

Vegetation unit mapping code	Quadrats	Vegetation description	Associated species	Area Mapped (ha)
EtApStCpEo	P1-Q05 P1-Q16 P2-Q11 P2-Q23C P2-Q38 P2-Q41S P2-Q42 P2-Q50 P2-Q53N	Landform: Sandy floodplain <i>Eucalyptus tectifica</i> low, open woodland, over <i>Acacia platycarpa</i> tall, over <i>Sorghum timorense</i> , <i>Chrysopogon pallidus</i> and <i>Eriachne obtusa</i> open tussock grassland Average species richness = 23.6 ± 1.9 Sample size = 7	<i>Acacia platycarpa</i> <i>Bauhinia cunninghamii</i> <i>Brachychiton diversifolius</i> subsp. <i>diversifolius</i> <i>Chrysopogon pallidus</i> <i>Dolichandrone heterophylla</i> <i>Eriachne obtusa</i> <i>Eucalyptus tectifica</i> <i>Glycine tomentella</i> <i>Sorghum timorense</i> <i>Spermacoce occidentalis</i>	1,759.5



Vegetation unit mapping code	Quadrats	Vegetation description	Associated species	Area Mapped (ha)
GpAmStTc	P1-Q04 P1-Q19 P2-Q17 P2-Q18S P2-Q19C P2-Q20 P2-Q35	<p>Landform: Gravelly plains</p> <p><i>Grevillea pyramidalis</i> subsp. <i>pyramidalis</i> low, open woodland, over <i>Acacia monticola</i> mid, sparse shrubland, over <i>Sorghum timorense</i> sparse tussock grassland and <i>Triodia caelestialis</i> (P3) sparse hummock grassland.</p> <p>Average species richness = 25.0 ± 1.6 Sample size = 7</p>	<p><i>Acacia hippuroides</i> <i>Acacia monticola</i> <i>Chrysopogon pallidus</i> <i>Corchorus sidoides</i> subsp. <i>vermicularis</i> <i>Corymbia greeniana</i> <i>Grevillea pyramidalis</i> subsp. <i>pyramidalis</i> <i>Grevillea refracta</i> subsp. <i>refracta</i> <i>Microstachys chamaelea</i> <i>Sorghum timorense</i> <i>Triodia caelestialis</i></p>	1,633.5



Vegetation unit mapping code	Quadrats	Vegetation description	Associated species	Area Mapped (ha)
MaMvEtCpCc	P1-Q01 P2-Q37N	<p>Landform: Sandy floodplain</p> <p><i>Melaleuca alsophila</i> or <i>Melaleuca viridiflora</i> and <i>Eucalyptus tectifera</i> low, open woodland, over <i>Chrysopogon pallidus</i> sparse tussock grassland and <i>Cyperus conicus</i> sparse sedgeland</p> <p>Average species richness = 17.5 ± 2.5 Sample size = 2</p>	<p><i>Bauhinia cunninghamii</i> <i>Chrysopogon pallidus</i> <i>Cyperus conicus</i> <i>Eragrostis cumingii</i> <i>Eriachne obtusa</i> <i>Eucalyptus tectifera</i> <i>Melaleuca alsophila</i> <i>Melaleuca viridiflora</i> <i>Sacciolepis indica</i> <i>Sorghum timorense</i> <i>Xerochloa laniflora</i></p>	352.6



Vegetation Condition

The majority of vegetation within the Proposal Area is described as being in very good condition, according to the Trudgen (1991) condition rating scale, however, overall condition ranged from very poor to excellent. Disturbances to vegetation condition were generally considered to be a result of livestock grazing and weed establishment. It was observed that the quadrats rated to be in poor or very poor condition were associated with water sources (bores). Areas assessed to be in excellent or very good condition were generally confined to rocky hillslopes and plains away from water sources and where difficult terrain and unpalatable hummock grasses (*Triodia* spp.) limit livestock utilisation, reducing disturbance and weed dispersal.

It should also be noted that due to the Proposals location within an active pastoral lease, the area is subject to regular burning. This is reflected in the assessment of the estimated time since fire at each surveyed quadrat, with majority of quadrats surveyed being burnt within the last five years.

Fire History

The vegetation survey area is located on an active pastoral lease and is subject to regular burning by pastoralists, other stakeholders and natural causes (ie lightning strikes). This is reflected in the assessment of the estimated time since fire recorded at quadrats during the Level 2 survey (Ecologia 2014a). The survey indicated that 28% of quadrats were assessed as having being burnt within the previous one to two years, 44% being burnt during the previous two to five years and the remaining quadrats as being either burnt less than one year ago (6%), greater than five years ago (20%) or indicating no evidence of fire (3%). The comprehensive recent burning pattern of the survey area is typical of fires lit by land users to control the amount of combustible fuel in the area instead of the sporadic and localised fire patterns created by wet season thunderstorms.

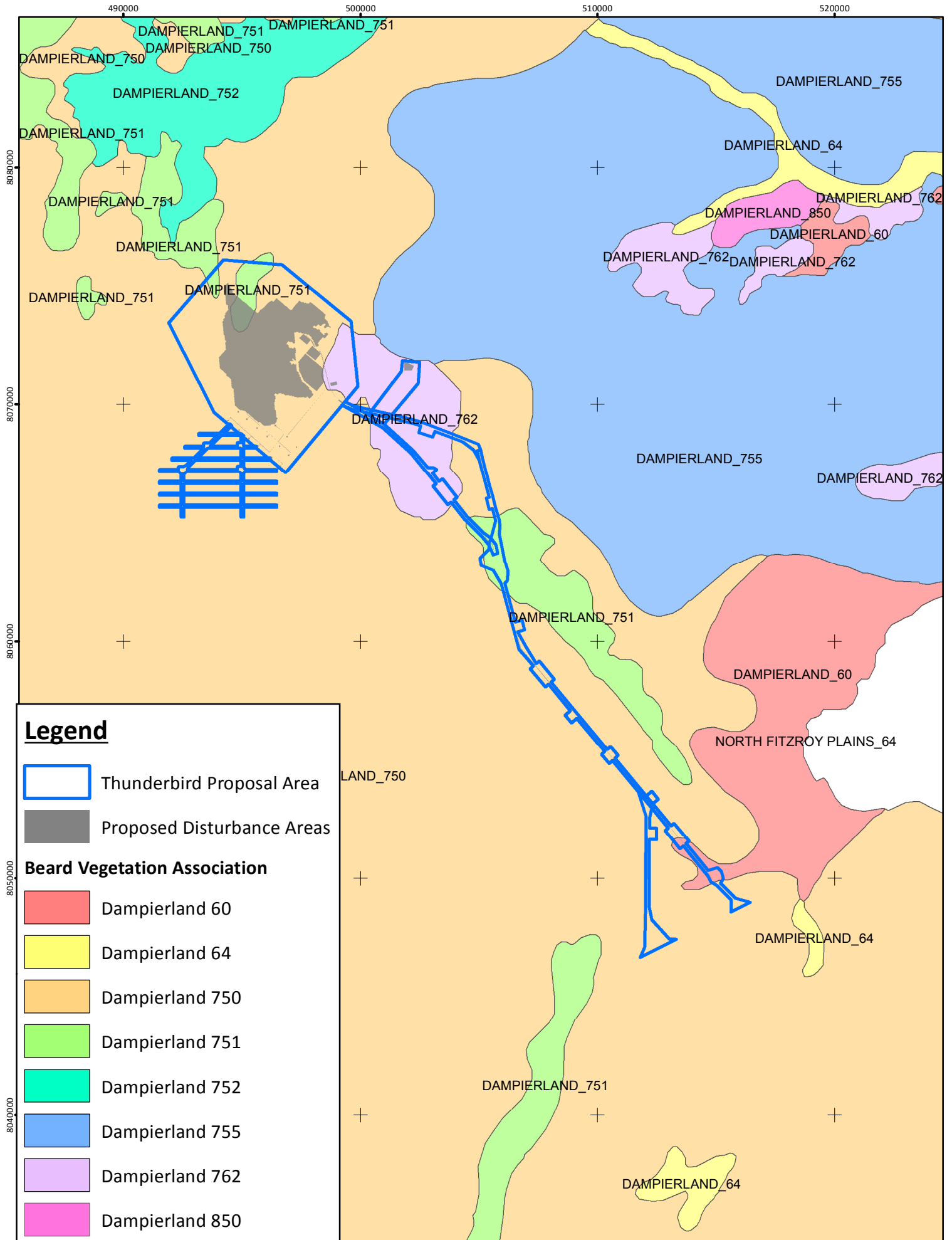
Regional Significance

Assessment of the significance of the vegetation at a state level is constrained by the lack of detailed mapping across the state at a scale comparable to the mapping conducted during surveys of the Thunderbird area. The only source of vegetation mapping available across the state is that conducted by Beard (and in some instances co-authors) at a scale of 1:1,000,000 (Beard 1976). Four Beard vegetation associations occur within the Proposal Area and surrounds (Figure 6.6):



- 60 – Grasslands, tall bunch grass savanna woodland, grey box and cabbage gum over ribbon grass
- 750 – Shrublands, pindan; *Acacia tumida* shrubland with grey box and cabbage gum medium woodland over ribbon grass and curly Spinifex
- 751 – Hummock grasslands, shrub steppe; *Acacia eriopoda* over soft Spinifex
- 762 – Shrublands, pindan; *Acacia eriopoda* & *A. tumida* shrubland with scattered low *Eucalyptus confertifolia* over curly Spinifex.

As shown on Figure 6.6, each of the four units occur more outside the Proposal Area and proposed disturbance areas than they do within. The four Beard vegetation associations are not considered likely to be significantly impacted by the Proposal.


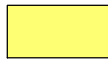




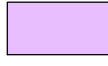

Land system mapping of the Kimberley region undertaken by Payne and Schoknecht (2011) also provides some insight into the distribution of broad scale vegetation in a regional context. Four land systems lie within the Proposal Area; Fraser, Reeves, Wagnut and Yeeda. As shown on Figure 6.7, all land systems are well represented regionally and the impact to these systems as a result of the Proposal is not considered significant.

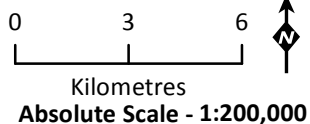


Legend

-  Thunderbird Proposal Area
-  Proposed Disturbance Areas

Beard Vegetation Association

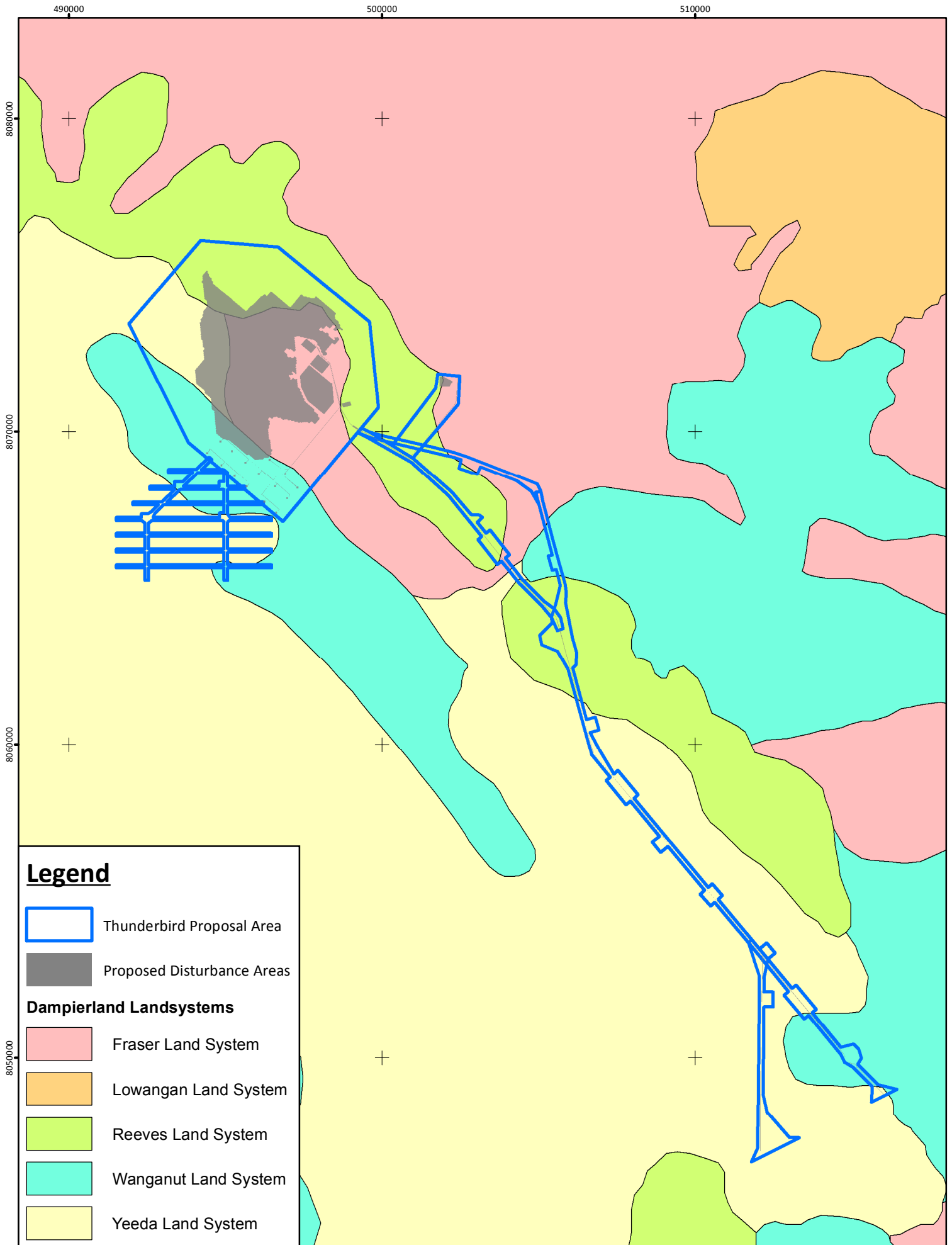
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-  Dampierland 64
-  Dampierland 750
-  Dampierland 751
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-  Dampierland 755
-  Dampierland 762
-  Dampierland 850



**Beard Mapping
Across the
Proposal Area**

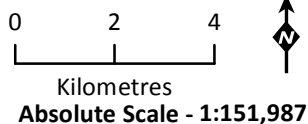
Figure: 6.6
Project ID: 1645
 Coordinate System
 Name: GDA 1994 MGA Zone 50
 Projection: Transverse Mercator
 Datum: GDA 1994

Drawn: BH
Date: 04.11.15



Legend

- Thunderbird Proposal Area
- Proposed Disturbance Areas
- Dampierland Landsystems**
- Fraser Land System
- Lowangan Land System
- Reeves Land System
- Wanganut Land System
- Yeeda Land System



**Land Systems
Across the
Proposal Area**

Figure: 6.7
Project ID: 1645

Drawn: BH
Date: 04.11.15

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Local Significance

Vegetation can be of conservation significance if it has “a role as a key habitat for threatened species” (EPA 2004b, pp. 30). In this context the degree to which Priority taxa were localised to particular vegetation units was also assessed.

Pterocaulon intermedium (P3) and *Triodia caelestialis* (P3) are well represented within the survey area, present across nine and ten vegetation units, respectively. As these taxa are not restricted to any one vegetation unit, the overall significance of impacts to these species as a result of disturbance to the vegetation communities in which support them is considered low.

Tephrosia valleculata (P3) was represented by only three populations which is not an adequate sample size to accurately make inferences of its specificity to any one vegetation unit.

Vegetation unit *CdTcTc* (rocky hillslopes) supports all three Priority taxa recorded in the Proposal Area. However, all 11 vegetation units described during the survey support at least one of the three Priority flora taxa recorded in the Proposal Area, lessening the significance of any one vegetation community mapped.

In a local context, vegetation can be considered significant if it is locally uncommon or is associated with habitats of local significance. The mapped area of each vegetation community was outlined in Table 11.

All vegetation units will be impacted to some degree as part of the Proposal, however, more than 60% (as a minimum) of each community is likely to remain undisturbed. Vegetation units *BdEcAtApSt*, *CgApSt* and *GpAmStTc* are likely to be the most impacted (37%, 25% and 16% respectively), largely due to their presence within the mine bit boundary. All other units are likely to be disturbed by less than 11% of their mapped extent.

Most of the mapped extent of vegetation units *AtCp* and *CgDhHc* are situated within the Proposal Area (both at 97%) and are predominately located along the internal haul road. However, only 2% and 3% (respectively) of each unit is likely to be impacted during the Proposal. It should also be noted that a large portion of the proposed internal haul road is already disturbed, due to the presence of existing tracks. Some additional disturbance may be required along these existing routes for road upgrades.

The least extensive vegetation units locally are *CdDhHc* (110.7 ha) and *MaMvEtCpCc* (352.6 ha), which represent <1 % and 2.4% of the mapped area, respectively. Large portions of *CdDhHc* is present within the Proposal Area (97%) and 10% of *MaMvEtCpCc*. However, only 3% of *CdDhHc* and <1% of *MaMvEtCpCc* are proposed to be disturbed by the Proposal, lessening the overall significance of impacts to these communities.

No mapped vegetation unit is restricted to either the Proposal Area or proposed disturbance areas.

6.2.1.5 Significant Vegetation Communities

No listed TECs or PECs were recorded in the Proposal Area or within 40 km of the Thunderbird area.

An area of vegetation unit *MaMvEtCpCc*, mapped during the vegetation surveys is considerable comparable in terms of both species composition and landform to the Priority 3 PEC, Assemblage of Lolly Well Springs wetland complex (Figure 6.8). The Lolly Well Springs wetland complex, located approximately 55 km north-north-west of the Proposal Area, is characterised by its location on an organic mound associated with an ephemeral spring. The identified section of vegetation unit *MaMvEtCpCc* is also associated with an ephemeral pool or spring. This section of vegetation unit *MaMvEtCpCc* is dominated by *Melaleuca alsophila* or *Melaleuca viridiflora* and *Eucalyptus tectifica* low, open woodland, over *Chrysopogon pallidus* sparse tussock grassland and *Cyperus conicus* sparse sedgeland. Species such as *Sacciolepis indica*, *Sorghum plumosum* and *Fuirena ciliaris* are also characteristic of this vegetation unit. The identified section of vegetation unit *MaMvEtCpCc* appears

to be localised and not associated with the main drainage channel, as is the case with the remainder of unit *MaMvEtCpCc*, instead being restricted to the ephemeral pool.

It should be noted that while this vegetation unit *MaMvEtCpCc* occurs outside the Proposal Area, it is highly dependent on the surface water present associated with the ephemeral pool and presumably would be highly susceptible to changes in the level of the water table. However, as discussed in Section 6.2.5.1, a hydrological assessment concluded that the soak is likely part of a perched aquifer, is unlikely to be connected with the Proposals underlying Broome aquifer and is therefore unlikely to be impacted by the Proposal.

6.2.2 Terrestrial Fauna

Four surveys (refer to Table 7) have been conducted in the Proposal Area in order to describe the local terrestrial fauna within and in the vicinity of the Proposal Area. A Level 1 survey was initially completed for the proposed active mining areas (i.e. mine pit, TSF, process plants, power plant, eastern portion of the borefield and northern sections of access roads) in 2012. Whilst the field survey did not record any observations of Threatened species, the desktop assessment identified a total of six vertebrate fauna species of conservation significance that had a medium to high likelihood of occurring in the survey area (Ecologia 2012). As a consequence, a Level 2 vertebrate fauna survey was recommended to provide a comprehensive assessment of potential impacts posed by the Proposal. Level 2 surveys of the Proposal Area (as described above) were conducted in 2013 (Ecologia 2014b) across both the wet and dry seasons (April and October, respectively) and the internal haul roads and accommodation camp areas were surveyed in May 2015 (Ecologia 2015).

Following interrogation of the results of the Level 2 survey which identified Threatened (Vulnerable under both EPBC and WC Acts) species, the Greater Bilby (*Macrotis lagotis*), a targeted additional targeted survey was conducted of the Thunderbird area to further understand the extent and distribution of the local Greater Bilby population with the Proposal Area (Ecologia, 2015 (in draft)).

The locations of these survey areas in relation to the Proposal are shown on Figure 6.9.

6.2.2.1 Sampling Methodology

The fauna surveys were undertaken using a variety of sampling techniques, both systematic and opportunistic. Systematic sampling refers to data methodically collected over a fixed time period in a discrete habitat type, using an equal or standardised sampling effort. The resulting information can be analysed statistically, facilitating comparisons between habitats. Opportunistic sampling includes data collected non-systematically from chance encounters with fauna or evidence of fauna. Sampling methods for the various fauna groups are summarised below.

Systematic Sampling Methods

The systematic sampling methods used during the fauna surveys are provided below.

- Non-volant Mammals and Herpetofauna
 - Standardised trapping format comprising a combination of pit-fall traps, Elliott box traps, funnel traps and cage traps.
- Avifauna
 - 30 minute set-time surveys at each fauna site, recording individuals and searching similar habitat within 500 m of survey site, conducted within three hours of dawn.
- Bats
 - Bat echolocation calls were recorded using SM2BAT 384 kHz long term passive recorder, programmed to record from dusk to dawn for each night that was surveyed.

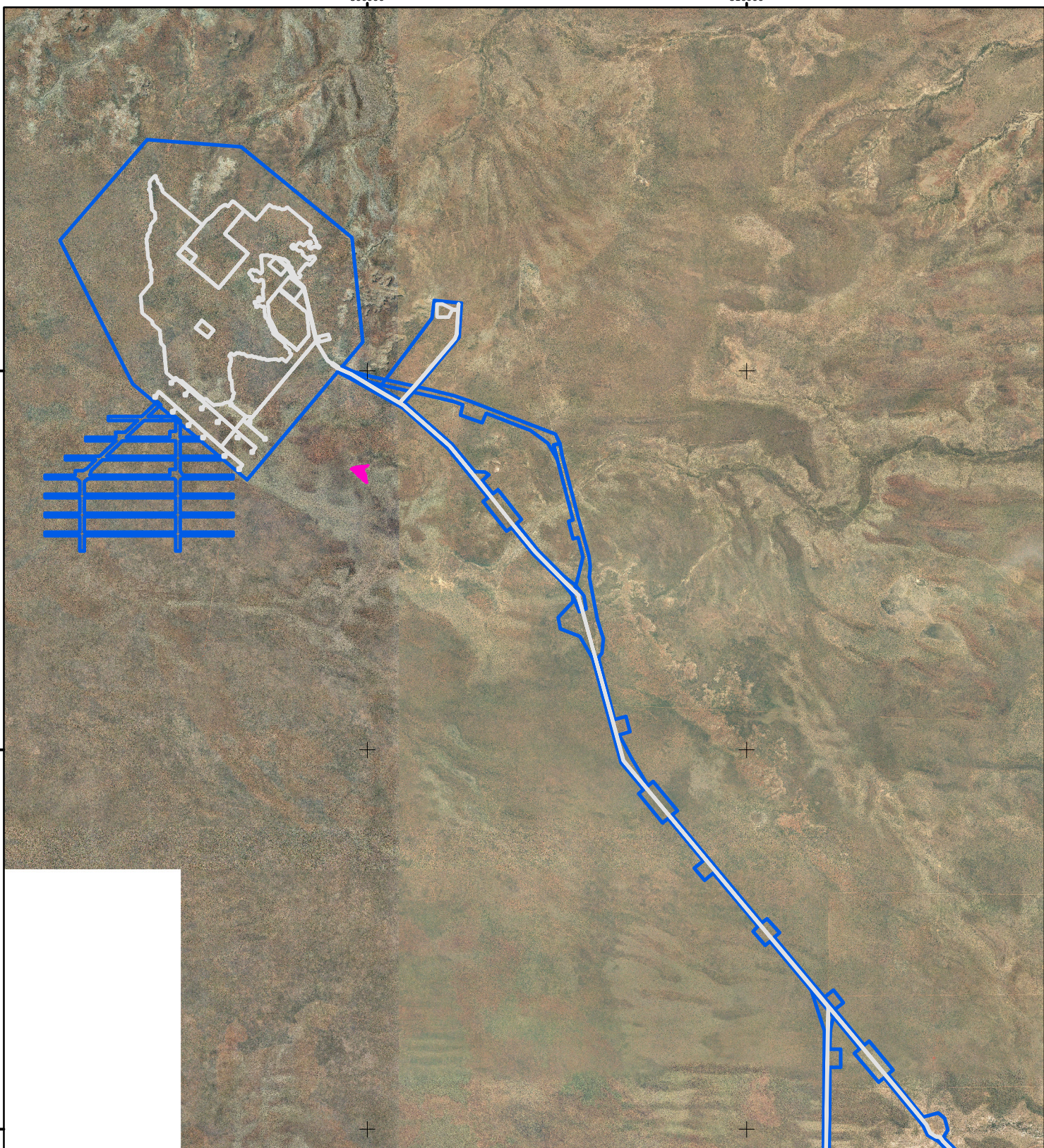
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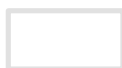

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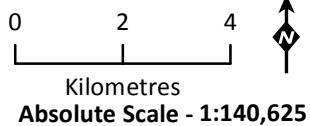
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Legend

-  Thunderbird Proposal Area
-  Proposed Disturbance Areas
-  Vegetation Community *MaMvEtCpCc*

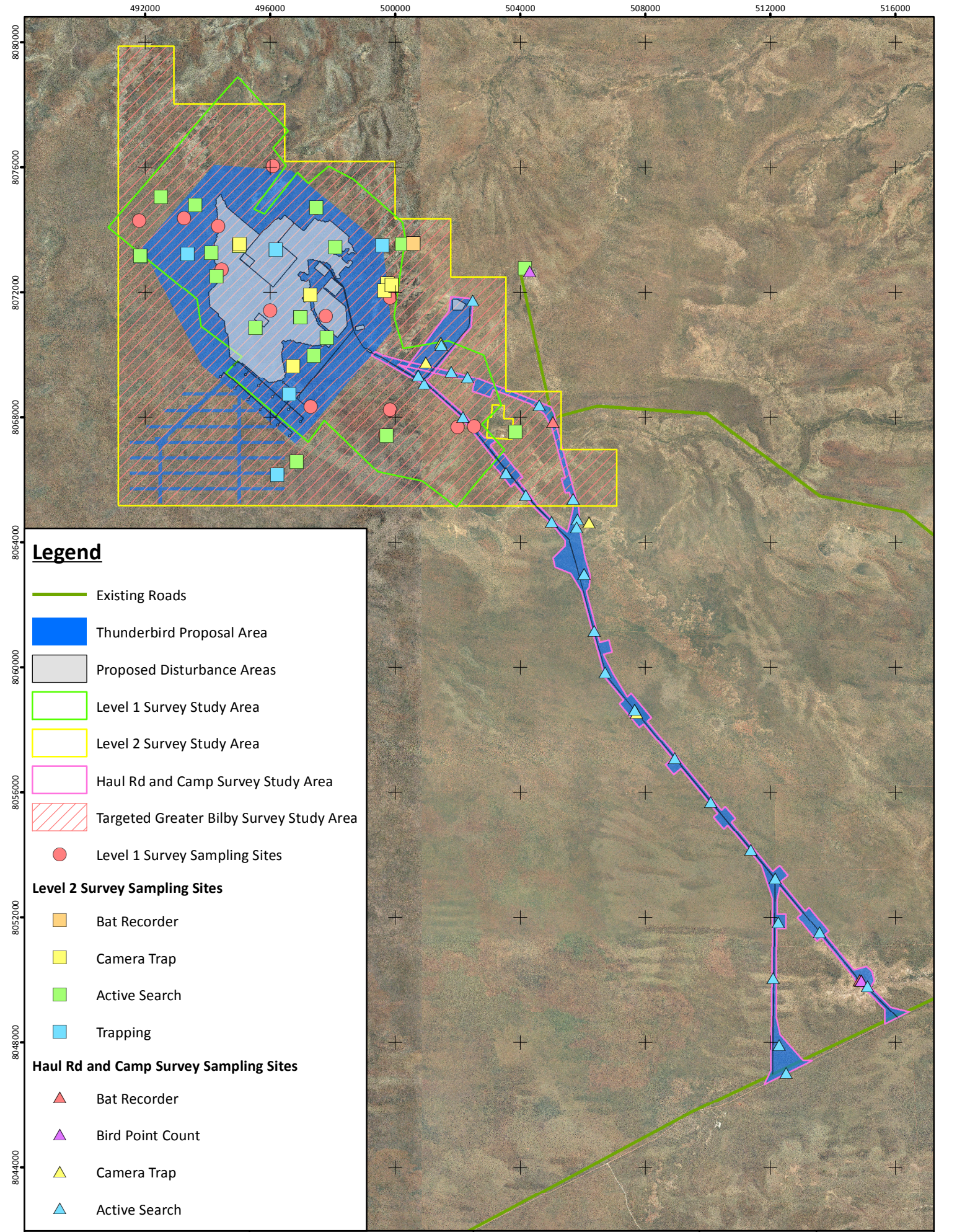


**Significant Vegetation
Community Recorded
near the Proposal Area**

Figure: 6.8
Project ID: 1645

Drawn: BH
Date: 18.11.15

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994



Legend

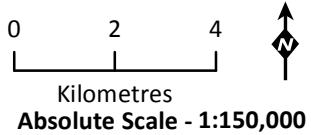
- Existing Roads
- Thunderbird Proposal Area
- Proposed Disturbance Areas
- Level 1 Survey Study Area
- Level 2 Survey Study Area
- Haul Rd and Camp Survey Study Area
- Targeted Greater Bilby Survey Study Area
- Level 1 Survey Sampling Sites

Level 2 Survey Sampling Sites

- Bat Recorder
- Camera Trap
- Active Search
- Trapping

Haul Rd and Camp Survey Sampling Sites

- Bat Recorder
- Bird Point Count
- Camera Trap
- Active Search



**Terrestrial Fauna
Survey Areas and
Sampling Sites**

Figure: 6.9
Project ID: 1645

Drawn: BH
Date: 10.11.15

Coordinate System
Name: GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Datum: GDA 1994