unlikely or highly unlikely to occur. The five taxa that may possibly occur have been recorded within 40 km of the MDE, suitable habitat is present within the survey area and the species can be cryptic (GHD 2019b). A summary of the likelihood of occurrence assessment is provided in Table 5-7.

Table 5-7 Summary of conservation significant flora likelihood of occurrence assessment within the mine development envelope (GHD 2019b)

Taxon	EPBC Act	BC Act/ DBCA	Likelihood
<i>Acacia subsessilis</i>		P3	Known
<i>Acacia speckii</i>		P4	Known
<i>Dodonaea amplisemina</i>		P4	Known
<i>Calotis</i> sp. Perrinvale Station (R.J. Cranfield 7096)		P3	Possible
<i>Gunniopsis divisa</i>		P3	Possible
<i>Rhodanthe collina</i>		P3	Possible
<i>Goodenia berringbinensis</i>		P4	Possible
<i>Goodenia neogoodenia</i>		P4	Possible
<i>Enekbatus dualis</i>		P1	Unlikely
<i>Grevillea rosieri</i>		P2	Unlikely



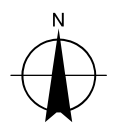
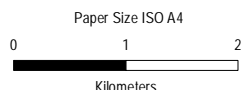
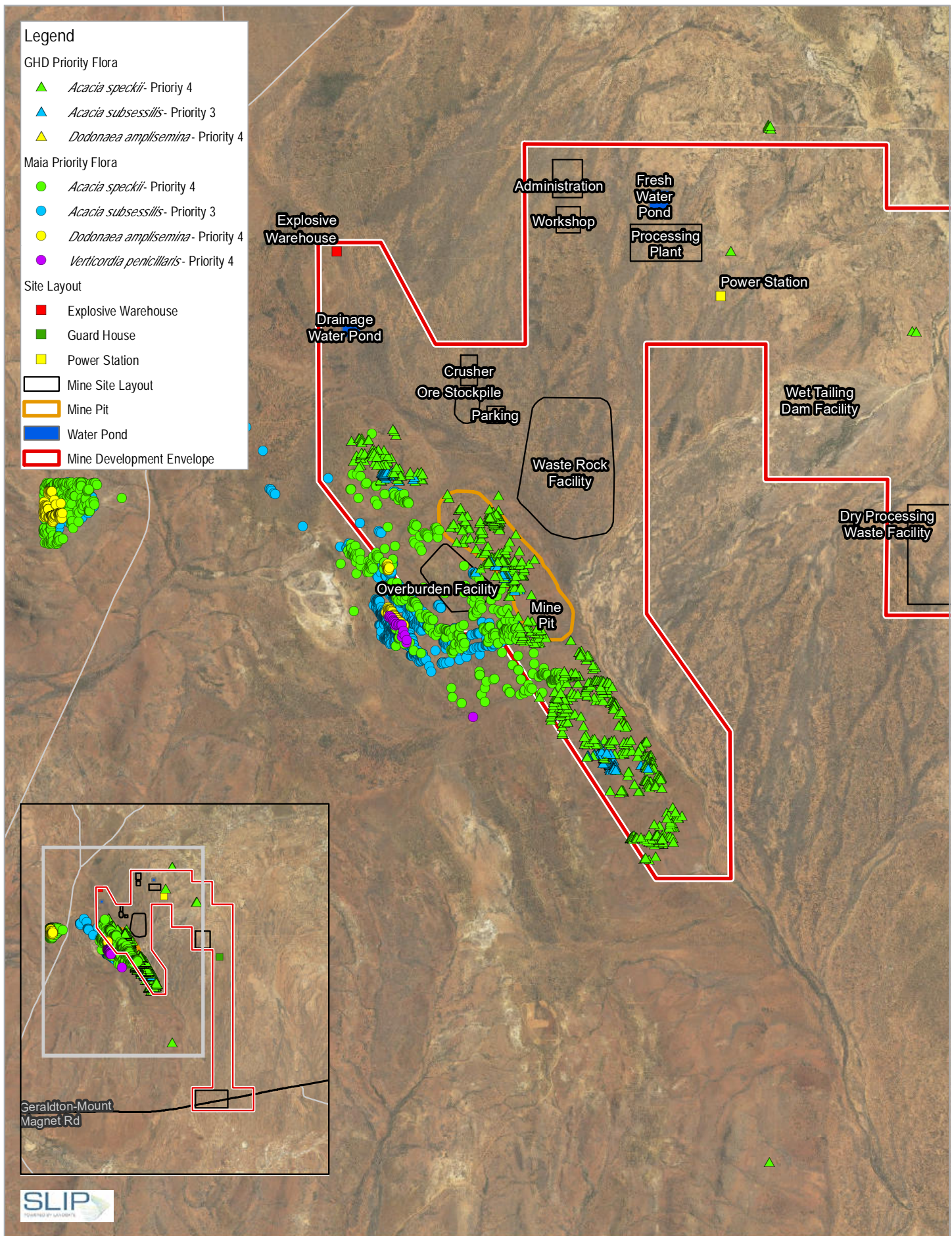
Taxon	EPBC Act	BC Act/ DBCA	Likelihood
<i>Euryomyrtus recurva</i>		P3	Unlikely
<i>Grevillea globosa</i>		P3	Unlikely
<i>Tecticornia fimbriata</i>		P3	Unlikely
<i>Triglochin protuberans</i>		P3	Unlikely
<i>Frankenia confusa</i>		P4	Unlikely
<i>Verticordia penicillaris</i>		P4	Unlikely
<i>Eremophila viscida</i>	E	T	Unlikely
<i>Ricinocarpos brevis</i>	E	T	Highly unlikely

### Introduced flora

Nine introduced flora taxa were recorded in the MDE. Of the introduced taxa, none are listed as Declared Pests under the *Biosecurity and Management Act 2007* (BAM Act) and/or as a Weeds of National Significance. All of the introduced flora have been previously recorded from the Yalgoo IBRA bioregion.

### Sheetflow and groundwater dependent and potentially groundwater dependent vegetation

No sheet-flow, groundwater dependent or potentially groundwater dependent vegetation was identified within the MDE.



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Priority Flora in the  
Mine Development Envelope

FIGURE 5-4



### 5.4.3 Pipeline Development Envelope

The PDE is divided into two portions for the purpose of this report: the western and eastern portions. The eastern portion is the approximately 80 km of the pipeline corridor, extending from the Yogi Mine Project to east of Mullewa and is the area covered by the pipeline flora and fauna technical study (GHD 2020c). The eastern portion of the PDE is approximately 500 meters (m) wide and covers 4,654.86 ha. The western portion comprises approximately 145 km of the pipeline corridor, and broadly follows the Mt Magnet Road extending from the Geraldton port eastwards to the locality of Pindar. The western portion of the PDE is covered by a desktop assessment (GHD 2020). The western PDE is approximately 5 km wide, and covers approximately 72,145 ha.

#### 5.4.3.1 Vegetation

##### Regional vegetation mapping

Broad scale (1:1,000,000) pre-European vegetation mapping of the Murchison region was completed by Beard (1976) at an association level. As shown in Table 5-8, 28 vegetation intersect the PDE along its length.

Table 5-8 Vegetation associations intersecting the pipeline development envelope (Beard 1976)

Vegetation association	Description	Location within PDE
18	Low woodland; mulga ( <i>Acacia aneura</i> )	Eastern portion
35	Shrublands; jam scrub with scattered York gum	Western portion
36	Shrublands; thicket, acacia-casuarina alliance	Western portion
125	Bare areas; salt lakes	Eastern portion
129	Bare areas; dune sand	Western portion
142	Medium woodland; York gum & salmon gum	Western portion
202	Shrublands; mulga & <i>Acacia quadrimarginea</i> scrub	Eastern portion
243	Shrublands; bowgada & minnie ritchie scrub	Eastern portion
352	Medium woodland; York gum	Western portion
353	Shrublands; mallee & acacia scrub with scattered York gum	Western portion
359	Shrublands; acacia & banksia scrub	Western portion
361	Shrublands; bowgada & minnieritchie scrub with scattered mulga	Eastern portion
364	Shrublands; bowgada scrub with scattered eucalypts & cypress pine	Eastern portion
371	Low forest; <i>Acacia rostellifera</i>	Western portion
372	Mosaic: Shrublands; scrub-heath on deep sandy flats / Shrublands; thicket, acacia-casuarina alliance	Western portion
379	Shrublands; scrub-heath on lateritic sandplain in the central Geraldton Sandplain Region	Western portion
380	Shrublands; scrub-heath on sandplain	Western portion
404	Shrublands; bowgada & <i>Acacia murrayana</i> scrub	Eastern portion
408	Shrublands; scrub-heath on coastal association, yellow sandplain	Western portion
419	Shrublands; bowgada, jam and <i>Melaleuca uncinata</i> thicket	Eastern and western portion
420	Shrublands; bowgada & jam scrub	Eastern and western portion
440	Shrublands; <i>Acacia ligulata</i> open scrub	Western portion
675	Shrublands; mixed thicket (melaleuca & hakea)	Western portion

Vegetation association	Description	Location within PDE
676	Succulent steppe; samphire	Eastern and western portion
683	Succulent steppe with open scrub; scattered <i>Acacia sclerosperma</i> & snakewood over samphire	Eastern portion
686	Medium woodland; York gum & red mallee	Eastern portion
687	Shrublands; bowgada & jam scrub with scattered <i>Allocasuarina huegeliana</i> & York gum	Western portion
1413	Shrublands; acacia, casuarina & melaleuca thicket	Western portion

## Vegetation types

The varying soil types, geology and landforms of the PDE have provided diverse growing conditions for vegetation. Twenty-one vegetation types as well as cleared areas were identified and described for the eastern portion of the PDE. The most dominant vegetation types included *Melaleuca eleuterostachya* open woodland (VT14), *Acacia rhodophloia* and *A. aptaneura* open woodland (VT01) and *Melaleuca lateriflora*, *M. hamata* and *Acacia tetragonophylla* shrubland (VT08). Vegetation type 18, *Acacia tetragonophylla* sparse shrubland on seasonally wet clay pan, expressed the lowest coverage within the PDE. The vegetation types recorded within the eastern portion of the PDE are described in Table 5-9 and mapped in Figure 5-5. The majority of the western portion of the PDE is cleared and does not support native vegetation.

Table 5-9 Vegetation types recorded within eastern portion of the PDE (GHD 2019a)

Vegetation type	Extent (ha)
<i>Acacia rhodophloia</i> and <i>Acacia aptaneura</i> open woodland (VT01)	688.06
<i>Acacia eremaea</i> and <i>Acacia acuminata</i> (narrow phyllode variant) open woodland (VT02)	34.49
<i>Acacia aptaneura</i> open woodland over <i>Acacia tetragonophylla</i> , <i>Acacia victoriae</i> and <i>Acacia burkittii</i> sparse shrubland (VT03)	51.46
<i>Acacia aptaneura</i> open woodland over <i>Eremophila galeata</i> , <i>Acacia tetragonophylla</i> and <i>Exocarpos aphyllus</i> sparse shrubland (VT04)	178.11
<i>Acacia tetragonophylla</i> , <i>Acacia victoriae</i> and <i>Pittosporum angustifolium</i> open shrubland (VT05)	3.06
<i>Acacia acuminata</i> (narrow phyllode variant), <i>Acacia victoriae</i> and <i>Acacia tetragonophylla</i> sparse shrubland (VT06)	79.21
<i>Melaleuca lateriflora</i> open to sparse shrubland (VT07)	163.72
<i>Melaleuca lateriflora</i> , <i>Melaleuca hamata</i> and <i>Acacia tetragonophylla</i> shrubland (VT08)	652.95
<i>Casuarina obesa</i> woodland to open woodland (VT09)	104.68
<i>Grevillea obliquistigma</i> subsp. <i>obliquistigma</i> sparse shrubland (VT10)	57.32
<i>Acacia acuminata</i> (narrow phyllode variant), <i>Acacia speckii</i> (P4) and <i>Acacia cuthbertsonii</i> subsp. <i>cuthbertsonii</i> sparse shrubland (VT11)	83.95
<i>Acacia ramulosa</i> var. <i>ramulosa</i> , <i>Acacia speckii</i> (P4) and <i>Acacia cuthbertsonii</i> subsp. <i>cuthbertsonii</i> sparse shrubland (VT12)	374.16
<i>Acacia burkittii</i> , <i>Acacia aptaneura</i> and <i>Acacia tetragonophylla</i> open shrubland (VT13)	84.76
<i>Melaleuca eleuterostachya</i> open woodland (VT14)	1,000.61
<i>Acacia rhodophloia</i> , <i>Callitris columellaris</i> and <i>Grevillea obliquistigma</i> subsp. <i>obliquistigma</i> shrubland (VT15)	327.44
<i>Acacia burkittii</i> , <i>Acacia rhodophloia</i> and <i>Acacia tetragonophylla</i> open shrubland (VT16)	47.72

Vegetation type	Extent (ha)
<i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i> open mallee woodland to woodland (VT17) Within the Avon Wheatbelt IBRA region VT17 represents the PEC Eucalypt Woodlands of the WA Wheatbelt	277.35
<i>Acacia tetragonophylla</i> sparse shrubland on seasonally wet clay pan (VT18)	1.36
<i>Acacia neurophylla</i> subsp. <i>erugata</i> and <i>Melaleuca hamata</i> open shrubland (VT19)	58.36
<i>Melaleuca hamata</i> and <i>Acacia acuminata</i> (narrow phyllode variant) shrubland on drainage flats (VT20)	33.12
<i>Acacia burkittii</i> , <i>Acacia effusifolia</i> and <i>Senna filifolia</i> shrubland (VT21)	34.28
Cleared areas	316.72

### Vegetation condition

The vegetation condition within the eastern portion of the PDE was rated from Excellent to Very Good with cleared areas not rated (GHD 2020c). The majority of the eastern portion was considered to be in excellent condition. Areas rated as Very Good had signs of historical grazing, which has reduced the native species cover in the understorey. Other disturbances include historical clearing for tracks and material gravel pits. Vegetation type 19 had been recently burnt (2-3 years ago) with good recruitment of native species. Recent fires were not recorded for the other vegetation types. This is mapped in Figure 5-6.

### Groundwater dependent ecosystems

No GDV or GDEs were recorded within the eastern or western portions of the PDE.

### Conservation significant ecological communities

Desktop searches (EPBC Act PMST and DBCA TEC and PEC database) identified one EPBC Act-listed TEC potentially occurring within the PDE. The DBCA TEC and PEC database identified an additional three PECs (and/or their buffers) that intersect the eastern portion of the PDE. No TECs or PECs intersect the western portion of the PDE. The desktop search results are presented in Table 5-10 and mapped in Figure 5-7.

Table 5-10 Conservation significant ecological communities

Community	Status	Location
Yalgoo (Gnows Nest/Wolla and Woolgah-Wadgingarra) vegetation complexes (banded ironstone formation)	DBCA: Priority 1 PEC	Eastern portion of PDE buffer intersects the PDE
Wagga Wagga and Yalgoo calcrete groundwater assemblage type on Yalgoo and Moore paleodrainage on Wagga Wagga and Bunnawarra Stations	DBCA: Priority 1 PEC	Eastern portion of PDE
Wheatbelt Woodlands Eucalypt woodlands of the Western Australian Wheatbelt	EPBC Act: Critically Endangered TEC <sup>1</sup> DBCA: Priority 3 PEC	Western portion of PDE Three individual patches intersect the PDE. These patches align with Beard (1976) vegetation association 686

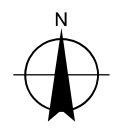
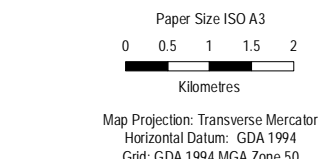
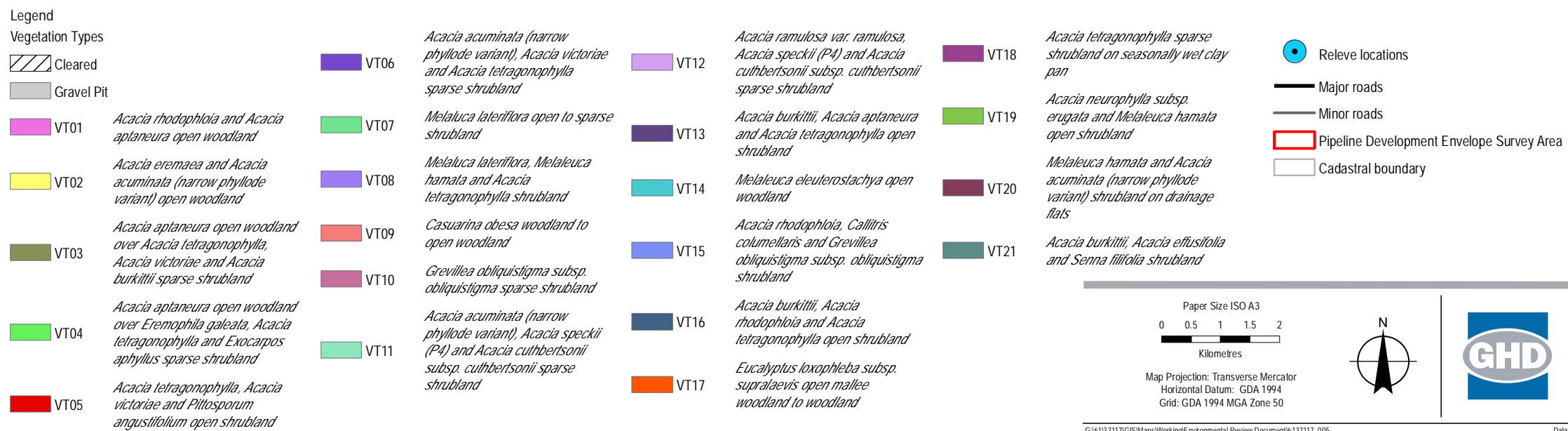
**Notes:**

<sup>1</sup>The field assessment confirmed the presence of VT 17 *Eucalyptus loxophleba* subsp. *supralaevis* open mallee woodland to woodland, however, this VT does not align with the Eucalypt Woodlands of the WA Wheatbelt TEC, listed as Critically Endangered under the EPBC Act, as it does not meet all of the key diagnostic criteria (GHD 2020c).

The GHD field assessment confirmed the presence of the Eucalypt Woodlands of the WA Wheatbelt PEC within the PDE (GHD 2020c). *Eucalyptus loxophleba* subsp. *supralaevis* open mallee woodland to woodland (VT17) represents the PEC based on the nomination advice (DEC 2011), which lists *Eucalyptus loxophleba* subsp. *loxophleba* as one of the dominant species that forms the PEC in the Avon Wheatbelt IBRA bioregion. Other subspecies are also listed, such as *Eucalyptus loxophleba* subsp. *supralaevis*, with this subspecies recognised as being a combination sprouter (a tree but becoming a mallee with repetitive disturbance events (DEC 2011)).

The Eucalypt Woodlands of the WA Wheatbelt PEC was recorded from six separate patches within the eastern portion of the PDE during the GHD field survey (2019a). The Eucalypt Woodlands of the WA Wheatbelt PEC only occurs in the Avon Wheatbelt IBRA bioregion; outside of this bioregion the PEC does not occur. The PEC patches mapped by GHD align with previously mapped PEC patches (as shown in the DBCA PEC database search results), with the exception of one patch. At this location the DBCA mapped occurrence does not represent the PEC as the vegetation type was recorded as a shrubland (VT21) and not a Eucalypt woodland. No occurrences of the Eucalypt Woodlands of the WA Wheatbelt TEC were recorded during the GHD field survey (2019a). Approximately 70 ha of the Eucalypt Woodlands of the WA Wheatbelt PEC was recorded in the PDE during the GHD field survey (2019a). The location of the Wheatbelt PEC is shown in Figure 5-8.





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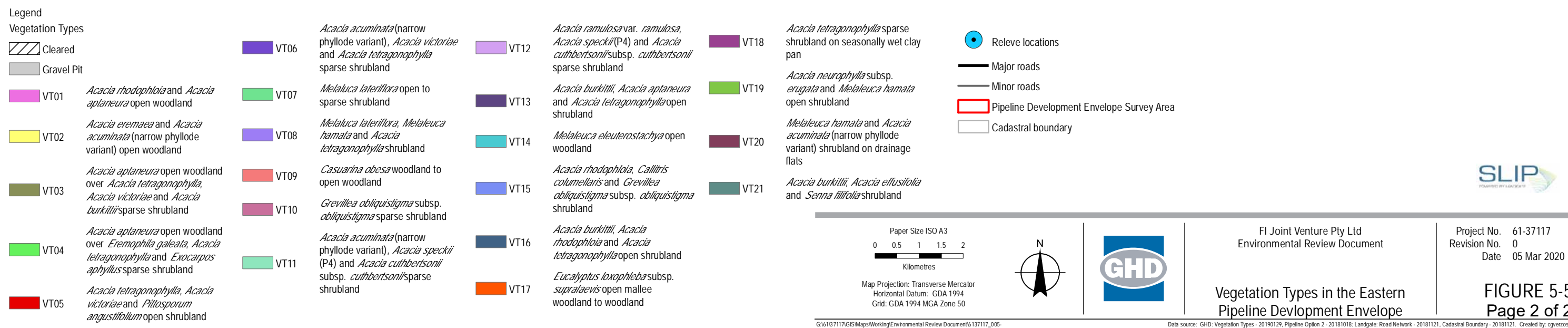
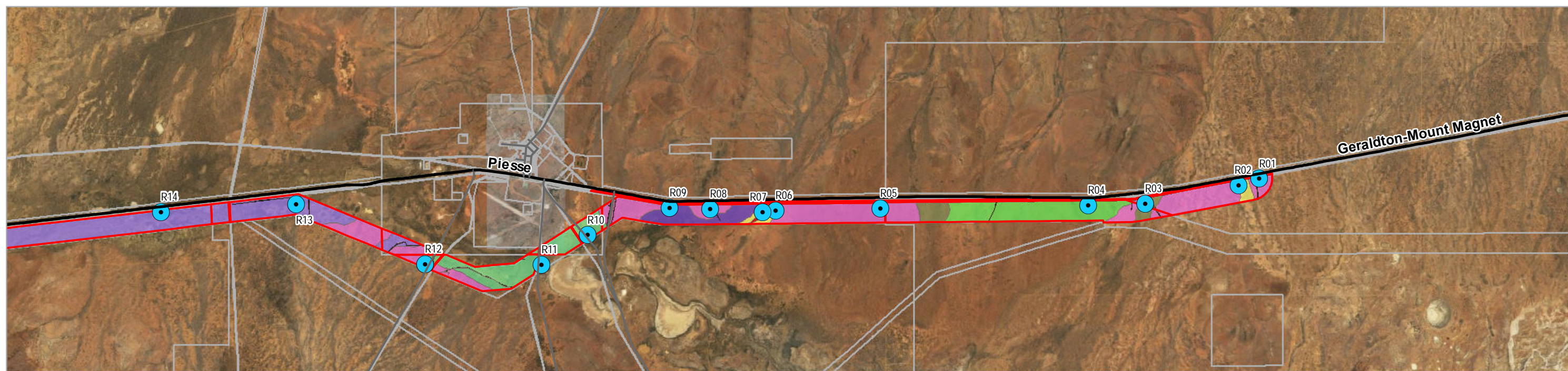
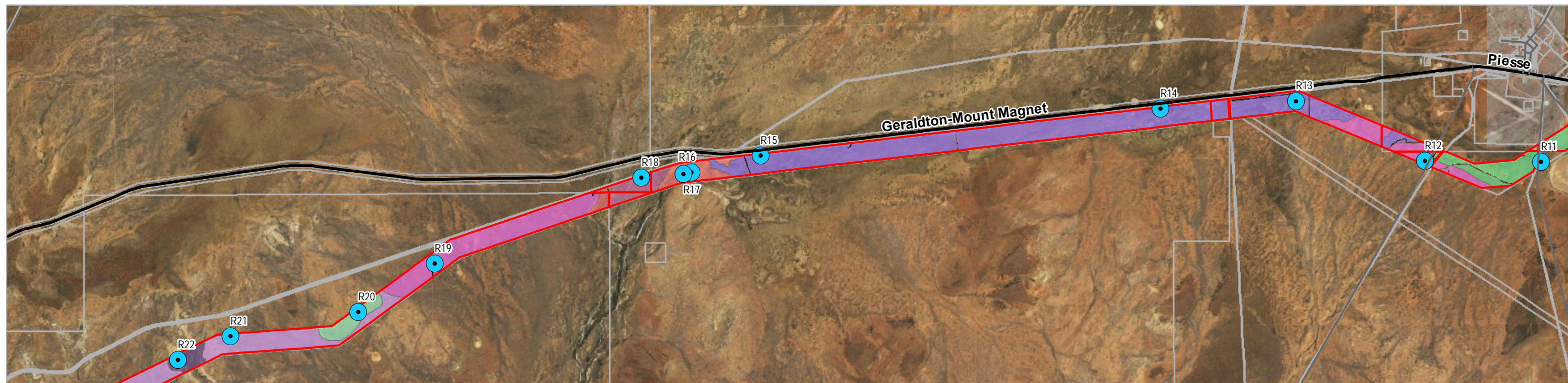
Vegetation Types in the Eastern  
Pipeline Development Envelope

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Date 05 Mar 2020

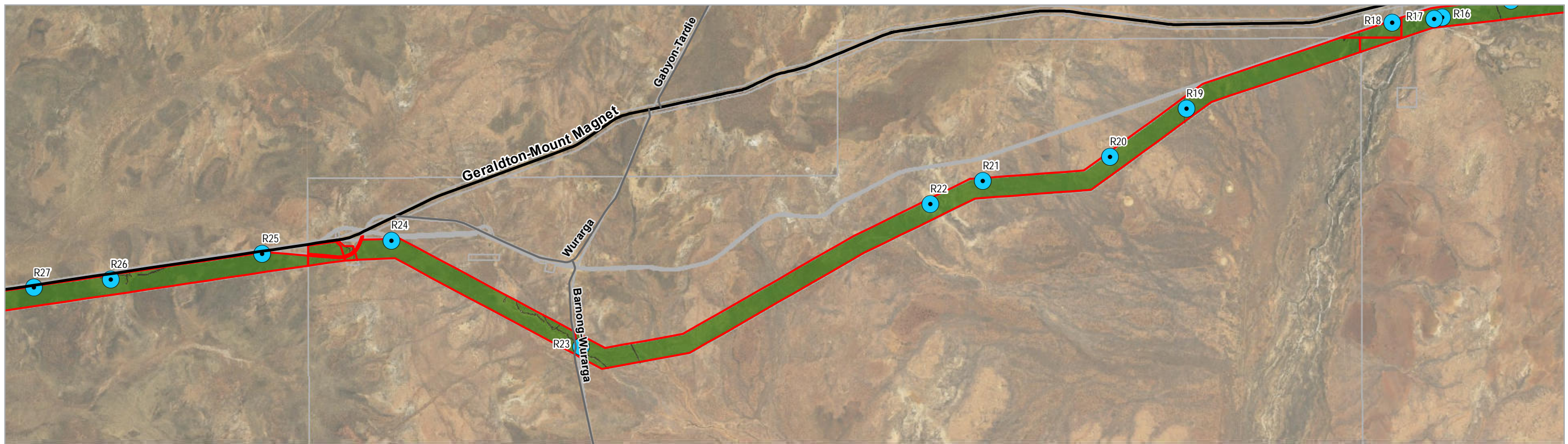
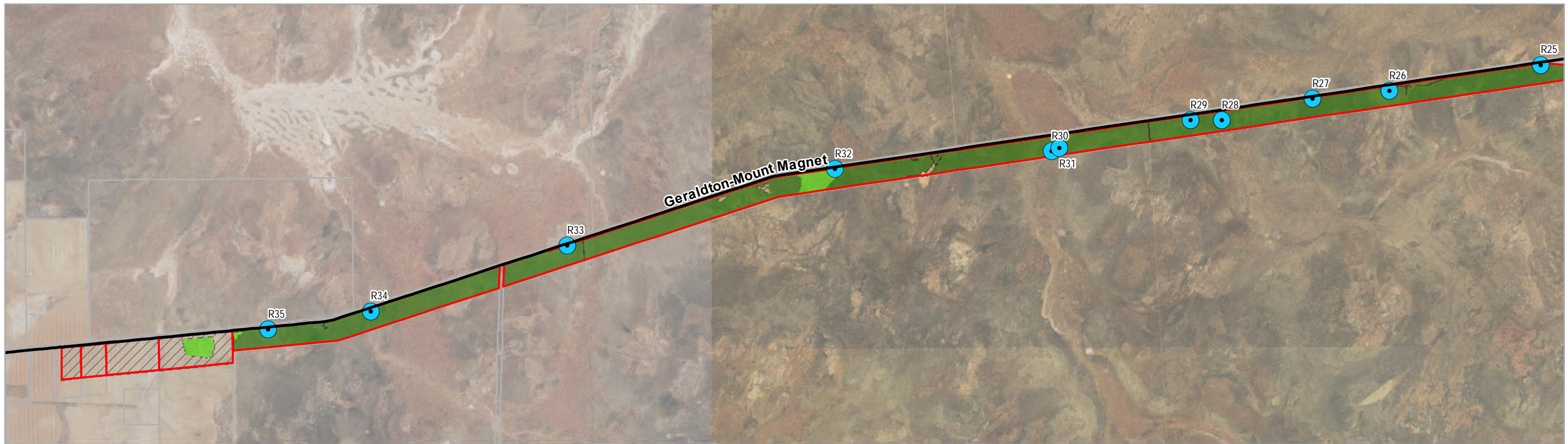
FIGURE 5-5  
Page 1 of 2



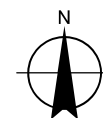
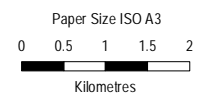








- Legend**
- Reveget locations
  - Major roads
  - Minor roads
  - Cadastral boundary
  - Pipeline Development Envelope Survey Area
- Vegetation Conditions**
- Excellent
  - Very Good
  - Cleared



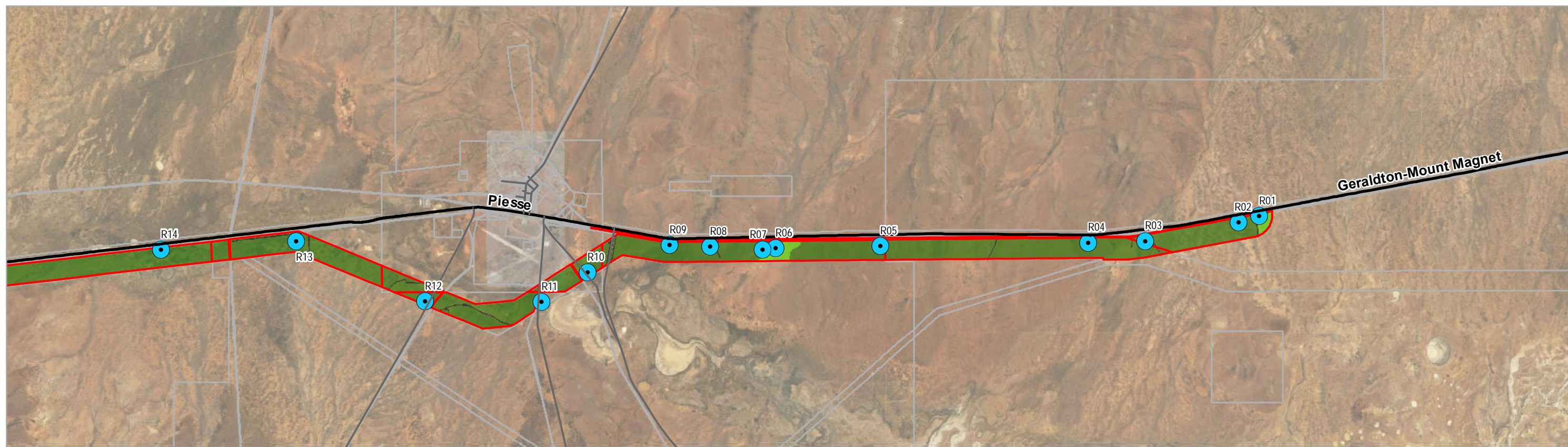
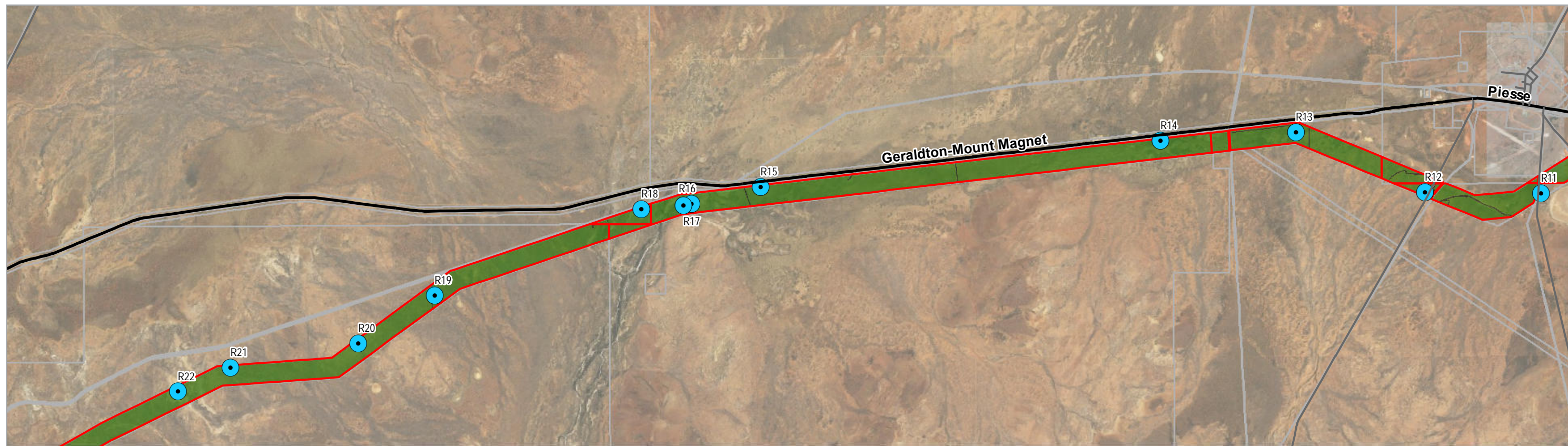
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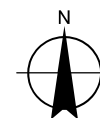
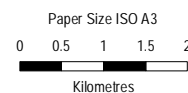
**Vegetation Condition in the Eastern Pipeline Development Envelope**

**FIGURE 5-6**  
Page 1 of 2





- Legend**
- Releve locations
  - Major roads
  - Minor roads
  - Cadastral boundary
  - Pipeline Development Envelope Survey Area
- Vegetation Conditions**
- Excellent
  - Very Good
  - Cleared



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**Vegetation Condition in the Eastern  
Pipeline Development Envelope**

**FIGURE 5-6  
Page 2 of 2**



**Legend**

**Fauna Conservation Status**

- Critically Endangered
- Endangered
- Vulnerable
- Presumed Extinct Species
- Migratory birds protected under an International Agreement
- Conservation Dependant
- Other specially protected fauna
- Priority 1
- Priority 2
- Priority 3
- Priority 4

- State Road
- Local Road
- Railways

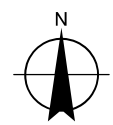
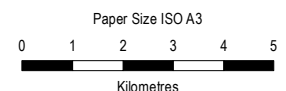
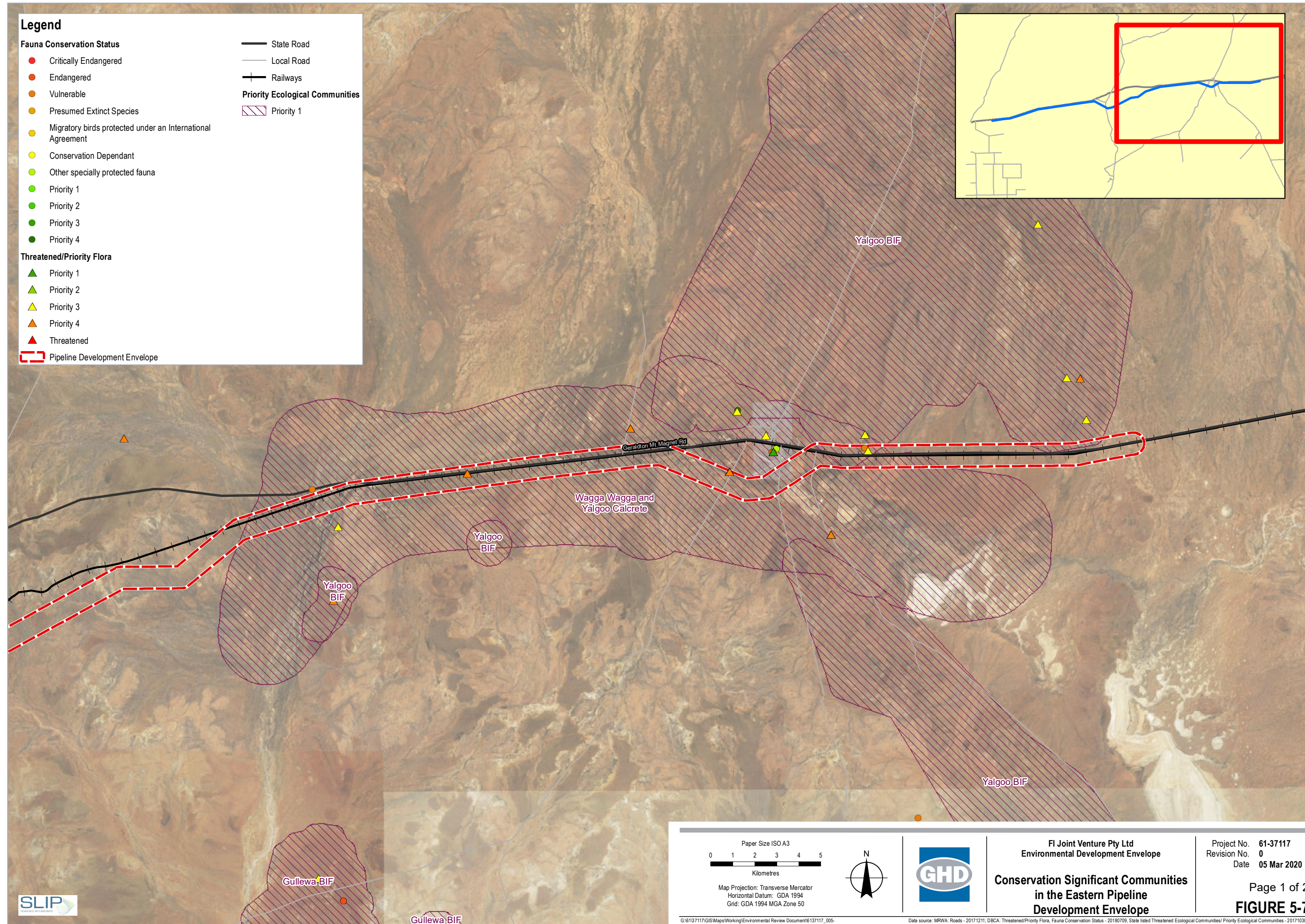
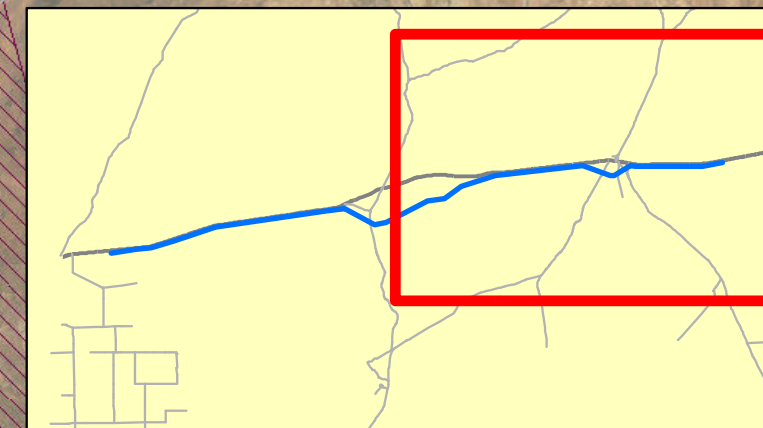
**Priority Ecological Communities**

- ▨ Priority 1

**Threatened/Priority Flora**

- ▲ Priority 1
- ▲ Priority 2
- ▲ Priority 3
- ▲ Priority 4
- ▲ Threatened

- ▭ Pipeline Development Envelope



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 Environmental Development Envelope  
**Conservation Significant Communities  
 in the Eastern Pipeline  
 Development Envelope**

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 Date 05 Mar 2020

Page 1 of 2  
**FIGURE 5-7**

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**Legend**

**Fauna Conservation Status**

- Critically Endangered
- Endangered
- Vulnerable
- Presumed Extinct Species
- Migratory birds protected under an International Agreement
- Conservation Dependant
- Other specially protected fauna
- Priority 1
- Priority 2
- Priority 3
- Priority 4

- State Road
- Local Road
- Railways

**DBCA Managed Lands and Waters**

- ▨ Nature Reserve

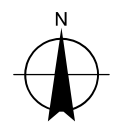
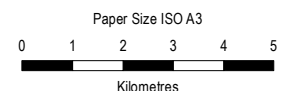
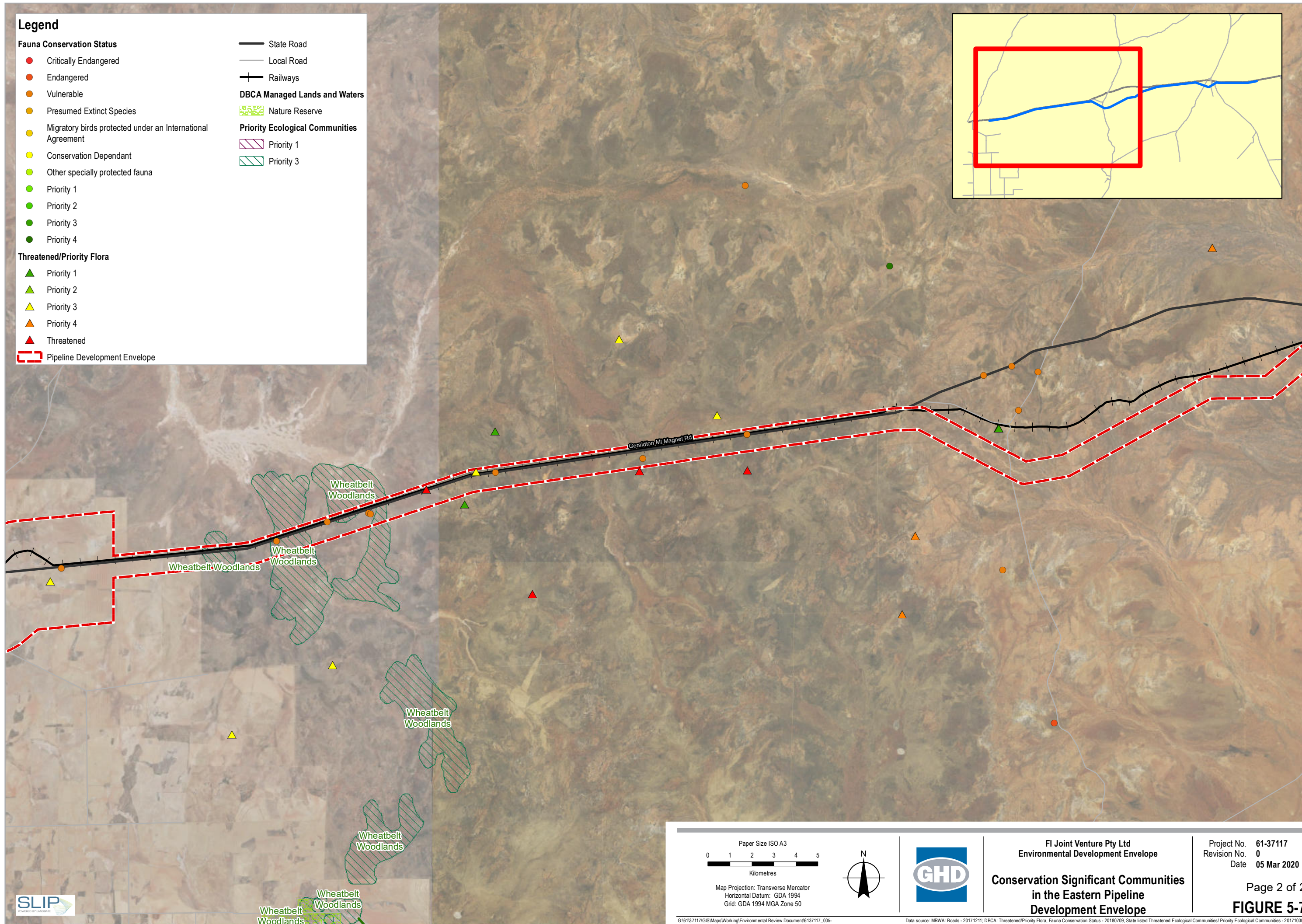
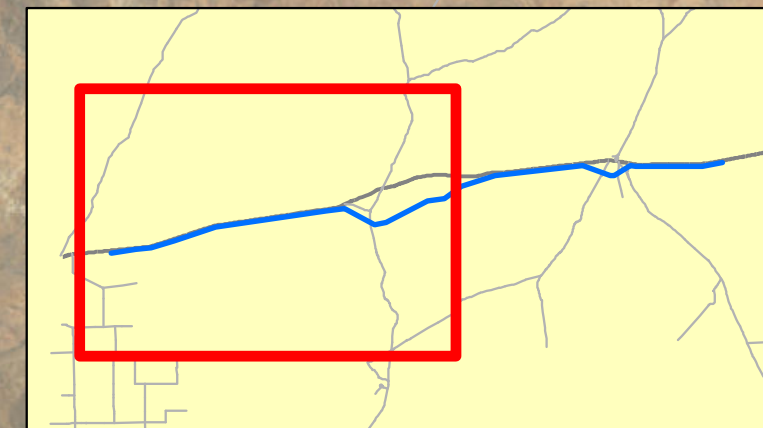
**Priority Ecological Communities**

- ▨ Priority 1
- ▨ Priority 3

**Threatened/Priority Flora**

- ▲ Priority 1
- ▲ Priority 2
- ▲ Priority 3
- ▲ Priority 4
- ▲ Threatened

- ▭ Pipeline Development Envelope



FI Joint Venture Pty Ltd  
 Environmental Development Envelope

**Conservation Significant Communities  
 in the Eastern Pipeline  
 Development Envelope**

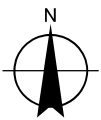
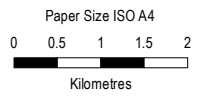
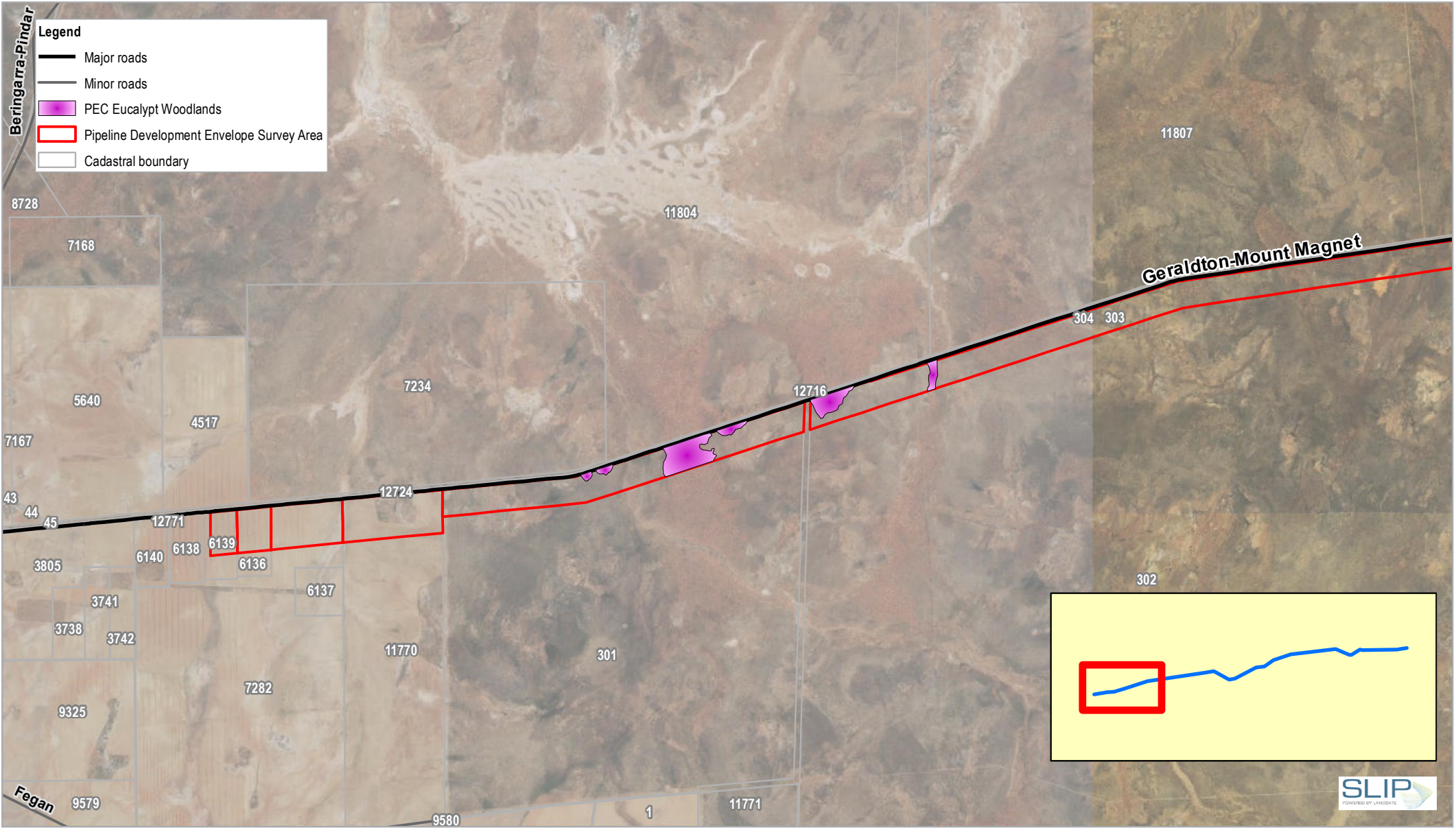
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Page 2 of 2  
**FIGURE 5-7**

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Data source: MRWA: Roads - 20171211; DBCA: Threatened/Priority Flora, Fauna Conservation Status - 20180709; State listed Threatened Ecological Communities/ Priority Ecological Communities - 20171030; DWER: Environmentally Sensitive Areas - 20151012; Landgate: Imagery - Accessed 20190318. Created by: cgyerzosa





Map Projection: Transverse Mercator  
 Horizontal Datum: GDA 1994  
 Grid: GDA 1994 MGA Zone 50

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**Eucalypt Woodlands of the  
 WA Wheatbelt PEC in the Eastern  
 Pipeline Development Envelope**

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**FIGURE 5-8**

### 5.4.3.2 Flora

#### Flora diversity

Ninety three flora taxa from 23 families and 43 genera were identified in the eastern portion of the PDE during the GHD field survey (2019b). The most commonly recorded families include Fabaceae, Chenopodiaceae, Amaranthaceae and Myrtaceae.

#### Conservation significant flora

Desktop searches of the EPBC Act PMST, *NatureMap*, DBCA TPFL and WAHERB databases identified the presence/potential presence of 33 conservation significant flora taxa within a 40 km buffer of the eastern portion of the PDE. Three DBCA Priority-listed flora species were recorded during the GHD field survey, *Philothea nutans* (Priority 1), *Dicrastylis linearifolia* (Priority 3) and *Acacia speckii* (Priority 4) (GHD 2019a). *Philothea nutans* was recorded in VT21 with 10 individuals identified, *Dicrastylis linearifolia* was recorded at VT15 with over 100 individuals identified and *Acacia speckii* was a dominant species in VT11, VT12 and VT13, occurring at <2% cover (GHD 2020c). Based on a conservative density of two plants per hectare, it is estimated 1,085 individuals occur within the PDE.

A likelihood of occurrence assessment was conducted for all conservation significant flora taxa identified in the desktop assessment. This assessment took into account previous records, habitat requirements, efficacy and intensity of the surveys, flowering times and the cryptic nature of species. Two of the flora species identified in the desktop searches were confirmed during the field survey; *Dicrastylis linearifolia* (P3) and *Acacia speckii* (P4). Both of these species have been previously recorded within the eastern portion of the PDE. In the eastern portion of the PDE, one species is considered likely to occur based on proximity of the records and suitable habitat. Two species were considered possible to occur due to close proximity of records and/or suitable habitat within the PDE. *Philothea nutans* (P1) was not identified in the desktop searches, however it was identified in the field and confirmed by the WA Herbarium. This represents a range extension for the species of approximately 150 km. A summary of the likelihood of occurrence assessment for the eastern portion of the PDE is provided in Table 5-11.

Table 5-11 Summary of conservation significant flora likelihood of occurrence assessment of eastern PDE (GHD 2020c)

Taxon	EPBC Act	BC Act/ DBCA	Likelihood
<i>Philothea nutans</i>		P1	Present
<i>Dicrastylis linearifolia</i>		P3	Present
<i>Acacia speckii</i>		P4	Present
<i>Chamelaucium</i> sp. Yalgoo (Y. Chadwich 1816)		P1	Likely
<i>Enekbatus dualis</i>		P1	Possible
<i>Eremophila viscida</i>	E	T	Possible
<i>Acacia lineolata</i> subsp. <i>multilineata</i>		P1	Unlikely
<i>Prostanthera pedicellata</i>		P1	Unlikely
<i>Stylidium pendulum</i>		P1	Unlikely
<i>Angianthus micropodioides</i>		P3	Unlikely
<i>Verticordia chrysostachys</i> var. <i>pallida</i>		P3	Unlikely
<i>Frankenia bracteata</i>		P1	Highly unlikely
<i>Grevillea rosieri</i>		P2	Highly unlikely
<i>Acacia subsessilis</i>		P3	Highly unlikely

Taxon	EPBC Act	BC Act/ DBCA	Likelihood
<i>Calotis</i> sp. Perrinvale Station (R.J. Cranfield 7096)		P3	Highly unlikely
<i>Cryptandra nola</i>		P3	Highly unlikely
<i>Darwinia</i> sp. Morawa (C.A. Gardner 2662)		P3	Highly unlikely
<i>Euryomyrtus recurva</i>		P3	Highly unlikely
<i>Gnephosis cassiniana</i>		P3	Highly unlikely
<i>Grevillea granulosa</i>		P3	Highly unlikely
<i>Gunniopsis divisa</i>		P3	Highly unlikely
<i>Persoonia pentasticha</i>		P3	Highly unlikely
<i>Petrophile pauciflora</i>		P3	Highly unlikely
<i>Rhodanthe collina</i>		P3	Highly unlikely
<i>Roebuckiella halophila</i>		P3	Highly unlikely
<i>Tecticornia fimbriata</i>		P3	Highly unlikely
<i>Triglochin protuberans</i>		P3	Highly unlikely
<i>Dodonaea amplisemina</i>		P4	Highly unlikely
<i>Frankenia confusa</i>		P4	Highly unlikely
<i>Goodenia berringbinensis</i>		P4	Highly unlikely
<i>Goodenia neogoodenia</i>		P4	Highly unlikely
<i>Verticordia penicillaris</i>		P4	Highly unlikely
<i>Eucalyptus synandra</i>		T	Highly unlikely
<i>Ricinocarpos brevis</i>	E	T	Highly unlikely

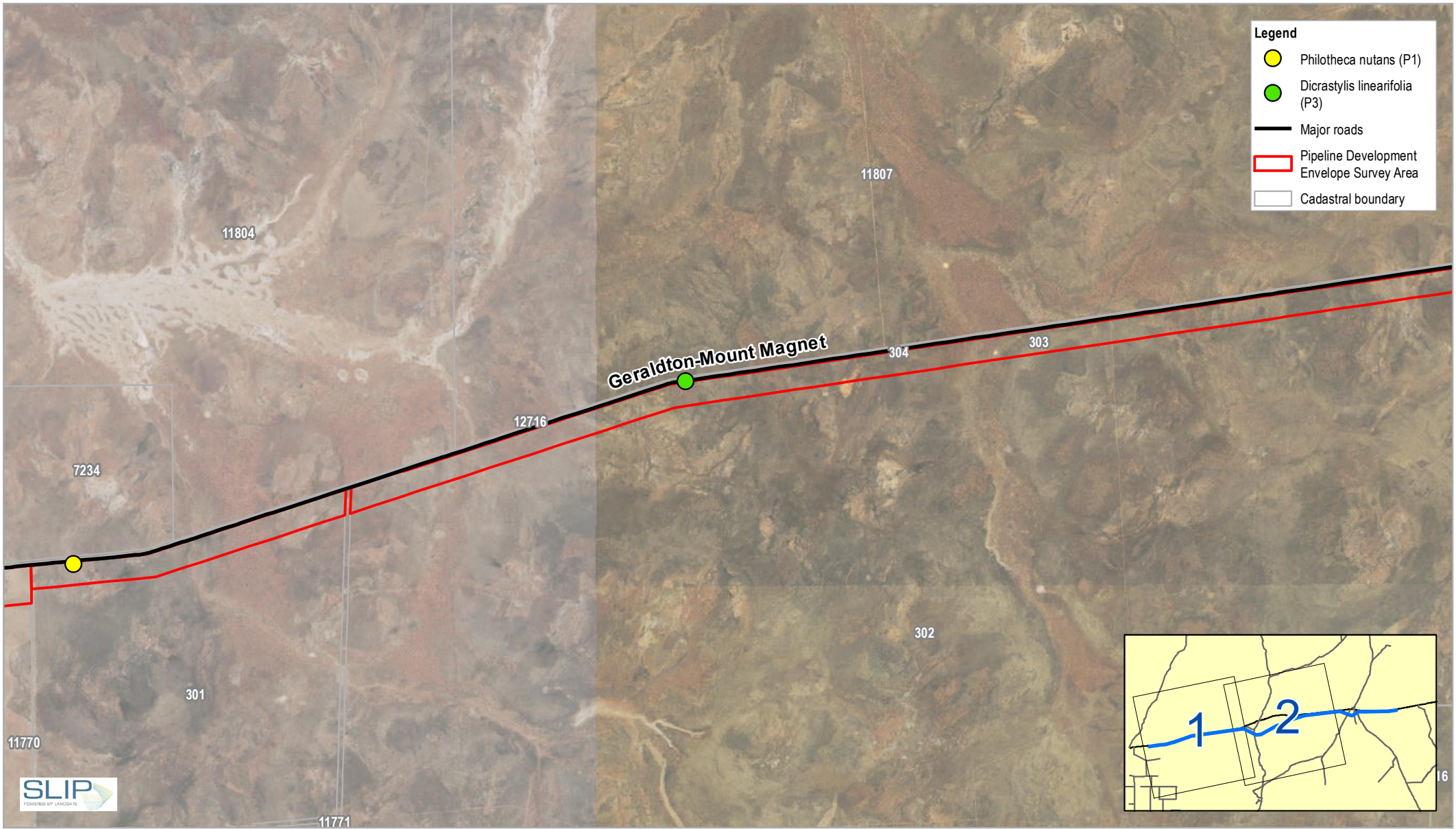
A similar search of the EPBC Act PMST, *NatureMap*, DBCA TPFL and WAHERB databases for the western portion of the PDE identified the presence/potential presence of 193 conservation significant flora species within a 40 km buffer of the western portion of the PDE. A likelihood of occurrence assessment conducted for all conservation significant flora taxa identified, is shown in Appendix D of the western pipeline desktop assessment (GHD 2020a, Appendix B of this document). A summary of the likely species is provided in Table 5-12.

	EPBC Act	BC Act/ DBCA
<i>Angianthus micropodioides</i>		P3
<i>Gnephosis cassiniana</i>		P3
<i>Roebuckiella halophila</i>		P3
<i>Vittadinia cervicalis</i> var. <i>occidentalis</i>		P1
<i>Psammomoya implexa</i>		P3
<i>Wurmbea tubulosa</i>	E	T
<i>Calectasia browneana</i>		P2
<i>Leucopogon marginatus</i>	E	T

	EPBC Act	BC Act/ DBCA
<i>Leucopogon nitidus</i>	E	T
<i>Beyeria cinerea</i> subsp. <i>cinerea</i>		P3
<i>Acacia ampliata</i>		P1
<i>Acacia lanceolata</i>		P3
<i>Acacia leptospermoides</i> subsp. <i>psammophila</i>		P3
<i>Acacia lineolata</i> subsp. <i>multilineata</i>		P1
<i>Acacia megacephala</i>		P3
<i>Chorizema humile</i>	E	T
<i>Gastrolobium propinquum</i>		P3
<i>Jacksonia velutina</i>		P4
<i>Dampiera krauseana</i>		P3
<i>Scaevola globosa</i>		P3
<i>Dicrastylis incana</i>		P2
<i>Hemigenia pimelifolia</i>		P2
<i>Hemigenia saligna</i>		P3
<i>Prostanthera pedicellata</i>		P1
<i>Baeckea</i> sp. <i>Walkaway</i> (A.S. George 11249)		P3
<i>Baeckea staminosa</i>		P1
<i>Calytrix formosa</i>		P3
<i>Calytrix purpurea</i>		P2
<i>Darwinia</i> sp. <i>Morawa</i> (C.A. Gardner 2662)		P3
<i>Enekbatus dualis</i>		P1
<i>Eremaea acutifolia</i>		P3
<i>Eucalyptus beardiana</i>	V	T
<i>Eucalyptus ebbanoensis</i> subsp. <i>photina</i>		P4
<i>Homalocalyx inerrabundus</i>		P2
<i>Leptospermum exsertum</i>		P1
<i>Malleostemon nephroideus</i>		P3
<i>Malleostemon pentagonus</i>		P3
<i>Melaleuca barlowii</i>		P3
<i>Scholtzia inaequalis</i>		P2
<i>Scholtzia longipedata</i> subsp. <i>Procera</i>		P3
<i>Scholtzia</i> sp. <i>Geraldton</i> (F. Lullfitz L 3216)		P3
<i>Thryptomene hubbardii</i>		P3
<i>Thryptomene orbiculata</i>		P3
<i>Thryptomene</i> sp. <i>Wandana</i> (M.E. Trudgen MET 22016)		P3
<i>Thryptomene stapfii</i>		P3
<i>Thryptomene stenophylla</i>		P2

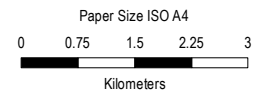


	EPBC Act	BC Act/ DBCA
<i>Thryptomene velutina</i>		P2
<i>Verticordia albida</i>	E	T
<i>Verticordia capillaris</i>		P4
<i>Verticordia chrysostachys</i> var. <i>pallida</i>		P3
<i>Verticordia densiflora</i> var. <i>roseostella</i>		P3
<i>Verticordia fragrans</i>		P3
<i>Verticordia luteola</i> var. <i>luteola</i>		P3
<i>Verticordia muelleriana</i> subsp. <i>Minor</i>		P2
<i>Verticordia penicillaris</i>		P4
<i>Verticordia polytricha</i>		P4
<i>Caladenia elegans</i>	E	T
<i>Caladenia pluvialis</i>		P2
<i>Caladenia wanosa</i>	V	T
<i>Drakaea concolor</i>	V	T
<i>Pterostylis macrocalymma</i>		P1
<i>Lachnagrostis drummondiana</i>		P1
<i>Comesperma rhadinocarpum</i>		P3
<i>Banksia benthamiana</i>		P4
<i>Banksia elegans</i>		P4
<i>Grevillea bracteosa</i> subsp. <i>howatharra</i>	CE	T
<i>Grevillea candicans</i>		P3
<i>Grevillea erinacea</i>		P3
<i>Grevillea granulosa</i>		P3
<i>Grevillea phanerophlebia</i>		T
<i>Grevillea tenuiloba</i>		P3
<i>Grevillea triloba</i>		P3
<i>Persoonia pentasticha</i>		P3
<i>Petrophile pilostyla</i> subsp. <i>syntoma</i>		P2
<i>Desmocladius ferruginipes</i>		P1
<i>Lepidobolus basiflorus</i>		P2
<i>Lepidobolus eurardyensis</i>		P1
<i>Blackallia nudiflora</i>		P3
<i>Cryptandra nola</i>		P3
<i>Stenanthemum bilobum</i>		P1
<i>Anthotroche myoporoides</i>		P3
<i>Stylidium pendulum</i>		P1

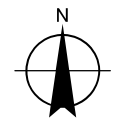


**Legend**

- Philothea nutans (P1)
- Dicrastylis linearifolia (P3)
- Major roads
- Pipeline Development Envelope Survey Area
- Cadastral boundary



Map Projection: Transverse Mercator  
 Horizontal Datum: GDA 1994  
 Grid: GDA 1994 MGA Zone 50



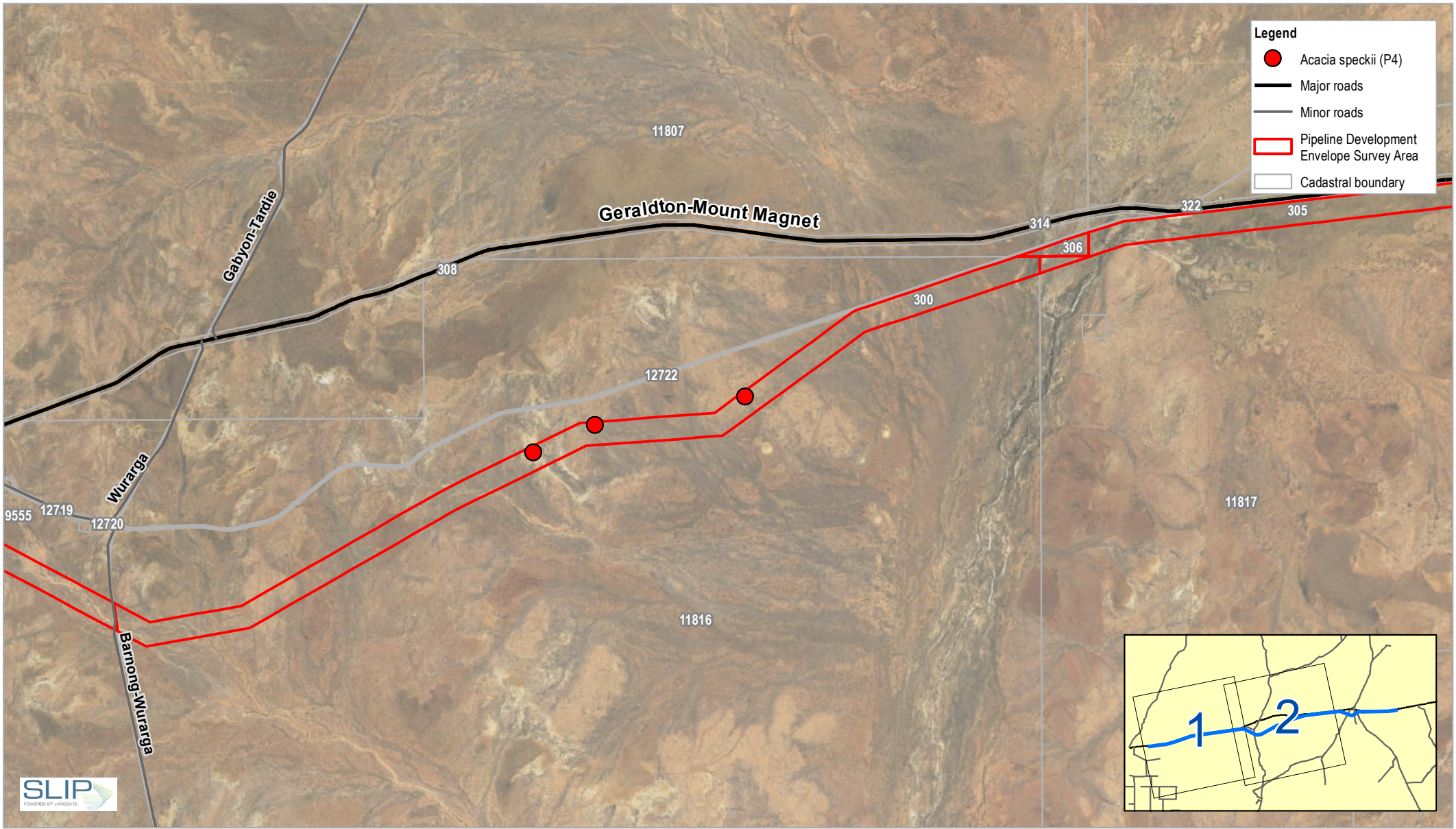
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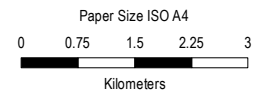
**FIGURE 5-9**  
 Page 1 of 2



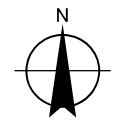


**Legend**

- Acacia speckii (P4)
- Major roads
- Minor roads
- Pipeline Development Envelope Survey Area
- Cadastral boundary



Map Projection: Transverse Mercator  
 Horizontal Datum: GDA 1994  
 Grid: GDA 1994 MGA Zone 50



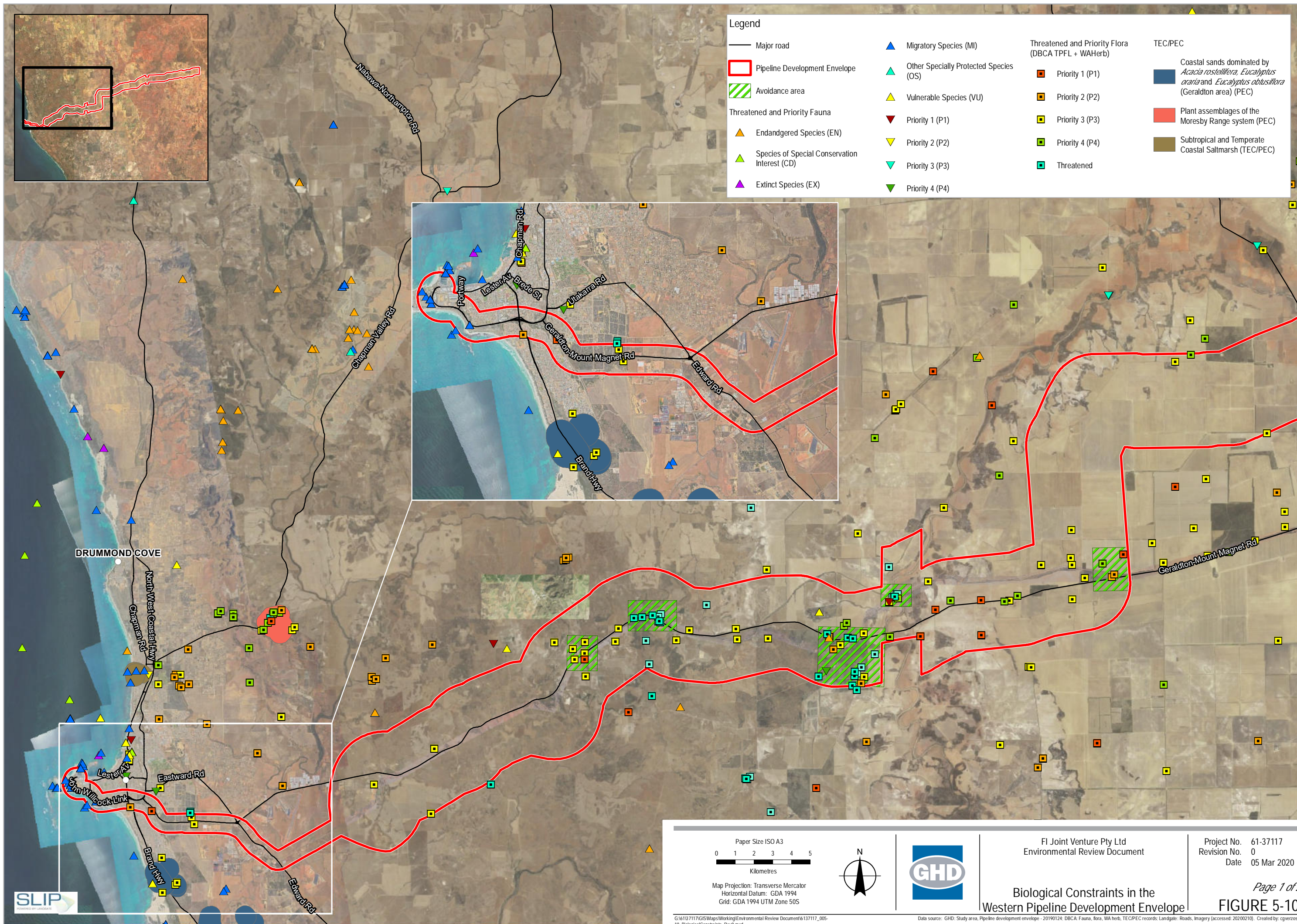
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**FIGURE 5-9**  
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**Legend**

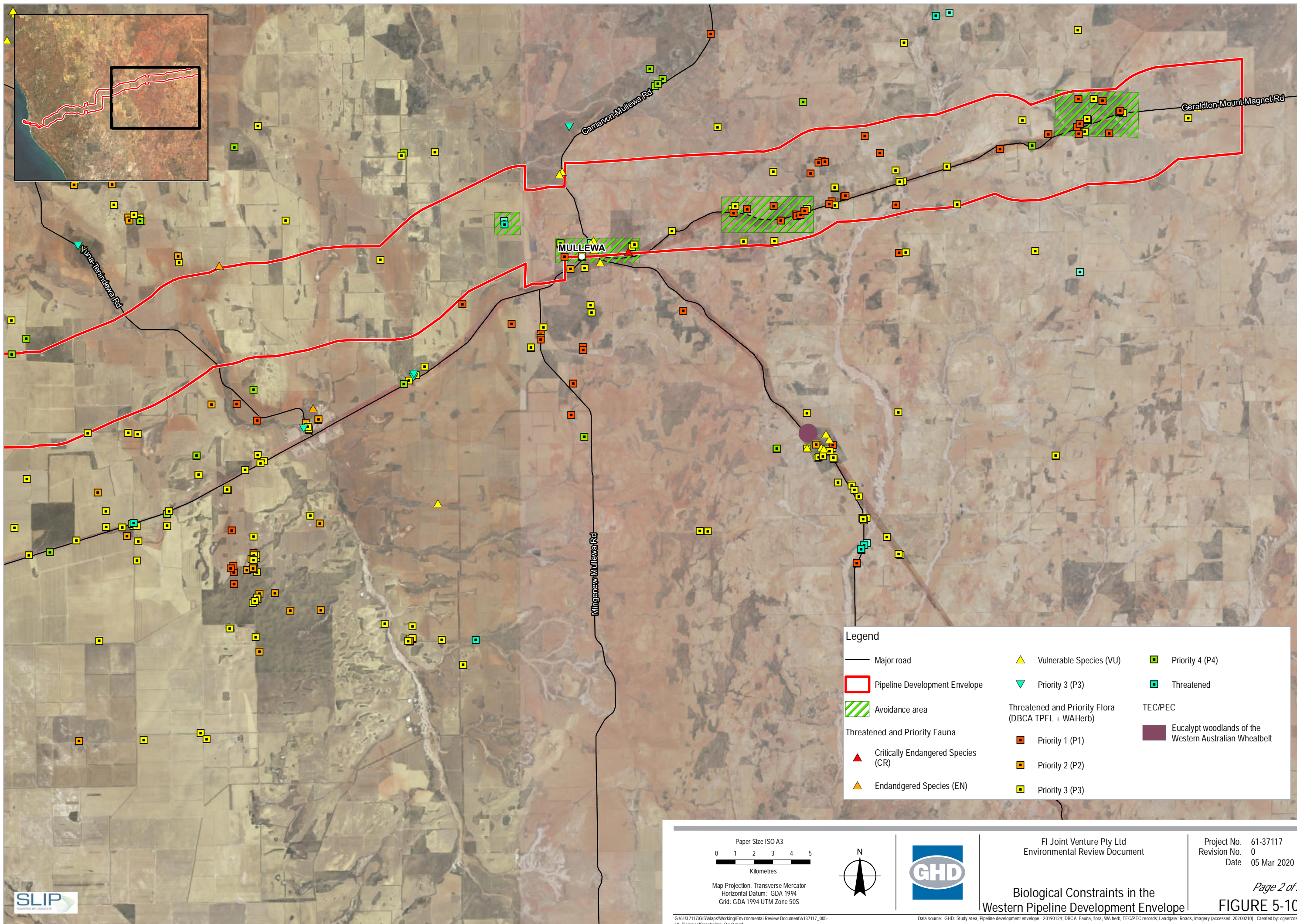
— Major road	▲ Migratory Species (MI)	Threatened and Priority Flora (DBCA TPFL + WAHerb)	TEC/PEC
▭ Pipeline Development Envelope	▲ Other Specially Protected Species (OS)	■ Priority 1 (P1)	■ Coastal sands dominated by <i>Acacia rostellifera</i> , <i>Eucalyptus orariorand</i> and <i>Eucalyptus obtusiflora</i> (Geraldton area) (PEC)
▨ Avoidance area	▲ Vulnerable Species (VU)	■ Priority 2 (P2)	■ Plant assemblages of the Moresby Range system (PEC)
<b>Threatened and Priority Fauna</b>		■ Priority 3 (P3)	■ Subtropical and Temperate Coastal Saltmarsh (TEC/PEC)
▲ Endangered Species (EN)	▼ Priority 1 (P1)	■ Priority 4 (P4)	
▲ Species of Special Conservation Interest (CD)	▼ Priority 2 (P2)	■ Threatened	
▲ Extinct Species (EX)	▼ Priority 3 (P3)		
	▼ Priority 4 (P4)		

<p>Paper Size ISO A3</p> <p>0 1 2 3 4 5</p> <p>Kilometres</p> <p>Map Projection: Transverse Mercator Horizontal Datum: GDA 1994 Grid: GDA 1994 UTM Zone 50S</p>			<p>FI Joint Venture Pty Ltd Environmental Review Document</p> <p>Project No. 61-37117 Revision No. 0 Date 05 Mar 2020</p> <p>Biological Constraints in the Western Pipeline Development Envelope</p>	<p>Page 1 of 2</p> <p><b>FIGURE 5-10</b></p>
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Print date: 05 Mar 2020 - 10:00  
Data source: GHD: Study area, Pipeline development envelope - 20190124; DBCA: Fauna, flora, WA herb, TEC/PEC records; Landgate: Roads, Imagery (accessed: 20200210). Created by: cgrwzosa

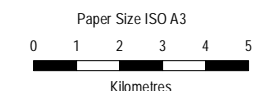




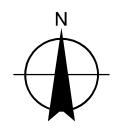


**Legend**

— Major road	▲ Vulnerable Species (VU)	■ Priority 4 (P4)
▭ Pipeline Development Envelope	▼ Priority 3 (P3)	■ Threatened
▨ Avoidance area	Threatened and Priority Flora (DBCA TPFL + WAHerb)	
Threatened and Priority Fauna		
▲ Critically Endangered Species (CR)	■ Priority 1 (P1)	■ TEC/PEC
▲ Endangered Species (EN)	■ Priority 2 (P2)	■ Eucalypt woodlands of the Western Australian Wheatbelt
	■ Priority 3 (P3)	



Map Projection: Transverse Mercator  
 Horizontal Datum: GDA 1994  
 Grid: GDA 1994 UTM Zone 50S



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Biological Constraints in the  
 Western Pipeline Development Envelope

Page 2 of 2  
**FIGURE 5-10**



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 Data source: GHD; Study area, Pipeline development envelope - 20190124; DBCA: Fauna, flora, WA herb, TEC/PEC records; Landgate: Roads, Imagery (accessed: 20200210). Created by: cgrwzosa



## Introduced flora

No Declared Pest plants (as listed under the BAM Act) or Weeds of National Significance were recorded during the survey. One environmental weeds, \**Mesembryanthemum nodiflorum* (Slender Iceplant) was recorded growing near a track south of Yalgoo town site.

## 5.5 Potential impacts

Potential direct and indirect impacts to flora and vegetation include the following:

- Direct:
  - Loss of flora and vegetation through clearing, including conservation significant vegetation and flora (Section 5.6.1)
- Indirect:
  - Dust generation during construction and operations (Section 5.6.2)
  - Introduction and spread of environmental weeds (Section 5.6.3)
  - Increased edge effect (Section 5.6.4)
  - Habitat loss and fragmentation from vegetation clearing (Section 5.6.5)
  - Alteration of fire regimes (Section 5.6.6)
  - Decline of species abundance and diversity (Section 5.6.7)
  - Alteration to surface and groundwater flows and quality (Section 5.6.8).

## 5.6 Assessment of impacts

### 5.6.1 Loss of flora and vegetation

#### Vegetation

The Proposal requires the clearing of up to 1,730 ha, which is made up of 1,530 ha of native vegetation within the MDE for the construction and operation of the Yogi Mine and up to 200 ha of native vegetation within the PDE for the construction of a pipeline corridor for a slurry pipeline, water pipeline and gas pipeline. The vegetation clearing will reduce the local and regional extent of vegetation types PECs and DBCA Priority-listed flora. The impact of vegetation clearing has been assessed using the vegetation types mapped within the MDE and PDE, and at local and regional scales using vegetation association mapping by Beard (1976).

Within the MDE eight of the nine vegetation types described will be directly affected from vegetation clearing. As shown in Table 5-13, none of the vegetation types will be reduced to less than 60% of their mapped occurrences, with the proposed clearing limited to less than 40% of each vegetation type recorded within the MDE. The proposed clearing within the PDE will directly impact 19 of the 21 vegetation types mapped within the eastern portion. As shown in Table 5-13, the proposed clearing will be limited to less than 6% of each vegetation type recorded within the PDE with no vegetation types reduced to less than 94% of their mapped occurrences. As identified in the *Western Pipeline Flora and Fauna Desktop Assessment* (GHD 2020) (Appendix B), there will be no clearing of vegetation within the identified 'avoidance areas' in the western portion of the PDE.

Of the proposed clearing within both the MDE and PDE, greater than 91% of the vegetation is in Excellent condition.

Table 5-13 Impacts to vegetation types within the MDE and PDE

Vegetation type	Extent within the MDE (ha)	Extent within the eastern portion of the PDE (ha)	Indicative clearing area (ha)	% remaining
ArrTdHc*	65.72	-	25.73	60.85
AtEgCd*	833.66	-	252.12	69.76
AEgRc*	141.70	-	34.12	75.92
APoEc	5,587.38	-	964.74	82.73
Mosaic: APoEc and AeFsEd	93.48	-	0	100
AeFsEd	391.26	-	3.79	99.03
AtSePd	99.77	-	25.01	74.93
AbCaPd	157.48	-	9.05	94.26
AuEeBs	824.44	-	198.93	75.87
AiMsSa	1.04	-	0	100
VT01	-	688.06	20.34	97.04
VT02	-	36.49	0.58	98.41
VT03	-	51.46	1.60	96.89
VT04	-	178.11	4.80	97.31
VT05	-	3.06	0.00	100.00
VT06	-	79.21	0.71	99.10
VT07	-	163.72	8.23	94.97
VT08	-	652.95	30.32	95.36
VT09	-	104.68	4.01	96.17
VT10	-	57.32	2.44	95.74
VT11	-	83.95	1.85	97.80
VT12	-	374.16	19.53	94.78
VT13	-	84.76	3.24	96.18
VT14	-	1,000.61	45.84	95.42
VT15	-	327.44	14.93	95.44
VT16	-	47.72	1.80	96.23
VT17	-	277.35	12.40	95.53
VT18	-	1.36	0	100.00
VT19	-	58.36	2.33	96.01
VT20	-	33.12	1.41	95.74
VT21	-	34.28	1.30	96.21
<b>Subtotal</b>			<b>1691.15</b>	
Cleared	33.57	316.07	12.71	-
Gravel Pit	-	0.65	0	-

\* Represents the Yalgoo vegetation complexes (banded ironstone formation) PEC

The proposal is not expected to significantly impact upon mapped vegetation associations at either local or regional scales. The proposed clearing within the MDE will be primarily located within vegetation association 420, and the proposed clearing within the PDE will be primarily located within vegetation associations 361, 419, 420 and 683. As show in Table 5-14, there is less than 0.27% of the current extents of all vegetation associations mapped within the indicative clearing area at a local scale (Shire of Yalgoo//City of Greater Geraldton) and less than 0.24% of the current extents of all vegetation associations mapped within indicative clearing area at a regional scale (Yalgoo/Avon Wheatbelt IBRA regions). The proposal is not expected to significantly reduce the extents of the vegetation associations at the local or regional scale. Within the MDE, should the maximum amount of the indicative clearing area be cleared none of the vegetation associations would be reduced to less than 99 % of their pre-

European extents at the local scale or less than 96 % of their pre-European extents at the regional scale. Within the PDE, two vegetation associations (125 and 676) have less than 30% of their pre-European extents remaining at the IBRA region, IBRA sub-region and/or LGA scales; proposed clearing within these associations has been minimised and reduced to 0 ha and 8.99 ha respectively. With the exception of vegetation associations 125 and 676, should the maximum amount of the indicative clearing area be cleared within the PDE, all of the vegetation associations would remain above 30% of their pre-European extents at both local and regional scales.

Three vegetation types mapped within the MDE are considered to represent the Yalgoo vegetation complexes PEC (vegetation types ArrTdHc, AtEgCd and AEgRc) (GHD 2019b). As shown in Table 5-13, there is 1,041.08 ha of this PEC within the MDE. The Proposal is expected to directly impact approximately 30% (312 ha) of the Yalgoo vegetation complexes PEC mapped within the MDE through vegetation clearing. DBCA data indicates the Yalgoo vegetation complexes PEC is restricted to the Yalgoo area, extending west and south of the MDE. Four separate occurrences of the PEC have been mapped covering approximately 38,000 ha. Based on this mapping approximately 2.74% of the known PEC extent intersects the MDE, with less than 1% expected to be directly impacted by the Proposal.

The Eucalypt Woodlands of the WA Wheatbelt PEC was recorded from six separate patches covering approximately 70 ha within the eastern portion of the PDE. The Proposal is expected to directly impact approximately 3.63% (2.54 ha) of this PEC through vegetation clearing for the construction of a pipeline corridor. The total area of eucalypt woodland (PEC) within the nominated Wheatbelt region is calculated to be 970,817 ha (DEC 2011). There is approximately 0.007% of this community mapped within the PDE with less than 0.001% within the indicative clearing area. Proposal impacts to this PEC are not considered significant.



Table 5-14 Impacts to vegetation associations mapped within the MDE, PDE (eastern portion) and indicative clearing area

VA	Scale	Pre-European extent (ha)	Current extent (ha)	% remaining	Extent within MDE (ha) (%)	Extent within PDE (eastern portion) (ha) (%)	Indicative clearing area (MDE and PDE) (ha) (%)	Current extent remaining after project clearing (ha) (%)
18	State: WA	19,892,306.46	19,843,148.07	99.75	2,321.74 (0.01%)	366.44 (<0.01%)	102.65 (<0.01%)	19,843,045.42 (99.75%)
	IBRA bioregion: YAL	101,331.17	101,232.93	99.90	2,321.74 (2.29%)	366.44 (0.36%)	102.65 (0.10%)	101,130.28 (99.80%)
	IBRA sub-region: YAL02	101,278.46	101,180.22	99.90	2,321.74 (2.29%)	366.44 (0.36%)	102.65 (<0.01%)	101,077.57 (99.80%)
	LGA: Shire of Yalgoo	548,671.48	548,555.14	99.98	2,321.74 (0.42%)	366.44 (0.07%)	102.65 (<0.01%)	548,452.49 (99.96%)
125	State: WA	3,485,785.49	3,146,487.22	90.27	-	33.93 (<0.01%)	0	3,146,487.22 (90.27%)
	IBRA bioregion: YAL	106,869.97	42,029.08	39.33	-	33.93 (0.08%)	0	42,029.08 (39.33%)
	IBRA sub-region: YAL02	106,869.97	42,029.08	39.33	-	33.93 (0.08%)	0	42,029.08 (39.33%)
	LGA: Shire of Yalgoo	77,136.66	21,603.94	<b>28.01</b>	-	33.93 (0.16%)	0	21,603.94 ( <b>28.01</b> %)
202	State: WA	448,529.31	448,343.80	99.96	-	67.38 (0.02%)	0	448,343.80 (99.96%)
	IBRA bioregion: YAL	45,096.14	45,011.91	99.81	-	67.38 (0.15%)	0	45,011.91 (99.81%)
	IBRA sub-region: YAL02	45,096.14	45,011.91	99.81	-	67.38 (0.15%)	0	45,011.91 (99.81%)
	LGA: Shire of Yalgoo	52,004.53	51,900.75	99.80	-	67.38 (0.13%)	0	51,900.75 (99.80%)
243	State: WA	148,432.56	148,426.20	100	-	215.59 (0.15%)	3.90 (<0.01%)	148,422.30 (99.99%)
	IBRA bioregion: YAL	40,588.09	40,581.74	99.98	-	215.59 (0.53%)	3.90 (0.01%)	40,577.84 (99.97%)
	IBRA sub-region: YAL02	40,177.72	40,171.36	99.98	-	215.59 (0.54%)	3.90 (0.01%)	40,167.46 (99.97%)
	LGA: Shire of Yalgoo	40,065.26	40,058.91	99.98	-	215.59 (0.54%)	3.90 (0.01%)	40,055.01 (99.97%)
361	State: WA	87,511.09	87,484.57	99.97	-	1,538.05 (1.76%)	29.7 (0.03%)	87,454.87 (99.94%)
	IBRA bioregion: YAL	76,479.74	76,453.22	99.97	-	1,538.05 (2.01%)	29.7 (0.04%)	76,423.52 (99.93%)
	IBRA sub-region: YAL02	76,456.96	76,430.44	99.97	-	1,538.05 (2.01%)	29.7 (0.04%)	76,400.74 (99.93%)
	LGA: Shire of Yalgoo	77,518.54	77,492.03	99.97	-	1,538.05 (1.98%)	29.7 (0.04%)	77,462.33 (99.93%)
364	State: WA	510,984.96	506,124.99	99.05	-	430.13 (0.08%)	9.92 (<0.01%)	506,115.07 (99.05%)
	IBRA bioregion: YAL	509,047.32	504,231.91	99.05	-	430.13 (0.09%)	9.92 (<0.01%)	504,221.99 (99.05%)
	IBRA sub-region: YAL02	122,194.01	119,461.81	97.76	-	430.13 (0.36%)	9.92 (<0.01%)	119,451.89 (97.76%)
	LGA: Greater Geraldton	20,148.16	19,866.51	98.60	-	430.13 (2.17%)	9.92 (0.05%)	19,856.59 (98.55%)
404	State: WA	206,553.92	198,504.92	96.10	-	79.64 (0.04%)	2.16 (<0.01%)	198,502.76 (96.10%)
	IBRA bioregion: YAL	151,772.33	143,906.80	94.82	-	79.64 (0.06%)	2.16 (<0.01%)	143,904.64 (94.82%)
	IBRA sub-region: YAL02	136,683.55	132,835.10	97.18	-	79.64 (0.06%)	2.16 (<0.01%)	132,832.94 (97.18%)
	LGA: Shire of Yalgoo	59,928.02	59,928.02	100.00	-	79.64 (0.13%)	2.16 (<0.01%)	59,925.86 (100.00%)
419	State: WA	313,225.36	296,195.62	94.56	-	2,304.54 (0.78%)	45.15 (0.02%)	296,150.47 (94.55%)
	IBRA bioregion: YAL	302,707.71	289,825.55	95.74	-	1,958.47 (0.68%)	37.87 (0.01%)	289,787.68 (95.73%)
	IBRA bioregion: AVW	10,517.64	6,370.07	60.57	-	346.07 (5.43%)	7.27 (0.11%)	6,362.80 (60.50%)
	IBRA sub-region: YAL02	302,707.72	289,825.56	95.74	-	1,958.47 (0.68%)	37.87 (0.01%)	289,787.69 (95.73%)

VA	Scale	Pre-European extent (ha)	Current extent (ha)	% remaining	Extent within MDE (ha) (%)	Extent within PDE (eastern portion) (ha) (%)	Indicative clearing area (MDE and PDE) (ha) (%)	Current extent remaining after project clearing (ha) (%)
	IBRA sub-region: AVW01	10,517.64	6,370.07	60.57	-	346.07 (5.43%)	7.27 (0.11%)	6,362.80 (60.50%)
	LGA: Shire of Yalgoo	90,566.53	89,276.96	98.58	-	107.34 (0.12%)	2.16 (<0.01%)	89,274.80 (98.57%)
	LGA: Greater Geraldton	94,775.26	91,002.31	96.02	-	2,197.2 (2.41%)	42.98 (0.05%)	90,959.33 (95.97%)
420	State: WA	859,632.29	830,216.29	96.58	5,908.35 (0.71%)	2,124.98 (0.26%)	1,460.09 (0.18%)	828,756.20 (96.41%)
	IBRA bioregion: YAL	621,396.05	620,265.57	99.82	5,908.35 (0.95%)	1,958.66 (0.32%)	1,456.19 (0.23%)	618,809.38 (99.58%)
	IBRA bioregion: AVW	44,968.05	17,161.76	38.16		166.33 (0.97%)	3.89 (0.02%)	17,157.87 (38.16%)
	IBRA sub-region: YAL02	615,816.17	614,685.69	99.82	5,908.35 (0.96%)	1,958.66 (0.32%)	1,456.19 (0.24%)	613,229.50 (99.58%)
	IBRA sub-region: AVW01	44,968.05	17,161.76	38.16		166.33 (0.97%)	3.89 (0.02%)	17,157.87 (38.16%)
	LGA: Shire of Yalgoo	549,363.25	548,343.31	99.81	5,908.35 (1.08%)	1,958.66 (0.36%)	1,456.19 (0.27%)	546,887.12 (99.55%)
	LGA: Greater Geraldton	43,129.59	22,990.59	53.31		166.33 (0.72%)	3.89 (0.02%)	22,986.70 (53.30%)
676	State: WA	2,063,413.95	1,963,881.55	95.18		513.46 (0.03%)	8.99 (<0.01%)	1,963,872.56 (95.18%)
	IBRA bioregion: AVW	124,573.10	30,418.61	<b>24.42</b>		513.46 (1.69%)	8.99 (0.03%)	30,409.62 ( <b>24.41%</b> )
	IBRA sub-region: AVW01	124,377.02	30,380.38	<b>24.43</b>		513.46 (1.69%)	8.99 (0.03%)	30,371.39 ( <b>24.42%</b> )
	LGA: Greater Geraldton	101,326.01	21,122.27	<b>20.85</b>		513.46 (2.43%)	8.99 (0.04%)	21,113.28 ( <b>20.84%</b> )
683	State: WA	50,318.87	49,976.10	99.32		2,125.55 (4.25%)	46.34 (0.09%)	49,929.76 (99.23%)
	IBRA bioregion: YAL	50,075.10	49,732.32	99.32		2,125.55 (4.27%)	46.34 (0.09%)	49,685.98 (99.22%)
	IBRA sub-region: YAL02	50,075.10	49,732.32	99.32		2,125.55 (4.27%)	46.34 (0.09%)	49,685.98 (99.22%)
	LGA: Shire of Yalgoo	46,866.17	46,852.33	99.97		2,125.55 (4.57%)	46.34 (0.10%)	46,805.99 (99.87%)
686	State: WA	13,135.07	8,436.97	64.23		233.21 (2.76%)	5.02 (0.06%)	8,431.95 (64.19%)
	IBRA bioregion: YAL	4,334.78	4,280.12	98.74		7.97 (0.19%)	0.15 (<0.01%)	4,279.97 (98.74%)
	IBRA bioregion: AVW	8,800.29	4,156.84	47.24		225.25 (5.42%)	4.86 (0.12%)	4,151.98 (47.18%)
	IBRA sub-region: YAL02	4,334.78	4,280.12	98.74		7.97 (0.19%)	0.15 (<0.01%)	4,279.97 (98.74%)
	IBRA sub-region: AVW01	8,800.29	4,156.84	47.24		225.25 (5.42%)	4.86 (0.12%)	4,151.98 (47.18%)
	LGA: Greater Geraldton	7,475.62	4,567.52	61.10		233.21 (5.11%)	5.02 (0.11%)	4,562.50 (61.03%)

Bold values indicate where the current extents of vegetation associations are below 30% of their pre-European extents.



## Flora

Five DBCA Priority listed flora species have the potential to be directly affected by the Proposal. As shown in Table 5-15, the impact to Priority flora species within the MDE and eastern portion of the PDE as a result of the Proposal is not expected to be significant. Of the three Priority flora species recorded within the MDE, two Priority species (*Acacia subsessilis* and *A. speckii*) occur within the indicative clearing area. Similarly, of the three Priority flora species recorded within the PDE, two Priority species (*Dicrastylis linearifolia* and *A. speckii*) occur within the indicative clearing area. Known individuals of *Philotheca nutans* and *Dodonaea amplisemina* will be avoided and no impacts are anticipated from the Proposal.

The expected loss through vegetation clearing within the indicative clearing area is less than 14% for *A. speckii*, 6% for *D. lineariflora* and 2% for *A. subsessilis* based on the conservative estimates of total individuals across WA (Table 5-15). *Acacia speckii* (P4) has been recorded both within the MDE and PDE. As noted in Section 5.4.2, field observations indicate *A. speckii* (and *A. subsessilis*) extend beyond and occur outside of the MDE, with *A. speckii* recorded in large numbers on neighbouring BIF rises (GHD 2019b, Maia 2011). The GHD survey of the eastern portion of PDE indicates that *A. speckii* occurred in VT11, VT12 and VT13 (GHD 2020c). It is likely *A. speckii* occurs at similar densities beyond PDE, with additional individuals not captured in this assessment. This is also likely for *D. linearifolia*, with individuals of this species expected to extend beyond the PDE. Whilst the Proposal is expected to impact upon recorded individuals of Priority listed flora both within the MDE and PDE, the percentage impact will be less than that presented in Table 5-15, with vegetation clearing for construction of the pipeline not expected to impact all individuals recorded within the PDE. The Proposal will avoid and minimise impacts to Priority listed flora, particularly *A. speckii* through final design.

Table 5-15 Impacts to Priority listed flora mapped within the MDE, PDE (eastern portion) and indicative clearing area

Species	Total no. individuals <sup>1</sup>	No. individuals in MDE	No. individuals in PDE	No. individuals in indicative clearing area (%)
<i>Philotheca nutans</i> (P1)	413 (25 records)	-	10	-
<i>Acacia subsessilis</i> (P3)	2,926 44 records)	450	-	50 (1.71%)
<i>Dicrastylis linearifolia</i> (P3)	1,938 (35 records)	-	100	100 (5.16%)
<i>Acacia speckii</i> (P4)	2,990 (53 records)	1,185	1,085	415 (13.88%)
<i>Dodonaea amplisemina</i> (P4)	10,639 (55 records)	53	-	-

<sup>1</sup> Source: NatureMap (2007–), FloraBase (WA Herbarium 1998–), GHD (2019b, c), Maia (2011).

NatureMap and FloraBase records often provide the count (frequency) in descriptors such as common, localised, sparse, isolated and scattered without providing an actual number of plants. For the purposes of this assessment these records have been counted as one individual. As such the estimates are underrepresented with the actual number of individuals expected to be much higher. Therefore, the percent impact calculated is considered to be very conservative.

### 5.6.2 Dust generation

Implementation of the Proposal is anticipated to generate dust during the construction and operation phases, and to some extent during closure, and is typically related to the movement of vehicles, blasting, earth moving and ore processing. Dust deposition on foliage has the potential to affect the ability of a plant to photosynthesise, or control water loss through transpiration. The

indirect impacts to flora and vegetation from dust deposition is difficult to quantify in isolation. It is important to consider the cumulative effect of dust due to weeds, fragmentation or surface water to degrade vegetation.

Dust accumulation on vegetation can be cyclical with increases in dust load occurring during dry conditions and decreases occurring as a result of rainfall and replacement of affected leaves by new growth. Dust suppression measures will be put in place in accordance with the EMP (GHD 2020d, Appendix C). The MDE is currently an active pastoral station, with dust generated as a result of cattle and vehicle movement. The mining operation are not expected to result in a measurable change to vegetation health, particularly given the management measures outlined in the EMP (GHD 2020d).

Dust levels are not expected to be high at the PDE as the frequency and size of vehicles in the PDE will be limited, and with the exception of during construction, minimal bulk earth works or heavy machinery in operation. Any changes in dust deposition is expected to be limited to the immediate vicinity of the mine and roads. Consequently, there will be no residual or significant impact relating to development of the pipeline.

### 5.6.3 Introduction and spread of environmental weeds

Clearing for development and increased movement of vehicles, including earth moving machinery may result in the establishment of new populations of weed species. Introduced flora taxa has been surveyed and recorded at both the MDE and PDE (Section 5.4.2 and 5.4.3).

Weed numbers can increase by:

- Windblown seed from existing populations spreading to adjoining areas;
- Weed seed in existing seed banks being spread during soil movement or disturbance; and
- Weed seed entering the site through contaminated vehicles, earthmoving equipment or construction materials.

Weed populations within the MDE and PDE are found in small, isolated populations with low numbers of individuals present. Of the introduced taxa in the MDE, none are listed as Declared Pests under the *Biosecurity and Management Act 2007* (BM Act) and/or as a Weeds of National Significance. All of the introduced flora have been previously recorded from the Yalgoo IBRA bioregion. No Declared Pest plants (as listed under the BM Act) or Weeds of National Significance were recorded during the survey within the PDE.

Weeds impacts may be cumulative in response to other impacts to native vegetation such that they may exacerbate the decline or change in native vegetation composition and disrupt ecological processes.

Infestations along water courses and other areas introduce a risk of altered fire regime. Effective management of weeds will ensure the fire potential is not exacerbated.

Weed hygiene will be implemented for all machinery entering both the MDE and PDE sites. This will assist in minimizing any weed ingress to the site on vehicles and machinery entering the development areas. This will be conducted in line with the EMP (GHD 2020d). Implementation of the EMP is expected to reduce the introduction of weeds to new areas and is assessed to have no significant impact.

### 5.6.4 Increased edge effects

Islands of vegetation can become degraded through 'edge effects' where cleared areas become vectors for weeds, changes to surface drainage and dust deposition. For some flora species within these vegetation fragments, the distance between vegetation may be too great for



pollination or seed dispersal. These vegetation fragments can degrade over time to the point where they are no longer suitable for some species of flora and fauna.

#### 5.6.5 Habitat loss and fragmentation from vegetation clearing

Through clearing as part of the development, suitable habitat for significant flora and vegetation will be removed, such as riparian vegetation, BIF and granitic formations. This will reduce the ability of these groups or species to diversify or recruit over a larger area. The patch size of remnant vegetation is anticipated to occupy smaller areas, and they may not continue to be representative of their original community structure. The indirect impacts to flora and vegetation from fragmentation is unquantifiable as, fragmentation by itself does not preclude the flora and vegetation from existing.

The proposed clearing through the PDE will intersect multiple vegetation types, and habitat fragmentation is the most substantial impact for this aspect of the proposal. The pipeline corridor will represent an approximately 20-40 m wide corridor in conjunction with the adjacent road and/or existing gas pipeline and will disconnect habitat on the south and north sides, and may result in reduced genetic diversity as seed dispersal over that distance may not be successful. It is notable that the pipeline corridor may cause fragmentation in the northern region of the ex Barnong pastoral lease, which is registered as a land of interest with the DBCA (Figure 2-8).

Table 5-13 and Table 5-14 outline the vegetation types found within the MDE and PDE. The removal of 1,530 ha is planned within MDE and 200 ha at within the eastern portion of the PDE. The Proposal will contribute to habitat loss and fragmentation through vegetation clearing, however, impacts are not expected to be significant given the extensive tracts of similar vegetation in the local and regional areas.

#### 5.6.6 Alteration of fire regimes

A change in fire regimes is often associated with increased human activity, leading to degradation of natural ecosystems. Mine operations pose a heightened risk of fire due to the increase of potential ignition sources.

Bushfire potential depends on many factors, with the previous wet season being the primary factor. The volume, location and timing of rainfall are critically important for determining fuel volumes and growth.

None of the vegetation types are identified as a significant fire risk, although VT2 is probably the most sensitive or likely to support bushfire movement through the landscape. Fire is a major determining factor in affecting species composition. It can cause disturbance to vegetation condition but can also be required for regeneration for some species.

Despite this, the increased risk posed by the implementation of this proposal is considered to be manageable and is not significant. The main focus is on identification of activities involving ignition sources with the potential to lead to fire occurring in areas of native vegetation, and the adoption of preventative measures.

#### 5.6.7 Decline of species abundance and diversity

Mining has the potential to affect biodiversity throughout the life cycle of a project, both directly and indirectly. Land clearances, alteration to surface and groundwater, and an increased dust emissions can all directly affect the health and productivity of flora and vegetation communities. Indirect impacts, whilst harder to identify, can contribute to social or environmental changes.

The maintenance of ecologically significant flora and vegetation communities is key in order to preserve the diversity of species, of genetic variations within one species, and of ecosystems.

As discussed in Section 5.6.1, the loss of vegetation associated with the proposal is unlikely to significantly impact upon biodiversity (and hence species abundance and diversity) within the MDE or PDE, or significantly impact upon the mapped vegetation associations at either local or regional scales. Whilst the MDE contains uncommon landform features such as the BIF range and granite outcrops, these areas do not support vegetation types that are restricted or contain uncommon, endemic or rare species. This observation was also noted by Markey and Dillon (2008) during their survey of the Yalgoo BIF areas. Furthermore, broad scale mapping indicates the vegetation associations within the MDE and PDE occur more broadly throughout the Yalgoo area and broader Murchison Region. The greatest species richness (diversity) within the MDE was recorded from vegetation type APoEc which covered approximately 68% of MDE. Similarly, the most dominant vegetation types within the PDE also recorded the greatest species richness. Given the proposed clearing will be limited to less than 40% of each vegetation type recorded within the MDE and less than 6% of each vegetation type recorded within the PDE, the Proposal is not expected to result in a significant decline of species abundance and diversity.

#### 5.6.8 Alteration to surface and groundwater flows and quality

Groundwater drawdown and disturbance to soil can result in changes to groundwater quality, such as pH and salinity, which will affect its suitability for use by plants. Reliance of vegetation on groundwater decreases with increasing depth to water table (Eamus *et al* 2006) (DoW 2009). Contribution of groundwater to whole plant water use is thought to be relatively small where the water table lies beyond 10 m below ground level. Beyond 20 m depth, the probability of groundwater as a significant resource is considered to be very low in most instances (Zencich *et al* 2002). Groundwater dependency is mostly restricted to areas where groundwater is less than 10 m from the surface (Barron & Emelyanova 2015).

While there are no groundwater dependent ecosystems present within the MDE, as discussed in Section 5.4.2 and 5.4.3, the potential for ecological communities or plant species (such as those with large root systems) to be affected is assessed to be low. Groundwater is assessed to be approximately 20 m bgl in the pit area and ranges from 10 m bgl in the south to 20 m bgl in the northern portion of the MDE. This depth to groundwater also indicates that any changes to groundwater quality are unlikely to have an impact.

Within the PDE, there are no potential impacts relating to groundwater drawdown and the changes to groundwater quality that may arise due to acid metalliferous drainage within the MDE (refer to Section 10.6.5) are not anticipated to be realised within the PDE.

There are no anticipated changes to surface water flows due to discharge of water from mine site operations into the environment as all water used during the processing of the magnetite will be recycled. Modifications of the MDE may result in a change to surface water flows in rain events, however given the annual rainfall in the region is approximately 217 mm, the impacts are assessed to be insignificant.

#### 5.6.9 Cumulative impacts

A summary of the impacts of other developments in close proximity to the Proposal is provided in Table 5-16. A comparison of impacts to flora and vegetation from the implementation of the Proposal to impacts from other developments indicates the following:

- Implementation of the Proposal will have negligible impact to conservation significant flora and vegetation at local or regional scales. Whilst individual projects may pose a risk to a number of conservation significant flora and vegetation communities, there is no overlap between recorded PECs and conservation significant flora.
- Implementation of the Proposal as well as other developments will result in the loss of vegetation and flora. The vegetation types recorded within the MDE and PDE are not



restricted to the local area. Whilst similar vegetation may be impacted from other nearby developments, given the remaining extents of native vegetation at local and regional scales cumulative impacts are expected to be minor and not considered significant.

- Moderate levels of species diversity and richness were recorded within vegetation types within the Proposal area. Many of the flora species recorded are common, and although recorded at the other developments are not restricted to these development and/or their development envelopes.
- Due to the distance between projects, there are to be no collective edge effects from the Yogi Mine and other mines within the region.
- Due to the separation distance between Yogi Mine and the other developments identified in Table 5-7, dust generation is not expected to have a cumulative impact on the surrounding area or the local air shed.
- Changed fire regimes have the ability to modify a landscape significantly, and while the other developments are assessed to be sufficiently far away, it must be acknowledged that the implementation of the Proposal presents as an additional ignition source to the region. However, it is unlikely that any will impact the same area as the closest site is at least 20 km away from the Yogi mine and separated by large expanses of sparse vegetation and linear infrastructure.
- The Yogi mine is sufficiently far away from other developments that it is not likely to have cumulative impact on groundwater dependent ecosystems or riparian vegetation, nor does it share the same surface water system with other proposals.

Table 5-16 Cumulative impacts to flora and vegetation of the Proposal and regional projects

Variable Company	Karara Mining Ltd	Mount Gibson Mining Ltd	Gindalbie Metals Ltd	Top Iron Pty Ltd.
Project name	Karara Iron Ore Project	Iron Hill Deposits Proposal	Shine Iron Ore Project	Mummaloo Iron Ore Project
Type	Magnetite Iron Ore	Iron Ore	Iron ore	Iron Ore
Location	Shire of Perenjori 215 east south east of Geraldton	Mount Gibson Range 270 km east south east of Geraldton	Shire of Yalgoo 68 km south of Yalgoo Approx. 290 km south east of Geraldton	Shire of Yalgoo Approx. 300 km south east of Geraldton.
IBRA Bioregion	Yalgoo	Avon Wheatbelt	Avon Wheatbelt	Avon Wheatbelt
Total vegetation cleared	1,742 ha of native vegetation clearing Additional clearing for infrastructure c. 691 ha	112 ha development envelope 87 ha native vegetation clearing	646 ha development envelope 200 ha of native vegetation clearing	440 ha development envelope 300 ha of native vegetation clearing
Conservation significant flora affected	Significant impacts to: <i>Acacia karina</i> (P1) <i>Lepidosperma</i> sp. Blue Hills (P1) <i>Acacia woodmaniorum</i> (T) <i>Millotia dimorpha</i> (P1)	<i>Darwinia masonii</i> (T) <i>Lepidosperma gibsonii</i> (T)	<i>Drummondita fulva</i> (P3) <i>Micromyrtus trudgenii</i> (P3)	<i>Allocasuarina tessellata</i> (P1) <i>Grevillea scabrida</i> (P3) <i>Grevillea subtiliflora</i> (P3) <i>Persoonia pentasticha</i> (P3)
Ecological communities affected	Blue Hills vegetation complexes PEC (Priority 1) NO TECs were recorded within the Proposal area	Mount Gibson Range Vegetation Complexes PEC (Priority 1) NO TECs were recorded within the Proposal area	Tallering Peak Vegetation Complexes PEC (Priority 1)  No TECs were recorded within the Proposal area	No TECs or PECS were recorded within the Proposal area



## 5.7 Mitigation

The mitigation hierarchy (avoid, minimise, rehabilitate) has been applied to this proposal in relation to flora and vegetation.

The inherent impacts that must be managed include:

- Clearing of native vegetation resulting in a fragmentation and edge effects, altered fire regimes, introduced weed and impacts to surface and groundwater.
- Dust impacts relating to the contraction and operation of Yogi Mine, and the construction of the pipeline.
- Loss of conservation significant flora and vegetation communities.

Management and monitoring measures for the above impacts are well practiced and understood in the industry, and are considered to be effective. FIJV will continue to offset flora and vegetation loss through progressive rehabilitation of areas disturbed by mining activities.

Proposed mitigation measures to address the above potential impacts to flora and vegetation are outlined in Table 5-17 and further discussed in the environmental management plans in relation to the mine site (GHD 2020d) and pipeline (GHD 2020e).

Table 5-17 Mitigation measures for impacts to flora and vegetation

Impact	Mitigation measures
Loss of vegetation and flora due to clearing	<p><b>Avoid</b></p> <ul style="list-style-type: none"> <li>• Review the proposed project design against the vegetation survey data to avoid/minimise clearing of significant flora and vegetation.</li> <li>• Pre-clearance surveys for significant flora, with the aim to avoid, all significant flora for the pipeline route.</li> <li>• Significant flora and vegetation will be mapped on site using a coloured peg system and avoided where possible during clearing</li> <li>• Section of haul road traversing BIF landform deviated and narrowed to avoid and reduce impact of the Yalgoo vegetation complexes BIF PEC (P1) and individuals of <i>Acacia subsessilis</i> (P3) and <i>A. speckii</i> (P4).</li> </ul> <p><b>Minimise</b></p> <ul style="list-style-type: none"> <li>• Minimise clearing and vegetation disturbance to ensure significant flora and vegetation are protected.</li> <li>• Develop and implement ground disturbance procedures for clearing within the development envelope.</li> <li>• Ensure staff and contractors are aware of the location of significant flora and vegetation on site and their responsibility to ensure they are protected.</li> <li>• Vehicles and mining equipment access limited to designated roads/access tracks and cleared areas.</li> </ul> <p><b>Rehabilitate</b></p> <ul style="list-style-type: none"> <li>• Waste dumps and general disturbance areas to be rehabilitated in accordance with the Proposal's MCP (GHD 2019c).</li> </ul>
Dust generation	<p><b>Avoid</b></p> <ul style="list-style-type: none"> <li>• Vehicles will be restricted to designated routes, where dust control measures are undertaken</li> </ul>

Impact	Mitigation measures
	<ul style="list-style-type: none"> <li>Dust associated with the operations will be managed in accordance with the <i>Environmental Management Plan (EMP)</i> (GHD 2020d, Appendix C).</li> </ul> <p><b>Minimise</b></p> <ul style="list-style-type: none"> <li>Dust suppression, including use of water carts on access roads, to be implemented during all Proposal phases</li> </ul>
Introduction of weeds	<p><b>Avoid</b></p> <ul style="list-style-type: none"> <li>Vehicles and mining equipment access limited to designated roads/access tracks and cleared areas, and prohibition of off-road driving.</li> </ul> <p><b>Minimise</b></p> <ul style="list-style-type: none"> <li>Implement biannual weed monitoring and targeted spraying program at the Proposal following completion of land clearing activities and during operations and closure activities.</li> <li>Continued biannual weed monitoring and targeted spraying program along the pipeline route to minimise existing weed populations and reduce potential spread into adjacent land</li> </ul>
Increased edge effect	<p><b>Avoid</b></p> <ul style="list-style-type: none"> <li>Vehicles will be restricted to designated routes, where dust control measures are undertaken</li> </ul> <p><b>Minimise</b></p> <ul style="list-style-type: none"> <li>Dust associated with the operations will be managed in accordance with the EMP (GHD 2020d, Appendix C).</li> </ul> <p><b>Rehabilitate</b></p> <ul style="list-style-type: none"> <li>FIJV will undertake progressive rehabilitation in areas where mining operations have been completed.</li> </ul>
Habitat loss and Fragmentation	<p><b>Minimise</b></p> <ul style="list-style-type: none"> <li>Minimise clearing and vegetation disturbance to conservation significant flora and communities</li> <li>Conduct clearing in accordance with the permit and clearing procedure</li> </ul> <p><b>Rehabilitate</b></p> <ul style="list-style-type: none"> <li>FIJV will undertake progressive rehabilitation in areas where mining operations have been completed.</li> </ul>
Altered fire regimes	<p><b>Avoid</b></p> <ul style="list-style-type: none"> <li>Proposal site induction to include information on prevention and management of fires.</li> <li>All machinery and vehicles undertaking clearing activities will be fitted with firefighting equipment.</li> <li>A Hot Work Permit system will be implemented.</li> </ul> <p><b>Minimise</b></p> <ul style="list-style-type: none"> <li>Firefighting equipment will be located on site and emergency personnel will be trained in fire response.</li> </ul>
Decline of species abundance and diversity	<p><b>Avoid</b></p> <ul style="list-style-type: none"> <li>Review the proposed project design against the vegetation survey data to avoid/minimise clearing of significant flora and vegetation.</li> </ul>



Impact	Mitigation measures
	<ul style="list-style-type: none"> <li>Ensure staff and contractors are aware of the location of significant flora and vegetation on site and their responsibility to ensure they are protected.</li> </ul> <p><b>Minimise</b></p> <ul style="list-style-type: none"> <li>Conduct vegetation clearing in accordance with a permit issued.</li> </ul>
Alteration to surface and groundwater flows and quality	<p><b>Avoid</b></p> <ul style="list-style-type: none"> <li>Local drainage will be considered when constructing new haul roads and access tracks and maintaining existing road infrastructure. This activity can be managed under the Mining Act.</li> </ul> <p><b>Minimise</b></p> <ul style="list-style-type: none"> <li>Disturbance to watercourses will be minimised to that required to achieve safe mine design and asset protection.</li> </ul>

## 5.8 Predicted outcome

### 5.8.1 Residual impact

A summary of residual impacts after the implementation of the proposal and the application of the mitigation measures outlined in Table 5-17 above is provided in Table 5-18.

Table 5-18 Residual impacts to flora and vegetation

Impact	Residual impact
Loss of vegetation and flora due to clearing	<p>Clearing of 1,530 ha of vegetation including 311.97 ha of the Yalgoo vegetation complexes BIF Priority 1 PEC within the MDE. Clearing within the MDE is expected to clear mostly vegetation association 420 (1,417.94 ha), of which 99.5% of the extent within the IBRA subregion YAL02 will remain following clearing for the Proposal.</p> <p>Clearing of 178 ha of vegetation within the eastern portion of the PDE, and approximately 22 ha in the western PDE. Clearing within the PDE is expected to clear 12 vegetation associations to different extents. Vegetation associations 125 and 676 are the most constrained associations, with less than 30% of these associations remaining within the IBRA subregions. Clearing of these associations are estimated to be 0 ha and 8.99 ha respectively, which represents 0% and 0.03% respectively of their extent within the relevant IBRA subregion. This indicates that implementation of the Proposal is not assessed to have a significant impact.</p> <p>Direct loss of conservation significant flora species within the MDE, including 50 individuals of <i>Acacia subsessilis</i> (P3) and 365 individuals of <i>Acacia speckii</i> (P4). Field observations indicate both species extend beyond and occur outside of the MDE, with <i>A. speckii</i> recorded in large numbers on neighbouring BIF rises (GHD 2019b, Maia 2011). Therefore impacts to both species are expected to be less than those presented here and are not significant.</p> <p>Direct loss of conservation significant flora species within the PDE, including 100 individuals of <i>Dicrasyllis linearifolia</i> (P3) and 50 individuals of <i>Acacia speckii</i> (P4).</p>

Impact	Residual impact
Dust generation	Dust impacts to flora and vegetation are anticipated to be minimal given the management measures proposed.
Introduction of weeds	The impact of weeds on flora and vegetation is assessed to be low following implementation of the weed control measures outlined above and in the EMP (GHD 2020d).
Increased edge effect	Edge effect will be minimised in the MDE by keeping infrastructure together, and avoiding clearing in new, discrete areas. There is anticipated to be increased edge effects, however their significant is estimated to be low as the vegetation and flora present onsite are well represented in the local area and region.
Fragmentation	There will be some fragmentation of flora and vegetation, however it is not assessed as significant as the vegetation and flora present onsite are well represented in the local area and region. Rehabilitation will create new ecological linkages between remnant and newly established flora and vegetation communities post-disturbance.
Altered fire regimes	Weed management, construction of firebreaks and hot work permits will reduce the risk of fires caused by the proposal such that their impact is assessed as low.
Decline of species abundance and diversity	The vegetation and flora present onsite are well represented in the local area and region and their removal is not assessed to impact species abundance and diversity.
Alteration to surface and groundwater flows and quality	Due to the absence of GDE and riparian vegetation within the MDE and PDE, and the depth of groundwater below ground level, impacts to flora and vegetation due to changes in groundwater quality and flor changes are considered low.

### 5.8.2 Assessment against the EPA objective

Following completion of the assessment and the residual impact outlined in Table 5-18, it is considered that the clearing required for the implementation of the proposal will not have significant residual impacts. As such, it meets the objective for this factor such that the biological diversity and ecological integrity of flora and vegetation are maintained.

### 5.8.3 Offsets

Based on the assessment that the clearing will not have significant residual impacts, no offsets are proposed.