

APPENDIX A. ENVIRONMENTAL MANAGEMENT PLAN



Pardoo Irrigated Agriculture Project – Stage 3 Environmental Management Plan

Pardoo Beef Corporation Pty Ltd

P07-J08

31 January 2018




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REPORT DETAILS

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SUMMARY

Table 1 below provides a summary of the proposal, environmental factors and key provisions of this Environmental Management Plan.

Table 1. Environmental Management Plan Summary

Item	Details		
Title of the proposal	Pardoo Irrigated Agriculture Project – Stage 3		
Proponent name	Pardoo Beef Corporation Pty Ltd		
Purpose of the EMP	Submitted with Referral under Part IV of <i>Environmental Protection Act (1986)</i>		
Key Environmental Factors and Objectives	Factor		EPA Objective
	LAND	Flora and Vegetation	To protect flora and vegetation so that biological diversity and ecological integrity are maintained.
		Terrestrial Environmental Quality	To maintain the quality of land and soils so that environmental values are protected.
		Terrestrial Fauna	To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.
	WATER	Hydrological Processes	To maintain the hydrological regimes of groundwater and surface water so that environmental values are protected.
		Inland waters Environmental Quality	To maintain the quality of groundwater and surface water so that environmental values are protected.
	PEOPLE	Social Surroundings	To protect social surroundings from significant harm.
Key Provisions of the Plan			
Factor and Provision No.	Potential Impact	Outcome/Objective	Criteria / Management Actions
Flora and Vegetation – Provision 1 (Outcome Based)	Trampling of Native Vegetation outside fenced areas	Cattle designated to graze the pivots will not be allowed outside the Stage 3 fenced areas.	Trigger Criterion: <ul style="list-style-type: none"> 1 occurrence of cattle escaping the fenced areas. Threshold Criterion: <ul style="list-style-type: none"> 2 occurrences of cattle escaping the fenced areas.
Flora and Vegetation – Provision 2 (Outcome Based)	Weeds - Spread of Rhodes Grass	Rhodes grass will not colonise environments outside the project area	Trigger Criterion: <ul style="list-style-type: none"> Rhodes grass spread more than 15 m outside any pivot boundary. Threshold Criterion: <ul style="list-style-type: none"> Rhodes grass spread more than 30 m outside any pivot boundary.
Flora and Vegetation – Provision 3 (Management Based)	Weeds - General	Avoid spread of weeds surrounding the Development Envelope due to Stage 3 activities.	Machinery will be washed and/or brushed down to remove weed seeds and propagules, prior to mobilising to site
Flora and Vegetation – Provision 4 (Management Based)	Fire	No fires will be started due to human activity on site and any naturally occurring fires will be controlled where practicable.	A Fire Management Plan will be implemented prior to commencement of construction of Stage 3

Factor and Provision No.	Potential Impact	Outcome/Objective	Criteria / Management Actions
Flora and Vegetation – Provision 5 (Management Based)	Inappropriate Rehabilitation	If operations cease, the site will be appropriately rehabilitated	A Closure and Rehabilitation Plan will be developed and approved by DWER at least 1 year before planned decommissioning and closure of the site
Terrestrial Environmental Quality – Provision 6 (Outcome Based)	Soil salinity	The Stage 3 project does not cause unacceptable soil salinity	<p>Trigger Criterion:</p> <ul style="list-style-type: none"> Soil salinity levels within the Development Envelope do not exceed 400mS/m in surface (0-10cm depth) or 600mS/m in subsurface (10-30cm depth) soils. <p>Threshold Criterion:</p> <ul style="list-style-type: none"> Soil salinity levels within the Development Envelope do not exceed 600mS/m in surface (0-10cm depth) or 800mS/m in subsurface (10-30cm depth) soils.
Terrestrial Environmental Quality – Provision 7 (Outcome Based)	Soil Sodicity	The Stage 3 project does not cause unacceptable soil sodicity	<p>Trigger Criterion:</p> <ul style="list-style-type: none"> Soil sodicity levels five years after commencement of irrigation do not exceed an Exchangeable Sodium Percentage (ESP) of 6% in surface (0-10cm depth) soils or 13% in subsurface (10-30cm depth) soils. <p>Threshold Criterion:</p> <ul style="list-style-type: none"> Soil sodicity levels five years after commencement of irrigation do not exceed an Exchangeable Sodium Percentage (ESP) of 10% in surface (0-10cm depth) soils or 16% in subsurface (10-30cm depth) soils.
Terrestrial Fauna – Provision 8 (Management Based)	Fauna mortality during clearing	Prevent mortality of burrow dependent conservation fauna species during clearing	Pre-clearance surveys, in particular for burrows, will be undertaken by a fauna specialist prior to ground disturbance activities. Where Bilby and Mulgara are recorded within the impact area, individuals will be relocated or otherwise managed in a way which is approved by DBCA.
Terrestrial Fauna – Provision 9 (Management Based)	Vehicle / equipment strikes	Minimise vehicle / equipment strikes of fauna	Vehicles and equipment will not be driven at night, will be restricted to designated roads/tracks and will comply with an on site speed limit of 60 km/hr. In addition, site personnel will be trained in fauna awareness including preventing fauna strike.
Terrestrial Fauna – Provision 10 (Management Based)	Entrapment	Prevent fauna entrapment in trenches and behind fences	Trenches dug for water pipelines will not be left open (pipelines will be immediately installed and buried) and fencing will be installed in long linear stretches without “alcoves” in which fauna become trapped.
Terrestrial Fauna – Provision 11 (Management Based)	Feral fauna	Prevent increases in feral fauna due to the Stage 3 project	<p>Feral fauna control will be undertaken on an annual basis in consultation with the local DBCA office including:</p> <ul style="list-style-type: none"> Shooting of wild dogs / foxes. Strategic baiting or trapping of cats; and If Cane Toad spreads to the region, implementing a station Cane Toad detection, eradication and reporting system

Factor and Provision No.	Potential Impact	Outcome/Objective	Criteria / Management Actions
Hydrological Processes – Provision 12 (Outcome Based)	Changes to surface water hydrological processes within or surrounding the project area.	The Stage 3 project will not cause changes to surface water hydrological processes within or surrounding the project area.	<p>Trigger Criterion:</p> <ul style="list-style-type: none"> Surface water inundation or flooding is evident within Stage 3 Development Envelope when no rainfall has occurred in the preceding 8 weeks. <p>Threshold Criterion</p> <ul style="list-style-type: none"> Surface water inundation or flooding is evident outside the Stage 3 Development Envelope (within a 1 km buffer) when no rainfall has occurred in the preceding 10 weeks.
Hydrological Processes – Provision 13 (Outcome Based)	Over irrigation causing changes to hydrological processes	Soil Moisture Levels within the pivots should be maintained ideally between 15 and 20% volumetric water content (except when preceding rainfall has occurred) and should always be lower than 30% (except when preceding rainfall has occurred).	<p>Trigger Criterion:</p> <ul style="list-style-type: none"> Soil moisture levels above 25% volumetric water content (except when rainfall has occurred in the preceding week). <p>Threshold Criterion:</p> <ul style="list-style-type: none"> Soil moisture levels above 30% volumetric water content (except when rainfall has occurred in the preceding week).
Inland Waters Environmental Quality – Provision 14 (Management Based)	Changes in water quality of the Broome Aquifer due to the Stage 3 project	No unacceptable impacts on groundwater quality of the Broome Aquifer as a result of the Stage 3 project.	Implement monitoring of Broome Aquifer water quality, downstream of project activities including 3 Broome Aquifer bores and all potential contaminants from the Stage 3 Project (salt, hydrocarbons, nutrients and herbicides). Compare the results to available baseline data and ongoing monitoring trends. If monitoring indicates contamination is occurring, investigate this and take appropriate corrective and preventative action.
Inland Waters Environmental Quality – Provision 15 (Management Based)	Changes in water quality of the surface water in the adjacent Ramsar area (when flooded) due to the Stage 3 project	No unacceptable impacts on groundwater quality of surface water in the adjacent Ramsar area (when flooded) as a result of the Stage 3 project.	Implement monitoring of surface water quality, downstream of project activities when surface water is available (after flooding rainfall events). Compare the results to available baseline data and ongoing monitoring trends. If monitoring indicates contamination is occurring, investigate this and take appropriate corrective and preventative action.

Factor and Provision No.	Potential Impact	Outcome/Objective	Criteria / Management Actions
Inland Waters Environmental Quality – Provision 16 (Management Based)	Spills of hydrocarbons, fertiliser or herbicides	Ensure appropriate prevention and management of spills of hydrocarbons, fertiliser or herbicides.	Potential contaminants will be managed as follows: <ul style="list-style-type: none"> hydrocarbons contained within bunds according to the requirements of Australian Standard 1940; liquid nitrogen tanks within a concrete bund which will capture 110% of the volume stored; granular fertilisers stored on a hard stand within a shed; herbicides will not be stored on site (they will be brought to site in when needed); and a Spill Response Procedure will be in place including appropriate staff training, appropriate spill clean up kits, waste disposal, spill reporting and corrective and preventative actions.
Social Surroundings – Provision 17 (Management Based)	Accidental damage to an Aboriginal Heritage Site	Avoid accidental damage to an Aboriginal Heritage Site	<ul style="list-style-type: none"> Prior to any land disturbance undertake appropriate Aboriginal Heritage Surveys. Wherever possible avoid any Aboriginal Heritage Sites identified. Where not possible to avoid sites, obtain a Section 18 Licence to disturb a heritage site under the <i>Aboriginal Heritage Act 1972</i>, prior to any disturbance occurring.

1 CONTEXT SCOPE AND RATIONALE

1.1 PROPOSAL

This Environmental Management Plan is in relation to Stage 3 of the Pardoo Irrigated Agriculture Project. Pardoo Station is located north of the Great Northern Highway, approximately 100 kilometres (km) east-north-east of Port Hedland and 365 km south west of Broome (Figure 1).

The pastoral lease contains large tracts of prime grazing land. However, the pastoral station requires a dry-season feeding capability to improve cattle welfare, condition and throughput during the dry-season when dry conditions result in limited cattle feed availability. Therefore, the owner of Pardoo Station, Pardoo Beef Corporation Pty Ltd (PBC), is proposing to develop a centre-pivot irrigated feed crop production facility.

1.1.1 DESCRIPTION

Stage 3 of the Pardoo Irrigated Agriculture Project is located approximately 4 km inland from the coast (Figure 1) with a footprint of 280 ha in total including:

- Three 50 ha pivots, one 40 ha pivot and two 38 ha pivots (total of 266 ha); and
- 14 ha for proposed support infrastructure such as fencing, pipelines, bores and roads (Figure 2).

The crop proposed to be grown in the Stage 3 pivots is Rhodes grass (*Chloris gayana*), a summer-growing, stoloniferous perennial, whose runners provide good soil cover for erosion control. Rhodes grass is adapted to a wide range of soils and provides excellent quality fodder for cattle (Department of Agriculture and Fisheries Qld, 2017).

1.1.2 SITE LAYOUT

The site layout (Figure 2) consists of:

- A fenced Development Envelope of 368 ha.
- A fenced main access road and ring road surrounding the central pivot (Pivot 18) which allows access into all of the pivot areas via gates.
- Five fenced cattle holding paddocks containing the five perimeter pivots (Pivot numbers 13, 14, 15, 16, and 17) and small amounts of additional land around each pivot which act as dry resting ground for cattle.
- A fenced central pivot (Pivot 18). This pivot does not have additional area fenced around it (only the pivot itself is fenced), which means that cattle need to be moved frequently to other paddocks to access dry resting ground.
- Three groundwater abstraction bores (PB8, PB9 and PB10) and pipelines to the centre of each pivot.
- Access roads to the centre of each pivot.
- A laydown area for equipment and vehicles located along the main access road.

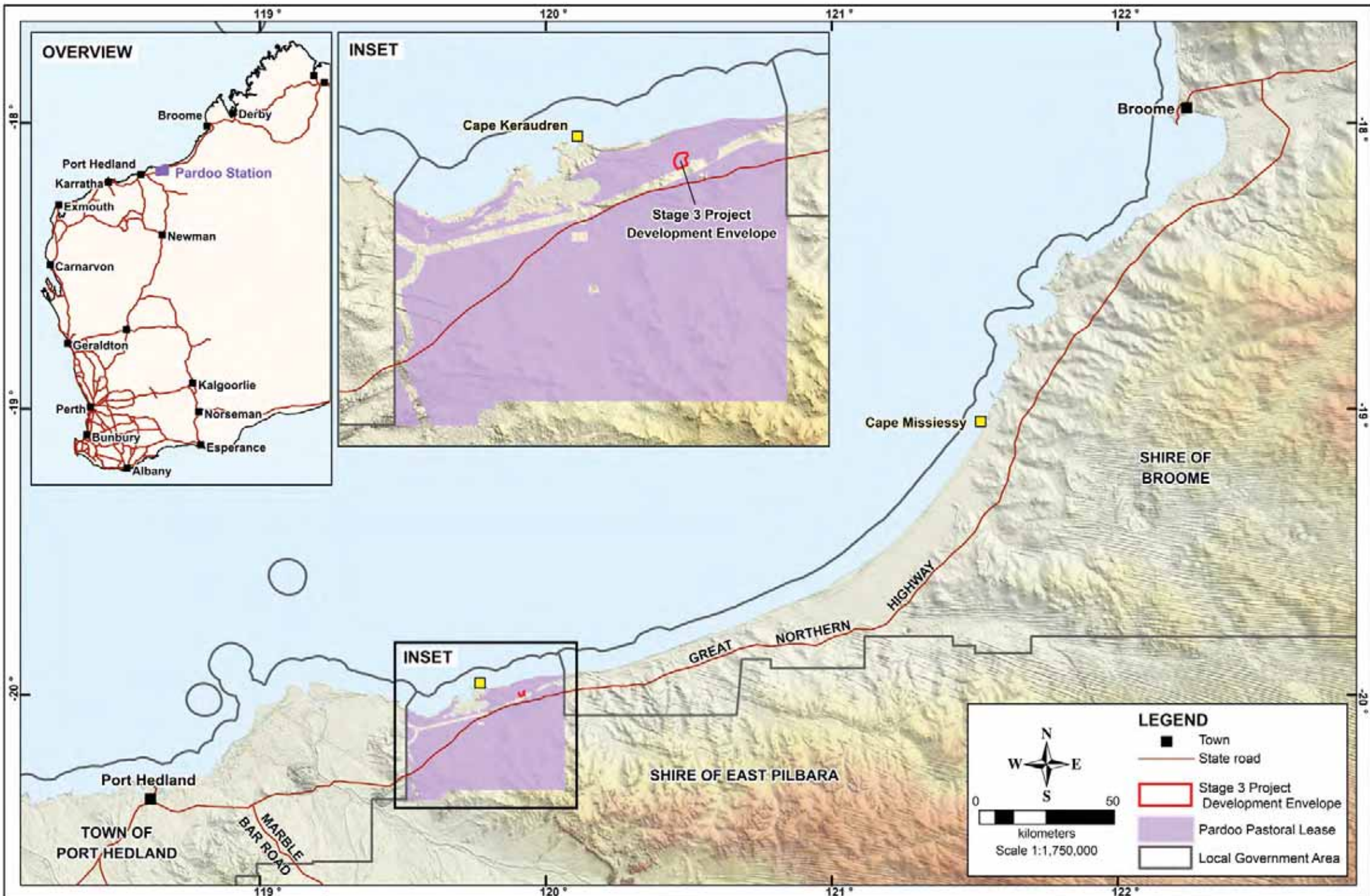
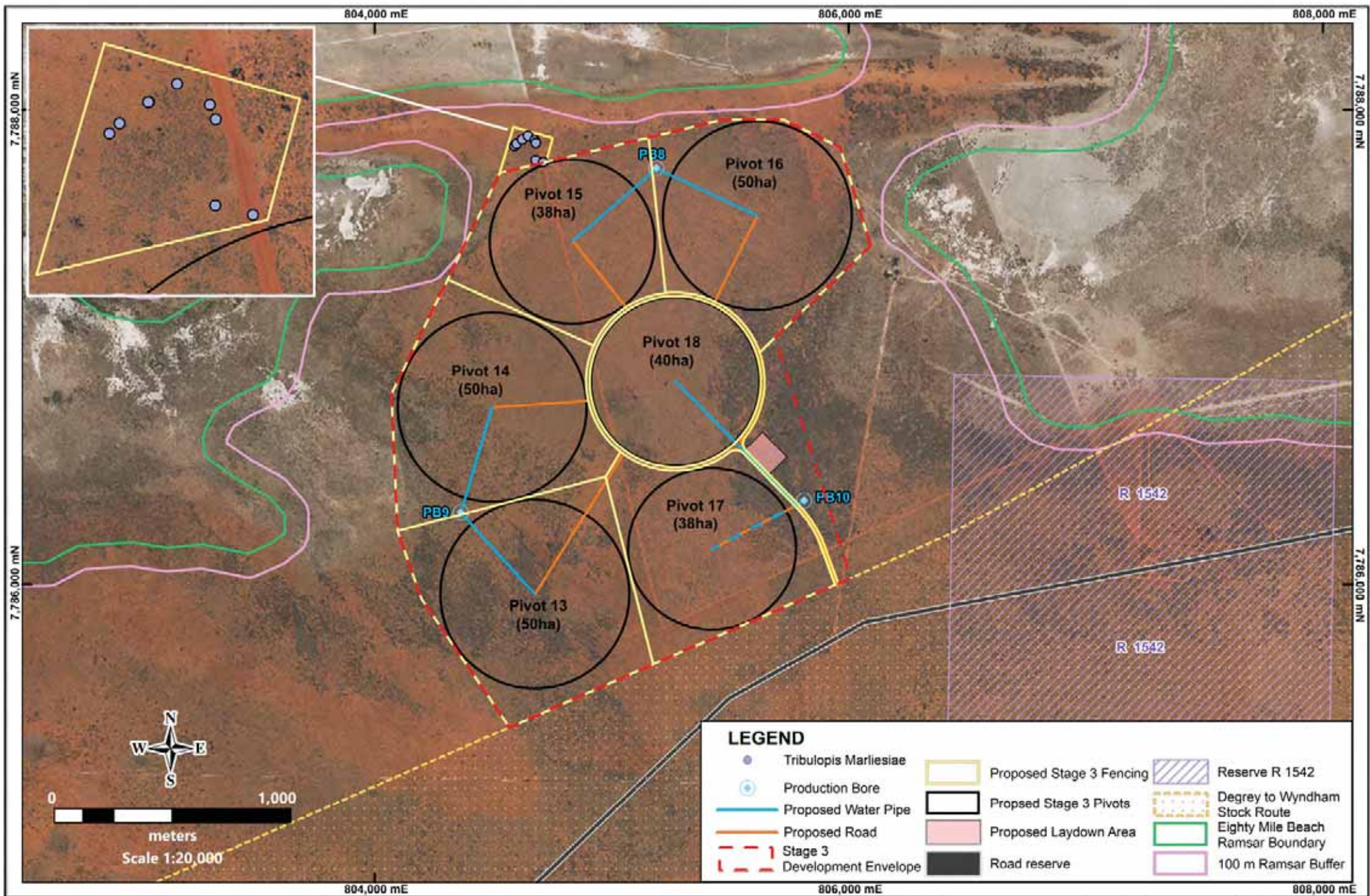


Figure 1. Pardoo Stage 3 Irrigation Project Location



LEGEND

- Tribulopsis Marliesiae
- Production Bore
- Proposed Water Pipe
- Proposed Road
- Stage 3 Development Envelope
- Proposed Stage 3 Fencing
- Proposed Stage 3 Pivots
- Proposed Laydown Area
- Road reserve
- Reserve R 1542
- Degrey to Wyndham Stock Route
- Eighty Mile Beach Ramsar Boundary
- 100 m Ramsar Buffer

Figure 2
Site Layout

1.1.3 SITE ESTABLISHMENT

Site establishment involves:

- Installation of bores to supply groundwater for irrigation.
- Clearing of circular areas of land where crops are proposed to be grown.
- Fencing of paddocks around the pivot areas (including some additional land outside each pivot) in order to contain cattle.
- Planting of Rhodes grass seeds.
- Application of water and fertiliser.
- Growing of the crops until maturity.
- Allowing cattle into selected pivot crop areas to graze directly.

It should be noted that:

- Clearing is carried out in a way which minimises erosion. Both the initial clearing and replanting strategy is timed to prevent erosion.
- Irrigation is applied to all pivots in a manner which ensures the water is consumed in-situ by the crop (and does not infiltrate to the groundwater). This is achieved by soil moisture monitoring and leaf tissue analysis to ensure that only the bare minimum of water is applied to achieve crop growth.
- No pesticides will be used in the Stage 3 irrigation project. They are not necessary for effective operations.
- The only contaminant in use is diesel, required for the diesel generators which drive the pivots.
- If herbicides are required to managed weeds, the Department of Biodiversity, Conservation and Attractions (DBCA) will be consulted and only herbicides agreed with the DBCA will be applied.
- No other chemicals or hydrocarbons are required on site.
- The Stage 3 project will carry approximately 3,000 size cattle at 200 kilograms each. This will increase the overall cattle numbers on the station by approximately 3,000 cattle.

1.1.4 DESCRIPTION OF CATTLE OPERATIONS

Cattle will be herded into the Stage 3 Development Envelope via a fenced track from existing cattle station holding yards to the south east – this fenced track will be installed as part of normal cattle station activities under the conditions of the pastoral lease.

Cattle will be herded up the main access road and gates will be opened and shut to facilitate access into the desired pivot area. Cattle will then be allowed to graze on the selected pivot until it is deemed by the operations manager that they should be moved (based on cattle condition/weight and crop fodder remaining, in accordance with the pastoral station's operational objectives).

There will be no additional trampling or grazing by cattle outside the fenced Development Envelope as cattle movement frequency and density is unlikely to change outside the fenced Development Envelope (cattle already move and graze freely within the local area as part of normal station activities regulated under the pastoral lease and installation of the pivots will not change this).

However, within the fenced Development Envelope there may still be some localised areas of indirect impact which are unavoidable due to increased trampling of cattle around the pivots. The fenced areas around the pivots will be used to restrict cattle when grazing on the pivots. The cattle tend to graze preferentially within the pivot crops themselves as they offer more nutritious and high calorie feed than surrounding native vegetation. However, some cattle may move off the pivots to rest after grazing and may impact surrounding native vegetation via trampling within the fenced areas when being herded for movement in and out of the fenced areas.

1.1.5 KEY CHARACTERISTICS

Table 2: Summary of the Proposal

Summary of the proposal	
Proposal title	Pardoo Irrigated Agriculture Project - Stage 3
Proponent name	Pardoo Beef Corporation Pty Ltd (PBC)
Short description	It is proposed to develop a centre-pivot irrigated feed crop production facility to improve cattle welfare, condition and throughput at Pardoo Station, a pastoral lease located north of the Great Northern Highway, approximately 100 kilometres (km) east-northeast of Port Hedland and 365 km southwest of Broome. The proposal includes the construction of pivot irrigation areas and associated infrastructure/activities (<i>access roads; laydown areas; production bores; diesel generators; water pipelines; fencing; pivot irrigators; and cattle fodder crops</i>).

Table 3: Location and proposed extent of physical and operational elements

Element	Indicative location	Existing Approval	Proposed change	Proposed extent authorised
Physical elements				
6 pivot fodder cropping areas	Within the 368 ha Development Envelope shown in Figure 4	None	Not applicable	Up to 266 hectares
Ancillary infrastructure (<i>access roads; laydown areas; production bores; diesel generators; water pipelines; fencing; pivot irrigators; and cattle fodder crops</i>)	Within 368 ha Development Envelope shown in Figure 4	None	Not applicable	Up to 14 hectares
Fenced paddock areas (for cattle containment)	Within 368 ha Development Envelope shown in Figure 4	None	Not applicable	Up to 88 hectares
Operational elements				
Abstraction of groundwater for irrigation - proposed abstraction already licensed: GWL158616(16)	From the production bores, with irrigation onto 266 ha of pivots shown in Figure 4	14.8 GL per annum for Pardoo Station of which 4.123 GL will be used for Stage 3 (already licenced by Groundwater Well Licence 158717(16))	None	No additional water required
Application of NPK fertiliser	Onto 266 ha of pivots shown in Figure 4	None	Not applicable	Up to 186 t per annum Nitrogen Up to 5.3 t per annum Phosphorus Up to 53 t per annum Potassium
Power Generation	Diesel Generators	None	Not applicable	0.096 MW
Diesel Consumption (in generators)	Diesel Generators	None	Not applicable	30 kL

1.2 HISTORIC AND FUTURE APPLICATIONS

1.2.1 PREVIOUSLY APPROVED – STAGES 1 AND 2

Two previous irrigation capability stages have already been approved as follows and are currently being implemented by the proponent) – Figure 3:

- Stage 1 – 270 ha footprint
 - Two developed 40 ha pivots plus 10 ha of operational areas –approved under Clearing Permit Number CPS 4207 for 90 ha (issued 28 July 2011)
 - Four developed 40 ha pivots approximately plus 20 ha of operational areas – already approved under Clearing Permit Number CPS 6552 for 180 ha (issued 23 July 2015).

- Stage 2 – 400 ha
 - Five 55 ha pivots, one 45 ha pivot and one 35 ha pivot currently being constructed (total of 355 ha for pivots)
 - 45 ha of support infrastructure.
 - Clearing Permit Number CPS 7312/1 (issued 13 July 2017).

Stages 1 and 2 do not form part of the current proposal.

1.2.2 POTENTIAL FUTURE PROPOSAL – STAGES 4, 5 AND 6

PBC is currently considering future referral to the EPA of subsequent irrigation capability Stages 4, 5 and 6. The details of these stages have not yet been determined. However, it is possible that a future referral for Stages 4, 5 and 6 may involve approximately 17 pivots and a footprint of approximately 1000 ha.

These Stages would also occur within the Land Tenure Envelope, but the exact location and layout has not yet been decided.

Potential future Stages do not form part of the current proposal.

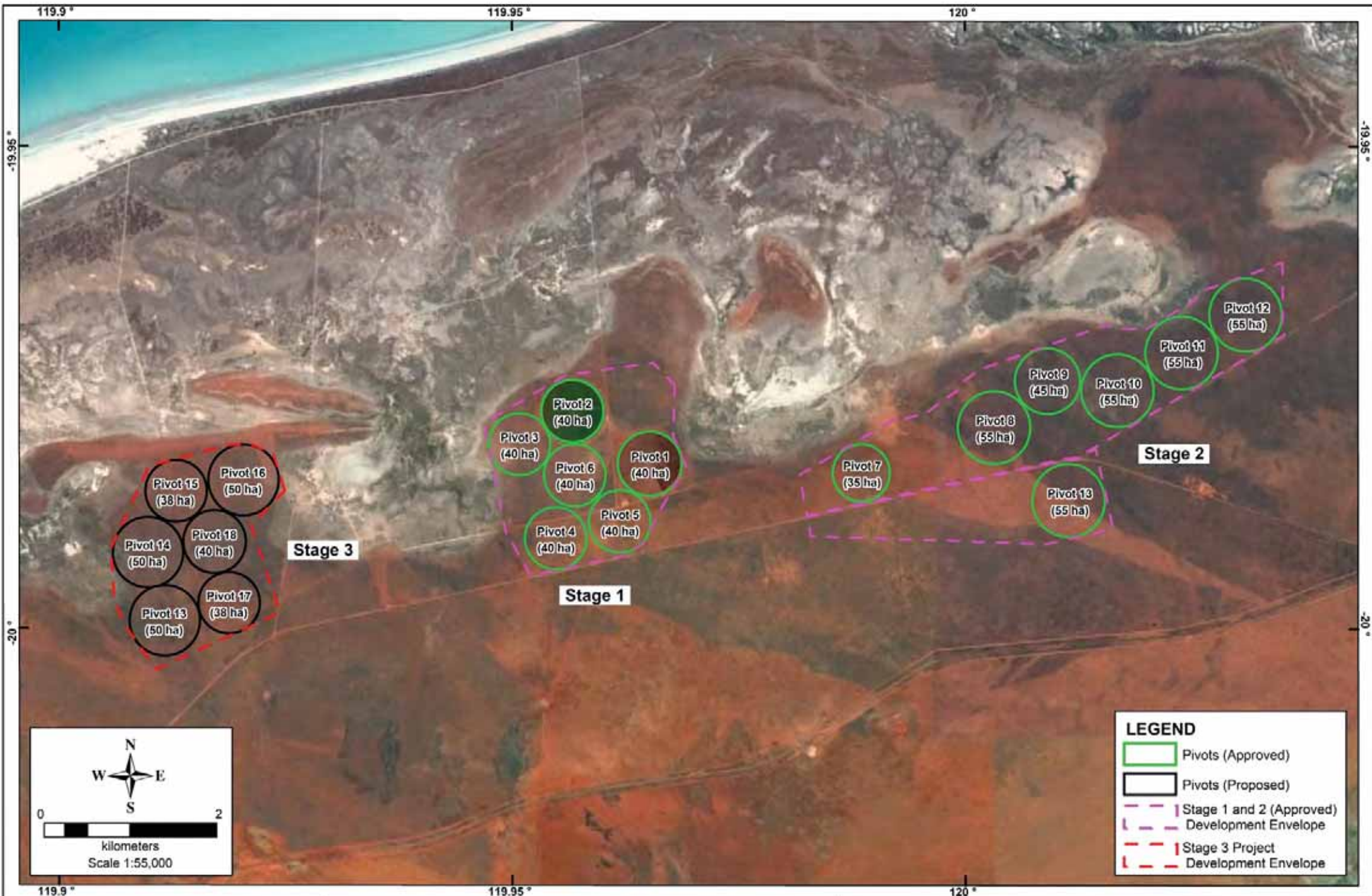


Figure 3. Pardoo Irrigation Historic Approvals

1.3 KEY ENVIRONMENTAL FACTORS

Key environmental factors are described in the table below.

Table 4: Key Environmental Factors

Item	Description
Flora and Vegetation	
Proposal activities affecting factor	<ul style="list-style-type: none"> • Clearing of terrestrial vegetation (for pivot irrigation areas and related infrastructure); • Crop establishment; • Fertiliser storage and use; • Irrigation and changes to drainage patterns; • Movement and grazing of cattle associated with pivot operations; • Operational activities (e.g. vehicle movement); and • Storage and handling of contaminants (hydrocarbons and chemicals).
Key environmental values	<ul style="list-style-type: none"> • Vegetation structure, condition and diversity • Priority flora • Priority ecological community
Ecosystem health / condition	<p>The Stage 3 Development Envelope:</p> <ul style="list-style-type: none"> • Has been continuously grazed for over 100 years. • Is sparsely vegetated with areas of degradation due to long term historical cattle grazing, trampling and fire. • Was burnt by a severe wildfire in 2015 thought to be started via lightning strike (covering 139 ha) with most of the vegetation in the fire's path destroyed; • Contains 10.3 ha of completely degraded vegetation mostly around stock watering points or along cattle movement trails; and • Due to the existing impacts above, has quite sparse vegetation with an average vegetation density (foliage cover) of only 35%. <p>Adjacent area of Ramsar Wetland:</p> <ul style="list-style-type: none"> • Has been continuously grazed for over 100 years. • Is sparsely vegetated with areas of degradation due to long term historical cattle grazing, trampling and fire. • Contains 73.5 ha of completely degraded vegetation mostly around stock watering points or along cattle movement trails.
Key assumptions	<ul style="list-style-type: none"> • Extensive regional and local information was available and was consulted. • DBCA Threatened Flora and TEC Databases were searched. • The author had conducted several previous studies in the region. • All specimens identified to species level. • Floristic community types are assemblages as defined by Gibson et al. (1994) The presence or absence of individual taxa in standard areas (quadrats) is used to define floristic groupings (or community types) based on shared species. A total of 176 floristic quadrats (each 50 m x 50 m or 2500 m²) were established within the native vegetation of the Stage 2 and 3 study areas. Within each quadrat all plant species were identified and their cover determined. • Structural vegetation mapping was conducted in the Ramsar Study area to the north to provide context regarding the surrounding environment.
Existing and/or potential uses	<ul style="list-style-type: none"> • Cattle grazing • Native fauna habitat (see factor below)
Terrestrial Environmental Quality	
Proposal activities affecting factor	<ul style="list-style-type: none"> • Mechanical disturbance during the clearing process; • Installation of equipment on site (generators, pipelines and irrigation equipment); • Trenching and burying water reticulation pipelines;

Item	Description
	<ul style="list-style-type: none"> • Fertiliser storage and use; • Waste generation and disposal; • Groundwater abstraction; • Operational activities (e.g. vehicle movement); and • Storage and handling of chemicals or hydrocarbons.
Key environmental values	<ul style="list-style-type: none"> • Surface and sub-surface soil condition and structure. • Surface and sub-surface soil quality.
Ecosystem health / condition	<p>The Stage 3 Development Envelope:</p> <ul style="list-style-type: none"> • Has been continuously grazed for over 100 years. • Has terrestrial areas of degradation due to long term historical cattle grazing, trampling and fire. • Contains 10.3 ha of completely degraded areas mostly around stock watering points or along cattle movement trails. <p>Adjacent area of Ramsar Wetland:</p> <ul style="list-style-type: none"> • Has been continuously grazed for over 100 years. • Has terrestrial areas of degradation due to long term historical cattle grazing, trampling and fire. • Contains 73.5 ha of completely degraded areas mostly around stock watering points or along cattle movement trails.
Key Assumptions	<ul style="list-style-type: none"> • Extensive regional and local information was available and was consulted. • Acid sulphate soil risk, surface geology and soil databases were searched. • Soil chemistry analysis was undertaken of 13 sub-surface soil samples in areas representative of the Stage 3 project area, the adjacent Ramsar area and the Stage 1 operational pivots. The soil chemistry analysis suite included: Colwell Phosphorous, Colwell Potassium, Sulphur (KCl 40), Organic Carbon (Walkley-Black), Nitrate Nitrogen, Ammonium Nitrogen, Electrical Conductivity, pH (water), pH (CaCl₂), Boron, Trace elements (DTPA: Copper, Zinc, Manganese, Iron) Exchangeable Cations (Calcium, Magnesium, Sodium, Potassium, Aluminium), Phosphorous Buffering Index (PBI). • Soil infiltration testing was also conducted at two locations within the Stage 3 project area and two locations within the adjacent Ramsar area.
Existing and/or potential uses	<ul style="list-style-type: none"> • Cattle grazing • Native fauna habitat (see factor below)
Terrestrial Fauna	
Proposal activities affecting factor	<ul style="list-style-type: none"> • Clearing of terrestrial fauna habitat (for pivot irrigation areas and related infrastructure); • Installation of equipment on site (generators, pipelines and irrigation equipment); • Crop establishment; • Fertiliser storage and use; • Irrigation and changes to drainage patterns; • Operational activities (e.g. vehicle movement); and • Storage and handling of contaminants (hydrocarbons) – note no chemicals or pesticides are used on site.
Key environmental values	<ul style="list-style-type: none"> • Terrestrial fauna habitat within project area. • Seasonal grassland dependent migratory bird habitat adjacent to project • Occasional (flooded every 10 years) and short lived (flooded for 2 – 5 weeks) wetland habitat adjacent to the project.
Ecosystem health / condition	<p>The Stage 3 Development Envelope:</p> <ul style="list-style-type: none"> • Has been continuously grazed for over 100 years.

Item	Description
	<ul style="list-style-type: none"> • Is sparsely vegetated with areas of degradation due to long term historical cattle grazing, trampling and fire. • Was burnt by a severe wildfire in 2015 thought to be started via lightning strike (covering 139 ha) with most of the vegetation in the fire's path destroyed; • Contains 10.3 ha of completely degraded vegetation mostly around stock watering points or along cattle movement trails; and • Due to the existing impacts above, has quite sparse vegetation with an average vegetation density (foliage cover) of only 35%. <p>Adjacent area of Ramsar Wetland:</p> <ul style="list-style-type: none"> • Has been continuously grazed for over 100 years. • Is sparsely vegetated with areas of degradation due to long term historical cattle grazing, trampling and fire. • Contains 73.5 ha of completely degraded vegetation mostly around stock watering points or along cattle movement trails.
Key Assumptions	<ul style="list-style-type: none"> • Extensive regional and local information was available and was consulted. • DBCA Threatened Fauna database was searched. • The author had conducted several previous studies in the immediate region. • All vertebrate fauna observed were identified. • All major Vegetation and Substrate Associations were visited and significant species habitat and traces were identified. • Site was fully surveyed to the level appropriate for a level 1 assessment and for the proposed impact. • Survey intensity was deemed adequate due to the scale of the project and the amount of data available in the region.
Existing and/or potential uses	<ul style="list-style-type: none"> • Cattle grazing • Native fauna habitat
Hydrological Processes	
Proposal activities affecting factor	<ul style="list-style-type: none"> • Clearing and earthworks to create pivots, roads, fencing and pipelines; • Irrigation of the pivots; and • Groundwater abstraction.
Key environmental values	<ul style="list-style-type: none"> • Groundwater hydrological processes in the Broome and Wallal aquifers • Surface water hydrological processes in the adjacent Ramsar area when flooded approximately every 10 years for 2-5 weeks
Ecosystem health / condition	<ul style="list-style-type: none"> • Groundwater system health assumed satisfactory because it is managed by the Department of Water and Environmental Regulation (DWER) through groundwater allocation and licencing processes. • Surface water system health assumed satisfactory, because impacts to hydrological processes unlikely in the local area (lack of development, urbanisation and other threatening processes).
Key assumptions	<ul style="list-style-type: none"> • Extensive regional and local information, including local meteorological data, terrain data, satellite imagery and soil mapping was available and was consulted. • The authors are experienced in hydraulic modelling and water balancing. • The hydraulic model was run for the three historical rainfall events. The overall extent and rate of retreat of the modelled flood water matches reasonably well with the observed satellite imagery and validates the model assumptions. • The largest rainfall record was modelled to capture the flood extent and duration – indicative of future increased rainfall in response to climate change. • Hydrological processes were modelled in both local and regional contexts with regard to existing and future groundwater users in the area.

Item	Description
	<ul style="list-style-type: none"> Extensive groundwater investigations have been ongoing on Pardoo Station since 2008 as part of the process of obtaining groundwater licences to abstract groundwater for irrigation purposes for the Pardoo Irrigation Project Stages 1, 2 and 3.
Existing and/or potential uses	<ul style="list-style-type: none"> Cattle grazing Neighbouring pastoral stations abstract groundwater Adjacent Ramsar wetland flood periodically after heavy prolonged rainfall providing temporary waterbird habitat for a small number of birds
Inland Waters Environmental Quality	
Proposal activities affecting factor	<ul style="list-style-type: none"> Clearing and earthworks to create pivots, roads, fencing and pipelines; Irrigation of the pivots; Application of fertiliser to crops; Storage, use and disposal of hydrocarbons; Waste generation and disposal; and Groundwater abstraction.
Key environmental values	<ul style="list-style-type: none"> Groundwater quality in the Broome and Wallal aquifers Surface water hydrological processes in the adjacent Ramsar area when flooded approximately every 10 years for 2-5 weeks
Ecosystem health / condition	Groundwater and surface water system health assumed satisfactory because impacts to water quality are unlikely in the local area (lack of contaminating processes such as industry, urbanisation and mining).
Key assumptions	<ul style="list-style-type: none"> Extensive regional and local information, including local meteorological data, terrain data, satellite imagery and soil mapping was available and was consulted. The authors are experienced in hydraulic modelling and nutrient impact assessment. Extensive groundwater investigations have been ongoing on Pardoo Station since 2008 as part of the process of obtaining groundwater licences to abstract groundwater for irrigation purposes for the Pardoo Irrigation Project Stages 1, 2 and 3. Groundwater quality has been monitored in the vicinity of the project since 2011, at production and monitoring bores for the existing Stage 1 irrigation project located approximately 2 km to the east of the proposed Stage 3.
Existing and/or potential uses	<ul style="list-style-type: none"> Cattle grazing Neighbouring pastoral stations abstract groundwater
Social Surroundings	
Proposal activities affecting factor	<ul style="list-style-type: none"> All land disturbance, excavation and construction activities
Key environmental values	<ul style="list-style-type: none"> Cultural heritage sites
Ecosystem health / condition	<ul style="list-style-type: none"> Assumed satisfactory as cultural heritage management measures ensure impacts to cultural heritage sites do not occur.
Key assumptions	<ul style="list-style-type: none"> An online search for relevant Aboriginal Heritage information was performed using the Department of Planning, Lands, and Heritage Aboriginal Heritage Inquiry System. The system incorporates both the Heritage Site Register and the Heritage Survey Database. Appropriate heritage surveys are currently being planned.
Existing and/or potential uses	<ul style="list-style-type: none"> Cattle grazing Neighbouring pastoral stations abstract groundwater Indigenous cultural heritage

1.4 CONDITION REQUIREMENTS

This project is at the stage of referral to the Environmental Protection Authority (EPA) under Part IV of *Environmental Protection Act (1986)*. Therefore, no Ministerial Statement or other conditions exist in relation to this project currently.

2 EMP PROVISIONS

The sub-sections below outline the proposed EMP provisions and the rationale for their selection.

2.1 FLORA AND VEGETATION

Table 5: Flora and Vegetation Objectives and Rationale

Objectives and Rationale for Provisions	Details
EPA Objective	To protect flora and vegetation so that biological diversity and ecological integrity are maintained.
Project Objectives	<ul style="list-style-type: none"> To contain impacts to flora and vegetation within the Development Envelope as far as practicable. To minimize impacts of the Stage 3 project on vegetation and flora surrounding the Development Envelope.
Baseline Monitoring/Studies	<p>Completed:</p> <ul style="list-style-type: none"> Detailed (Level 2) Flora and Vegetation Assessment (EnviroWorks Consulting, 2017a). <ul style="list-style-type: none"> Desktop review of available datasets. Detailed Flora and Vegetation Survey including 176 floristic quadrats (50 m x 50 m each) 11th – 21st July 2016 Targeted Priority Flora Survey including regional searches 25th – 28th August 2016 Reconnaissance (Level 1) Flora and Vegetation Survey of Ramsar area to the north of the project area 21 – 23rd September. Primary survey timing selected to occur after significant rainfall. <p>Proposed additional monitoring/studies prior to proposal implementation:</p> <ul style="list-style-type: none"> None.
Study Findings (EnviroWorks Consulting, 2017a)	<ul style="list-style-type: none"> Within Stage 3 Development Envelope, four floristic community types were identified by multivariate analysis. Within the Ramsar study area to the north, 6 structural vegetation communities were identified. The native plant communities present range from degraded to very good in ecological condition. Completely degraded vegetation covers 84 ha and occurs in association with cattle station activity and stock watering points (Figure 4). Percentage foliage cover (vegetation density), varies from 0% in areas completely devoid of vegetation (e.g. tracks, fence lines, agricultural infrastructure) to 40-60% in Pindan Shrublands. A fire in 2015 reduced cover in the western Pindan Shrublands to 20-30%. On average the vegetation cover across the Stage 3 development envelope is estimated to be 35% (Figure 4). No Threatened or Priority Ecological Communities (TEC's/PEC's) were identified within the Stage 3 Development Envelope. The scale of impacts to vegetation is considered to be small in a regional context, with only 0.15 and 0.002% of regional Pre-European Vegetation communities Pindan 32 and Mandora Coastal Plain 73 proposed to be impacted. These vegetation communities are not considered under threat, with 100% of their original extents remaining. 129 native plant species representing 79 genera and 35 families were recorded within the study areas.

Objectives and Rationale for Provisions	Details
	<ul style="list-style-type: none"> • Four weed species were recorded (<i>Aerva javanica</i>, <i>Calotropis procera</i>, <i>Cenchrus ciliaris</i> and <i>Tamarix aphylla</i>). <i>Aerva javanica</i> and <i>Cenchrus ciliaris</i> are common weeds associated with grazing. • A record of the Eighty Mile Land System Priority 3 PEC occurs 320 m immediately north of the Stage 3 Development Envelope. The buffer of the PEC overlaps the Stage 3 Development Envelope, however the occurrence of the PEC does not. • <i>Bonamia oblongifolia</i> (Priority 1) was identified as occurring in the Stage 3 Development Envelope and also further afield at intervals along tracks and firebreaks (0.013% of the estimated regional population proposed to be impacted) • <i>Tribulopsis marliesiae</i> (Priority 3) was located in a small area immediately north of the Stage 3 Development Envelope. No plants surveyed will be impacted.
Sensitive components of factor	<ul style="list-style-type: none"> • <i>Tribulopsis marliesiae</i> (Priority 3) – small local population with regional population unknown due to lack of surveys. Local surveyed population is not within Stage 3 Development Envelope and will be fenced to prevent cattle damage. • Eighty Mile Land System Priority 3 PEC 320 m immediately north of the Stage 3 Development Envelope. There will be no additional trampling or grazing by cattle outside the fenced Development Envelope as cattle movement frequency and density is unlikely to change in these areas (cattle already move and graze freely within the local area as part of normal station activities regulated under the pastoral lease and installation of the pivots will not change this).
Key impacts and risks	Clearing, trampling, weeds, inappropriate fire regimes and dust deposition.
Management approach	The mitigation hierarchy (avoid, minimise and rehabilitate) has been applied.
Project design impact avoidance measures	<ul style="list-style-type: none"> • All clearing for the Stage 3 project will be contained within the Development Envelope. The Development Envelope is located 100 m from the adjacent Ramsar wetland boundary and 320 m from the Eighty Mile Land System Priority 3 PEC record. • All cattle grazing on the Stage 3 pivots will be contained within the fenced Development Envelope to avoid damage to vegetation outside the Development Envelopment. • The local surveyed population of <i>Tribulopsis marliesiae</i> (Priority 3) is located outside the Development Envelope and will be fenced to prevent cattle damage.
Rationale for provisions	<ul style="list-style-type: none"> • Outcome based provisions capable of objective measurement and reporting have been proposed for: trampling of native vegetation and spread of Rhodes Grass (the proposed crop and a potential weed). • Management based provisions for actions which are less measurable have been proposed for: weeds, fire and rehabilitation. • Hydrological changes and contamination are covered under Hydrological Processes (Section 2.4) and Inland Waters Environmental Quality (Section 0).

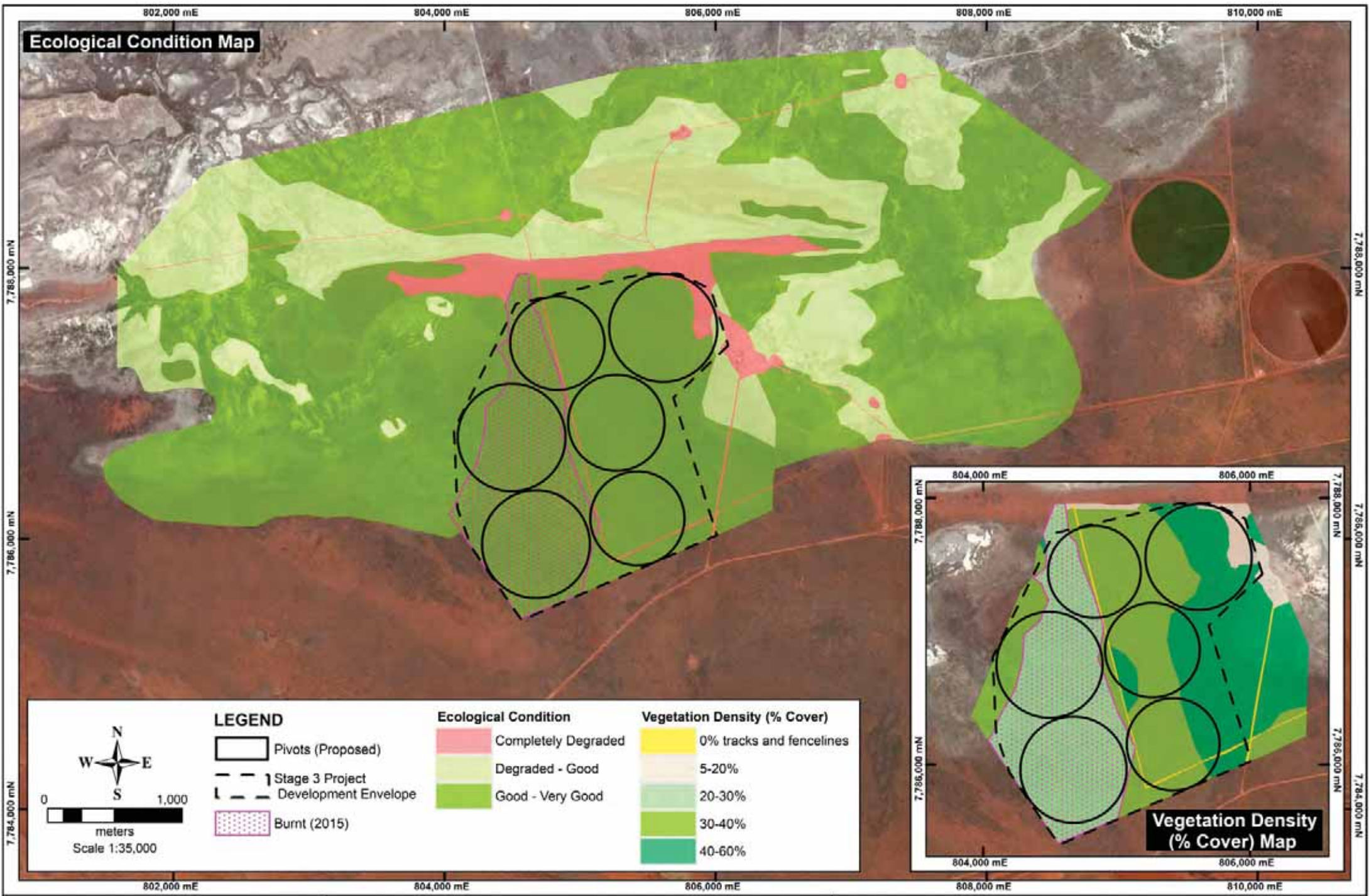


Table 6: Flora and Vegetation Outcome Based Provisions

Potential Impacts	Proposal Specific Outcome	Criteria	Response Actions	Monitoring	Reporting
Trampling of Native Vegetation outside fenced areas	Cattle designated to graze the pivots will not be allowed outside the Stage 3 fenced areas.	<p>Trigger Criterion: 1 occurrence of cattle escaping the fenced areas.</p> <p>Threshold Criterion: 2 occurrences of cattle escaping the fenced areas.</p>	<p>Trigger Actions:</p> <ul style="list-style-type: none"> • Cattle herded back to a contained area. • Incident investigated, and appropriate preventative actions implemented to prevent re-occurrence. <p>Threshold Actions:</p> <ul style="list-style-type: none"> • Cattle herded back to a contained area. • Incident investigated, and appropriate preventative actions implemented to prevent re-occurrence. • Incident report to the DWER. 	<p>Weekly site inspections</p> <p>Monthly environmental inspections</p>	<p>Incident report to DWER if threshold criteria exceeded.</p> <p>Annual Ministerial Statement Compliance Assessment Report to DWER</p>
Weeds - Spread of Rhodes Grass	Rhodes grass will not colonise environments outside the project area	<p>Trigger Criterion: Rhodes grass spread more than 15 m outside any pivot boundary.</p> <p>Threshold Criterion: Rhodes grass spread more than 30 m outside any pivot boundary.</p>	<p>Trigger Action:</p> <ul style="list-style-type: none"> • Eradication of Rhodes grass outbreaks with a DBCA approved herbicide. <p>Threshold Actions:</p> <ul style="list-style-type: none"> • Eradication of Rhodes grass outbreak with a DBCA approved herbicide. • Re-evaluation of irrigation and weed control methods, to prevent spread of Rhodes grass continuing further. 	Monthly environmental inspections	<p>Incident report to DWER if threshold criteria exceeded.</p> <p>Annual Ministerial Statement Compliance Assessment Report to DWER</p>

Table 7: Flora and Vegetation Management Based Provisions

Potential Impacts	Proposal Specific Objective	Management Actions	Management Targets	Monitoring	Reporting
Weeds General	- Avoid spread of weeds surrounding the Development Envelope due to Stage 3 activities.	Machinery will be washed and/or brushed down to remove weed seeds and propagules, prior to mobilising to site	<ul style="list-style-type: none"> Machinery clean down checklists followed and signed prior to mobilisation to site. 	<p>Monthly environmental inspections.</p> <p>Machinery clean down checklists completed.</p>	Annual Ministerial Statement Compliance Assessment Report to DWER.
Fire	No fires will be started due to human activity on site and any naturally occurring fires will be controlled where practicable.	A Fire Management Plan will be implemented prior to commencement of construction of Stage 3	<ul style="list-style-type: none"> A Fire Management Plan will be developed and implemented prior to commencement of construction of Stage 3 	Annual Ministerial Statement Compliance Assessment.	Annual Ministerial Statement Compliance Assessment Report to DWER.
Inappropriate Rehabilitation	If operations cease, the site will be appropriately rehabilitated	A Closure and Rehabilitation Plan will be developed and approved by DWER at least 1 year before planned decommissioning and closure of the site	<ul style="list-style-type: none"> A Closure and Rehabilitation Plan will be developed and approved by DWER at least 1 year before planned decommissioning and closure of the site. 	Annual Ministerial Statement Compliance Assessment.	Annual Ministerial Statement Compliance Assessment Report to DWER.

2.2 TERRESTRIAL ENVIRONMENTAL QUALITY

Table 8: Terrestrial Environmental Quality Objectives and Rationale

Objectives and Rationale for Provisions	Details
EPA Objective	To maintain the quality of land and soils so that environmental values are protected.
Project Objectives	<ul style="list-style-type: none"> To maintain soil productivity and to ensure no decline in soil quality, as a result of the Stage 3 development.
Baseline Monitoring/Studies	<p>Completed:</p> <ul style="list-style-type: none"> Desktop review of available datasets (surface geology, soil landscapes mapping, acid sulphate soils mapping) (EnviroWorks Consulting, 2017b). Soil chemistry analysis of 13 sub-surface soil samples in areas representative of the Stage 3 project area, the adjacent Ramsar area and the Stage 1 operational pivots (EnviroWorks Consulting, 2017b). Soil infiltration testing at two locations within the Stage 3 project area and two locations within the adjacent Ramsar area (Water Technology, 2017). <p>Proposed additional monitoring/studies prior to proposal implementation:</p> <ul style="list-style-type: none"> None.
Study Findings (EnviroWorks Consulting, 2017b)	<ul style="list-style-type: none"> Surface geology: <ul style="list-style-type: none"> <i>Stage 3 project area</i>: Sand or gravel plains; may include some residual alluvium; quartz sand sheets commonly with ferruginous pisoliths or pebbles; local clay, calcrete, laterite, silcrete, silt, colluvium. This geology type is typical of that found in the wider catchment and will not be altered by irrigation activities. <i>Ramsar area</i>: paleo-tidal in nature, consists of Estuarine, tidal delta and lagoonal deposits (paleo-tidal); coastal mud flats, silt and evaporite deposits (paleo-tidal); may contain older vegetated black soils. Acid Sulphate Soils: <ul style="list-style-type: none"> <i>Stage 3 project area</i>: majority lies within an area of Extremely Low (1-5% chance) acid sulphate soil risk, with a small area of High (>70% chance) acid sulphate soil probability occurring in the western corner. There will be no excavation in the area of High probability, so the risk of acid generation is considered low. <i>Ramsar area</i>: majority lies within an area of High (>70% chance) acid sulphate soil probability. pH <ul style="list-style-type: none"> <i>Stage 3 project area</i>: ranges from slightly acidic to neutral. <i>Ramsar area</i>: ranges from neutral to slightly basic. Infiltration rate <ul style="list-style-type: none"> <i>Stage 3 project area</i>: sandy soils representative of the wider catchment, with very high infiltration rates (~155 mm/hour). These high infiltration rates hinder lateral movement of contaminants (i.e. fertiliser, hydrocarbon spills) to the neighbouring Ramsar area, but facilitate movement of contaminants into the soil profile (and possibly groundwater). <i>Ramsar area</i>: low infiltration rates (~1 – 7 mm/hour).

Objectives and Rationale for Provisions	Details
	<ul style="list-style-type: none"> • Nutrients <ul style="list-style-type: none"> ○ <i>Stage 3 project area</i>: nutrient levels within the Stage 3 pre-development soils are low. ○ <i>Ramsar area</i>: elevated levels of nutrients, organics and salts (several orders of magnitude higher than the soils within the irrigation project area). The Ramsar area will not be disturbed. • The scale of impact to terrestrial environmental quality is considered to be small in a regional context, with only 0.025% of soil type 117 Nt proposed to be impacted regionally. • The scale of impact to terrestrial environmental quality is considered to be small in a local context, with only 0.22% of soil type 117 Nt proposed to be impacted on Pardoo Station.
Sensitive components of factor	<ul style="list-style-type: none"> • The high infiltration rates (~155 mm/hour) of the Stage 3 project area may facilitate rapid infiltration of contaminants (fertiliser, hydrocarbon spills) into the soil profile. • Areas of high acid sulphate soil probability could lead to acid generation if disturbed (via excavation) or dewatered (via groundwater abstraction or other hydrological changes). • Excessive application of fertilizer or water could result in nutrient accumulation, salination or sodicity. • Spills of contaminants (diesel, fertilizer or approved herbicides) could result in soil contamination.
Key impacts and risks	Soil degradation risks including erosion, salinisation, sodification, acid sulphate soil disturbance, nutrient accumulation and contamination.
Management approach	The mitigation hierarchy (avoid, minimise and rehabilitate) has been applied.
Project design impact avoidance measures	<ul style="list-style-type: none"> • Direct disturbance of the terrestrial environment will be avoided outside the Stage 3 Development Envelope, by fencing the Development Envelope to contain cattle within it. A buffer of 100 m is proposed from the adjacent Ramsar wetland. • The Stage 3 project is located on red sandy soils with a high infiltration rate. Because of their very high infiltration rate, and low clay content, these soils are not prone to surface water erosion, salinity or sodicity. • The only excavation required for the project is to install water pipelines (in trenches) from the bores to the centre of each pivot. None of these pipelines are located in an area of high ASS risk, therefore no excavation of high ASS risk areas will occur. • Irrigation volumes will be managed to prevent over irrigation leading to shallow water table rise and mobilization of naturally occurring salts (refer to Inland Waters Environmental Quality, Section 0). • Nutrient application rates will be managed to prevent nutrient build up (refer to Inland Water Environmental Quality, Section 0). • Potential contaminants will be appropriately stored and handled.
Rationale for provisions	<ul style="list-style-type: none"> • Outcome based provisions capable of objective measurement and reporting have been proposed for: salinity and sodicity. • Other potential impacts such as nutrient accumulation and other contamination have been covered under Inland Waters Environmental Quality (given the high infiltration rate of the soils will facilitate infiltration to groundwater).

Table 9: Terrestrial Environmental Quality Outcome Based Provisions

Potential Impacts	Project Specific Outcome	Criteria	Response Actions	Monitoring	Reporting
Soil salinity	The Stage 3 project does not cause unacceptable soil salinity	<p>Trigger Criterion: Soil salinity levels within the Development Envelope do not exceed 400mS/m in surface (0-10cm depth) or 600mS/m in subsurface (10-30cm depth) soils.</p> <p>Threshold Criterion: Soil salinity levels within the Development Envelope do not exceed 600mS/m in surface (0-10cm depth) or 800mS/m in subsurface (10-30cm depth) soils.</p>	<p>Trigger Actions:</p> <ul style="list-style-type: none"> • Identify the distribution of soil with salinity exceeding trigger levels. • Investigate the cause of the salinity levels. • Verify the adequacy of the estimated leaching rate in controlling salinity. • Identify whether remedial action is required • Implement remedial actions. • Increase monitoring to quarterly in key affected locations. <p>Threshold Actions:</p> <ul style="list-style-type: none"> • Identify the distribution of soil with salinity exceeding threshold levels. • Investigate the cause of the salinity levels. • Verify the adequacy of the estimated leaching rate in controlling salinity. • Identify whether remedial action is required • Implement remedial actions. • Incident report to DWER. 	<p>Annual soil sampling at representative locations across the Development Envelope.</p> <p>Increase frequency to quarterly in key affected locations if trigger criterion exceeded.</p>	<p>Incident report to DWER if threshold criteria exceeded.</p> <p>Annual Ministerial Statement Compliance Assessment Report to DWER</p>

Potential Impacts	Project Specific Outcome	Criteria	Response Actions	Monitoring	Reporting
Soil Sodidity	The Stage 3 project does not cause unacceptable soil sodicity	<p>Trigger Criterion: Soil sodicity levels five years after commencement of irrigation do not exceed an Exchangeable Sodium Percentage (ESP) of 6% in surface (0-10cm depth) soils or 13% in subsurface (10-30cm depth) soils.</p> <p>Threshold Criterion: Soil sodicity levels five years after commencement of irrigation do not exceed an Exchangeable Sodium Percentage (ESP) of 10% in surface (0-10cm depth) soils or 16% in subsurface (10-30cm depth) soils.</p>	<p>Trigger Actions:</p> <ul style="list-style-type: none"> Identify the distribution of soil with sodicity exceeding trigger levels. Investigate the cause of the sodicity levels. Verify the adequacy of the estimated leaching rate in controlling sodicity. Identify whether remedial action is required Implement remedial actions. Increase monitoring to quarterly in key affected locations. <p>Threshold Actions:</p> <ul style="list-style-type: none"> Identify the distribution of soil with sodicity exceeding threshold levels. Investigate the cause of the sodicity levels. Verify the adequacy of the estimated leaching rate in controlling sodicity. Identify whether remedial action is required Implement remedial actions. Incident report to DWER. 	<p>Annual soil sampling at representative locations across the Development Envelope.</p> <p>Increase frequency to quarterly in key affected locations if trigger criterion exceeded.</p>	<p>Incident report to DWER if threshold criteria exceeded.</p> <p>Annual Ministerial Statement Compliance Assessment Report to DWER</p>

2.3 TERRESTRIAL FAUNA

Table 10: Terrestrial Fauna Objectives and Rationale

Objectives and Rationale for Provisions	Details
EPA Objective	To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.
Project Objectives	<ul style="list-style-type: none"> • To avoid impacts on the fauna and habitat within the Ramsar area to the North of the Stage 3 project. • To minimise other impacts on fauna and habitat as a result of the Stage 3 project.
Baseline Monitoring/Studies	<p>Completed:</p> <ul style="list-style-type: none"> • Level 1 Assessment (Bamford Consulting Ecologists, 2017): <ul style="list-style-type: none"> ○ Targeted survey for Greater Bilby and Brush-tailed Mulgara (fauna specialists walked transects 200 m apart in project area and surrounds) 12th – 14th July 2017. ○ Level 1 Survey of Stage 3 and Ramsar area to the North (Fauna specialists traversed as much of the area as possible to describe fauna habitat and make opportunistic observations. Targeted searches were also conducted for Greater Bilby, Mulgara and waterbirds. One evening also spent listening for rare fauna and spotlighting for reptiles) 18th – 21st September. <p>Proposed additional monitoring/studies prior to proposal implementation:</p> <ul style="list-style-type: none"> • During the month prior to clearing occurring, pre-clearance surveys (in accordance with DBCA guidelines) will be conducted by a fauna specialist for Mulgara and Greater Bilby within the Stage 3 Development Envelope. • Any individuals found during pre-clearance surveys will be moved on or relocated by a fauna specialist prior to the commencement of clearing in consultation with the DBCA.
Study Findings (Bamford Consulting Ecologists, 2017)	<ul style="list-style-type: none"> • Fauna assemblage is largely intact and moderately rich, but highly variable seasonally and annually. Assemblage includes elements of the Great Sandy Desert, Pilbara and Kimberley. • Desktop study identified 235 vertebrate fauna species as potentially occurring in the project area: 5 frogs, 44 reptiles, 148 birds and 38 mammals. • No invertebrate species of conservation significance are expected in the survey area based on database searches. • 43 species of conservation significance could be present, most are expected only as vagrants or irregular visitors. • Few conservation significant species expected to be regularly reliant on the Stage 3 project area and adjacent Ramsar area. The most notable are the Bilby, Brush-tailed Mulgara and Spectacled Hare-Wallaby (regular visitors to Stage 3) and some grassland-dependent migratory waterbirds (Oriental Plover, Little Curlew and Oriental Pratincole) that can be expected to be regular migrants visiting the dry grasslands of the adjacent Ramsar area • The Stage 3 area and Ramsar site represent quite different landscapes and support few but distinct Vegetation and Substrate Associations. <ul style="list-style-type: none"> ○ <i>The Stage 3 project area</i> occurs within an area characterised by Pindan (red sandy) soils which support acacia and mixed species shrublands over spinifex grasslands. The area does not flood and is not seasonally wet,

Objectives and Rationale for Provisions	Details
	<p>due to the high infiltration rates of the pindan soil. The Stage 3 project area provides habitat values for species which utilise the dry, sandy, shrubland environment such as Bilby and Mulgara.</p> <ul style="list-style-type: none"> ○ <i>The Ramsar area</i> contains a mixture of grasslands and shrublands, as well as small salt pans on white to grey clayey soil. This area can be categorised as a coastal floodplain which is seasonally damp and floods infrequently for short periods after heavy prolonged rainfall. It provides habitat values for grassland-dependent migratory waterbirds (Oriental Plover, Little Curlew and Oriental Pratincole) that can be expected to be regular migrants visiting the dry grasslands of the adjacent Ramsar site. ● The area of habitat loss across the largely intact landscape is proportionately small, and therefore the impact upon fauna biodiversity from habitat loss is predicted to be negligible. The 1028 ha of disturbance/impact from Stages 1, 2 and 3 at Pardoo represents 1.7% of the 61,143 ha of native vegetation from the Nita Land System the within a 15km buffer around the three project areas. ● The fauna assemblage does not appear to be reliant upon connectivity or existing habitat corridors, and therefore the threat from population fragmentation due to pivot development appears negligible. ● Abundance of waterbirds is not expected to be high and the likelihood of meeting the criteria for Ramsar listing in terms of numbers of birds is extremely low. Instead, the criteria for Ramsar listing are met by the coastal mudflat areas of Eighty Mile Beach 4 km away. ● Some of the fauna is sensitive to feral species such as Foxes and wild dogs/Dingoes. The pivots may represent an environment where such feral species will increase in abundance, either due to increased access to water or increased access to food.
Sensitive components of factor	<ul style="list-style-type: none"> ● The closest coastal beaches and mudflats which meet the criteria for Ramsar listing in terms of numbers of migratory waterbirds are approximately 4 km away from the Stage 3 project (along Eighty Mile Beach). Due to distance they are unlikely to be affected by the project. ● The Ramsar area 100 m to the north of the Stage 3 project: <ul style="list-style-type: none"> ○ Provides seasonal habitat values for small numbers of grassland-dependent migratory waterbirds (Oriental Plover, Little Curlew and Oriental Pratincole). ○ Provides occasional habitat values for small numbers of wetland-dependent waterbirds when flooded for periods of up to 5 weeks, approximately every 10 years. ● The Stage 3 project area provides habitat for Mulgara and Bilby which are species which live and reproduce in burrows and are therefore sensitive to clearing activities if animals are not relocated/moved on from burrows before clearing commences.
Key impacts and risks	Habitat clearing, vehicle/equipment strike, entrapment, exposure to toxicants, behaviour changes, altered fire regimes and increases in feral species.
Management approach	The mitigation hierarchy (avoid, minimise and rehabilitate) has been applied.

Objectives and Rationale for Provisions	Details
Project design impact avoidance measures	<ul style="list-style-type: none"> All clearing for the Stage 3 project will be contained within the Development Envelope. A buffer of 100 m is proposed from the Ramsar wetland boundary. All cattle grazing on the Stage 3 pivots will be contained within the fenced Development Envelope. To avoid fauna behavioural changes, no project lighting will occur, all waste disposal will occur off site and no surface water ponding will occur as a result of irrigation (all irrigation water will infiltrate the soil). No pesticides will be used on site and only DBCA approved herbicides will be used when it is necessary to control weeds.
Rationale for provisions	<ul style="list-style-type: none"> Management based provisions for actions which are less measurable have been proposed for: preventing fauna mortality during clearing, vehicle/equipment strike, entrapment and feral fauna. Other potential impacts such as hydrological changes and toxicant exposure (via contaminants) have been covered under Hydrological Processes (Section 2.4) and Inland Waters Environmental Quality (Section 0).

Table 11: Terrestrial Fauna Management Based Provisions

Potential Impacts	Proposal Specific Objective	Management Actions	Management Targets	Monitoring	Reporting
Fauna mortality during clearing	Prevent mortality of burrow dependent conservation fauna species during clearing	Pre-clearance surveys, in particular for burrows, will be undertaken by a fauna specialist prior to ground disturbance activities. Where Bilby and Mulgara are recorded within the impact area, individuals will be relocated or otherwise managed in a way which is approved by DBCA.	<ul style="list-style-type: none"> Pre-clearance surveys undertaken by fauna specialist prior to ground disturbance. Any Bilby or Mulgara individuals are managed as approved by DBCA. 	<ul style="list-style-type: none"> Pre-clearance survey report. 	Annual Ministerial Statement Compliance Assessment Report to DWER.

Potential Impacts	Proposal Specific Objective	Management Actions	Management Targets	Monitoring	Reporting
Vehicle / equipment strikes	Minimise vehicle / equipment strikes of fauna	Vehicles and equipment will not be driven at night, will be restricted to designated roads/tracks and will comply with an on site speed limit of 60 km/hr. In addition, site personnel will be trained in fauna awareness including preventing fauna strike.	<ul style="list-style-type: none"> No driving of vehicles / equipment at night. Vehicles will be restricted to designated access roads. Speed will be limited to 60 km/hr. Training of personnel in fauna awareness including preventing fauna strike will occur. 	<ul style="list-style-type: none"> Daily inspections during clearing. Monthly environmental inspections. Training records. 	Annual Ministerial Statement Compliance Assessment Report to DWER.
Entrapment	Prevent fauna entrapment in trenches and behind fences	Trenches dug for water pipelines will not be left open (pipelines will be immediately installed and buried) and fencing will be installed in long linear stretches without "alcoves" in which fauna become trapped.	<ul style="list-style-type: none"> No trenches left open. Fencing to be in long linear stretches without alcoves. 	<ul style="list-style-type: none"> Daily inspections during clearing and fence installation. 	Annual Ministerial Statement Compliance Assessment Report to DWER.
Feral fauna	Prevent increases in feral fauna due to the Stage 3 project	Feral fauna control will be undertaken on an annual basis in consultation with the local DBCA office including: <ul style="list-style-type: none"> Shooting of wild dogs / foxes. Strategic baiting or trapping of cats; and If Cane Toad spreads to the region, implementing a station Cane Toad detection, eradication and reporting system 	<ul style="list-style-type: none"> Annual feral fauna control in consultation with the local DBCA office. 	<ul style="list-style-type: none"> Feral fauna control records. 	Annual Ministerial Statement Compliance Assessment Report to DWER.

2.4 HYDROLOGICAL PROCESSES

Table 12: Hydrological Processes Objectives and Rationale

Objectives and Rationale for Provisions	Details
EPA Objective	To maintain the hydrological regimes of groundwater and surface water so that environmental values are protected.
Project Objectives	To ensure the Stage 3 project does not cause changes to the hydrological processes of the Broome or Wallal Aquifers. To ensure that the Stage 3 project does not cause changes to the hydrological processes of local surface water regimes.
Baseline Monitoring/Studies	<p>Completed:</p> <ul style="list-style-type: none"> • A hydrological assessment of surface water conditions including (Water Technology, 2017): <ul style="list-style-type: none"> ○ A review of meteorological, terrain, satellite imagery and soil mapping data available. ○ Characterisation of the catchment soils and hydrology. ○ Preparation of a hydraulic model to determine the extent, duration and frequency of local flooding. • Extensive groundwater investigations and monitoring have been ongoing on Pardoo Station since 2008 as part of the process of obtaining groundwater licences to abstract groundwater for irrigation purposes for the Pardoo Irrigation Project Stages 1, 2 and 3 (Groundwater Consulting Services, 2008, 2009, 2011, 2013, 2014a, 2014b, 2015, 2016a, 2016b, 2017a, 2017b). <p>Proposed ongoing monitoring/studies:</p> <ul style="list-style-type: none"> • A detailed groundwater monitoring program is in place under the Operating Strategy required by Groundwater Well Licence 158717(16).
Study Findings (Water Technology, 2017); (Groundwater Consulting Services, 2008, 2009, 2011, 2013, 2014a, 2014b, 2015, 2016a, 2016b, 2017a, 2017b).	<ul style="list-style-type: none"> • Clearing and earthworks will affect approximately 280 ha of land within the Pindan red sandy soil type, and irrigation will be carried out on 266 ha of the Pindan red sandy soil type. • The Pindan red sandy soil type has a very high infiltration rate of around 155 mm/hour. After clearing, earthworks and crop establishment, it is expected that the infiltration rate in these areas will not change significantly, because the soil will remain in situ. • The irrigation project is located on relatively flat terrain, which when coupled with the high soil permeability means that runoff is negligible (as is typical of desert catchments). Streamlines are not well defined and there are no signs of concentrated flow, and modelling shows that no significant surface flows occur across the proposed Stage 3. The land is unlikely to become saturated due a depth to groundwater in excess of 3 m and an average annual rainfall of approximately 320 mm. • The boundary of Eighty Mile Beach Ramsar and Nationally Important Wetland occurs 100 m from the Stage 3 development. • Ponding occurs across parts of the adjacent Ramsar wetland due to the presence of more clayey soils and low infiltration rate (~1 – 7 mm/hour), however there is no obvious interaction between the two areas. • The combination of annual rainfall (320 mm) and irrigation on the pivot areas (1550 mm) results in 1,870 mm of water falling on the pivot areas annually. The area's potential evapotranspiration rate (APER) is around 1,755 mm/yr. Consequently, the annual 1,550 mm/m² of irrigation water will be used by the plants (or lost via evapotranspiration) and is unlikely to infiltrate to groundwater.

Objectives and Rationale for Provisions	Details
	<ul style="list-style-type: none"> • Irrigation application of water will be minimal (and timed to occur during periods of no rainfall). No post-development surface flows will be generated by the project because irrigation water will infiltrate to the plant root zone and will not create surface flow. Therefore, there will be no erosion due to surface water flows and no surface run-off related changes to flooding in the adjacent Ramsar wetland. • Likewise, there will be no significant changes in groundwater recharge or flows beneath the project due to surface irrigation. • The contours of the land will not be altered, therefore erosion and drainage lines will not be created. • There will also not be an artificial ecosystem created outside the project boundary as surface flows will not exist to sustain such an ecosystem. • Heavy rainfall will still infiltrate through the crop root zone to the groundwater (as is the case naturally within the Pindan soils prior to crop establishment). Therefore, the pivot irrigation is unlikely to have a significant impact on groundwater hydrological processes. • The surficial aquifer beneath the Stage 3 project area and coastal plain is known as the Broome aquifer which occurs within the Broome Sandstone, a cross-bedded sandstone, siltstone and conglomerate (its approximate thickness ranges from 30 – 70 m). Beneath the project area it is greater than 3 m depth below ground surface and flows in a northerly direction towards the coast. This is the receiving aquifer for any water or contaminant infiltration from the Stage 3 Project. • The deeper artesian aquifer is known as the Wallal aquifer, located within both the Alexander Formation (a fine to medium grained sandstone and interbedded mudstone) and the Wallal sandstone (a poorly consolidated coarse to fine grained sandstone). It is a confined aquifer separated from the Broome Aquifer by a layer known as the Jarlenai siltstone, a light-grey to black, puggy, silty clay (its approximate thickness ranges from 50 – 100 m). All groundwater abstraction on Pardoo Station occurs from the Wallal aquifer. • There are no groundwater dependent ecosystems close to the Stage 3 project. Parts of the Mandora Salt Marsh, approximately 120 km east of the Stage 3 project are thought to be groundwater dependent. In addition, there are several springs located 20 – 45 km south west of the Stage 3 project which are groundwater dependent. Some plant species in the adjacent Ramsar area may access saturated surface soil or the surficial Broome aquifer, however not the deeper artesian Wallal aquifer. • Groundwater Well Licence 158717(16) approves groundwater abstraction from the artesian water resources of the Wallal aquifer. This abstraction: <ul style="list-style-type: none"> ○ Will not change soil saturation as the Wallal Aquifer is artesian in nature and not connected to surface soils. Therefore, soil saturation and flooding in the adjacent Ramsar wetland will not be impacted by groundwater abstraction for the project. ○ Is unlikely to reduce groundwater availability for other groundwater users because the abstraction is modest in terms of the water available within the Wallal aquifer (abstraction of 4.123 GL annually is a small proportion of the 100 GL annual flow through the aquifer (4%) and therefore does not affect the total storage of groundwater within the aquifer). ○ Will not impact groundwater dependent ecosystems, because the water abstraction is from the artesian Wallal aquifer. ○ Will not impact stygofauna, because the Wallal aquifer does not contain suitable habitat for stygofauna.

Objectives and Rationale for Provisions	Details
	<ul style="list-style-type: none"> To date there are no trends evident of unacceptable groundwater drawdown impacts in the Wallal aquifer or changes to hydrological processes within the Broome aquifer resulting from groundwater abstraction in place for Stages 1 and 2 of the Pardoo Irrigation Project, with monitoring ongoing since 2011.
Sensitive components of factor	<ul style="list-style-type: none"> The Broome aquifer could be sensitive to hydrological changes caused by over irrigation of crops. The Wallal aquifer could be sensitive to hydrological changes caused by excessive groundwater abstraction. Local surface water processes could be affected if the project causes a change in infiltration of surface water on the red sandy pindan soils within the Stage 3 Development Envelope or flooding regimes on the adjacent clayey/silty soils within the Ramsar area.
Key impacts and risks	<ul style="list-style-type: none"> Wallal Aquifer – groundwater drawdown and potential impacts on other users, groundwater dependent ecosystems or stygofauna. Broome Aquifer – over irrigation leading to shallow water table rise causing salinity and/or flooding. Surface Water – changes in contours leading to changes in flow paths/flooding, over irrigation leading to water logging/flooding, changes in soil structure leading to changes in infiltration.
Management approach	The mitigation hierarchy (avoid, minimise and rehabilitate) has been applied.
Project design impact avoidance measures	<ul style="list-style-type: none"> Impacts to surface water processes have been avoided given no pre-development surface flows exist in the project area (due to high infiltration rates) and none will be created post-development (given the soil will remain in situ, infiltration rates will not change and irrigation rates are less than projected crop evapotranspiration rates). Impacts on other groundwater users have been avoided by only accessing 4% of the annual flow through of the Wallal aquifer (a resource which is managed by the DWER through the groundwater allocation and licencing process). Impacts on groundwater dependent ecosystems have been avoided by utilising the artesian resources of the Wallal aquifer (given any coastal plain vegetation would access groundwater from saturated surface soils or the Broome aquifer, which is separated from the Wallal aquifer). Impacts on groundwater dependent springs and wetlands (located 20 – 120 km away) have been avoided by their distance from the project. Impacts on subterranean fauna have been avoided by utilising the artesian resources of the Wallal aquifer which does not contain suitable habitat for subterranean fauna.
Rationale for provisions	<ul style="list-style-type: none"> Outcome based provisions capable of objective measurement and reporting have been proposed for: changes to surface water hydrological processes and over-irrigation changing hydrological processes.

Table 13: Hydrological Processes Outcome Based Provisions

Potential Impacts	Proposal Specific Outcome	Criteria	Response Actions	Monitoring	Reporting
Changes to surface water hydrological processes within or surrounding the project area.	The Stage 3 project will not cause changes to surface water hydrological processes within or surrounding the project area.	<p>Trigger Criterion: Surface water inundation or flooding is evident within Stage 3 Development Envelope when no rainfall has occurred in the preceding 8 weeks.</p> <p>Threshold Criterion Surface water inundation or flooding is evident outside the Stage 3 Development Envelope (within a 1 km buffer) when no rainfall has occurred in the preceding 10 weeks.</p>	<p>Trigger Actions:</p> <ul style="list-style-type: none"> Investigate the cause of the surface water inundation or flooding. Undertake appropriate corrective action. <p>Threshold Actions:</p> <ul style="list-style-type: none"> Investigate the cause of the surface water inundation or flooding. Undertake appropriate corrective action. Incident report to DWER 	<p>Weekly site inspections.</p> <p>Monthly environmental inspections.</p> <p>Dry season monthly review of satellite imagery for flooding extents and review of rainfall records in the preceding months.</p>	Annual Ministerial Statement Compliance Assessment Report to DWER.
Over irrigation causing changes to hydrological processes	Soil Moisture Levels within the pivots should be maintained ideally between 15 and 20% volumetric water content (except when preceding rainfall has occurred) and should always be lower than 30% (except when preceding rainfall has occurred).	<p>Trigger Criterion: Soil moisture levels above 25% volumetric water content (except when rainfall has occurred in the preceding week).</p> <p>Threshold Criterion: Soil moisture levels above 30% volumetric water content (except when rainfall has occurred in the preceding week).</p>	<p>Trigger Actions:</p> <ul style="list-style-type: none"> Investigate the reason for soil moisture levels above 25%. If due to excessive irrigation, reduce irrigation rates. <p>Threshold Actions:</p> <ul style="list-style-type: none"> Investigate the reason for soil moisture levels above 30%. If due to excessive irrigation, reduce irrigation rates and report incident to Department of Water and Environment Regulation (DWER). 	Soil moisture levels within the pivots to be modelled and monitored on a daily basis.	Annual Ministerial Statement Compliance Assessment Report to DWER.

2.5 INLAND WATERS ENVIRONMENTAL QUALITY

Table 14: Inland Waters Environmental Quality Objectives and Rationale

Objectives and Rationale for Provisions	Details
EPA Objective	To maintain the quality of groundwater and surface water so that environmental values are protected.
Project Objectives	<ul style="list-style-type: none"> • To maintain the quality of the Wallal aquifer so that no significant changes occur compared to background • To maintain the quality of the Broome aquifer so that no significant changes occur compared to background. • To maintain the quality of short-lived local surface water bodies (which occur after flooding approximately every 10 years) so that no significant changes occur compared to background.
Baseline Monitoring/Studies	<p>Completed:</p> <ul style="list-style-type: none"> • A hydrological assessment of surface water conditions including (Water Technology, 2017): <ul style="list-style-type: none"> ○ A review of meteorological, terrain, satellite imagery and soil mapping data available. ○ Characterisation of the catchment soils and hydrology. ○ Preparation of a hydraulic model to determine the extent, duration and frequency of local flooding. • Extensive groundwater investigations and monitoring have been ongoing on Pardoo Station since 2008 as part of the process of obtaining groundwater licences to abstract groundwater for irrigation purposes for the Pardoo Irrigation Project Stages 1, 2 and 3 (Groundwater Consulting Services, 2008, 2009, 2011, 2013, 2014a, 2014b, 2015, 2016a, 2016b, 2017a, 2017b). <p>Proposed ongoing monitoring/studies:</p> <ul style="list-style-type: none"> • A detailed groundwater monitoring program is in place under the Operating Strategy under Groundwater Licence 158717(16).
Study Findings (Water Technology, 2017); (Groundwater Consulting Services, 2008, 2009, 2011, 2013, 2014a, 2014b, 2015, 2016a, 2016b, 2017a, 2017b).	<ul style="list-style-type: none"> • There is no surface water within the project area, given all rainfall infiltrates quickly in the sandy pindan soils and reports to groundwater. • There will be no sedimentation caused by irrigation water (no surface water will be generated as all irrigation water will be utilised by the plant root zone and heavy rainfall will continue to infiltrate to groundwater). • Vegetation in the neighbouring Ramsar wetland area is indicative of brackish water quality, which may occur due to build-up of salts during evaporative processes. • Local groundwater quality monitoring indicates: <ul style="list-style-type: none"> ○ The Wallal aquifer: contains hard, but fresh water ranging from slightly acidic to slightly alkaline pH. Nitrate levels are very low (in most cases below detection). Total phosphorous varies, with most readings low (below 0.01 mg/L). ○ The Broome aquifer: can contain soft or hard water, which is marginally fresh or slightly brackish and slightly alkaline. Nitrate levels are naturally elevated in the Broome aquifer (with nitrate readings actually decreasing since irrigation commenced – likely to be due to natural variation due to rainfall recharge). Total phosphorous ranged from 0.01 – 0.03 mg/L. ○ There are no trends evident of increasing nutrient or salt levels in either the Broome or Wallal aquifers since the commencement of irrigation at Pardoo Stage 1 and 2

Objectives and Rationale for Provisions	Details
	<ul style="list-style-type: none"> • The high infiltration rates (~155 mm/hour) of the Stage 3 project area may facilitate rapid infiltration of contaminants (fertiliser, hydrocarbon spills) into the soil profile, and possibly groundwater. • Based on an annual groundwater through-flow of 890,000 kL, approximately 0.0005 mg/L would be present from fertilisation of Stage 3 pivots in the Broome aquifer down gradient of the irrigation site. This is an insignificant amount of nitrate in the context of the naturally occurring nitrate levels in the Broome aquifer, which range from 0.2 to 4.9 mg/L • Cumulatively the three stages are not likely to increase nitrates in groundwater significantly, given the large flow of groundwater beneath the sites (due to annual aquifer replenishment from rainfall) and the modest amounts of fertiliser application which are unlikely to raise nutrient levels above natural background. • Salinisation could occur if over irrigation caused the shallow ground water table to rise, resulting in the mobilisation naturally occurring salts in the soil profile. However, as described above, irrigation will be limited to the minimal amounts needed for plant growth, such that no irrigation water will infiltrate to the groundwater. Therefore, the shallow water table will not rise as a result of the project.
Sensitive components of factor	<ul style="list-style-type: none"> • Abstraction from the Wallal aquifer could cause changes to groundwater quality. • The Broome aquifer could be sensitive to water quality changes caused excessive fertigation of crops, salination due to over-irrigation, contamination by spills of hydrocarbons/fertiliser/herbicides or acid sulphate soil disturbance. • Surface water ponding areas in the adjacent Ramsar wetland area (when flooding occurs after heavy rainfall) could be sensitive to sedimentation, contamination by spills of hydrocarbons/fertilizer/herbicides or acid sulphate soil disturbance.
Key impacts and risks	Excessive fertigation of crops, salination due to over-irrigation, contamination by spills of hydrocarbons/fertiliser/herbicides or acid sulphate soil disturbance.
Management approach	The mitigation hierarchy (avoid, minimise and rehabilitate) has been applied.
Project design impact avoidance measures	<ul style="list-style-type: none"> • No pre-development surface flows exist in the project area and none will be created post-development. • The irrigation water applied to the project will not infiltrate to the groundwater. Therefore, over irrigation causing the shallow ground water table to rise and resulting in the mobilisation of salts will not occur. • Nutrient increases in the Broome aquifer will be minimised by only applying the minimum fertiliser needed for plant growth. • Spills of hydrocarbons/fertilizer/herbicides will be avoided by appropriate storage and handling. • Sedimentation will not occur given erosion will be avoided as described under Terrestrial Environmental Quality (Section 2.2). • Acid sulphate soils will not be disturbed as described under Terrestrial Environmental Quality (Section 2.2).
Rationale for provisions	<ul style="list-style-type: none"> • Management based provisions for actions which are less measurable have been proposed for: groundwater quality, surface water quality and spills of hydrocarbons/fertiliser/herbicides.

Table 15: Inland Waters Environmental Quality Management Based Provisions

Potential Impacts	Proposal Specific Objective	Management Actions	Management Targets	Monitoring	Reporting
Changes in water quality of the Broome Aquifer due to the Stage 3 project	No unacceptable impacts on groundwater quality of the Broome Aquifer as a result of the Stage 3 project.	Implement monitoring of Broome Aquifer water quality, downstream of project activities including 3 Broome Aquifer bores and all potential contaminants from the Stage 3 Project (salt, hydrocarbons, nutrients and herbicides). Compare the results to available baseline data and ongoing monitoring trends. If monitoring indicates contamination is occurring, investigate this and take appropriate corrective and preventative action.	<ul style="list-style-type: none"> Monitor water quality of the Broome Aquifer downstream of the project. Address any contamination appropriately. 	<ul style="list-style-type: none"> Quarterly water quality monitoring. 	<p>As stipulated in Groundwater Well Licence 158717(16) or subsequent revision of replacement of that licence.</p> <p>Annual Ministerial Statement Compliance Assessment Report to DWER.</p>
Changes in water quality of the surface water in the adjacent Ramsar area (when flooded) due to the Stage 3 project	No unacceptable impacts on groundwater quality of surface water in the adjacent Ramsar area (when flooded) as a result of the Stage 3 project.	Implement monitoring of surface water quality, downstream of project activities when surface water is available (after flooding rainfall events). Compare the results to available baseline data and ongoing monitoring trends. If monitoring indicates contamination is occurring, investigate this and take appropriate corrective and preventative action.	<ul style="list-style-type: none"> Monitor water quality of surface water downstream of the project. Address any contamination appropriately. 	<ul style="list-style-type: none"> Water quality monitoring when surface water exists. 	<p>Annual Ministerial Statement Compliance Assessment Report to DWER.</p>

Potential Impacts	Proposal Specific Objective	Management Actions	Management Targets	Monitoring	Reporting
Spills of hydrocarbons, fertiliser or herbicides	Ensure appropriate prevention and management of spills of hydrocarbons, fertiliser or herbicides.	<p>Potential contaminants will be managed as follows</p> <ul style="list-style-type: none"> hydrocarbons contained within bunds according to the requirements of Australian Standard 1940; liquid nitrogen tanks within a concrete bund which will capture 110% of the volume stored; granular fertilisers stored on a hard stand within a shed; herbicides will not be stored on site (they will be brought to site when needed); and a Spill Response Procedure will be in place including appropriate staff training, appropriate spill clean up kits, waste disposal, spill reporting and corrective and preventative actions. 	<ul style="list-style-type: none"> Appropriate storage of all contaminants. Appropriate spill procedures will be followed in the event of an accidental spill. 	<ul style="list-style-type: none"> Weekly site inspections. Monthly Environmental inspection. Incident reporting of all spills. 	Annual Ministerial Statement Compliance Assessment Report to DWER.

2.6 SOCIAL SURROUNDINGS

Table 16: Social Surroundings Objectives and Rationale

Objectives and Rationale for Provisions	Details
EPA Objective	To protect social surroundings from significant harm.
Project Objectives	To comply with the <i>Aboriginal Heritage Act 1972</i> .
Baseline Monitoring/Studies	Completed: <ul style="list-style-type: none"> • Desktop review of available datasets (aboriginal reserves, Aboriginal heritage sites and European heritage sites). • Discussions have also been ongoing with traditional owners (refer to Section 3 Stakeholder consultation). Proposed additional monitoring/studies prior to proposal implementation: <ul style="list-style-type: none"> • Aboriginal heritage surveys are planned to be conducted prior to ground disturbance.
Study Findings (EnviroWorks Consulting, 2017b)	<ul style="list-style-type: none"> • There are no known heritage sites intersecting the Stage 3 Project. • No Aboriginal reserves or communities occur in the vicinity of the Stage 3 Project. • Four Aboriginal heritage sites occur within 5 km of the Stage 3 Project. These heritage sites do not occur within the Stage 3 Development Envelope, so impacts are unlikely.
Sensitive components of factor	<ul style="list-style-type: none"> • Four Aboriginal heritage sites occur within 5 km of the Stage 3 Project. These heritage sites do not occur within the Stage 3 Development Envelope, so there will be no disturbance, excavation or construction near these sites and indirect impacts (such as altered hydrological processes) are unlikely. • Appropriate Aboriginal heritage surveys are currently being planned to determine if any other sensitive components exist.
Key impacts and risks	<ul style="list-style-type: none"> • Accidental damage to an Aboriginal Heritage Site
Management approach	The mitigation hierarchy (avoid, minimise and rehabilitate) has been applied.
Project design impact avoidance measures	<ul style="list-style-type: none"> • Heritage surveys will be undertaken. • The proponent will comply with the <i>Aboriginal Heritage Act 1972</i>.
Rationale for provisions	<ul style="list-style-type: none"> • Management based provisions for actions which are less measurable have been proposed for: accidental damage to Aboriginal Heritage sites.

Table 17: Social Surroundings Management Based Provisions

Potential Impacts	Proposal Specific Objective	Management Actions	Management Targets	Monitoring	Reporting
Accidental damage to an Aboriginal Heritage Site	Avoid accidental damage to an Aboriginal Heritage Site	<ul style="list-style-type: none"> • Prior to any land disturbance undertake appropriate Aboriginal Heritage Surveys. • Wherever possible avoid any Aboriginal Heritage Sites identified. • Where not possible to avoid sites, obtain a Section 18 Licence to disturb a heritage site under the <i>Aboriginal Heritage Act 1972</i>, prior to any disturbance occurring. 	<ul style="list-style-type: none"> • Undertake Aboriginal Heritage Surveys. • Avoid sites where possible. • Where not possible to avoid sites obtain a Section 18 Licence to disturb a heritage site under the <i>Aboriginal Heritage Act 1972</i>, prior to any disturbance occurring. 	<ul style="list-style-type: none"> • Aboriginal heritage survey reports. • Section 18 licence records. 	Annual Ministerial Statement Compliance Assessment Report to DWER.

3 ADAPTIVE MANAGEMENT AND REVIEW

The Proponent will implement adaptive management to learn from the implementation of mitigation measures, monitoring and evaluation against trigger and threshold criteria, to more effectively meet the required outcomes and objectives.

The following approach will be adhered to:

- Monitoring data and records will be systematically reviewed and analysed on a continuous basis to determine and understand any trends or important results.
- Based on the analysis of this monitoring data and records, the Proponent will review and adjust the management measures in consultation with EPA Services, DWER.

4 STAKEHOLDER CONSULTATION

To date stakeholder communication and engagement has focussed on providing information to key stakeholders regarding:

- Proposed Project location and scale;
- Pardoo Beef Corporations's commitment to environmental management;
- Proposed approach for minimising and mitigating environmental impacts and risks; and
- Anticipated Project timing.

Table 18 below outlines the specific stakeholder consultation that has been undertaken.

Table 18: Stakeholder Consultation

Date	Issues/topics raised	Proponent response / outcome
Environmental Protection Authority (EPA)		
10/8/2017	<ul style="list-style-type: none"> • Overview of proposed project • Overview of environmental management measures 	<ul style="list-style-type: none"> • EPA Chairman advised that referral to the EPA was likely warranted.
29/8/2017	<ul style="list-style-type: none"> • Details regarding proposed referral of Stage 3 of irrigation project 	<ul style="list-style-type: none"> • EPA Chairman advised that Stage 3 could be referred if a transparent approach adopted regarding other subsequent stages.
Department of Water and Environmental Regulation (DWER) – Previously Department of Water (DoW) and Department of Environment Regulation (DER)		
2010 - 2011	<ul style="list-style-type: none"> • Application submitted to then DER for Stage 1 Clearing Permit • Ongoing discussion on details conducted 	<ul style="list-style-type: none"> • Clearing Permit Number CPS 4207 for 90 ha issued 28 July 2011
2016 - 2017	<ul style="list-style-type: none"> • Application submitted to then DER for Stage 2 Clearing Permit • Ongoing discussion on details conducted 	<ul style="list-style-type: none"> • Clearing Permit Number CPS 7312/1 issued 13 July 2017.
Feb 2017 – Aug 2018	<ul style="list-style-type: none"> • Application submitted to then DER for Stage 3 Clearing Permit • Ongoing discussion on details conducted 	<ul style="list-style-type: none"> • DER advised referral of Stage 3 to EPA may be warranted. • PBC commenced discussions with EPA and withdrew Clearing Permit Application
2015 - 2017	<ul style="list-style-type: none"> • Application submitted to then DoW for Groundwater Licence for water abstraction • Ongoing discussion on details conducted 	<ul style="list-style-type: none"> • Groundwater Well Licence 158616(11) was issued on 20 March 2015 for 7,740,000 kL/annum • Groundwater Well Licence 158616(14) was issued on 27 June 2016 for 10,000,000 kL/annum • Groundwater Well Licence 158717(16) was issued on 25 January 2017 for 14,822,250 kL/annum
Department of Biodiversity Conservation and Attractions (DBCA)		
Aug – Sept 2017	<ul style="list-style-type: none"> • Requested details regarding the boundary and values of the Eighty Mile Beach Ramsar Wetland 	<ul style="list-style-type: none"> • Details provided regarding the coastal plain boundary and potential flooding of the coastal plain creating waterbird habitat.
Department of Planning, Lands and Heritage (DPLH)		
2015 - 2017	<ul style="list-style-type: none"> • Applications for Permits to Diversify Submitted • Ongoing discussion on details conducted. 	<ul style="list-style-type: none"> • Permit to Diversify for Stage 1 issued 18 November 2015. • Permit to Diversify for Stage 2 issued 14 July 2017.

Date	Issues/topics raised	Proponent response / outcome
Pilbara Development Commission (PDC)		
April, August & Nov. 2017	<ul style="list-style-type: none"> Held ongoing meetings and discussions regarding the project and potential benefits to the Pilbara. 	<ul style="list-style-type: none"> PDC have indicated they are supportive of the project and the potential benefits it brings to the region.
Pilbara Regional Council (PRC)		
April, August & Nov. 2017 and Jan. 2018	<ul style="list-style-type: none"> Held ongoing meetings and discussions regarding the project and potential benefits to the Pilbara. 	<ul style="list-style-type: none"> PRC have indicated they are supportive of the project and the potential benefits it brings to the region.
Shire of East Pilbara		
2016	<ul style="list-style-type: none"> Requested confirmation that a Shire Development Application was not required for the project. 	<ul style="list-style-type: none"> Shire confirmed a Development Application was not required on 28 October 2016
Ngarla Traditional owners		
2015 - 2017	<ul style="list-style-type: none"> Indigenous Land Use Agreement (ILUA) negotiations. Pardoo has attended meetings with the traditional owners (Ngarla people) legal entity the Wanparta Aboriginal Corporation (WAC) Board. These meetings discussed all aspects of Pardoo's proposed use of the land for its project and were to negotiate an agreement regarding Pardoo's engagement with the Ngarla People and benefits to be provided to them. These meetings occurred on 18 September 2015, 19 August 2016, 25-26 October 2016 and 23 March 2017. Pardoo and its lawyers also met with WAC's lawyers on 20 March 2017 and 14 November 2017 to discuss matters relating to the agreement and Pardoo's proposed activities on the freehold envelope. 	<ul style="list-style-type: none"> Traditional owners have been supportive of the proposed pastoral activities (including Stage 3) and the potential partnership opportunities that may arise from these activities. No significant environmental or heritage issues have been raised by traditional owners during negotiations. Appendix C includes copies of letters received during consultation with the traditional owners. ILUA has been drafted. It is expected that the ILUA will be signed in Quarter 1 2018.

5 REFERENCES

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APPENDIX B. RAMSAR & NATIONALLY IMPORANT WETLAND CRITERIA

Eighty Mile Beach Ramsar and Nationally Important Wetland Listing Criteria

(Hale, 2009)

Ramsar Criteria		
No.	A wetland should be considered internationally important if it:	Justification for Inclusion of Eighty-mile Beach (coastal section)
1	Contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region.	Eighty-mile beach represents the greatest extent of continuous intertidal mudflat in excellent condition within the “Northwest” Integrated Marine and Coastal Regionalisation of Australia (IMCRA) bioregion.
2	Supports vulnerable, endangered, or critically endangered species or threatened ecological communities.	The site supports the Flatback Turtle (<i>Natator depressus</i>) listed as vulnerable under the federal <i>Environmental Protection and Biodiversity Conservation 1999</i> (EPBC) Act and data deficient under the IUCN Red List
3	Supports populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region.	Not related to coastal section of wetland – justification is related to Mandora Salt Marsh being a unique marsh habitat which is an important refugia for biological diversity.
4	Supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions.	The Eighty-mile Beach Ramsar site is considered one of the most important sites for stop-over and feeding by migratory shorebirds in Australia. Furthermore, Eighty-mile Beach represents the most important site internationally (in terms of total number of individuals) for nine species of migratory shorebird in the East Asian-Australasian flyway. In addition, the site is significant for the breeding of at least one species of marine turtle (Flatback Turtle, <i>Natator depressus</i>).
5	Regularly supports 20,000 or more waterbirds.	Eighty-mile Beach is considered to regularly support in excess of 500,000 birds. Total counts (summer) for a small portion of the 220km intertidal site are generally > 200,000. There is one record of 2.88 million Oriental Pratincoles on the beach in February 2004.
6	Regularly supports 1% of the individuals in a population of one species or subspecies of waterbird.	Eighty-mile Beach supports more than 1% of the flyway population (or 1% of the Australian population for resident species) of 21 waterbirds, including 17 migratory species and 4 Australian resident species.
Nationally Important Wetland Criteria		
Criteria for listing		An outstanding example of a major beach with associated inter-tidal flats and coastal floodplain, located in the arid tropics”, serving as “one of the most important migration stop-over areas for shorebirds in East Asia - Australasia, supporting more than 300,000 birds. It is one of the most important sites in the world for migration of Great Knot <i>Calidris tenuirostris</i> and it supports at least 1% of the national population of 21 shorebird species” (Department of the Environment and Energy, 2010).

APPENDIX C. CONSULTATION LETTERS - TRADITIONAL OWNERS

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18 April 2016

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Department of Lands
Gordon Stephenson House
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Our Reference
WANP01 2013

Dear Ms Bailey

Pardoo Beef Corporation Pty Ltd
Pastoral Lease N050324, Crown Lease M907732, Part Lot 1556 on Deposited Plan 70856

We refer to the above matter and to our letter to you dated 21 March 2016 ('Letter').

We confirm that Wanparta has since considered the Aboriginal heritage issues over the land and has completed discussions with Pardoo Beef Corporation Pty Ltd on same.

Accordingly, we can confirm that there are no native title or Aboriginal heritage impediments restricting the grant of the permits.

Please do not hesitate to contact us should you have any questions or wish to discuss the matter further.

Yours faithfully

MacLean Legal

MacLean Legal

Copied to:

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BY EMAIL

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BY EMAIL



Mowanjum Aboriginal Corporation

PO Box 3

DERBY WA 6728

ABN: 38 721 336 893 ICN: 90

Mr Bruce Cheung
Pardoo Beef Corporation
Level 5, 189 St George's Terrace
Perth WA 6000

Dear Bruce

Re: Transformational Project for the Pilbara Pastoral region.

We are very fortunate to have you join the northern pastoral industry to which you bring genuine partnership opportunities with not only access to world recognised genetic transformation but also economic and social benefits for our communities and much needed visibility in offshore markets.

As we adapt to the slow-down of business in the resources sector, it is very encouraging to see an investor such as yourself prepared to do the hard yards required to provide tangible diversification benefits to the north west of our State.

I see our business partnership as one with long term opportunities and look forward to being part of the Pardoo initiative to deliver a prime Wagyu product for the export market that will make the Pilbara and Western Australia proud.

We would also like to commend you for your support in agisting cattle at our pastoral property. This has directly assisted in improving the viability of our fledgling 100% Indigenous owned cattle enterprise and we have no doubt provide additional Indigenous employment opportunities in the future.

We also acknowledge your capability to attract and engage with large Asian buyers of prime quality beef and are privileged to have access to these buyers through our engagement with Pardoo Beef Corporation.

Rest assured of our support and committed participation for this very exciting transformation for our State,

Yours sincerely,

A handwritten signature in black ink, appearing to read 'Steve Austin'.

Steve Austin
Chief Executive Officer
Mowanjum Aboriginal Corporation
July 2016

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15 July 2016

Brett Blanchett
Chief Executive Officer
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Our Reference
WANP02 2016

Dear Mr Blanchett

Confirming of commencing negotiations of Indigenous Land Use Agreement negotiations between Wanparta Aboriginal Corporation RNTBC (ICN 4695) and Pardoo Beef Corporation Pty Ltd

We refer to the matter above.

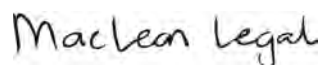
Further we confirm that MacLean Legal represents the Wanparta Aboriginal Corporation RNTBC (ICN 4695) ('**Wanparta**') that holds the Ngarla People's native title rights and interest in trust.

Further, we confirm that Wanparta and Pardoo Beef Corporation Pty Ltd ('**Pardoo Beef**') are due to commence negotiations of an Indigenous Land Use Agreement ('**ILUA**') for the purposes of Pardoo Beef receiving its necessary consents for its irrigated agriculture project.

Wanparta looks forward to progressing this matter with Pardoo Beef.

Please do not hesitate to contact us should you have any questions or wish to discuss the matter further.

Yours faithfully



MacLean Legal

Copied to:

Monica Chetty
Director (Strategic Partnerships)
Monica.chetty@pardoo.com

APPENDIX D. FLORA AND VEGETATION STUDY

Flora and Vegetation Study Pardoo Station Pivot
Irrigation Project Stage 3

Pardoo Beef Corporation Pty Ltd

P07 – J07

1 November 2017



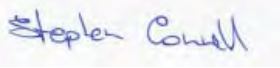

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REPORT DETAILS

Project Number: P07 – J07	
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Project Manager	Name: Laura Todd
Report Author	Name: Stephen Connell

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Please Note: This document is considered uncontrolled once printed.

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EXECUTIVE SUMMARY

EnviroWorks Consulting (EnviroWorks) was commissioned by Pardoo Beef Corporation Pty Ltd (PBC) to undertake a Flora and Vegetation Study at Pardoo Cattle Station.

Pardoo Station is located north of the Great Northern Highway, approximately 100 kilometres (km) east-north-east of Port Hedland and 365 km south west of Broome, Western Australia (Figure 1).

The study areas (Figure 2) are located approximately 40 km northeast of the Station homestead and included:

- Stage 2 irrigation project (now approved and under development); and
- Stage 3 irrigation project and the Ramsar wetland area immediately north (currently in the approvals application process).

This report focuses on the Stage 3 irrigation project study area which is currently in the approvals application process, however where relevant contextual information is provided regarding the Stage 2 study area and regional surveys.

This study has been conducted in accordance with *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (Environmental Protection Authority, 2016).

The first field survey was undertaken from 11th to 21st July 2016 and involved a Detailed Survey for the establishment of floristic quadrats and traversals of the Stage 2 and 3 study areas during which plant specimens were collected for later identification. Field studies focused on determining the type of plant communities present, compilation of comprehensive plant species lists, assessment of Threatened and Priority flora and a description of fauna habitat. During traversal, particular attention was paid to determining the extent of Rare and Priority species and, if found, the status of any populations of these species. A total of 176 floristic quadrats (each 50 m x 50 m or 2500 m²) were established. Within each quadrat all plant species were identified and their cover determined. Plant specimens were identified and verified using the resources of the State Herbarium and on-line State Herbarium database 'FloraBase'. Mapping of native vegetation was based on aerial photograph interpretation with the field studies providing details of community floristics and structure.

The second field survey was undertaken from 25th – 28th August 2016 and included priority flora searches within the Stage 2 and 3 study areas. Traverses were conducted of specific sections of the study areas where species of conservation significance were known to occur based on the July 2016 survey. These traverses were in a grid pattern with survey personnel walking approximately 40 m apart. GPS coordinates, plant counts (estimated where large numbers were found) and photographs were recorded of conservation significant flora. Flagging tape was strung up on surrounding vegetation to indicate the location of priority flora. The survey also included wider searches as necessary to assess the regional population of the priority flora species *Bonamia oblongifolia* (Priority 1).

The third field survey occurred from 21st – 23rd September 2017 and included re-examination of the Stage 3 area, as well as a Reconnaissance Survey and structural vegetation mapping of adjacent areas to the North (including the Ramsar wetland). The survey involved traversal of the study area during which plant specimens were collected for later identification. During traversal, particular attention was paid to determining the extent of Rare and Priority species and, if found, the status of any populations of these species. Plant specimens were identified and verified using the resources of the State Herbarium and on-line State Herbarium database 'FloraBase'.

Six native vegetation community types were identified locally across the Stage 2 and 3 irrigation project areas by multivariate floristic analysis:

- Acacia Shrubland A (Pindan) occupying 471.7 ha. It consists of open low woodland over an *Acacia* sp. scrub/low scrub over grassland and is mostly in good ecological condition). *Bonamia oblongifolia* (Priority 1) and *Phyllanthus eremicus* (Priority 3) occur infrequently in grazed areas.
- Acacia Shrubland B (Pindan) occupying 393.7 ha. It is open low woodland over an *Acacia* sp. scrub/low scrub over grassland and is mostly in good to very good ecological condition). Approximately 170 ha of this community were burnt in 2014-2015. *Bonamia oblongifolia* (Priority 1) occurs infrequently in grazed and burnt areas and at the periphery of the community
- Mixed Species Shrubland A (Pindan) is found over 68.4 ha covering flats and plains higher in the landscape than Acacia Shrubland A. It consists of low open woodland over a low mixed-species shrubland in good to very good ecological condition.
- Mixed Species Shrubland B (Pindan) is found over 6164 ha covering rises and ridges higher in the landscape than Acacia Shrubland B. It consists of low open woodland over a low mixed-species shrubland in good ecological condition.
- Melaleuca-Acacia Shrubland A (65.1 ha). This community occurs on brown sands below Acacia Shrubland A. It consists of low open woodland over a low mixed-species shrubland in degraded to good ecological condition. The main disturbance is grazing.
- Melaleuca-Acacia Shrubland B (65.1 ha). This community occurs on brown sands and white clays below Acacia Shrubland B. It consists of low open woodland over a low mixed-species shrubland in degraded to good ecological condition. The main disturbance is grazing

Structurally the four acacia and mixed species shrubland communities are similar Pindan communities with only minor variations in species composition. The two melaleuca-acacia shrubland communities are also structurally quite similar with only minor variations in species composition.

Broadly, these community types occur across an elevation gradient with Mixed-species Shrublands occurring on red sand loams higher in the landscape and in association with low ridgelines. Slightly lower in the landscape are found Acacia shrublands. These shrublands were extensive in the study areas. Melaleuca-Acacia shrublands occur on flat and gently undulating plains of white and brown sandy loams.

A Reconnaissance Level Survey including structural mapping of plant communities was carried out of the area to the north of the Stage 3 project area (including the Ramsar wetland). Six structural plant communities were mapped. For comparison purposes, the Stage 3 floristic mapping (described above) was translated into structural vegetation mapping as outlined in Table E1.

Table E1: Extent of Vegetation Communities Stage 3 Irrigation Project Study Area

Structural Type	Vegetation	Floristic Community	Stage 3 Development Envelope (ha)	Adjacent Study Area including Ramsar Wetland (ha)
Pindan Shrublands		Acacia Shrublands A and B (Pindan) and Mixed Species Shrubland B (Pindan).	346.6	228.6
Coastal Plain Thickets and Shrublands		Melaleuca-Acacia Shrubland B	13.5	954.6
Coastal Plain Grasslands and Low Shrublands		Does not exist in Stage 3	0	387.3
Salt Pans		Do not exist in stage 3	0	55.9
Low Limestone Ridges		Do not exist in Stage 3	0	60.4
Completely Degraded (includes Tracks)		Completely Degraded	11.4	72.4

No Threatened or Priority Ecological Communities (TEC's/PEC's) were identified within the study area through the Department of Biodiversity, Conservation and Attractions (DBCA) database search or through field visits. A DBCA record of the Eighty Mile Land System Priority 3 PEC occurs 320m immediately north of the Stage 3 Development Envelope. The 500m buffer of the PEC overlaps the Stage 3 Development Envelope, however the occurrence of the PEC does not. The Eighty Mile Land System PEC is described as: "Beach foredunes, longitudinal coastal dunes and sandy plains with tussock grasslands and spinifex grasslands" (Department of Biodiversity, Conservation and Attractions, 2017b). The quadrat based sampling and multivariate analysis within the Stage 3 Development Envelope did not find any occurrences of the Eighty Mile Land System PEC or other locally known PECs. The floristic community types identified within the Stage 3 Development Envelope are ubiquitous shrublands (Acacia Shrublands A and B (Pindan), Mixed Species Shrubland B (Pindan), and Melaleuca-Acacia Shrubland B) which are not similar to the local DBCA PEC records.

The native plant communities present within the study area range from degraded to very good in ecological condition. Weed invasion and physical disturbance associated with cattle station operations are the main disturbances. Completely degraded vegetation covers 11.4 ha in Stage 3 and 72.4 ha in the adjacent study area (including the Ramsar Wetland) and occurs in association with cattle station activity and stock watering points.

Within Stage 3, percentage foliage cover (vegetation density), varies from 0% in areas completely devoid of vegetation (e.g. tracks, fencelines, agricultural infrastructure) to 40-60% in Pindan Shrublands. A fire in 2015 reduced cover in the Pindan Shrublands of the western section. Vegetation in this area is currently in a regrowth stage. On average the vegetation cover across the Stage 3 Development Envelope is estimated to be 35%.

129 native plant species representing 79 genera and 35 families were recorded within the Pardoo study areas. The most common plant families included Fabaceae, Malvaceae and Amaranthaceae. Species of *Acacia* and *Melaleuca* dominate the shrub flora while Amaranthaceae, Malvaceae, Poaceae and Fabaceae species are most common within the lower strata. Four weed species were recorded. *Aerva javanica* and *Cenchrus ciliaris* are common weeds associated with grazing.

Two species of conservation significance were detected within or in close proximity to the Stage 3 study area – *Bonamia oblongifolia* (Priority 1) and *Tribulopsis marliesiae* (Priority 3) as described below:

- *Bonamia oblongifolia* (Priority 1) was identified as occurring in both the eastern and Stage 3 areas and also further afield at intervals along tracks and firebreaks. *Bonamia oblongifolia* is a low scrambling woody perennial. It occurs within Acacia Shrubland A and B communities and extends into Melaleuca-Acacia Shrubland A in the Stage 2 area. This species was also found to occur more widely within the region, during opportunistic searches over a 50 km stretch of Great Northern Highway south from 80 Mile Beach Rd and during separate field studies at Wallal Downs (EnviroWorks Consulting, 2016b). The regional population of *Bonamia oblongifolia* is estimated to be approximately 1,208,577 plants (refer to Section 4.6). When clearing is taken into account at Pardoo Stage 2, Wallal Downs and Anna Plains the remaining regional population is approximately 1,177,724 plants. Clearing (110 plants) and indirect disturbance (48 plants) at Pardoo Stage 3 represents only 0.013% of this regional population. Within the study areas, *Bonamia oblongifolia* occurs as localised populations with plants being found underneath taller shrubs and also exposed on open sandy areas often associated with disturbances. Populations were healthy and in fruit at the time of the field surveys.
- *Tribulopsis marliesiae* was located in a small area immediately north of the Stage 3 Development Envelope. The species was found within the Acacia Shrubland B Floristic Community – thirteen plants were identified outside the Stage 3 Development Envelope. The extent of this species at Pardoo is uncertain. It was not detected within the Stage 3 Development Envelope in any of the field surveys.

1 INTRODUCTION

EnviroWorks Consulting (EnviroWorks) was commissioned by Pardoo Beef Corporation Pty Ltd (PBC) to undertake a Flora and Vegetation Study at Pardoo Cattle Station.

Pardoo Station is located north of the Great Northern Highway, approximately 100 kilometres (km) east-north-east of Port Hedland and 365 km south west of Broome, Western Australia (Figure 1).

The study areas are located approximately 40 km northeast of the Station homestead and included (Figure 2):

- Stage 2 irrigation project (now approved and under development);
- Stage 3 irrigation project (currently in the approvals application process); and
- The Ramsar wetland area immediately north of the Stage 3 irrigation project area.

The objectives of this study were to:

- Develop an inventory of the flora occurring within the survey areas and to determine the presence of any flora of conservation significance.
- Undertake an assessment of vegetation communities present, their condition and potential conservation significance.
- Document the occurrence of Priority flora.
- Assess the regional population of *Bonamia oblongifolia*.

2 METHODS

Potentially significant species and associations of flora expected to occur within the vicinity of the project area were identified and compiled by searching Department of Biodiversity, Conservation and Attractions (DBCA) databases using a 50 km search buffer for flora and fauna species around the Stage 3 study area. Databases searched included the following:

- The Threatened (Declared Rare) and Priority Flora database (Ref: 27-0817FL).
- The Threatened and Priority Fauna database (Ref: 2017/000390 #5501).
- The Western Australian Herbarium Specimen database (Ref: 27-0817FL).
- The Threatened and Priority Flora List (Ref: 27-0817FL).
- The Threatened and Priority Ecological Community Database (Ref: 06-0917DBCA).

The study areas (Figure 2) are located approximately 40 km northeast of the Station homestead and included:

- Stage 2 irrigation project (now approved and under development); and
- Stage 3 irrigation project and the Ramsar wetland area immediately north (currently in the approvals application process).

This report focuses on the Stage 3 irrigation project study area which is currently in the approvals application process, however where relevant contextual information is provided regarding the Stage 2 study area and regional surveys.

This study has been conducted in accordance with *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (Environmental Protection Authority, 2016).

The first field survey was undertaken from 11th to 21st July 2016 and involved a Detailed Survey for the establishment of floristic quadrats and traversals of the Stage 2 and 3 study areas during which plant specimens were collected for later identification. Field studies focused on determining the type of plant communities present, compilation of comprehensive plant species lists, assessment of threatened and Priority flora and a description of fauna habitat. During traversal, particular attention was paid to determining the extent of Declared Rare and Priority species and, if found, the status of any populations of these species. A total of 176 floristic quadrats (each 50 m x 50 m or 2500 m²) were established. Within each quadrat all plant species were identified and their cover determined. Plant specimens were identified and verified using the resources of the State Herbarium and on-line State Herbarium database 'FloraBase'. Mapping of native vegetation was based on aerial photograph interpretation with the field studies providing details of community floristics and structure.

The second field survey was undertaken from 25th – 28th August 2016 and included priority flora searches within the Stage 2 and 3 study areas. Traverses were conducted of specific sections of the study areas where species of conservation significance were known to occur based on the July 2016 survey. These traverses were in a grid pattern with survey personnel walking approximately 40 m apart. GPS coordinates, plant counts (estimated where large numbers were found) and photographs were recorded of conservation significant flora. Flagging tape was strung up on surrounding vegetation to indicate the location of Threatened and Priority flora. All plant counts were based on 100 square metre areas and these counts were used to determine population sizes within and outside study areas. Estimates of *Bonamia oblongifolia* population sizes were obtained by extrapolation of counts obtained during foot and car traverses to 200m x 200m (4 ha) grid cells. The survey also included wider searches as necessary to assess the regional population of the priority flora species *Bonamia oblongifolia* (Priority 1).

The third field survey occurred from 21st – 23rd September 2017 and included re-examination of the Stage 3 area, as well as a Reconnaissance Survey and structural vegetation mapping of adjacent areas to the North

(including the Ramsar wetland). The survey involved traversal of the study area during which plant specimens were collected for later identification. During traversal, particular attention was paid to determining the extent of Rare and Priority species and, if found, the status of any populations of these species. Plant specimens were identified and verified using the resources of the State Herbarium and on-line State Herbarium database 'FloraBase'.

Floristic community types are assemblages as defined by Gibson et al. (1994). The presence or absence of individual taxa in standard areas (quadrats) is used to define floristic groupings (or community types) based on shared species.

Vegetation was mapped at the community level and is based on floristics, structure and land systems. Quadrats were classified by creating a dendrogram based on Sorensen's index of similarity (equivalent to Bray-Curtis index, with species presence-absence data only). The dendrogram was created using the Group Average Method ('UPGMA'), implemented in Primer v6 (Clarke & Gorley, 2006; Legendre & Legendre, 2012).

Ecological condition was assessed according to Keighery (1994). The vegetation condition rating scale used is included as Appendix A. Plant structural formation definitions follow Muir (1977) as outlined in Appendix B.

All maps and data are in GDA94 Zone 51 coordinates (except where stated otherwise).

3 ASSESSMENT OF CONSERVATION SIGNIFICANCE

The conservation status of both flora and fauna species is assessed under Commonwealth and State legislation such as the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the *WA Wildlife Conservation Act 1950* (WC Act). The significance levels for species used in the EPBC Act are those recommended by the International Union for the Conservation of Nature and Natural Resources (IUCN). The WC Act uses a set of Schedules but also classifies species using IUCN categories.

In Western Australia, the Department of Biodiversity, Conservation and Attractions (DBCA) has also produced a supplementary list of Priority flora and fauna, being species that are not considered Specially Protected under the WC Act, but for which there is cause for concern.

The following levels of conservation significance are recognised in this report (summarised in Table 1).

International: ICUN Classifications

- Extinct (EX): no reasonable doubt that the last individual has died
- Extinct in the Wild (EW): known only to survive in cultivation, in captivity or as a naturalized population (or populations) well outside the past range
- Critically Endangered (CR): considered to be facing an extremely high risk of extinction in the wild.
- Endangered (EN): considered to be facing a very high risk of extinction in the wild.
- Vulnerable (VU): considered to be facing a high risk of extinction in the wild.
- Near Threatened (NT): does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying (or is likely to qualify) for a threatened category in the near future.
- Least Concern (LC): does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.
- Data Deficient (DD): inadequate information to make an assessment of its risk of extinction.
- Not Evaluated (NE): has not yet been evaluated.

National: EPBC Act Classifications (as described above)

- Extinct
- Extinct in the wild
- Critically Endangered
- Endangered
- Vulnerable
- Conservation dependent

These categories are determined by the total distribution of the species, and not just their distribution within WA.

State: WC Act Classification

Threatened (T) species are published as Specially Protected under the WC Act and are listed under the *Wildlife Conservation (Rare Flora) Notice 2016* and the *Wildlife Conservation (Specially Protected Fauna) Notice 2016* as:

- **Schedule 1:** considered rare or likely to become extinct, as **critically endangered (CR)**
- **Schedule 2:** considered rare or likely to become extinct, as **endangered (EN)**
- **Schedule 3:** considered rare or likely to become extinct, as **vulnerable (VU)**
- **Schedule 4:** presumed to be **extinct (EX)**

The *Wildlife Conservation (Specially Protected Fauna) Notice 2016* contains an additional three Schedules of WC Act listed Specially Protected fauna:

- **Schedule 5:** Migratory birds protected under an international agreement (**IA**)
- **Schedule 6:** special conservation need as conservation dependent fauna (**CD**)
- **Schedule 7:** Other specially protected fauna (**OS**)

State: DBCA Priority Species

The DBCA maintain a list of Priority species which are of conservation significance but do not meet the criteria for inclusion as Specially Protected Wildlife under the WC Act. Priority species are broken into four DBCA management categories:

- Poorly-known (or inadequately surveyed) species:
 - **Priority One (P1):** Taxa known from few locations (generally <5), with occurrences either small or under immediate threat of habitat destruction / by other threatening process.
 - **Priority Two (P2):** Taxa known from few locations (generally <5) on conservation managed lands (e.g. national parks, nature reserves) or appear to be under threat from known threatening processes.
 - **Priority Three (P3):** Taxa that do not appear to be under immediate threat and are either known from several locations or from a few locations with large populations / significant areas of suitable habitat and, or
- Rare / Near Threatened / in need of monitoring:
 - **Priority Four (P4):** Taxa that:
 - may become rare if present circumstances change
 - are close to qualifying as Vulnerable (but are not listed as Conservation Dependent)
 - have been removed from the list of Threatened species in the last 5 years (for non-taxonomic reasons).

These categories are determined by the WA distribution of the species (unless part of a contiguous population extending into adjacent States).

Table 1: Categories Used to Define the Conservation Status of Species.

Level	Governing Body, Legislation (if relevant)	Conservation Categories
International	IUCN	Extinct (EX) Extinct in the Wild (EW) Threatened: Critically Endangered (CR) Endangered (EN) Vulnerable (VU) Near Threatened (NT) Least Concern (LC) Data Deficient (DD) Not Evaluated (NE)
National	DoEE, EPBC Act	Extinct Extinct in the Wild Critically Endangered Endangered Vulnerable Conservation Dependent

State of WA	DBCA, WC Act	Threatened Fauna / DRF (T): Schedule 1 (CR) Schedule 2 (EN) Schedule 3 (VU) Schedule 4 (EX) Schedule 5 (IA) Schedule 6 (CD) Schedule 7 (OS)
State of WA	DBCA supplementary priority list (not listed under legislation)	Priority species: Priority One Priority Two Priority Three Priority Four

4 RESULTS

The Stage 3 study area is located within the Pindanland IBRA subregion (Graham, 2001).

4.1 REGIONAL CONTEXT

The IBRA7 classification recognises 89 bioregions (Department of the Environment and Energy, n.d.). The study area occurs within the Dampierland bioregion, within the Pindanland subregion (Graham, 2001; May & McKenzie, 2003). The Pindanland subregional area is 5,198,904 ha and is described by the Australian Natural Resources Atlas (ANRA) as follows:

“The Pindanland subregion (DL2) is the coastal, semi-arid, north-western margin of the Canning Basin. The region has a semi-arid, hot, tropical climate with summer rainfall. Quaternary sandplains mantle Jurassic and Mesozoic sandstones and support Pindan vegetation on the plains and hummock grasslands on hills. Specific Plant Communities include:

- *Acacia ancistrocarpa* and/or *Acacia eriopoda* and/or *Acacia monticola* tall shrubland with *Triodia intermedia* and *Triodia pungens* hummock grasses.
- *Grevillea refracta*/*Hakea lorea* open shrubland with *Triodia pungens* hummock grasses.
- *Triodia pungens* and/or *Triodia schinzii* hummock grassland wooded with low trees and *Acacia* spp. Shrubs.”

Regional vegetation mapping was undertaken by Beard (1981) while Beeston et al. (2002) converted the existing paper maps to digital format. They analysed the information with respect to vegetation loss and reported on the current conservation status of community types. This information was last updated in March 2017 (Department of Biodiversity, Conservation and Attractions, 2017a).

The Stage 2 and 3 study areas are covered predominantly by the pre-European vegetation type “Pindan 32”, whilst the area to the North (including the Ramsar wetland) is covered predominantly by the pre-European vegetation type “Mandora Coastal Plain 73” (Figure 3). These Vegetation Units are not considered under threat, with 100% of their original extents remaining (Table 2).

Table 2: Pre-European Vegetation

Vegetation Association	Description	Original Extent (ha)	Extent (2012) (ha)
Pindan 32	Shrublands, pindan; acacia shrubland with scattered low trees over <i>Plectrachne</i> sp. & <i>Triodia</i> spp.	33,389	33,389 (100%)
Mandora Coastal Plain 73	Grasslands, short bunch grass savanna, grass; salt water grassland (<i>Sporobolus australasicus</i>)	249,064	249,064 (100%)

The composition of the native species flora within the study area is consistent with Vegetation Associations Pindan 32 and Mandora Coastal Plain 73. Plant communities mapped across the study area are described below.

4.2 QUADRAT BASED FLORISTIC ANALYSIS – STAGES 2 AND 3

Floristic community types are assemblages as defined by Gibson et al. (1994). The presence or absence of individual taxa in standard areas (quadrats) is used to define floristic groupings (or community types) based on shared species. A total of 176 floristic quadrats (each 50 m x 50 m or 2500 m²) were established within the native vegetation of the Stage 2 and 3 study areas. Within each quadrat all plant species were identified and their cover determined.

Six native vegetation community types were identified locally across the Stage 2 and 3 irrigation project areas by multivariate floristic analysis:

- Acacia Shrubland A (Pindan) occupying 471.7 ha. It consists of open low woodland over an *Acacia* sp. scrub/low scrub over grassland and is mostly in good ecological condition). *Bonamia oblongifolia* (Priority 1) and *Phyllanthus eremicus* (Priority 3) occur infrequently in grazed areas.
- Acacia Shrubland B (Pindan) occupying 393.7 ha. It is open low woodland over an *Acacia* sp. scrub/low scrub over grassland and is mostly in good to very good ecological condition). Approximately 170 ha of this community were burnt in 2014-2015. *Bonamia oblongifolia* (Priority 1) occurs infrequently in grazed and burnt areas and at the periphery of the community
- Mixed Species Shrubland A (Pindan) is found over 68.4 ha covering flats and plains higher in the landscape than Acacia Shrubland A. It consists of low open woodland over a low mixed-species shrubland in good to very good ecological condition.
- Mixed Species Shrubland B (Pindan) is found over 6164 ha covering rises and ridges higher in the landscape than Acacia Shrubland B. It consists of low open woodland over a low mixed-species shrubland in good ecological condition.
- Melaleuca-Acacia Shrubland A (65.1 ha). This community occurs on brown sands below Acacia Shrubland A. It consists of low open woodland over a low mixed-species shrubland in degraded to good ecological condition. The main disturbance is grazing.
- Melaleuca-Acacia Shrubland B (65.1 ha). This community occurs on brown sands and white clays below Acacia Shrubland B. It consists of low open woodland over a low mixed-species shrubland in degraded to good ecological condition. The main disturbance is grazing

Structurally the four acacia and mixed species shrubland communities are similar Pindan communities with only minor variations in species composition. The two melaleuca-acacia shrubland communities are also structurally quite similar with only minor variations in species composition.

Broadly, these community types occur across an elevation gradient with Mixed-species Shrublands occurring on red sand loams higher in the landscape and in association with low ridgelines. Slightly lower in the landscape are found Acacia shrublands. These shrublands were extensive in the study areas. Melaleuca-Acacia shrublands occur on flat and gently undulating plains of white and brown sandy loams.

Figures 4 and 5 show the classified floristic quadrats and vegetation communities present. Appendix C presents the multivariate analysis dendrogram, Appendix D provides detailed descriptions, Appendix E lists the coordinates of floristic quadrats while Appendix F tabulates their species lists for floristic analysis.

4.3 STRUCTURAL PLANT COMMUNITIES - RAMSAR AREA AND STAGE 3

A Reconnaissance Level Survey including structural mapping of plant communities was carried out of the area to the north of the Stage 3 project area (including the Ramsar wetland) – Figure 6. Six structural plant communities were mapped. For comparison purposes, the Stage 3 floristic mapping (described above) was translated into structural vegetation mapping as outlined in Table 3 below.

Each of the six structural communities is described in further detail within the sub-sections below.

Table 3: Extent of Vegetation Communities

Structural Type	Vegetation	Floristic Community	Stage 3 Development Envelope (ha)	Adjacent Study Area including Ramsar Wetland (ha)
Pindan Shrublands		Acacia Shrublands A and B (Pindan) and Mixed Species Shrubland B (Pindan).	346.6	179.2
Coastal Plain Thickets and Shrublands		Melaleuca-Acacia Shrubland B	10.21	957.7
Coastal Plain Grasslands and Low Shrublands		Does not exist in Stage 3	0	387.2
Salt Pans		Do not exist in stage 3	0	55.9
Low Limestone Ridges		Do not exist in Stage 3	0	60.4
Completely Degraded (includes Tracks)		Completely Degraded	10.26	73.5

4.3.1 PINDAN SHRUBLANDS

Pindan shrublands occur on red or red-brown sands predominantly within the Stage 3 project area and are located at a higher elevation in the landscape than the adjacent coastal plain vegetation types. These shrublands are often dense and are typically in good to very good ecological condition with grazing and trampling being mostly localised and more common in areas adjacent to Ramsar shrublands and grasslands (Plates 1 and 2). This community type occupies 346.6 ha (94%) of the Stage 3 Development Envelope and 179.2 ha (10.5%) of the adjacent survey area.

These pindan shrublands include the following floristic communities which are described in greater detail in Appendix D:

- Acacia Shrubland A (Pindan): Open Low Woodland B (to 4m) of *Bauhinia cunninghamii* and *Dolichandrone heterophylla* over low scrub/scrub to 2m (*Acacia stellaticeps*, *Acacia colei*, *Carrisa lanceolata*, *Melaleuca lasiandra*), over a variable ground layer of low grasses (*Triodia schinzii*, *Enneapogon purpurascens*, *Cenchrus ciliaris*, *Eragrostis falcata*) and herbs (*Corchorus sidoides* subsp. *sidoides*, *Corchorus parviflorus*, *Sida arenicola*, *Bonamia rosea*, *Solanum diversiflorum*, *Bonamia alatisemina*).
- Acacia Shrubland B (Pindan): Open Low woodland B (to 4m) of *Bauhinia cunninghamii*, *Erythrophleum chlorostachys* and *Dolichandrone heterophylla* over low scrub/scrub to 2m (*Acacia stellaticeps*, *Acacia colei*, *Carrisa lanceolata*, *Acacia ancistrocarpa*, *Acacia sericophylla*, *Grevillea pyramidalis*, *Acacia monticola*), over a variable ground layer of low grasses (*Triodia schinzii*, *Cenchrus ciliaris*, *Eragrostis falcata*) and herbs (*Corchorus sidoides* subsp. *sidoides*, *Corchorus parviflorus*, *Sida arenicola*, *Bonamia rosea*, *Ptilotus astrolasius*, *Indigofera monophylla*, *Jacksonia aculeata*).

- Mixed Species Shrubland B (Pindan): Open Low woodland B (to 4m) of *Corymbia hammerslayana*, *Erythrophleum chlorostachys* and *Dolichandrone heterophylla* over low scrub/scrub to 2m (*Acacia stellaticeps*, *Acacia coleii*, *Acacia dictyophleba*, *Hakea macrocarpa*, *Acacia ptychophylla*, *Stylobasium australe*, *Acacia ancistrocarpa*, *Acacia sericophylla*, *Grevillea pyramidalis*, *Acacia monticola*), over a variable ground layer of low grasses (*Triodia schinzii*, *Eragrostis falcata*), shrubs and herbs (*Bonamia rosea*, *Heliotropium vestitum*, *Jacksonia aculeata*).



Plate 1: *Acacia stellaticeps* low shrubland.



Plate 2: Grazed and trampled *A. stellaticeps* shrubland

4.3.2 COASTAL PLAIN THICKETS AND SHRUBLANDS

Coastal Plain thickets and shrublands occur predominantly in the Ramsar section of the study area on grey to white clayey silty soil and brown sandy loam, at a lower elevation in the landscape compared with the Pindan shrublands.

They consist of *Melaleuca alsophila* and *Acacia ampliceps* thickets/shrublands (to 6m) over grasses (*Sporobolus australasicus*, *Cenchrus ciliaris*), low herbs (commonly *Pluchea* spp. *Trianthema* spp.) and disturbed bare ground, on grey/white clays which are seasonally wet and may be occasionally flooded (Plates 3 and 4).

Melaleuca alsophila resprouts after fire while *Acacia ampliceps* is apparently killed by fire. Shrublands of *Acacia ampliceps* therefore often represent single (or few) recruitment events giving rise to equal aged and similarly sized plants within the community (Plates 5 and 6). Grazing and trampling by cattle is localised and the community type is in good to very good ecological condition. The community is of limited extent within the Stage 3 Development Envelope (10.21 ha, 2.8%) and extensive within the adjacent Ramsar study area (957.7 ha, 55.9%).



Plate 3: *Melaleuca alsophila* thicket



Plate 4: *Acacia ampliceps* tall shrubland.



Plate 5: *Acacia ampliceps* shrubland with cattle damage.



Plate 6: *Acacia ampliceps* low shrubland.

4.3.3 COASTAL PLAIN GRASSLANDS AND LOW SHRUBLANDS

Coastal Plain grasslands and low shrublands occur predominantly in the Ramsar section of the study area on grey to white clayey silty soil, at a lower elevation in the landscape compared with the Pindan shrublands. These grasslands form a mosaic with the coastal plain thickets and shrublands described above.

They consist of grasses (*Cenchrus ciliaris*, *Sporobolus australasicus*, *Eragrostis* sp., *Whiteochloa airoides*) and low shrubs to 1.5m (*Indigofera oblongifolia*, *Salsola australis*, *Trianthema* spp., *Triodia* spp.) which are sparse to dense in cover, and occur on grey/white clays (Plates 7 and 8). Some areas are likely to be seasonally wet and may occasionally flood after heavy prolonged rainfall.

These areas often grazed and trampled by cattle (Plate 9). They vary from degraded to good in ecological condition and are absent from Stage 3, but occupy 387.2 ha of the adjacent survey area (22.6%). Around troughs and station infrastructure these areas are completely degraded.



Plate 7: *Cenchrus ciliaris* grassland.



Plate 8: *Indigofera oblongifolia* very open shrubland over grassland/herbland



Plate 9: Grazed and trampled *Indigofera oblongifolia* shrubland.

4.3.4 SALT PANS

Salt pans occur in minor depressions in the landscape within the Ramsar section of the study area at slightly lower elevation than surrounding areas on grey to white clay. These depressions naturally collect rainfall from surrounding areas after rainfall and evaporation results in the build-up of salts over time.

They consist of bare salt pan areas and associated low samphire, herblands and shrublands (*Trianthema turgidifolia*, *T. pilosa*, *T. cussackiana*, *Tecticornia auriculata*, *Frankenia ambiata*, *Salsola australis*).

They are likely to be seasonally wet and subject to occasional flooding after heavy prolonged rainfall (Plates 10 and 11).

The community occurs on grey/white clays, it is absent from Stage 3 and occupies 55.9 ha within the adjacent survey area (3.3% of total). Ecological condition varies from (completely) degraded to good with cattle damage being the main disturbance (Plate 12).



Plate 10: Salt Pan.



Plate 11: Samphire low shrubland/herbland.



Plate 12: Salt pan with cattle footprints

4.3.5 LIMESTONE RIDGES

Low limestone ridges occur in localised areas to the north of the Stage 3 development envelope with limestone cap rock visible at the surface. They are sparsely vegetated and occur with shallow red or brown sands.

Common plant species include *Ptilotus axillaris*, *Trainthema* spp., *Cenchrus ciliaris* and *Cleome uncifera* with occasional emergent shrubs of, *Acacia coleyi* and *A. stellaticeps*.

These areas are absent from the Stage 3 Development Envelope and localised (60.4 ha) within the adjacent Ramsar survey area (3.5% of study area). They are mostly in degraded ecological condition (Plate 13). Cattle grazing and trampling are the main disturbances.



Plate 13: Grazed low Limestone Ridge.

4.4 CONSERVATION SIGNIFICANT NATIVE VEGETATION COMMUNITIES

A Threatened or Priority Ecological Community (TEC or PEC) is one that has been endorsed by WA's Environment Minister as being subject to processes that threaten to destroy or significantly modify it across much of its range.

A search of the DBCA TEC/PEC database indicated 3 PECs occur within a 50 km buffer of the Stage 3 study area (Table 4, Figure 6), however none occur within the Stage 3 Development Envelope itself. These PECs are based on land system mapping by Schoknecht and Payne (2011) and van Vreeswyk et al. (2004). A DBCA record of the Eighty Mile Land System Priority 3 PEC occurs 320m immediately north of the Stage 3 Development Envelope. The 500m buffer of the PEC overlaps the Stage 3 Development Envelope, however the occurrence of the PEC does not (Figure 6).

The Eighty Mile Land System PEC is described as: "Beach foredunes, longitudinal coastal dunes and sandy plains with tussock grasslands and spinifex grasslands" (Department of Biodiversity, Conservation and Attractions, 2017b).

The quadrat based sampling and multivariate analysis within the Stage 3 Development Envelope (Figures 4 and 5) did not find any occurrences of the Eighty Mile Land System PEC or other locally known PECs. The floristic community types identified within the Stage 3 Development Envelope are ubiquitous shrublands (Acacia Shrublands A and B (Pindan), Mixed Species Shrubland B (Pindan) and Melaleuca-Acacia Shrubland B) which are not similar to the local DBCA PEC descriptions (Table 4).

Table 4: Priority Ecological Community Records in 50 km Buffer DBCA Database Search

Community	Description	Conservation Status
Eighty Mile Land System	Beach foredunes, coastal dunes and sandy plains supporting buffel grass grasslands and soft spinifex grasslands.	Priority Ecological Community (Priority 3)
Lime Land System	Calcareous plains supporting soft and hard spinifex grasslands and melaleuca shrublands.	Priority Ecological Community (Priority 3)
Roebuck Land System	Saline coastal flats with broad plains of salt water couch grasslands, samphire, and bare mud flats.	Priority Ecological Community (Priority 3)

4.5 ECOLOGICAL CONDITION AND VEGETATION COVER

The native plant communities present within the Stage 3 Development Envelope are mostly in good to very good ecological condition Keighery (1994) – see Figure 7, Table 5. Weeds, grazing, fire and physical damage have caused localised disturbances in Stage 3 and adjacent areas.

Table 5: Ecological Condition

Condition	Stage 3 Development Envelope (ha)	Adjacent Survey Area (ha)
Completely Degraded	9.6	72.4
Degraded-Good	2.2	526.3
Good-Very Good	355.2	1160.6

Percentage vegetation cover within Stage 3 Development Envelope is shown in Figure 8 and summarised in Table 6. Percentage cover is an indicator of vegetation density. Within Stage 3, cover varies from 0% in areas completely devoid of vegetation (e.g. tracks, fencelines, agricultural infrastructure) to 40-60% in Pindan Shrublands. On average the vegetation cover across the Stage 3 development envelope is estimated to be 35%. A fire in 2015 reduced cover in the Pindan Shrublands of the western section. Vegetation in this area is currently in a regrowth stage. Grazing and trampling by cattle may reduce vegetation or alter its composition by allowing the establishment of grasses and weeds leading to an increase in overall cover. Some of the eastern sections of Stage 3 show this with *Cenchrus ciliaris* being commonly found around localised disturbances.

Table 6: Vegetation Cover in Stage 3

Cover Class	Area (ha)
0%	3.5
5-20%	7.9
20-30%	138.6
30-40%	137.3
40-60%	79.6

4.6 GROUNDWATER DEPENDENT ECOSYSTEMS

Within the Stage 3 project area itself, the predominant vegetation types (Acacia and Mixed Species Pindan Shrublands) are not groundwater dependent. However, the adjacent Ramsar area has some species which may access saturated surface soils or the shallow groundwater ephemerally.

4.7 NATIVE FLORA

129 native plant species were recorded at Pardoo. 106 native species were located within Stage 3 Development Envelope while 42 species were identified from the Ramsar area (some species were recorded across both areas – Table 7). A total of 79 genera and 35 families were recorded at Pardoo (Table 7, see also Appendix H). The most common plant families included Fabaceae, Malvaceae and Amaranthaceae. Species of *Acacia* dominate the shrub flora while Malvaceae, Amaranthaceae, Poaceae and Fabaceae species are most common within the ground flora.

Table 7: Native Plant Species

Species	Author	Family	Stage 3	Ramsar
<i>Abutilon indicum</i>	(L.) Sweet	Malvaceae	1	
<i>Abutilon lepidum</i>	(F.Muell.) A.S.Mitch.	Malvaceae	1	
<i>Abutilon otocarpum</i>	F.Muell.	Malvaceae		
<i>Acacia ampliceps</i>	Maslin	Fabaceae	1	1
<i>Acacia ancistrocarpa</i>	Maiden & Blakely	Fabaceae	1	
<i>Acacia coleii</i>	Maslin & L.A.J.Thomson	Fabaceae	1	1
<i>Acacia dictyophleba</i>	F.Muell.	Fabaceae	1	
<i>Acacia drepanocarpa subsp. drepanocarpa</i>	F.Muell.	Fabaceae		
<i>Acacia hilliana</i>	Maiden	Fabaceae	1	
<i>Acacia monticola</i>	J.M.Black	Fabaceae	1	
<i>Acacia ptychophylla</i>	F.Muell.	Fabaceae	1	
<i>Acacia sericophylla</i>	F.Muell.	Fabaceae	1	
<i>Acacia stellaticeps</i>	Kodela, Tindale & D.Keith Kodela, Tindale & D.Keith	Fabaceae	1	1
<i>Acacia tumida</i>	Benth.	Fabaceae		
<i>Achyranthes aspera</i>	L.	Amaranthaceae	1	
<i>Amaranthus undulatus</i>	R.Br.	Amaranthaceae	1	1
<i>Aristida inaequiglumis</i>	Domin	Poaceae	1	
<i>Bauhinia cunninghamii</i>	(Benth.) Benth.	Fabaceae	1	
<i>Bonamia alatisemina</i>	R.W.Johnson	Convolvulaceae	1	1
<i>Bonamia erecta</i>	R.W.Johnson	Convolvulaceae		
<i>Bonamia linearis</i>	(R.Br.) Hallier f.	Convolvulaceae		
<i>Bonamia oblongifolia</i>	Myint	Convolvulaceae	1	
<i>Bonamia rosea</i>	(F.Muell.) Hallier	Convolvulaceae	1	
<i>Calandrinia strophiolata</i>	(F.Muell.) Ewart, B.Rees & B.Wood	Portulacaceae	1	1
<i>Calytrix carinata</i>	Craven	Myrtaceae	1	
<i>Capparis umbonata</i>	Juss	Capparaceae	1	
<i>Carissa lanceolata</i>	R.Br.	Apocynaceae	1	1
<i>Cassytha filiformis</i>	L.	Lauraceae	1	1
<i>Cleome uncifera</i>	Kers.	Cleomaceae	1	1
<i>Codonocarpus cotinifolius</i>	(Desf.) F.Muell.	Gyrostemonaceae		
<i>Corchorus parviflorus</i>	(Benth.) Domin	Malvaceae	1	
<i>Corchorus sidoides subsp. sidoides</i>	F.Muell.	Malvaceae	1	1

Species	Author	Family	Stage 3	Ramsar
<i>Corymbia hammerslayana</i>	K.D.Hill & L.A.S.Johnson,	Myrtaceae	1	
<i>Corymbia zygophylla</i>	(Blakely) K.D.Hill & L.A.S.Johnson,	Myrtaceae	1	
<i>Corynotheca micrantha</i>	(Lindley) J.F. Macbride	Hemerocallidaceae	1	
<i>Cucumis variabilis</i>	P.Sebastian & I.Telford	Cucurbitaceae	1	1
<i>Cyanostegia cyanocalyx</i>	(F.Muell.) C.A.Gardner	Lamiaceae	1	
<i>Dodonaea coriacea</i>	(Ewart & O.B. Davies) McGill.	Sapindaceae	1	
<i>Dolichandrone heterophylla</i>	(R.Br.) F.Muell.	Bignoniaceae	1	
<i>Duboisia hopwoodii</i>	(F.Muell.) F.Muell.	Solanaceae	1	
<i>Enneapogon purpurascens</i>	(R.Br.) P. Beauv.	Poaceae	1	1
<i>Eragrostis falcata</i>	(Gaudich.) Steud.	Poaceae	1	1
<i>Erythrophleum chlorostachys</i>	(F.Muell.) Baill.	Fabaceae	1	
<i>Eulalia aurea</i>	(Bory) Kunth	Poaceae	1	
<i>Euphorbia australis</i>	Boiss.	Euphorbiaceae	1	1
<i>Euphorbia drummondii</i>	Bioss.	Euphorbiaceae	1	
<i>Evolvulus alsinoides</i>	(L.) L.	Convolvulaceae	1	
<i>Frankenia ambita</i>	Ostenf.	Frankeniaceae		1
<i>Goodenia azurea</i>	F.Muell.	Goodeniaceae	1	
<i>Goodenia microptera</i>	F.Muell.	Goodeniaceae	1	1
<i>Grevillea eriostachya</i>	Lindl.	Proteaceae	1	
<i>Grevillea pyramidalis</i>	R.Br.	Proteaceae	1	
<i>Grevillea refracta</i>	R.Br.	Proteaceae	1	
<i>Grevillea wickhamii</i>	Meisn.	Proteaceae	1	
<i>Gyrostemon tepperi</i>	(H.Walter) A.S.George	Gyrostemonaceae	1	
<i>Hakea chordophylla</i>	F.Muell.	Proteaceae	1	
<i>Hakea macrocarpa</i>	R.Br.	Proteaceae	1	
<i>Heliotropium leptaleum</i>	Craven	Boraginaceae	1	
<i>Heliotropium vestitum</i>	Benth.	Boraginaceae	1	
<i>Hybanthus aurantiacus</i>	(Benth.) F.Muell.	Violaceae	1	
<i>Indigofera colutea</i>	(Burm.f.) Merr.	Fabaceae	1	
<i>Indigofera linnaei</i>	Ali	Fabaceae	1	
<i>Indigofera monophylla</i>	DC	Fabaceae	1	
<i>Indigofera oblongifolia</i>	Forssk.	Fabaceae	1	1
<i>Ipomoea muelleri</i>	Benth.	Convolvulaceae	1	
<i>Jacksonia aculeata</i>	W.Fitz.	Fabaceae	1	
<i>Leptosema anomalum</i>	(Ewart & Morrison) Crisp	Fabaceae	1	
<i>Melaleuca alsophila</i>	Benth.	Myrtaceae	1	1
<i>Melaleuca lasiandra</i>	F.Muell.	Myrtaceae	1	1
<i>Melhania oblongifolia</i>	F.Muell.	Malvaceae	1	1
<i>Neobassia astrocarpa</i>	(F.Muell.) A.J.Scott	Chenopodiaceae	1	
<i>Newcastelia cladotricha</i>	F.Muell.	Lamiaceae	1	
<i>Nicotiana rosulata subsp. rosulata</i>	(S.Moore) Domin	Solanaceae	1	
<i>Panicum decompositum</i>	R.Br.	Poaceae	1	
<i>Persoonia falcata</i>	R.Br.	Proteaceae		

Species	Author	Family	Stage 3	Ramsar
<i>Phyllanthus eremicus</i>	R.L.Barrett & I.Telford	Phyllanthaceae		
<i>Pimelea ammocharis</i>	F.Muell.	Thymeleaceae	1	
<i>Pluchea dentex</i>	Benth.	Asteraceae	1	1
<i>Pluchea ferdinandi-muelleri</i>	Domin	Asteraceae	1	1
<i>Pluchea tetrantha</i>	F.Muell.	Asteraceae	1	1
<i>Polymeria ambigua</i>	R.Br.	Convolvulaceae	1	
<i>Portulaca oleracea</i>	L.	Portulacaceae	1	
<i>Portulaca pilosa</i>	L.	Portulacaceae	1	1
<i>Pterocaulon sphacelatum</i>	(Labill.)F.Muell.	Asteraceae	1	1
<i>Ptilotus arthrolasius</i>	F.Muell.	Amaranthaceae	1	
<i>Ptilotus astrolasius</i>	F.Muell.	Amaranthaceae	1	
<i>Ptilotus axillaris</i>	(Benth.) F.Muell.	Amaranthaceae	1	1
<i>Ptilotus calostachyus</i>	F.Muell.	Amaranthaceae	1	
<i>Ptilotus chamaecladus</i>	Diels	Amaranthaceae	1	
<i>Ptilotus clementii</i>	(Farmar) Benl	Amaranthaceae	1	
<i>Ptilotus fusiformis</i>	(R.Br.)Poir	Amaranthaceae		
<i>Rhynchosia minima</i>	(L.) DC.	Fabaceae	1	
<i>Salsola australis</i>	L.	Chenopodiaceae		1
<i>Santalum lanceolatum</i>	R.Br.	Santalaceae	1	
<i>Scaevola collaris</i>	F.Muell.	Goodeniaceae	1	
<i>Scaevola spinescens</i>	R.Br.	Goodeniaceae		1
<i>Senna artemisioides subsp. helmsii</i>	(Symon) Randell	Fabaceae		
<i>Senna curvistyla</i>	(J.M.Black) Randell	Fabaceae	1	
<i>Senna glutinosa subsp. glutinosa</i>	(DC.) Randell	Fabaceae	1	
<i>Senna notabilis</i>	(F.Muell.) Randell	Fabaceae		
<i>Senna venusta</i>	(F.Muell.) Randell	Fabaceae	1	1
<i>Seringia velutina</i>	(Steetz) F.Muell.	Malvaceae	1	
<i>Sida arenicola</i>	S.T. Reynolds & A.E. Holland	Malvaceae	1	
<i>Sida calyxhymania</i>	DC	Malvaceae	1	
<i>Solanum dioicum</i>	W.Fitz.	Solanaceae	1	
<i>Solanum diversiflorum</i>	F.Muell.	Solanaceae	1	1
<i>Solanum esuriale</i>	Lindl.	Solanaceae	1	1
<i>Solanum lucani</i>	F.Muell.	Solanaceae	1	
<i>Sporobolus australasicus</i>	Domin	Poaceae		1
<i>Stemodia grossa</i>	Benth.	Plantaginaceae	1	1
<i>Streptoglossa tenuiflora</i>	Dunlop	Asteraceae	1	
<i>Stylobasium australe</i>	(Hook.) Prance	Stylobasiaceae	1	
<i>Surreya diandra</i>	(R.Br.) R.Masson & G.Kadereit	Amaranthaceae	1	
<i>Swainsona pterostylis</i>	(DC.) Bakh.f.	Fabaceae		
<i>Tecticornia auriculata</i>	(Paul G.Wilson) K.A.Sheph. & Paul G.Wilson	Chenopodiaceae		1
<i>Tephrosia leptoclada</i>	Benth.	Fabaceae	1	
<i>Trachymene oleracea</i>	(Domin) B.L.Burt	Araliaceae		1

Species	Author	Family	Stage 3	Ramsar
<i>Trianthema pilosum</i>	F.Muell.	Aizoaceae	1	1
<i>Trianthema triquetra</i>	Willd	Aizoaceae	1	1
<i>Trianthema turgidifolia</i>	F.Muell.	Aizoaceae	1	1
<i>Tribulopsis marliesiae</i>	R.L.Barrett	Zygophyllaceae		
<i>Tribulus occidentalis</i>	R.Br.	Zygophyllaceae		
<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>	(Burm.f.) R.Br.	Boraginaceae		1
<i>Trigastrotheca molluginea</i>	(F.Muell.)	Molluginaceae	1	
<i>Triodia epactia</i>	S.W.L. Jacobs	Poaceae	1	1
<i>Triodia schinzii</i>	Lazarides	Poaceae	1	
<i>Triumfetta chaetocarpa</i>	F.Muell.	Malvaceae	1	
<i>Whiteochloa airoides</i>	(R.Br.) Lazarides	Poaceae		1
<i>Xerochloa barbata</i>	R.Nr.	Poaceae		1

4.8 CONSERVATION SIGNIFICANT FLORA

A significant flora search requested from the DBCA (Ref. 27-0817FL) (Department of Biodiversity, Conservation and Attractions, 2017c) for a 50 km buffer of the study area found 9 species of conservation significance. No DBCA records occur within the Stage 3 project area.

All significant flora species from the DBCA search are listed in Table 8, along with their conservation significance and an assessment of the likely presence within the Stage 3 Development Envelope.

Two species of conservation significance were located within or in close proximity to the Stage 3 Development Envelope (Figure 9) during field studies as described in the sub-sections below.

Table 8: DBCA Significant Flora Records within 50 km Buffer of Stage 3 Development Envelope.

Taxon	Cons. Code	Description	Habitat	Presence in the Development Envelope
<i>Acacia monticola</i> x <i>tumida</i> var. <i>kulparn</i>	P3	Shrub, to 2 m high, flower yellow April - August	Red sand, ironstone or lateritic soils, sandstone. Pindan plains, stony plains, low rocky ridges.	Not detected and unlikely to be present, field studies corresponded to flowering time
<i>Bonamia oblongifolia</i>	P1	Perennial, herb or shrub. Flowers blue, February to August	Sandy or gravelly soils.	Present in Stage 3
<i>Bulbostylis burbidgeae</i>	P4	Tufted, erect to spreading annual sedge, 0.03-0.25 m high, Fl. brown, Mar or Jun to Aug.	Granitic soils. Granite outcrops, cliff bases.	Not located and unlikely to be present as its preferred habitat is absent
<i>Euphorbia clementii</i>	P2	Erect herb, to 0.6 m high.	Gravelly hillsides, stony grounds.	Not located and unlikely to be present, other species of herbaceous spurges were noted during the survey

Taxon	Cons. Code	Description	Habitat	Presence in the Development Envelope
<i>Nicotiana umbratica</i>	P3	Erect, short-lived annual or perennial, herb, 0.3-0.7 m high. Fl. white, Apr to Jun.	Shallow soils. Rocky outcrops.	Not located and unlikely to be present as its preferred habitat is absent
<i>Phyllanthus eremicus</i>	P3	Sub-shrub to 50cm. Flowers green/cream. May to September	Rocky outcrops or on red sandplains	Not detected and unlikely to be present, field studies corresponded to flowering time, found elsewhere at Pardoo
<i>Rothia indica</i> subsp. <i>australis</i>	P1	Prostrate annual, herb, to 0.3 m high, densely covered in spreading hairs. Fl. Apr to Aug.	Sandy soils. Sandhills and sandy flats.	Not detected and unlikely to be present, field studies corresponded to flowering time, other species of Pea were noted during the survey
<i>Seringia katatona</i>	P3	Shrub to 80cms. Flowers purple/green. March to August	Dune swales in red sands (Pindan)	Not detected and unlikely to be present, field studies corresponded to flowering time and species is conspicuous
<i>Tribulopsis marliesiae</i>	P3	Perennial, prostrate and open shrub: 0.10 m high and 1 m wide. Yellow flower.	Plains and dune swales. Brown dry sand.	Present adjacent to Stage 3

4.8.1 BONAMIA OBLONGIFOLIA (PRIORITY 1)

Bonamia oblongifolia is a low scrambling woody perennial. *B. oblongifolia* is most similar to *B. linearis* but differs from it in possessing shorter petioles, smaller flowers and by having obtuse (versus acute) leaf apices and bases (Myint & Ward, 1968).

Bonamia oblongifolia (Plate 14) was identified as occurring in both the Stage 2 and Stage 3 development areas and also further afield (Figures 9 and 10). Within the Stage 2 and 3 areas, *B. oblongifolia* occurs as individual plants or small localised populations (<20 plants). Plants are found underneath taller shrubs and also exposed on open sandy areas often associated with disturbances from stock grazing and trampling (Plates 14 to 17).

To the north of the Pardoo development areas, *B. oblongifolia* occurs in larger numbers and is more extensive in distribution. These areas are lower in the landscape than the development areas and were mostly more degraded due to stock damage. *B. oblongifolia* also occurs at intervals along tracks and firebreaks, e.g. the fenceline around the existing Stage 1 pivots (Plates 16 and 17).

Bonamia oblongifolia occurs within Acacia Shrubland A and B communities and extends into Melaleuca-Acacia Shrubland A in the Stage 2 study area. *B. oblongifolia* was also found to occur more widely within the region, being found during opportunistic searches over a 70 km stretch of Great Northern Highway south from 80 Mile Beach Rd.

Populations of the species were also assessed in three areas during field studies at Wallal Downs where it occurred more extensively (EnviroWorks Consulting, 2016b) and at Anna Plains where it was localised (EnviroWorks Consulting, 2017).

B. oblongifolia estimated population sizes at Pardoo, Wallal Downs and Anna Plains identified during surveys are shown in Table 9 and in Figure 10. EnviroWorks (2016b) details the species presence at Wallal Downs Station, whilst EnviroWorks Consulting (2017) details the species presence at Anna Plains Station. Populations at Pardoo were healthy and in fruit at the time of the field surveys. GPS records for all Pardoo locations are included in Appendix G.

An estimate of the *Bonamia oblongifolia* regional population size was prepared by extrapolation of plant counts obtained during foot and car traverses to 200m x 200m (4 ha) grid cells. Figure 10 and Table 9 shows a conservative regional population estimate on this basis.

Table 9: Population estimates of *Bonamia oblongifolia* at Pardoo, Wallal Downs and Anna Plains.

Location	Estimated Population	Plants Proposed or Approved to be Cleared
Pardoo, Stage 2 – Survey Area (961 ha)	5,544	
Pardoo, Stage 2 – Development Envelope (790 ha)	50	50
Pardoo, Stage 3 – Survey Area – not including development envelope	714	
Pardoo, Stage 3 – Development Envelope outside pivots	48	48
Pardoo, Stage 3 - Development envelope inside Pivots	110	110
Pardoo, Pivots – Targeted Search Area (1 ha)	145	
Wallal Downs - Survey Area (5,600 ha)	1,170,000	
Wallal Downs – Homestead Development Envelope	30,752	30,752
Anna Plains – Survey Area (350 ha)	1,163	
Anna Plains – Development Envelope (200 ha)	51	51
Total	1,208,577	31,011

The total regional population size of *Bonamia oblongifolia* was estimated to be approximately 1,208,577 plants. This is an under-estimate because time constraints precluded exploration of additional areas outside of the Pardoo, Wallal Downs and Anna Plains study areas and the species is likely to be widespread in other areas in the region.

When clearing is taken into account at Pardoo Stage 2, Wallal Downs and Anna Plains the remaining regional population is approximately 1,177,724 plants. Clearing (110 plants) and indirect disturbance (48 plants) at Pardoo Stage 3 represents only 0.013% of this approximate regional population.



Plate 14: *Bonamia oblongifolia* (mature plant).



Plate 15: *Bonamia oblongifolia* habitat – heavily grazed Pindan Vegetation.



Plate 16: *Bonamia oblongifolia* habitat – roadside drains



Plate 17: *Bonamia oblongifolia* habitat –firebreaks and fencelines.

4.8.2 TRIBULOPIS MARLIESIAE (PRIORITY 3)

Tribulopsis marliesiae is a slender herb with a perennial corky rootstock. It grows to 40 cm high and 80 cm across. It is distinguished from *T. angustifolia*. by the following combination of characters: erect perennial herb with branches decumbent at length, leaves that possess 2 or 3 pairs of filiform, subtly grooved leaflets. The yellow flowers are borne on long pedicels 33–62 mm from August to November (Plate 18).

The species occurs from Pardoo Roadhouse north to Roebuck Plains Station in the Dampier Botanical District and inland to the northern Great Sandy Desert. It is considered to be restricted to red sands in heath and low pindan, particularly with *Acacia tumida*. *Tribulopsis marliesiae* often co-occurs with *T. angustifolia* (Barrett & Barrett, 2015).

In the Stage 3 Development Envelope, *Tribulopsis marliesiae* occurs within the Acacia Shrubland B Floristic Community (Figure 9) being found in association with hummocks of *Triodia* (Plate 19). The extent of its distribution at Pardoo and within the region is uncertain given regional targeted surveys have not been conducted. It was first located during the September 2017 field survey. Thirteen plants were located in total. GPS records for all Pardoo locations are included in Appendix G. No plants were located within the Stage 3 Development Envelope.



Plate 18: *Tribulopsis marlliesiae* flower.



Plate 19: *Tribulopsis marlliesiae* habit, growing with *Triodia* hummock.

4.9 WEEDS

During the field surveys four weed species were recorded as outlined below in Table 10. *Aerva javanica* and *Cenchrus ciliaris* are common weeds associated with disturbance and agriculture. *Tamarix aphylla* occurs as persistent trees around an abandoned outstation and near watering troughs. Weeds were generally uncommon within Stage 3 except where grazing and trampling were also main disturbances.

Table 10: Weed Species Recorded in Field Surveys

Species	Author	Family	Stage 3	Ramsar
<i>Aerva javanica</i>	(Burm.f.)Schult.	Amaranthaceae	1	1
<i>Calotropis procera</i>	(Aiton) W.T.Aiton	Apocynaceae	1	
<i>Cenchrus ciliaris</i>	L.	Poaceae	1	1
<i>Tamarix aphylla</i>	(L.) H.Karst	Tamaricaceae	1	1

5 LIMITATIONS

There are a number of limitations that may arise during flora and vegetation surveying. These survey limitations are addressed in Table 11 below.

Table 11: Consideration of Study Limitations

Limitation	Comment
Survey Intensity (In retrospect, was the intensity adequate?)	Survey intensity (desktop research followed by 3 site visits in July, August and September) follows EPA recommendations for a survey associated with main flowering time. Quadrat intensity in Development Envelope very high.
Competency/experience of the consultant(s) carrying out the survey.	The author has had significant experience in flora and vegetation surveys including desktop reviews, site inspections and report writing.
Scope. (life forms sampled etc).	100% of flora species observed during the site visits were identified.
Proportion of flora collected and identified (based on sampling, timing and intensity).	Only species which were not identifiable in the field were collected for further identification. This was deemed suitable for the type of survey undertaken.
Timing/weather/season/cycle.	Survey timing follows EPA recommendations.
Disturbances (e.g. fire, flood, accidental human intervention etc.) which affected results of survey.	No disturbances affected the survey.
Completeness (e.g. was relevant area fully surveyed) and further work which might be needed.	Desktop study covered proposed clearing area. Site inspection covered all areas of proposed disturbance. No further work is currently deemed necessary.
Resources (e.g. degree of expertise available in flora identification to taxon level).	Appropriate resources were used. All specimens identified to species level.
Mapping reliability.	All mapping completed is deemed reliable. Hand held GPS used to record coordinates and mapping done using professional GIS system.
Access problems.	No access problems encountered.
Sources of information and availability of contextual information (i.e. pre-existing background versus new material).	Extensive regional and local information was available and was consulted. DBCA Threatened Flora and TEC Databases were searched and the author had conducted several previous studies in the region.

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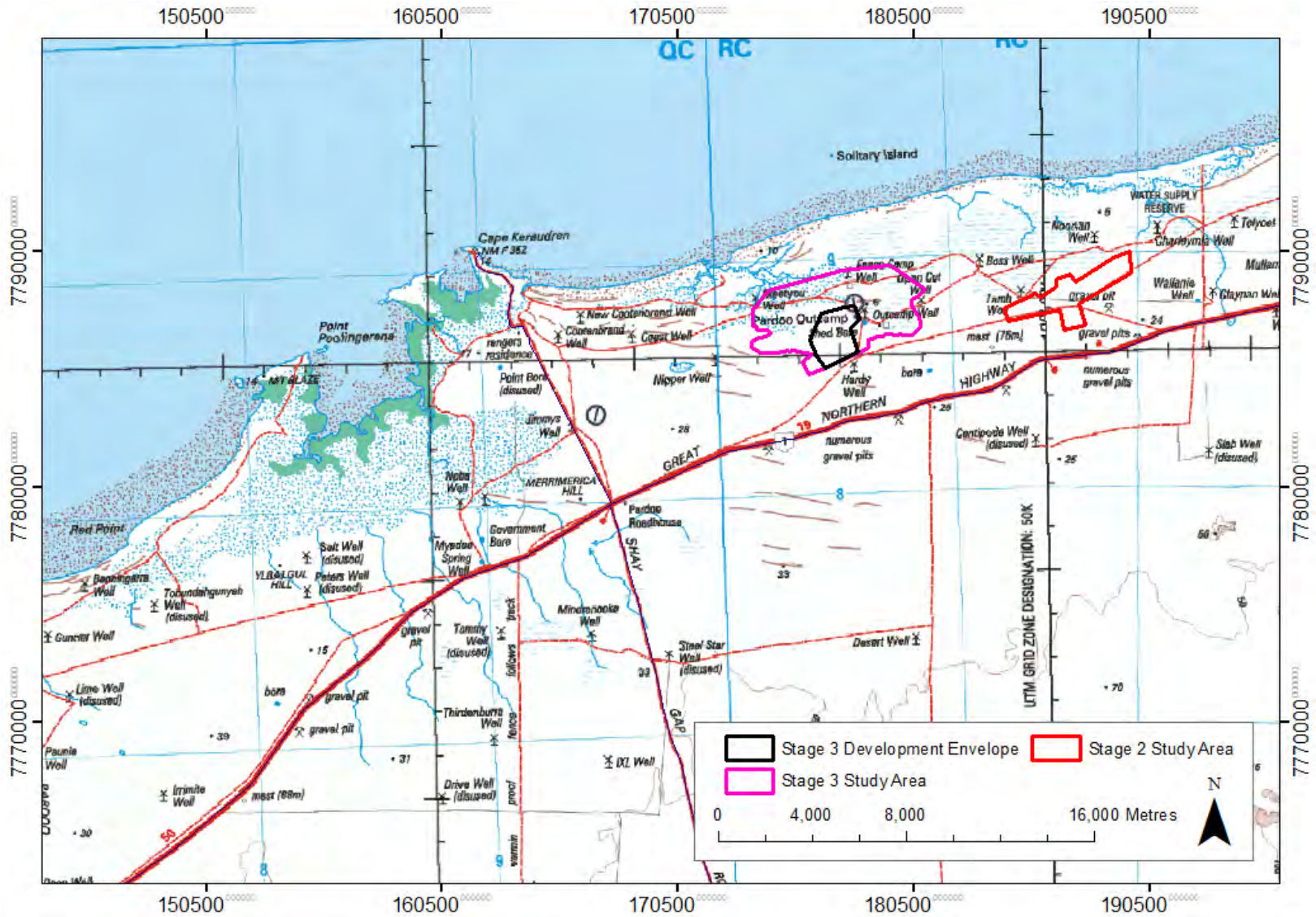


Figure 1: Location of Study Areas

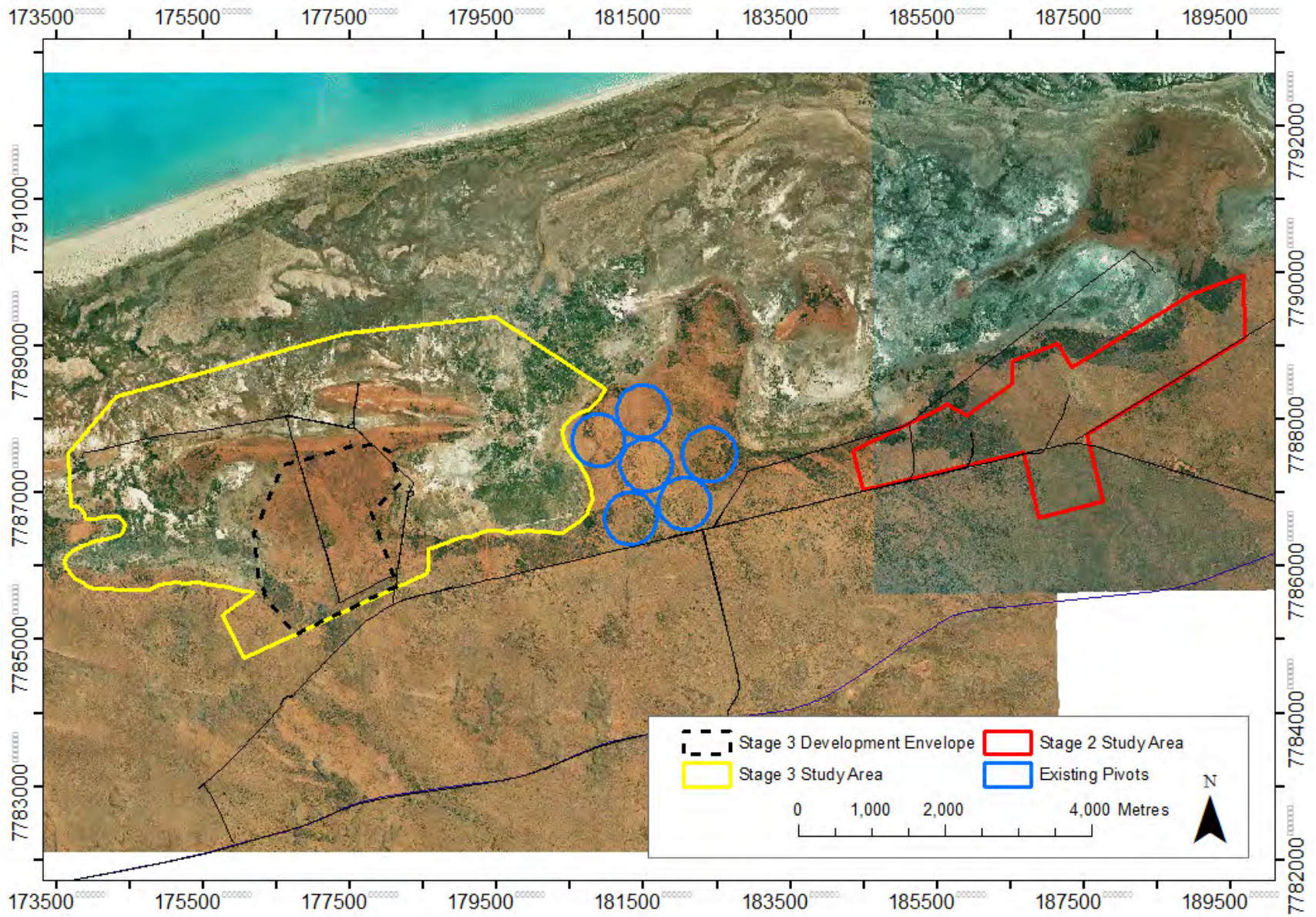


Figure 2: Aerial Photography and Study Areas

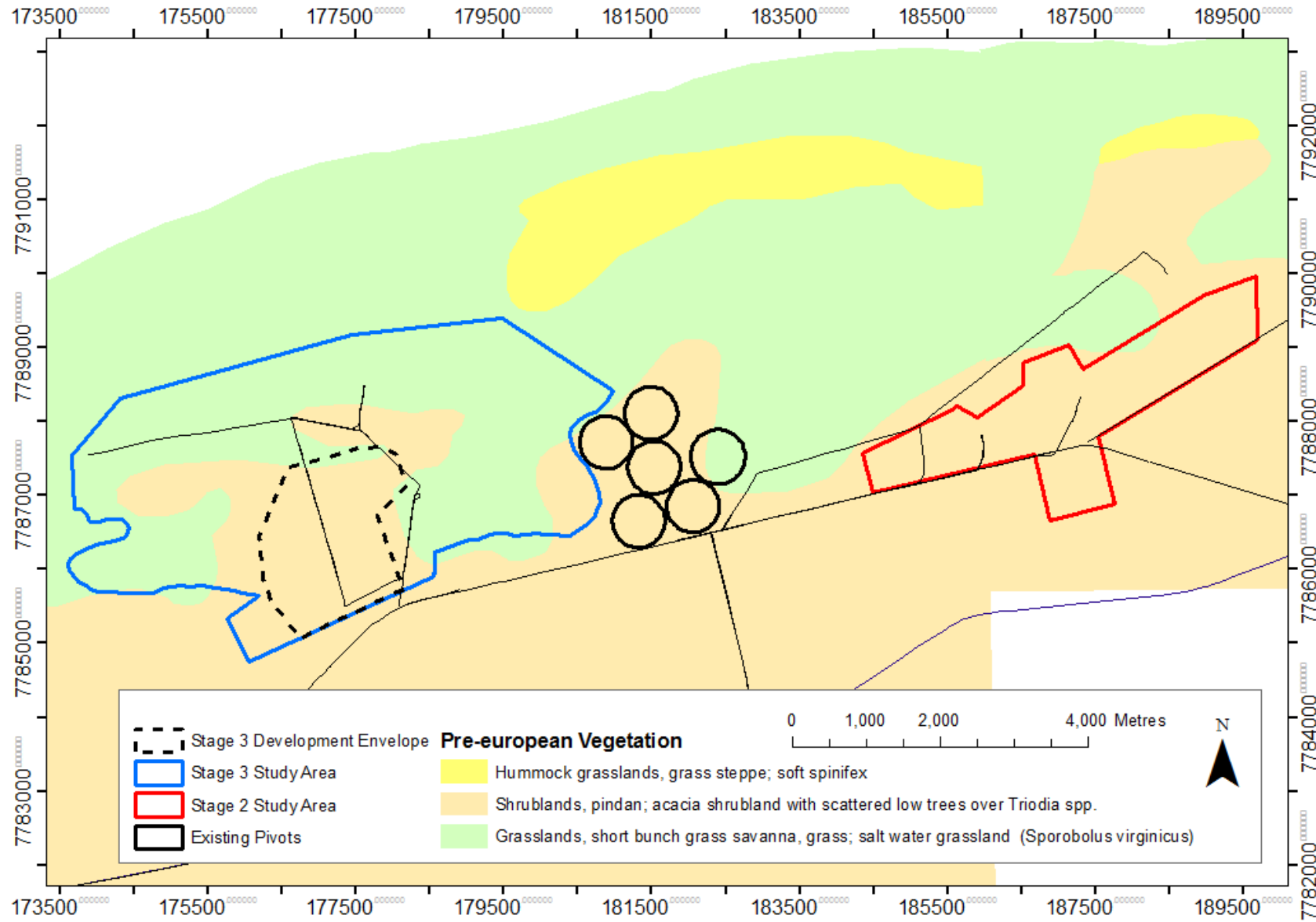


Figure 3: Pre-European Vegetation

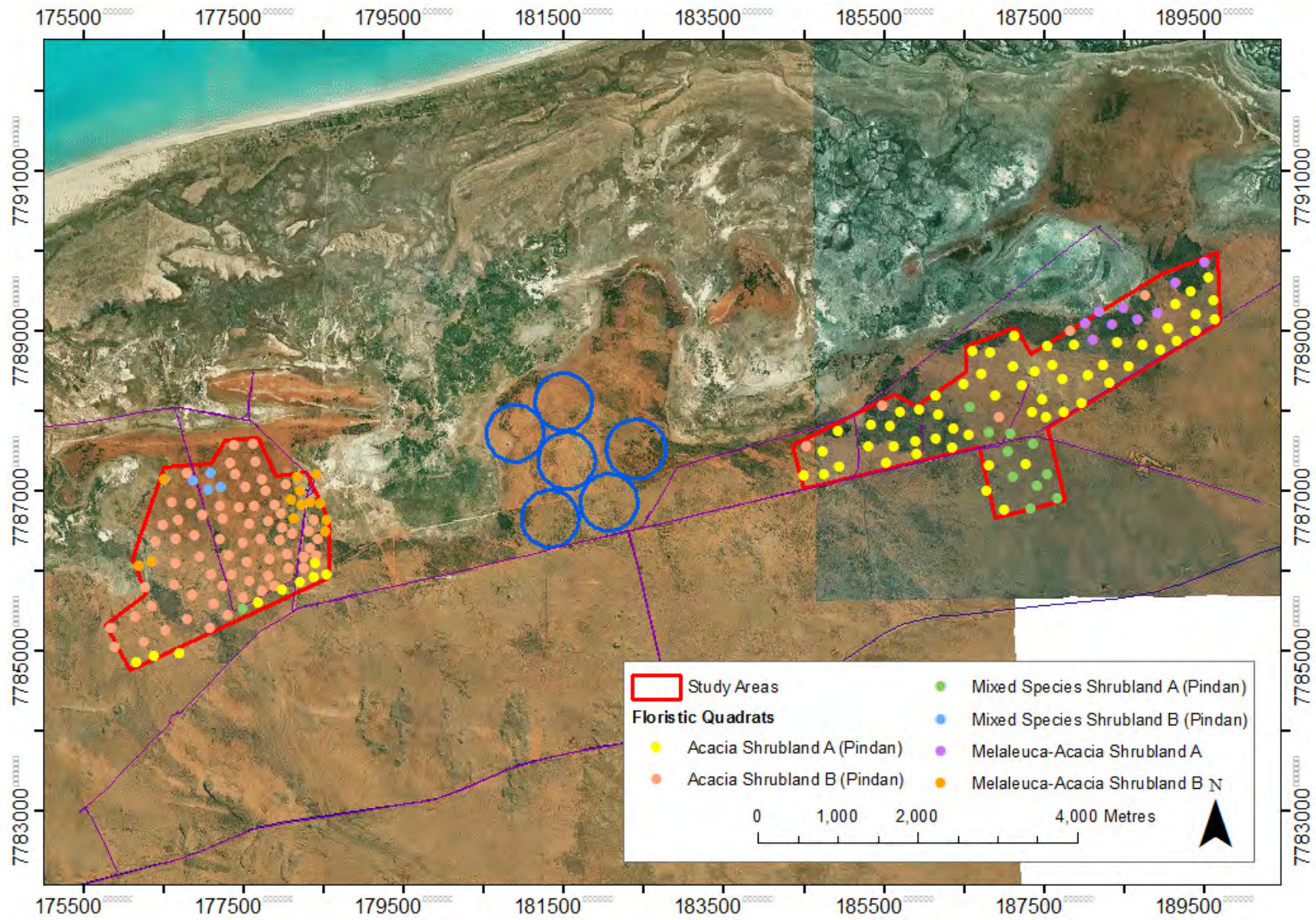


Figure 4: Floristic Quadrats

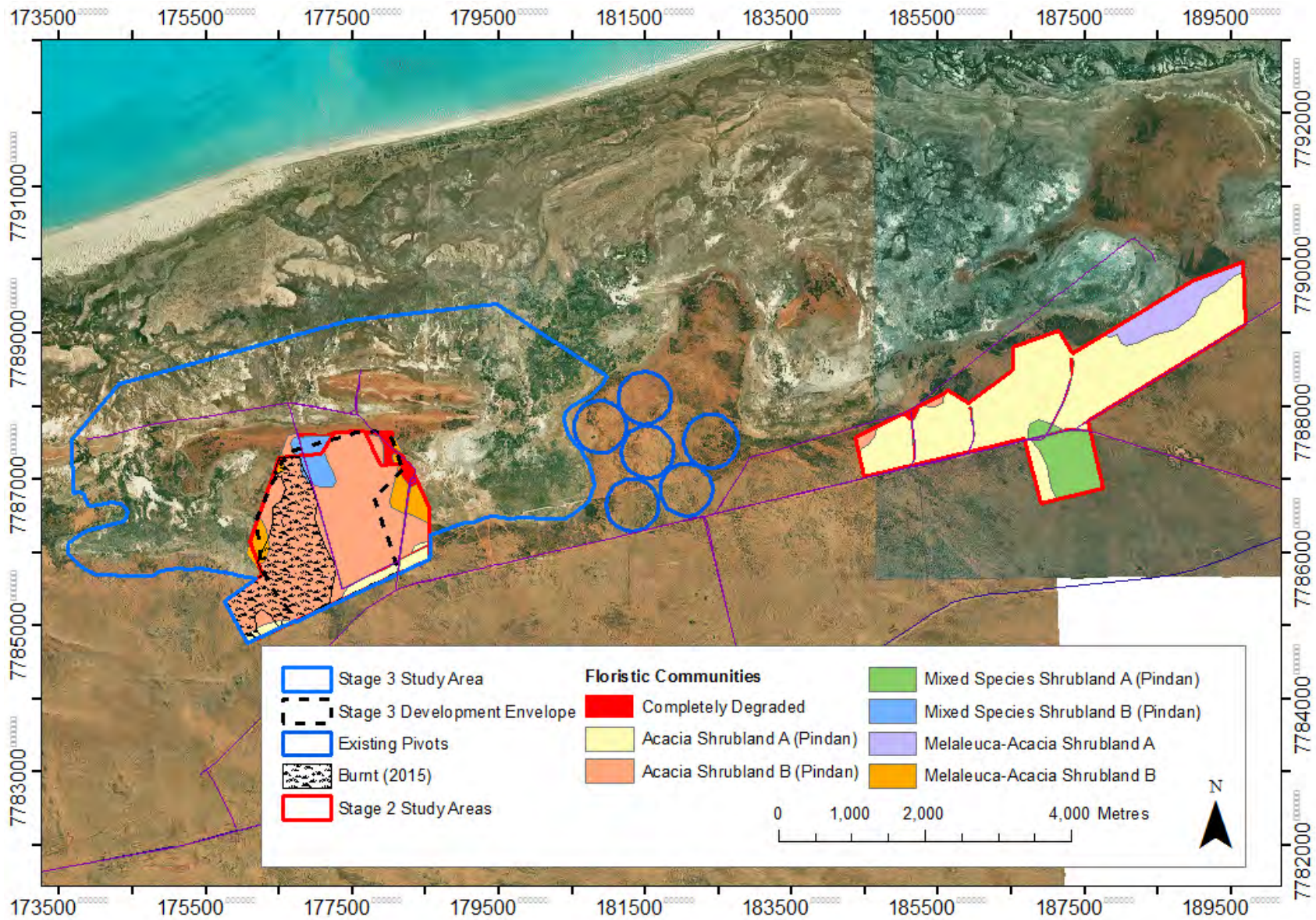


Figure 5: Floristic Communities

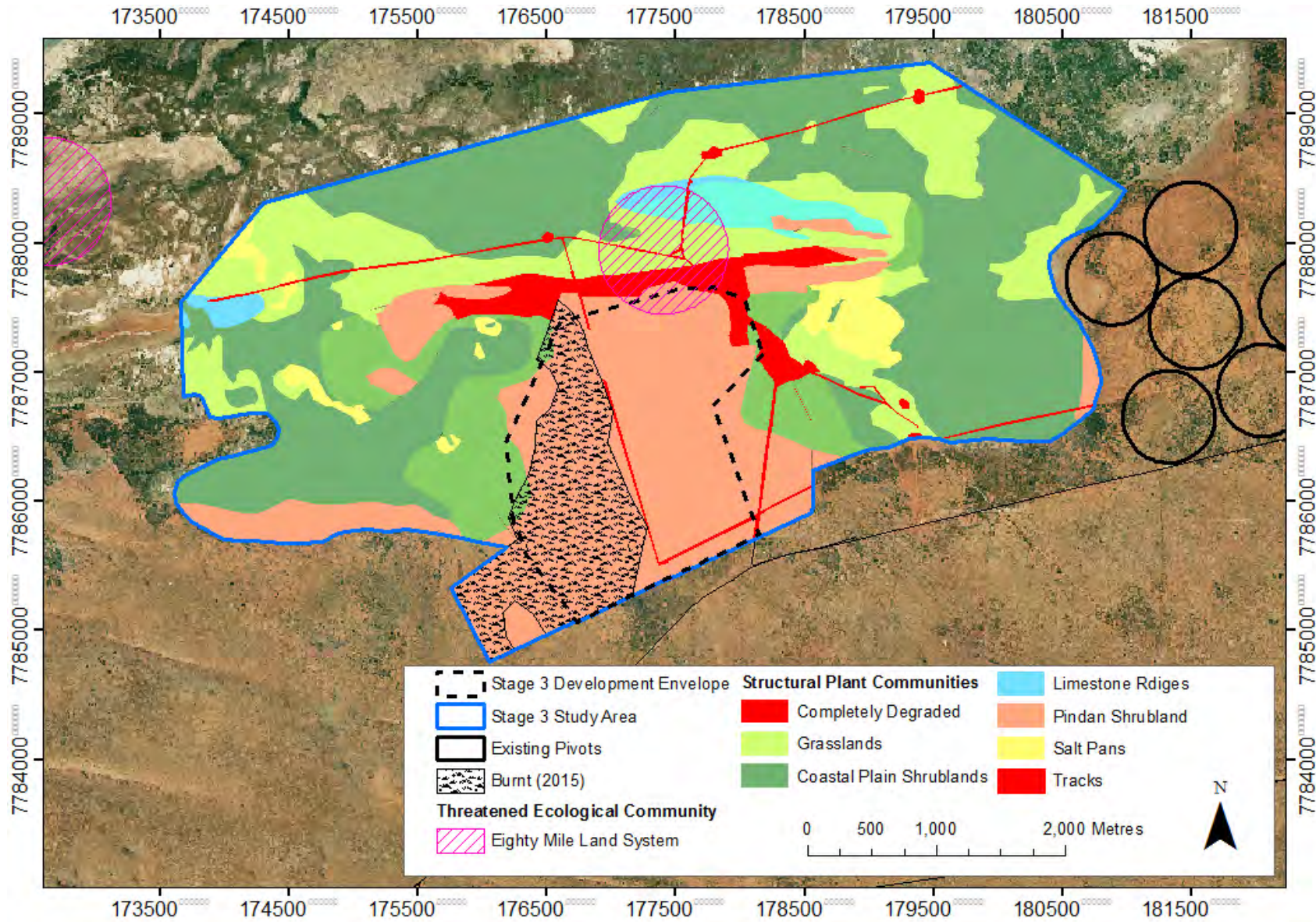


Figure 6: Structural Plant Communities in Stage 3 and Ramsar Area.

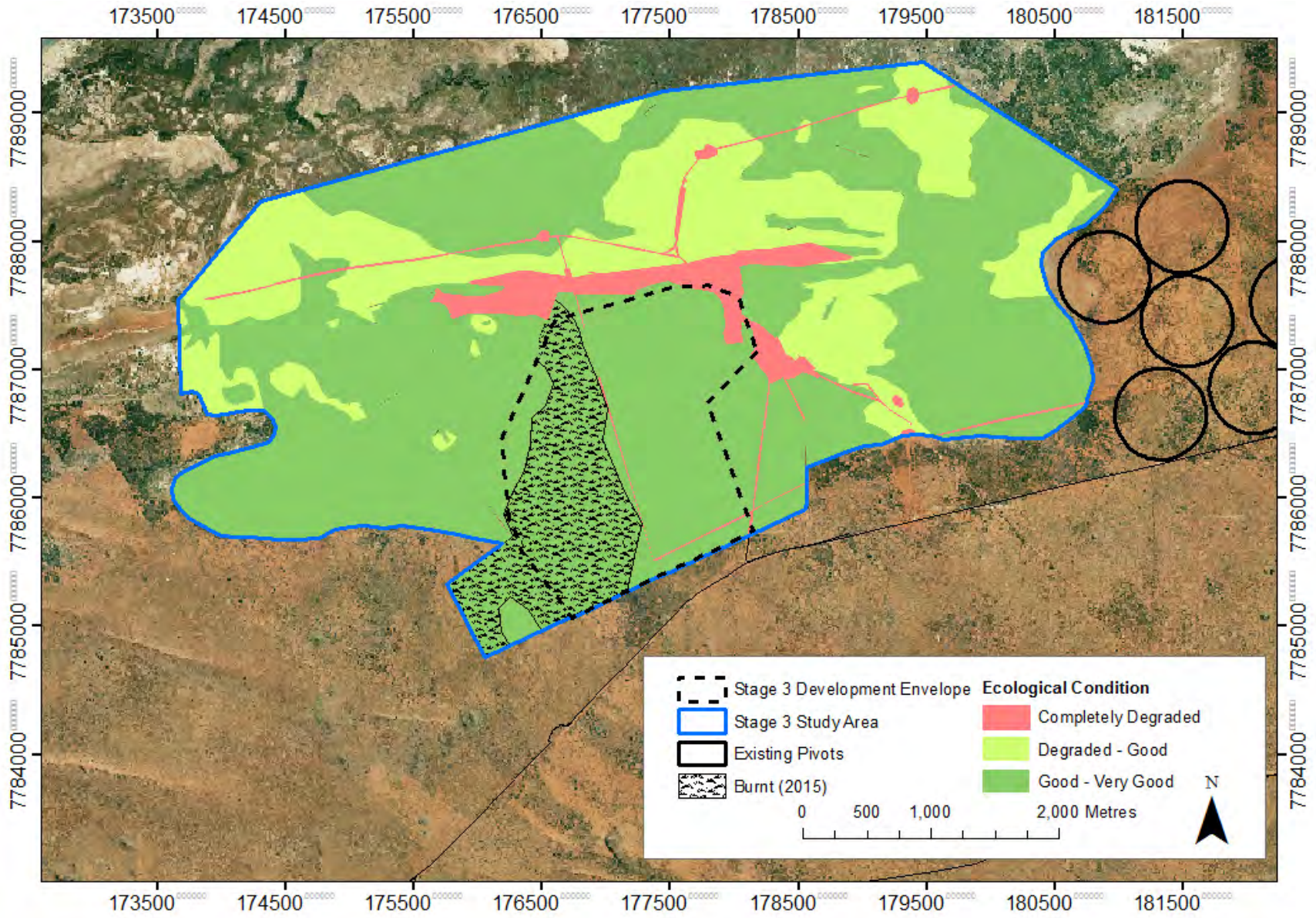


Figure 7: Ecological Condition

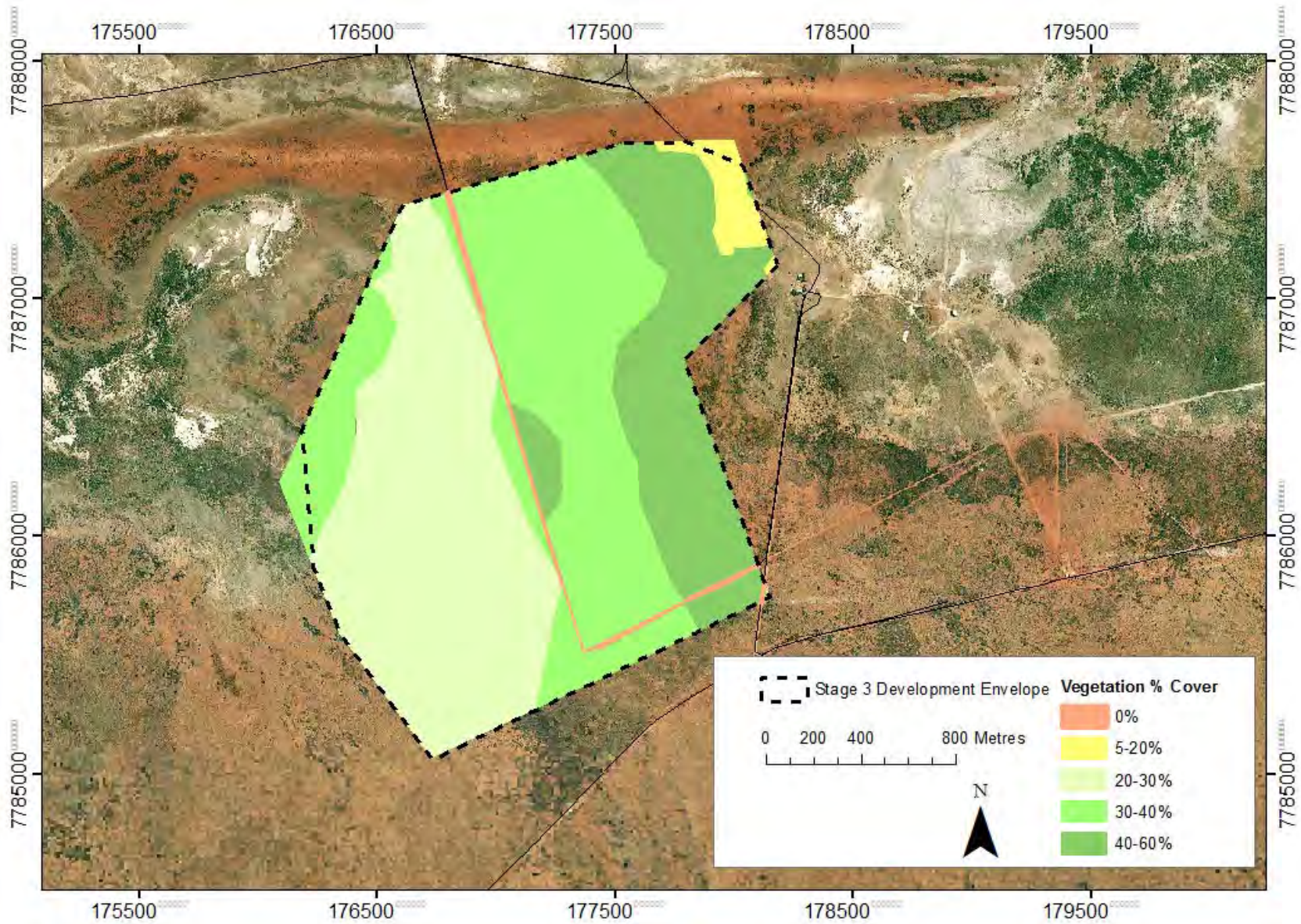


Figure 8: Foliage Percent Cover, Stage 3 Development Envelope

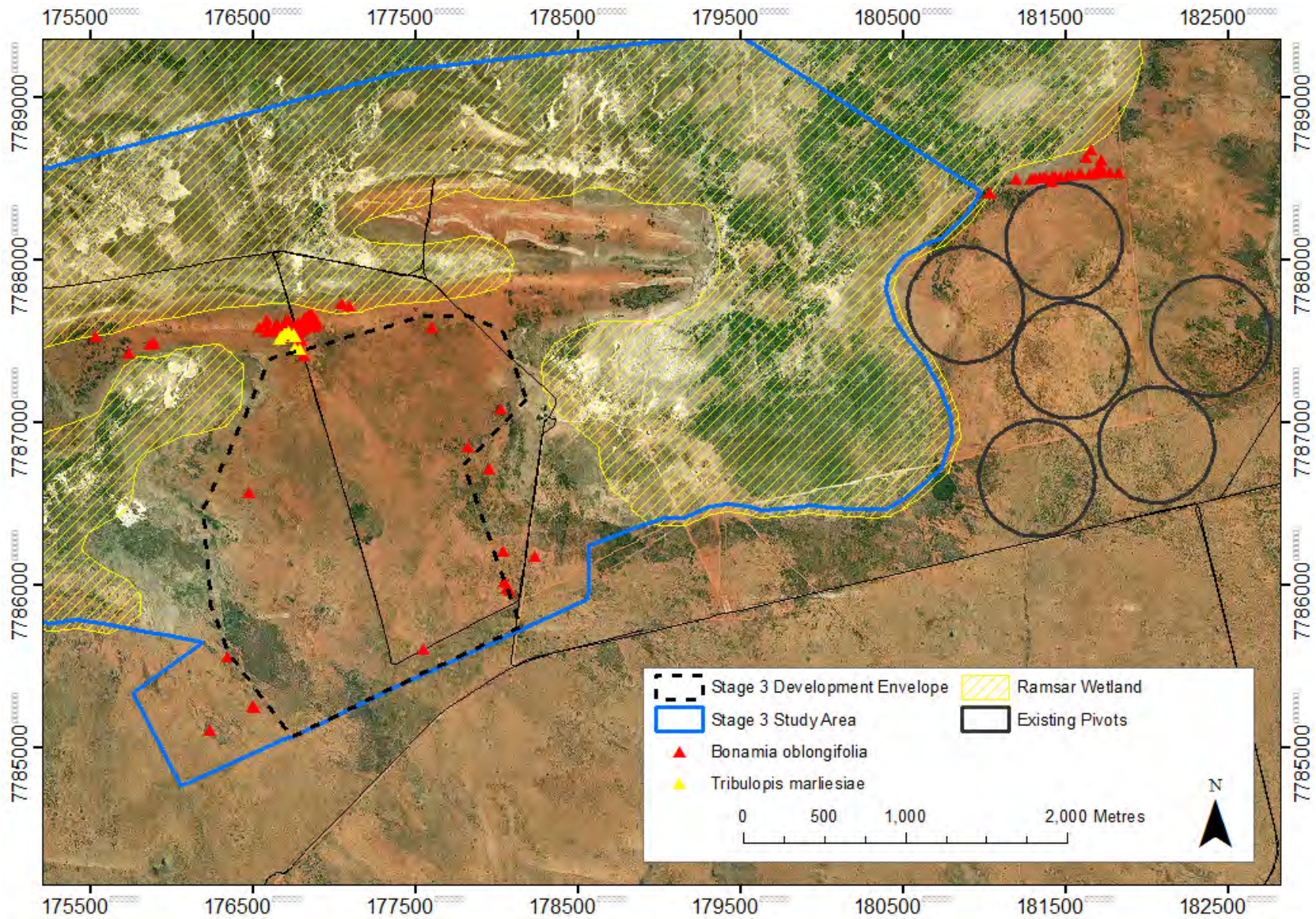


Figure 9: Flora of Conservation Significance

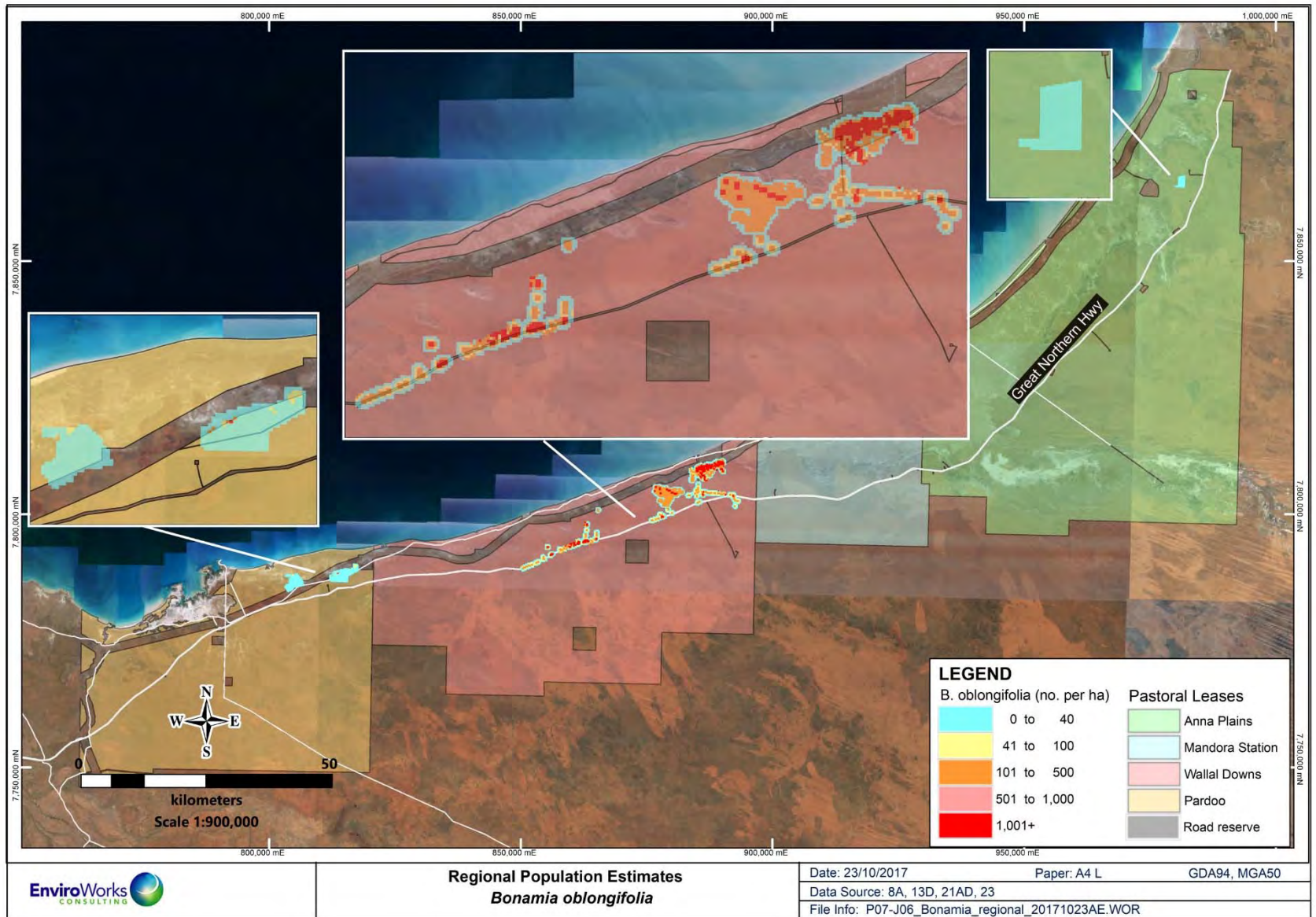


Figure 10: Regional Population Estimate of *Bonamia oblongifolia*

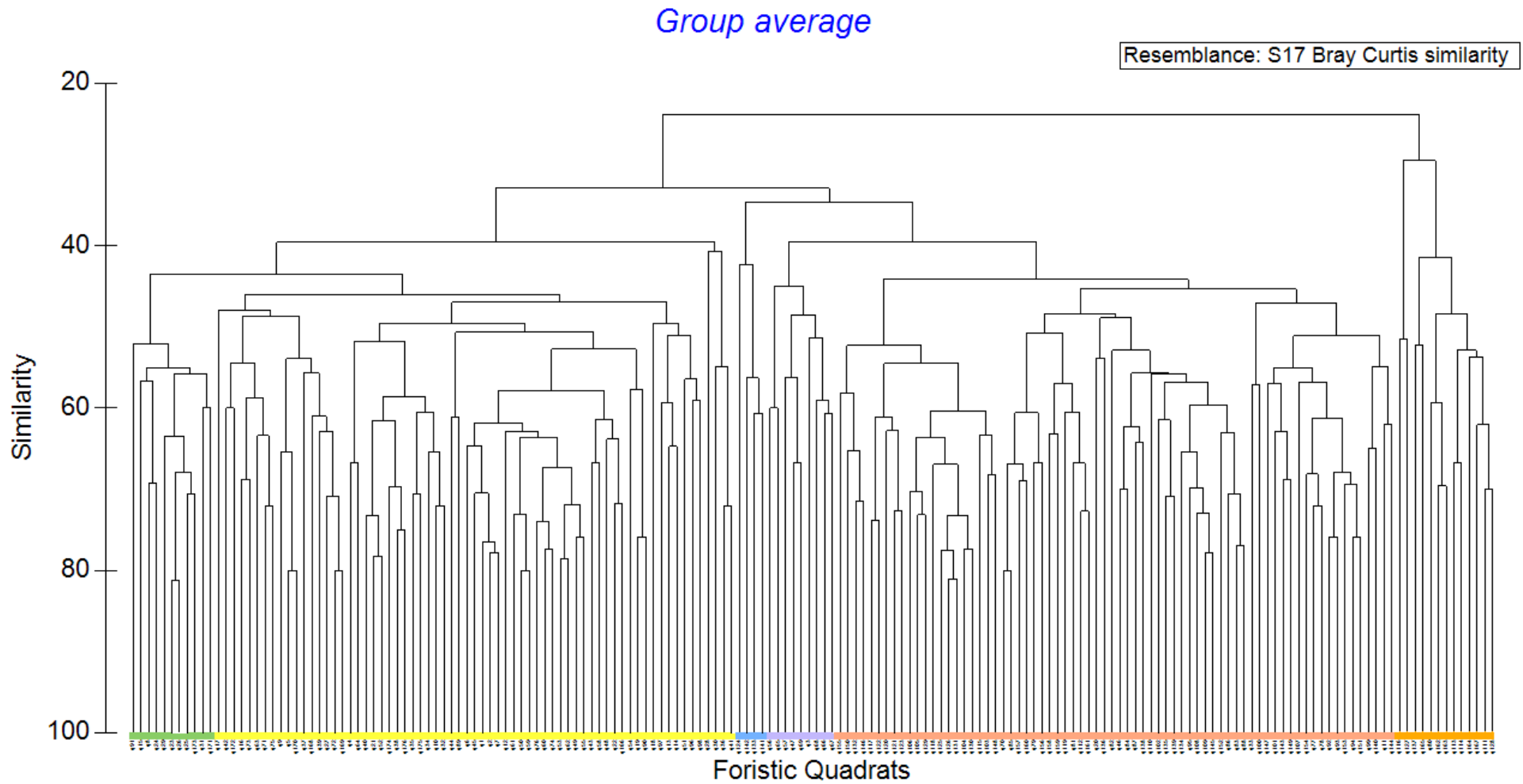
APPENDIX A. CRITERIA USED FOR THE ASSESSMENT OF REMNANT VEGETATION CONDITION (KEIGHERY, 1994)

Rating	Criteria
Pristine	Pristine or nearly so, no obvious signs of disturbance.
Excellent	Vegetation structure intact; disturbance affecting individual species; weeds are non-aggressive species.
Very good	Vegetation structure altered; obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires; the presence of some more aggressive weeds; dieback; logging; grazing
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires; the presence of some very aggressive weeds at high density; partial clearing; dieback; grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires; the presence of very aggressive weeds; partial clearing; dieback; grazing.
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

APPENDIX B. PLANT COMMUNITY STRUCTURAL FORMATION AND HEIGHT CLASSES (MUIR, 1977)

LIFE FORM/ HEIGHT CLASS	CANOPY COVER			
	Dense 70% - 100%	Mid-Dense 30% - 70%	Sparse 10% - 30%	Very Sparse 2% - 10%
Trees > 30 m	Dense Tall Forest	Tall Forest	Tall Woodland	Open Tall Woodland
Trees 15 – 30 m	Dense Forest	Forest	Woodland	Open Woodland
Trees 5 – 15 m	Dense Low Forest A	Low Forest A	Low woodland A	Open Low Woodland A
Trees < 5 m	Dense Low Forest B	Low Forest B	Low Woodland B	Open Low Woodland B
Mallee Tree Form	Dense Tree Mallee	Tree Mallee	Open Tree Mallee	Very Open Tree Mallee
Mallee Shrub Form	Dense Shrub Mallee	Shrub Mallee	Open Shrub Mallee	Very Open Shrub Mallee
Shrubs > 2 m	Dense Thicket	Thicket	Scrub	Open Scrub
Shrubs 1.5 – 2 m	Dense Heath A	Heath A	Low Scrub A	Open Low Scrub A
Shrubs 1 – 1.5 m	Dense Heath B	Heath B	Low Scrub B	Open Low Scrub B
Shrubs 0.5 – 1 m	Dense Low Heath C	Low Heath C	Dwarf Scrub C	Open Dwarf Scrub C
Shrubs 0 – 0.5 m	Dense Low Heath D	Low Heath D	Dwarf Scrub D	Open Dwarf Scrub D
Mat Plants	Dense Mat Plants	Mat Plants	Open Mat Plants	Very Open Mat Plants
Hummock	Dense Hummock	Mid-dense Hummock	Hummock	Open Hummock
Grass	Grass	Grass	Grass	Grass
Bunch grass >0.5 m	Dense Tall Grass	Tall Grass	Open Tall Grass	Very Open Tall Grass
Bunch grass < .5 m	Dense Low Grass	Low Grass	Open Low Grass	Very Open Low Grass
Herbaceous spp.	Dense Herbs	Herbs	Open Herbs	Very Open Herbs
Sedges > 0.5 m	Dense Tall Sedges	Tall Sedges	Open Tall Sedges	Very Open Tall Sedges
Sedges < 0.5 m	Dense Low Sedges	Low Sedges	Open Low Sedges	Very Open Low Sedges
Ferns	Dense ferns	Ferns	Open Ferns	Very Open Ferns
Mosses, liverworts	Dense Mosses	Mosses	Open Mosses	Very Open Mosses

APPENDIX C. MULTIVARIATE ANALYSIS DENDOGRAM



APPENDIX D. DETAILED FLORISTIC COMMUNITY DESCRIPTIONS

Community 1: Acacia Shrubland A (Pindan)

Area: 471.7 ha (67 floristic quadrats)

Landscape: flat and gently undulating plains

Substrate: red sandy loam,

Native Species richness (2500m²): 15.2 (range 8-27)

Plant Cover: 35% (range 20 – 50%)

Weed Frequency: 0.5 (range 0-1)

Vegetation Condition: good-very good 368.3 ha, degraded-good 103.3ha

Structural units:

Low open woodland

Low/Scrub

Heath, low heath

Herbs

Hummock grass

Illustration: Plates 20 and 21

Description: Open Low Woodland B (to 4m) of *Bauhinia cunninghamii* and *Dolichandrone heterophylla* over low scrub/scrub to 2m (*Acacia stellaticeps*, *Acacia coleii*, *Carrisa lanceolata*, *Melaleuca lasiandra*), over a variable ground layer of low grasses (*Triodia schinzii*, *Enneapogon purpurascens*, *Cenchrus ciliaris*, *Eragrostis falcata*) and herbs (*Corchorus sidoides* subsp. *sidoides*, *Corchorus parviflorus*, *Sida arenicola*, *Bonamia rosea*, *Solanum diversiflorum*, *Bonamia alatisemina*). This community occurs on red sandy loams in the Stage 2 study area on a gentle slope. The community is mostly in good ecological condition with grazing being the most common disturbance. *Bonamia oblongifolia* (Priority 1) and *Phyllanthus eremicus* (Priority 3) occur infrequently in grazed areas.



Plate 20: Acacia Shrubland A



Plate 21: Acacia Shrubland A – grazed.

Community 2: Acacia Shrubland B (Pindan)

Area: 393.7 ha (72 floristic quadrats)

Landscape: flat and gently undulating plains

Substrate: red/yellow sandy loams, gravels and rocky outcrops

Species richness (2500 m²): 17.9 (range 10-27)

Plant Cover: 30% (range 10 – 50%)

Weed Frequency: 0.7 (range 0-2)

Vegetation Condition: good-very good 386.4 ha, degraded-good 7.3 ha

Structural units:

Low open woodland

Low/Scrub

Heath, low heath

Herbs

Hummock grass

Illustration: Plates 22 and 23

Description: Open Low woodland B (to 4m) of *Bauhinia cunninghamii*, *Erythrophleum chlorostachys* and *Dolichandrone heterophylla* over low scrub/scrub to 2m (*Acacia stellaticeps*, *Acacia coleii*, *Carrisa lanceolata*, *Acacia ancistrocarpa*, *Acacia sericophylla*, *Grevillea pyramidalis*, *Acacia monticola*), over a variable ground layer of low grasses (*Triodia schinzii*, *Cenchrus ciliaris*, *Eragrostis falcata*) and herbs (*Corchorus sidoides* subsp. *sidoides*, *Corchorus parviflorus*, *Sida arenicola*, *Bonamia rosea*, *Ptilotus astrolasius*, *Indigofera monophylla*, *Jacksonia aculeata*). This community occurs on red sandy loams in the Stage 3 study area on a gentle slope. The community is mostly in good ecological condition with grazing being the most common disturbance. Approximately 170 ha was burnt in 2014/2015. *Bonamia oblongifolia* (Priority 1) occurs infrequently in grazed and burnt areas and at the periphery of the community.



Plate 22: Acacia Shrubland B



Plate 23: Low Acacia Shrubland B - burnt

Mixed Species Shrubland A (Pindan)

Area: 68.4 ha (11 floristic quadrats)

Landscape: flat and gently undulating plains

Substrate: red sandy loam,

Native Species richness (2500m²): 15.1 (range 11-19)

Plant Cover: 35% (range 25 – 50%)

Weed Frequency: 0.5 (range 0-1)

Vegetation Condition: good/very good 68.4ha

Structural units:

Low open woodland

Low/Scrub

Heath, low heath

Herbs

Hummock grass

Illustration: Plate 24

Description: Open Low Woodland B (to 4m) of *Dolichandrone heterophylla* emergent over low scrub/scrub to 2m (*Acacia stellaticeps*, *Acacia colei*, *Carrisa lanceolata*, *Acacia ancistrocarpa*, *Grevillea pyramidalis*), over a variable ground layer of low grasses (*Triodia schinzii*, *Cenchrus ciliaris*, *Eragrostis falcata*) and herbs (*Dodonaea coriacea*, *Corchorus parviflorus*, *Triumfetta chaetocarpa*, *Jacksonia aculeata*, *Ptilotus arthrolasius*, *Bonamia rosea*, *Solanum diversiflorum*, *Senna venusta*, *Solanum dioicum*). This community occurs on stony red sandy loams in the Stage 2 study area on a gentle slope leading to Acacia Shrubland A. The community is mostly in good ecological condition with grazing being the most common disturbance.



Plate 24: Mixed Species Shrubland A

Mixed Species Shrubland B (Pindan)

Area: 16.4 ha (4 floristic quadrats)
Landscape: flat and gently undulating plains
Substrate: red sandy loam,
Native Species richness (2500 m²): 14.8 (range 12-19)
Plant Cover: 30% (range 20 – 45%)
Weed Frequency: 0
Vegetation Condition: good-very good 16.4 ha
Structural units:
 Low open woodland
 Low/Scrub
 Heath, low heath
 Herbs
 Hummock grass

Illustration: Plate 25

Description: Open Low Woodland B (to 4m) of *Corymbia hammerslayana*, *Erythrophleum chlorostachys* and *Dolichandrone heterophylla* over low scrub/scrub to 2m (*Acacia stellaticeps*, *Acacia coleii*, *Acacia dictyophleba*, *Hakea macrocarpa*, *Acacia ptychophylla*, *Stylobasium australe*, *Acacia ancistrocarpa*, *Acacia sericophylla*, *Grevillea pyramidalis*, *Acacia monticola*), over a variable ground layer of low grasses (*Triodia schinzii*, *Eragrostis falcata*), shrubs and herbs (*Bonamia rosea*, *Heliotropium vestitum*, *Jacksonia aculeata*). This community is localised and occurs on rises and ridgelines of red sandy loams in the Stage 3 study area leading to Acacia Shrubland B. The community is mostly in good ecological condition with grazing being the most common disturbance.



Plate 25: Mixed Species Shrubland B

Melaleuca-Acacia Shrubland A

Area: 65.1 ha (13 floristic quadrats)
Landscape: flat and gently undulating plains
Substrate: brown sandy loam,
Native Species richness (2500m²): 12.8 (range 8-20)
Plant Cover: 30% (range 20 – 50%)
Weed Frequency: 0.5 (range 0-2)
Vegetation Condition: degraded-good 65.1ha
Structural units:
 Low open woodland
 Low/Scrub
 Heath, low heath
 Herbs
 Hummock grass

Illustration: Plate 26

Description: Open Low Woodland B (to 4m) of *Bauhinia cunninghamii* emergent over low scrub/scrub to 2m (*Acacia stellaticeps*, *Acacia colei*, *Carrisa lanceolata*), over a variable ground layer of low grasses (*Cenchrus ciliaris*, *Triodia epactia*, *Triodia schinzii*, *Eragrostis falcata*, *Enneapogon purpurascens*), shrubs and herbs (*Corchorus parviflorus*, *Abutilon otocarpum*, *Sida calyxhymeria*, *Solanum diversiflorum*, *Abutilon indicum*). This community occurs on brown sandy loams in the Stage 2 study area. The community is mostly in degraded to good ecological condition with grazing being the most common disturbance.



Plate 26: Melaleuca-Acacia Shrubland A

Melaleuca – Acacia Shrubland B

Area: 34.3 ha (9 floristic quadrats)

Landscape: flat and gently undulating plains

Substrate: brown sandy loam and white clay,

Native Species richness (2500 m²): 16.0 (range 14-21)

Plant Cover: 25% (range 10 – 50%)

Weed Frequency: 0.5 (range 0-1)

Vegetation Condition: good-very good 12.8 ha, degraded-good 21.8 ha

Structure: Low Open woodland over

Structural units:

Low open woodland

Low/Scrub

Heath, low heath

Herbs

Hummock grass

Illustration: Plate 27

Description: Open Low Woodland B (to 4m) of *Melaleuca alsophila* and *Acacia ampliceps* over low scrub/scrub to 2m (*Acacia stellaticeps*, *Acacia coleii*, *Carrisa lanceolata*, *Melaleuca lasiandra*), over a variable ground layer of low grasses (*Cenchrus ciliaris*, *Triodia epactia*, *Triodia schinzi*) shrubs and herbs (*Solanum esuriale*, *Pluchea ferdinandi-muelleri*, *Stemodia grossa*, *Pluchea tetrantha*, *Pterocaulon sphacelatum*, *Senna venusta*). The community is mostly in degraded to good ecological condition with grazing being the most common disturbance.



Plate 27: Melaleuca-Acacia Shrubland B

Completely degraded

Vegetation is completely degraded around stock watering points and when adjacent to agricultural structures (e.g. fence lines, tracks, buildings, see Plate 28). Approximately 17.5 ha is completely degraded.



Plate 28: Completely degraded vegetation caused by grazing

APPENDIX E. QUADRAT LOCATIONS

Quadrat	Easting	Northing
Q1	187542	7788808
Q2	187881	7788826
Q3	188198	7789240
Q4	188243	7788566
Q5	187737	7788405
Q6	187122	7788944
Q7	186834	7788731
Q8	186580	7788052
Q9	186137	7788187
Q10	186895	7788185
Q11	186931	7787930
Q12	186364	7787784
Q13	186351	7787537
Q14	186562	7787707
Q15	186809	7787735
Q16	187526	7787930
Q17	187975	7788101
Q18	185937	7788020
Q19	185699	7787985
Q20	185471	7788071
Q21	185569	7787804
Q22	186181	7787958
Q23	187367	7787588
Q24	187548	7787211
Q25	187665	7786909
Q26	187328	7786787

Quadrat	Easting	Northing
Q27	186998	7786759
Q28	186780	7787003
Q29	187108	7787177
Q30	186812	7787324
Q31	187046	7787492
Q32	184490	7787186
Q33	184523	7787555
Q34	184926	7787753
Q35	185339	7787832
Q36	185300	7787562
Q37	184941	7787302
Q38	185621	7787557
Q39	185526	7787351
Q40	185891	7787621
Q41	186143	7787647
Q42	187106	7788553
Q43	186723	7788464
Q44	186500	7788332
Q45	186599	7788743
Q46	188759	7789446
Q47	188916	7789227
Q48	189050	7789040
Q49	189164	7788876
Q50	189405	7789002
Q51	189631	7789146
Q52	189394	7789209

Quadrat	Easting	Northing
Q53	189620	7789381
Q54	189334	7789493
Q55	189559	7789669
Q56	189515	7789866
Q57	189146	7789613
Q58	189153	7789330
Q59	188957	7788768
Q60	188736	7788833
Q61	188416	7788858
Q62	188559	7788557
Q63	188323	7788359
Q64	188046	7788450
Q65	188110	7788883
Q66	188017	7789090
Q67	188486	7789284
Q68	188348	7789088
Q69	188672	7789153
Q70	187833	7788999
Q71	187606	7788579
Q72	187222	7788322
Q73	187353	7787987
Q74	178192	7785856
Q75	178360	7785926
Q76	178520	7785947
Q77	178238	7786031
Q78	178389	7786188

Quadrat	Easting	Northing
Q79	178405	7786390
Q80	178503	7786488
Q81	178303	7786500
Q82	178318	7786291
Q83	178235	7786179
Q84	178036	7786207
Q85	177810	7786138
Q86	177797	7785939
Q87	177867	7785810
Q88	178048	7786026
Q89	177966	7785763
Q90	177673	7785611
Q91	177467	7785528
Q92	177469	7785663
Q93	177719	7785753
Q94	177287	7785448
Q95	177067	7785283
Q96	176681	7784974
Q97	176361	7784944
Q98	176149	7784856
Q99	175864	7785042
Q100	175826	7785283
Q101	176133	7785428
Q102	176230	7785109
Q103	176507	7785250
Q104	176338	7785563
Q105	176775	7785396
Q106	177102	7785587
Q107	177361	7787572
Q108	177311	7787358

Quadrat	Easting	Northing
Q109	177626	7787361
Q110	177600	7787584
Q111	178311	7786862
Q112	178364	7786639
Q113	178530	7786637
Q114	178442	7786846
Q115	176780	7787230
Q116	176488	7787145
Q117	176582	7786851
Q118	176478	7786572
Q119	176377	7786366
Q120	176635	7786395
Q121	176870	7786440
Q122	176662	7786635
Q123	176816	7786841
Q124	176852	7787135
Q125	176931	7786170
Q126	176627	7786090
Q127	176340	7786105
Q128	176171	7786066
Q129	176260	7785799
Q130	176620	7785829
Q131	176847	7785701
Q132	177084	7785953
Q133	177072	7787217
Q134	177384	7787210
Q135	177714	7787149
Q136	178020	7787089
Q137	178078	7786897
Q138	177867	7786829

Quadrat	Easting	Northing
Q139	177767	7786994
Q140	177501	7787044
Q141	177204	7787042
Q142	177048	7787016
Q143	177196	7786813
Q144	177427	7786800
Q145	177612	7786804
Q146	177550	7786587
Q147	177222	7786649
Q148	176961	7786697
Q149	177192	7786396
Q150	177482	7786354
Q151	177522	7786114
Q152	177293	7786194
Q153	177329	7785947
Q154	177550	7785867
Q155	177228	7785807
Q156	177935	7786379
Q157	177691	7786400
Q158	177789	7786616
Q159	177956	7786719
Q160	177973	7786548
Q161	178096	7786468
Q162	178108	7786648
Q163	178199	7786820
Q164	178395	7787203
Q165	178158	7787178
Q167	178194	7786996
Q166	178376	7786092
Q168	187749	7787981

Quadrat	Easting	Northing
Q169	187485	7788150
Q170	187384	7788491
Q171	187075	7787717

Quadrat	Easting	Northing
Q172	187275	7787342
Q173	187413	7787059
Q174	185909	7787469

Quadrat	Easting	Northing
Q175	184747	7787206
Q176	184737	7787499

APPENDIX F. FLORISTIC DATA

name	q1	q2	q3	q4	q5	q6	q7	q8	q9	q10	q11	q12	q13	q14	q15	q16
<i>Abutilon indicum</i>		1				1	1						1			
<i>Abutilon otocarpum</i>	1	1	1	1		1	1									
<i>Acacia ampliceps</i>																
<i>Acacia ancistrocarpa</i>	1	1	1	1	1	1	1	1	1	1			1	1	1	1
<i>Acacia colei</i>	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1
<i>Acacia dictyophleba</i>							1			1					1	
<i>Acacia drepanocarpa</i> subsp. <i>drepanocarpa</i>	1	1		1			1	1								
<i>Acacia hilliana</i>	1				1						1					
<i>Acacia monticola</i>						1										1
<i>Acacia ptychophylla</i>																
<i>Acacia sericophylla</i>	1		1	1		1	1	1				1	1	1	1	
<i>Acacia stellaticeps</i>	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1
<i>Aerva javanica</i>	1	1					1					1				
<i>Amaranthus undulatus</i>																
<i>Aristida inaequiglumis</i>																
<i>Bauhinia cunninghamii</i>	1	1	1	1		1	1		1			1		1		1
<i>Bonamia alatisemina</i>									1		1			1	1	
<i>Bonamia oblongifolia</i>																
<i>Bonamia rosea</i>	1	1								1	1	1	1	1		1
<i>Calandrinia strophiolata</i>																
<i>Calytrix carinata</i>																
<i>Capparis umbonata</i>																
<i>Carrisa lanceolata</i>	1	1	1			1	1	1				1				
<i>Cassytha filiformis</i>		1	1									1			1	1
<i>Cenchrus ciliaris</i>	1		1						1							
<i>Cleome uncifera</i>																
<i>Codonocarpus cotinifolius</i>																
<i>Corchorus parviflorus</i>		1	1	1		1					1					
<i>Corchorus sidoides</i> subsp. <i>sidoides</i>							1			1	1	1	1	1	1	1
<i>Corymbia hammerslayana</i>													1			1
<i>Corymbia zygophylla</i>																
<i>Corynotheca micrantha</i>																
<i>Cucumis variabilis</i>																

name	q1	q2	q3	q4	q5	q6	q7	q8	q9	q10	q11	q12	q13	q14	q15	q16
<i>Cyanostegia cyanocalyx</i>																
<i>Dodonaea coriacea</i>											1					
<i>Dolichandrone heterophylla</i>					1			1	1		1		1		1	
<i>Duboisia hopwoodii</i>																
<i>Enneapogon purpurascens</i>			1													
<i>Eragrostis falcata</i>	1	1			1		1	1	1			1	1			
<i>Erythrophleum chlorostachys</i>					1				1	1	1					1
<i>Eulalia aurea</i>																
<i>Euphorbia australis</i>			1													
<i>Euphorbia drummondii</i>																
<i>Evolvulus alsinoides</i>																
<i>Goodenia azurea</i>																
<i>Goodenia microptera</i>																
<i>Grevillea eriostachya</i>																
<i>Grevillea pyramidalis</i>								1			1			1	1	
<i>Grevillea refracta</i>																
<i>Hakea chordophylla</i>																
<i>Hakea macrocarpa</i>		1			1						1				1	1
<i>Heliotropium vestitum</i>								1							1	
<i>Hemichroa diandra</i>																
<i>Hybanthus aurantiacus</i>										1			1	1		1
<i>Indigofera collutea</i>																
<i>Indigofera linnaei</i>																
<i>Indigofera monophylla</i>	1	1		1	1	1	1						1	1		1
<i>Indigofera oblongifolia</i>																
<i>Ipomoea muelleri</i>																
<i>Jacksonia aculeata</i>								1	1				1	1	1	1
<i>Keraudrenia velutina</i>							1									1
<i>Leptosema anomalum</i>														1		
<i>Melaleuca alsophila</i>																
<i>Melaleuca lasiandra</i>												1		1		
<i>Mollugo molluginea</i>																
<i>Neobassia astrocarpa</i>																
<i>Newcastelia cladotricha</i>																
<i>Panicum decompositum</i>																
<i>Persoonia falcata</i>	1															
<i>Phyllanthus eremicus</i>																
<i>Pluchea dentex</i>																
<i>Pluchea ferdinandi-muelleri</i>																

name	q1	q2	q3	q4	q5	q6	q7	q8	q9	q10	q11	q12	q13	q14	q15	q16
<i>Pluchea tetrantha</i>																
<i>Polymeria ambigua</i>																
<i>Portulaca oleracea</i>																
<i>Portulaca pilosa</i>																
<i>Pterocaulon sphacelatum</i>																
<i>Ptilotus arthrolasius</i>			1													
<i>Ptilotus astrolasius</i>	1	1		1	1		1	1	1	1	1					
<i>Ptilotus calostachyus</i>																
<i>Ptilotus chamaecladus</i>																
<i>Ptilotus clementii</i>																
<i>Rhynchosia minima</i>																
<i>Santalum lanceolatum</i>																
<i>Scaevola collaris</i>																
<i>Senna curvistyla</i>									1							
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>		1		1			1								1	1
<i>Senna venusta</i>													1			
<i>Sida arenicola</i>			1	1						1						
<i>Sida calyxhymenia</i>			1													
<i>Solanum dioicum</i>																
<i>Solanum diversiflorum</i>			1	1												
<i>Solanum esuriale</i>													1	1	1	
<i>Solanum lucani</i>																
<i>Stemodia grossa</i>																
<i>Streptoglossa tenuiflora</i>												1	1			
<i>Stylobasium australe</i>															1	
<i>Tephrosia leptoclada</i>																
<i>Trianthema pilosa</i>			1													
<i>Trianthema triquetra</i>																
<i>Trianthema turgidifolia</i>																
<i>Trichodesma zeylandica</i>					1							1		1		
<i>Triodia epactia</i>			1													
<i>Triodia schinzii</i>	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1
<i>Triumfetta chaetocarpa</i>																

name	q17	q18	q19	q20	q21	q22	q23	q24	q25	q26	q27	q28	q29	q30	q31	q32
<i>Abutilon indicum</i>	1	1		1												
<i>Abutilon otocarpum</i>																
<i>Acacia ampliceps</i>																
<i>Acacia ancistrocarpa</i>	1	1	1		1	1	1	1			1	1		1	1	1

name	q17	q18	q19	q20	q21	q22	q23	q24	q25	q26	q27	q28	q29	q30	q31	q32
<i>Acacia coleii</i>	1	1	1	1	1	1	1	1		1	1	1	1	1		1
<i>Acacia dictyophleba</i>							1		1	1			1		1	1
<i>Acacia drepanocarpa</i> subsp. <i>drepanocarpa</i>							1									
<i>Acacia hilliana</i>												1			1	
<i>Acacia monticola</i>	1						1			1	1					
<i>Acacia ptychophylla</i>					1			1			1		1			
<i>Acacia sericophylla</i>	1			1		1	1	1	1	1	1	1	1		1	1
<i>Acacia stellaticeps</i>		1	1	1	1	1	1	1	1	1	1		1			1
<i>Aerva javanica</i>	1															
<i>Amaranthus undulatus</i>																
<i>Aristida inaequiglumis</i>																
<i>Bauhinia cunninghamii</i>		1		1		1										
<i>Bonamia alatisemina</i>		1	1	1		1									1	
<i>Bonamia oblongifolia</i>																
<i>Bonamia rosea</i>	1	1	1			1	1		1	1	1				1	
<i>Calandrinia strophiolata</i>																
<i>Calytrix carinata</i>	1						1			1						
<i>Capparis umbonata</i>						1										
<i>Carrisa lanceolata</i>		1	1	1		1		1								
<i>Cassytha filiformis</i>						1										
<i>Cenchrus ciliaris</i>		1		1							1					
<i>Cleome uncifera</i>																
<i>Codonocarpus cotinifolius</i>																
<i>Corchorus parviflorus</i>																
<i>Corchorus sidoides</i> subsp. <i>sidoides</i>		1	1		1	1						1		1		1
<i>Corymbia hammerslayana</i>	1			1					1	1		1	1	1		
<i>Corymbia zygophylla</i>					1											1
<i>Corynotheca micrantha</i>																
<i>Cucumis variabilis</i>		1				1										
<i>Cyanostegia cyanocalyx</i>																
<i>Dodonaea coriacea</i>						1		1								
<i>Dolichandrone heterophylla</i>		1				1			1		1	1	1			
<i>Duboisia hopwoodii</i>																
<i>Enneapogon purpurascens</i>				1												
<i>Eragrostis falcata</i>		1		1	1	1								1	1	
<i>Erythrophleum chlorostachys</i>							1		1	1	1			1		1
<i>Eulalia aurea</i>																
<i>Euphorbia australis</i>		1														
<i>Euphorbia drummondii</i>																

name	q17	q18	q19	q20	q21	q22	q23	q24	q25	q26	q27	q28	q29	q30	q31	q32
<i>Evolvulus alsinoides</i>			1													
<i>Goodenia azurea</i>																
<i>Goodenia microptera</i>																
<i>Grevillea eriostachya</i>													1	1		
<i>Grevillea pyramidalis</i>							1	1	1	1	1		1		1	
<i>Grevillea refracta</i>																
<i>Hakea chordophylla</i>																
<i>Hakea macrocarpa</i>							1	1		1	1		1	1	1	
<i>Heliotropium vestitum</i>										1						
<i>Hemichroa diandra</i>																
<i>Hybanthus aurantiacus</i>	1			1		1			1				1			
<i>Indigofera collutea</i>																
<i>Indigofera linnaei</i>																
<i>Indigofera monophylla</i>		1	1		1							1				1
<i>Indigofera oblongifolia</i>																
<i>Ipomoea muelleri</i>												1	1	1		1
<i>Jacksonia aculeata</i>		1					1	1	1	1			1	1	1	
<i>Keraudrenia velutina</i>		1	1	1	1	1			1							
<i>Leptosema anomalum</i>																
<i>Melaleuca alsophila</i>																
<i>Melaleuca lasiandra</i>		1	1			1										
<i>Mollugo molluginea</i>		1														
<i>Neobassia astrocarpa</i>																
<i>Newcastelia cladotricha</i>																
<i>Panicum decompositum</i>												1				
<i>Persoonia falcata</i>																
<i>Phyllanthus eremicus</i>		1														
<i>Pluchea dentex</i>																
<i>Pluchea ferdinandi-muelleri</i>																
<i>Pluchea tetrantha</i>																
<i>Polymeria ambigua</i>																
<i>Portulaca oleracea</i>																
<i>Portulaca pilosa</i>		1										1				
<i>Pterocaulon sphacelatum</i>																
<i>Ptilotus arthrolasius</i>																
<i>Ptilotus astrolasius</i>	1		1			1	1	1	1	1	1	1	1	1	1	1
<i>Ptilotus calostachyus</i>												1				
<i>Ptilotus chamaecladus</i>																
<i>Ptilotus clementii</i>		1														

name	q17	q18	q19	q20	q21	q22	q23	q24	q25	q26	q27	q28	q29	q30	q31	q32
<i>Rhynchosia minima</i>														1		
<i>Santalum lanceolatum</i>																
<i>Scaevola collaris</i>																
<i>Senna curvistyla</i>																
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>									1		1					
<i>Senna venusta</i>		1														
<i>Sida arenicola</i>								1	1	1						1
<i>Sida calyxhymenia</i>																
<i>Solanum dioicum</i>		1		1					1	1				1		1
<i>Solanum diversiflorum</i>																
<i>Solanum esuriale</i>				1												
<i>Solanum lucani</i>																
<i>Stemodia grossa</i>																
<i>Streptoglossa tenuiflora</i>																
<i>Stylobasium australe</i>		1	1									1				
<i>Tephrosia leptoclada</i>		1										1				
<i>Trianthema pilosa</i>																
<i>Trianthema triquetra</i>																
<i>Trianthema turgidifolia</i>																
<i>Trichodesma zeylandica</i>																
<i>Triodia epactia</i>														1		
<i>Triodia schinzii</i>	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
<i>Triumfetta chaetocarpa</i>																

name	q33	q34	q35	q36	q37	q38	q39	q40	q41	q42	q43	q44	q45	q46	q47	q48
<i>Abutilon indicum</i>	1												1	1	1	
<i>Abutilon otocarpum</i>																
<i>Acacia ampliceps</i>																
<i>Acacia ancistrocarpa</i>		1	1	1	1	1	1	1	1	1	1	1	1			1
<i>Acacia coleii</i>	1	1	1	1	1	1	1	1	1		1		1	1	1	1
<i>Acacia dictyophleba</i>																
<i>Acacia drepanocarpa</i> subsp. <i>drepanocarpa</i>													1			1
<i>Acacia hilliana</i>									1	1						
<i>Acacia monticola</i>					1		1			1						
<i>Acacia ptychophylla</i>	1							1			1					
<i>Acacia sericophylla</i>	1				1	1	1	1		1		1				1
<i>Acacia stellaticeps</i>	1	1	1			1		1			1	1	1	1	1	1
<i>Aerva javanica</i>																
<i>Amaranthus undulatus</i>	1			1												

name	q33	q34	q35	q36	q37	q38	q39	q40	q41	q42	q43	q44	q45	q46	q47	q48
<i>Aristida inaequiglumis</i>																
<i>Bauhinia cunninghamii</i>	1	1			1		1		1		1		1		1	1
<i>Bonamia alatisemina</i>					1				1					1		
<i>Bonamia oblongifolia</i>														1		
<i>Bonamia rosea</i>	1					1	1	1		1	1	1				1
<i>Calandrinia strophiolata</i>																
<i>Calytrix carinata</i>																
<i>Capparis umbonata</i>																1
<i>Carrisa lanceolata</i>	1				1	1						1	1	1	1	
<i>Cassytha filiformis</i>												1				
<i>Cenchrus ciliaris</i>	1	1				1		1					1	1		
<i>Cleome uncifera</i>																
<i>Codonocarpus cotinifolius</i>																
<i>Corchorus parviflorus</i>	1													1		1
<i>Corchorus sidoides</i> subsp. <i>sidoides</i>	1	1		1		1		1	1	1	1	1	1	1	1	
<i>Corymbia hammerslayana</i>				1												
<i>Corymbia zygophylla</i>	1						1									
<i>Corynotheca micrantha</i>																
<i>Cucumis variabilis</i>															1	
<i>Cyanostegia cyanocalyx</i>																
<i>Dodonaea coriacea</i>												1				
<i>Dolichandrone heterophylla</i>	1										1	1				1
<i>Duboisia hopwoodii</i>																
<i>Enneapogon purpurascens</i>								1				1			1	
<i>Eragrostis falcata</i>				1	1	1		1	1	1	1		1	1		1
<i>Erythrophleum chlorostachys</i>					1		1			1		1				
<i>Eulalia aurea</i>																
<i>Euphorbia australis</i>																
<i>Euphorbia drummondii</i>																
<i>Evolvulus alsinoides</i>		1									1					1
<i>Goodenia azurea</i>																
<i>Goodenia microptera</i>																
<i>Grevillea eriostachya</i>																
<i>Grevillea pyramidalis</i>										1	1	1				
<i>Grevillea refracta</i>												1				
<i>Hakea chordophylla</i>																
<i>Hakea macrocarpa</i>															1	
<i>Heliotropium vestitum</i>											1	1				
<i>hemichfroa diandra</i>																

name	q33	q34	q35	q36	q37	q38	q39	q40	q41	q42	q43	q44	q45	q46	q47	q48
<i>Hybanthus aurantiacus</i>	1		1			1	1		1		1	1				
<i>Indigofera collutea</i>																
<i>Indigofera linnaei</i>																
<i>Indigofera monophylla</i>	1		1			1		1	1	1	1	1				
<i>Indigofera oblongifolia</i>																
<i>Ipomoea muelleri</i>	1															
<i>Jacksonia aculeata</i>				1		1			1		1					
<i>Keraudrenia velutina</i>											1					
<i>Leptosema anomalum</i>				1		1			1							
<i>Melaleuca alsophila</i>																
<i>Melaleuca lasiandra</i>																
<i>Mollugo molluginea</i>																
<i>Neobassia astrocarpa</i>																
<i>Newcastelia cladotricha</i>																
<i>Panicum decompositum</i>																
<i>Persoonia falcata</i>																
<i>Phyllanthus eremicus</i>			1													
<i>Pluchea dentex</i>																
<i>Pluchea ferdinandi-muelleri</i>																
<i>Pluchea tetrantha</i>																
<i>Polymeria ambigua</i>																
<i>Portulaca oleracea</i>																
<i>Portulaca pilosa</i>																
<i>Pterocaulon sphacelatum</i>																
<i>Ptilotus arthrolasius</i>																
<i>Ptilotus astrolasius</i>		1				1				1	1	1	1		1	1
<i>Ptilotus calostachyus</i>						1	1									
<i>Ptilotus chamaecladus</i>																
<i>Ptilotus clementii</i>																
<i>Rhynchosia minima</i>																
<i>Santalum lanceolatum</i>																1
<i>Scaevola collaris</i>																
<i>Senna curvistyla</i>																
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>							1	1		1						
<i>Senna venusta</i>														1	1	
<i>Sida arenicola</i>	1	1	1	1	1	1		1	1	1	1	1				
<i>Sida calyxhymenia</i>												1		1		
<i>Solanum dioicum</i>	1			1					1		1					
<i>Solanum diversiflorum</i>														1	1	

name	q33	q34	q35	q36	q37	q38	q39	q40	q41	q42	q43	q44	q45	q46	q47	q48
<i>Solanum esuriale</i>														1		
<i>Solanum lucani</i>																
<i>Stemodia grossa</i>																
<i>Streptoglossa tenuiflora</i>											1					
<i>Stylobasium australe</i>										1				1	1	
<i>Tephrosia leptoclada</i>																
<i>Trianthema pilosa</i>														1		
<i>Trianthema triquetra</i>																
<i>Trianthema turgidifolia</i>																
<i>Trichodesma zeylandica</i>																
<i>Triodia epactia</i>																
<i>Triodia schinzii</i>	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
<i>Triumfetta chaetocarpa</i>																

name	q49	q50	q51	q52	q53	q54	q55	q56	q57	q58	q59	q60	q61	q62	q63	q64
<i>Abutilon indicum</i>	1						1			1				1		
<i>Abutilon otocarpum</i>							1	1	1	1			1	1		1
<i>Acacia ampliceps</i>																
<i>Acacia ancistrocarpa</i>	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1
<i>Acacia coleii</i>	1	1	1	1	1		1	1	1	1	1	1	1	1		1
<i>Acacia dictyophleba</i>																
<i>Acacia drepanocarpa</i> subsp. <i>drepanocarpa</i>																
<i>Acacia hilliana</i>												1	1			
<i>Acacia monticola</i>														1	1	1
<i>Acacia ptychophylla</i>		1		1						1	1	1	1			
<i>Acacia sericophylla</i>	1	1	1		1	1	1			1	1	1		1		
<i>Acacia stellaticeps</i>	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
<i>Aerva javanica</i>		1						1			1		1			
<i>Amaranthus undulatus</i>																
<i>Aristida inaequiglumis</i>																
<i>Bauhinia cunninghamii</i>	1	1	1		1	1		1	1	1	1	1	1	1	1	1
<i>Bonamia alatisemina</i>																
<i>Bonamia oblongifolia</i>			1						1						1	
<i>Bonamia rosea</i>	1	1	1	1	1	1	1				1	1	1	1	1	
<i>Calandrinia strophiolata</i>																
<i>Calytrix carinata</i>																
<i>Capparis umbonata</i>										1						
<i>Carrisa lanceolata</i>	1	1			1	1	1		1		1	1	1	1		

name	q49	q50	q51	q52	q53	q54	q55	q56	q57	q58	q59	q60	q61	q62	q63	q64
<i>Cassytha filiformis</i>												1	1			
<i>Cenchrus ciliaris</i>		1		1	1			1	1		1		1	1		
<i>Cleome uncifera</i>																
<i>Codonocarpus cotinifolius</i>						1										
<i>Corchorus parviflorus</i>		1						1			1		1			
<i>Corchorus sidoides</i> subsp. <i>sidoides</i>	1	1	1	1	1		1		1	1	1	1		1	1	1
<i>Corymbia hammerslayana</i>																
<i>Corymbia zygophylla</i>																
<i>Corynotheca micrantha</i>																
<i>Cucumis variabilis</i>						1	1		1							
<i>Cyanostegia cyanocalyx</i>																
<i>Dodonaea coriacea</i>			1													
<i>Dolichandrone heterophylla</i>	1	1					1			1		1				
<i>Duboisia hopwoodii</i>																
<i>Enneapogon purpurascens</i>								1	1							
<i>Eragrostis falcata</i>		1	1	1			1	1	1	1	1	1	1			
<i>Erythrophleum chlorostachys</i>			1											1		
<i>Eulalia aurea</i>									1							
<i>Euphorbia australis</i>																
<i>Euphorbia drummondii</i>																
<i>Evolvulus alsinoides</i>		1	1			1		1	1	1						
<i>Goodenia azurea</i>																
<i>Goodenia microptera</i>																
<i>Grevillea eriostachya</i>																
<i>Grevillea pyramidalis</i>		1	1				1			1	1		1			
<i>Grevillea refracta</i>																
<i>Hakea chordophylla</i>																
<i>Hakea macrocarpa</i>																1
<i>Heliotropium vestitum</i>																
<i>hemichfroa diandra</i>																
<i>Hybanthus aurantiacus</i>		1			1					1						1
<i>Indigofera collutea</i>																
<i>Indigofera linnaei</i>																
<i>Indigofera monophylla</i>	1			1											1	1
<i>Indigofera oblongifolia</i>																
<i>Ipomoea muelleri</i>								1			1		1			
<i>Jacksonia aculeata</i>	1	1														
<i>Keraudrenia velutina</i>			1	1		1		1								
<i>Leptosema anomalum</i>																

name	q49	q50	q51	q52	q53	q54	q55	q56	q57	q58	q59	q60	q61	q62	q63	q64
<i>Melaleuca alsophila</i>																
<i>Melaleuca lasiandra</i>																
<i>Mollugo molluginea</i>																
<i>Neobassia astrocarpa</i>																
<i>Newcastelia cladotricha</i>																
<i>Panicum decompositum</i>																
<i>Persoonia falcata</i>																
<i>Phyllanthus eremicus</i>																
<i>Pluchea dentex</i>																
<i>Pluchea ferdinandi-muelleri</i>																
<i>Pluchea tetrantha</i>																
<i>Polymeria ambigua</i>																
<i>Portulaca oleracea</i>																
<i>Portulaca pilosa</i>																
<i>Pterocaulon sphacelatum</i>																
<i>Ptilotus arthrolasius</i>																
<i>Ptilotus astrolasius</i>	1	1		1	1	1	1			1	1	1	1	1		1
<i>Ptilotus calostachyus</i>						1										
<i>Ptilotus chamaecladus</i>																
<i>Ptilotus clementii</i>																
<i>Rhynchosia minima</i>																
<i>Santalum lanceolatum</i>								1								
<i>Scaevola collaris</i>												1				
<i>Senna curvistyla</i>				1												
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>		1	1								1					1
<i>Senna venusta</i>																
<i>Sida arenicola</i>				1							1					1
<i>Sida calyxhymenia</i>									1							
<i>Solanum dioicum</i>			1													
<i>Solanum diversiflorum</i>		1			1									1		
<i>Solanum esuriale</i>											1					
<i>Solanum lucani</i>																
<i>Stemodia grossa</i>																
<i>Streptoglossa tenuiflora</i>							1									
<i>Stylobasium australe</i>						1				1		1				
<i>Tephrosia leptoclada</i>					1											
<i>Trianthema pilosa</i>																
<i>Trianthema triquetra</i>																
<i>Trianthema turgidifolia</i>																

name	q49	q50	q51	q52	q53	q54	q55	q56	q57	q58	q59	q60	q61	q62	q63	q64
<i>Trichodesma zeylandica</i>																1
<i>Triodia epactia</i>																
<i>Triodia schinzii</i>	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
<i>Triumfetta chaetocarpa</i>																

name	q65	q66	q67	q68	q69	q70	q71	q72	q73	q74	q75	q76	q77	q78	q79	q80
<i>Abutilon indicum</i>	1	1	1		1	1								1		
<i>Abutilon otocarpum</i>	1	1	1									1	1	1		
<i>Acacia ampliceps</i>																
<i>Acacia ancistrocarpa</i>							1	1	1	1	1	1				
<i>Acacia coleii</i>	1		1		1			1	1	1	1	1	1	1		1
<i>Acacia dictyophleba</i>																
<i>Acacia drepanocarpa</i> subsp. <i>drepanocarpa</i>																
<i>Acacia hilliana</i>							1	1								
<i>Acacia monticola</i>							1	1	1		1					
<i>Acacia ptychophylla</i>	1								1			1				
<i>Acacia sericophylla</i>	1						1	1	1	1	1	1				
<i>Acacia stellaticeps</i>	1	1	1	1	1	1		1		1		1	1	1	1	1
<i>Aerva javanica</i>	1	1			1	1										
<i>Amaranthus undulatus</i>												1				
<i>Aristida inaequiglumis</i>																
<i>Bauhinia cunninghamii</i>	1	1	1	1	1	1			1	1	1	1	1	1		
<i>Bonamia alatisemina</i>													1	1	1	
<i>Bonamia oblongifolia</i>		1														
<i>Bonamia rosea</i>						1	1	1	1	1	1	1	1	1		
<i>Calandrinia strophiolata</i>																
<i>Calytrix carinata</i>																
<i>Capparis umbonata</i>	1												1	1		
<i>Carrisa lanceolata</i>	1		1		1	1				1		1	1	1	1	1
<i>Cassytha filiformis</i>					1					1						
<i>Cenchrus ciliaris</i>	1	1	1	1	1	1				1		1	1	1	1	1
<i>Cleome uncifera</i>																
<i>Codonocarpus cotinifolius</i>																
<i>Corchorus parviflorus</i>	1	1	1	1												
<i>Corchorus sidoides</i> subsp. <i>sidoides</i>				1		1	1			1	1	1		1	1	
<i>Corymbia hammerslayana</i>									1							
<i>Corymbia zygophylla</i>																

name	q65	q66	q67	q68	q69	q70	q71	q72	q73	q74	q75	q76	q77	q78	q79	q80
<i>Corynotheca micrantha</i>																
<i>Cucumis variabilis</i>		1			1											
<i>Cyanostegia cyanocalyx</i>																
<i>Dodonaea coriacea</i>											1					
<i>Dolichandrone heterophylla</i>										1	1	1	1			
<i>Duboisia hopwoodii</i>																
<i>Enneapogon purpurascens</i>						1										
<i>Eragrostis falcata</i>		1		1	1	1				1		1		1	1	1
<i>Erythrophleum chlorostachys</i>								1								
<i>Eulalia aurea</i>																
<i>Euphorbia australis</i>		1														
<i>Euphorbia drummondii</i>																
<i>Evolvulus alsinoides</i>	1	1		1												
<i>Goodenia azurea</i>																
<i>Goodenia microptera</i>																
<i>Grevillea eriostachya</i>																
<i>Grevillea pyramidalis</i>										1						
<i>Grevillea refracta</i>																
<i>Hakea chordophylla</i>							1									
<i>Hakea macrocarpa</i>							1	1	1	1	1	1				
<i>Heliotropium vestitum</i>																
<i>hemichfroa diandra</i>																
<i>Hybanthus aurantiacus</i>									1							
<i>Indigofera collutea</i>																
<i>Indigofera linnaei</i>																
<i>Indigofera monophylla</i>							1		1		1	1				
<i>Indigofera oblongifolia</i>																
<i>Ipomoea muelleri</i>																
<i>Jacksonia aculeata</i>									1							
<i>Keraudrenia velutina</i>	1										1					
<i>Leptosema anomalum</i>																
<i>Melaleuca alsophila</i>																
<i>Melaleuca lasiandra</i>		1				1								1	1	1
<i>Mollugo molluginea</i>																
<i>Neobassia astrocarpa</i>																
<i>Newcastelia cladotricha</i>																
<i>Panicum decompositum</i>		1														
<i>Persoonia falcata</i>																
<i>Phyllanthus eremicus</i>																

name	q65	q66	q67	q68	q69	q70	q71	q72	q73	q74	q75	q76	q77	q78	q79	q80
<i>Pluchea dentex</i>																
<i>Pluchea ferdinandi-muelleri</i>																
<i>Pluchea tetrantha</i>															1	
<i>Polymeria ambigua</i>																
<i>Portulaca oleracea</i>																
<i>Portulaca pilosa</i>																
<i>Pterocaulon sphacelatum</i>																
<i>Ptilotus arthrolasius</i>																
<i>Ptilotus astrolasius</i>									1							
<i>Ptilotus calostachyus</i>																
<i>Ptilotus chamaecladus</i>																
<i>Ptilotus clementii</i>																
<i>Rhynchosia minima</i>																
<i>Santalum lanceolatum</i>																
<i>Scaevola collaris</i>	1			1												
<i>Senna curvistyla</i>																
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	1	1				1	1				1	1				
<i>Senna venusta</i>		1	1		1								1		1	
<i>Sida arenicola</i>		1		1											1	
<i>Sida calyxhymenia</i>		1	1	1	1	1									1	
<i>Solanum dioicum</i>	1								1							
<i>Solanum diversiflorum</i>		1	1	1		1								1		
<i>Solanum esuriale</i>			1	1												
<i>Solanum lucani</i>																
<i>Stemodia grossa</i>																
<i>Streptoglossa tenuiflora</i>																
<i>Stylobasium australe</i>				1	1											
<i>Tephrosia leptoclada</i>																
<i>Trianthema pilosa</i>																
<i>Trianthema triquetra</i>																
<i>Trianthema turgidifolia</i>																
<i>Trichodesma zeylandica</i>																
<i>Triodia epactia</i>		1	1	1												1
<i>Triodia schinzii</i>	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
<i>Triumfetta chaetocarpa</i>																

name	q81	q82	q83	q84	q85	q86	q87	q88	q89	q90	q91	q92	q93	q94	q95	q96
<i>Abutilon indicum</i>		1	1	1	1	1		1		1					1	

name	q81	q82	q83	q84	q85	q86	q87	q88	q89	q90	q91	q92	q93	q94	q95	q96
<i>Abutilon otoparpum</i>																
<i>Acacia ampliceps</i>																
<i>Acacia ancistrocarpa</i>									1				1	1		1
<i>Acacia coleii</i>	1					1	1	1		1	1	1	1	1	1	
<i>Acacia dictyophleba</i>											1					
<i>Acacia drepanocarpa</i> subsp. <i>drepanocarpa</i>																
<i>Acacia hilliana</i>																
<i>Acacia monticola</i>																
<i>Acacia ptychophylla</i>									1		1					
<i>Acacia sericophylla</i>									1		1			1		
<i>Acacia stellaticeps</i>	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
<i>Aerva javanica</i>																
<i>Amaranthus undulatus</i>				1												
<i>Aristida inaequiglumis</i>																
<i>Bauhinia cunninghamii</i>			1		1	1		1	1	1		1	1	1		1
<i>Bonamia alatisemina</i>			1	1		1	1	1		1		1	1	1	1	1
<i>Bonamia oblongifolia</i>			1	1				1								
<i>Bonamia rosea</i>									1	1	1	1	1	1		1
<i>Calandrinia strophiolata</i>																
<i>Calytrix carinata</i>																
<i>Capparis umbonata</i>			1			1										
<i>Carrisa lanceolata</i>	1		1	1	1	1	1		1	1		1	1	1	1	
<i>Cassytha filiformis</i>																
<i>Cenchrus ciliaris</i>	1	1	1	1	1	1		1	1		1	1	1		1	
<i>Cleome uncifera</i>															1	1
<i>Codonocarpus cotinifolius</i>																
<i>Corchorus parviflorus</i>			1	1	1		1	1		1		1	1	1	1	1
<i>Corchorus sidoides</i> subsp. <i>sidoides</i>	1	1	1	1	1	1	1	1		1			1		1	1
<i>Corymbia hammerslayana</i>																
<i>Corymbia zygophylla</i>																
<i>Corynotheca micrantha</i>																
<i>Cucumis variabilis</i>				1										1		
<i>Cyanostegia cyanocalyx</i>																
<i>Dodonaea coriacea</i>						1				1		1	1			
<i>Dolichandrone heterophylla</i>									1			1	1			1
<i>Duboisia hopwoodii</i>																
<i>Enneapogon purpurascens</i>		1	1	1	1	1	1	1	1				1	1	1	
<i>Eragrostis falcata</i>		1	1	1	1	1	1	1			1	1	1	1	1	1
<i>Erythrophleum chlorostachys</i>																1

name	q81	q82	q83	q84	q85	q86	q87	q88	q89	q90	q91	q92	q93	q94	q95	q96
<i>Eulalia aurea</i>																
<i>Euphorbia australis</i>		1	1	1				1								1
<i>Euphorbia drummondii</i>																
<i>Evolvulus alsinoides</i>		1	1	1		1		1		1		1			1	1
<i>Goodenia azurea</i>																
<i>Goodenia microptera</i>																
<i>Grevillea eriostachya</i>																
<i>Grevillea pyramidalis</i>							1		1		1					1
<i>Grevillea refracta</i>																
<i>Hakea chordophylla</i>																
<i>Hakea macrocarpa</i>							1									
<i>Heliotropium vestitum</i>																
<i>hemichfroa diandra</i>																
<i>Hybanthus aurantiacus</i>																
<i>Indigofera collutea</i>				1												
<i>Indigofera linnaei</i>																
<i>Indigofera monophylla</i>																
<i>Indigofera oblongifolia</i>																
<i>Ipomoea muelleri</i>															1	
<i>Jacksonia aculeata</i>														1		1
<i>Keraudrenia velutina</i>		1														1
<i>Leptosema anomalum</i>																
<i>Melaleuca alsophila</i>																
<i>Melaleuca lasiandra</i>		1		1	1					1				1	1	
<i>Mollugo molluginea</i>			1													
<i>Neobassia astrocarpa</i>																
<i>Newcastelia cladotricha</i>																
<i>Panicum decompositum</i>			1													
<i>Persoonia falcata</i>																
<i>Phyllanthus eremicus</i>																
<i>Pluchea dentex</i>																
<i>Pluchea ferdinandi-muelleri</i>	1															
<i>Pluchea tetrantha</i>	1															
<i>Polymeria ambigua</i>																
<i>Portulaca oleracea</i>		1	1	1		1		1								
<i>Portulaca pilosa</i>		1	1													
<i>Pterocaulon sphacelatum</i>																
<i>Ptilotus arthrolasius</i>																
<i>Ptilotus astrolasius</i>									1	1					1	

name	q81	q82	q83	q84	q85	q86	q87	q88	q89	q90	q91	q92	q93	q94	q95	q96
<i>Ptilotus calostachyus</i>		1														
<i>Ptilotus chamaecladus</i>	1	1		1												
<i>Ptilotus clementii</i>																
<i>Rhynchosia minima</i>																
<i>Santalum lanceolatum</i>				1					1				1			
<i>Scaevola collaris</i>									1							
<i>Senna curvistyla</i>																
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>																1
<i>Senna venusta</i>	1	1	1	1			1	1				1			1	1
<i>Sida arenicola</i>		1	1			1			1						1	
<i>Sida calyxhymenia</i>		1		1	1											1
<i>Solanum dioicum</i>												1				
<i>Solanum diversiflorum</i>		1		1												1
<i>Solanum esuriale</i>	1	1				1		1								
<i>Solanum lucani</i>																
<i>Stemodia grossa</i>	1															
<i>Streptoglossa tenuiflora</i>																1
<i>Stylobasium australe</i>				1			1		1	1	1					
<i>Tephrosia leptoclada</i>																
<i>Trianthema pilosa</i>		1	1	1				1							1	
<i>Trianthema triquetra</i>																
<i>Trianthema turgidifolia</i>																
<i>Trichodesma zeylandica</i>																
<i>Triodia epactia</i>	1		1													
<i>Triodia schinzii</i>	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
<i>Triumfetta chaetocarpa</i>																

name	q97	q98	q99	q100	q101	q102	q103	q104	q105	q106	q107	q108	q109	q110	q111	q112
<i>Abutilon indicum</i>													1	1		
<i>Abutilon otocarpum</i>					1			1	1			1				
<i>Acacia ampliceps</i>															1	
<i>Acacia ancistrocarpa</i>	1	1														
<i>Acacia colei</i>	1	1	1		1						1	1	1		1	1
<i>Acacia dictyophleba</i>																
<i>Acacia drepanocarpa</i> subsp. <i>drepanocarpa</i>																
<i>Acacia hilliana</i>																
<i>Acacia monticola</i>																

name	q97	q98	q99	q100	q101	q102	q103	q104	q105	q106	q107	q108	q109	q110	q111	q112
<i>Acacia ptychophylla</i>																
<i>Acacia sericophylla</i>	1	1	1													
<i>Acacia stellaticeps</i>	1	1	1	1	1	1	1	1			1	1	1	1	1	1
<i>Aerva javanica</i>																
<i>Amaranthus undulatus</i>												1				
<i>Aristida inaequiglumis</i>												1				
<i>Bauhinia cunninghamii</i>	1	1	1	1						1	1	1	1	1		
<i>Bonamia alatisemina</i>		1	1		1	1	1	1	1	1	1	1	1	1		1
<i>Bonamia oblongifolia</i>						1	1							1		
<i>Bonamia rosea</i>	1	1	1	1	1	1					1			1		
<i>Calandrinia strophiolata</i>				1				1	1	1						
<i>Calytrix carinata</i>																
<i>Capparis umbonata</i>																
<i>Carrisa lanceolata</i>		1		1		1			1	1		1	1	1	1	1
<i>Cassytha filiformis</i>																
<i>Cenchrus ciliaris</i>				1	1				1	1		1	1	1	1	1
<i>Cleome uncifera</i>		1		1	1		1	1	1	1						
<i>Codonocarpus cotinifolius</i>																
<i>Corchorus parviflorus</i>		1	1	1	1			1			1	1	1	1		1
<i>Corchorus sidoides</i> subsp. <i>sidoides</i>			1	1		1	1	1	1	1		1		1		1
<i>Corymbia hammerslayana</i>																
<i>Corymbia zygophylla</i>																
<i>Corynotheca micrantha</i>																
<i>Cucumis variabilis</i>																
<i>Cyanostegia cyanocalyx</i>																
<i>Dodonaea coriacea</i>	1															
<i>Dolichandrone heterophylla</i>	1		1	1	1	1	1		1	1	1					
<i>Duboisia hopwoodii</i>		1	1				1									
<i>Enneapogon purpurascens</i>					1			1	1	1	1	1	1	1		
<i>Eragrostis falcata</i>		1			1	1			1	1	1	1	1	1		
<i>Erythrophleum chlorostachys</i>																
<i>Eulalia aurea</i>																
<i>Euphorbia australis</i>							1	1								
<i>Euphorbia drummondii</i>			1	1	1		1		1	1				1		
<i>Evolvulus alsinoides</i>		1	1		1	1	1	1					1			1
<i>Goodenia azurea</i>											1					
<i>Goodenia microptera</i>														1	1	
<i>Grevillea eriostachya</i>																
<i>Grevillea pyramidalis</i>	1	1									1			1		

name	q97	q98	q99	q100	q101	q102	q103	q104	q105	q106	q107	q108	q109	q110	q111	q112
<i>Grevillea refracta</i>																
<i>Hakea chordophylla</i>																
<i>Hakea macrocarpa</i>																
<i>Heliotropium vestitum</i>																
<i>hemichfroa diandra</i>											1					
<i>Hybanthus aurantiacus</i>			1									1	1	1		
<i>Indigofera collutea</i>																
<i>Indigofera linnaei</i>									1							
<i>Indigofera monophylla</i>																
<i>Indigofera oblongifolia</i>																
<i>Ipomoea muelleri</i>	1			1							1					
<i>Jacksonia aculeata</i>	1	1														
<i>Keraudrenia velutina</i>			1						1							
<i>Leptosema anomalum</i>	1	1														
<i>Melaleuca alsophila</i>															1	1
<i>Melaleuca lasiandra</i>					1		1	1	1	1					1	1
<i>Mollugo molluginea</i>										1						
<i>Neobassia astrocarpa</i>																
<i>Newcastelia cladotricha</i>			1													
<i>Panicum decompositum</i>																
<i>Persoonia falcata</i>																
<i>Phyllanthus eremicus</i>																
<i>Pluchea dentex</i>																
<i>Pluchea ferdinandi-muelleri</i>									1						1	1
<i>Pluchea tetrantha</i>																1
<i>Polymeria ambigua</i>											1	1		1		
<i>Portulaca oleracea</i>						1			1							
<i>Portulaca pilosa</i>													1	1		
<i>Pterocaulon sphacelatum</i>															1	
<i>Ptilotus arthrolasius</i>																
<i>Ptilotus astrolasius</i>			1		1									1		
<i>Ptilotus calostachyus</i>																
<i>Ptilotus chamaecladus</i>														1		
<i>Ptilotus clementii</i>						1										
<i>Rhynchosia minima</i>														1		
<i>Santalum lanceolatum</i>																
<i>Scaevola collaris</i>		1														
<i>Senna curvistyla</i>				1						1						
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>																

name	q97	q98	q99	q100	q101	q102	q103	q104	q105	q106	q107	q108	q109	q110	q111	q112
<i>Senna venusta</i>		1	1	1	1	1	1	1	1	1		1	1	1		1
<i>Sida arenicola</i>		1		1	1	1	1	1	1	1		1	1			
<i>Sida calyxhymenia</i>			1				1		1							
<i>Solanum dioicum</i>		1					1		1		1		1			
<i>Solanum diversiflorum</i>					1		1	1	1	1			1			1
<i>Solanum esuriale</i>										1				1	1	1
<i>Solanum lucani</i>																
<i>Stemodia grossa</i>																1
<i>Streptoglossa tenuiflora</i>	1								1							
<i>Stylobasium australe</i>	1				1	1										
<i>Tephrosia leptoclada</i>								1								
<i>Trianthema pilosa</i>		1					1		1			1	1	1		
<i>Trianthema triquetra</i>																
<i>Trianthema turgidifolia</i>															1	
<i>Trichodesma zeylandica</i>																
<i>Triodia epactia</i>															1	1
<i>Triodia schinzii</i>	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
<i>Triumfetta chaetocarpa</i>											1	1	1			

name	q113	q114	q115	q116	q117	q118	q119	q120	q121	q122	q123	q124	q125	q126	q127	q128
<i>Abutilon indicum</i>															1	
<i>Abutilon otoparpum</i>						1	1	1			1				1	
<i>Acacia ampliceps</i>		1														1
<i>Acacia ancistrocarpa</i>																
<i>Acacia coleii</i>	1		1													
<i>Acacia dictyophleba</i>																
<i>Acacia drepanocarpa</i> subsp. <i>drepanocarpa</i>																
<i>Acacia hilliana</i>																
<i>Acacia monticola</i>																
<i>Acacia ptychophylla</i>																
<i>Acacia sericophylla</i>								1								
<i>Acacia stellaticeps</i>	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
<i>Aerva javanica</i>	1															
<i>Amaranthus undulatus</i>																
<i>Aristida inaequiglumis</i>																
<i>Bauhinia cunninghamii</i>			1					1		1						
<i>Bonamia alatisemina</i>			1	1	1	1		1	1	1	1		1	1	1	
<i>Bonamia oblongifolia</i>						1										

name	q113	q114	q115	q116	q117	q118	q119	q120	q121	q122	q123	q124	q125	q126	q127	q128
<i>Bonamia rosea</i>								1	1		1	1				
<i>Calandrinia strophiolata</i>				1	1	1		1	1	1	1		1		1	
<i>Calytrix carinata</i>																
<i>Capparis umbonata</i>																
<i>Carrisa lanceolata</i>		1	1				1						1			
<i>Cassytha filiformis</i>																
<i>Cenchrus ciliaris</i>	1	1		1	1		1	1	1						1	
<i>Cleome uncifera</i>			1			1		1		1			1	1		
<i>Codonocarpus cotinifolius</i>																
<i>Corchorus parviflorus</i>			1				1				1					
<i>Corchorus sidoides</i> subsp. <i>sidoides</i>			1		1	1	1	1	1	1			1	1	1	
<i>Corymbia hammerslayana</i>																
<i>Corymbia zygophylla</i>																
<i>Corynotheca micrantha</i>			1			1						1				
<i>Cucumis variabilis</i>																
<i>Cyanostegia cyanocalyx</i>																
<i>Dodonaea coriacea</i>																
<i>Dolichandrone heterophylla</i>			1		1				1	1	1	1				
<i>Duboisia hopwoodii</i>										1						
<i>Enneapogon purpurascens</i>						1	1		1		1		1	1	1	
<i>Eragrostis falcata</i>					1						1		1	1		
<i>Erythrophleum chlorostachys</i>																
<i>Eulalia aurea</i>																
<i>Euphorbia australis</i>			1	1		1			1	1				1		
<i>Euphorbia drummondii</i>			1	1	1	1	1	1	1	1	1		1	1	1	
<i>Evolvulus alsinoides</i>								1	1	1	1		1	1		
<i>Goodenia azurea</i>																
<i>Goodenia microptera</i>																
<i>Grevillea eriostachya</i>																
<i>Grevillea pyramidalis</i>									1	1	1	1				
<i>Grevillea refracta</i>																
<i>Hakea chordophylla</i>																
<i>Hakea macrocarpa</i>												1				
<i>Heliotropium vestitum</i>					1	1		1	1	1	1			1		
<i>hemichfroa diandra</i>	1	1														
<i>Hybanthus aurantiacus</i>			1		1				1		1		1			
<i>Indigofera collutea</i>																
<i>Indigofera linnaei</i>				1									1			
<i>Indigofera monophylla</i>																

name	q113	q114	q115	q116	q117	q118	q119	q120	q121	q122	q123	q124	q125	q126	q127	q128
<i>Indigofera oblongifolia</i>				1									1			
<i>Ipomoea muelleri</i>										1	1				1	
<i>Jacksonia aculeata</i>						1		1	1	1	1	1				
<i>Keraudrenia velutina</i>			1													
<i>Leptosema anomalum</i>					1			1	1	1	1					
<i>Melaleuca alsophila</i>		1		1												
<i>Melaleuca lasiandra</i>		1				1		1					1	1	1	1
<i>Mollugo molluginea</i>																
<i>Neobassia astrocarpa</i>																
<i>Newcastelia cladotricha</i>												1				
<i>Panicum decompositum</i>																
<i>Persoonia falcata</i>																
<i>Phyllanthus eremicus</i>																
<i>Pluchea dentex</i>	1	1					1									
<i>Pluchea ferdinandi-muelleri</i>	1	1		1			1								1	1
<i>Pluchea tetrantha</i>	1	1		1			1									
<i>Polymeria ambigua</i>																
<i>Portulaca oleracea</i>													1	1		
<i>Portulaca pilosa</i>																
<i>Pterocaulon sphacelatum</i>																
<i>Ptilotus arthrolasius</i>					1	1				1		1				
<i>Ptilotus astrolasius</i>								1	1							
<i>Ptilotus calostachyus</i>																
<i>Ptilotus chamaecladus</i>															1	
<i>Ptilotus clementii</i>																
<i>Rhynchosia minima</i>				1											1	
<i>Santalum lanceolatum</i>																
<i>Scaevola collaris</i>																
<i>Senna curvistyla</i>					2											
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>					1	1										
<i>Senna venusta</i>			1	1	1	1	1	1	1	1	1		1	1	1	
<i>Sida arenicola</i>			1		1	1	1		1	1		1	1	1		
<i>Sida calyxhymenia</i>								1	1						1	
<i>Solanum dioicum</i>					1			1		1						
<i>Solanum diversiflorum</i>			1		1	1	1	1	1	1		1			1	
<i>Solanum esuriale</i>			1	1			1								1	1
<i>Solanum lucani</i>																
<i>Stemodia grossa</i>		1		1												
<i>Streptoglossa tenuiflora</i>																

name	q113	q114	q115	q116	q117	q118	q119	q120	q121	q122	q123	q124	q125	q126	q127	q128
<i>Stylobasium australe</i>					1					1	1	1				
<i>Tephrosia leptoclada</i>			1		1	1		1		1			1	1		
<i>Trianthema pilosa</i>			1		1					1						
<i>Trianthema triquetra</i>	1	1														
<i>Trianthema turgidifolia</i>		1														1
<i>Trichodesma zeylandica</i>																
<i>Triodia epactia</i>	1	1					1								1	1
<i>Triodia schinzii</i>	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1
<i>Triumfetta chaetocarpa</i>			1													

name	q129	q130	q131	q132	q133	q134	q135	q136	q137	q138	q139	q140	q141	q142	q143	q144
<i>Abutilon indicum</i>			1				1									
<i>Abutilon otoparpum</i>																
<i>Acacia ampliceps</i>																
<i>Acacia ancistrocarpa</i>					1											
<i>Acacia coleii</i>			1				1	1		1	1	1				1
<i>Acacia dictyophleba</i>																
<i>Acacia drepanocarpa</i> subsp. <i>drepanocarpa</i>																
<i>Acacia hilliana</i>																
<i>Acacia monticola</i>																
<i>Acacia ptychophylla</i>												1			1	
<i>Acacia sericophylla</i>												1				1
<i>Acacia stellaticeps</i>	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1
<i>Aerva javanica</i>																
<i>Amaranthus undulatus</i>							1									
<i>Aristida inaequiglumis</i>											1					
<i>Bauhinia cunninghamii</i>				1												1
<i>Bonamia alatisemina</i>	1	1	1	1	1	1	1	1		1	1	1	1		1	1
<i>Bonamia oblongifolia</i>								1								
<i>Bonamia rosea</i>					1	1	1				1	1	1	1	1	
<i>Calandrinia strophiolata</i>	1	1	1													
<i>Calytrix carinata</i>																
<i>Capparis umbonata</i>																
<i>Carrisa lanceolata</i>				1	1	1	1	1	1	1	1					
<i>Cassytha filiformis</i>					1											
<i>Cenchrus ciliaris</i>			1		1	1	1	1	1					1	1	1

name	q129	q130	q131	q132	q133	q134	q135	q136	q137	q138	q139	q140	q141	q142	q143	q144
<i>Cleome uncifera</i>	1	1	1			1										
<i>Codonocarpus cotinifolius</i>																
<i>Corchorus parviflorus</i>	1				1	1	1	1	1	1	1	1	1	1	1	1
<i>Corchorus sidoides</i> subsp. <i>sidoides</i>	1	1	1	1			1		1	1	1	1				1
<i>Corymbia hammerslayana</i>																
<i>Corymbia zygophylla</i>																
<i>Corynotheca micrantha</i>					1								1	1		
<i>Cucumis variabilis</i>			1													
<i>Cyanostegia cyanocalyx</i>																
<i>Dodonaea coriacea</i>						1					1	1	1		1	1
<i>Dolichandrone heterophylla</i>	1		1				1				1	1	1	1	1	1
<i>Duboisia hopwoodii</i>																
<i>Enneapogon purpurascens</i>	1	1	1	1	1	1	1	1	1				1	1	1	
<i>Eragrostis falcata</i>	1	1	1		1		1			1	1	1			1	
<i>Erythrophleum chlorostachys</i>																
<i>Eulalia aurea</i>											1					
<i>Euphorbia australis</i>			1							1						
<i>Euphorbia drummondii</i>	1	1	1	1												
<i>Evolvulus alsinoides</i>		1	1			1	1				1	1			1	1
<i>Goodenia azurea</i>																
<i>Goodenia microptera</i>																
<i>Grevillea eriostachya</i>													1			
<i>Grevillea pyramidalis</i>							1				1			1		1
<i>Grevillea refracta</i>																
<i>Hakea chordophylla</i>																
<i>Hakea macrocarpa</i>							1									1
<i>Heliotropium vestitum</i>																
<i>hemichfroa diandra</i>									1							
<i>Hybanthus aurantiacus</i>					1	1	1	1				1	1	1		
<i>Indigofera collutea</i>										1						
<i>Indigofera linnaei</i>																
<i>Indigofera monophylla</i>													1			
<i>Indigofera oblongifolia</i>																
<i>Ipomoea muelleri</i>						1									1	1
<i>Jacksonia aculeata</i>																
<i>Keraudrenia velutina</i>																
<i>Leptosema anomalum</i>																
<i>Melaleuca alsophila</i>									1	1						
<i>Melaleuca lasiandra</i>	1		1	1						1					1	

name	q129	q130	q131	q132	q133	q134	q135	q136	q137	q138	q139	q140	q141	q142	q143	q144
<i>Mollugo molluginea</i>														1		
<i>Neobassia astrocarpa</i>																
<i>Newcastelia cladotricha</i>						1										
<i>Panicum decompositum</i>																
<i>Persoonia falcata</i>																
<i>Phyllanthus eremicus</i>																
<i>Pluchea dentex</i>																
<i>Pluchea ferdinandi-muelleri</i>	1															
<i>Pluchea tetrantha</i>																
<i>Polymeria ambigua</i>																
<i>Portulaca oleracea</i>	1		1				1						1			
<i>Portulaca pilosa</i>							1	1								
<i>Pterocaulon sphacelatum</i>									1							
<i>Ptilotus arthrolasius</i>					1							1				
<i>Ptilotus astrolasius</i>				1	1							1			1	
<i>Ptilotus calostachyus</i>																
<i>Ptilotus chamaecladus</i>	1		1							1	1	1				
<i>Ptilotus clementii</i>							1				1					
<i>Rhynchosia minima</i>																
<i>Santalum lanceolatum</i>																
<i>Scaevola collaris</i>																
<i>Senna curvistyla</i>															1	
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>																
<i>Senna venusta</i>	1	1	1	1	1	1	1			1	1	1		1		
<i>Sida arenicola</i>	1	1	1	1		1	1					1				
<i>Sida calyxhymenia</i>																
<i>Solanum dioicum</i>		1			1		1		1		1		1			1
<i>Solanum diversiflorum</i>	1	1			1		1	1			1	1			1	1
<i>Solanum esuriale</i>						1	1		1	1	1					
<i>Solanum lucani</i>									1							
<i>Stemodia grossa</i>									1							
<i>Streptoglossa tenuiflora</i>																
<i>Stylobasium australe</i>														1		
<i>Tephrosia leptoclada</i>		1	1													
<i>Trianthema pilosa</i>						1	1									
<i>Trianthema triquetra</i>																
<i>Trianthema turgidifolia</i>																
<i>Trichodesma zeylandica</i>																
<i>Triodia epactia</i>									1							

name	q129	q130	q131	q132	q133	q134	q135	q136	q137	q138	q139	q140	q141	q142	q143	q144
<i>Triodia schinzii</i>	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
<i>Triumfetta chaetocarpa</i>					1	1						1	1	1		

name	q145	q146	q147	q148	q149	q150	q151	q152	q153	q154	q155	q156	q157	q158	q159	q160
<i>Abutilon indicum</i>			1										1		1	1
<i>Abutilon otocarpum</i>								1								
<i>Acacia ampliceps</i>																
<i>Acacia ancistrocarpa</i>								1								
<i>Acacia coleii</i>							1	1		1	1			1	1	
<i>Acacia dictyophleba</i>																
<i>Acacia drepanocarpa</i> subsp. <i>drepanocarpa</i>																
<i>Acacia hilliana</i>																
<i>Acacia monticola</i>																
<i>Acacia ptychophylla</i>					1			1						1		
<i>Acacia sericophylla</i>							1									
<i>Acacia stellaticeps</i>	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
<i>Aerva javanica</i>																
<i>Amaranthus undulatus</i>											1					
<i>Aristida inaequiglumis</i>																
<i>Bauhinia cunninghamii</i>		1		1		1	1	1	1	1	1		1			
<i>Bonamia alatisemina</i>	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
<i>Bonamia oblongifolia</i>															1	
<i>Bonamia rosea</i>			1	1	1		1		1	1			1			
<i>Calandrinia strophiolata</i>				1												
<i>Calytrix carinata</i>																
<i>Capparis umbonata</i>			1							1						
<i>Carrisa lanceolata</i>	1	1	1		1	1	1	1	1	1			1	1	1	1
<i>Cassytha filiformis</i>								1					1	1		
<i>Cenchrus ciliaris</i>		1	1	1		1	1			1	1	1	1	1	1	1
<i>Cleome uncifera</i>				1							1					
<i>Codonocarpus cotinifolius</i>																
<i>Corchorus parviflorus</i>	1		1	1	1				1	1		1	1		1	1
<i>Corchorus sidoides</i> subsp. <i>sidoides</i>	1	1	1	1	1	1		1		1	1	1	1		1	1
<i>Corymbia hammerslayana</i>																
<i>Corymbia zygophylla</i>										1						
<i>Corynotheca micrantha</i>																
<i>Cucumis variabilis</i>																
<i>Cyanostegia cyanocalyx</i>																

name	q145	q146	q147	q148	q149	q150	q151	q152	q153	q154	q155	q156	q157	q158	q159	q160
<i>Dodonaea coriacea</i>		1	1			1										
<i>Dolichandrone heterophylla</i>	1			1	1	1	1	1		1						
<i>Duboisia hopwoodii</i>																
<i>Enneapogon purpurascens</i>	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1
<i>Eragrostis falcata</i>	1		1		1	1	1	1	1			1		1	1	1
<i>Erythrophleum chlorostachys</i>																
<i>Eulalia aurea</i>																
<i>Euphorbia australis</i>	1	1		1							1					
<i>Euphorbia drummondii</i>				1												
<i>Evolvulus alsinoides</i>	1	1	1	1		1		1			1				1	
<i>Goodenia azurea</i>																
<i>Goodenia microptera</i>																
<i>Grevillea eriostachya</i>																
<i>Grevillea pyramidalis</i>										1	1					
<i>Grevillea refracta</i>																
<i>Hakea chordophylla</i>																
<i>Hakea macrocarpa</i>										1						
<i>Heliotropium vestitum</i>																
<i>hemichfroa diandra</i>																
<i>Hybanthus aurantiacus</i>	1	1														
<i>Indigofera collutea</i>																
<i>Indigofera linnaei</i>				1											1	
<i>Indigofera monophylla</i>																
<i>Indigofera oblongifolia</i>																
<i>Ipomoea muelleri</i>				1												
<i>Jacksonia aculeata</i>			1		1											
<i>Keraudrenia velutina</i>																
<i>Leptosema anomalum</i>					1			1								
<i>Melaleuca alsophila</i>														1		
<i>Melaleuca lasiandra</i>		1		1							1	1	1	1	1	1
<i>Mollugo molluginea</i>						1										
<i>Neobassia astrocarpa</i>																
<i>Newcastelia cladotricha</i>			1													
<i>Panicum decompositum</i>																
<i>Persoonia falcata</i>																
<i>Phyllanthus eremicus</i>																
<i>Pluchea dentex</i>																
<i>Pluchea ferdinandi-muelleri</i>														1	1	1
<i>Pluchea tetrantha</i>												1	1	1	1	

name	q145	q146	q147	q148	q149	q150	q151	q152	q153	q154	q155	q156	q157	q158	q159	q160
<i>Polymeria ambigua</i>																
<i>Portulaca oleracea</i>							1	1								
<i>Portulaca pilosa</i>				1				1								
<i>Pterocaulon sphacelatum</i>															1	
<i>Ptilotus arthrolasius</i>						1										
<i>Ptilotus astrolasius</i>		1			1	1	1	1			1					
<i>Ptilotus calostachyus</i>																
<i>Ptilotus chamaecladus</i>															1	
<i>Ptilotus clementii</i>																
<i>Rhynchosia minima</i>																
<i>Santalum lanceolatum</i>												1				
<i>Scaevola collaris</i>																
<i>Senna curvistyla</i>																
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>																
<i>Senna venusta</i>	1			1				1			1					
<i>Sida arenicola</i>	1	1		1		1		1						1	1	1
<i>Sida calyxhymenia</i>																
<i>Solanum dioicum</i>	1		1		1	1									1	
<i>Solanum diversiflorum</i>		1		1	1	1			1							1
<i>Solanum esuriale</i>				1				1					1	1	1	1
<i>Solanum lucani</i>																
<i>Stemodia grossa</i>															1	
<i>Streptoglossa tenuiflora</i>																
<i>Stylobasium australe</i>						1										
<i>Tephrosia leptoclada</i>											1				1	
<i>Trianthema pilosa</i>	1	1		1							1					
<i>Trianthema triquetra</i>																
<i>Trianthema turgidifolia</i>																
<i>Trichodesma zeylandica</i>																
<i>Triodia epactia</i>																
<i>Triodia schinzii</i>	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
<i>Triumfetta chaetocarpa</i>	1															

name	q161	q162	q163	q164	q165	q166	q167	q168	q169	q170	q171	q172	q173	q174	q175	q176
<i>Abutilon indicum</i>	1															1
<i>Abutilon otocarpum</i>																1
<i>Acacia ampliceps</i>			1	1			1									
<i>Acacia ancistrocarpa</i>						1		1	1	1	1	1		1	1	1

name	q161	q162	q163	q164	q165	q166	q167	q168	q169	q170	q171	q172	q173	q174	q175	q176
<i>Acacia coleii</i>	1	1	1		1	1	1	1	1	1	1	1		1	1	1
<i>Acacia dictyophleba</i>											1	1	1			
<i>Acacia drepanocarpa</i> subsp. <i>drepanocarpa</i>								1	1							
<i>Acacia hilliana</i>						1				1						
<i>Acacia monticola</i>								1	1	1	1	1				
<i>Acacia ptychophylla</i>																
<i>Acacia sericophylla</i>								1	1		1		1	1		1
<i>Acacia stellaticeps</i>	1	1	1		1	1	1	1	1	1	1	1	1			1
<i>Aerva javanica</i>																
<i>Amaranthus undulatus</i>																
<i>Aristida inaequiglumis</i>																
<i>Bauhinia cunninghamii</i>						1								1		1
<i>Bonamia alatisemina</i>	1					1	1				1					
<i>Bonamia oblongifolia</i>											1					
<i>Bonamia rosea</i>						1		1	1	1		1	1	1	1	1
<i>Calandrinia strophiolata</i>																
<i>Calytrix carinata</i>													1			
<i>Capparis umbonata</i>						1										
<i>Carrisa lanceolata</i>		1	1		1	1	1									1
<i>Cassytha filiformis</i>		1	1													
<i>Cenchrus ciliaris</i>	1	1	1	1	1		1					1	1		1	1
<i>Cleome uncifera</i>																
<i>Codonocarpus cotinifolius</i>																
<i>Corchorus parviflorus</i>		1														
<i>Corchorus sidoides</i> subsp. <i>sidoides</i>	1					1					1	1		1	1	1
<i>Corymbia hammerslayana</i>											1		1			
<i>Corymbia zygophylla</i>															1	
<i>Corynotheca micrantha</i>																
<i>Cucumis variabilis</i>																
<i>Cyanostegia cyanocalyx</i>									1							
<i>Dodonaea coriacea</i>	1							1				1				
<i>Dolichandrone heterophylla</i>						1				1			1			
<i>Duboisia hopwoodii</i>																
<i>Enneapogon purpurascens</i>	1							1						1		
<i>Eragrostis falcata</i>	1					1		1		1	1			1		1
<i>Erythrophleum chlorostachys</i>								1	1	1	1		1			
<i>Eulalia aurea</i>																
<i>Euphorbia australis</i>				1		1										
<i>Euphorbia drummondii</i>																

name	q161	q162	q163	q164	q165	q166	q167	q168	q169	q170	q171	q172	q173	q174	q175	q176
<i>Evolvulus alsinoides</i>	1					1										
<i>Goodenia azurea</i>																
<i>Goodenia microptera</i>								1								
<i>Grevillea eriostachya</i>																
<i>Grevillea pyramidalis</i>											1	1	1			
<i>Grevillea refracta</i>																
<i>Hakea chordophylla</i>												1				
<i>Hakea macrocarpa</i>											1		1	1		
<i>Heliotropium vestitum</i>													1			
<i>hemichfroa diandra</i>				1			1									
<i>Hybanthus aurantiacus</i>						1		1					1	1	1	1
<i>Indigofera collutea</i>																
<i>Indigofera linnaei</i>																
<i>Indigofera monophylla</i>												1	1	1	1	1
<i>Indigofera oblongifolia</i>					1											
<i>Ipomoea muelleri</i>																
<i>Jacksonia aculeata</i>								1				1	1			
<i>Keraudrenia velutina</i>																
<i>Leptosema anomalum</i>													1			
<i>Melaleuca alsophila</i>			1													
<i>Melaleuca lasiandra</i>	1	1	1													
<i>Mollugo molluginea</i>						1										
<i>Neobassia astrocarpa</i>					1		1									
<i>Newcastelia cladotricha</i>																
<i>Panicum decompositum</i>																
<i>Persoonia falcata</i>																
<i>Phyllanthus eremicus</i>														1		
<i>Pluchea dentex</i>																
<i>Pluchea ferdinandi-muelleri</i>	1			1			1									
<i>Pluchea tetrantha</i>	1	1														
<i>Polymeria ambigua</i>																
<i>Portulaca oleracea</i>				1		1										
<i>Portulaca pilosa</i>				1												
<i>Pterocaulon sphacelatum</i>					1											
<i>Ptilotus arthrolasius</i>																
<i>Ptilotus astrolasius</i>						1		1		1	1	1	1	1		
<i>Ptilotus calostachyus</i>														1		
<i>Ptilotus chamaecladus</i>																
<i>Ptilotus clementii</i>																

name	q161	q162	q163	q164	q165	q166	q167	q168	q169	q170	q171	q172	q173	q174	q175	q176
<i>Rhynchosia minima</i>																
<i>Santalum lanceolatum</i>											1					1
<i>Scaevola collaris</i>																
<i>Senna curvistyla</i>														1		
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>								1		1						
<i>Senna venusta</i>	1		1													
<i>Sida arenicola</i>								1						1	1	1
<i>Sida calyxhymenia</i>																
<i>Solanum dioicum</i>																
<i>Solanum diversiflorum</i>	1	1									1					
<i>Solanum esuriale</i>	1	1	1	1	1		1									
<i>Solanum lucani</i>																
<i>Stemodia grossa</i>					1											
<i>Streptoglossa tenuiflora</i>																
<i>Stylobasium australe</i>												1	1			
<i>Tephrosia leptoclada</i>																
<i>Trianthema pilosa</i>																
<i>Trianthema triquetra</i>		1	1	1												
<i>Trianthema turgidifolia</i>				1												
<i>Trichodesma zeylandica</i>										1						
<i>Triodia epactia</i>	1		1	1	1		1									
<i>Triodia schinzii</i>	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1
<i>Triumfetta chaetocarpa</i>																

APPENDIX G. CONSERVATION SIGNIFICANT SPECIES DATA

Bonamia oblongifolia (Priority 1)

Easting	Northing
185990	7787829
185713	7788293
185541	7788237
185270	7788151
185879	7788440
185866	7788423
185862	7788422
185798	7788466
185762	7788278
185743	7788272
185738	7788266
185512	7788212
185475	7788184
185471	7788182
185446	7788177
185442	7788199
185374	7788194
185347	7788197
185339	7788195
185312	7788130
185288	7788149
184462	7787575
184551	7787742
184572	7787751
184576	7787747
184622	7787820
184604	7787809
184603	7787808
184602	7787806
184544	7787787
184485	7787781
184274	7787606
185750	7788689
185747	7788503
188913	7789778
188944	7789789
188971	7789797
188999	7789818
189010	7789885
189124	7790018

Easting	Northing
189192	7790070
189278	7790118
189365	7790126
189450	7790033
188064	7788997
188054	7788995
187917	7789047
187906	7789060
187865	7789071
187865	7789082
188845	7789659
188877	7789724
188901	7789741
188956	7789776
189023	7789795
189043	7789797
189055	7789805
189085	7789809
189163	7789873
189247	7789922
189288	7789993
189009	7790153
188843	7790128
188747	7790101
177263	7784816
175732	7787430
175885	7787489
188899	7789821
188913	7789832
188913	7789833
188913	7789833
188912	7789834
188910	7789845
188890	7789845
189008	7789901
189015	7789907
189019	7789912
189019	7789913
189021	7789927
189019	7789930

Easting	Northing
189016	7789959
189073	7789952
189072	7789956
189072	7789962
189075	7789964
189098	7790006
189093	7790025
189095	7790031
189091	7790038
189090	7790046
189109	7790046
189110	7790045
189147	7790038
189192	7790036
189206	7790039
189220	7790046
189225	7790047
189226	7790047
189227	7790048
189228	7790058
189232	7790072
189233	7790073
189234	7790073
189234	7790076
189228	7790084
189224	7790104
189225	7790106
189226	7790106
189227	7790108
189227	7790109
189226	7790109
189225	7790110
189225	7790111
189225	7790111
189225	7790111
189225	7790112
189230	7790114
189234	7790122
189242	7790138
189252	7790143

Easting	Northing
189259	7790152
189320	7790147
189348	7790125
189496	7789981
189526	7789978
189548	7789917
189419	7789717
189419	7789724
189418	7789731
189352	7789756
189332	7789752
189221	7789699
189091	7789567
187969	7789066
187962	7789055
187515	7789163
175529	7787534
175863	7787484
175872	7787488
176499	7785253
176763	7787560
176769	7787531
176779	7787509
176787	7787522
176754	7787601
176757	7787590
176761	7787576
176761	7787570
176765	7787586
176792	7787509
176889	7787609
176885	7787620
176883	7787626
176878	7787638
176859	7787669
176852	7787667
176839	7787663
176815	7787653
176777	7787614
176781	7787602

Easting	Northing
176780	7787595
176785	7787561
176883	7787593
176842	7787645
176831	7787639
176821	7787633
176791	7787610
176790	7787602
176790	7787596
176789	7787584
176804	7787577
176822	7787587
176836	7787591
176850	7787591
176865	7787592
176857	7787614
176854	7787620
176834	7787631
176815	7787618
176828	7787599
176825	7787611
176795	7787456
176808	7787414
185955	7788015
176728	7787569
176727	7787570
176643	7787570
176626	7787571
176587	7787565
176536	7787583
176583	7787607
176588	7787630
176644	7787606
176647	7787571
176655	7787563
176678	7787524
176690	7787552
176694	7787568
176695	7787577
176698	7787600

Easting	Northing
176700	7787614
176700	7787626
176699	7787628
176719	7787635
176742	7787562
177042	7787738
177094	7787715
181036	7788412
181290	7788505
181316	7788506
181349	7788511
181370	7788511
181381	7788512
181422	7788514
181438	7788518
181471	7788519
181517	7788521
181539	7788523
181592	7788528
181648	7788528
181735	7788536
181778	7788541
185258	7788383
185302	7788202
185368	7788178
177547	7785604
178079	7785968
181698	7788553
181700	7788547
181715	7788585
181720	7788621
181661	7788683
181624	7788633
181413	7788487
181832	7788540
184400	7787801
185399	7788457
185415	7788405
185418	7788401

Tribulopsis marliesiae (Priority 3)

Easting	Northing
176664	7787519
176673	7787528
176697	7787547
176696	7787546
176720	7787563
176749	7787546
176754	7787534
176756	7787461
176788	7787455

APPENDIX H. PARDOO SPECIES LIST

Family	Species
Aizoaceae	<i>Trianthema pilosum</i>
	<i>Trianthema triquetra</i>
	<i>Trianthema turgidifolia</i>
Amaranthaceae	<i>Achyranthes aspera</i>
	<i>Aerva javanica</i>
	<i>Amaranthus undulatus</i>
	<i>Ptilotus arthrolasius</i>
	<i>Ptilotus astrolasius</i>
	<i>Ptilotus axillaris</i>
	<i>Ptilotus calostachyus</i>
	<i>Ptilotus chamaecladus</i>
	<i>Ptilotus clementii</i>
	<i>Ptilotus fusiformis</i>
	<i>Surreya diandra</i>
Apocynaceae	<i>Calotropis procera</i>
	<i>Carissa lanceolata</i>
Araliaceae	<i>Trachymene oleracea</i>
Asteraceae	<i>Pluchea dentex</i>
	<i>Pluchea ferdinandi-muelleri</i>
	<i>Pluchea tetrantha</i>
	<i>Pterocaulon sphacelatum</i>
	<i>Streptoglossa tenuiflora</i>
Bignoniaceae	<i>Dolichandrone heterophylla</i>
Boraginaceae	<i>Heliotropium leptaleum</i>
	<i>Heliotropium vestitum</i>
	<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>
Capparaceae	<i>Capparis umbonata</i>
Chenopodiaceae	<i>Neobassia astrocarpa</i>
	<i>Salsola australis</i>
	<i>Tecticornia auriculata</i>
Cleomaceae	<i>Cleome uncifera</i>
Convolvulaceae	<i>Bonamia alatisemina</i>
	<i>Bonamia erecta</i>
	<i>Bonamia linearis</i>
	<i>Bonamia oblongifolia</i>
	<i>Bonamia rosea</i>
	<i>Evolvulus alsinoides</i>
	<i>Ipomoea muelleri</i>
	<i>Polymeria ambigua</i>
Cucurbitaceae	<i>Cucumis variabilis</i>
Euphorbiaceae	<i>Euphorbia australis</i>

Family	Species
	<i>Euphorbia drummondii</i>
Fabaceae	<i>Acacia ampliceps</i>
	<i>Acacia ancistrocarpa</i>
	<i>Acacia colei</i>
	<i>Acacia dictyophleba</i>
	<i>Acacia drepanocarpa</i> subsp. <i>drepanocarpa</i>
	<i>Acacia hilliana</i>
	<i>Acacia monticola</i>
	<i>Acacia ptychophylla</i>
	<i>Acacia sericophylla</i>
	<i>Acacia stellaticeps</i>
	<i>Acacia tumida</i>
	<i>Bauhinia cunninghamii</i>
	<i>Erythrophleum chlorostachys</i>
	<i>Indigofera colutea</i>
	<i>Indigofera linnaei</i>
	<i>Indigofera monophylla</i>
	<i>Indigofera oblongifolia</i>
	<i>Jacksonia aculeata</i>
	<i>Leptosema anomalum</i>
	<i>Rhynchosia minima</i>
	<i>Senna artemisioides</i> subsp. <i>helmsii</i>
	<i>Senna curvistyla</i>
	<i>Senna glutinosa</i> subsp. <i>glutinosa</i>
	<i>Senna notabilis</i>
	<i>Senna venusta</i>
	<i>Swainsona pterostylis</i>
	<i>Tephrosia leptoclada</i>
Frankeniaceae	<i>Frankenia ambita</i>
Goodeniaceae	<i>Goodenia azurea</i>
	<i>Goodenia microptera</i>
	<i>Scaevola collaris</i>
	<i>Scaevola spinescens</i>
Gyrostemonaceae	<i>Codonocarpus cotinifolius</i>
	<i>Gyrostemon tepperi</i>
Hemerocallidaceae	<i>Corynotheca micrantha</i>
Lamiaceae	<i>Cyanostegia cyanocalyx</i>
	<i>Newcastelia cladotricha</i>
Lauraceae	<i>Cassytha filiformis</i>
Malvaceae	<i>Abutilon indicum</i>
	<i>Abutilon lepidum</i>
	<i>Abutilon otocarpum</i>
	<i>Corchorus parviflorus</i>
	<i>Corchorus sidoides</i> subsp. <i>sidoides</i>
	<i>Melhania oblongifolia</i>

Family	Species
	<i>Seringia velutina</i>
	<i>Sida arenicola</i>
	<i>Sida calyxhymentia</i>
	<i>Triumfetta chaetocarpa</i>
Molluginaceae	<i>Trigastrotheca molluginea</i>
Myrtaceae	<i>Calytrix carinata</i>
	<i>Corymbia hammerslayana</i>
	<i>Corymbia zygophylla</i>
	<i>Melaleuca alsophila</i>
	<i>Melaleuca lasiandra</i>
Phyllanthaceae	<i>Phyllanthus eremicus</i>
Plantaginaceae	<i>Stemodia grossa</i>
Poaceae	<i>Aristida inaequiglumis</i>
	<i>Cenchrus ciliaris</i>
	<i>Enneapogon purpurascens</i>
	<i>Eragrostis falcata</i>
	<i>Eulalia aurea</i>
	<i>Panicum decompositum</i>
	<i>Sporobolus australasicus</i>
	<i>Triodia epactia</i>
	<i>Triodia schinzii</i>
	<i>Whiteochloa airoides</i>
	<i>Xerochloa barbata</i>
Portulacaceae	<i>Calandrinia strophilata</i>
	<i>Portulaca oleracea</i>
	<i>Portulaca pilosa</i>
Proteaceae	<i>Grevillea eriostachya</i>
	<i>Grevillea pyramidalis</i>
	<i>Grevillea refracta</i>
	<i>Grevillea wickhamii</i>
	<i>Hakea chordophylla</i>
	<i>Hakea macrocarpa</i>
	<i>Persoonia falcata</i>
Santalaceae	<i>Santalum lanceolatum</i>
Sapindaceae	<i>Dodonaea coriacea</i>
Solanaceae	<i>Duboisia hopwoodii</i>
	<i>Nicotiana rosulata</i> subsp. <i>rosulata</i>
	<i>Solanum dioicum</i>
	<i>Solanum diversiflorum</i>
	<i>Solanum esuriale</i>
	<i>Solanum lucani</i>
Stylobasiaceae	<i>Stylobasium australe</i>
Tamaricaceae	<i>Tamarix aphylla</i>
Thymeleaceae	<i>Pimelea ammocharis</i>
Violaceae	<i>Hybanthus aurantiacus</i>

Family	Species
Zygophyllaceae	<i>Tribulopsis marliesiae</i>
	<i>Tribulus occidentalis</i>