



PHOENIX

ENVIRONMENTAL SCIENCES

Single season Detailed flora and vegetation survey for the Port Hedland Transmission Project

Prepared for APA

April 2025

Final



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Version history

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EXECUTIVE SUMMARY

APA are seeking to build and operate a 220 kilovolt (kV) transmission line connecting Port Hedland Power Station to a customer located approximately 65 km southwest of Port Hedland.

Detailed flora and vegetation surveys have previously been completed for a large portion of the Port Hedland Transmission Project. APA engaged Phoenix Environmental Sciences (Phoenix) to conduct additional surveys in some smaller sections that have not previously been surveyed. The study area for the survey comprises 3 areas with a total area of 248.3 ha.

The scope of work for the single season Detailed flora and vegetation survey includes desktop study and Detailed field survey. Field survey was conducted during spring, from 9th – 11th October 2024 with 12 quadrats and 1 relevé surveyed across the study area.

A total of 58 flora taxa, 56 determined to species level, representing 19 families and 37 genera were recorded in the study area. The assemblage included 56 native species and 2 introduced species. Neither introduced species was a Declared Pest nor Weed of National significance. The most prominent families recorded were Fabaceae (15 spp.), Poaceae (10 spp.), Malvaceae (7 spp.) and Amaranthaceae (4 spp.).

Records of 11 significant flora species were identified within the desktop search extent as occurring in the vicinity of the study area. These records identified comprised of one Priority 1 flora taxa, one Priority 2 flora taxa, 7 Priority 3 flora taxa and 2 Priority 4 flora taxa.

No Threatened flora were recorded during the field survey. *Tephrosia rosea* var. Port Hedland (A.S. George 1114) (P1) was the only Priority species recorded during the survey from a single plant. *Tephrosia rosea* var. Port Hedland (A.S. George 1114) is known from 52 records that occur in the Chichester and Roebourne sub-regions of the Pilbara bioregion and the Mackay sub-region of the Great Sandy Desert bioregion, none of the records occur in conservation estate.

Priority 3 species *Abutilon* sp. Pritzelianum (S. van Leeuwen 5095), identified in the desktop search, was not recorded during this field survey. As records of this species were confirmed outside of the current study area, it is possible that the species may be present in the soil seed bank at previously recorded locations.

Following the field survey the Priority 3 species, *Rothia indica* subsp. *australis*, was considered to possibly occur in the study area.

There were 5 vegetation types defined for the study area that comprised open *Corymbia* woodlands over *Acacia* spp. shrublands over *Triodia* grasslands and *Acacia* shrublands over *Triodia* grasslands. None of the vegetation in the study area was considered representative of a Threatened Ecological Community or Priority Ecological Community. All of the vegetation types mapped within the study area represent the broader vegetation associations (647, 93 and 117), of which, all maintain a high proportion of pre-European extent and are classified to be of Least Concern.

The botanical values present in the study area are restricted to a single plant of the Priority 1 species *Tephrosia rosea* var. Port Hedland (A.S. George 1114), the potential for *Abutilon* sp. Pritzelianum (S. van Leeuwen 5095) (P3) to be present in the soil seed bank and the possibility that a Priority 3 species, *Rothia indica* subsp. *australis*, may occur. None of the vegetation identified in the field is considered to be conservation significant.

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ACRONYMS AND ABBREVIATIONS

BoM	Bureau of Meteorology
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DPIRD	Department of Primary Industries and Regional Development
ESA	Environmentally Sensitive Areas
IBRA	Interim Biogeographic Regionalisation of Australia
IBSA	Index of Biodiversity Surveys for Assessment
NES	National Environmental Significance
NVCP	Native Vegetation Clearing Permit
NVIS	National Vegetation Information System
PEC	Priority Ecological Communities
WoNS	Weed of National Significance

1 INTRODUCTION

APA are seeking to build and operate a 220 kilovolt (kV) transmission line connecting Port Hedland Power Station to a customer located approximately 65 km southwest of Port Hedland. The study area is located in the Chichester and Roebourne subregions of the Pilbara bioregion within the Eremaean Botanical Province as defined by EPA (2016b).

Detailed flora and vegetation surveys have previously been completed for a large portion of the Port Hedland Transmission Project, however APA have identified additional area that has not been previously surveyed and surveys are required to apply for a Native Vegetation Clearing Permit (NVCP). In July 2024, Phoenix Environmental Sciences Pty Ltd (Phoenix) was commissioned by APA to undertake a single season Detailed flora and vegetation survey for the Project, to amalgamate with previous surveys undertaken by Biologic (2024).

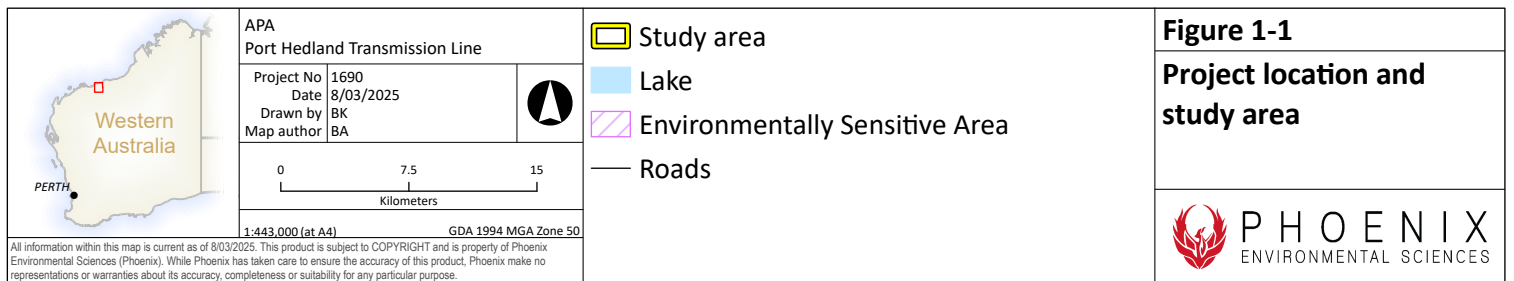
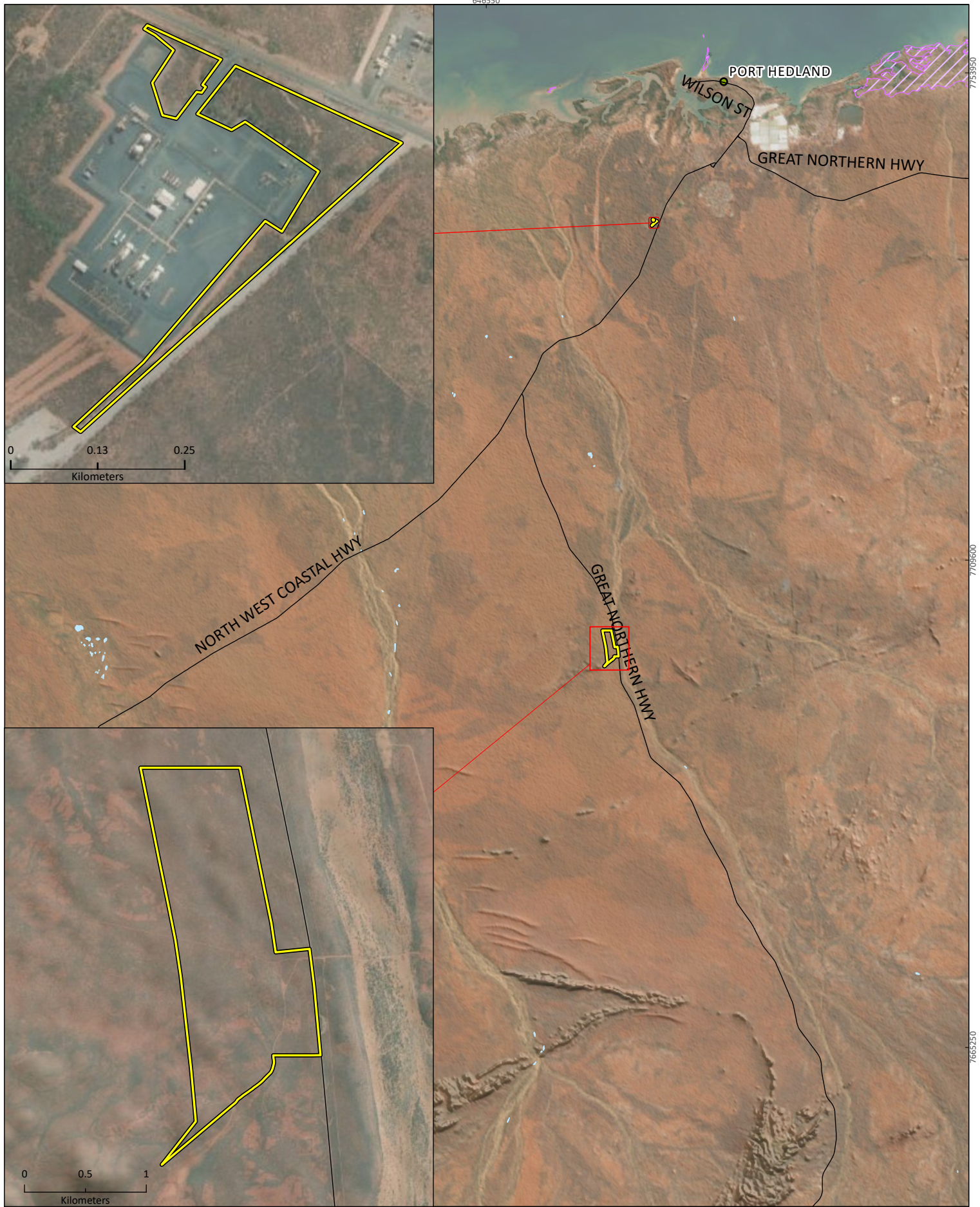
1.1 SCOPE OF WORK

The scope of work for the single season Detailed flora and vegetation survey was as follows:

- Desktop study –
 - to gather contextual information of the potential flora and vegetation of the study area.
 - to identify field survey requirements.
- Detailed survey –
 - to provide adequate local and regional context relative to the values of the flora and vegetation within the study area.
 - to inform an NVCP assessment for the Project.

1.2 STUDY AREA

The study area for the survey comprises 3 polygons, 2 in the north approximately 0.7 ha and 3.5 ha and a third area to the south 244.1 ha for a total area of 248.3 ha (Figure 1-1).



2 LEGISLATIVE CONTEXT

The protection of flora in WA is principally governed by 3 acts:

- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- State *Biodiversity Conservation Act 2016* (BC Act)
- State *Environmental Protection Act 1986* (EP Act).

2.1 COMMONWEALTH

The EPBC Act is administered by the Federal Department of Climate Change, Energy, the Environment and Water (DCCEEW). The EPBC Act provides for the listing of Threatened flora and Threatened Ecological Communities (TECs) as matters of National Environmental Significance (NES). Under the EPBC Act, actions that have, or are likely to have, a significant impact on a matter of NES, require approval from the Australian Government Minister for the Environment through a formal referral process. Key threats and habitat critical to the survival of EPBC Act Threatened species are usually defined in the conservation advice and/or recovery plan for the species.

Conservation categories applicable to Threatened flora species under the EPBC Act are as follows:

- Extinct (EX)¹ – there is no reasonable doubt that the last individual has died
- Extinct in the Wild (EW) – taxa known to survive only in captivity
- Critically Endangered (CR) – taxa facing an extremely high risk of extinction in the wild in the immediate future
- Endangered (EN) – taxa facing a very high risk of extinction in the wild in the near future
- Vulnerable (VU) – taxa facing a high risk of extinction in the wild in the medium-term
- Conservation Dependent (CD)¹ – taxa whose survival depends upon ongoing conservation measures; without these measures, a conservation dependent taxon would be classified as Vulnerable, Endangered, or Critically Endangered.

Ecological communities are defined as ‘naturally occurring biological assemblages that occur in a particular type of habitat’ (English & Blyth 1997). There are 3 categories of TECs under the EPBC Act: Critically Endangered, Endangered, and Vulnerable.

2.2 STATE

2.2.1 Threatened and Priority species

In WA, the BC Act provides for the listing of Threatened flora species (Government of Western Australia 2018a, b) in the following categories:

- Critically Endangered (CR) – species facing an extremely high risk of extinction in the wild in the immediate future.²
- Endangered (EN) – species facing a very high risk of extinction in the wild in the near future.²
- Vulnerable (VU) – species facing a high risk of extinction in the wild in the medium-term future².

¹ Species listed as Extinct and Conservation Dependent are not matters of NES and therefore do not trigger the EPBC Act.

² As determined in accordance with criteria set out in the ministerial guidelines.

The Department of Biodiversity, Conservation, and Attractions (DBCA) administers the BC Act and also maintains a non-statutory list of Priority flora. Priority species are still considered to be of conservation significance – that is they may be Threatened – but cannot be considered for listing under the BC Act until there is adequate understanding of threat levels imposed on them. Species on the Priority flora list are assigned to one of 4 Priority (P) categories, P1 (highest) – P4 (lowest), based on level of knowledge/concern.

2.2.2 Critical habitat

Under the BC Act, habitat is eligible for listing as critical habitat if it is critical to the survival of a Threatened species or a TEC and its listing is otherwise in accordance with the ministerial guidelines.

2.2.3 Threatened and Priority Ecological Communities

The BC Act provides for the listing of TECs in the following categories:

- Critically Endangered – facing an extremely high risk of becoming eligible for listing as a collapsed ecological community in the immediate future²
- Endangered – facing a very high risk of becoming eligible for listing as a collapsed ecological community in the near future²
- Vulnerable – facing a high risk of becoming eligible for listing as a collapsed ecological community in the medium-term future².

An ecological community may be listed as a collapsed ecological community under the BC Act if there is no reasonable doubt that the last occurrence of the ecological community has collapsed or the ecological community has been so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure.

The DBCA also maintains a non-statutory list of Priority Ecological Communities (PECs), which may become TECs in the future; however, do not currently meet survey criteria or that are not adequately defined. PECs are assigned to one of 5 categories depending on their priority for survey or definition, with Priority 1 of highest concern and Priority 5 of lowest concern.

2.2.4 Other significant flora and vegetation

Under the EPA's environmental factor guideline (EPA 2016a), flora and vegetation may be considered significant for a range of reasons other than listing as Threatened or Priority. Specifically:

- flora may be significant for
 - local endemism or association with a restricted habitat type (e.g. surface water or groundwater dependent ecosystems).
 - new species or anomalous features that indicate a potential new species.
 - representing the range of a species (particularly at the extremes of range, recently discovered range extensions, or isolated outliers of the main range).
 - being unusual species, including restricted subspecies, varieties, or naturally occurring hybrids.
 - having relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.
- vegetation may be significant for:
 - having restricted distribution.
 - subject to a degree of historical impact from threatening processes.
 - having a role as a refuge.

- providing an important function required to maintain ecological integrity of a significant ecosystem.

Provided in the guide for assessment of applications to clear native vegetation (DER 2014) is a scale for assessing the bioregional conservation status of ecological vegetation classes (Table 2-1).

Table 2-1 Bioregional conservation status of ecological vegetation classes

Conservation status	Description
Presumed extinct	Probably no longer present in the bioregion
Endangered*	Less than 10% of pre-European extent remains
Vulnerable*	10-30% of pre-European extent exists
Depleted*	More than 30% and up to 50% pre-European extent exists
Least concern	More than 50% of pre-European extent exists and subject to little or no degradation over a majority of this area

*or a combination of depletion, loss of quality, current threats, and rarity gives a comparable status.

2.2.5 Environmentally sensitive areas

Under section 51B of the EP Act the Minister for Environment may declare by notice either a specified area of the State or a class of areas to be Environmentally Sensitive Areas (ESAs). ESAs are declared in the *Environmental Protection (Environmentally Sensitive Areas) Notice 2005* (Government of Western Australia 2005). ESAs are areas where the vegetation has high conservation value and include:

- the area covered by vegetation within 50 m of Threatened flora, to the extent to which the vegetation is continuous with the vegetation in which the Threatened flora is located.
- the area covered by a TEC.
- a defined wetland (Ramsar wetlands, conservation category wetlands and nationally important wetlands) and the area within 50 m of the wetland.
- Bush Forever sites.

2.2.6 Introduced flora

Introduced flora (weeds) pose threats to biodiversity and natural values by successfully out-competing native species for available nutrients, water, space, and sunlight; reducing the natural structural and biological diversity by smothering native plants or preventing them from growing back after clearing, fire, or other disturbance; replacing the native plants that animals use for shelter, food and nesting; and altering fire regimes, often making fires hotter and more destructive (AWC 2007).

Management of some weed species is required under Commonwealth or State frameworks. Key classifications for significant introduced flora that are relevant to this report are:

- Declared Pest – the Biosecurity and Agriculture Management Act 2007, Section 22 makes provision for a plant taxon to be listed as a Declared Pest organism in parts of, or the entire State. Under the Biosecurity and Agriculture Management Regulations 2013 Declared Pests are assigned to one of 3 control categories that dictate the level of management required (DPIRD 2019).
- Weed of National Significance (WoNS) – high impact, established introduced flora causing major economic, environmental, social and/or cultural impacts in a number of states/territories, and which have strong potential for further spread (Australian Weeds Committee 2012). Management is required in accordance with Department of Primary Industries and Regional Development (DPIRD) guidelines for particular WoNS.

Throughout this report, introduced flora species are indicated with an asterisk (*).

3 EXISTING ENVIRONMENT

3.1 INTERIM BIOGEOGRAPHIC REGIONALISATION OF AUSTRALIA

The Interim Biogeographic Regionalisation of Australia (IBRA) classifies Australia's landscapes into 89 'bioregions' and 419 'subregions' based on climate, geology, landform, native vegetation and species information (DoEE 2016). In WA there are 27 bioregions and 55 subregions. The study areas are located within the Chichester (PIL1) and Roebourne (PIL4) subregions of the Pilbara bioregion (Figure 3-1).

The Chichester subregion encompasses the northern part of the Pilbara Craton. It consists of undulating Archaean granite and basalt plains, featuring areas of notable basaltic ranges. Drainage is concentrated in the northern areas due to numerous rivers. The plains are characterized by shrub steppes dominated by *Acacia inaequilatera* over *Triodia wiseana* hummock grasslands, while the ranges are home to *Eucalyptus leucophloia* tree steppes.

The Roebourne subregion features Quaternary alluvial and older colluvial coastal and subcoastal plains, characterized by a grass savannah of mixed bunch and hummock grasses, alongside dwarf shrub steppe dominated by *Acacia stellaticeps*, *A. pyrifolia*, and *A. inaequilatera*. The uplands are primarily covered by *Triodia* hummock grasslands. Ephemeral drainage lines support woodlands of *Eucalyptus victrix* or *Corymbia hamersleyana*. Samphire, Sporobolus, and mangrove communities thrive on marine alluvial flats and river deltas. Resistant linear ranges of basalt traverse the coastal plains, with minor granite exposures. The islands are either Quaternary sand accumulations or composed of basalt or limestone, or a combination of all.

3.2 LAND SYSTEMS AND SURFACE GEOLOGY

DPIRD undertook land system mapping for WA using a nesting soil-landscape mapping hierarchy (Payne & Schoknecht 2011). While the primary purpose of the mapping is to inform pastoral and agricultural land capability, it is also useful for informing biological assessments. Under this hierarchy, land systems are defined as areas with recurring patterns of landforms, soils, vegetation and drainage (Payne & Leighton 2004).

The study area intersects 3 land systems (Table 3-1; Figure 3-2).

Table 3-1 Land systems and extent in study area

Land system	Description	Area (ha)	% of study area
Uaroo System	Broad sandy plains, pebbly plains, and drainage tracts supporting hard and soft spinifex hummock grasslands with scattered Acacia shrubs.	139.62	56.25
Mallina System	Sandy surfaced alluvial plains supporting soft spinifex grasslands and minor hard spinifex and tussock grasslands.	69.17	27.87
Ruth System	Hills and ridges of volcanic and other rocks supporting shrubby hard spinifex and occasionally soft spinifex grasslands.	39.42	15.88

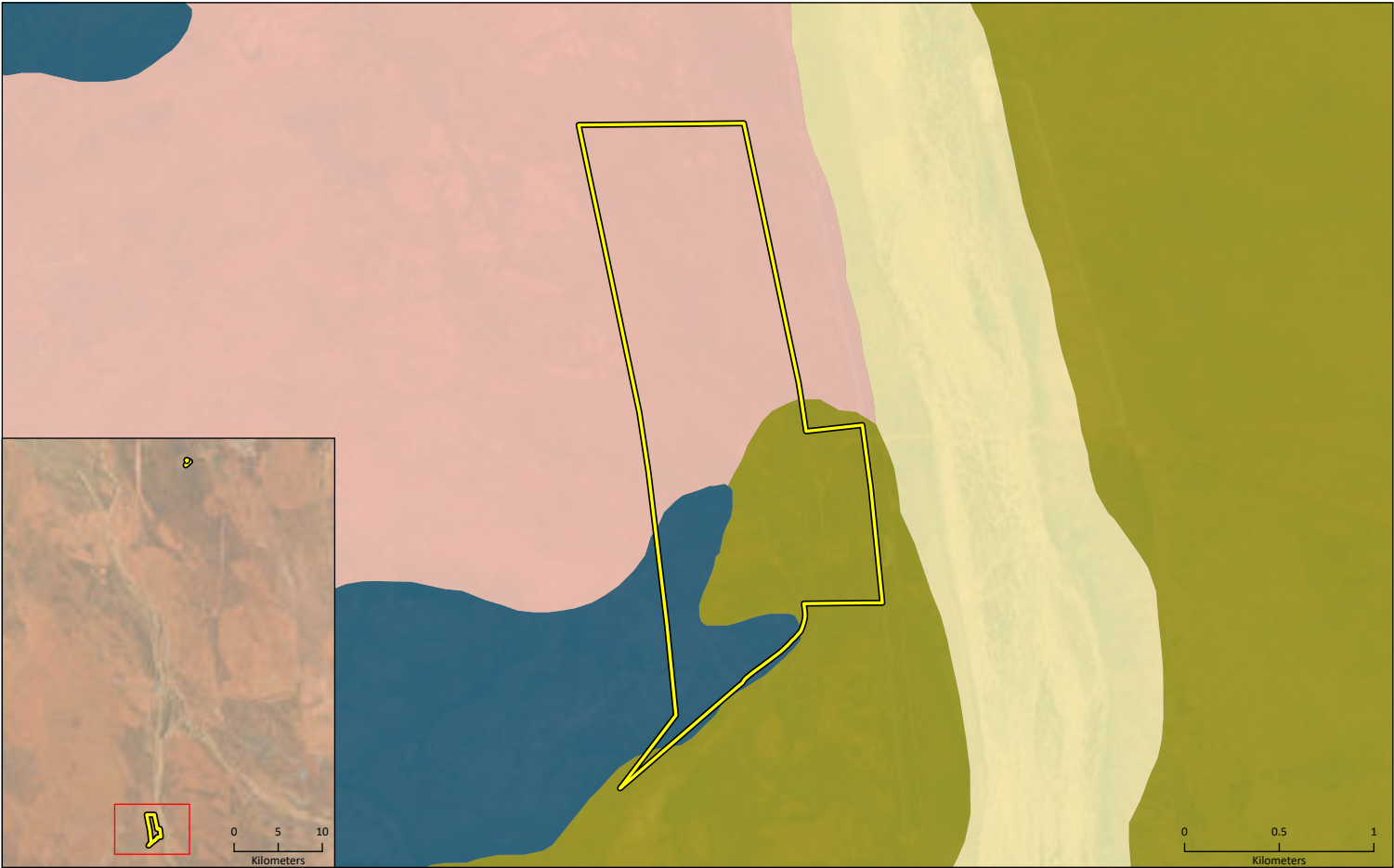
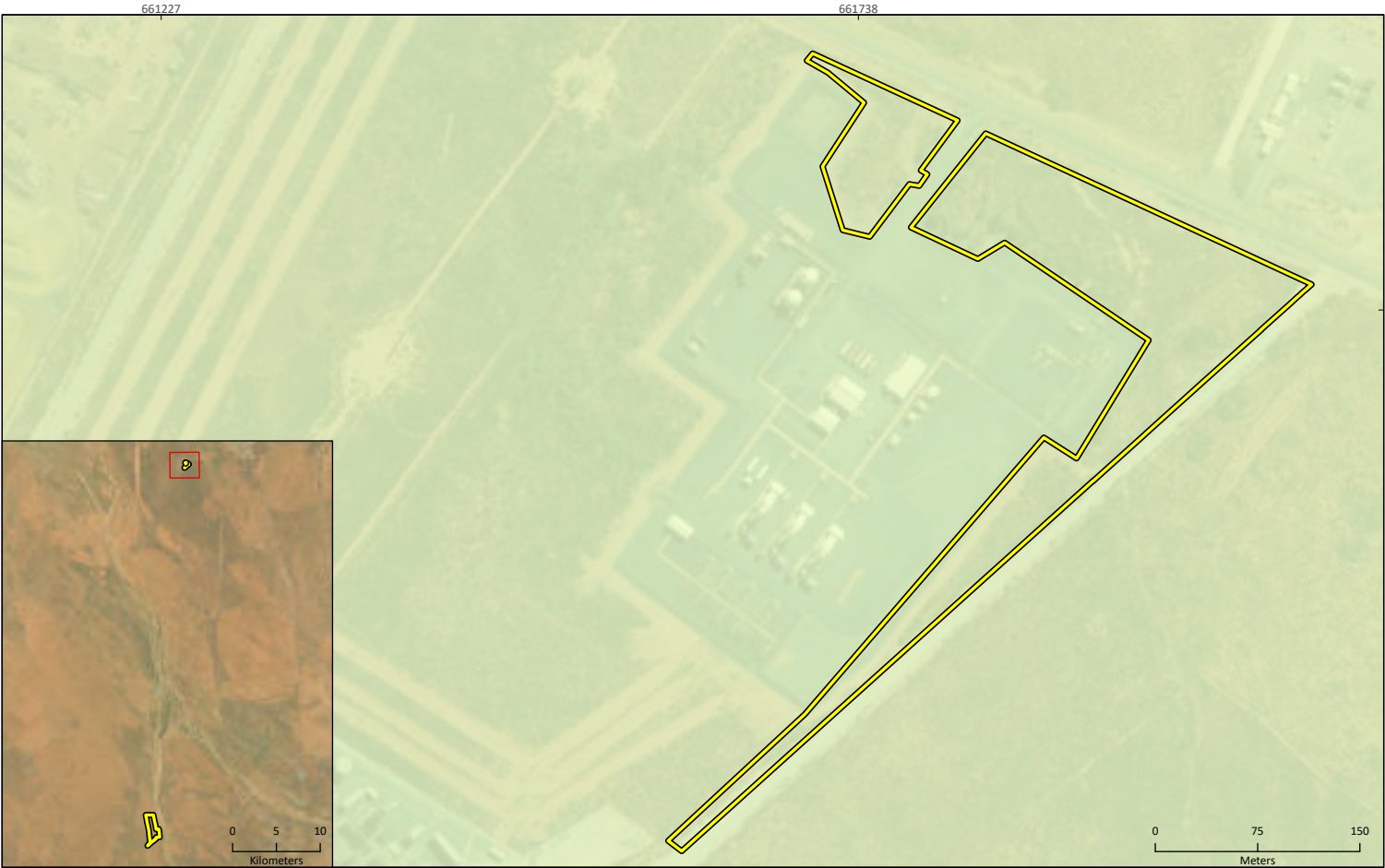
According to the Surface Geology of Australia 1:1,000,000 scale, Western Australia database (Stewart *et al.* 2008), the study area intersects 2 geological formations (Table 3-2; Figure 3-3).

Table 3-2 Surface geology of the study area, extent by deposit type

Surface geology	Abbreviation	Description	Area (ha)	% of study area
alluvium 38485	Qa	Channel and flood plain alluvium; gravel, sand, silt, clay, locally calcreted	188.84	76.08
Constantine Sandstone	Ascc	Metamorphosed fine to coarse grained wacke, shale, iron formation, poorly sorted arkose, sub-arkosic, and lithic sandstone, conglomerate, pebbly sandstone, siltstone, tuff, turbidite, basalt; intruded by mafic to ultramafic sills	59.37	23.92



Western Australia PERTH	APA Port Hedland Transmission Line <table border="1"> <tr> <td>Project No</td> <td>1690</td> </tr> <tr> <td>Date</td> <td>9/01/2025</td> </tr> <tr> <td>Drawn by</td> <td>BK</td> </tr> <tr> <td>Map author</td> <td>BA</td> </tr> </table> Kilometers 1:181,700 (at A4) GDA 1994 MGA Zone 50 All information within this map is current as of 9/01/2025. This product is subject to COPYRIGHT and is property of Phoenix Environmental Sciences (Phoenix). While Phoenix has taken care to ensure the accuracy of this product, Phoenix make no representations or warranties about its accuracy, completeness or suitability for any particular purpose.	Project No	1690	Date	9/01/2025	Drawn by	BK	Map author	BA	Study area Region, subregion Pilbara, Chichester Pilbara, Roebourne	Figure 3-1 Study area in relation to IBRA bioregions and subregions PHOENIX ENVIRONMENTAL SCIENCES
Project No	1690										
Date	9/01/2025										
Drawn by	BK										
Map author	BA										



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Port Hedland Transmission Line

Project No 1690
Date 9/01/2025
Drawn by BK
Map author BA



1:5,114 (at A4) GDA 1994 MGA Zone 50

Study area

Land systems

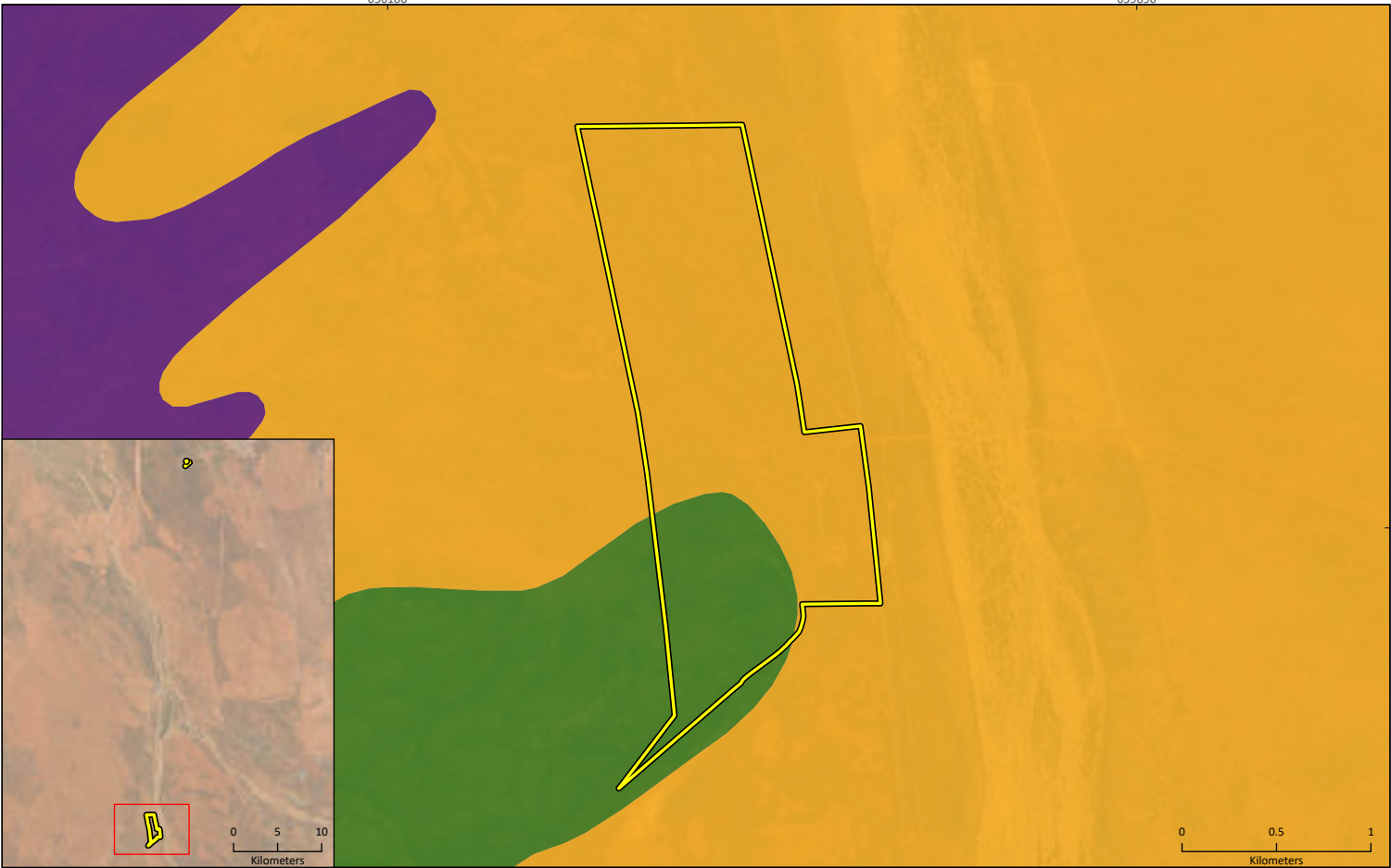
- Mallina System
- River System
- Ruth System
- Uaroo System
- Uaroo System

Figure 3-2

Land systems within the study area



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	APA Port Hedland Transmission Line			 Study area	Surface geology	 Qa	 Ascc	 Asd	 Qa
	Project No 1690 Date 9/01/2025 Drawn by BK Map author BA								
1:5,114 (at A4)		GDA 1994 MGA Zone 50							

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Figure 3-3
Surface geology in the study area



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3.3 CLIMATE AND WEATHER

The climate of the Chichester and Roebourne subregions are described as arid (semi-desert) tropical. The nearest Bureau of Meteorology (BoM) weather station with comprehensive data collection and recent historic climate data is Port Hedland Airport (no. 04032, Latitude: 20.37°S Longitude 118.63°E), located 10.6 km NE of the 2 smaller study areas, and 45.4km NE of the larger study area.

Port Hedland Airport records the highest mean maximum monthly temperature (36.8°C) in December and March (lowest in July, 27.4°C) and the lowest minimum mean monthly temperature (12.5°C) in July (highest in January, 25.7°C; Figure 3-4).

Mean annual rainfall is 313.1 mm with February and January recording the highest monthly means (88.3 and 61.5 mm respectively; Figure 3-4).

Daily mean maximum temperatures at Port Hedland Airport preceding the surveys trended towards warmer than the average by up to 5.8 degrees (Figure 3-4). The daily minimum temperatures were also warmer than the long-term averages by up to 1.9 °C, with the exception of January and March which recorded minimum temperatures up to 1.0 °C below the average (Figure 3-4). This shows a warming trend within the Pilbara region (Figure 3-4).

Records from Port Hedland Airport show the highest rainfall preceding the survey was August with a total monthly rainfall of 28.8 mm, which was 24 mm higher than the long-term average (Figure 3 3). Despite this, the region had a very dry 12 months leading up to the survey, with the region receiving just 86 mm total rainfall (227.1 mm less than the annual average; Figure 3-4).

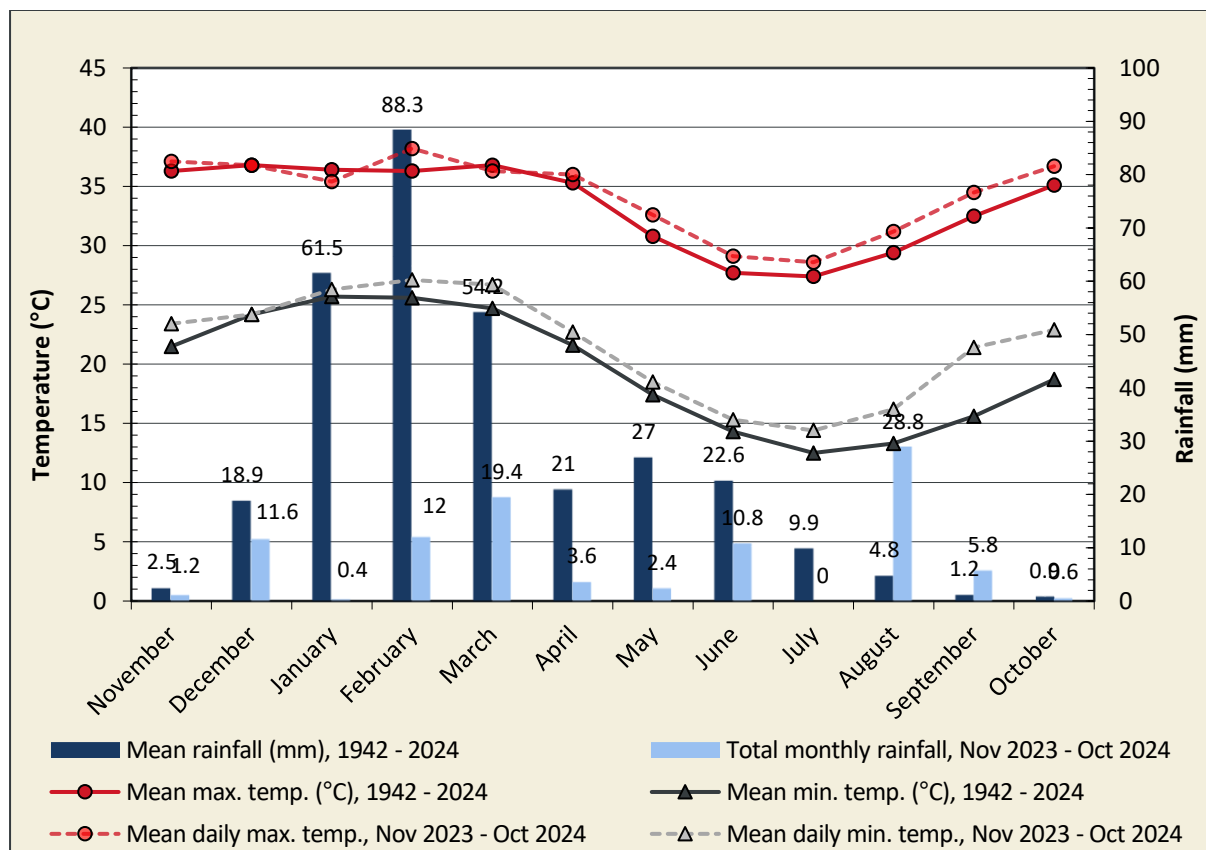


Figure 3-4 Annual climate and weather data for Port Hedland Airport (no. 04032) and mean monthly data for the 12 months preceding the survey (BoM 2023)

3.4 LAND USE

The dominant land uses within the Chichester and Roebourne subregions are grazing of native pastures, followed by Aboriginal lands, and Reserves, Conservation areas, and mining leases (Kendrick & McKenzie 2001; Kendrick & Stanley 2001).

3.5 CONSERVATION RESERVES AND ESAs

There are no lands of interest or Environmentally Sensitive Areas that intersect the Port Hedland Transmission Line study area. No conservation reserves, national parks, or State forests occur within 50 km of the study area. The closest ESA is 14.45 km northwest of the northern most polygon. There are 4 ESAs within a 30 km radius of the northern polygons (Figure 1-1).

4 METHODS

The single season Detailed survey was conducted in accordance with relevant survey guidelines and guidance, including:

- *EPA Environmental Factor Guideline: Flora and vegetation* (EPA 2016a).
- *EPA Technical Guidance: Flora and vegetation surveys for Environmental Impact Assessment* (EPA 2016b).

4.1 DESKTOP REVIEW

Searches of several biological databases were undertaken previously (Biologic 2024) for the Project, this data was provided to Phoenix by APA to identify and prepare lists of significant flora and vegetation that may occur within the study area (Table 4-1).

Table 4-1 Database searches conducted for the desktop review*

Database	Target group/s	Search coordinates and extent
Protected Matters Search Tool (DAWE 2022)	EPBC Act Threatened flora and ecological communities	Study area plus a 40 km buffer
DBCA Threatened and Priority flora Database (DBCA 2022c)	Threatened and Priority flora	Study area plus a 40 km buffer
DBCA Threatened and Priority Ecological Communities Database (DBCA 2022b)	TECs and PECs	Study area plus a 40 km buffer
Western Australian Herbarium databases (DBCA 2022c)	Flora records	Study area plus a 40 km buffer
Dandjoo Biodiversity Data Repository (DBCA 2022a)	Flora records	Approximate centre point of study area (-20.664, 118.463) with 40 km buffer
Atlas of Living Australia (ALA 2022)	Flora records	Study area plus a 40 km buffer
Declared Plants Database – Western Australian Organism List (WAOL) (DPIRD 2022)	Declared pest records	Town of Port Hedland
Index of Biodiversity Surveys for Assessment (IBSA) database (DWER 2024) for nearby survey reports and data	Flora and vegetation survey records and data	Study area plus a 40 km buffer

*content referenced from previous report by Biologic (2024) with IBSA searched for new previous surveys

A literature search was conducted for accessible reports for biological surveys conducted within 40 km of the study area to build on the lists developed from the database searches (Table 4-2). In total, 5 previous surveys overlap the original study area.

Table 4-2 Survey reports included in the desktop review*

Report author	Survey description	Project	Distance from original study area
360 Environmental (2018)	Detailed flora and vegetation survey	Wodgina Gas Pipeline	Partially overlapping
ENV (2011)	Detailed flora and vegetation assessment	Port Hedland Regional	Partially overlapping
GHD (2010)	Area Detailed flora and fauna assessment	LandCorp Report for Proposed Boodarie Industrial	Partially overlapping
Woodman (2011)	Detailed Flora and Vegetation Studies	Atlas Iron Limited Mount Dove Direct Shipping Ore Project	Partially overlapping
ENV (2009)	Targeted Priority flora Survey	Port Hedland Area	Partially overlapping
Ecoscape (2018)	Flora and Vegetation Desktop Assessment	Pilbara Transmission	Directly adjacent east
Phoenix (2022)	Detailed flora and vegetation assessment	Port Hedland Solar Farm Project	Directly adjacent east
Biota (2008)	A Flora and Fauna Assessment	RGP5 DMMA A, Port Hedland Harbour	~7 km N
Emerge (2019)	Technical Memorandum: Reconnaissance Flora and Fauna Survey	Port Hedland International Airport-Highway precinct 2	9.6 km NE
Ecotec (2018)	Extension Reconnaissance Flora, Vegetation, and Fauna Habitat Survey	Proposed Wilga Quarry	~30 km E
Outback Ecology (2009)	Detailed Flora and Vegetation Assessment	Wodgina DSO Project	36.1 km SE
Ecologia (2012)	Detailed Flora and Vegetation Assessment	Fortescue Metals Group Ltd North Star	38.4 km SE
Ecoscape (2020)	Reconnaissance Flora and Fauna Survey	Pippingarra and Wodgina Roads	~42 km SE
Ecoscape (2014)	Reconnaissance Flora and Vegetation Assessment	Rutila Resources Railway Corridor	~78 km SW

*content referenced from previous report by Biologic (2024)

4.2 FIELD SURVEY

4.2.1 Survey timing

Field survey dates for the current one season flora and vegetation Detailed survey were during spring from 9th – 11th October 2024.

4.2.2 Field methods

Field methods for the flora and vegetation survey of the study area included:

- surveying of quadrats and relevés (see 4.2.2.1)
- targeted flora searches (4.2.2.2)

- vegetation type and condition mapping (4.2.2.3, 4.2.2.4,)
- TEC/PEC assessment (4.2.2.5).

Prior to the commencement of the field survey, data including satellite imagery, survey boundary, and pre-selected vegetation quadrats, and relevés were loaded onto electronic field devices. The field survey involved assessing and mapping vegetation boundaries, conducting quadrat, and relevé sampling and collecting opportunistic flora specimens. GPS locations of vegetation and condition boundaries, survey sites, and flora specimen data were recorded digitally.

4.2.2.1 Quadrats, relevés and mapping notes

Quadrat locations were selected to ensure that an accurate representation of the major vegetation types within the study area were sampled adequately, with a goal of 3 quadrats per vegetation type. Two methods were used for the selection of quadrat placement within the study area. Preliminary quadrat locations were pre-selected using aerial photography, with selection based on apparent changes in the vegetation visible in the aerial imagery. Final quadrat placement was determined in the field while ground-truthing the study area on foot. Some preliminary quadrats were moved to locations which better represented vegetation types and some quadrats were changed to relevés, where only dominant vegetation was recorded for the purposes of accurate vegetation mapping.

In total, 12 quadrats and 1 relevé were surveyed across the study area (Figure 4-1; Appendix 1).

Quadrat sampling dimensions were 50 m x 50 m in accordance with EPA guidance for the Pilbara bioregion. The following information was recorded for each quadrat (Appendix 2):

- location – the geographic coordinates of all 4 corners of the quadrat in WGS84 projection
- description of vegetation – a broad description utilising the structural formation and height classes based on National Vegetation Information System (ESCAVI 2003) and in accordance with EPA (2016b) (Appendix 3)
- habitat – a brief description of landform and habitat
- geology – a broad description of surface soil type and rock type
- disturbance history – a description of any observed disturbance including an estimate of time since last fire, weed invasions, soil disturbance, human activity, and fauna activity
- vegetation condition – using the condition scale in EPA (2016b) for the Eremaean Botanical Province
- height and percentage foliage cover (PFC) – a visual estimate of cover of total vegetation cover, cover of shrubs and trees >2 m tall, cover of shrubs <2 m, total grass cover and total herb cover
- photograph – a colour photograph of the vegetation within each quadrat in a south-easterly direction from the north-west corner of the quadrat
- flora species list – comprehensive list of all flora species recorded within the quadrat.

To ensure accurate taxonomic identification of flora species present within the study area, collections were made of each specimen at least once and each collection was pressed and documented for identification using the WA Herbarium resources.

For each species identified, records on FloraBase and the Australasian Virtual Herbarium were consulted to provide information on known ranges to determine whether the study area represented a range extension for the species.

Relevés were sampled within vegetation units where dominant species, soils, and topography were representative of vegetation surveyed in quadrats. Information collected in relevés was the same as for quadrats with the exception that:

- only a single geographic coordinate was recorded

- only prominent flora species were recorded.

Mapping notes comprised a brief description of the vegetation to assist with mapping and to describe vegetation in the vicinity of opportunistic collections of species not present in quadrats and relevés.

4.2.2.2 Targeted flora searches

Targeted searches were undertaken for significant flora (Threatened and Priority), Declared Pests, and WoNS. Remnant vegetation was traversed by foot in meandering transects with the searches focused on habitats considered likely to support significant flora, in addition to previously recorded locations of significant plants or populations in close proximity to the study area.

If a flora species was considered to potentially be a significant species (i.e. similar floristic characteristics and occurring within suitable habitat) the following information was collected:

- GPS coordinates, including population boundary where applicable.
- description of the habitat and floristic community in which the potential significant species was located.
- population size estimate (i.e. estimated number of individual plants) where applicable.
- specimen collection for taxonomic identification and lodgement at the WA Herbarium.
- photograph of live plant in situ and description of important details, such as flower colour, height of individual, or average height of population.

Following the field survey, the likelihood of occurrence for each significant flora species identified in the desktop review was assessed and assigned to one of 3 ratings:

- recorded – species recorded within the study area by previous or current survey.
- possible – study area within known range of species; potential habitat within the study area, records within 5 km of study area and may not have been detectable during survey (e.g. survey conducted outside flowering period, annual plant survey conducted outside likely period of occurrence, small herbaceous plant in dense vegetation), or entire area of habitat not thoroughly searched.
- unlikely – study area outside known range of species and/or no suitable habitat present in study area and/or suitable/potential habitat present but study area considered adequately searched for the species.

4.2.2.3 Vegetation type mapping

Vegetation mapping was undertaken at a scale of 1:10,000 using the National Vegetation Information System (NVIS) sub-association level (L5) for structural descriptions (ESCAVI 2003). The vegetation descriptions from quadrats and relevés from the survey were grouped according to similarity of community structure (i.e. canopy levels), species composition and combination of species and the prevalent community structure (i.e. woodland, shrubland, etc.). The vegetation boundaries were mapped utilising ArcGIS ESRI imagery and from vegetation boundaries recorded on GPS during the field survey.

To support delineation of vegetation types, a cluster analysis was conducted based on species presence in each quadrat. The fusion strategy for the site classification was flexible UPGMA with a beta value of -0.1 and Bray Curtis association measure in the software package PATN (Belbin 2003). A dendrogram was produced to illustrate the similarities between the vegetation units identified. Statistically distinct vegetation units (the floristic group) classified the vegetation at a local scale. Local scale vegetation units were described at NVIS Level V – Association (ESCAVI 2003). The term

‘vegetation type’ was used for local scale vegetation units in accordance with EPA technical guidance (EPA 2016b).

4.2.2.4 Vegetation condition mapping

The condition of vegetation was mapped across the study area based on the appropriate condition scale for the Eremaean Botanical Province (Trudgen 1988 in EPA 2016b) (Table 4-3). The vegetation condition ratings relate to vegetation structure, the level of disturbance, and weed cover at each structural layer and the ability of the vegetation unit to regenerate. Vegetation condition ranges from Excellent being the highest rating to Completely Degraded as the lowest.

Table 4-3 Vegetation condition rating scale (EPA 2016b)

Condition rating	Description
Excellent	Pristine or nearly so, no obvious signs of damage caused by human activities since European settlement.
Very Good	Some relatively slight signs of damage caused by human activities since European settlement. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds, or occasional vehicle tracks.
Good	More obvious signs of damage caused by human activity since European settlement, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or slightly aggressive weeds.
Poor	Still retains basic vegetation structure or ability to regenerate it after very obvious impacts of human activities since European settlement, such as grazing, partial clearing, frequent fires, or aggressive weeds.
Degraded	Severely impacted by grazing, very frequent fires, clearing, or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species present including very aggressive species.
Completely Degraded	Areas that are completely or almost completely without native species in the structure of their vegetation; i.e. areas that are cleared or ‘parkland cleared’ with their flora comprising weed or crop species with isolated native trees or shrubs.

4.2.2.5 TEC/PEC assessment

The description and locations provided in the DBCA TEC/PEC database search were compared to observations made in the field and following statistical analysis of significant vegetation types to arrive at conclusions regarding the presence/absence of ecological communities reported in the database searches.

4.2.2.6 Analysis of survey completeness

A species accumulation curve based on accumulated species versus number of sites surveyed was used to evaluate the level of adequacy of the survey effort. The species accumulation curve was generated by inputting the site-species matrix into Phoenix’s proprietary spreadsheet.

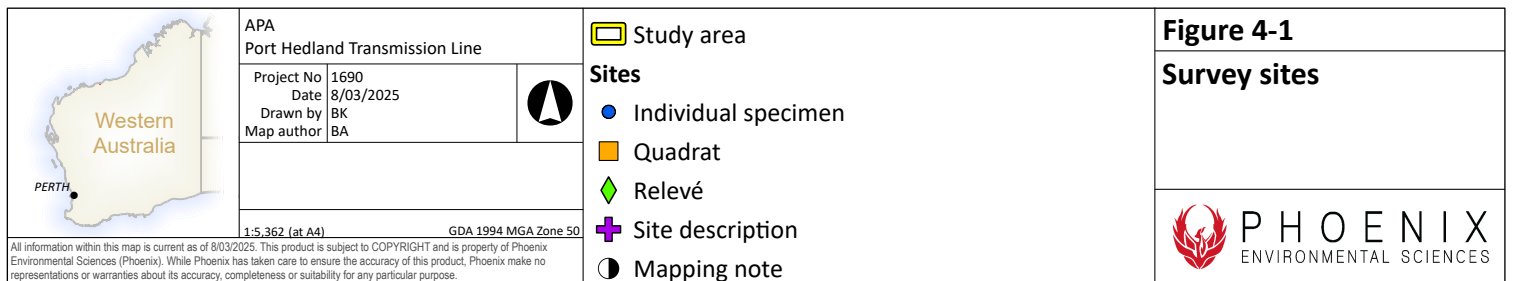
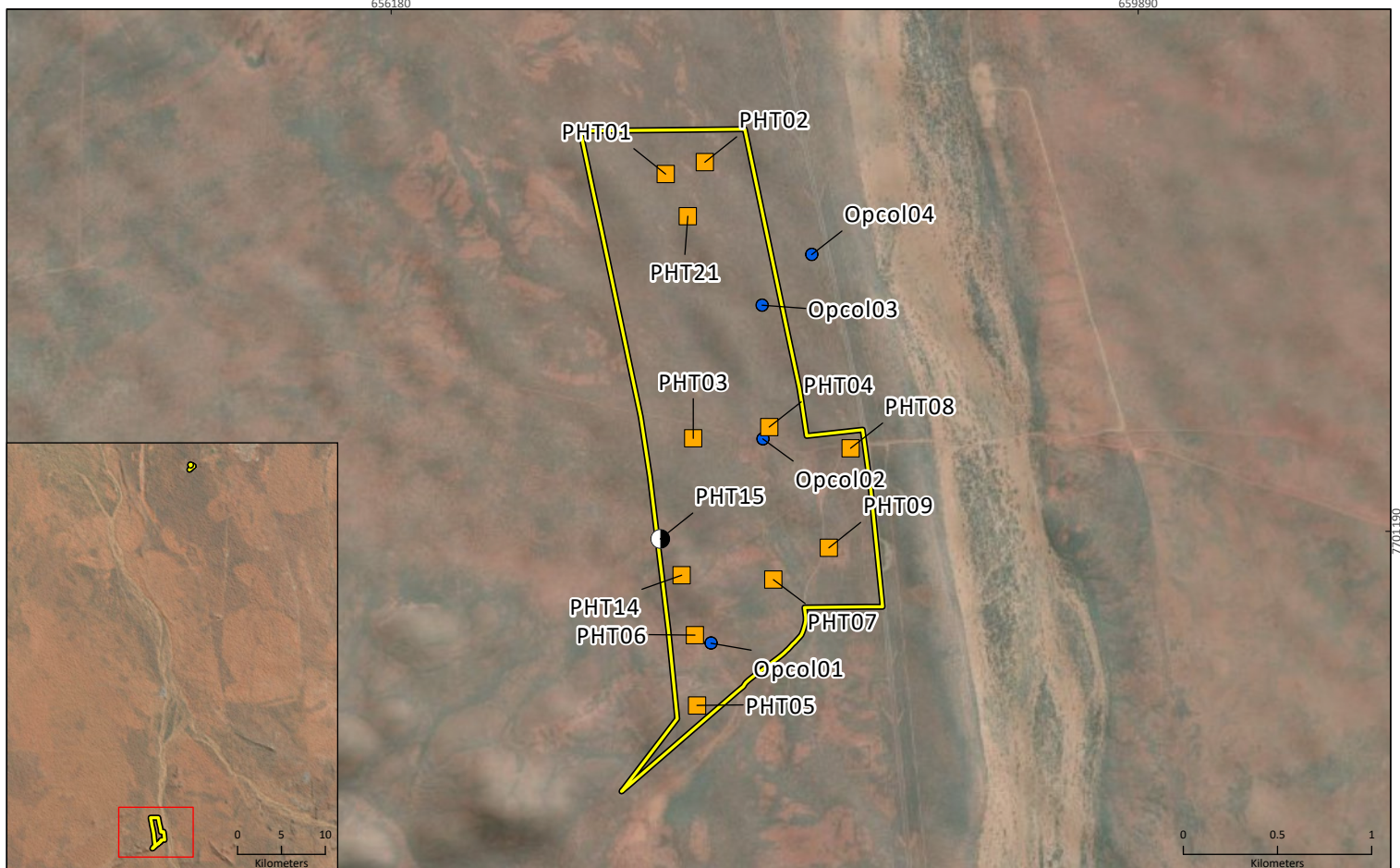
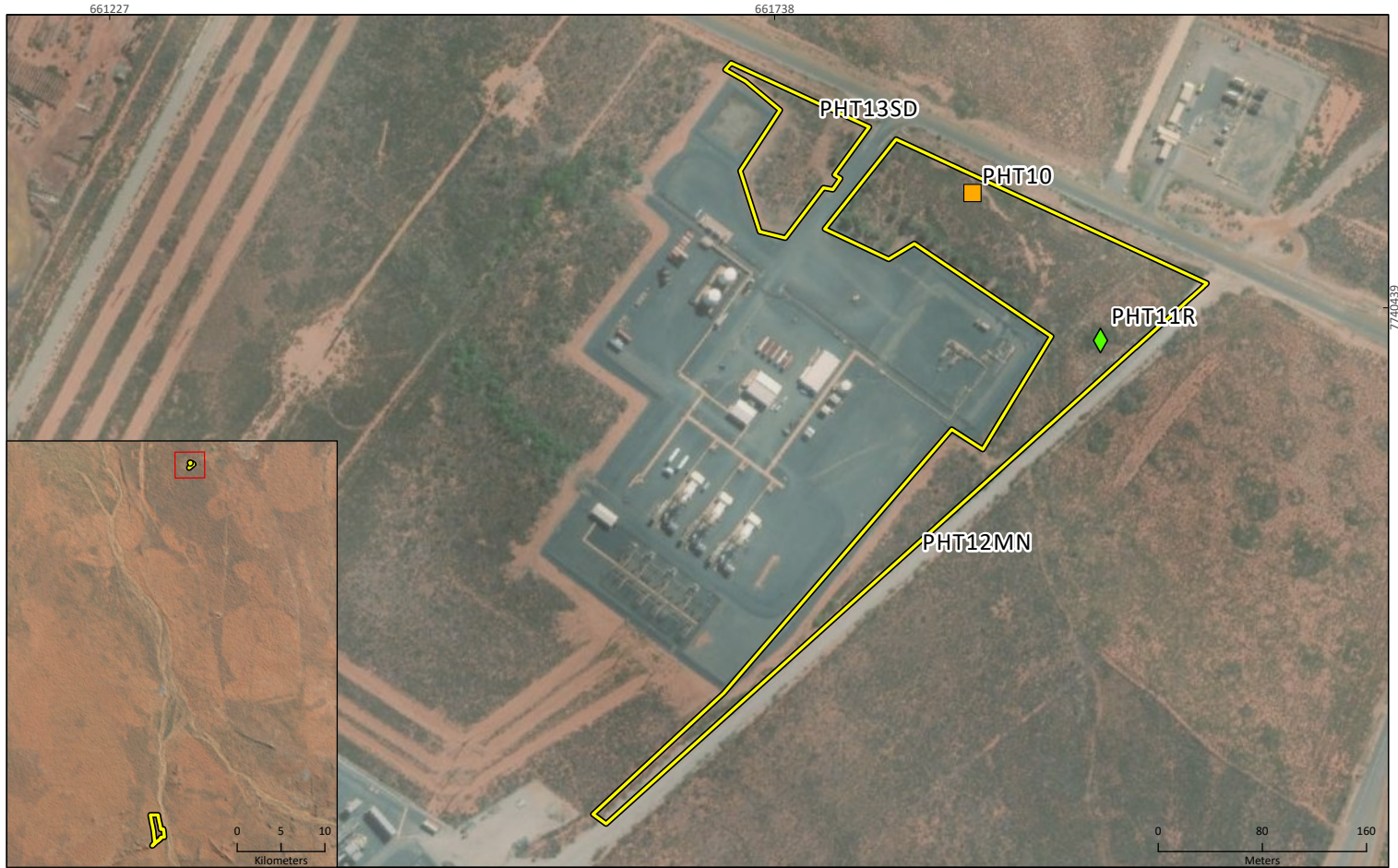
A minimum of 3 quadrats per vegetation type were installed where practicable (subject to available hectares of each vegetation type within the study area and avoidance of pseudo-replication within the single polygons) during the current survey.

4.2.3 Survey personnel

The personnel involved in the surveys are listed in Table 4-4. All survey work was carried out under relevant licences issued by DBCA under the BC Act.

Table 4-4 Survey personnel

Name	Permit	Qualifications	Role/s
Dr David Leach	FB62000045 TFL 2324-0019	PhD (Plant Biology); BAppSciHons (Conservation & Park Management)	Senior Botanist, team leader, fieldwork, taxonomy
Beth Arbery	FB 62000639 TFL 2324-0057	Bach of Science (Environmental Science, and Conservation, and Wildlife Biology)	Botanist, fieldwork, taxonomy, reporting
Dr Grant Wells	NA	PhD (Botany)	Reporting, report review
Dr Grace Wells	NA	PhD (Botany)	Mapping, report review
Dr Andrew Perkins	NA	BSc. (Hons) (University of Sydney); PhD (University of Sydney)	Taxonomy
Tim Morald	NA	BAppSci (Environmental Management)	Taxonomy
Brody Loneragan	NA	BSc. Hons (Env.Sci.)	Taxonomy
Brigitte Kovar	NA	Master of Geospatial Intelligence	Map production



5 RESULTS

5.1 DESKTOP REVIEW

5.1.1 Flora assemblage

The desktop search extent identified records of 756 flora taxa within the desktop search extent. The taxa represented 87 families and 274 genera, the most prominent families were the Asteraceae (63), Fabaceae (57) and Chenopodiaceae (50).

5.1.2 Significant flora

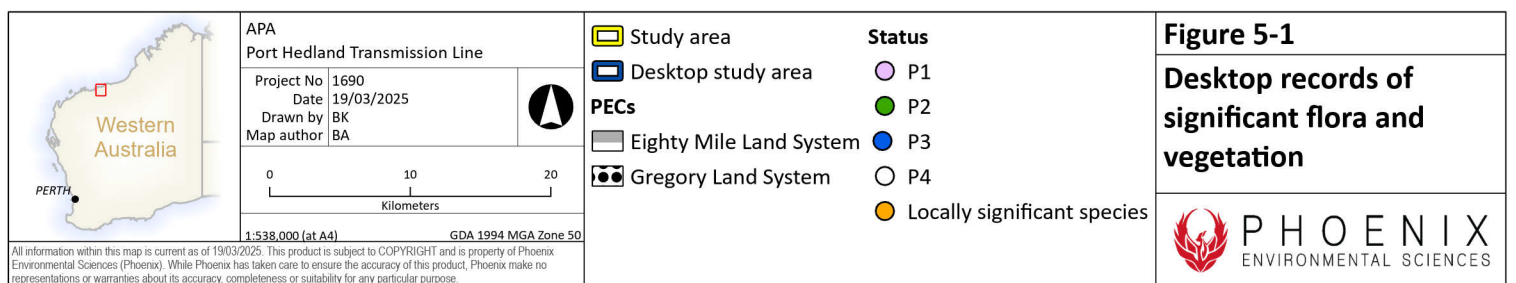
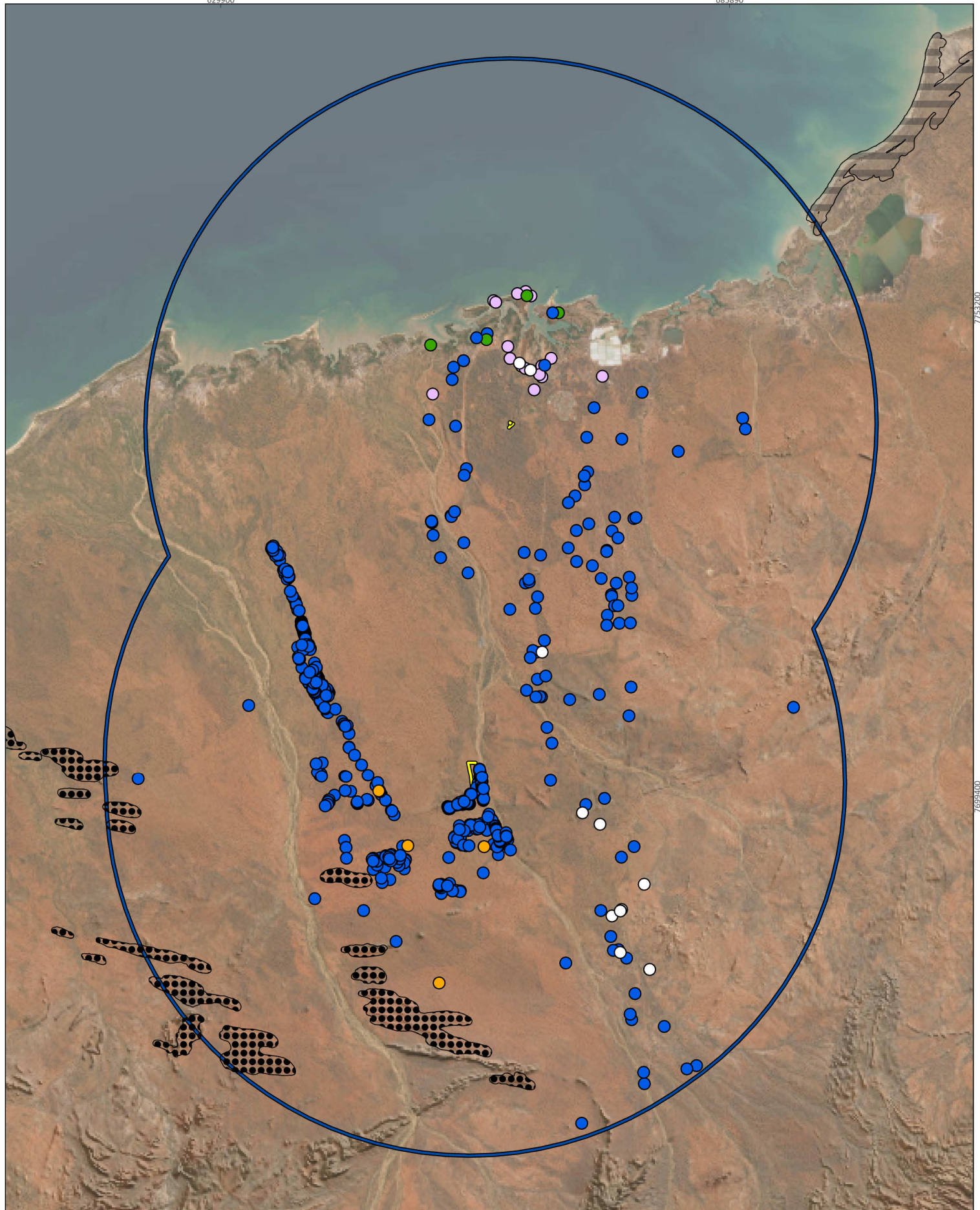
Records of 11 significant flora species (listed under the EPBC Act, BC Act, or DBCA's Priority List) were identified within the desktop search extent as occurring in the vicinity of the study area (Table 5-1). These records identified comprised:

- one Priority 1 flora taxa.
- one Priority 2 flora taxa.
- 7 Priority 3 flora taxa.
- 2 Priority 4 flora taxa.

1 significant flora taxon, *Abutilon* sp. Pritzelianum (S. van Leeuwen 5095) (P3), was recorded as occurring in the study area (Figure 5-1) (Biologic 2024).

Table 5-1 Significant flora identified in the desktop review

Species	Status	Proximity to study area	Habitat
<i>Tephrosia rosea</i> var. Port Hedland (A.S. George 1114)	P1 (DBCA)	4.4 km NNE of study area	Predominantly recorded on coastal dunes but also in red sand plain in <i>Acacia</i> shrublands over <i>Triodia</i> hummock grasslands. Flowers in March and July to September.
<i>Gomphrena pusilla</i>	P2 (DBCA)	9.4 km NNW of study area	Grows in open Shrubland of <i>Acacia bivenosa</i> over open <i>Triodia epactia</i> hummock grassland of over an open tussock of <i>Cenchrus ciliaris</i> along limestone ridge tops on brown loam, exposed calcrete rock, and calcareous coastal dunes. Flowers March to April or June.
<i>Abutilon</i> sp. Pritzelianum (S. van Leeuwen 5095)	P3 (DBCA)	Within study area	Sand plains. orange-brown sandy loam substrate. Flowers in April or June to September.
<i>Euphorbia clementii</i>	P3 (DBCA)	12.3 km E of study area	Gravelly hillsides, stony grounds.
<i>Gomphrena leptophylla</i>	P3 (DBCA)	8.2 km NW of study area	Grows in hummock grassland, with <i>Triodia epactia</i> , <i>T. secunda</i> along drainage lines and floodplains in red sandy loam soils. Open flats, sandy creek beds, edges salt pans & marshes, stony hillsides. Flowers March to September.
<i>Gymnanthera cunninghamii</i>	P3 (DBCA)	7.5 km NNE of study area	Grows in <i>Eucalyptus</i> , <i>Melaleuca</i> and <i>Acacia</i> woodlands over mixed grasslands associated with riverbanks, creeks, drainage lines, and floodplains. Flowers January to December.
<i>Rothia indica</i> subsp. <i>australis</i>	P3 (DBCA)	10.3 km NE of study area	Grows in shrublands over <i>Triodia</i> hummock grasslands in red sandy to loamy soils. Flowers April to August.
<i>Stylidium weeliwolli</i>	P3 (DBCA)	23.8 km SE of study area	On the edge of permanent water. Red/brown sand/loam/clay. Flowers August to September.
<i>Triodia chichesterensis</i>	P3 (DBCA)	12.7 km NE of study area	Grows in clay-loam soils frequently associated with quartzite on undulating plains and low rises in woodlands and shrublands over <i>Triodia</i> hummock grasslands.
<i>Bulbostylis burbridgeae</i>	P4 (DBCA)	6.2 km NNE of study area	Grows in <i>Triodia</i> hummock grasslands typically associated with granite boulders, hill tops, and outcrops. Flowers in March or June to August.
<i>Ptilotus mollis</i>	P4 (DBCA)	14.2 km NNE of study area	Grows on iron outcropping, hill slopes in skeletal red/brown clay-loam soils. Flowers in May or September.



5.1.3 Introduced flora

The desktop review identified records of 96 introduced species within the desktop search extent, of which 48 are a Declared Pest and 23 are WoNS (Table 5-2; Appendix 4).

Table 5-2 Desktop records of significant weeds

Family	Taxon	Declared Pest	WoNS
Alismataceae	* <i>Sagittaria platyphylla</i>	✓	✓
Apocynaceae	* <i>Calotropis procera</i>	✓	
	* <i>Cryptostegia madagascariensis</i>	✓	
Araceae	* <i>Pistia stratiotes</i>	✓	
	* <i>Zantedeschia aethiopica</i>	✓	
Araliaceae	* <i>Hydrocotyle ranunculoides</i>	✓	
Asparagaceae	* <i>Asparagus asparagoides</i>	✓	✓
Asteraceae	* <i>Chondrilla juncea</i>	✓	
	* <i>Onopordum acaulon</i>	✓	
	* <i>Silybum marianum</i>	✓	
	* <i>Xanthium spinosum</i>	✓	
	* <i>Xanthium strumarium</i>	✓	
Boraginaceae	* <i>Echium plantagineum</i>	✓	
Cactaceae	* <i>Austrocylindropuntia cylindrica</i>	✓	✓
	* <i>Austrocylindropuntia subulata</i>	✓	✓
	* <i>Cylindropuntia fulgida</i>	✓	
	* <i>Cylindropuntia imbricata</i>	✓	
	* <i>Cylindropuntia kleiniae</i>	✓	
	* <i>Cylindropuntia pallida</i>	✓	
	* <i>Cylindropuntia tunicata</i>	✓	
	* <i>Opuntia elata</i>	✓	✓
	* <i>Opuntia elatior</i>	✓	✓
	* <i>Opuntia engelmannii</i>	✓	✓
	* <i>Opuntia ficus-indica</i>	✓	✓
	* <i>Opuntia microdasys</i>	✓	✓
	* <i>Opuntia monacantha</i>	✓	✓
	* <i>Opuntia polyacantha</i>	✓	✓
	* <i>Opuntia puberula</i>	✓	✓
	* <i>Opuntia stricta</i>	✓	✓
	* <i>Opuntia tomentosa</i>	✓	✓
Cucurbitaceae	* <i>Coccinia grandis</i>	✓	
Euphorbiaceae	* <i>Jatropha gossypifolia</i>	✓	
Fabaceae	* <i>Alhagi maurorum</i>	✓	
	* <i>Neltuma glandulosa</i> × <i>velutina</i>	✓	✓
	* <i>Parkinsonia aculeata</i>	✓	✓

Family	Taxon	Declared Pest	WoNS
	<i>*Senna alata</i>	✓	
	<i>*Senna obtusifolia</i>	✓	
	<i>*Ulex europaeus</i>	✓	✓
Iridaceae	<i>*Moraea flaccida</i>	✓	
	<i>*Moraea miniata</i>	✓	
Rhamnaceae	<i>*Ziziphus mauritiana</i>	✓	
Rosaceae	<i>*Rubus anglocandicans</i>	✓	✓
	<i>*Rubus laudatus</i>	✓	✓
	<i>*Rubus rugosus</i>	✓	✓
Solanaceae	<i>*Solanum elaeagnifolium</i>	✓	✓
	<i>*Solanum linnaeanum</i>	✓	
Tamaricaceae	<i>*Tamarix aphylla</i>	✓	✓
Verbenaceae	<i>*Lantana camara</i>	✓	✓

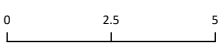
5.1.4 Vegetation associations

Regional scale pre-European vegetation mapping for Western Australia (Beard *et al.* 2013; DPIRD 2018) identifies mapped 4 vegetation associations in the study area (Table 5-3; Figure 5-2). The remaining extent of all vegetation associations at the Statewide scale exceeds 96% (Government of Western Australia 2019) and they are therefore considered of Least Concern (Table 5-3). All 4 associations have over 94% remaining at the bioregional scale (DBCA 2018a).

Table 5-3 Statewide extent of Pre-European vegetation associations present in the study area (DPIRD 2018)

Vegetation association	Pre-European extent (ha)	Current extent (ha)	Remaining (%)	Current extent in DBCA lands (%)	% of study area
647, Hummock grasslands, dwarf shrub steppe; Acacia translucens over soft spinifex	195,860.89	191,711.41	97.88	NULL	55.76
93, Hummock grasslands, shrub steppe; kanji over soft spinifex	3,044,309.52	3,040,640.98	99.88	1.96	41.3
589, Mosaic: Short bunch grassland - savanna / grass plain (Pilbara) / Hummock grasslands, grass steppe; soft spinifex	807,698.58	802,713.40	99.38	1.91	1.67
117, Hummock grasslands, grass steppe; soft spinifex	919,517.05	886,005.79	96.36	14.79	1.26



APA Port Hedland Transmission Line	
Project No	1690
Date	9/01/2025
Drawn by	BK
Map author	BA
	
	
1:181,700 (at A4) GDA 1994 MGA Zone 50	

 Study area
Pre-european vegetation association
 93, Hummock grasslands, shrub steppe; kanji over soft spinifex
 117, Hummock grasslands, grass steppe; soft spinifex
 589, Mosaic: Short bunch grassland - savanna / grass plain (Pilbara) / Hummock grasslands, grass steppe; soft spinifex
 619, Medium woodland; river gum (Eucalyptus camaldulensis)
 647, Hummock grasslands, dwarf-shrub steppe; Acacia translucens over soft spinifex

Figure 5-2
Pre-European vegetation associations within the study area



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5.1.5 Significant vegetation

The DBCA Threatened and Priority Ecological Communities database searches and previous surveys indicated that there are no TECs or PECs intersecting or occurring within the study area. 2 PECs were identified as occurring within 50 km within the desktop search extent (Figure 5-1; Table 5-4).

Table 5-4 PECs identified in the desktop review

Community name	Status	Proximity to study area	Description
Gregory Land System	P3 (DBCA)	16.6 km NE of study area	Linear dunes and restricted sandplains supporting shrubby hard spinifex (and occasionally soft spinifex) grasslands
Eighty Mile Land System	P3 (DBCA)	38.9 km SW of study area	Beach foredunes, longitudinal coastal dunes, and sandy plains with tussock grasslands and spinifex grasslands

5.2 FIELD SURVEY

5.2.1 Flora assemblage

A total of 58 flora taxa representing 19 families and 37 genera were recorded in the study area during the field surveys (Appendix 5). Species richness ranged from 5 - 23 species between quadrats (Appendix 2; Appendix 6). The assemblage included 56 native species and 2 introduced species, including 49 perennial species, 7 annual or short-lived species, and 2 annual-perennial species. The most prominent families recorded were Fabaceae (15 spp.), Poaceae (10 spp.), Malvaceae (7 spp.) and Amaranthaceae (4 spp.).

The near flattening of the species accumulation curve (Figure 5-3) indicates sufficient survey was conducted to capture the species present in the study area.

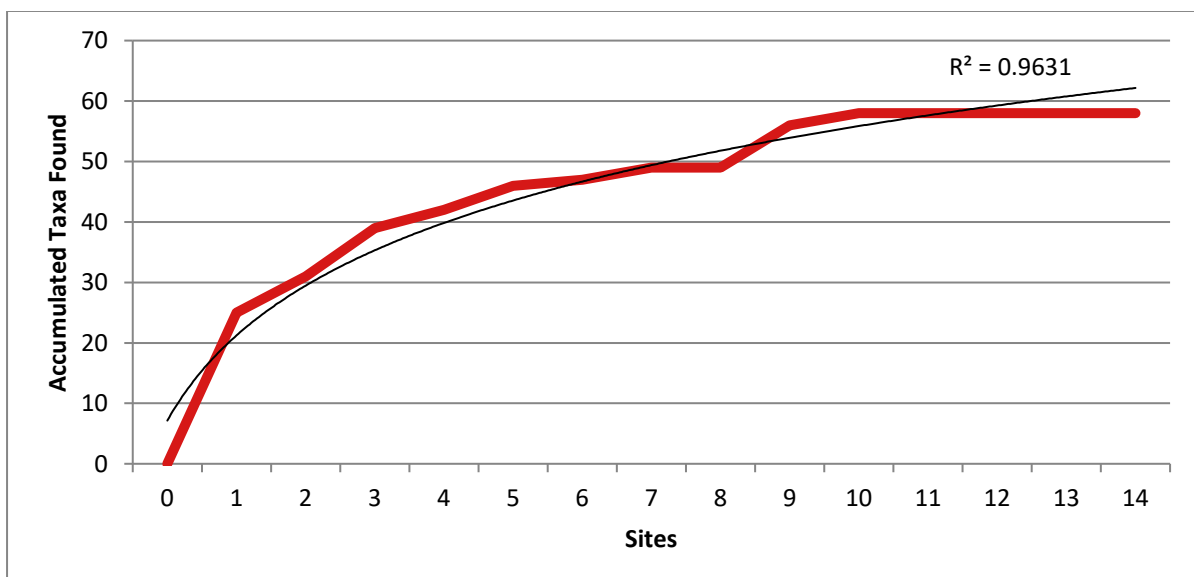


Figure 5-3 Species accumulation curve

5.2.2 Significant flora

No Threatened flora and one Priority flora were recorded during the field survey, *Tephrosia rosea* var. Port Hedland (A.S. George 1114) (P1) (Table 5-5; Figure 5-4).

The likelihood of occurrence assessment (section 4.2.2.2) for the remaining significant species identified in the desktop review determined 2 may possibly occur and 8 are unlikely to occur in the study area (Table 5-6).

Table 5-5 **Details of significant flora recorded during the field survey**

Species	Status	Distribution and ecology	Survey records	Photograph
<i>Tephrosia rosea</i> var. Port Hedland (A.S. George 1114)	P1 (DBCA)	Occurs in the Great Sandy Desert and Pilbara bioregions (WA Herbarium 2024). There are 44 records of this species in FloraBase and 4,057 records in ALA. Habitat descriptions include sandy and sandy loam soils, often tan, deep sands in coastal dunes. Population sizes for the FloraBase records range from 1 to 300 individuals.	1 population comprised of 1 plant was recorded during the survey, found in red-brown loamy sand plain of <i>Acacia</i> spp. shrubland over hummock grassland of <i>Triodia epactia</i> .	 (Butcher <i>et al.</i> 2017)



APA
Port Hedland Transmission Line

Project No 1690
Date 15/04/2025
Drawn by BK, GW
Map author BA



0 50 100
Meters

1:3 500 (at A4) GDA 1994 MGA Zone 50



Study area



Tephrosia rosea var. Port Hedland (A.S.
George 1114), P1 (DBCA list)

Vegetation type

AtAsTe

Figure 5-4

**Significant flora records
from the field survey**



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Table 5-6 Likelihood of occurrence for significant flora identified in the desktop review

<i>Species</i>	<i>Status</i>	<i>Likelihood of occurrence</i>
<i>Gomphrena pusilla</i>	P2 (DBCA)	Unlikely, lack of suitable habitat in study area.
<i>Abutilon</i> sp. Pritzelianum (S. van Leeuwen 5095)	P3 (DBCA)	Possible, previously recorded in study area and while no plants were recorded in the current survey the species may still be present in the soil seed bank.
<i>Euphorbia clementii</i>	P3 (DBCA)	Unlikely, lack of suitable habitat in study area.
<i>Gomphrena leptophylla</i>	P3 (DBCA)	Unlikely, lack of suitable habitat in study area.
<i>Gymnanthera cunninghamii</i>	P3 (DBCA)	Unlikely, lack of suitable habitat in study area.
<i>Rothia indica</i> subsp. <i>australis</i>	P3 (DBCA)	Possible, suitable habitat in the study area and this annual species recorded flowering April to August (WA Herbarium 1998) may not have been present at the time of the survey.
<i>Stylidium weeliwolli</i>	P3 (DBCA)	Unlikely, study area is well outside of the recorded distribution of the species and there is no suitable habitat in the study area.
<i>Triodia chichesterensis</i>	P3 (DBCA)	Unlikely, lack of suitable habitat in study area.
<i>Bulbostylis burbridgeae</i>	P4 (DBCA)	Unlikely, lack of suitable habitat in study area.
<i>Ptilotus mollis</i>	P4 (DBCA)	Unlikely, lack of suitable habitat in study area.

5.2.3 Introduced flora

**Aerva javanica* and **Cenchrus ciliaris* are the only introduced flora species recorded during the survey, neither of which are a WoNS/Declared Pest.

5.2.4 Unidentified flora

Two specimens collected during the survey could not be identified to species level; *Cajanus* sp. and *Cassytha* sp. This was a result of insufficient taxonomic characters, as plants were sterile (lacking reproductive structures).

5.2.5 Vegetation types

There were 5 vegetation types defined for the study area based on the cluster analysis (Figure 5-5). They comprised open *Corymbia* woodlands over *Acacia* spp. shrublands over *Triodia* grasslands and *Acacia* shrublands over *Triodia* grasslands (Table 5-8; Figure 5-6). The open *Corymbia* woodlands over *Triodia* accounted for 41.4% of the study area with *Acacia* shrublands over *Triodia* accounting for the remaining 58.6% (Table 5-8). Vegetation type AtAsTe was recorded in the small section of the northern study area and accounted for only 1.7% of the overall study area but this is largely the result of the small study areas being disjunct from the larger southern study area rather than this being a restricted vegetation type.

5.2.6 Vegetation condition

Remnant vegetation in the study area was recorded to be in Degraded to Excellent condition (Figure 5-7), completely cleared areas, e.g. tracks, were recorded as Completely Degraded. A large proportion of the study area (92.6%) was in Excellent to Very Good condition showing little evidence of disturbance (Table 5-7). Disturbances in areas recorded to be in Poor to Good condition included historic clearing, weed infestation, evidence of feral animals, and vehicle tracks. One area was recorded in Degraded condition due to the presence of more recent clearing for exploration and included drill spoils, cleared drill pads, and tracks.

Table 5-7 Vegetation condition – extent of each condition rating in study area

Condition rating	Area (ha)	% of study area
Excellent	67.86	27.3
Very Good	162.05	65.3
Good	6.96	2.8
Poor	3.41	1.4
Degraded	2.66	1.1
Completely Degraded	5.27	2.1

5.2.7 Significant vegetation

None of the vegetation in the study area was considered representative of a TEC or PEC, and none of the vegetation was considered regionally significant.

Vegetation type AtAsTe may be considered locally significant providing a refuge for the Priority 1 flora species *Tephrosia rosea* var. Port Hedland (A.S. George 1114).

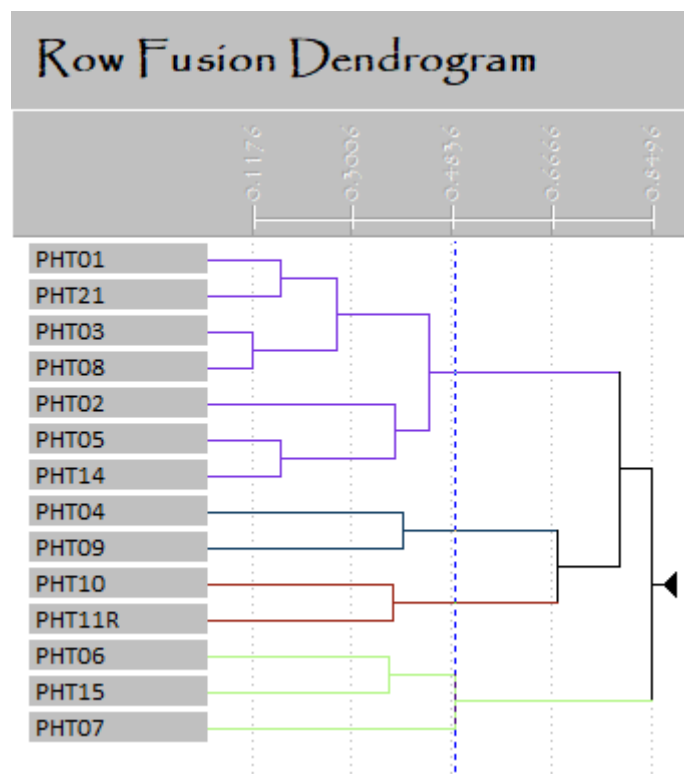


Figure 5-5 Hierarchical clustering (UPGMA) of the flora quadrats of the study area

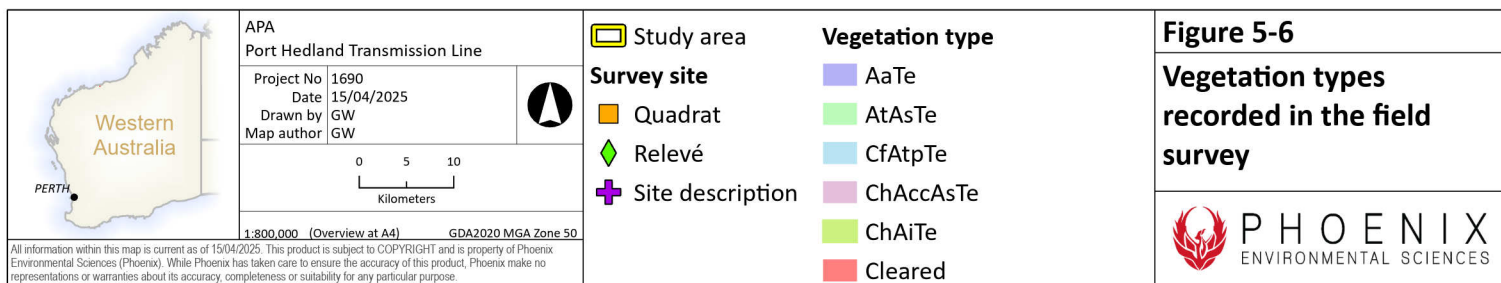
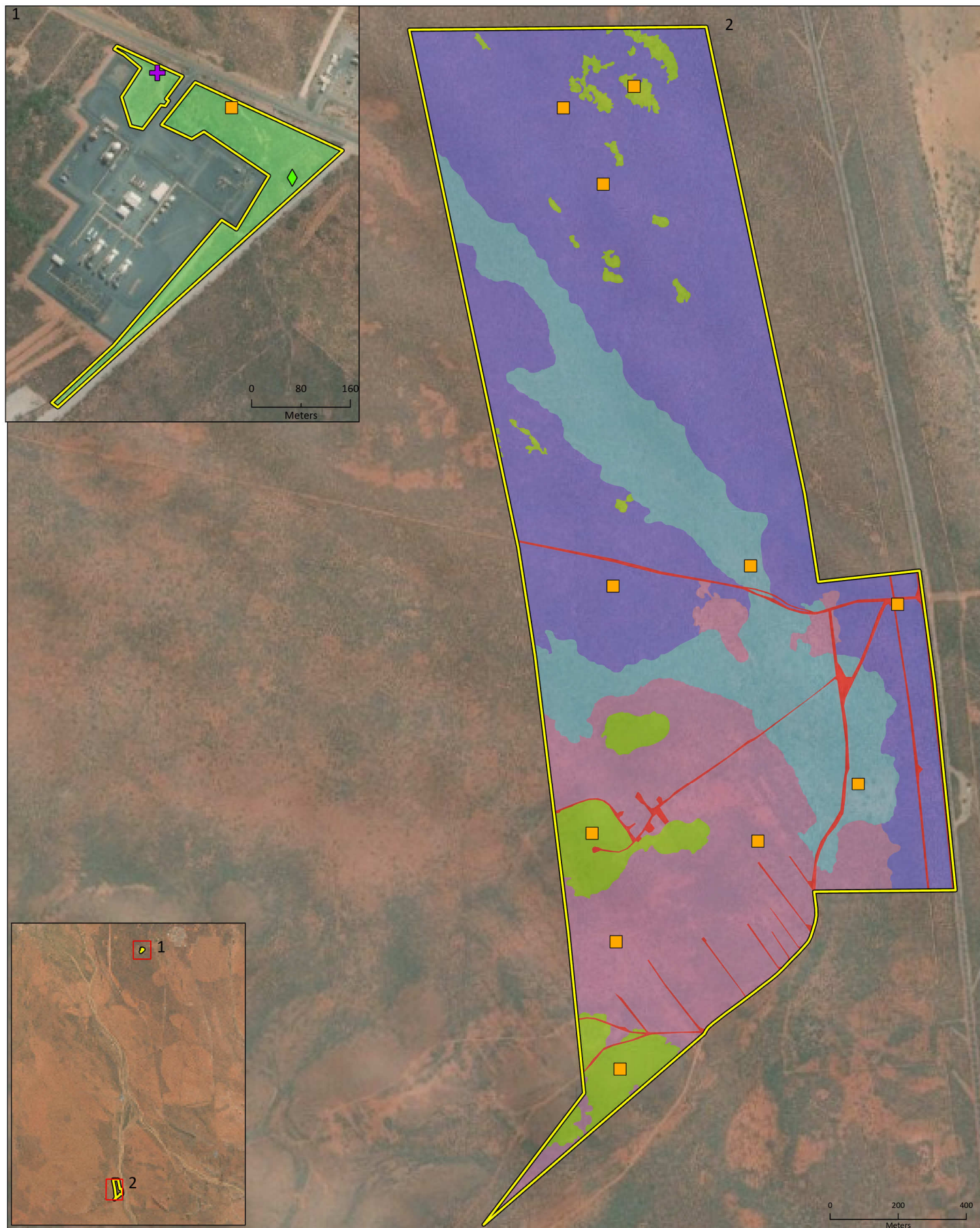
Table 5-8 Vegetation types, description, and extent in the study area

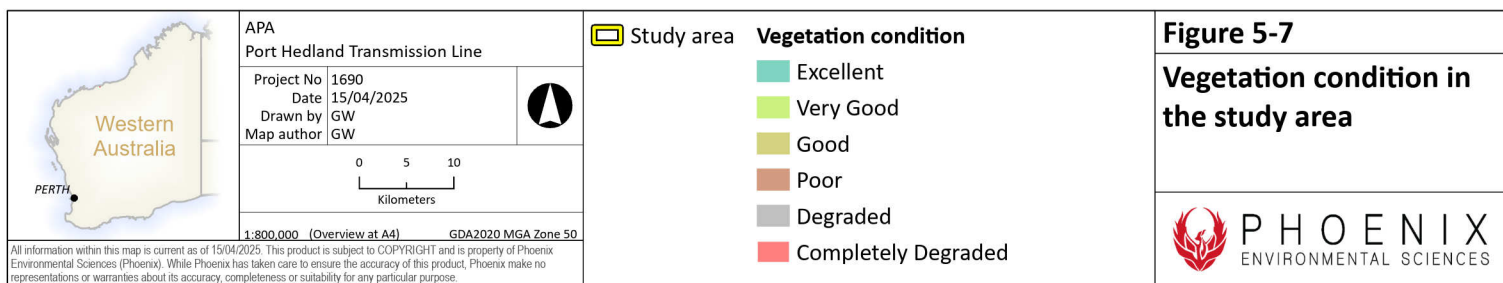
Vegetation type	Site/s	Vegetation description	Extent in study area (ha) and % of study area	Representative photograph
AaTe	PHT01, PHT03, PHT08, PHT21	Tall sparse to open shrubland of <i>Acacia ancistrocarpa</i> , <i>A. inaequilatera</i> , and <i>A. tumida</i> var. <i>pilbarensis</i> , over low hummock grassland of <i>Triodia epactia</i> .	120.5, 48.6%	
ChAiTe	PHT02, PHT05, PHT14	Variably present low isolated trees of <i>Corymbia hamersleyana</i> , over tall isolated shrubs of <i>Acacia inaequilatera</i> , <i>A. ancistrocarpa</i> , and <i>A. acradenia</i> , over low hummock grassland of <i>Triodia epactia</i> .	15.4, 6.2%	

Single season Detailed flora and vegetation survey for the Port Hedland Transmission Project
Prepared for APA

Vegetation type	Site/s	Vegetation description	Extent in study area (ha) and % of study area	Representative photograph
CfAtpTe	PHT04, PHT09	Mid-open woodland of <i>Corymbia flavescens</i> over tall sparse shrubland of <i>Acacia tumida</i> var. <i>pilbarensis</i> , <i>A. colei</i> var. <i>colei</i> , and <i>A. sericophylla</i> , over low open hummock grassland to hummock grassland of <i>Triodia epactia</i> .	47.8, 19.2%	
AtAsTe	PHT10, PHT11R	Tall isolated shrubs of <i>Acacia trachycarpa</i> , over mid-sparse shrubland to shrubland of <i>Acacia stellaticeps</i> with <i>Pluchea ferdinandi-muelleri</i> and <i>Corchorus incanus</i> subsp. <i>incanus</i> , over low sparse to hummock grassland of <i>Triodia epactia</i> , with <i>Chrysopogon fallax</i> , and <i>Eriachne obtusa</i> .	4.2, 1.7%	

Vegetation type	Site/s	Vegetation description	Extent in study area (ha) and % of study area	Representative photograph
ChAsTe	PHT06, PHT07, PHT15	Low open woodland of <i>Corymbia hamersleyana</i> over tall sparse to open shrubland of <i>Acacia colei</i> var. <i>colei</i> and <i>A. inaequilatera</i> , over mid-sparse shrubland of <i>Acacia stellaticeps</i> with <i>A. sphaerostachya</i> , over low open hummock grassland to hummock grassland of <i>Triodia epactia</i> and <i>T. basedowii</i> .	55.1, 22.2%	





5.3 SURVEY LIMITATIONS

The limitations of the flora and vegetation survey have been considered in accordance with EPA (2016b) (Table 5-9).

Table 5-9 Consideration of potential survey limitations

Limitations	Comments
Availability of contextual information at a regional and local scale	Not a limitation: Previous survey by Biologic (2024) provided a concise species list of possible taxa within the study area and the Port Hedland area has been sufficiently surveyed in the past to provide enough contextual information at a regional and local scale.
Competency/experience of the team carrying out the survey	Not a limitation: Field team leader, Dr David Leach, has over 17 years' experience conducting Detailed surveys in the Pilbara bioregion.
Scope and completeness	Not a limitation: The survey scope satisfied the requirements of the Technical Guidance (EPA 2016b). Sufficient field survey effort was available to complete the survey.
Proportion of flora recorded and/or collected, any identification issues	Minor limitation: Only 2 collections were unable to be identified to species level due to insufficient material.
Access within the study area	Not a limitation: A wide range of tracks cross through the study area and areas where there were limited tracks were traversed on foot.
Timing, rainfall, season	Limitation: Rainfall in the 12 months prior to the survey was 227.1 mm less than the annual average, with the region only receiving 86 mm total. These conditions may have resulted in less germination of annuals, which is reflected in appendix 5, and therefore less diversity within the surveyed areas. The survey took place during the supplementary survey period and so it is possible that the low diversity of species (especially ephemeral species) is due to timing.
Disturbance that may have affected the results of the survey	Minor limitation: Both study areas occur next to roads and the northern study area borders the power station and so some disturbance is expected and has reduced the vegetation condition ratings.

6 DISCUSSION

A total of 56 taxa determined to species level representing 19 families and 37 genera were recorded in the study area, equating to 7.67% of the species identified in the desktop assessment. 2 taxa could not be identified to species level.

The most prominent families recorded in this survey Fabaceae (15 spp.), Poaceae (10 spp.), Malvaceae (7 spp.) and Amaranthaceae (4 spp.), were not comparable to those found in the desktop search extent; with the most prominent families being Asteraceae (63), Fabaceae (57) and Chenopodiaceae (50).

The differences between desktop assessment and the field survey reflect the small, fragmented study areas, dry seasonal conditions, and low diversity of habitats within the study area.

6.1 SIGNIFICANT FLORA

Tephrosia rosea var. Port Hedland (A.S. George 1114) (P1) was the only Priority species recorded during the survey. There are multiple populations of this species within close proximity to the current study area (Phoenix 2023, 2024; WA Herbarium 1998) and there is a large amount of suitable habitat for the species outside of the current study area. Records of the species found by (Phoenix 2023); Phoenix (2024) occurred in disturbed areas indicating that the species is a disturbance opportunist.

Tephrosia rosea var. Port Hedland (A.S. George 1114) is known from 52 records that occur in the Chichester and Roebourne sub-regions of the Pilbara bioregion and the Mackay sub-region of the Great Sandy Desert bioregion, none of the records occur in conservation estate (WA Herbarium 1998). Recorded population sizes range from single plants to the largest population of 300 individuals, with 6 records of 50+ individuals and 3 records of populations with >100 individuals (WA Herbarium 1998). Despite searching previous records of *Abutilon* sp. Pritzelianum (S. van Leeuwen 5095) (P3), in the study area the species was not recorded during this survey. Records of this species from Biologic (2024) were confirmed outside of the current study area. Although no plants were recorded in the current survey, it is possible that the species may be present in the soil seed bank at previously recorded locations.

Abutilon sp. Pritzelianum (S. van Leeuwen 5095) has been recorded in the Carnarvon, Murchison and Pilbara bioregions (WA Herbarium 1998). There are 51 records of the species with population sizes ranging from 1 to 500+ individuals. There are 3 records of 100+ individuals and 3 of 50+ individuals (WA Herbarium 1998). There are 2 records of the species in the Cane River Conservation Park and a third record in an area gazetted to become nature reserve (WA Herbarium 1998).

Following the field survey one Priority 3 species was considered to possibly occur in the study area, *Rothia indica* subsp. *australis*. *Rothia indica* subsp. *australis* is known from 23 records that occur in the Dampierland, Great Sandy Desert, Pilbara and Victoria Bonaparte bioregions (WA Herbarium 1998). Population sizes recorded include 2 populations of 100+ individuals and 2 populations of 40+ individuals. No records of this species occur in nature reserve (WA Herbarium 1998).

The 2 specimens that could not be identified to species level, *Cajanus* sp. and *Cassytha* sp., are not considered likely to represent significant flora as neither of these genera have any conservation significant species in Western Australia.

6.2 INTRODUCED FLORA

**Aerva javanica* and **Cenchrus ciliaris* are the only introduced flora species recorded during the survey, neither of which are a WoNS/Declared Pest. Both species are common and widespread in the Pilbara region.

6.3 VEGETATION

All of the vegetation types are representative of the broader vegetation associations (647, 93 and 117) mapped in the area that comprised a combined 98.1% of the study area. The vegetation types therefore represent vegetation with a high proportion of pre-European extent remaining, is assigned the Least Concern category and cover a large area outside of the current study area.

Vegetation type AtAsTe may be considered locally significant providing a refuge for the Priority 1 flora species *Tephrosia rosea* var. Port Hedland (A.S. George 1114). However, this vegetation was in Good to Poor condition with multiple disturbances and was surrounded by roads and industrial infrastructure and it is therefore possible that vegetation condition may further deteriorate. Subsequently it is considered that none of the vegetation in the study area is considered to have conservation significance.

6.4 CONCLUSION

The botanical values present in the study area are restricted to a single plant of the Priority 1 species *Tephrosia rosea* var. Port Hedland (A.S. George 1114), the potential for *Abutilon* sp. Pritzelianum (S. van Leeuwen 5095) (P3) to be present in the soil seed bank at previous records and the possibility that a Priority 3 species, *Rothia indica* subsp. *australis*, may occur. None of the vegetation is considered to be conservation significant.

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Appendix 1 Survey site locations

Site name	Site type	Sample type	Latitude	Longitude
PHT01	Botany site	Quadrat	-20.7662	118.5133
PHT02	Botany site	Quadrat	-20.7657	118.5152
PHT03	Botany site	Quadrat	-20.7780	118.5146
PHT04	Botany site	Quadrat	-20.7775	118.5183
PHT05	Botany site	Quadrat	-20.7899	118.5148
PHT06	Botany site	Quadrat	-20.7868	118.5147
PHT07	Botany site	Quadrat	-20.7843	118.5185
PHT08	Botany site	Quadrat	-20.7784	118.5221
PHT09	Botany site	Quadrat	-20.7829	118.5211
PHT10	Botany site	Quadrat	-20.4267	118.5517
PHT11	Botany site	Relevé	-20.4277	118.5527
PHT12	Botany site	Mapping note	-20.4292	118.5513
PHT13	Botany site	Site description	-20.4262	118.5506
PHT14	Botany site	Quadrat	-20.7841	118.5141
PHT15	Botany site	Mapping note	-20.7825	118.5131
PHT21	Botany site	Quadrat	-20.7681	118.5143

Appendix 2 Flora survey site descriptions

Site details			
Site	PHT01	Position (WGS84)	118.5133, -20.7662
Slope	negligible	Topography	plain
Soil colour	red-brown	Soil texture	sand
Rock cover (%)	0	Rock type	none

Observation details - visit 1 (11 Oct 2024)

Site description	Tall shrubland of <i>Acacia ancistrocarpa</i> , <i>A. inaequilatera</i> , over hummock grassland of <i>Triodia epactia</i> .
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Habitat	shrubland
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Disturbance	grazing-medium, livestock tracks
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Vegetation condition	Very Good	Fire age	long-unburnt (>10 years)
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Total veg. cover (%)	50	Tree cover (%)	0
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Shrub cover (%)	30	Grass cover (%)	40
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Herb cover (%)	0
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Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Quadrat	1	11 Oct 2024	50m x 50m	David Leach

Species (6)	Status	Cover (%)	Height (m)
<i>Triodia epactia</i>		40.0	0.5
<i>Acacia ancistrocarpa</i>		30.0	3.0
<i>Acacia inaequilatera</i>		1.0	3.5
<i>Acacia tumida</i> var. <i>pilbarensis</i>		0.1	2.5
<i>Acacia colei</i> var. <i>colei</i>		0.1	2.1
<i>Eragrostis eriopoda</i>		0.1	0.03

Site details			
Site	PHT02	Position (WGS84)	118.5152, -20.7657
Slope	negligible	Topography	plain
Soil colour	red-brown	Soil texture	sand
Rock cover (%)	0	Rock type	none

Observation details - visit 1 (11 Oct 2024)

Site description	Tall sparse shrubland of <i>Acacia inaequilatera</i> , <i>A. ancistrocarpa</i> , over hummock grassland of recently burnt <i>Triodia epactia</i> .
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Habitat	spinifex grassland
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Disturbance	livestock tracks
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Vegetation condition	Excellent	Fire age	recent (1 year)
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Total veg. cover (%)	25	Tree cover (%)	0
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Shrub cover (%)	1	Grass cover (%)	25
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Herb cover (%)	0
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Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Quadrat	1	11 Oct 2024	50m x 50m	David Leach

Species (6)	Status	Cover (%)	Height (m)
<i>Triodia epactia</i>		20.0	0.3
<i>Triodia epactia</i>		5.0	0.5
<i>Acacia inaequilatera</i>		0.5	3.0
<i>Acacia ancistrocarpa</i>		0.25	3.0
<i>Acacia stellaticeps</i>		0.1	1.2
<i>Pluchea tetranthera</i>		0.1	0.4

Site details			
Site	PHT03	Position (WGS84)	118.5146, -20.7780
Slope	negligible	Topography	undulating plain
Soil colour	red-brown	Soil texture	sand
Rock cover (%)	0	Rock type	none

Observation details - visit 1 (10 Oct 2024)

Site description	Tall open shrubland of <i>Acacia acradenia</i> , <i>A. ancistrocarpa</i> , <i>A. inaequilatera</i> , over open hummock grassland of <i>Triodia epactia</i> .
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Habitat	shrubland
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Disturbance	none evident
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Vegetation condition	Excellent	Fire age	long-unburnt (>10 years)
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Total veg. cover (%)	40	Tree cover (%)	0
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Shrub cover (%)	20	Grass cover (%)	35
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Herb cover (%)	0
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Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Quadrat	1	10 Oct 2024	50m x 50m	David Leach

Species (5)	Status	Cover (%)	Height (m)
<i>Triodia epactia</i>		35.0	0.4
<i>Acacia acradenia</i>		15.0	2.3
<i>Acacia ancistrocarpa</i>		5.0	2.3
<i>Acacia inaequilatera</i>		1.0	3.0
<i>Acacia tumida</i> var. <i>pilbarensis</i>		0.25	2.0

Site details			
Site	PHT04	Position (WGS84)	118.5183, -20.7775
Slope	gentle	Topography	drainage line
Soil colour	red-brown	Soil texture	sand
Rock cover (%)	0	Rock type	none

Observation details - visit 1 (10 Oct 2024)

Site description	Low to mid scattered trees of <i>Corymbia flavescentis</i> , over tall shrubland of <i>Acacia tumida</i> var. <i>pilbarensis</i> , <i>A. colei</i> var. <i>colei</i> , <i>A. ancistrocarpa</i> , over open hummock grassland of <i>Triodia epactia</i> .
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Habitat	woodland
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Disturbance	livestock tracks
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Vegetation condition	Very Good	Fire age	long-unburnt (>10 years)
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Total veg. cover (%)	40	Tree cover (%)	6
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Shrub cover (%)	15	Grass cover (%)	35
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Herb cover (%)	0
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Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Quadrat	1	10 Oct 2024	50m x 50m	David Leach

Species (11)	Status	Cover (%)	Height (m)
<i>Triodia epactia</i>		35.0	0.4
<i>Acacia tumida</i> var. <i>pilbarensis</i>		10.0	3.0
<i>Corymbia flavescens</i>		6.0	15.0
<i>Acacia colei</i> var. <i>colei</i>		5.0	2.2
<i>Acacia ancistrocarpa</i>		1.0	2.0
<i>Acacia orthocarpa</i>		0.25	2.4
<i>Acacia sericophylla</i>		0.1	3.0
<i>Acacia inaequilatera</i>		0.1	2.2
<i>Corchorus laniflorus</i>		0.1	0.4
<i>Pluchea tetranthera</i>		0.1	0.3
<i>Sida spinosa</i>		0.1	0.25

Site details			
Site	PHT05	Position (WGS84)	118.5148, -20.7899
Slope	moderate	Topography	hill top
Soil colour	red-brown	Soil texture	loam
Rock cover (%)	0	Rock type	siltstone / mudstone

Observation details - visit 1 (10 Oct 2024)

Site description	Tall sparse shrubland of <i>Acacia acradenia</i> , <i>A. inaequilatera</i> , <i>Grevillea pyramidalis</i> subsp. <i>leucadendron</i> , over low hummock grassland of <i>Triodia epactia</i> .
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Habitat	shrubland
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Disturbance	none evident
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Vegetation condition	Excellent	Fire age	not evident
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Total veg. cover (%)	35	Tree cover (%)	0
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Shrub cover (%)	10	Grass cover (%)	35
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Herb cover (%)	0
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Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Quadrat	1	10 Oct 2024	50m x 50m	David Leach

Species (10)	Status	Cover (%)	Height (m)
<i>Triodia epactia</i>		35.0	0.3
<i>Acacia acradenia</i>		2.0	2.5
<i>Acacia inaequilatera</i>		1.0	3.0
<i>Grevillea pyramidalis</i> subsp. <i>leucadendron</i>		0.5	2.0
<i>Acacia tumida</i> var. <i>pilbarensis</i>		0.1	2.5
<i>Acacia ancistrocarpa</i>		0.1	2.0
<i>Grevillea wickhamii</i>		0.1	2.0
<i>Corymbia hamersleyana</i>		0.1	1.8
<i>Ptilotus schwartzii</i> var. <i>schwartzii</i>		0.1	0.4
<i>Goodenia stobbsiana</i>		0.1	0.1

Site details			
Site	PHT06	Position (WGS84)	118.5147, -20.7868
Slope	negligible	Topography	undulating plain
Soil colour	red-brown	Soil texture	sandy clay
Rock cover (%)	0	Rock type	none

Observation details - visit 1 (10 Oct 2024)

Site description	Scattered low trees of <i>Corymbia hamersleyana</i> , over sparse tall shrubland of <i>Acacia inaequilatera</i> , <i>A. acradenia</i> , <i>Grevillea wickhamii</i> , over low open shrubland of <i>Acacia stellaticeps</i> , over open hummock grassland of <i>Triodia basedowii</i> , <i>T. epactia</i> .
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Habitat	shrubland
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Disturbance	exploration (drill pads and access tracks), revegetation
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Vegetation condition	Very Good	Fire age	long-unburnt (>10 years)
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Total veg. cover (%)	35	Tree cover (%)	1
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Shrub cover (%)	10	Grass cover (%)	35
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Herb cover (%)	0
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Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Quadrat	1	10 Oct 2024	50m x 50m	David Leach

Species (9)	Status	Cover (%)	Height (m)
<i>Triodia basedowii</i>		32.5	0.4
<i>Acacia stellaticeps</i>		10.0	1.0
<i>Triodia epactia</i>		2.5	0.4
<i>Corymbia hamersleyana</i>		1.0	3.5
<i>Acacia inaequilatera</i>		0.5	2.5
<i>Acacia acradenia</i>		0.5	1.9
<i>Grevillea wickhamii</i>		0.5	1.8
<i>Acacia sphaerostachya</i>		0.1	1.2
<i>Tinospora smilacina</i>		0.1	0.1

Site details			
Site	PHT07	Position (WGS84)	118.5185, -20.7843
Slope	negligible	Topography	undulating plain
Soil colour	red-brown	Soil texture	sand
Rock cover (%)	0	Rock type	none

Observation details - visit 1 (10 Oct 2024)

Site description	Low open woodland of <i>Corymbia hamersleyana</i> , over tall open shrubland of <i>Acacia inaequilatera</i> , <i>A. coleii</i> var. <i>coleii</i> , <i>Grevillea wickhamii</i> , over mid sparse shrubland of <i>A. stellaticeps</i> , over hummock grassland of <i>Triodia epactia</i> .
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Habitat	open woodland
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Disturbance	evidence of feral animals
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Vegetation condition	Excellent	Fire age	long-unburnt (>10 years)
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Total veg. cover (%)	65	Tree cover (%)	15
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Shrub cover (%)	25	Grass cover (%)	60
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Herb cover (%)	0
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Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Quadrat	1	10 Oct 2024	50m x 50m	David Leach

Species (13)	Status	Cover (%)	Height (m)
<i>Triodia epactia</i>		60.0	0.5
<i>Acacia colei</i> var. <i>colei</i>		25.0	2.5
<i>Corymbia hamersleyana</i>		10.0	4.0
<i>Acacia inaequilatera</i>		2.0	3.0
<i>Acacia stellaticeps</i>		1.0	1.2
<i>Acacia colei</i> var. <i>colei</i>		0.5	3.0
<i>Grevillea wickhamii</i>		0.5	2.2
<i>Hakea lorea</i> subsp. <i>lorea</i>		0.25	1.5
<i>Acacia sphaerostachya</i>		0.1	2.5
<i>Gossypium australe</i>		0.1	0.45
<i>Bonamia rosea</i>		0.1	0.3
<i>Eragrostis eriopoda</i>		0.1	0.2
<i>Tinospora smilacina</i>		0.1	0.1

Site details			
Site	PHT08	Position (WGS84)	118.5221, -20.7784
Slope	negligible	Topography	plain
Soil colour	red-brown	Soil texture	sand
Rock cover (%)	0	Rock type	none

Observation details - visit 1 (10 Oct 2024)

Site description	Tall open shrubland of <i>Acacia acradenia</i> , <i>A. ancistrocarpa</i> , <i>A. inaequilatera</i> , over hummock grassland of <i>Triodia epactia</i> .
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Habitat	shrubland
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Disturbance	firebreak
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Vegetation condition	Very Good	Fire age	long-unburnt (>10 years)
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Total veg. cover (%)	70	Tree cover (%)	0
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Shrub cover (%)	25	Grass cover (%)	60
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Herb cover (%)	0
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Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Quadrat	1	10 Oct 2024	50m x 50m	David Leach

Species (7)	Status	Cover (%)	Height (m)
<i>Triodia epactia</i>		60.0	0.8
<i>Acacia acradenia</i>		10.0	2.5
<i>Acacia ancistrocarpa</i>		5.0	2.0
<i>Acacia inaequilatera</i>		1.0	2.0
<i>Acacia tumida</i> var. <i>pilbarensis</i>		1.0	2.0
<i>Acacia orthocarpa</i>		0.5	2.0
<i>Chrysopogon fallax</i>		0.1	0.2

Site details			
Site	PHT09	Position (WGS84)	118.5211, -20.7829
Slope	gentle	Topography	drainage line
Soil colour	orange	Soil texture	sand
Rock cover (%)	0	Rock type	none

Observation details - visit 1 (10 Oct 2024)

Site description	Mid sparse woodland of <i>Corymbia flavescens</i> , over sparse tall shrubland of <i>Acacia tumida</i> var. <i>pilbarensis</i> , <i>A. colei</i> var. <i>colei</i> , over open hummock grassland of <i>Triodia epactia</i> .
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Habitat	woodland
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Disturbance	grazing-low, livestock tracks
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Vegetation condition	Very Good	Fire age	long-unburnt (>10 years)
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Total veg. cover (%)	30	Tree cover (%)	10
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Shrub cover (%)	5	Grass cover (%)	20
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Herb cover (%)	0
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Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Quadrat	1	10 Oct 2024	50m x 50m	David Leach

Species (21)	Status	Cover (%)	Height (m)
<i>Triodia epactia</i>		20.0	4.0
<i>Corymbia flavescens</i>		10.0	16.0
<i>Acacia tumida</i> var. <i>pilbarensis</i>		2.5	3.0
<i>Acacia colei</i> var. <i>colei</i>		0.5	2.0
<i>Pluchea tetranthera</i>		0.25	0.4
<i>Pluchea tetranthera</i>		0.25	0.25
<i>Acacia sericophylla</i>		0.1	2.5
<i>Cajanus</i> sp.		0.1	0.5
<i>Corchorus incanus</i> subsp. <i>incanus</i>		0.1	0.3
<i>Pimelea ammodarid</i>		0.1	0.3
<i>Solanum lasiophyllum</i>		0.1	0.25
<i>Eragrostis eriopoda</i>		0.1	0.2
<i>Goodenia lamprosperma</i>		0.1	0.2
<i>Senna notabilis</i>		0.1	0.2
<i>Trigastrotheca molluginea</i>		0.1	0.2
<i>Dysphania kalpari</i>		0.1	0.1
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>		0.1	0.1
<i>Sida spinosa</i>		0.1	0.1
<i>Amaranthus undulatus</i>		0.1	0.05
<i>Boerhavia schomburgkiana</i>		0.1	0.05
<i>Tinospora smilacina</i>		0.1	0.05

Site details			
Site	PHT10	Position (WGS84)	118.5517, -20.4267
Slope	gentle	Topography	undulating plain
Soil colour	light-brown	Soil texture	loamy sand
Rock cover (%)	0	Rock type	none

Observation details - visit 1 (09 Oct 2024)

Site description	Tall sparse shrubland of <i>Acacia trachycarpa</i> , over low sparse shrubland of <i>A. stellaticeps</i> , over hummock grassland of <i>Triodia epactia</i> .
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Habitat	tussock grassland
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Disturbance	firebreak, historic clearing, vehicle tracks
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Vegetation condition	Poor	Fire age	not evident
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Total veg. cover (%)	70	Tree cover (%)	0
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Shrub cover (%)	5	Grass cover (%)	70
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Herb cover (%)	1
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Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Quadrat	1	09 Oct 2024	100m x 25m	Beth Arbery

Species (23)	Status	Cover (%)	Height (m)
<i>Triodia epactia</i>		70.0	0.5
<i>Acacia stellaticeps</i>		2.0	0.7
<i>Cassytha</i> sp.		2.0	0.5
<i>Acacia trachycarpa</i>		1.0	3.0
<i>Pluchea tetranthera</i>		0.3	0.2
<i>Pluchea ferdinandi-muelleri</i>		0.2	0.4
<i>Eriachne obtusa</i>		0.2	0.3
<i>Abutilon lepidum</i>		0.2	0.1
<i>Chrysopogon fallax</i>		0.1	1.0
* <i>Aerva javanica</i>	Weed	0.1	0.6
* <i>Cenchrus ciliaris</i>	Weed	0.1	0.4
<i>Chrysopogon fallax</i>		0.1	0.3
<i>Corchorus laniflorus</i>		0.1	0.3
<i>Pluchea tetranthera</i>		0.1	0.3
<i>Ptilotus polystachyus</i>		0.1	0.3
<i>Sida fibulifera</i>		0.1	0.3
<i>Afrohybanthus aurantiacus</i>		0.1	0.2
<i>Corchorus incanus</i> subsp. <i>incanus</i>		0.1	0.2
<i>Dactyloctenium radulans</i>		0.1	0.1
<i>Dysphania kalpari</i>		0.1	0.1
<i>Paspalidium rarum</i>		0.1	0.1
<i>Sida spinosa</i>		0.1	0.1
<i>Sporobolus australasicus</i>		0.1	0.1

Site details			
Site	PHT11R	Position (WGS84)	118.5527, -20.4278
Slope	negligible	Topography	plain
Soil colour	red-brown	Soil texture	loamy sand
Rock cover (%)	0	Rock type	none

Observation details - visit 1 (09 Oct 2024)

Site description	Tall open shrubland of <i>Acacia trachycarpa</i> and <i>A. tumida</i> var. <i>pilbarensis</i> , <i>A. colei</i> var. <i>colei</i> , over low shrubland of <i>A. stellaticeps</i> , <i>Pluchea ferdinandi-muelleri</i> , over open hummock grassland of <i>Triodia epactia</i> .
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Habitat	shrubland
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Disturbance	evidence of feral animals, vehicle tracks, weed infestation
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Vegetation condition	Good	Fire age	long-unburnt (>10 years)
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Total veg. cover (%)	70	Tree cover (%)	0
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Shrub cover (%)	60	Grass cover (%)	10
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Herb cover (%)	1
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Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Relevé	1	09 Oct 2024	unbounded	Beth Arbery

Species (17)	Status	Cover (%)	Height (m)
<i>Acacia stellaticeps</i>		60.0	1.3
<i>Triodia epactia</i>		10.0	0.5
<i>Cassytha</i> sp.		5.0	1.0
<i>Acacia trachycarpa</i>		3.0	3.0
<i>Acacia tumida</i> var. <i>pilbarensis</i>		1.0	4.0
<i>Acacia colei</i> var. <i>colei</i>		1.0	3.5
<i>Pluchea ferdinandi-muelleri</i>		1.0	1.0
<i>Chrysopogon fallax</i>		1.0	0.5
<i>Tephrosia rosea</i> var. <i>Port Hedland</i> (A.S. George 1114)	P1 (DBCA list)	0.5	0.8
<i>Eriachne obtusa</i>		0.25	0.4
<i>Corchorus laniflorus</i>		0.1	0.4
<i>Solanum lasiophyllum</i>		0.1	0.4
* <i>Cenchrus ciliaris</i>	Weed	0.1	0.3
<i>Acacia monticola</i> x <i>trachycarpa</i>		0.1	0.3
<i>Corchorus incanus</i> subsp. <i>incanus</i>		0.1	0.3
<i>Ptilotus polystachyus</i>		0.1	0.3
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>		0.1	0.2

Site details			
Site	PHT13SD	Position (WGS84)	118.5506, -20.4262
Slope	negligible	Topography	undulating plain
Soil colour	red-brown	Soil texture	loamy sand
Rock cover (%)	0	Rock type	none

Observation details - visit 1 (09 Oct 2024)

Site description	Sparse tall shrubland of <i>Acacia trachycarpa</i> and <i>A. colei</i> var. <i>colei</i> , over low open shrubland of <i>A. stellaticeps</i> over hummock grassland of <i>Triodia epactia</i> with <i>*Aerva javanica</i> and <i>*Cenchrus ciliaris</i> .
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Habitat	shrubland
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Disturbance	historic clearing, vehicle tracks
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Vegetation condition	Good	Fire age	not evident
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Total veg. cover (%)	60	Tree cover (%)	0
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Shrub cover (%)	25	Grass cover (%)	35
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Herb cover (%)	0
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Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Site description	1	09 Oct 2024	unbounded	Beth Arbery

Species (1)	Status	Cover (%)	Height (m)
<i>Acacia colei</i> var. <i>colei</i>		0.1	1.5

Site details			
Site	PHT14	Position (WGS84)	118.5141, -20.7841
Slope	moderate	Topography	hill top
Soil colour	red-brown	Soil texture	clay loam
Rock cover (%)	0	Rock type	siltstone / mudstone

Observation details - visit 1 (10 Oct 2024)

Site description	Isolated trees of <i>Corymbia hamersleyana</i> , over tall sparse shrubland of <i>Acacia tumida</i> var. <i>pilbarensis</i> , <i>A. inaequilatera</i> , <i>Grevillea wickhamii</i> , over open hummock grassland of <i>Triodia epactia</i> .
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Habitat	shrubland
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Disturbance	none evident
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Vegetation condition	Excellent	Fire age	long-unburnt (>10 years)
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Total veg. cover (%)	30	Tree cover (%)	0
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Shrub cover (%)	1	Grass cover (%)	30
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Herb cover (%)	0
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Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Quadrat	1	10 Oct 2024	50m x 50m	David Leach

Species (12)	Status	Cover (%)	Height (m)
<i>Triodia epactia</i>		35.0	0.4
<i>Acacia tumida</i> var. <i>pilbarensis</i>		1.0	2.4
<i>Acacia inaequilatera</i>		0.5	2.0
<i>Acacia acradenia</i>		0.5	1.8
<i>Grevillea wickhamii</i>		0.25	2.0
<i>Acacia stellaticeps</i>		0.25	1.2
<i>Acacia ancistrocarpa</i>		0.1	2.2
<i>Corymbia hamersleyana</i>		0.1	2.0
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>		0.1	1.3
<i>Sida pilbarensis</i>		0.1	0.5
<i>Ptilotus schwartzii</i> var. <i>schwartzii</i>		0.1	0.4
<i>Senna notabilis</i>		0.1	0.03

Site details			
Site	PHT21	Position (WGS84)	118.5144, -20.7681
Slope	negligible	Topography	plain
Soil colour	red-brown	Soil texture	sand
Rock cover (%)	0	Rock type	none

Observation details - visit 1 (11 Oct 2024)

Site description	Tall open shrubland of <i>Acacia ancistrocarpa</i> , <i>A. inaequilatera</i> , <i>A. acradenia</i> , over open hummock grassland of <i>Triodia epactia</i> .
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Habitat	shrubland
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Disturbance	grazing-medium, vehicle tracks
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Vegetation condition	Very Good	Fire age	long-unburnt (>10 years)
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Total veg. cover (%)	55	Tree cover (%)	0
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Shrub cover (%)	12	Grass cover (%)	55
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Herb cover (%)	0
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Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Quadrat	1	11 Oct 2024	50m x 50m	David Leach

Species (6)	Status	Cover (%)	Height (m)
<i>Triodia epactia</i>		55.0	0.5
<i>Acacia ancistrocarpa</i>		9.0	3.5
<i>Acacia inaequilatera</i>		1.0	4.0
<i>Acacia acradenia</i>		0.75	2.0
<i>Acacia tumida</i> var. <i>pilbarensis</i>		0.1	3.0
<i>Eragrostis eriopoda</i>		0.1	0.03

Appendix 3 NVIS hierarchy

Western Australia Current Practice			National Standard		
Hierarchy of terms	Brief description in WA	Indicative scale	NVIS Level	Description	NVIS structural/floristic components required
Vegetation formation	Structure and growth form – e.g. Forest, Woodland.	1:5 000 000	I	Class	Dominant growth form for the ecologically or structurally dominant stratum.
Vegetation sub-formation	Structural and dominant vegetation layer - Eucalypt Forest, Banksia Woodland.	1:2 500 000 I	II	Structural Formation	Dominant growth form, cover, and height for the ecologically or structurally dominant stratum.
Vegetation association	Structural form and dominant species – e.g. Medium woodland; York gum (<i>Eucalyptus loxophleba</i>) & Wandoo.	1:1 000 000 to 1:250 000	III	Broad Floristic Formation	Dominant growth form, cover, height, and dominant land cover genus for the uppermost or dominant stratum.
Vegetation complex	Structural and floristic description linked to geomorphology – e.g. Quindalup Complex.	1:250 000 to 1:100 000	IV	Sub-Formation	Dominant growth form, cover, height, and dominant genus and Family for the 3 traditional strata. (i.e. Upper, Mid, and Ground).
Vegetation type	Floristic definition by strata with structural detail. Often represented with a code and floristic description.	1:100 000 to 1:10 000	V	Association	Dominant growth form, height, cover, and up to 3 species for the 3 traditional strata. (i.e. Upper, Mid, and Ground).
Plant community	Basic unit of vegetation classification, site specific, and highly localised with detailed floristics for each stratum.	1:10 000	VI	Sub-Association	Dominant growth form, height, cover and up to 5 species for all layers/ strata.
Floristic Community Type	Floristic composition definition; e.g. Northern banksia woodlands over herb rich shrublands on the Swan Coastal Plain.	No absolute scale			

Appendix 4 Introduced flora identified in the desktop review

Family	Taxon	Source				DPP	WoNS
		NatureMap	ALA	WAOL	Biologic (2024)		
Aizoaceae	<i>Trianthema portulacastrum</i>	✓					
Alismataceae	<i>Sagittaria platyphylla</i>			✓		✓	✓
Amaranthaceae	<i>Aerva javanica</i>	✓	✓		✓		
	<i>Gomphrena celosioides</i>	✓					
	<i>Pupalia lappacea</i>	✓					
Anacardiaceae	<i>Mangifera indica</i>		✓				
Apocynaceae	<i>Calotropis procera</i>	✓		✓	✓	✓	
	<i>Cryptostegia madagascariensis</i>			✓		✓	
Araceae	<i>Pistia stratiotes</i>			✓		✓	
	<i>Zantedeschia aethiopica</i>			✓		✓	
Araliaceae	<i>Hydrocotyle ranunculoides</i>			✓		✓	
Asparagaceae	<i>Asparagus asparagoides</i>			✓		✓	✓
Asteraceae	<i>Chondrilla juncea</i>			✓		✓	
	<i>Cyanthillium cinereum</i> var. <i>cinereum</i>	✓					
	<i>Erigeron bonariensis</i>	✓					
	<i>Flaveria trinervia</i>	✓					
	<i>Onopordum acaulon</i>			✓		✓	
	<i>Silybum marianum</i>			✓		✓	
	<i>Symphotrichum squamatum</i>	✓					
	<i>Tridax procumbens</i>	✓					
	<i>Xanthium spinosum</i>			✓		✓	
	<i>Xanthium strumarium</i>			✓		✓	
Boraginaceae	<i>Echium plantagineum</i>			✓		✓	
Cactaceae	<i>Austrocylindropuntia cylindrica</i>			✓		✓	✓

Single season Detailed flora and vegetation survey for the Port Hedland Transmission Project
Prepared for APA

Family	Taxon	Source				DPP	WoNS
		NatureMap	ALA	WAOL	Biologic (2024)		
	<i>Austrocylindropuntia subulata</i>			✓		✓	✓
	<i>Cylindropuntia fulgida</i>			✓		✓	
	<i>Cylindropuntia imbricata</i>	✓	✓	✓		✓	
	<i>Cylindropuntia kleiniae</i>			✓		✓	
	<i>Cylindropuntia pallida</i>			✓		✓	
	<i>Cylindropuntia tunicata</i>			✓		✓	
	<i>Opuntia elata</i>	✓	✓	✓		✓	✓
	<i>Opuntia elatior</i>			✓		✓	✓
	<i>Opuntia engelmannii</i>			✓		✓	✓
	<i>Opuntia ficus-indica</i>			✓		✓	✓
	<i>Opuntia microdasys</i>			✓		✓	✓
	<i>Opuntia monacantha</i>			✓		✓	✓
	<i>Opuntia polyacantha</i>			✓		✓	✓
	<i>Opuntia puberula</i>			✓		✓	✓
	<i>Opuntia stricta</i>	✓		✓		✓	✓
	<i>Opuntia tomentosa</i>			✓		✓	✓
Convolvulaceae	<i>Distimake dissectus</i>		✓				
	<i>Distimake dissectus</i> var. <i>dissectus</i>	✓					
Cucurbitaceae	<i>Citrullus amarus</i>	✓	✓				
	<i>Coccinia grandis</i>	✓		✓		✓	
Cyperaceae	<i>Cyperus vorsteri</i>				✓		
Euphorbiaceae	<i>Euphorbia hirta</i>				✓		
	<i>Euphorbia maculata</i>		✓				
	<i>Euphorbia tirucalli</i>	✓	✓				
	<i>Jatropha gossypifolia</i>			✓		✓	

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Family	Taxon	Source				DPP	WoNS
		NatureMap	ALA	WAOL	Biologic (2024)		
	<i>Ricinus communis</i>	✓					
Fabaceae	<i>Alhagi maurorum</i>			✓		✓	
	<i>Clitoria ternatea</i>	✓					
	<i>Desmodium scorpiurus</i>	✓					
	<i>Indigofera hochstetteri</i>	✓	✓				
	<i>Indigofera oblongifolia</i>	✓	✓		✓		
	<i>Indigofera sessiliflora</i>	✓					
	<i>Leucaena leucocephala</i>	✓	✓				
	<i>Neltuma glandulosa</i> × <i>velutina</i>			✓		✓	✓
	<i>Parkinsonia aculeata</i>	✓		✓		✓	✓
	<i>Senna alata</i>			✓		✓	
	<i>Senna obtusifolia</i>			✓		✓	
	<i>Senna occidentalis</i>	✓					
	<i>Stylosanthes guianensis</i> var. <i>guianensis</i>	✓					
	<i>Stylosanthes hamata</i>	✓	✓		✓		
	<i>Ulex europaeus</i>			✓		✓	✓
	<i>Vachellia farnesiana</i>	✓					
Iridaceae	<i>Moraea flaccida</i>			✓		✓	
	<i>Moraea miniata</i>			✓		✓	
Malvaceae	<i>Gossypium hirsutum</i>	✓	✓				
	<i>Malvastrum americanum</i>	✓			✓		
Papaveraceae	<i>Argemone ochroleuca</i> subsp. <i>ochroleuca</i>	✓					
Passifloraceae	<i>Passiflora foetida</i>		✓				
	<i>Passiflora foetida</i> var. <i>hispida</i>	✓					
Poaceae	<i>Andropogon gayanus</i>	✓					

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Family	Taxon	Source				DPP	WoNS
		NatureMap	ALA	WAOL	Biologic (2024)		
	<i>Cenchrus ciliaris</i>	✓	✓		✓		
	<i>Cenchrus setaceus</i>	✓					
	<i>Cenchrus setiger</i>	✓	✓		✓		
	<i>Chloris barbata</i>	✓					
	<i>Chloris virgata</i>	✓	✓				
	<i>Cynodon dactylon</i>	✓					
	<i>Dactyloctenium aegyptium</i>	✓					
	<i>Digitaria ciliaris</i>	✓			✓		
	<i>Echinochloa colona</i>	✓	✓		✓		
	<i>Eragrostis minor</i>	✓	✓				
	<i>Eragrostis pilosa</i>	✓	✓				
	<i>Lamarckia aurea</i>	✓					
	<i>Paspalum fasciculatum</i>	✓					
	<i>Setaria sphacelata</i>	✓					
	<i>Setaria verticillata</i>				✓		
Portulacaceae	<i>Portulaca pilosa</i>	✓					
Rhamnaceae	<i>Ziziphus mauritiana</i>			✓		✓	
Rosaceae	<i>Rubus anglocandicans</i>			✓		✓	✓
	<i>Rubus laudatus</i>			✓		✓	✓
	<i>Rubus rugosus</i>			✓		✓	✓
Solanaceae	<i>Physalis angulata</i>	✓					
	<i>Solanum elaeagnifolium</i>			✓		✓	✓
	<i>Solanum linnaeanum</i>			✓		✓	
Tamaricaceae	<i>Tamarix aphylla</i>			✓		✓	✓
Verbenaceae	<i>Lantana camara</i>			✓		✓	✓

Appendix 5 Flora species inventory

Family	Species	Lifecycle	Status
Amaranthaceae	<i>*Aerva javanica</i>	P	Weed
	<i>Amaranthus undulatus</i>	A	
	<i>Ptilotus polystachyus</i>	A	
	<i>Ptilotus schwartzii</i> var. <i>schwartzii</i>	P	
Asteraceae	<i>Pluchea ferdinandi-muelleri</i>	P	
	<i>Pluchea tetranthera</i>	P	
Chenopodiaceae	<i>Dysphania kalpari</i>	A	
Cleomaceae	<i>Arivela viscosa</i>	AP	
Convolvulaceae	<i>Bonamia rosea</i>	P	
	<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	P	
Fabaceae	<i>Acacia acradenia</i>	P	
	<i>Acacia ancistrocarpa</i>	P	
	<i>Acacia colei</i> var. <i>colei</i>	P	
	<i>Acacia inaequilatera</i>	P	
	<i>Acacia monticola</i> x <i>trachycarpa</i>	P	
	<i>Acacia orthocarpa</i>	P	
	<i>Acacia sericophylla</i>	P	
	<i>Acacia sphaerostachya</i>	P	
	<i>Acacia stellaticeps</i>	P	
	<i>Acacia trachycarpa</i>	P	
	<i>Acacia tumida</i> var. <i>pilbarensis</i>	P	
	<i>Cajanus</i> sp.	P	
	<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	P	
	<i>Senna notabilis</i>	P	
	<i>Tephrosia rosea</i> var. Port Hedland (A.S. George 1114)	P	P1 (DBCA)
Goodeniaceae	<i>Goodenia lamprosperma</i>	P	
	<i>Goodenia stobbsiana</i>	P	
Lauraceae	<i>Cassytha</i> sp.	P	
Malvaceae	<i>Abutilon lepidum</i>	P	
	<i>Corchorus incanus</i> subsp. <i>incanus</i>	P	
	<i>Corchorus laniflorus</i>	P	
	<i>Gossypium australe</i>	P	
	<i>Sida fibulifera</i>	P	
	<i>Sida pilbarensis</i>	P	
	<i>Sida spinosa</i>	P	
Menispermaceae	<i>Tinospora smilacina</i>	P	
Molluginaceae	<i>Trigastrotheca molluginea</i>	A	
Myrtaceae	<i>Corymbia flavescens</i>	P	
	<i>Corymbia hamersleyana</i>	P	
	<i>Corymbia zygophylla</i>	P	
Nyctaginaceae	<i>Boerhavia schomburgkiana</i>	P	

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Poaceae	<i>*Cenchrus ciliaris</i>	P	Weed
	<i>Aristida contorta</i>	AP	
	<i>Chrysopogon fallax</i>	P	
	<i>Dactyloctenium radulans</i>	A	
	<i>Eragrostis eriopoda</i>	P	
	<i>Eriachne obtusa</i>	P	
	<i>Paspalidium rarum</i>	A	
	<i>Sporobolus australasicus</i>	A	
	<i>Triodia basedowii</i>	P	
	<i>Triodia epactia</i>	P	
Proteaceae	<i>Grevillea pyramidalis</i> subsp. <i>leucadendron</i>	P	
	<i>Grevillea wickhamii</i>	P	
	<i>Hakea lorea</i> subsp. <i>lorea</i>	P	
Solanaceae	<i>Solanum lasiophyllum</i>	P	
Thymelaeaceae	<i>Pimelea ammodarid</i>	P	
Violaceae	<i>Afrohybanthus aurantiacus</i>	P	
Zygophyllaceae	<i>Tribulus occidentalis</i>	P	

Appendix 6 Flora species by site matrix

