Biota Environmental Sciences

Brockman 4 Riparian Vegetation Mapping

Prepared for Rio Tinto Pty Ltd

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1.0 Summary

Rio Tinto Pty Ltd is considering discharging excess dewatering water generated by the Brockman 4 iron ore mine into the Boolgeeda Creek system, which is located 60 km west-northwest of Tom Price. Biota Environmental Sciences was commissioned to survey the flora and vegetation of the Boolgeeda Creek, with a view to providing information to support an Assessment on Proponent Information process for the proposed project. The objectives of the survey were to determine the floristic composition, map the vegetation communities and assess the condition of the riparian vegetation along a 42 km section of Boolgeeda Creek (the study area).

The field survey was conducted in August 2013 by four botanists. A total of 17 permanent quadrats and two relevés were established to collect floristic information. Some 110 mapping notes were also taken during foot traverses along the length of the creekline. The data obtained were combined to define the vegetation units of the study area.

Fifteen vegetation units were described for the study area, highlighting some notable differences between the vegetation communities of the western and eastern sections. None of the vegetation units described represented Threatened Ecological Communities or Priority Ecological Communities. However, six riparian vegetation units (C2, C3, C4, C5, C6 and C7) were considered to be of conservation significance, as they are at risk from a number of threats (including grazing and invasion by weeds), which are known to negatively impact the vegetation of major ephemeral watercourses. These six vegetation units represented 34% of the study area (443 ha) and were distributed over the length of the study area except for the easternmost section. Similar vegetation units dominated by *Eucalyptus victrix* and *Eucalyptus camaldulensis* (representing an area of over 618 ha) have been previously described in the locality of the study area.

An additional feature of interest in the study area was the presence of six small ephemeral pools in a segment of the western meandering channel in vegetation unit C6.

A total of 226 native vascular flora species from 116 genera belonging to 42 families were recorded for the study area. No Threatened flora species were recorded within the study area and none would be expected to occur. Four Priority flora species were recorded in the study area: the Priority 1 *Peplidium* sp. Fortescue Marsh (S. van Leeuwen 4865), Priority 2 *Pentalepis trichodesmoides* subsp. *hispida*, Priority 3 *Indigofera* sp. Bungaroo Creek (S. van Leeuwen 4301) and Priority 4 *Goodenia nuda*.

Thirteen introduced flora species were recorded. The most prolific introduced species, Buffel Grass *(*Cenchrus ciliaris),* was distributed throughout the study area. Mexican Poppy (**Argemone ochroleuca* subsp. *ochroleuca*), which is a declared pest species, occurred mostly as dense patches of seedlings in open areas of the creek bed.

The vegetation condition of the creek bed was ranked as being Very Good despite the presence of **Cenchrus ciliaris,* which was growing both as scattered grasses and very open tussock grasslands. In fact, the creekline supported a healthy and diverse range of flora species. Compared to the creek bed, the floodplains were subject to a higher degree of invasion by **Cenchrus ciliaris,* which occurred as an open tussock to tussock grassland. In general, the vegetation condition of the floodplains was categorised as Good. Disturbance factors included a dirt track running along part of the creek bed in the westernmost section of the study area, and pronounced erosion at three sites located on the braided part of channel on the eastern section where the creek banks were less stable.

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2.0 Introduction

2.1 Project Background

Rio Tinto Pty Ltd (Rio Tinto) operates Brockman 4, an iron ore mine located 58 km west-northwest of Tom Price in the Pilbara region of Western Australia. The current preferred management option for disposal of excess water from Brockman 4 is discharge to the Boolgeeda Creek system. Boolgeeda Creek is a tributary of Duck Creek within the regional Ashburton River catchment, and is located approximately 60 km to the west-northwest of Tom Price (Figure 2.1).

Biota Environmental Sciences (Biota) was commissioned to undertake a flora and vegetation survey of the discharge footprint for the Boolgeeda Creek option. Based on a maximum discharge footprint of 37 km calculated for a peak discharge volume of 17.5 ML/day, the survey area was designed to include the section of creek extending approximately 38 km downstream and 4 km upstream of the discharge point. The survey area also included the adjacent floodplain habitat. A further 3 km section of creekline located between a main access track and the upstream end of the survey area (as outlined in the scope of work) was also subsequently assessed, with a view to provide additional information on the vegetation communities further upstream of the discharge point. Collectively, these survey areas are hereafter referred to as the study area.

2.2 Scope and Objectives of this Study

A botanical survey of Boolgeeda Creek was conducted in order to collate supporting information suitable for an Assessment on Proponent Information (API) process.

The primary objective of this investigation of the riparian flora and vegetation assemblages of the Boolgeeda Creek system was to provide baseline information to assist in evaluating its potential as a receiving water body for the excess water. This report documents the findings of the riparian flora and vegetation survey conducted by Biota of a section of the Boolgeeda Creek.

The objectives of the survey were to:

- undertake a Level 2 vegetation and flora survey consistent with the Western Australian Environmental Protection Authority (EPA) Guidance Statement 51 (EPA 2004) and EPA Position Statement No 3 (EPA 2002);
- describe and map the vegetation units occurring within the study area;
- document the flora assemblage of the study area using accepted sampling techniques, including quadrat-based floristic sampling;
- assess local and regional significance of vegetation units within the study area, including discussion of any Threatened Ecological Communities (TECs) or Priority Ecological Communities (PECs) as well as areas of potential conservation significance such as ephemeral pools;
- identify and record Threatened and Priority flora species and assess their local and regional significance;
- record populations of introduced flora (weeds) and map the vegetation condition; and
- identify the occurrence of erosion processes and other disturbance factors .

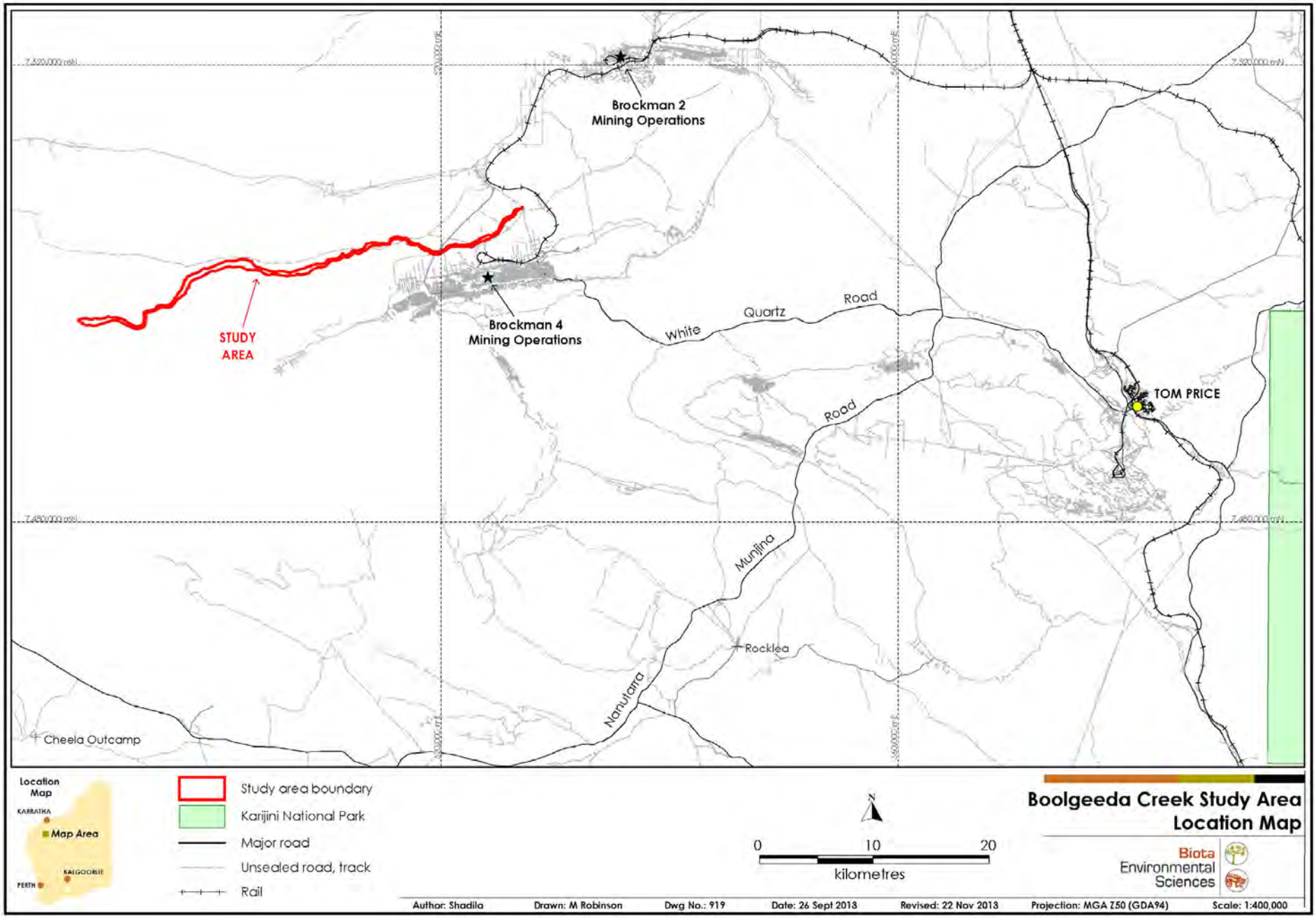

Figure 2.1: Location of the Boolgeeda Creek study area.

3.0 Methodology

3.1 Desktop Review

A search of the NatureMap[1] database was conducted on the 17th of September 2013 to identify all flora species previously recorded within a 40 km radial distance of the study area. The centre of the study area (22ª 35' 18"S; 117ª 04' 34"E) was buffered by 40 km for this search. The results of the NatureMap search are presented in Appendix 2. Various botanical surveys completed in the locality were also reviewed, together with records of species of conservation significance held by Rio Tinto.

The desktop review identified one Threatened species and 29 Priority flora species as having been previously recorded in the Boolgeeda locality. Each species was assigned a ranking to reflect the likelihood that it would occur in the study area, based on a combination of the known distribution of the species, the proximity of other records, and whether suitable habitat is present (see Table 3.1 and Table 4.2).

Table 3.1: Ranking system used to assign the likelihood that a species would occur in the study area.

Rank	Criteria
Recorded	1. The species has been previously recorded in the study area.
Likely	1. There are existing records of the species in close proximity to the study area, or from the locality; and • the species is strongly linked to a specific habitat, which is present in the study area; or • the species has more general habitat preferences, and suitable habitat is present.
May potentially occur	1. There are existing records of the species from the locality, however • the species is strongly linked to a specific habitat, of which only a small amount is present in the study area; or • the species has more general habitat preferences, but only some suitable habitat is present. 2. There is suitable habitat in the study area, but the species is recorded infrequently in the region.
Unlikely	1. The species is linked to a specific habitat, which is absent from the study area; or 2. Suitable habitat is present, however there are no existing records of the species from the locality despite reasonable previous search effort in suitable habitat; or 3. There is some suitable habitat in the study area, however the species is very infrequently recorded in the region.
Would not occur	1. The species is strongly linked to a specific habitat, which is absent from the study area; and/or 2. The species' range is very restricted and would not include the study area.

[1] NatureMap is a collaborative project between the Western Australian Museum and the Department of Parks and Wildlife (DPaW). http://naturemap.dec.wa.gov.au.

3.2 Flora and Vegetation Survey

3.2.1 Field Survey and Climatic Conditions

The field survey was carried out by a team of Biota botanists (comprising Ms Cassie Adam, Ms Preeti Chukowry, Mr Ben Eckermann and Dr Shadila Venkatasamy) from 21 to 28 August 2013. A total of 32 person days were spent on the field component of the study.

Rainfall data from the nearest Bureau of Meteorology (BoM) recording station (Hamersley and where data were unavailable, Paraburdoo Aero) were collated for the six months preceding the survey (Figure 3.1). Although minimal rainfall was recorded in July and August, 78.4 mm occurred in June, equating to almost three times the long-term average rainfall of 23.6 mm. Above average rainfall was also recorded for the months of April and May (Figure 3.1). The flora and vegetation of the study area were observed to be in very good condition, with many annual species present and the majority of species being in flower. Consequently, seasonal conditions for conducting the survey were favourable.

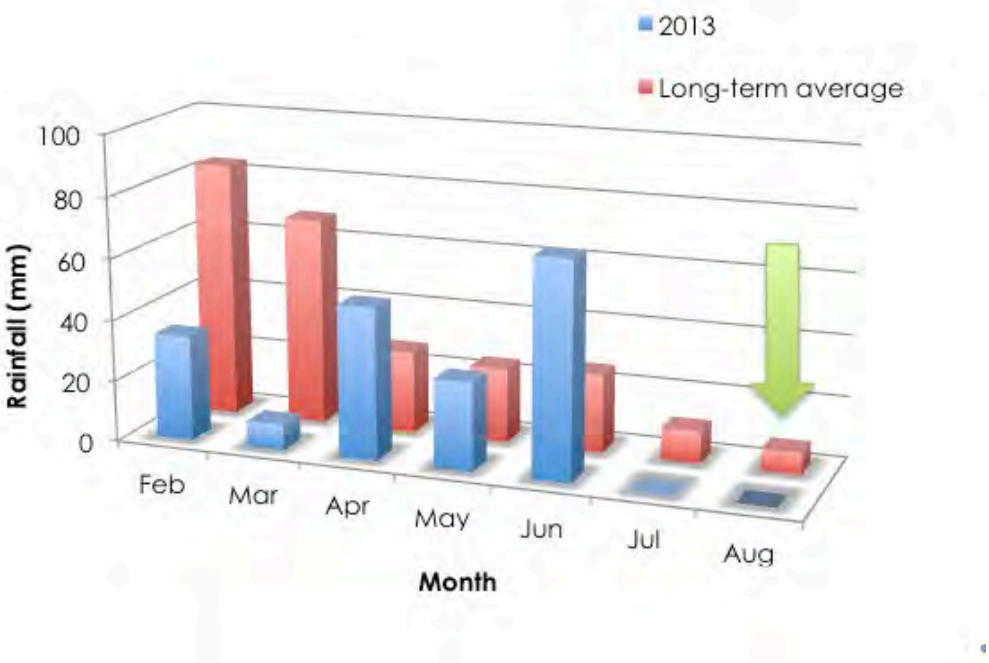

Figure 3.1: Monthly rainfall data for the six months preceding the survey taken from the Hamersley (#5005) weather recording station and Paraburdoo Aero (#7185) weather recording station (July and August 2013 only), compared to the long-term average for Hamersley. Data from BoM (http://www.bom.gov.au). Green arrow indicates survey timing.

3.2.2 Establishment and Assessment of Quadrats and Relevés

Indicative sampling sites were selected prior to the field survey based on the broad habitats and changes in vegetation communities apparent on aerial imagery. Once in the field, final locations of sampling sites were adjusted when necessary.

Quadrats (flora sampling sites of a fixed area) were established at each indicative sampling site wherever possible. Most quadrats established were 50 m x 50 m in size. This quadrat area of 2,500 m^2 is recognised as providing an adequate sample of species presence for the Pilbara vegetation and is the standard quadrat size for botanical survey work in the region (Clarke 2009). Where a square quadrat was unsuitable for sampling the vegetation type (e.g. along narrow creeklines), a rectangular quadrat of equivalent area (e.g. 40 m x 62.5 m) was established instead. The quadrats were permanently marked using steel fence droppers on all four corners. An optical square and measuring tapes were used to accurately position the quadrat boundaries.

In cases where quadrats could not be established (e.g. due to the small size or irregular shape of the habitat), the sampling sites were either surveyed as relevés or recorded in the form of mapping notes (see Section 3.2.3). A relevé is an unbounded flora sampling site with a similar area to a standard quadrat; essentially the same information is recorded as for a quadrat, however the sampling of flora is typically not as thorough. A mapping note includes a brief collection of flora and vegetation data at a point location. A total of 17 quadrats and two relevés were sampled in the study area (see Appendix 3). Mapping notes are discussed in Section 3.2.3.

The following information was recorded for each quadrat and relevé:

- Location: Australian Map Grid (AMG) coordinates recorded in WGS84 datum (to an accuracy of typically ±5 m) using a handheld Global Positioning System (GPS); coordinates were recorded for all four corners of a quadrat, and either the central point of a circular relevé or the start and end points of a linear relevé (e.g. a 100 m long drainage line);
- Vegetation description: a broad description based on the height and estimated cover value of dominant species (after Muir 1977 and Aplin 1979; Appendix 5);
- Habitat description: a description of the landform and habitat;
- Broad soil type: a description of the soil colour, texture and any stony surface mantle;
- Fire history: approximate time since last fire, where applicable;
- Vegetation condition ranking: considering evidence of grazing, physical disturbance, weed invasion etc. (based on Trudgen 1988; Appendix 5);
- The estimated percentage foliar cover of each flora species present within the quadrat or a relevé; and
- A colour photograph of each site (typically taken from the northwest corner of a quadrat, facing southeast).

3.2.3 Vegetation Description, Mapping and Condition Assessment

The vegetation units in the study area were described and mapped using a combination of the information from the quadrats, relevés and mapping notes.

Mapping notes were recorded during foot traverses along the creek system. The objective was to mark boundaries and changes in the vegetation types, and the notes therefore included details regarding habitat and vegetation type. A short list of associated species was also typically recorded. A total of 110 mapping notes were taken during the foot traverses and mapping exercises. The locations of these mapping notes are provided in Appendix 4.

Vegetation descriptions that were considered alike shared a suite of perennial species with a similar range of cover values. These descriptions were grouped to form the vegetation mapping units for the study area.

Each vegetation unit mapped for this report was given two unique codes:

1. A detailed alphabetic code represented the dominant flora species from the tallest to lowest stratum. Species names were abbreviated to capital letter(s) for the genus, followed by lower case letter(s) for species, with multiple letters used where necessary to ensure a unique code (for example: *Acacia citrinoviridis* = Aci; *Themeda triandra* = THt).
2. To aid interpretation, each vegetation unit was also assigned an alpha-numeric code as a unique precursor to the species-driven code. This was a short string comprising a character representing the broad landform group (for example: 'C' for Creeklines, 'F' for floodplains) followed by a number sequence (e.g. F1: AciApyCEcTe was a particular vegetation sub-association occurring on a floodplain). The simplified coding was used on the vegetation maps and in the map legend (see Appendix 3), while both codes and a full description for each vegetation unit are presented in Section 5.2.

The vegetation condition assessments were based on a condition ranking scale developed by Trudgen (1988), which comprised a ranking from Excellent to Completely Degraded (see Appendix 5). The rankings were based on the degree of perceived impact arising from (a) vegetation clearing and other human impacts, (b) the presence of weeds and (c) grazing as well as trampling from livestock and feral animals. Vegetation condition was assessed at each sampling site (quadrat, relevé or mapping note) and the results are mapped in Appendix 10.

3.2.4 Searches for Conservation Significant Flora and Weeds

Searches for conservation significant flora were undertaken within quadrats and relevés, as well as during the foot traverses conducted for the vegetation mapping.

All locations of significant flora were recorded using a GPS (WGS84 datum). The number of individuals, habitat and associated species were also recorded for each location. Threatened and Priority Flora Report Forms will be lodged with DPaW for all flora of conservation significance found.

Introduced flora species (weeds) were also recorded within quadrats and relevés and during foot traverses as part of the survey. Any additional native flora species that had not been previously recorded in the study area were also noted as opportunistic collections during the foot traverses, to improve the list of flora recorded for the area..

3.2.5 Specimen Identification, Nomenclature and Data Management

Common species that were well known to the survey botanists were identified in the field. Voucher specimens of all other species were collected and assigned a unique number to facilitate tracking of data. These were pressed in the field, and dried immediately using portable heaters.

The voucher specimens were identified by (a) using flora keys and relevant publications, (b) checking voucher reference collections, and (c) comparing the specimens to the collections held at the WA Herbarium. Biota botanists (Dr Shadila Venkatasamy, Ms Rachel Butler and Mr Ben Eckermann) identified most specimens, the majority of which were confirmed by Biota's principal botanist (Ms Michi Maier). A few plant samples, particularly those exhibiting uncommon phenotypic variation, were sent to Mr Andrew Perkins (taxonomist at the WA Herbarium) for further examination. These included the specimens of *Peplidium* sp. Fortescue Marsh (S. van Leeuwen 4865) and *Pentalepis trichodesmoides* subsp. *hispida*.

Nomenclature was checked against the current listing of scientific names recognised by the WA Herbarium and updated when necessary. A list of vascular flora species found in the study area is given in Appendix 6.

3.3 Limitations of this Study

Overall, this report provides comprehensive flora and vegetation data for the riparian vegetation along Boolgeeda Creek and its associated floodplains. However, there are limitations to the study that must be considered when reviewing and applying the results detailed in this report:

- While foot traverses and quadrats covered the length of the study area, systematic searches were not conducted through the entire area for Threatened and Priority flora or introduced flora.
- The species list presented in this report includes only names currently recognised by the WA Herbarium[2]. Some specimens collected from the area are unresolved; it is possible that some of these may represent new taxa, or they may represent named species that are already listed for the study area (see Section 6.2.3). These have been referred to the closest possible recognised taxon for this report. Further taxonomic work (preferably including genetic analysis) would be required to determine whether these entities represent separate species.

[2] See FloraBase website: http://florabase.dec.wa.gov.au/

- Whilst the climatic conditions at the time of the survey were adequate for recording most ephemeral and cryptic perennial flora, the study area was not systematically searched and only a single phase of sampling was conducted. The list of vascular flora documented from the study area is therefore representative but should not be considered exhaustive.
- Fungi and nonvascular flora (e.g. algae, mosses and liverworts) were not sampled, as is typical for surveys of this nature.
- The vegetation types for the study area were defined through a combination of quadrat/relevé data and mapping notes recorded in the field, together with interpretation of aerial photography. The mapping provides a spatial representation of the vegetation of the study area, and vegetation boundaries should be treated as indicative rather than absolute.
- A small section of the creek bed in the vicinity of quadrat BRV18 was not traversed on foot. This was due to safety concerns regarding threatening behaviour from herds of livestock and feral donkeys, which had congregated near the pools of water and more shaded areas of the creekline.

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4.0 Existing Environment

4.1 IBRA Bioregion and Subregion

The Interim Biographic Regionalisation for Australia (IBRA) defines 26 bioregions for Western Australia (DoE 2013). The study area lies within the Pilbara bioregion. The Pilbara is further divided into four subregions: Chichester (PIL1), Fortescue Plains (PIL2), Hamersley (PIL3) and Roebourne Plains (PIL4).

The study area is located in the Hamersley subregion (see Kendrick 2003) which is described as a "mountainous area of Proterozoic ranges and plateaus with low Mulga (*Acacia aneura*) woodland over bunch grasses on fine textured soils, and Snappy Gum (*Eucalyptus leucophloia*) over *Triodia brizoides* on the skeletal sandy soils of the ranges."

4.2 Conservation Reserves in the Locality

The main conservation reserve in the locality, and also the closest to the study area, is Karijini National Park, which is located 66 km to the east.

4.3 Land Systems

Land systems mapping covering the study area has been prepared by Agriculture Western Australia (now the Department of Agriculture and Food) (Payne et al. 1988). Land systems are comprised of repeating patterns of topography, soils and vegetation (Chapple 2003) (i.e. a series of "land units" that occur on characteristic physiographic units within the land system).

A total of 105 land systems have been identified and mapped for the Pilbara bioregion[3]. Four of these are mapped within the study area as outlined in Table 4.1.

The distribution of the land systems in the locality is illustrated in Figure 4.1. It is apparent that the broad scale of the land systems mapping does not recognise the continuous drainage feature of Boolgeeda Creek, which should be mapped entirely as River land system. Instead, the active floodplains and major channels of the River land system are only mapped over two broad areas in the eastern and western sections of the study area. The remainder of the study area is variously mapped as the Boolgeeda land system (central and eastern sections of the study area), Robe land system (parts of the western and central sections) or Newman land system (parts of the western section of the study area). The area of each land system mapped within the study area is a very small percentage of their overall representation in the Pilbara bioregion.

The majority of the land systems mapped for the study area are generally not susceptible to erosion. However, the River land system becomes highly, or very highly, susceptible to erosion if vegetation cover is removed. This land system is generally stabilised by Buffel Grass (**Cenchrus ciliaris*), or by spinifex and native tussock grasses in undisturbed areas.

3 This information was obtained by merging the Ashburton land system mapping (Payne et al. 1988) and Pilbara land system mapping (Van Vreeswyk et al. 2004) and intersecting this with the Pilbara bioregion (Environment Australia 2000) in ArcView (v. 3.2).

4.4 Beard's Vegetation Mapping

Beard (1975) mapped the vegetation of the Pilbara at a scale of 1:1,000,000. The study area is located on the Hamersley Plateau, which is within the Fortescue Botanical District of the Eremaean Botanical Province as defined by Beard. The vegetation of this province is typically open, and frequently dominated by spinifex, wattles and occasional eucalypts.

The study area intersects two of Beard's vegetation units (Figure 4.2), namely:

- Hamersley 18: *Acacia pyrifolia* shrubland over *Triodia pungens* hummock grassland; 838 ha in the study area.
- Hamersley 82: Snappy Gum (*Eucalyptus leucophloia*) scattered low trees over *Triodia wiseana* hummock grasslands; 463 ha in the study area.

Given the broad scale of Beard's vegetation mapping, these two units provide only limited information about the vegetation occurring in the study area.

Table 4.1: Land systems intersected by the study area (Payne et al. 1988, van Vreeswyk et al. 2004)

Land System	Description	Total Area of Land System in the Hamersley Subregion (ha)	Area of Land System in Study Area (ha)	Percentage of Study Area in Hamersley Subregion (%)
Boolgeeda	Stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands and mulga shrublands. Component landforms include low hills and rises (4%), stony slopes and upper plains (20%), stony lower plains (65%), groves (1%), and narrow drainage and channels (10%). System not susceptible to erosion.	606, 771	256.1	0.04
Newman	Rugged jaspilite plateaus, ridges and mountains supporting hard spinifex grasslands. Component landforms include plateaus, ridges, mountains and hills (70%), lower slopes (20%), stony plains (5%), and narrow drainage floors with channels (5%). System not susceptible to erosion.	1,853,935	208.7	0.01
River	Active flood plains and major rivers supporting grassy eucalypt woodlands, tussock grasslands and soft spinifex grasslands. Component landforms include sandy levees and sand sheets (15%), upper terraces (5%), floodplains and lower terraces (50%), stony plains (10%), and minor and major channels (20%). Accelerated erosion uncommon unless vegetation cover is removed.	72,628	611.5	0.84
Robe	Low limonite mesas and buttes supporting soft spinifex (and occasionally hard spinifex) grasslands. Component landforms include low plateaus, mesas and buttes (60%), lower slopes (20%), gravelly plains (15%), and drainage floors and channels (5%). System not generally susceptible to erosion.	103,116	225.0	0.22

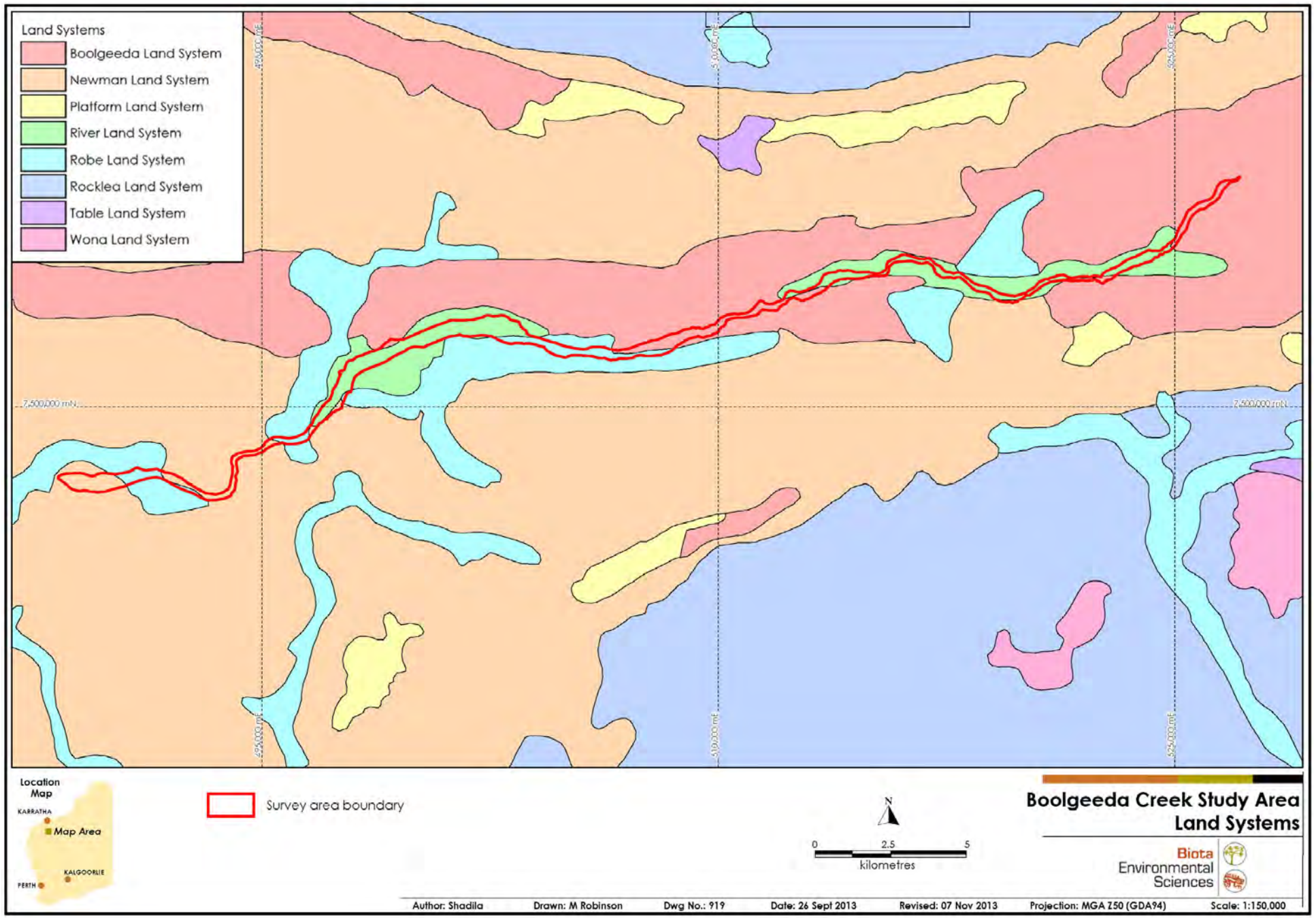

Figure 4.1: Land systems for the study area (Payne et al. 1988).

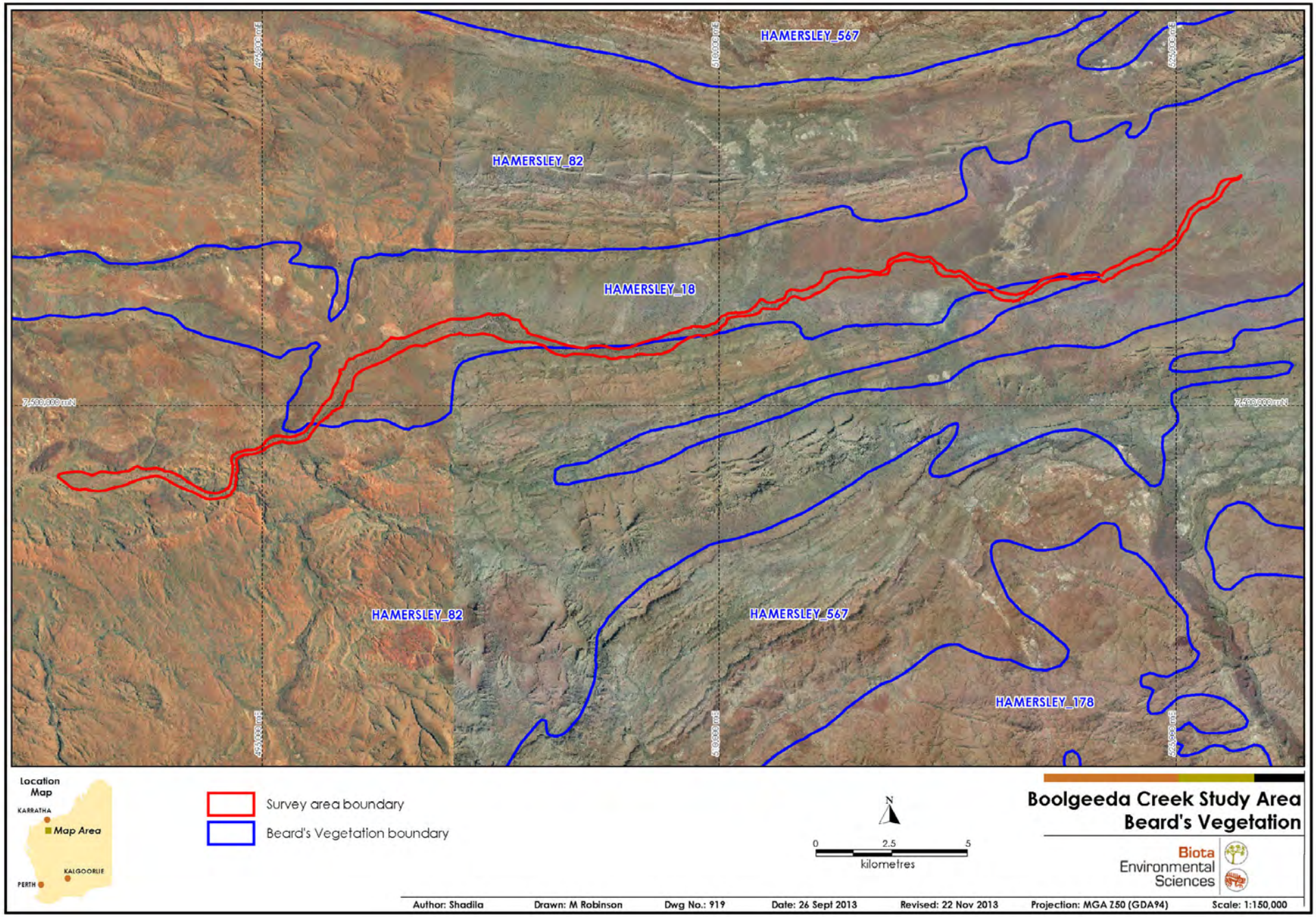

Figure 4.2: Beard's (1975) vegetation mapping for the study area.

4.5 Vegetation Communities of Conservation Significance in the Locality

The framework for ranking communities of conservation significance is presented in Appendix 1.

4.5.1 TECs Known from the Locality

TECs are described by DPaW as biological assemblages occurring in a particular habitat, which are under threat of modification or destruction from various processes. TECs listed by DPaW are conservation significant at the State level and are protected as Environmentally Sensitive Areas under Schedule 5 of the *Environmental Protection Act 1970*. Twenty-three of the 69 TECs listed in Western Australia are also nationally recognised and listed under the *Environment Protection and Biodiversity Conservation (EPBC) Act 1999*. This does not include either of the two TECs listed for the Pilbara bioregion.

No TECs listed for WA have been recorded in the study area. The '*Themeda* grasslands on cracking clays (Hamersley Station, Pilbara)' TEC is mapped as occurring approximately 26 km north of the study area. This TEC is considered to be at risk from (a) grazing and trampling by livestock, (b) weed invasion, (c) changed fire regimes and (d) alteration of hydrology (DEC 2012a). There is no suitable habitat for this TEC in the current study area and it would not occur.

4.5.2 PECs Known from the Locality

PECs are biological communities that are recognised to be of significance, but do not meet the criteria to be classified as a TEC (DEC 2012b). There are five categories of PECs, none of which are protected under legislation (see Appendix 1). Based on data available for current PEC locations, only the 'Brockman Iron cracking clay communities of the Hamersley Range' has been identified as occurring in the locality, approximately 25 km north of the study area. This PEC is a rare tussock grassland dominated by *Astrebla lappacea* in the Hamersley Range, occurring on the Newman land system. It is considered to be at risk from heavy grazing and infrastructure developments. There is no suitable habitat for this PEC in the current study area and it would not occur.

4.6 Conservation Significant Flora in the Locality

The framework under which significant species are classified in WA is provided in Appendix 1.

4.6.1 Threatened Flora

Three Threatened Flora species (*Lepidium catapycnon*, *Thryptomene wittweri* and *Aluta quadrata*) are known from the Pilbara bioregion. *Lepidium catapycnon* and *Thryptomene wittweri* are listed as Threatened flora under the Commonwealth *EPBC Act 1999* as well as the WA *Wildlife Conservation Act 1950*. *Aluta quadrata* has only recently been listed as a Threatened species in WA (State of Western Australia 2012) and is currently only recognised as such under the *Wildlife Conservation Act 1950*.

These species are described briefly below:

- *Lepidium catapycnon* (Hamersley Lepidium) is a woody perennial herb or low shrub occurring mainly on hillsides in skeletal soils, particularly in association with the Newman land system. It typically occurs in hummock grasslands on low stony hills and occasionally stony plains. This relatively short-lived shrub species is often recorded from areas that have been recently disturbed, apparently persisting for only a few years. Now known from a number of locations in the Hamersley Range, *Lepidium catapycnon* extends broadly from Tom Price across to Newman. *Lepidium catapycnon* has been previously recorded within 40 km of the study area (Rio Tinto data; see Table 4.2), but there is no suitable habitat for this species in the study area and it would not occur.

- *Thryptomene wittweri* is a spreading, perennial shrub occurring in skeletal stony soils on breakaways and in drainage channels, typically high in the landscape on mountains of greater than 1,000 m elevation. *Thryptomene wittweri* has not been previously recorded within 40 km of the study area. There is no suitable habitat for this species in the study area and it would not occur.
- *Aluta quadrata* is a perennial shrub occurring mainly in rocky gullies, although it sometimes extends down along the creeklines draining the gullies, or out onto the adjacent ridge slopes and crests. This species is currently thought to be restricted to the southern flanks of the range of hills surrounding Paraburdoo, where it occurs over an east-west range of approximately 40 km. *Aluta quadrata* has not been previously recorded within 40 km of the study area. Due to its restricted distribution and a lack of suitable habitat in the study area, it would not be expected to occur.

4.6.2 Priority Flora

Based on the database searches and literature reviews conducted for this study, a total of 29 Priority flora species have been recorded within a 40 km radius of the study area. A brief description of each of these species and the corresponding survey/data source from which they were recorded is provided in Table 4.2.

There is suitable habitat in the study area for nine of these Priority species, for which the following likelihood rankings were assigned (see Table 3.1):

1. Likely to occur in the study area:
   - *Indigofera* sp. Bungaroo Creek (S. van Leeuwen 4301) (Priority 3); and
   - *Goodenia nuda* (Priority 4).
2. May potentially occur in the study area:
   - *Ipomoea racemigera* (Priority 2);
   - *Oxalis* sp. Pilbara (M.E Trudgen 12725) (Priority 2);
   - *Eragrostis surreyana* (Priority 3);
   - *Glycine falcata* (Priority 3);
   - *Nicotiana umbratica* (Priority 3);
   - *Rostellularia adscendens* var. *latifolia* (Priority 3); and
   - *Rhynchosia bungarensis* (Priority 4).

The remaining 20 Priority species are considered unlikely to occur in the study area or would not occur, as there is either no suitable habitat, or only limited suitable habitat but no records in close proximity.

Table 4.2: Threatened and Priority flora species previously recorded from the Boolgeeda locality.

Species	Habit	Habitat	Source of Record													Likelihood of Occurrence within Study Area
			NatureMap	Biota 2005	Biota 2007	Biota 2009a	Biota 2009b	Biota 2010a	Biota 2010b	Biota 2011	Biota 2012a	Biota 2012b	Biota 2013a	Biota 2013b	Biota 2013c	Rio Tinto data	
Threatened																	
Lepidium catapycnon	Perennial herb or shrub.	Skeletal soils on stony plains and hill slopes.	✔													✔	Would not occur; no suitable habitat.
Priority 1																	
Grevillea sp. Turee (J. Bull & G. Hopkinson ONS JJ 01.01)	Small tree or tall shrub.	Steep, rocky hill slopes, often with Mulga.									✔		✔				Would not occur; no suitable habitat.
Hibiscus sp. Mt Brockman (E. Thoma ET 1354)	Erect spindly shrub.	Rocky areas on hill crests and slopes; rocky gullies.	✔								✔						Would not occur; no suitable habitat.
Sida sp. Hamersley Range (K. Newbey 10692)	Low shrub.	Skeletal stony soils; rocky hills, breakaways.	✔				✔					✔				✔	Would not occur; no suitable habitat.
Priority 2																	
Ipomoea racemigera	Annual creeper.	Along watercourses.										✔			✔		May potentially occur; the creekline in the study area may represent suitable habitat; recorded from Beasley River and Caves Creek in the broader locality.
Oxalis sp. Pilbara (M.E Trudgen 12725)	Rhizomatous, perennial herb	Loamy soil with a stony mantle/in association with creek banks, gullies and spinifex grasslands.										✔					May potentially occur; the creek banks in the study area may represent suitable habitat; recorded from Caves Creek in the broader locality.

Species	Habit	Habitat	Source of Record													Likelihood of Occurrence within Study Area
			NatureMap	Biota 2005	Biota 2007	Biota 2009a	Biota 2009b	Biota 2010a	Biota 2010b	Biota 2011	Biota 2012a	Biota 2012b	Biota 2013a	Biota 2013b	Biota 2013c	Rio Tinto data	
Spartothamnella puberula	Spindly shrub.	Rocky loam, sandy or skeletal soils, usually in gullies in the Pilbara.														✔	Would not occur; no suitable habitat.
Priority 3																	
Astrebla lappacea	Tufted perennial grass.	Clay to clay-loam on plains.	✔						✔							✔	Would not occur; no suitable habitat.
Dampiera anonyma	Low perennial shrub.	Skeletal soils over banded ironstone; hill summits, slopes (above 1,000 m).	✔								✔			✔			Would not occur; no suitable habitat.
Eragrostis surreyana	Small annual grass.	Seasonal wetland areas in the Hamersley and Roebourne subregions.										✔					May potentially occur; the creek beds in the study area may represent suitable habitat; recorded from Caves Creek in the broader locality.
Eremophila magnifica subsp. *velutina*	Shrub.	Skeletal soils over ironstone on tall hills and breakaways.	✔							✔				✔		✔	Would not occur; no suitable habitat.
Glycine falcata	Perennial herb.	Occurs mainly on clay soil plains in the Pilbara, but also along creeklines.	✔									✔					May potentially occur; recorded from Caves Creek in the broader locality.
Goodenia sp. East Pilbara (A.A. Mitchell PRP 727)	Annual to biennial herb.	Low undulating calcrete plains.	✔							✔				✔			Would not occur; no suitable habitat.

Species	Habit	Habitat	Source of Record													Likelihood of Occurrence within Study Area
			NatureMap	Biota 2005	Biota 2007	Biota 2009a	Biota 2009b	Biota 2010a	Biota 2010b	Biota 2011	Biota 2012a	Biota 2012b	Biota 2013a	Biota 2013b	Biota 2013c	Rio Tinto data	
Iotasperma sessilifolium	Erect herb.	Cracking clay, black loam; edges of waterholes in clay plains.	✔														Unlikely to occur; no suitable habitat.
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Low to medium shrub.	Drainage lines.	✔			✔		✔			✔	✔		✔	✔	✔	Likely to occur; drainage lines and floodplains in the study area may represent suitable habitat.
Nicotiana umbratica	Erect, short-lived annual or perennial herb.	Shallow soils, rock outcrops, riverbeds.	✔											✔			May potentially occur; the creek beds in the study area may represent suitable habitat.
Oldenlandia sp. Hamersley Station (A.A. Mitchell PRP 1479)	Spreading, annual herb.	Cracking clay.				✔										✔	Unlikely to occur; no suitable habitat.
Ptilotus subspinescens	Low shrub.	Stony plains with a calcareous silty-clay substrate, occasionally extending up onto adjacent gentle rocky scree slopes; semi-saline colluvial plains.	✔	✔	✔	✔					✔		✔	✔		✔	Would not occur; no suitable habitat.
Rostellularia adscendens var. *latifolia*	Herb or low shrub	Various; creeks, rocky hills, calcrete.			✔						✔				✔		May potentially occur; recorded from a wide variety of habitats.

Species	Habit	Habitat	Source of Record														Likelihood of Occurrence within Study Area
			NatureMap	Biota 2005	Biota 2007	Biota 2009a	Biota 2009b	Biota 2010a	Biota 2010b	Biota 2011	Biota 2012a	Biota 2012b	Biota 2013a	Biota 2013b	Biota 2013c	Rio Tinto data	
Sida sp. Barlee Range (S. van Leeuwen 1642)	Low spreading shrub.	Skeletal soils on steep rocky slopes, breakaways, and in gullies.	✔				✔	✔		✔	✔			✔		✔	Would not occur; no suitable habitat.
Swainsona thompsoniana R.W Davis & P.J.H Hurter	Prostrate annual herb.	Open floodplains on heavy clay soils.	✔														Unlikely to occur; no suitable habitat.
Themeda sp. Hamersley Station (M.E. Trudgen 11431)	Annual tussock grass.	Clay pans, grass plains.	✔													✔	Unlikely to occur; no suitable habitat.
Triodia sp. Robe River (M.E. Trudgen et al. MET 12367)	Soft spinifex.	Crests and upper slopes of mesas; ironstone substrates, sometimes on clay loam.	✔													✔	Would not occur; no suitable habitat.
Priority 4																	
Acacia bromilowiana	Tree or tall shrub.	Skeletal loamy soils on rocky hills, breakaways, scree slopes, gorges and associated creek beds.	✔						✔		✔					✔	Would not occur; no suitable habitat.
Goodenia nuda	Herb.	Clay loam to clay soils, particularly in drainage areas.	✔											✔		✔	Likely to occur; a widespread and frequently recorded species; creeklines in the study area would represent suitable habitat.

Species	Habit	Habitat	Source of Record													Likelihood of Occurrence within Study Area
			NatureMap	Biota 2005	Biota 2007	Biota 2009a	Biota 2009b	Biota 2010a	Biota 2010b	Biota 2011	Biota 2012a	Biota 2012b	Biota 2013a	Biota 2013b	Biota 2013c	Rio Tinto data	
Eremophila magnifica subsp. *magnifica*	Shrub.	Rocky slopes of tall hills, breakaways.		✔			✔				✔			✔		✔	Would not occur; no suitable habitat.
Livistona alfredii	Tree-like monocot (palm).	Edges of permanent pools.										✔					Would not occur; no suitable habitat. Only ephemeral pools are present in the study area.
Ptilotus mollis	Compact perennial shrub.	Stony hills and screes.	✔								✔						Would not occur; no suitable habitat.
Ptilotus trichocephalus	Prostrate herb.	Sandy soils and colluvial plains, typically with an open surface layer of manganese 'gibber'.	✔			✔											Would not occur; no suitable habitat.
Rhynchosia bungarensis	Compact prostrate shrub.	Creeklines through rocky gullies; moderate to major creeklines.	✔														May potentially occur; creeklines may provide suitable habitat.

5.0 Vegetation

5.1 Overview

A total of 15 vegetation units were defined for the study area. Table 5.1 shows the area that each vegetation unit occupied, with units divided into two groups according to whether they occurred in creeklines or on floodplains.

Table 5.1: Area covered by each vegetation unit in the study area.

Mapping Unit / Vegetation Sub-Association	Area (ha)	Proportion of Study Area (%)
Vegetation of Creeklines		
C1: ChAciAtuGOr	10.52	0.81
C2: EvAciAtuAPyTHtTe	6.48	0.50
C3: EvEcAciAPyTErEUa	30.28	2.33
C4: EvEcAciEUa	26.29	2.02
C5: EvEcAciCEc	179.90	13.83
C6: EvEcAciMgAam	46.85	3.60
C7: EvEcAciMgCEcTe	152.74	11.74
Vegetation of Floodplains		
F1: ChAciAtuGOrCEcTe	26.71	2.05
F2: AciAPyTErTHtCEcTe	69.30	5.33
F3: AciAPyEUaTHtCEcTe	37.44	2.88
F4: ChAciAPyCEcTe	26.77	2.06
F5: AciAPyCEcTe	463.27	35.60
F6: PlAsclTe	13.29	1.02
F7: ChAciPlAsclCEcTe	40.83	3.14
F8: AciAPyPlCEcTe	170.56	13.11

The topography of Boolgeeda Creek varied significantly, with the western end being classified as a meandering creek while the eastern end formed a braided channel. The central section of the creek was a mosaic of meandering and braided features. A meandering planform[4] is characterised by a single and sinuous main channel with a few point bars (accumulation of sediment), cut-banks (eroded, concave bank) and well-defined banks (Taylor 2002). Pools usually occur at the outer edges of the bends and at shallower sections on the straighter segments between bends. In contrast, a braided planform is distinguished by poorly defined channels with numerous interlaced channels that divide and rejoin around unstable bars and small islands. In addition, the floodplains of braided creeks vary in extent and architecture (Taylor 2002). They are also less stable than the floodplains of meandering creeks.

Reflecting these differences in creek morphology, some notable differences were observed between the vegetation communities of the western and eastern sections of the study area. Species like *Melaleuca glomerata* and *Acacia ampliceps* were present only in the western section. In contrast, *Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186), *Themeda triandra* and *Eulalia aurea* were more prevalent along the eastern section of the creekline. *Acacia tumida* var. *pilbarensis* was restricted to the easternmost segment, where the channel was more defined and the creek bed was deeper. The tree and shrub strata were also denser in the western section compared to the eastern section, with the latter having a more open overstorey and therefore supporting more grasses and herbs in the understorey.

4 Planform refers to the form of a river as seen from above; i.e. from a 'bird's eye' or 'plan' view.

Reflecting these differences in species composition, the 15 vegetation units can be grouped into five broad vegetation classes:

1. Creekline dominated by *Corymbia hamersleyana* (C1): *Corymbia hamersleyana* dominated open woodland over *Acacia citrinoviridis*, *Acacia tumida* var. *pilbarensis* and *Gossypium robinsonii*. The absence of *Eucalyptus victrix* and *E. camaldulensis* subsp. *refulgens* resulted in this vegetation assemblage being distinctly different from the remainder of the creekline.
2. Creekline dominated by *Eucalyptus victrix* and/or *E. camaldulensis* (C2, C3, C4, C5, C6 and C7): *Eucalyptus victrix* or *E. camaldulensis* subsp. *refulgens* (the latter usually co-dominant with *E. victrix*) dominated open woodland over *Acacia citrinoviridis* and/or *Melaleuca glomerata* over tussock grasses (**Cenchrus ciliaris, Eulalia aurea, Themeda triandra*).
3. Floodplains with *Corymbia hamersleyana* (F1 and F4): Floodplains with *Corymbia hamersleyana* as scattered trees or open woodland over *Acacia citrinoviridis* over tussock grasses (**Cenchrus ciliaris, Eulalia aurea, Themeda triandra*) and the hummock grass *Triodia epactia.*
4. Floodplains dominated by *Acacia citrinoviridis* and *A. pyrifolia* (F2, F3, F5 and F8): Floodplains with a significant cover of *Acacia citrinoviridis* and *A. pyrifolia* over tussock grasses (**Cenchrus ciliaris, Eulalia aurea, Themeda triandra*).
5. Floodplains supporting *Acacia sclerosperma* subsp. *sclerosperma* (F6 and F7): Floodplains supporting an assemblage of *Petalostylis labicheoides*, *Acacia sclerosperma* subsp. *sclerosperma* and *Triodia epactia*.

5.2 Descriptions of Vegetation Units

Most vegetation units were represented by one or more quadrats and/or relevés on which the vegetation descriptions were based, however the following units were described from mapping notes only:

- Two vegetation units (C1 and C2) were restricted to a segment of the creek located outside the survey area that was originally designated in the scope of work. Although not supported by quadrat or relevé sampling points, descriptions of these units have been included to provide additional information on the gradual transitions in species composition along the creekline further upstream from the proposed discharge point.
- Four vegetation units (F3, F4, F7 and F8) were very similar to other vegetation units, but have been mapped separately rather than being incorporated into these similar units. Although described only from mapping notes, these units were retained in order to highlight the subtle changes in vegetation that otherwise would have been overlooked. Inclusion of these units has strengthened the baseline data by providing information on the shifting pattern of species dominance along the creekline.
- Unit F6 was considered to be relatively degraded, and therefore no quadrats or relevés were established.

At the infraspecific level, *Acacia pyrifolia* var. *pyrifolia, Acacia tumida* var. pilbarensis, *Eucalyptus camaldulensis* subsp. *refulgens* and *Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186) were the taxa within these species that were found to be dominant in vegetation of the study area. For simplicity, these have been referred to as "*Acacia pyrifolia*", "*Acacia tumida*", "*Eucalyptus camaldulensis*" and "*Tephrosia rosea*" in the following vegetation descriptions.

5.2.1 Vegetation of Creeklines

C1: ChAciAtuGOr — *Corymbia hamersleyana* open woodland over *Acacia citrinoviridis* low open woodland over *Acacia tumida*, *Gossypium robinsonii* scattered tall shrubs

Habitat	This unit occurred in a channel exhibiting mostly braided features with broad floodways. However some meandering characteristics like distinct banks were present in some areas and the creek beds there were also relatively incised. This unit occurred in the easternmost section of the study area. It was distinguished from the adjoining unit F1 by the absence of **Cenchrus ciliaris* and *Triodia epactia*.
Other associated species	Trees and Tall Shrubs: *Acacia pyrifolia* var. *pyrifolia, Androcalva luteiflora, Eremophila longifolia, Gossypium robinsonii, Indigofera* sp. Bungaroo Creek (S. van Leeuwen 4301). Low Shrubs: *Isotropis atropurpurea, Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186). Grasses: **Cenchrus ciliaris*, *Enneapogon lindleyanus, Eulalia aurea*, *Themeda triandra.* Herbs: *Phyllanthus maderaspatensis*, *Stemodia grossa.*
Vegetation condition	Good: presence of **Cenchrus ciliaris* in the grass understorey.
Described from	Mapping notes; this unit was located outside the original designated survey area.
Notes	The morphology of this segment of the creekline gradually changed to become a shallow channel, which supported vegetation unit C2.
Photo	Plate 5.1.

C2: EvAciAtuAPyTHtTe — *Eucalyptus victrix* open woodland over *Acacia citrinoviridis* scattered low trees over *Acacia tumida*, *A. bivenosa*, *A. pyrifolia* tall open shrubland over *Themeda triandra* very open tussock grassland over *Triodia epactia* very open hummock grassland

Habitat	This unit occurred on a channel exhibiting braided characteristics with broad floodways and no distinct banks. It occurred in the easternmost section of the study area.
Other associated species	Trees and Tall Shrubs: *Androcalva luteiflora, Gossypium robinsonii.* Low Shrubs: *Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186), *Corchorus crozophorifolius.* Grasses: **Cenchrus ciliaris, Eriachne tenuiculmis, Eulalia aurea.* Herbs: *Phyllanthus maderaspatensis, Stemodia grossa.*
Vegetation condition	Very good: scattered **Cenchrus ciliaris* in the grass understorey.
Described from	Mapping notes; this unit was located outside the original designated survey area.
Photo	Plate 5.2.

C3: EvEcAciAPyTErEUa *Eucalyptus victrix*, *E. camaldulensis* open woodland over *Acacia citrinoviridis* low open woodland over *A. pyrifolia* tall open shrubland over *Tephrosia rosea* low open shrubland over very open mixed herbland over *Eulalia aurea* open tussock grassland

Habitat	This unit occurred on a channel exhibiting braided characteristics with broad floodways and no distinct banks. It occurred towards the eastern end of the study area. The herb stratum was dominated by patches of mixed herbs including *Goodenia lamprosperma, G. stobbsiana* and *Stemodia grossa.*
Other associated species	Trees and Tall Shrubs: *Acacia bivenosa*, *Androcalva luteiflora, Gossypium robinsonii, Grevillea pyramidalis, Indigofera sp.* Bungaroo Creek (S. van Leeuwen 4301). Low Shrubs: *Corchorus crozophorifolius.* Grasses: **Cenchrus ciliaris*, *Eriachne pulchella, Eriachne tenuiculmis*, *Themeda triandra.* Herbs: *Gomphrena canescens* subsp. *canescens, Goodenia lamprosperma, G. stobbsiana*, *Phyllanthus maderaspatensis, Stemodia grossa.*
Vegetation condition	Very Good: scattered **Cenchrus ciliaris* in the grass understorey.
Described from	Quadrat BRV02 and mapping notes.
Photo	Plate 5.3.

C4: EvEcAciEUa *Eucalyptus victrix*, *E. camaldulensis* woodland over *Acacia citrinoviridis* low open woodland over *Eulalia aurea* very open tussock grassland over very open mixed herbland

Habitat	This unit occurred on part of a channel exhibiting braided characteristics. It occurred towards the eastern section of the study area. The herb stratum was again dominated by patches of mixed herbs, including *Goodenia lamprosperma, G. stobbsiana* and *Stemodia grossa.*
Other associated species	Trees and Tall Shrubs: *Acacia bivenosa*, *A. pyrifolia* var. *pyrifolia*, *Androcalva luteiflora, Gossypium robinsonii, Indigofera sp.* Bungaroo Creek (S. van Leeuwen 4301). Low Shrubs: *Corchorus crozophorifolius, Dipteracanthus australasicus* subsp. *australasicus*, *Waltheria indica.* Grasses: **Cenchrus ciliaris, Eragrostis cumingii*, *E. tenellula.* Herbs: *Centipeda minima* subsp. *macrocephala, Cleome viscosa, Evolvulus alsinoides* var. *villosicalyx*, *Goodenia stobbsiana, G. lamprosperma*, *Phyllanthus exilis, Pluchea rubelliflora, Stemodia grossa.*
Vegetation condition	Good: presence of **Cenchrus ciliaris* in the grass understorey.
Described from	Quadrat BRV05 and mapping notes.
Notes	The understorey vegetation consisted of a mixed very open herbland. This was not included in the broad vegetation description due to its short-lived nature.
Photo	Plate 5.4.

C5: EvEcAciCEc *Eucalyptus victrix*, *E. camaldulensis* woodland over *Acacia citrinoviridis* low open woodland over **Cenchrus ciliaris* scattered tussock grasses

Habitat	This unit occurred on a channel exhibiting intermediate characteristics between meandering and braided planforms. It occurred in the central section and towards the western end of the study area. It also occurred on a channel exhibiting braided characteristics with broad floodways and no distinct banks. In this channel, the unit was observed towards the eastern section of the study area.
Other associated species	Trees and Tall Shrubs: *Acacia bivenosa*, *Androcalva luteiflora, Gossypium robinsonii*, *Indigofera sp.* Bungaroo Creek (S. van Leeuwen 4301), *Melaleuca glomerata.* Low Shrubs: *Corchorus crozophorifolius*, *Ptilotus astrolasius*, *Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186), *Waltheria indica.* Grasses: *Digitaria brownii, Eriachne pulchella*, *Eulalia aurea*, *Themeda triandra.* Herbs: *Centipeda minima* subsp. *macrocephala, Goodenia lamprosperma*, *Phyllanthus maderaspatensis, Ptilotus nobilis* subsp. *nobilis, Stemodia grossa.*
Vegetation condition	Good: presence of **Cenchrus ciliaris* in the grass understorey.
Described from	Quadrats BRV06, BRV10 and BRV15; and mapping notes.
Photo	Plate 5.5.

C6: EvEcAciMgAam *Eucalyptus victrix*, *E. camaldulensis* woodland over *Acacia citrinoviridis* low open woodland over *Melaleuca glomerata*, *Acacia ampliceps* tall shrubland

Habitat	This unit occurred in the western section of the study area, in a channel exhibiting a meandering planform with a few point bars and well defined banks.
Other associated species	Trees and Tall Shrubs: *Acacia coriacea* subsp. *pendens, A. pyrifolia* var. *pyrifolia*, *Androcalva luteiflora, Gossypium robinsonii*, *Indigofera sp.* Bungaroo Creek (S. van Leeuwen 4301), *Petalostylis labicheoides.* Low Shrubs: *Dipteracanthus australasicus* subsp. *australasicus*, *Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186), *Waltheria indica.* Grasses: **Cenchrus ciliaris, *C. setiger, Eragrostis cumingii*, *Eriachne tenuiculmis*, *Eulalia aurea.* Sedges: *Cyperus vaginatus, Schoenoplectus subulatus.* Herbs: **Argemone ochroleuca* subsp. *ochroleuca*, *Goodenia forrestii, G. lamprosperma, Pluchea rubelliflora, Pterocaulon sphacelatum, Stemodia grossa.*
Vegetation condition	Very Good: scattered **Cenchrus ciliaris* in the grass understorey.
Described from	Quadrat BRV19 and mapping notes.
Notes	The six ephemeral pools in the study area were all recorded from this vegetation unit (see Section 7.1).
Photo	Plate 5.6.

C7: EvEcAciMgCEcTe *Eucalyptus victrix*, *E. camaldulensis* woodland over *Acacia citrinoviridis* low open woodland over *Melaleuca glomerata* tall shrubland over **Cenchrus ciliaris* scattered tussock grasses over *Triodia epactia* scattered hummock grasses

Habitat	This unit occurred in the western section of the study area on two main channel planforms: a meandering planform with a few point bars and well defined banks in the westernmost part of the study area, and a more braided channel with no distinct banks at the eastern end.
Other associated species	Trees and Tall Shrubs: *Acacia coriacea* subsp. p*endens, A. pyrifolia* var. *pyrifolia*, *Androcalva luteiflora, Gossypium robinsonii, Indigofera sp.* Bungaroo Creek (S. van Leeuwen 4301). Low Shrubs: *Dipteracanthus australasicus* subsp. *australasicus, Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186), W*altheria indica.* Grasses: *Eragrostis cumingii, Eriachne pulchella, Eulalia aurea, Themeda triandra.* Sedges: *Cyperus vaginatus, Schoenoplectus subulatus.* Herbs: **Argemone ochroleuca* subsp. *ochroleuca*, *Cleome viscosa*, *Goodenia lamprosperma, G. stobbsiana, Heliotropium pachyphyllum, Pluchea rubelliflora, Pterocaulon sphacelatum, Stemodia grossa.*
Vegetation condition	Very Good. A few patches in the vicinity of BRV18 were deemed as being in Poor condition due to the presence of **Cenchrus ciliaris* and trampling by cattle and donkeys. However, in general, the condition of this vegetation unit was Very Good.
Described from	Quadrats BRV13, BRV17, BRV18 and BRV20; and mapping notes.
Photo	Plate 5.7.

Plate 5.1: Vegetation unit C1.

Plate 5.2: Vegetation unit C2.

Plate 5.3: Vegetation unit C3.

Plate 5.4: Vegetation unit C4.

Plate 5.5: Vegetation unit C5.

Plate 5.6: Vegetation unit C6.

Plate 5.7: Vegetation unit C7.

5.2.2 Vegetation of Floodplains

F1: ChAciAtuGOrCEcTe *Corymbia hamersleyana* open woodland over *Acacia citrinoviridis* low open woodland over *A. tumida*, *Gossypium robinsonii* scattered tall shrubs over **Cenchrus ciliaris* very open tussock grassland over *Triodia epactia* scattered hummock grasses

Habitat	This unit occurred on the floodplains located in the easternmost section of the study area. This area appeared more stable than the adjoining braided associated floodplain and was at a relatively higher elevation compared to the creek bed.
Other associated species	Trees and Tall Shrubs: *Acacia bivenosa*, *A. pyrifolia* var. *pyrifolia*, *Androcalva luteiflora, Gossypium robinsonii, Indigofera sp.* Bungaroo Creek (S. van Leeuwen 4301). Low Shrubs: *Eremophila longifolia, Isotropis atropurpurea*, *Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186). Grasses: *Aristida holathera* var. *holathera*, *Eulalia aurea, Themeda triandra.* Herbs: *Phyllanthus maderaspatensis*, *Stemodia grossa.*
Vegetation condition	Good: presence of **Cenchrus ciliaris* in the grass understorey.
Described from	Relevé BRV-SA and mapping notes. This unit was located outside the originally designated survey area.
Notes	The architecture of the floodplain gradually changed to be less demarcated from the creek bed when moving downstream, and supported a dense stratum of grasses as described for vegetation unit F2.
Photo	Plate 5.8.

F2: AciAPyTErTHtCEcTe *Acacia citrinoviridis* low open woodland over *A. pyrifolia* tall open shrubland over *Tephrosia rosea* low open shrub over *Themeda triandra*, **Cenchrus ciliaris* tussock grassland over *Triodia epactia* very open hummock grassland

Habitat	This unit occurred on the floodplains located towards the eastern section of the study area. The floodplain in this section was broad, flat and extended over several hundred metres from the creekline. It was interlaced with drainage lines.
Other associated species	Trees and Tall Shrubs: *Acacia ancistrocarpa, Androcalva luteiflora, Gossypium robinsonii, Grevillea wickhamii, Indigofera sp.* Bungaroo Creek (S. van Leeuwen 4301). Low Shrubs: *Corchorus crozophorifolius, Indigofera monophylla, Ptilotus astrolasius, Waltheria indica.* Grasses: *Eulalia aurea, Eriachne pulchella, E. tenuiculmis, Themeda triandra.* Herbs: *Evolvulus alsinoides* var. *villosicalyx, Goodenia lamprosperma, *Malvastrum americanum, Phyllanthus maderaspatensis, Pluchea rubelliflora, Stemodia grossa.*
Vegetation condition	Good: presence of **Cenchrus ciliaris* in the grass understorey and **Malvastrum americanum* in the herb stratum.
Described from	Quadrat BRV01 and mapping notes.
Notes	The ground layer was dominated by a dense cover of the grasses mentioned in the vegetation description.
Photo	Plate 5.9.

F3: AciAPyEUaTHtCEcTe *Acacia citrinoviridis* low open woodland over *A. pyrifolia* tall open shrubland over *Eulalia aurea*, *Themeda triandra, *Cenchrus ciliaris* tussock grassland over *Triodia epactia* very open hummock grassland

Habitat	This unit occurred on the floodplains located towards the eastern section of the study area. The floodplain in this section was broad, flat and extended over several hundred metres from the creekline. It was interlaced with drainage lines.
Other associated species	Trees and Tall Shrubs: *Androcalva luteiflora, Gossypium robinsonii, Hakea lorea* subsp. *lorea, Indigofera sp.* Bungaroo Creek (S. van Leeuwen 4301), *Petalostylis labicheoides, Stylobasium spathulatum.* Low Shrubs: *Corchorus crozophorifolius, Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186), *Waltheria indica.* Grasses: *Aristida holathera* var. *holathera.* Herbs: *Evolvulus alsinoides* var. *villosicalyx, Goodenia lamprosperma, G. stobbsiana, Pluchea rubelliflora, Stemodia grossa.*
Vegetation condition	Good: presence of **Cenchrus ciliaris* in the grass understorey.
Described from	Mapping notes.
Notes	This unit showed a high degree of similarity to vegetation unit F2, except for a lower cover of *Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186) and a higher cover of *Eulalia aurea*. The ground layer was dominated by a dense cover of grasses.
Photo	Plate 5.10.

F4: ChAciAPyCEcTe — *Corymbia hamersleyana* scattered trees over *Acacia citrinoviridis* low woodland over *A. pyrifolia* tall shrubland over **Cenchrus ciliaris* open tussock grassland over *Triodia epactia* open hummock grassland

Habitat	This unit occurred on a floodplain located in the central section of the study area. The width of the floodplain in this section was intermediate, ranging from a narrow floodplain at the western end to a flat broad floodplain at the eastern end.
Other associated species	Trees and Tall Shrubs: *Acacia bivenosa*, *Androcalva luteiflora*, *Hakea lorea* subsp. *lorea.* Low Shrubs: *Ptilotus obovatus*, *Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186), *Waltheria indica.* Grasses: *Aristida holathera* var. *holathera*, *Chrysopogon fallax, Eulalia aurea, Themeda triandra.* Herbs: *Goodenia forrestii*, *Phyllanthus maderaspatensis.*
Vegetation condition	Good: presence of **Cenchrus ciliaris* in the grass understorey. Some patches were trampled by cattle and were heavily grazed. However, in general, the condition of this vegetation unit was Good.
Described from	Mapping notes.
Notes	This unit showed a high degree of similarity to vegetation unit F5, except for the presence of *Corymbia hamersleyana* in the tree stratum of F4.
Photo	Plate 5.11.

F5: AciAPyCEcTe — *Acacia citrinoviridis* open woodland over *A. pyrifolia* tall open shrubland over **Cenchrus ciliaris* open tussock grassland over *Triodia epactia* very open hummock grassland

Habitat	This unit was the most common vegetation unit encountered. It was more predominant in the central section of the study area on floodplains and an island within the creek channel. The width of the floodplain in this section was intermediate, ranging from a narrow floodplain at the western end to a flat broad floodplain at the eastern end. It also occurred to a lesser extent towards the eastern and western ends of the study area.
Other associated species	Trees and Tall Shrubs: *Acacia bivenosa*, *Androcalva luteiflora, Gossypium robinsonii*, *Hakea lorea* subsp. l*orea, Indigofera sp.* Bungaroo Creek (S. van Leeuwen 4301), *Petalostylis labicheoides.* Low Shrubs: *Corchorus crozophorifolius, Dipteracanthus australasicus* subsp. *australasicus*, *Senna artemisioides* subsp*. oligophylla*, *Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186). Grasses: *Aristida contorta*, **Cenchrus setiger*, *Enneapogon caerulescens*, *Eulalia aurea, Themeda triandra.* Herbs: *Evolvulus alsinoides* var. *villosicalyx*, *Gomphrena canescens* subsp. *canescens*, *Goodenia stobbsiana, G. lamprosperma*, *Pluchea rubelliflora, Stemodia grossa.*
Vegetation condition	Good: presence of **Cenchrus ciliaris* in the grass understorey. A few patches in the vicinity of quadrats BRV16 and BRV07 were ranked as Poor due to a dense cover of **Cenchrus ciliaris* and trampling by cattle. In general, however, the condition of this vegetation unit was Good.
Described from	Quadrats BRV07, BRV08, BRV09, BRV12, BRV14 and BRV16; relevé BRVC; and mapping notes.
Notes	*Acacia bivenosa* and *Gossypium robinsonii* were the dominant species in a small area of the floodplain bordering the slope of a ridge.
Photo	Plate 5.12.

F6: PlAsclTe — *Petalostylis labicheoides*, *Acacia sclerosperma* tall open shrubland over *Triodia epactia* very open hummock grassland

Habitat	This unit occurred on a floodplain located in the western section of the study area. This section was flanked to the north and south by outcropping Boolgeeda Iron Formation and Robe Pisolite mesas, resulting in narrow or no floodplains.
Other associated species	Trees and Tall Shrubs: *Acacia pyrifolia var. pyrifolia, A. inaequilatera, Eucalyptus victrix, Gossypium robinsonii, Stylobasium spathulatum.* Low Shrubs: *Corchorus crozophorifolius, Ptilotus astrolasius, Senna notabilis, Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186), *Waltheria indica.* Grasses: *Aristida contorta, *Cenchrus ciliaris, Themeda triandra.* Herbs: *Evolvulus alsinoides* var. *villosicalyx, Pluchea rubelliflora, Stemodia grossa.*
Vegetation condition	Very Good: presence of a few individuals of **Cenchrus ciliaris* in the grass understorey.
Described from	Mapping notes.
Notes	This unit comprised a small area degraded by cattle activity, which supported a patch of *Acacia sclerosperma*. The ground surface consisted of deteriorated soil with little tussock grass or herb cover. The observed species diversity was consequently very low. This unit is similarity to vegetation unit F7, but was considered too degraded to warrant a formal relevé. It has been mapped as a separate unit to capture the existence of an *Acacia sclerosperma* dominated vegetation community in this area.
Photo	Plate 5.13.

F7: ChAciPlAsclCEcTe — *Corymbia hamersleyana* scattered trees over *Acacia citrinoviridis* low woodland over *A. pyrifolia*, *Petalostylis labicheoides*, *A. sclerosperma* tall shrubland over **Cenchrus ciliaris* open tussock grassland over *Triodia epactia* scattered hummock grasses

Habitat	This unit occurred on a floodplain located in the western section of the study area. This section was flanked north and south by outcropping Boolgeeda Iron Formation and Robe Pisolite mesas, resulting in narrow or no floodplains.
Other associated species	Trees and Tall Shrubs: *Acacia bivenosa*, *Gossypium robinsonii*, *Grevillea wickhamii*, *Hakea lorea* subsp. *lorea*, *Stylobasium spathulatum.* Low Shrubs: *Corchorus crozophorifolius, Gossypium australe*, *Ptilotus astrolasius, P. obovatus.* Grasses: *Eragrostis cumingii*, *Eulalia aurea*, *Themeda triandra.* Herbs: *Evolvulus alsinoides* var. *villosicalyx*, *Goodenia forrestii, Ptilotus nobilis.*
Vegetation condition	Good: presence of **Cenchrus ciliaris* in the grass understorey.
Described from	Mapping notes.
Notes	Both this unit and vegetation unit F1 showed a marked dominance of *Corymbia hamersleyana*, *Acacia citrinoviridis*, **Cenchrus ciliaris* and *Triodia epactia* compared to the other floodplain vegetation units.
Photo	Plate 5.14.

F8: AciAPyPlCEcTe *Acacia citrinoviridis* open woodland over *A. pyrifolia*, *Petalostylis labicheoides* tall open shrubland over **Cenchrus ciliaris* open tussock grassland over *Triodia epactia* very open hummock grassland

Habitat	This unit occurred in the western section of the study area on floodplains and islands within the creek channel. This section was flanked north and south by outcropping Boolgeeda Iron Formation and Robe Pisolite mesas, resulting in narrow or no floodplains.
Other associated species	Trees and Tall Shrubs: *Androcalva luteiflora, Gossypium robinsonii*, *Hakea lorea* subsp. *lorea*, *Indigofera* sp. Bungaroo Creek (S. van Leeuwen 4301), *Melaleuca glomerata.* Low Shrubs: *Corchorus crozophorifolius, Dipteracanthus australasicus* subsp. *australasicus*, *Senna artemisioides* subsp. *oligophylla*, *Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186), *Waltheria indica.* Grasses: *Aristida contorta*, *Eriachne tenuiculmis*, *E. pulchella*, *Eulalia aurea, Themeda triandra.* Herbs: **Argemone ochroleuca* subsp. *ochroleuca*, *Evolvulus alsinoides* var. *villosicalyx, Gomphrena canescens* subsp. *canescens*, *Goodenia stobbsiana, G. lamprosperma, Pluchea rubelliflora*, *Stemodia grossa.*
Vegetation condition	Good: presence of **Cenchrus ciliaris* in the grass understorey and **Argemone ochroleuca* subsp. *ochroleuca* in the herb stratum.
Described from	Mapping notes.
Notes	This unit showed a high degree of similarity to vegetation unit F5, except for a higher cover of *Petalostylis labicheoides*.
Photo	Plate 5.15.

Plate 5.8: Vegetation unit F1.

Plate 5.9: Vegetation unit F2.

Plate 5.10: Vegetation unit F3.

Plate 5.11: Vegetation unit F4.

Plate 5.12: Vegetation unit F5.

Plate 5.13: Vegetation unit F6.

Plate 5.14: Vegetation unit F7.

Plate 5.15: Vegetation unit F8.

5.3 Vegetation Condition

In general, the vegetation condition of the creek bed was ranked as being Very Good, while that of the floodplain was categorised as Good. Thirteen weed species were recorded in the study area. **Cenchrus ciliaris* and **Argemone ochroleuca* subsp. *ochroleuca* were the most abundant species and were widespread along the length of the creek bed. **Cenchrus ciliaris* occurred as scattered grasses or very open tussock grasslands along the creekline, while **Argemone ochroleuca* subsp. *ochroleuca* was observed in the open areas of the creek bed as dense patches of mostly seedlings. The floodplains had a higher degree of invasion by **Cenchrus ciliaris,* which occurred there as open tussock grasslands to tussock grasslands. Moreover, the patches of **Cenchrus ciliaris* encountered between quadrats BRV19 and BRV18 (in the western section of the study area) were mostly grazed but covered a broad area. The diversity of native grasses and herbs in this area was observed to be very low. Furthermore, this zone was trampled by herds of cattle and donkeys, leading to an apparent deterioration in the structure of the topsoil layer. **Cenchrus ciliaris* also occurred as a few small high-density patches in areas around quadrats BRV16 (western section of the study area) and BRV07 (eastern section), leading to a Poor vegetation condition ranking for those minor segments.

The vegetation was cleared along a stretch of single dirt track running along the creek bed between quadrats BRV18 and BRV20. However, as the creek was broad in that segment, the condition of the vegetation on either side of the track was still Very Good.

5.4 Conservation Significance of the Vegetation Units

5.4.1 Threatened Ecological Communities

No TECs occur within the study area. The nearest mapped TEC, the '*Themeda* grasslands on cracking clays (Hamersley Station, Pilbara)', is located approximately 25 km north of the study area and would not occur in the study area due to a lack of suitable habitat (clay plains; see Section 4.5.1).

5.4.2 Priority Ecological Communities

No PECs have been recorded within the study area. The nearest mapped PEC, the 'Brockman Iron cracking clay communities of the Hamersley Range', is located approximately 25 km north of the study area. This unit would not occur in the study area due to a lack of suitable habitat (clay plains; see Section 4.5.2).

5.4.3 Ecosystems at Risk

A number of ecosystems in each WA IBRA subregion are listed as being "at risk" from various threatening processes. Of those listed for the Hamersley subregion (see Kendrick 2003), only one is of relevance to the study area:

- "All major ephemeral water courses" – *Eucalyptus* forests with a shrubby understorey; these communities are under threat from cattle grazing, feral animals (particularly donkeys, horses and cattle) and invasive weeds (particularly Buffel Grass **Cenchrus ciliaris* and Ruby Dock **Acetosa vesicaria*).

Such habitats occur throughout the Pilbara, from near the northern coast to the southern edge of the bioregion. Their distribution is approximated by the mapping of the River land system (Payne et al. 1988, van Vreeswyk et al. 2004) but this does not adequately capture a number of significant drainage systems (e.g. Boolgeeda Creek, Beasley River and the Caves Creek / Duck Creek system in the Brockman locality).

Although none of the vegetation units described for study area are Eucalypt forests, Boolgeeda Creek is a major ephemeral watercourse and several of the units would be similarly at risk from these threats. These units have therefore been identified as being of some conservation significance (Section 5.4.4).

5.4.4 Other Vegetation Communities of Conservation Significance – Riparian Eucalypt Woodlands

Six vegetation units (C2, C3, C4, C5, C6 and C7) have been defined as *Eucalyptus victrix* and *Eucalyptus camaldulensis* woodland to open woodland. These riparian vegetation units occur along the major ephemeral watercourse and are at risk from similar threats to the *Eucalyptus* forests discussed in Section 5.4.3. These have been classified as units of conservation significance. These vegetation units represent 34% (443 ha) of the study area and are distributed along the length of the creekline except for the easternmost section.

Other vegetation units similarly dominated by *Eucalyptus victrix* and *Eucalyptus camaldulensis* have been recorded in the vicinity of the study area, as indicated in Table 5.2. With regard to the broader extent of such vegetation, riparian vegetation with mixed scattered *Eucalyptus camaldulensis, E. victrix* trees over *Acacia citrinoviridis* tall shrubs/low trees has been recorded over a range of approximately 200 km through the southern half of the Pilbara bioregion, from Caves Creek in the west to the vicinity of Hope Downs in the east (Biota unpubl. data).

Table 5.2: Vegetation units comprising riparian Eucalypts on major ephemeral water courses in the vicinity of the study area.

Location	Distance from Study Area	Broad Description	Area (ha)
West Turner (Biota 2013b)	35 km southeast	*Eucalyptus* spp. woodland over tall open scrub	408.0
West Turner (Biota 2013b)	35 km southeast	*Eucalyptus victrix* low open woodland over tall open shrubland over very open tussock grassland	4.3
Beasley River (Biota 2009c)	9 km south-southeast	*Eucalyptus camaldulensis*, *E. victrix* open woodland over *Acacia citrinoviridis*, *A. coriacea* subsp. *pendens*, *Melaleuca glomerata* tall shrubland over **Cenchrus ciliaris* very open tussock grassland	151.9
Beasley River (Biota 2009c)	9 km south-southeast	*Eucalyptus victrix*, *E. xerothermica* open woodland over *Acacia citrinoviridis* tall closed scrub over **Cenchrus ciliaris* closed tussock grassland	1.6
Boolgeeda Creek (upstream of survey area) (Biota 2005)	3 km northeast	*Eucalyptus victrix*, *E. xerothermica* low open woodland over *Acacia citrinoviridis* tall open shrubland over *Themeda triandra*, *Chrysopogon fallax* tussock grassland	42.9
Caves Creek and Duck Creek (Biota 2012b)	28 km north	*Eucalyptus victrix, E. camaldulensis* low open woodland to closed forest	NA (not mapped).

6.0 Flora

6.1 Overview

A total of 226 native vascular flora taxa from 116 genera belonging to 42 families were recorded in the study area (Appendix 6). Data collected for the quadrats and relevés are provided in Appendix 7.

The most speciose families and genera across both sampling phases are listed in Table 6.1. These are typical of the most well represented families and genera for the Pilbara bioregion.

Table 6.1: The most speciose families and genera recorded within the study area.

Family	No. of Native Taxa
Fabaceae	45
Poaceae	34
Malvaceae	22
Amaranthaceae	14
Asteraceae	10
Chenopodiaceae	10
Genus	No. of Native Taxa
Acacia	21
Senna	12
Ptilotus	7
Abutilon	6

6.2 Flora of Conservation Significance

6.2.1 Threatened Flora

No Threatened Flora listed under the *EPBC Act 1999* or the *Wildlife Conservation Act 1950* have been recorded within the study area and none would be expected to occur (see Section 4.5.1).

6.2.2 Priority Flora

Four Priority species were recorded in the study area: *Goodenia nuda* (P4), *Indigofera* sp. Bungaroo Creek (S. van Leeuwen 4301) (P3), *Pentalepis trichodesmoides* subsp. *hispida* (P2) and *Peplidium* sp. Fortescue Marsh (S. van Leeuwen 4865) (P1). The locations of the four Priority species are provided in Appendix 8 and mapped in Appendix 9.

Goodenia nuda and *Indigofera* sp. Bungaroo Creek (S. van Leeuwen 4301) were previously recorded within 40 km of the study area, and had been considered likely to occur in the study area (Table 4.2). However, neither *Pentalepis trichodesmoides* subsp. *hispida* nor *Peplidium* sp. Fortescue Marsh (S. van Leeuwen 4865) had been previously recorded in the locality. *Pentalepis trichodesmoides* subsp. *hispida* has only recently been discriminated (Orchard and Cross 2012), and subsequently listed as a Priority taxon. This species is likely to be poorly vouchered as a result. *Peplidium* sp. Fortescue Marsh (S. van Leeuwen 4865) is a small annual species, which is currently known from only one other location in the Pilbara. This species would be under-collected due to its habit, and the fact that it would only be recorded during favourable collecting conditions.

Each species is described further below:

- *Goodenia nuda* Priority 4
  Goodenia nuda is an erect to ascending, slender herb growing to 50 cm in height (Plate 6.1 and Plate 6.2), with narrow, pale green glaucous leaves (DPaW 2013). The basal leaves are entire or narrowly toothed. This species is typically found growing near creeklines and in wet areas. Specimens of *Goodenia nuda* were collected from five locations from both creek bed (vegetation units C4 and C7) and floodplain (vegetation units F2 and F5) habitats.

  This species has a broad distribution; most records occur over a range of approximately 450 km through the Pilbara bioregion, with populations known from Karijini and Millstream-Chichester National Parks. There is also an outlying record from the Canning Stock Route in the Gascoyne bioregion.

Plate 6.1: Growth form of *Goodenia nuda*.

Plate 6.2: Flowers of *Goodenia nuda*.

- *Indigofera* sp. Bungaroo Creek (S. van Leeuwen 4301) Priority 3
  Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301) is a perennial shrub that grows to 2 m in height Plate 6.3 and Plate 6.4), and prefers gully and creekline habitats (DPaW 2013). Some 1,626 individuals of this taxon were recorded from 134 locations within the study area. *Indigofera* sp. Bungaroo Creek (S. van Leeuwen) was recorded from both creek bed and floodplain habitats.

Plate 6.3: Growth form of *Indigofera* sp. Bungaroo Creek (S. van Leeuwen 4301).

Plate 6.4: Flowering stem of *Indigofera* sp. Bungaroo Creek (S. van Leeuwen 4301).

- *Pentalepis trichodesmoides* subsp. *hispida* Priority 2
  Pentalepis trichodesmoides subsp. *hispida* is an upright shrub found in *Triodia* hummock grasslands. *Pentalepis trichodesmoides* subsp. *hispida* has only recently been discriminated (Orchard and Cross 2012), and subsequently listed as a Priority taxon. On the basis of the current voucher specimens, this species occurs over a broad range of over 200 km, from the vicinity of Roebourne in the north and Tom Price in the south. Specimens have been collected from both Millstream-Chichester National Park and Karijini National Park. *Pentalepis trichodesmoides* subsp. *hispida* was collected from a floodplain in the central section of the study area (vegetation unit F5), and has also been collected from West Turner (Biota 2013b). It is likely that the range of this species will be extended as further collections are made.

- *Peplidium* sp. Fortescue Marsh (S. van Leeuwen 4865) Priority 1
  Peplidium sp. Fortescue Marsh (S. van Leeuwen 4865) is small herb growing up to 4 cm tall and 30 cm across and it flowers in August (DPaW 2013). One specimen of this taxon was collected from the study area from an open creek bed supporting vegetation unit C3. There is only one other record of this species, from a saline flat on the northern apron of the Fortescue Marsh, approximately 270 km east of the study area. This small annual herb would only be visible for a short period following adequate rainfall, which may explain the lack of additional records of this species from the region.

6.2.3 Unresolved taxa

Other species, while not formally listed as Threatened or Priority flora may be considered to be of conservation interest for a number of reasons; for instance, if they represent apparently new (undescribed) taxa, if they are poorly collected, or the record represents a considerable range extension).

- Malvaceae family

Numerous undescribed taxa within the Malvaceae family have been recorded from the Pilbara bioregion. Four apparently undescribed entities belonging to the genera *Abutilon* and *Gossypium* were identified from the study area, however as these are not yet formally recognised, they have not been separately recognised in the species list (Appendix 6). All of the entities have been recorded from other areas in the Pilbara (Biota internal records). It is not clear at this stage whether these specimens represent new species or simply variations within existing species. Further work (including genetic analysis) would be required to determine their taxonomic status.

  - *Abutilon* aff. *lepidum*

    Two phenotypic variants in the *Abutilon "lepidum"* species complex were identified from the study area; these were informally designated *Abutilon* aff. l*epidum* and *Abutilon* aff. *lepidum* (1) (MET 15 352) using the reference set held by M.E. Trudgen & Associates.

  - *Gossypium australe*

    Two forms of *Gossypium australe* were identified from the study area; these were informally designated *Gossypium australe* (Burrup Peninsula form) and *G. australe* (Whim Creek form) using the reference set held by M.E. Trudgen & Associates. Both entities are widespread in the Pilbara: the former is more common, occurring in drainage areas and on plains, while the latter occurs mainly on hillslopes and rocky areas and can be distinguished by the more dense, felty indumentum on the leaves. Further work is required to allocate formal phrase names to these taxa.

- **Portulaca oleracea/P. intraterranea*

  The taxonomy of "*Portulaca oleracea*" in the Pilbara is currently unresolved. It is not clear whether collections from this region belong to the introduced species **Portulaca oleracea,* the native species *P. intraterranea* and/or one or more undescribed taxa (S. Dillon, WA Herbarium, pers. comm. 2012). For the purpose of this report, all specimens have been allocated to **Portulaca oleracea/P. intraterranea*" and this taxon has been treated as a potential weed species.

6.3 Introduced Flora

Thirteen introduced flora (weed) species were recorded in the study area (see Appendix 8 for the locations and Appendix 10 for their distribution on maps). These species are typically found in creekline systems and habitats disturbed by livestock.

One of the introduced species recorded in the study area, **Argemone ochroleuca* subsp. *ochroleuca*, is listed as a declared pest for the whole of Western Australia under the *Biosecurity and Agriculture Management Act 2007*. However **Cenchrus ciliaris* and **C. setiger* are considered to be serious environmental weeds according to the Draft Environmental Weed Strategy for Western Australia (EWSWA) (CALM 1999) and DPaW's Invasive Plant Prioritisation Process (IPPP) weed list for the Pilbara region (DEC 2012c). Of the other introduced species recorded, those considered to be rapidly invasive by the IPPP are **Argemone ochroleuca* subsp. *ochroleuca*, **Bidens bipinnata*, **Malvastrum americanum*, **Setaria verticillata*, **Sigesbeckia orientalis*, **Sonchus oleraceus*, **Tribulus terrestris* and **Vachellia farnesiana*. Traits for the successful colonisation of invasive weeds include prolific seed production, rapid vegetative reproduction and good seed viability among others.

A brief description of each introduced species is provided in Table 6.2, including an ecological impact and invasiveness rating based on the IPPP recommendation.

Table 6.2: Introduced species recorded in the study area.

Weed Species	Habit	Habitat	Locations	IPPP rating
**Argemone ochroleuca* subsp. *ochroleuca* (Mexican Poppy)	Annual herb growing up to 1 m tall, with yellow, cream or white flowers and deeply divided, large prickly leaves (Hussey et al. 1997). This robust annual is difficult to control as it produces very large quantities of seed, and flooding of its habitat can spread the seed large distances.	Typically occurs in open, gravelly creek beds.	Mexican Poppy is a relatively common weed of major creeklines in the Hamersley subregion. It was recorded from 160 locations in the study area.	Ecological Impact: Low. Invasiveness: Rapid.
**Bidens bipinnata* (Bipinnate Beggartick)	Annual daisy, which grows to 90 cm tall and produces yellow flowers between March and September.	Commonly observed in Mulga vegetation and along creeklines in the Pilbara. It may occur in high densities within suitable habitats and given appropriate conditions, but on its own does not appear to cause exclusion of native flora species.	Bipinnate Beggartick is distributed across the north of the State from Kununurra to Carnarvon and is scattered throughout the Pilbara and Gascoyne regions (Hussey et al. 1997). It was recorded from 1 location in the study area.	Ecological Impact: Unknown. Invasiveness: Rapid.
**Cenchrus ciliaris* (Buffel Grass)	Tufted or sometimes stoloniferous perennial grass growing to a height of 0.2-1.5 m. It produces a purplish inflorescence from February to October. Buffel Grass was introduced by pastoralists as a fodder species. It has demonstrated allelopathic capacities whereby it releases chemicals that inhibit the growth of other plants (Cheam 1984). It is an aggressive and effective competitor with native flora species, forming dense tussock grasslands in susceptible habitats.	Occurs along creeklines, floodplains and in sandy coastal areas.	It is common in the Pilbara, Gascoyne, Carnarvon and Kimberley regions, and is also found throughout desert areas in central Western Australia, as well as in Perth. It was recorded from 153 locations within the study area.	Ecological Impact: High. Invasiveness: Rapid.
**Cenchrus setiger* (Birdwood Grass)	Erect stoloniferous perennial grass usually to 1 m tall, producing cream-purplish flowers from April to May. Less common than Buffel Grass, but appears equally invasive and occurs in many of the same areas.	Occurs along creeklines, floodplains and in sandy coastal areas.	Birdwood Grass occurs mainly in the Pilbara, Gascoyne, Carnarvon and Kimberley regions. It was recorded from seven locations in the study area.	Ecological Impact: High. Invasiveness: Rapid.
**Cucumis melo* subsp. *agrestis* (Ulcardo Melon)	Trailing annual herb with bristly or softly hairy leaves and yellow flowers in autumn and spring. The mature fruit are ellipsoid, 2-5 cm in length, green to yellow in colour, and become glabrescent with age.	Grows in a variety of habitats including grasslands on cracking clays, *Eucalyptus*, *Corymbia*, *Acacia*, or *Grevillea* grassy woodlands on clay flats.	Ulcardo Melon is a widespread weed throughout the Kimberley, Pilbara and Gascoyne bioregions. It was recorded from seven locations in the study area.	Not rated.
**Flaveria trinervia* (Speedy Weed)	Annual, erect herb growing up to 1.5 m tall. The inflorescence consists of a large dense cluster of yellowish flower heads.	This species occurs in a variety of habitats, including drainages and disturbed areas.	Speedy Weed is common in the Pilbara. It was recorded from two locations in the study area.	Not rated.

Weed Species	Habit	Habitat	Locations	IPPP rating
**Malvastrum americanum* (Spiked Malvastrum)	Erect, perennial herb or shrub growing to 1.3 m tall, with yellow or orange flowers produced from April to July.	Common weed of Mulga vegetation, hillsides, floodplains and drainage lines.	Spiked Malvastrum is widespread throughout the Kimberley, Pilbara, Gascoyne and Carnarvon bioregions. It was recorded from 33 locations within the creek system.	Ecological Impact: High. Invasiveness: Rapid.
**Portulaca oleracea* (Purslane)	Succulent, usually prostrate, annual herb that can grow to 20 cm tall. It produces yellow flowers from April to May.	Purslane prefers sandy or clay-loam soils and is often found at sites that have been previously disturbed, although it is also recorded in apparently intact native vegetation.	It is not clear whether the *Portulaca* specimens from the study area represent **P. oleracea, P. intraterranea* or another species. The taxon designated as **Portulaca oleracea / P. intraterranea* was recorded from three locations in the study area.	Not rated.
**Setaria verticillata* (Whorled Pigeon Grass)	Loosely tufted, annual grass species growing to 1.3 m tall with a dense, spike-like inflorescence (Hussey et al. 1997).	Whorled Pigeon Grass is a common species of creeklines and Mulga vegetation in the Pilbara, but rarely occurs in large numbers.	Whorled Pigeon Grass is widespread around the State from Kununurra to Albany. It was recorded from one location in the study area.	Ecological Impact: High. Invasiveness: Rapid.
**Sigesbeckia orientalis* (Indian Weed)	Annual daisy growing to 1 m in height.	Indian Weed has been found in rocky gullies, limestone ranges and creek beds.	Indian Weed occurs from the Pilbara to the Southwest region of Western Australia. It was recorded from one location in the study area.	Ecological Impact: Unknown. Invasiveness: Rapid to Moderate.
**Sonchus oleraceus* (Common Sowthistle)	Erect annual growing to 1.5 m tall with yellow flowers produced year round.	Common Sowthistle is a widespread annual weed of creeklines, floodplains, wasteland and disturbed areas.	Common Sowthistle is common from Exmouth to the Nullarbor and is also found scattered in the Kimberley, Pilbara and Murchison bioregions (Hussey et al. 1997). It was recorded from five locations in the study area.	Ecological Impact: Low. Invasiveness: Rapid.
**Tribulus terrestris* (Caltrop)	Prostrate and villous annual herb producing flowers all year.	Caltrop grows on sandy soils and waste places.	Caltrop is widespread around the State from Kununurra to Albany. It was recorded from one location in the study area.	Ecological Impact: Low. Invasiveness: Slow.

Weed Species	Habit	Habitat	Locations	IPPP rating
**Vachellia farnesiana* (Mimosa Bush)	Spreading, thorny shrub growing to 4 m tall, with dark grey bark, pinnate leaves and yellow flowers in winter.	Mimosa Bush occurs along drainage systems and in adjacent low-lying areas.	Mimosa Bush is widespread from the Kimberley to near Perth. It is thought to have been introduced prior to European settlement and now occurs as scattered shrubs to dense thickets (Hussey et al. 1997). It was recorded from 16 locations in the study area.	Ecological Impact: High. Invasiveness: Rapid.

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7.0 Other Environmental Features

7.1 Ephemeral pools

Ephemeral pools (Plate 7.1 to Plate 7.6) were observed solely in the vicinity of quadrat BRV19 in the western section of the study area in vegetation unit C6. In this part of the creekline, the channel was meandering and flanked on both sides by the slopes of a continuous range of hills. Herds of cattle and donkeys were observed in this locality. It was noted that the density of Buffel Grass (**Cenchrus ciliaris*) in this particular area was higher, albeit grazed, and the native ground cover vegetation was almost non-existent. However, *Eucalyptus victrix* and *E. camaldulensis* subsp. *refulgens* occurred as an open forest to a woodland over a low open woodland to a woodland of *Acacia citrinoviridis*, thus providing a shaded environment. Details on the ephemeral pools are provided in Table 7.1.

Table 7.1: Ephemeral pools observed in the study area.

Feature	Location		Dimension	Associated Species
	Easting	Northing		
Pool 1	494191	7498346	20 m x 25 m	*Melaleuca glomerata, Acacia ampliceps, Schoenoplectus subulatus.*
Pool 2	496225	7498956	5 m x 35 m	*Eucalyptus victrix, Acacia ampliceps, Melaleuca glomerata.*
Pool 3	496452	7499152	3 m x 6 m	*Eucalyptus victrix, Acacia ampliceps, Melaleuca glomerata, Schoenoplectus subulatus.*
Pool 4	496495	7499200	1.5 m x 10 m	*Eucalyptus camaldulensis* subsp. *refulgens, Eucalyptus victrix, Acacia ampliceps, Cyperus vaginatus.*
Pool 5	496652	7499331	25 m x 40 m	*Eucalyptus camaldulensis* subsp. *refulgens, Eucalyptus victrix.*
Pool 6	494035	7498059	5 m x 25 m	*Melaleuca glomerata, Cyperus vaginatus, Schoenoplectus subulatus, Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186).

Plate 7.1: Ephemeral pool 1.

Plate 7.2: Ephemeral pool 2.

Plate 7.3: Ephemeral pool 3.

Plate 7.4: Ephemeral pool 4.

Plate 7.5: Ephemeral pool 5.

Plate 7.6: Ephemeral pool 6.

7.2 Erosion

Pronounced erosion was recorded at three sites, which were located on the braided part of the creek channel where the banks appeared less stable. These sites were in the vicinity of quadrats BRV09 and BRV05 in the eastern section of the study area. The locations of the erosion sites are provided in Table 7.2.

Table 7.2: Locations where erosion was recorded in the study area.

Location		Photograph
Easting	Northing	
517117	7504497	
511488	7503313	 

Location		Photograph
Easting	Northing	
517801	7504371	
		

8.0 Glossary and Acronyms

*	Used prior to a species name to denote a weed species.
Annual (plant)	A plant that lives for only one year.
Braided channel	A braided planform is distinguished by poorly defined channels with numerous interlaced channels that divide and rejoin around unstable bars and small islands.
Conservation Significant	A plant that is recognised to be rare, unusual, new or poorly sampled; may have a formally assigned conservation ranking (see Appendix 1 for more on the WA conservation framework).
Cover value	Species are quantified by estimating the "birds-eye-view" percentage of the ground occupied in a survey area; the percentage is called the cover value.
Cut banks	An eroded, concave bank formed at a bend of a river or creek by the flow of water around the bend.
Cryptic	Plants that die back to a perennial root-stock under dry conditions; considered cryptic (meaning hidden) because although they are consistently present, it is difficult to tell unless suitable conditions prevail.
DEC	Former Department of Environment and Conservation, currently known as Department of Parks and Wildlife.
Dominant species	The species that occur most abundantly in an area or vegetation stratum.
DPaW	Department of Parks and Wildlife, formally known as the Department of Environment and Conservation.
EPA	Environmental Protection Authority of Western Australia.
EPBC Act 1999	The Federal *Environment Protection and Biodiversity Conservation Act 1999.*
Ephemeral	A plant that lives a very short time; less than one year or, usually, less than six months.
Ephemeral pools	Temporary pools of water.
Flora keys	Botanical publications containing a series of questions (regarding the plant's characteristics) aiding in the identification of a taxon.
Foot traverse	Consists of walking through an area to confirm or note the vegetation and/or species presence (usually sampling a narrow corridor/cross section of vegetation).
IBRA	Interim Biogeographical Regionalisation for Australia.
Infraspecific	Taxon designation below species level; e.g. variety (var.) or subspecies (subsp.).
Meandering channel	A meandering planform is characterised by a single and sinuous main channel with a few point bars, cut-banks and well-defined banks.
Opportunistic	A plant species collected from outside the formal quadrat sites; sometimes abbreviated to "Opp."
Perennial	A plant that lives for more than two growing seasons.
PEC	Priority Ecological Community (see Appendix 1 for more on the WA conservation framework).
Planform	Form of a river seen from above; i.e. from a 'bird's eye' or 'plan' view.
Point bar	Accumulation of sediment located on the inside of a meander bend.
Priority flora	Flora listed by DPaW as requiring additional information to properly evaluate their conservation significance; see Appendix 1 for more on the WA conservation framework.
Quadrat	A bounded sample area of uniform vegetation in which all species present are recorded; the standard quadrat size for the Pilbara is 50 m by 50 m, or an equivalent area (2,500 m^2).

Relevé	An unbounded flora sampling site, with a similar area to a quadrat, in which most species present are recorded.
Riparian	Vegetation associated with water and characterised by hydrophilic plants.
Stratum (plural: strata)	A horizontal level of vegetation defined by growth habit (and sometimes height); e.g. low trees, tall trees, tussock grasses, hummock grasses).
Taxon (plural: taxa)	An entity at species level or below.
TEC	Threatened Ecological Community (see Appendix 1 for more on the WA conservation framework).
Threatened flora	Flora protected by legislation, either listed under the Commonwealth *EPBC Act 1999* or the WA *Wildlife Conservation Act 1950* (species formerly known as Declared Rare Flora); see Appendix 1 for more on the WA conservation framework.

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Appendix 1

Framework for Conservation Significance Ranking of Communities and Species in WA

A. Definitions, Categories and Criteria for Threatened and Priority Ecological Communities

1. General Definitions

Ecological Community
A naturally occurring biological assemblage that occurs in a particular type of habitat.

Note: The scale at which biological communities are defined will often depend on the level of detail in the information source, therefore no particular scale is specified.

A threatened ecological community (TEC) is one which is found to fit into one of the following categories; "presumed totally destroyed", "critically endangered", "endangered" or "vulnerable".

Possible threatened ecological communities that do not meet survey criteria are added to DPaW's Priority Ecological Community Lists under Priorities 1, 2 and 3. Ecological Communities that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

An assemblage is a defined group of biological entities.

Habitat is defined as the areas in which an organism and/or assemblage of organisms lives. It includes the abiotic factors (e.g. substrate and topography), and the biotic factors.

Occurrence: a discrete example of an ecological community, separated from other examples of the same community by more than 20 metres of a different ecological community, an artificial surface or a totally destroyed community.

By ensuring that every discrete occurrence is recognised and recorded future changes in status can be readily monitored.

Adequately Surveyed is defined as follows:
"An ecological community that has been searched for thoroughly in most likely habitats, by relevant experts."

Community structure is defined as follows:
"The spatial organisation, construction and arrangement of the biological elements comprising a biological assemblage" (e.g. *Eucalyptus salmonophloia* woodland over scattered small shrubs over dense herbs; structure in a faunal assemblage could refer to trophic structure, e.g. dominance by feeders on detritus as distinct from feeders on live plants).

Definitions of Modification and Destruction of an ecological community:

Modification: "changes to some or all of ecological processes (including abiotic processes such as hydrology), species composition and community structure as a direct or indirect result of human activities. The level of damage involved could be ameliorated naturally or by human intervention."

Destruction: "modification such that reestablishment of ecological processes, species composition and community structure within the range of variability exhibited by the original community is unlikely within the foreseeable future even with positive human intervention."

Note: Modification and destruction are difficult concepts to quantify, and their application will be determined by scientific judgement. Examples of modification and total destruction are cited below:

Modification of ecological processes: The hydrology of Toolibin Lake has been altered by clearing of the catchment such that death of some of the original flora has occurred due to dependence on fresh water. The system may be bought back to a semblance of the original state by redirecting saline runoff and pumping waters of the rising underground watertable away to restore the hydrological balance. Total destruction of downstream lakes has occurred due to hydrology being altered to the point that few of the original flora or fauna species are able to tolerate the level of salinity and/or water logging.

Modification of structure: The understorey of a plant community may be altered by weed invasion due to nutrient enrichment by addition of fertiliser. Should the additional nutrients be removed from the system the balance may be restored, and the original plant species better able to compete. Total destruction may occur if additional nutrients continue to be added to the system causing the understorey to be completely replaced by weed species, and death of overstorey species due to inability to tolerate high nutrient levels.

Modification of species composition: Pollution may cause alteration of the invertebrate species present in a freshwater lake. Removal of pollutants may allow the return of the original inhabitant species. Addition of residual highly toxic substances may cause permanent changes to water quality, and total destruction of the community.

Threatening processes are defined as follows:
"Any process or activity that threatens to destroy or significantly modify the ecological community and/or affect the continuing evolutionary processes within any ecological community."

Examples of some of the continuing threatening processes in Western Australia include: general pollution; competition, predation and change induced in ecological communities as a result of introduced animals; competition and displacement of native plants by introduced species; hydrological changes; inappropriate fire regimes; diseases resulting from introduced micro-organisms; direct human exploitation and disturbance of ecological communities.

Restoration is defined as returning an ecological community to its pre-disturbance or natural state in terms of abiotic conditions, community structure and species composition.

Rehabilitation is defined as the re-establishment of ecological attributes in a damaged ecological community although the community will remain modified.

2. Definitions and Criteria for Presumed Totally Destroyed, Critically Endangered, Endangered and Vulnerable Ecological Communities

ECOLOGICAL COMMUNITIES

Presumed Totally Destroyed (PD)
An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future.

An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies (A or B):

A) Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats or

B) All occurrences recorded within the last 50 years have since been destroyed

Critically Endangered (CR)
An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated.

An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C):

A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply (i or ii):

   i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years);

   ii) modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated.

B) Current distribution is limited, and one or more of the following apply (i, ii or iii):

   i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years);

ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes;

iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes.

C) The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).

Endangered (EN)
An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.

An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B, or C):

A) The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement and either or both of the following apply (i or ii):

i) the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years);

ii) modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated.

B) Current distribution is limited, and one or more of the following apply (i, ii or iii):

i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years);

ii) there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes;

iii) there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes.

C) The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).

Vulnerable (VU)
An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.

An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B or C):

A) The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated.

B) The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations.

C) The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.

3. Definitions and Criteria for Priority Ecological Communities

PRIORITY ECOLOGICAL COMMUNITY LIST
Possible threatened ecological communities that do not meet survey criteria or that are not adequately defined are added to the Priority Ecological Community Lists under Priorities 1, 2 and 3. These three categories are ranked in order of priority for survey and/or definition of the community, and evaluation of conservation status, so that consideration can be given to their declaration as threatened ecological communities. Ecological Communities that are adequately known, and are rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

Priority One: Poorly-known ecological communities
Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.

Priority Two: Poorly-known ecological communities
Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.

Priority Three: Poorly known ecological communities

(i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or:

(ii) communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or;

(iii) communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes.

Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.

Priority Four: Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.

(a) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands.

(b) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.

(c) Ecological communities that have been removed from the list of threatened communities during the past five years.

Priority Five: Conservation Dependent ecological communities
Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

B. Threatened Flora Statutory Framework

In Western Australia, all native flora species are protected under the *Wildlife Conservation Act 1950-1979,* making it an offence to remove or harm native flora species without approval. In addition to this basic level of statutory protection, a number of plant species are assigned an additional level of conservation significance based on the fact that there are a limited number of known populations, some of which may be under threat.

Species of the highest conservation significance are designated Threatened, either extant or presumed extinct:

- X: Presumed Extinct (Threatened Flora - Presumed Extinct): taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently, and have been gazetted as such, following approval by the Minister for the Environment, after recommendation by the State's Endangered Flora Consultative Committee;
- T: Threatened Flora (Threatened Flora - Extant): taxa which have been adequately searched for, and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such, following approval by the Minister for the Environment, after recommendation by the State's Endangered Flora Consultative Committee (Atkins 2008). *(= Threatened Flora = Endangered + Vulnerable)*

Species that appear to be rare or threatened, but for which there is insufficient information to properly evaluate their conservation significance, are assigned to one of four Priority flora categories:

- P1: Priority One - Poorly Known: taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat, e.g. road verges, urban areas, farmland, active mineral leases, etc., or the plants are under threat, e.g. from disease, grazing by feral animals, etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
- P2: Priority Two - Poorly Known: taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
- P3: Priority Three - Poorly Known: taxa which are known from several populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but are in need of further survey.
- P4: Priority Four - Rare: taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5–10 years.
- P5: Priority Five – Conservation Dependent: taxa that are subject to a specific conservation program, the cessation of which would result in the taxon becoming Threatened within five years.

Note that of the above classifications, only 'Threatened' has statutory standing. The Priority Flora classifications are employed by the Department of Environment and Conservation to manage and classify their database of species considered potentially rare or at risk, but these categories have no legislative status. Note also that proposals that appear likely to affect Threatened flora require formal written approval from the Minister for the Environment under Section 23(f) of the *Wildlife Conservation Act 1950-1979* in addition to the requirements of the *Environmental Protection (Native Vegetation Clearing) Regulations 2004*.

Appendix 2

Nature Map Search Results

FAMILY	SPECIES	CONSERVATION STATUS
Acanthaceae	*Dicladanthera forrestii*	
	Rostellularia adscendens var. *clementii*	
	Rostellularia adscendens var. *latifolia*	P4
	Trianthema oxycalyptra var. *oxycalyptra*	
	Zaleya galericulata subsp. *galericulata*	
Amaranthaceae	*Alternanthera angustifolia*	
	Alternanthera denticulata	
	Alternanthera nana	
	Amaranthus cuspidifolius	
	Amaranthus undulatus	
	Gomphrena canescens	
	Gomphrena canescens subsp. *canescens*	
	Gomphrena kanisii	
	Ptilotus aervoides	
	Ptilotus astrolasius	
	Ptilotus auriculifolius	
	Ptilotus calostachyus	
	Ptilotus clementii	
	Ptilotus fusiformis	
	Ptilotus gomphrenoides	
	Ptilotus mollis	P4
	Ptilotus obovatus	
	Ptilotus rotundifolius	
	Ptilotus schwartzii	
	Ptilotus subspinescens	P3
Apiaceae	*Daucus glochidiatus*	
Apocynaceae	*Carissa lanceolata*	
	Cynanchum floribundum	
Araliaceae	*Trachymene oleracea*	
	Trachymene oleracea subsp. *oleracea*	
	Trachymene pilbarensis	
Arecaceae	*Livistona alfredii*	P4
Asphodelaceae	*Bulbine pendula*	
Asteraceae	**Bidens bipinnata*	
	Blumea tenella	
	Calocephalus beardii	
	Calocephalus sp. Wittenoom (A.S. George 1082)	
	Calotis hispidula	
	Centipeda crateriformis subsp. *crateriformis*	
	Centipeda minima	
	Centipeda minima subsp. *macrocephala*	
	Chrysocephalum gilesii	
	**Flaveria trinervia*	
	Helichrysum luteoalbum	
	Iotasperma sessilifolium	P3
	Olearia fluvialis	
	Olearia xerophila	
	Peripleura arida	
	Pluchea rubelliflora	
	Pterocaulon sphacelatum	
	Rhodanthe humboldtiana	
	Rhodanthe margarethae	
	**Sonchus oleraceus*	
	Streptoglossa bubakii	
	Streptoglossa cylindriceps	
	Streptoglossa decurrens	
	Streptoglossa tenuiflora	
Boraginaceae	*Heliotropium crispatum*	

FAMILY	SPECIES	CONSERVATION STATUS
	Heliotropium ovalifolium	
	Heliotropium tanythrix	
	Heliotropium tenuifolium	
	Trichodesma zeylanicum var. *zeylanicum*	
Brassicaceae	*Lepidium muelleri-ferdinandii*	
	Lepidium oxytrichum	
	Lepidium phlebopetalum	
	Lepidium pholidogynum	
	Stenopetalum anfractum	
Campanulaceae	*Lobelia arnhemiaca*	
	Wahlenbergia caryophylloides	
	Wahlenbergia tumidifructa	
Capparaceae	*Capparis lasiantha*	
	Capparis umbonata	
Caryophyllaceae	*Polycarpaea holtzei*	
	Polycarpaea involucrata	
Celastraceae	*Stackhousia intermedia*	
Chenopodiaceae	*Dysphania glomulifera* subsp. *eremaea*	
	Dysphania kalpari	
	Dysphania rhadinostachya subsp. *rhadinostachya*	
	Dysphania sphaerosperma	
	Enchylaena tomentosa var. *tomentosa*	
	Maireana carnosa	
	Maireana eriosphaera	
	Maireana georgei	
	Maireana melanocoma	
	Maireana planifolia	
	Maireana suaedifolia	
	Maireana trichoptera	
	Salsola australis	
	Sclerolaena costata	
	Sclerolaena cuneata	
	Sclerolaena eriacantha	
	Sclerolaena lanicuspis	
	Sclerolaena minuta	
	Tecticornia disarticulata	
Convolvulaceae	*Convolvulus angustissimus*	
	Duperreya commixta	
	Ipomoea muelleri	
	Polymeria ambigua	
	Polymeria longifolia	
Cyperaceae	*Bulbostylis barbata*	
	Bulbostylis turbinata	
	Cyperus cunninghamii	
	Cyperus iria	
	Cyperus squarrosus	
	Eleocharis atropurpurea	
	Eleocharis geniculata	
	Eleocharis spiralis	
	Fimbristylis microcarya	
	Fimbristylis simulans	
	Lipocarpha microcephala	
	Schoenoplectus laevis	
	Schoenoplectus subulatus	
Dilleniaceae	*Hibbertia glaberrima*	
Elatinaceae	*Bergia ammannioides*	
Euphorbiaceae	*Adriana tomentosa*	
	Euphorbia australis	

FAMILY	SPECIES	CONSERVATION STATUS
	Euphorbia boophthona	
	Euphorbia inappendiculata var. *inappendiculata*	
	Euphorbia tannensis subsp. eremophila	
	Euphorbia trigonosperma	
Fabaceae	*Acacia adsurgens*	
	Acacia ampliceps	
	Acacia aneura	
	Acacia aptaneura	
	Acacia arida	
	Acacia atkinsiana	
	Acacia bivenosa	
	Acacia bromilowiana	P4
	Acacia coriacea subsp. *coriacea*	
	Acacia cowleana	
	Acacia elachantha	
	Acacia exilis	
	Acacia hamersleyensis	
	Acacia kempeana	
	Acacia marramamba	
	Acacia monticola	
	Acacia pruinocarpa	
	Acacia pyrifolia	
	Acacia pyrifolia var. *pyrifolia*	
	Acacia sclerosperma subsp. *sclerosperma*	
	Acacia sibirica	
	Acacia spondylophylla	
	Acacia tenuissima	
	Cullen graveolens	
	Cullen leucanthum	
	Cullen leucochaites	
	Cullen pogonocarpum	
	Gastrolobium grandiflorum	
	Glycine canescens	
	Glycine falcata	P3
	Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	P3
	Isotropis atropurpurea	
	Lotus cruentus	
	Mirbelia viminalis	
	Rhynchosia australis	
	Rhynchosia bungarensis	P4
	Rhynchosia minima	
	Senna artemisioides subsp. *oligophylla*	
	Senna glutinosa	
	Senna hamersleyensis	
	Senna stricta	
	Senna symonii	
	Swainsona kingii	
	Swainsona maccullochiana	
	Swainsona thompsoniana	
	Templetonia egena	
	Tephrosia oxalidea	
	Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)	
	Tephrosia sp. Fortescue (A.A. Mitchell 606)	
	Tephrosia sp. NW Eremaean (S. van Leeuwen et al. PBS 0356)	
	Tephrosia stipuligera	

FAMILY	SPECIES	CONSERVATION STATUS
Goodeniaceae	*Dampiera anonyma*	P3
	Dampiera candicans	
	Dampiera dentata	
	Goodenia lamprosperma	
	Goodenia microptera	
	Goodenia muelleriana	
	Goodenia pascua	
	Goodenia stellata	
	Goodenia stobbsiana	
	Goodenia tenuiloba	
	Scaevola acacioides	
Gyrostemonaceae	*Codonocarpus cotinifolius*	
Haloragaceae	*Haloragis gossei*	
	Haloragis gossei var. *inflata*	
	Haloragis maierae	
Hydrocharitaceae	*Najas tenuifolia*	
Lamiaceae	*Prostanthera albiflora*	
Loranthaceae	*Amyema fitzgeraldii*	
	Amyema miquelii	
	Amyema sp. Fortescue (M.E. Trudgen 5358)	
	Diplatia grandibractea	
	Lysiana casuarinae	
Malvaceae	*Abutilon amplum*	
	Abutilon malvifolium	
	Abutilon sp. Pilbara (W.R. Barker 2025)	
	Androcalva luteiflora	
	Brachychiton acuminatus	
	Brachychiton gregorii	
	Corchorus crozophorifolius	
	Corchorus lasiocarpus subsp. *parvus*	
	Corchorus sidoides	
	Corchorus tridens	
	Gossypium australe	
	Gossypium sturtianum var. *sturtianum*	
	Hibiscus coatesii	
	Hibiscus goldsworthii	
	Hibiscus leptocladus	
	Hibiscus sp. Mt Brockman (E. Thoma ET 1354)	P1
	Hibiscus sturtii var. campylochlamys	
	Keraudrenia nephrosperma	
	Keraudrenia velutina subsp. elliptica	
	Lawrencia densiflora	
	**Malvastrum americanum*	
	**Melochia pyramidata*	
	Sida arsiniata	
	Sida echinocarpa	
	Sida fibulifera	
	Sida sp. Articulation below (A.A. Mitchell PRP 1605)	
	Sida sp. Barlee Range (S. van Leeuwen 1642)	P3
	Sida sp. Hamersley Range (K. Newbey 10692)	P1
	Sida sp. Shovelanna Hill (S. van Leeuwen 3842)	
	Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)	
	Sida sp. verrucose glands (F.H. Mollemans 2423)	
	Sida spinosa	
	Sida trichopoda	
	Triumfetta clementii	
	Triumfetta leptacantha	
	Waltheria indica	

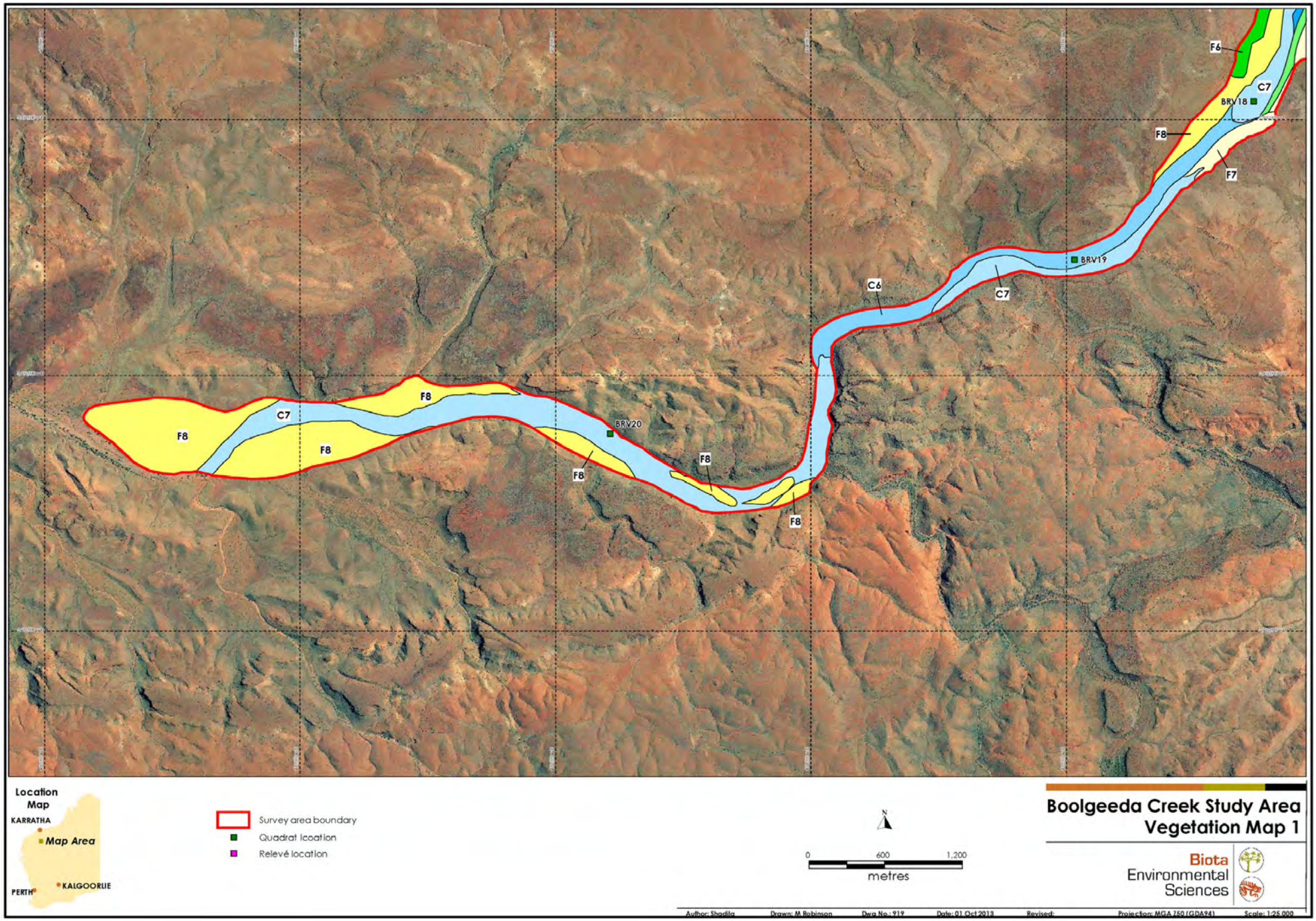
FAMILY	SPECIES	CONSERVATION STATUS
	Waltheria virgata	
Marsileaceae	*Marsilea hirsuta*	
Molluginaceae	*Glinus lotoides*	
	Mollugo molluginea	
Moraceae	*Ficus brachypoda*	
Myrtaceae	*Calytrix carinata*	
	Corymbia deserticola	
	Corymbia hamersleyana	
	Eucalyptus camaldulensis subsp. *obtusa*	
	Eucalyptus camaldulensis subsp. *refulgens*	
	Eucalyptus kingsmillii subsp. *kingsmillii*	
	Eucalyptus leucophloia	
	Eucalyptus leucophloia subsp. *leucophloia*	
	Eucalyptus lucasii	
	Eucalyptus pilbarensis	
	Eucalyptus socialis	
	Eucalyptus trivalva	
	Melaleuca bracteata	
	Melaleuca glomerata	
	Melaleuca leiocarpa	
Nyctaginaceae	*Boerhavia repleta*	
	Boerhavia schomburgkiana	
Oleaceae	*Jasminum didymum* subsp. *lineare*	
Papaveraceae	**Argemone ochroleuca* subsp. *ochroleuca*	
Phrymaceae	*Peplidium muelleri*	
Phyllanthaceae	*Notoleptopus decaisnei* var. Orbicularis (A.B. Craig 428)	
Plantaginaceae	*Plantago cunninghamii*	
	Stemodia grossa	
Poaceae	*Aristida contorta*	
	Aristida holathera	
	Aristida latifolia	
	Astrebla elymoides	
	Astrebla lappacea	P3
	Bothriochloa ewartiana	
	Brachyachne convergens	
	Brachyachne prostrata	
	Chloris pectinata	
	Chloris pumilio	
	Cymbopogon obtectus	
	Dactyloctenium radulans	
	Dichanthium fecundum	
	Dichanthium sericeum subsp. *humilius*	
	Digitaria ammophila	
	Elytrophorus spicatus	
	Enneapogon avenaceus	
	Enneapogon caerulescens	
	Enneapogon lindleyanus	
	Enneapogon polyphyllus	
	Enneapogon robustissimus	
	Eragrostis exigua	
	Eragrostis setifolia	
	Eragrostis tenellula	
	Eragrostis xerophila	
	Eriachne aristidea	
	Eriachne benthamii	
	Eriachne flaccida	
	Eriachne mucronata	

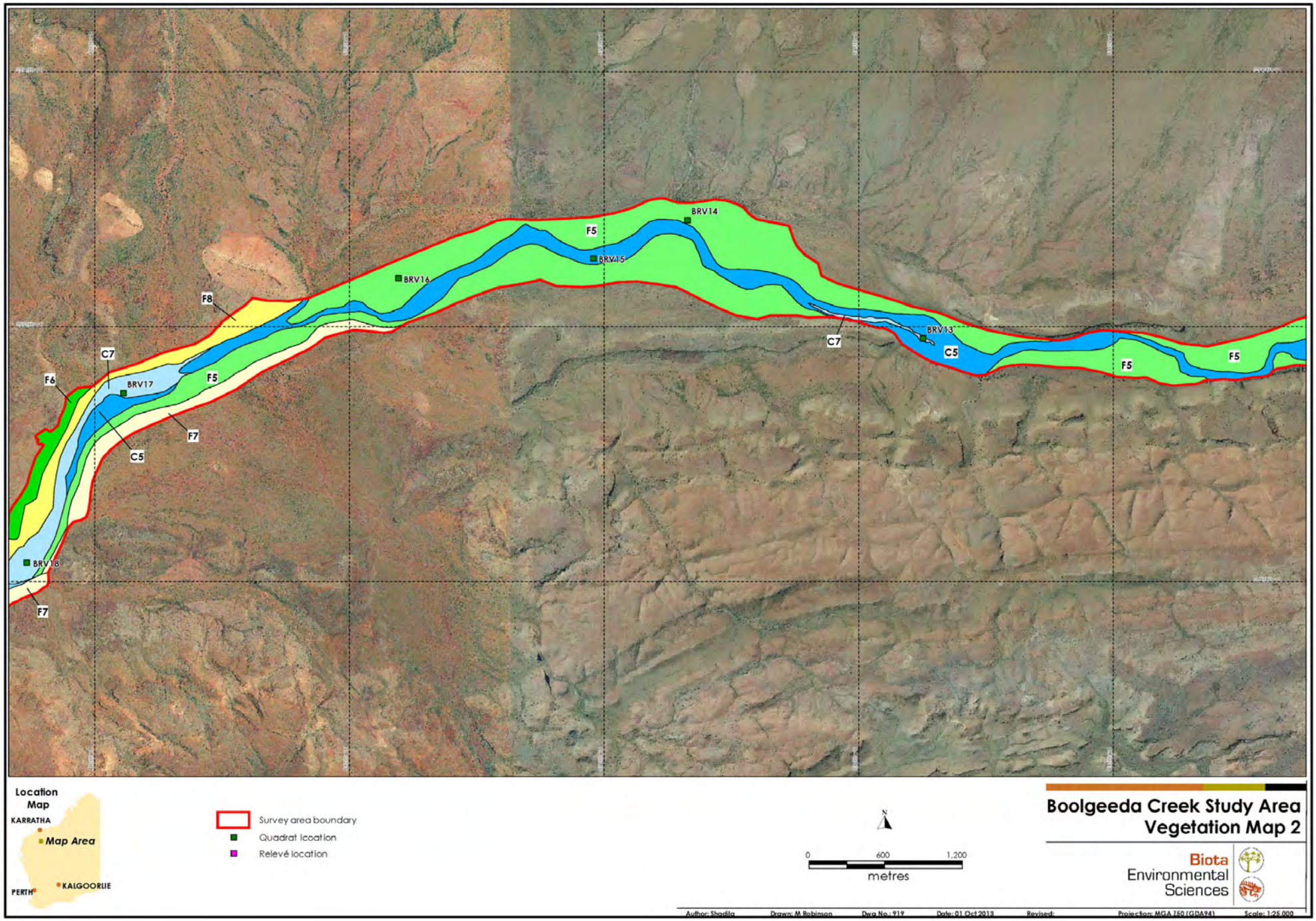
FAMILY	SPECIES	CONSERVATION STATUS
	Eriachne pulchella subsp. *pulchella*	
	Eulalia aurea	
	Iseilema dolichotrichum	
	Iseilema fragile	
	Iseilema macratherum	
	Iseilema vaginiflorum	
	Paspalidium clementii	
	Setaria dielsii	
	Sporobolus australasicus	
	Themeda sp. Hamersley Station (M.E. Trudgen 11431)	P3
	Triodia angusta	
	Triodia epactia	
	Triodia longiceps	
	Triodia sp. Robe River (M.E. Trudgen et al. MET 12367)	P3
	Triodia wiseana	
	Triraphis mollis	
Polygalaceae	*Polygala glaucifolia*	
Portulacaceae	**Portulaca oleracea*	
Primulaceae	*Samolus* sp. Millstream (M.I.H. Brooker 2076)	
Proteaceae	*Grevillea pyramidalis*	
	Grevillea sp. Turee (J. Bull & G. Hopkinson ONS JJ 01.01)	P1
	Grevillea striata	
Pteridaceae	*Cheilanthes sieberi* subsp. *sieberi*	
Rhamnaceae	*Cryptandra monticola*	
Rubiaceae	*Oldenlandia crouchiana*	
	Pomax rupestris	
Sapindaceae	*Dodonaea coriacea*	
	Dodonaea lanceolata var. *lanceolata*	
	Dodonaea pachyneura	
	Dodonaea petiolaris	
	Dodonaea viscosa subsp. *mucronata*	
Scrophulariaceae	*Eremophila cuneifolia*	
	Eremophila forrestii	
	Eremophila forrestii subsp. *hastieana*	
	Eremophila fraseri subsp. *fraseri*	
	Eremophila latrobei subsp. *filiformis*	
	Eremophila latrobei subsp. *glabra*	
	Eremophila latrobei subsp. *latrobei*	
	Eremophila magnifica subsp. *magnifica*	
	Eremophila magnifica subsp. *velutina*	
	Eremophila tietkensii	
Solanaceae	**Datura leichhardtii*	
	Nicotiana occidentalis	
	Nicotiana rosulata	
	Nicotiana umbratica	
	Solanum diversiflorum	
	Solanum horridum	
	Solanum lasiophyllum	
Stylidiaceae	*Stylidium fluminense*	
Thymelaeaceae	*Pimelea ammocharis*	
	Pimelea forrestiana	
Violaceae	*Hybanthus aurantiacus*	
Zygophyllaceae	*Zygophyllum iodocarpum*	

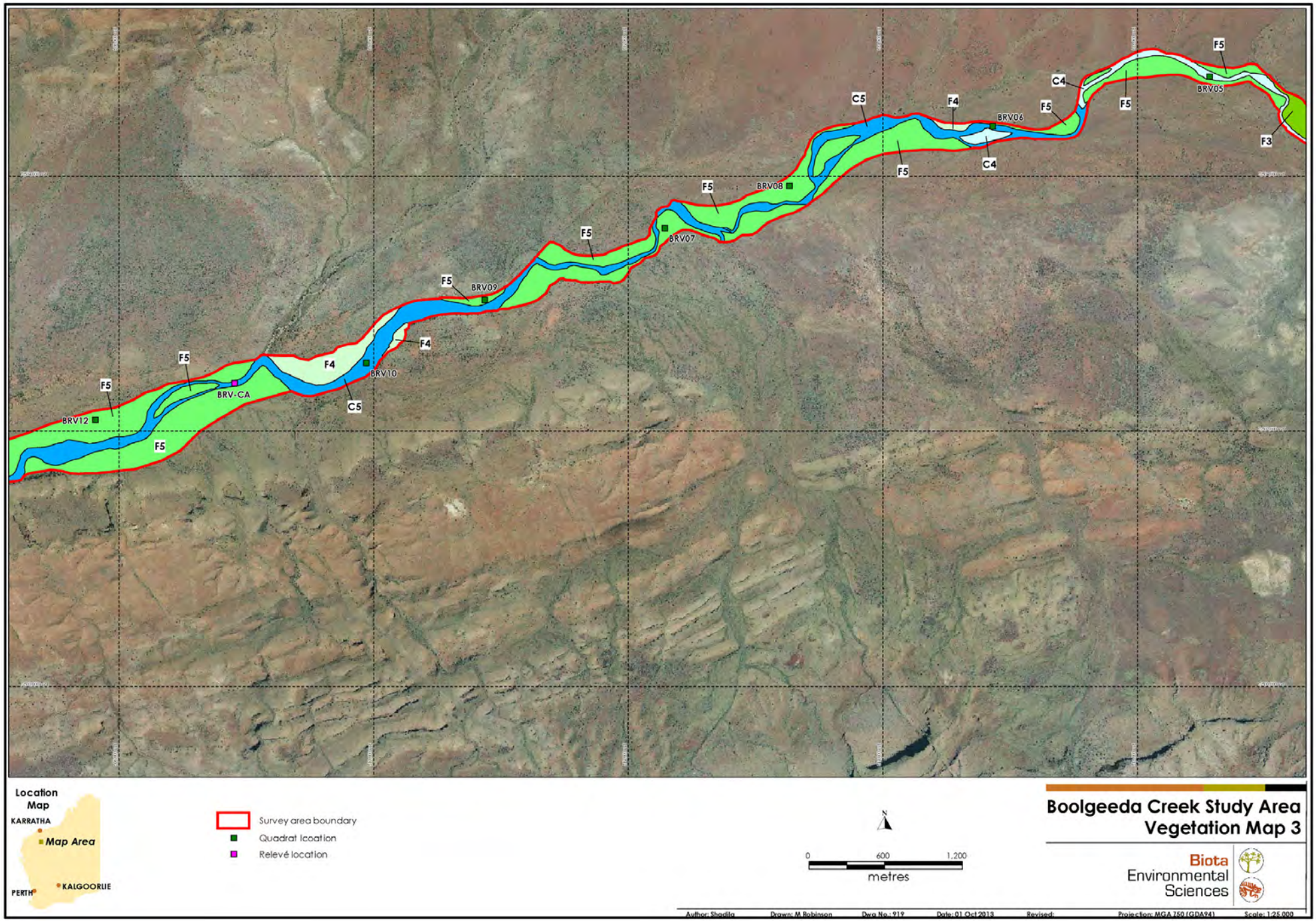
* denotes an introduced (weed) species.

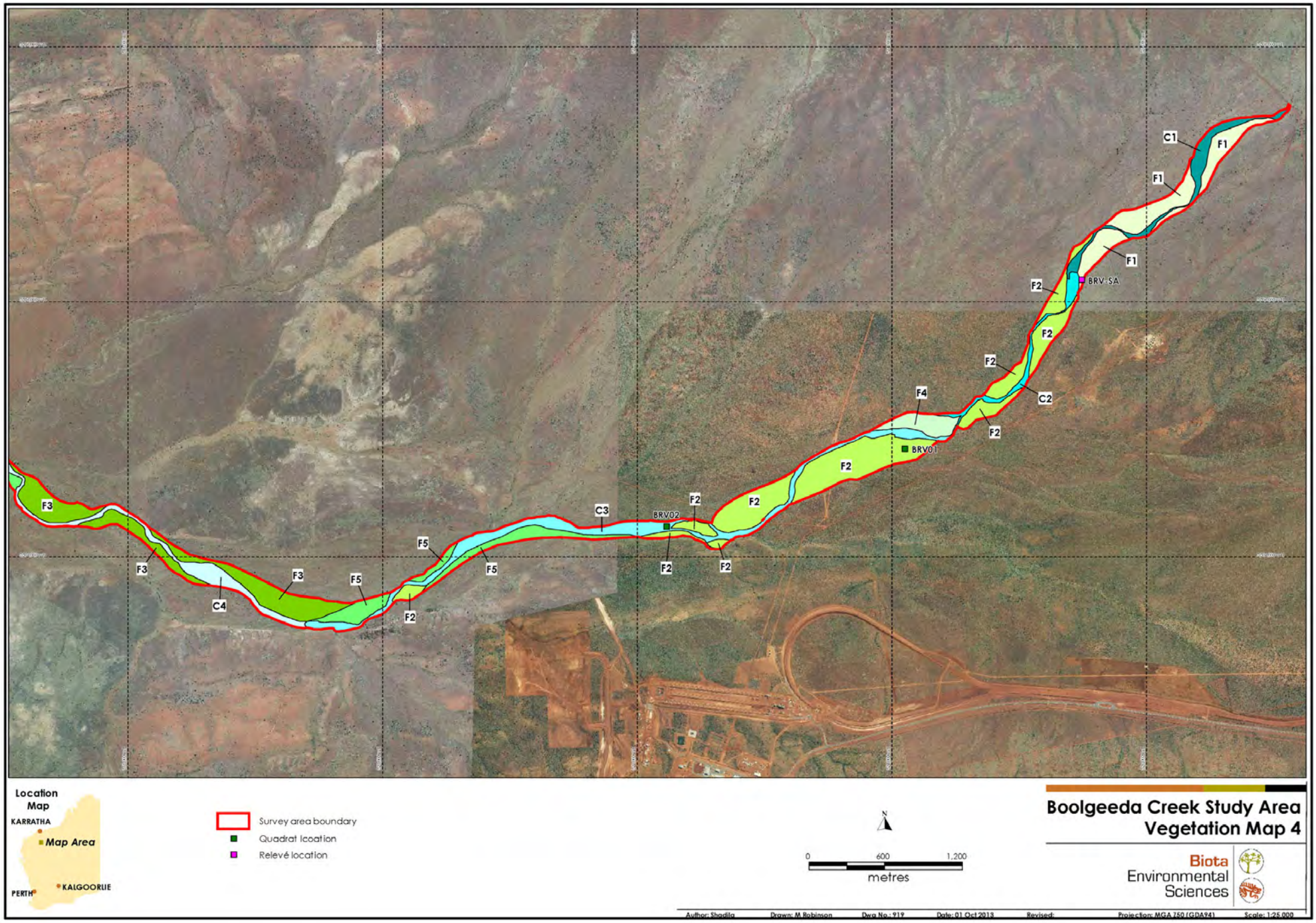
Appendix 3

Vegetation Maps of the Study Area, with Locations of Quadrats and Relevés


F6
C7
BRV18
F8
F7
BRV19
C6
C7
F8
C7
F8
BRV20
F8
F8
F8
Location Map
KARRATHA
Map Area
PERTH
KALGOORLIE
Survey area boundary
Quadrat location
Relevé location
0
600
1,200
metres
Boolgeeda Creek Study Area
Vegetation Map 1
Biota
Environmental
Sciences
Author: Shadila
Drawn: M Robinson
Dwg No.: 919
Date: 01 Oct 2013
Revised:
Projection: MGA 50 (GDA94)
Scale: 1:25,000


BRV14
F5
BRV15
BRV16
F8
C7
BRV13
C5
F5
F5
F6
C7
BRV17
F5
F7
C5
BRV18
F7
Location Map
KARRATHA
Map Area
PERTH
KALGOORLIE
Survey area boundary
Quadrat location
Relevé location
0
600
1,200
metres
Boolgeeda Creek Study Area
Vegetation Map 2
Biota
Environmental
Sciences
Author: Shadila
Drawn: M Robinson
Dwg No.: 919
Date: 01 Oct 2013
Revised:
Projection: MGA Z50 (GDA94)
Scale: 1:25,000


F5
C4
F5
BRV05
F3
C5
F4
F5
BRV06
C4
F5
BRV08
F5
BRV07
F5
F5
BRV09
F4
F4
BRV10
C5
F5
BRV-CA
F5
BRV12
F5
Location Map
KARRATHA
Map Area
PERTH
KALGOORLIE
Survey area boundary
Quadrat location
Relevé location
N
0
600
1,200
metres
Boolgeeda Creek Study Area
Vegetation Map 3
Biota Environmental Sciences
Author: Shadila
Drawn: M Robinson
Dwg No: 919
Date: 01 Oct 2013
Revised:
Projection: MGA 50 (GDA94)
Scale: 1:25,000


C1
F1
F1
F1
BRV-SA
F2
F2
F2
C2
F4
F2
BRV01
F2
F2
F2
C3
BRV02
F2
F2
F5
F5
F5
F3
F3
F3
C4
F2
Location Map
KARRATHA
Map Area
PERTH
KALGOORLIE
Survey area boundary
Quadrat location
Relevé location
0
600
1,200
metres
Boolgeeda Creek Study Area
Vegetation Map 4
Biota Environmental Sciences
Author: Shadila
Drawn: M Robinson
Dwg No: 919
Date: 01 Oct 2013
Revised:
Projection: MGA Z50 (GDA94)
Scale: 1:25,000

Vegetation of Brockman 4 Riparian

Vegetation of Creeklines

C1: ChAciAtuGOr

Corymbia hamersleyana open woodland over *Acacia citriniviridis* low open woodland over *A. tumida*, *Gossypium robinsonii* scattered tall shrubs

C2: EvAciAtuAPyTHtTe

Eucalyptus victrix open woodland over *Acacia citrinoviridis* scattered low trees over *A. tumida*, *A. bivenosa*, *A. pyrifolia* tall open shrubland over *Themeda triandra* very open tussock grassland over *Triodia epactia* very open hummock grassland

C3: EvEcAciAPyTErEUa

Eucalyptus victrix, *E. camaldulensis* open woodland over *Acacia citrinoviridis* low open woodland over *A. pyrifolia* tall open shrubland over *Tephrosia rosea* low open shrubland over very open mixed herbland over *Eulalia aurea* open tussock grassland

C4: EvEcAciEUa

Eucalyptus victrix, *E. camaldulensis* woodland over *Acacia citrinoviridis* low open woodland over *Eulalia aurea* very open tussock grassland over very open mixed herbland

C5: EvEcAciCEc

Eucalyptus victrix, *E. camaldulensis* woodland over *Acacia citrinoviridis* low open woodland over **Cenchrus ciliaris* scattered tussock grasses

C6: EvEcAciMgAam

Eucalyptus victrix, *E. camaldulensis* woodland over *Acacia citrinoviridis* low open woodland over *Melaluca glomerata*, *Acacia ampliceps* tall shrubland

C7: EvEcAciMgCEcTe

Eucalyptus victrix, *E. camaldulensis* woodland over *Acacia citrinoviridis* low open woodland over *Melaluca glomerata* tall shrubland over **Cenchrus ciliaris* scattered tussock grasses over *Triodia epactia* scattered hummock grasses

Vegetation Type Descriptions for the Brockman 4 Riparian Vegetation Maps

Legend Sheet 1

Biota Environmental Sciences

Vegetation of Brockman 4 Riparian

Vegetation of Floodplains

F1: ChAciAtuGOrCEcTe — *Corymbia hamersleyana* open woodland over *Acacia citrinoviridis* low open woodland over *A. tumida*, *Gossypium robinsonii* scattered tall shrubs over **Cenchrus ciliaris* open tussock grassland over *Triodia epactia* scattered hummock grasses

F2: AciAPyTErTHtCEcTe — *Acacia citrinoviridis* low open woodland over *A. pyrifolia* tall open shrubland over *Tephrosia rosea* low open shrub over *Themeda triandra*, **Cenchrus ciliaris* tussock grassland over *Triodia epactia* very open hummock grassland

F3: AciAPyEUaTHtCEcTe — *Acacia citrinoviridis* low open woodland over *A. pyrifolia* tall open shrubland over *Eulalia aurea*, *Themeda triandra* **Cenchrus ciliaris* tussock grassland over *Triodia epactia* very open hummock grassland

F4: ChAciAPyCEcTe — *Corymbia hamersleyana* scattered trees over *Acacia citrinoviridis* low woodland over *A. pyrifolia* tall shrubland over **Cenchrus ciliaris* open tussock grassland over *Triodia epactia* open hummock grassland

F5: AciAPyCEcTe — *Acacia citrinoviridis* open woodland over *A. pyrifolia* tall open shrubland over **Cenchrus ciliaris* open tussock grassland over *Triodia epactia* very open hummock grassland

F6: PlAsclTe — *Petalosylis labicheoides*, *Acacia sclerosperma* tall open shrubland over *Triodia epactia* very open hummock grassland

F7: ChAciPlAsclCEcTe — *Corymbia hamersleyana* scattered trees over *Acacia citrinoviridis* low woodland over *A. pyrifolia*, *Petalostylis labicheoides*, *A. sclerosperma* tall shrubland over **Cenchrus ciliaris* open tussock grassland over *Triodia epactia* scattered hummock grasses

F8: AciAPyPlCEcTe — *Acacia citrinoviridis* open woodland over *A. pyrifolia*, *Petalostylis labicheoides* tall open shrubland over **Cenchrus ciliaris* open tussock grassland over *Triodia epactia* very open hummock grassland

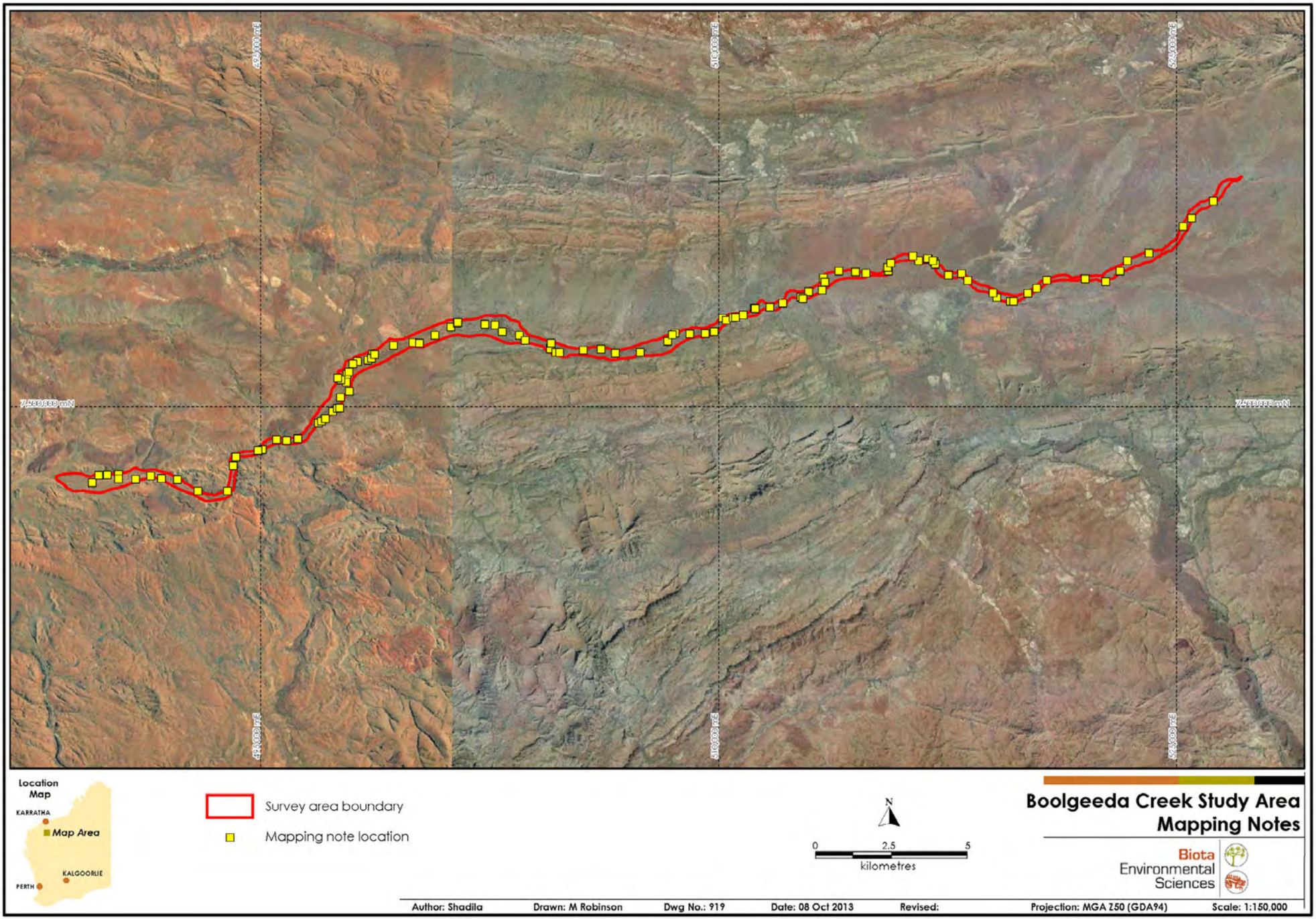
Vegetation Type Descriptions for the Brockman 4 Riparian Vegetation Maps

Legend Sheet 2

Biota Environmental Sciences

Appendix 4

Location of Mapping Notes Recorded within the Study Area


Location Map
KARRATHA
Map Area
KALGOORLIE
PERTH
Survey area boundary
Mapping note location
N
0
2.5
5
kilometres
Boolgeeda Creek Study Area
Mapping Notes
Biota Environmental Sciences
Author: Shadila
Drawn: M Robinson
Dwg No.: 919
Date: 08 Oct 2013
Revised:
Projection: MGA 50 (GDA94)
Scale: 1:150,000

Appendix 5

Vegetation Structural Classes and Condition Scale

Vegetation Structural Classes*

Stratum	Canopy Cover (%)				
	70-100%	30-70%	10-30%	2-10%	<2%
Trees over 30 m	Tall closed forest	Tall open forest	Tall woodland	Tall open woodland	Scattered tall trees
Trees 10-30 m	Closed forest	Open forest	Woodland	Open woodland	Scattered trees
Trees under 10 m	Low closed forest	Low open forest	Low woodland	Low open woodland	Scattered low trees
Shrubs over 2 m	Tall closed scrub	Tall open scrub	Tall shrubland	Tall open shrubland	Scattered tall shrubs
Shrubs 1-2 m	Closed heath	Open heath	Shrubland	Open shrubland	Scattered shrubs
Shrubs under 1 m	Low closed heath	Low open heath	Low shrubland	Low open shrubland	Scattered low shrubs
Hummock grasses	Closed hummock grassland	Hummock grassland	Open hummock grassland	Very open hummock grassland	Scattered hummock grasses
Grasses, Sedges, Herbs	Closed tussock grassland / bunch grassland / sedgeland / herbland	Tussock grassland / bunch grassland / sedgeland / herbland	Open tussock grassland / bunch grassland / sedgeland / herbland	Very open tussock grassland / bunch grassland / sedgeland / herbland	Scattered tussock grasses / bunch grasses / sedges / herbs

* Based on Muir (1977), and Aplin's (1979) modification of the vegetation classification system of Specht (1970): Aplin T.E.H. (1979). The Flora. Chapter 3 *In* O'Brien, B.J. (ed.) (1979). *Environment and Science.* University of Western Australia Press; Muir B.G. (1977). Biological Survey of the Western Australian Wheatbelt. Part II: Vegetation and habitat of Bendering Reserve. *Records of the Western Australian Museum, Suppl.* No. 3; Specht R.L. (1970). Vegetation. *In The Australian Environment.* 4th edn (Ed. G.W. Leeper). Melbourne.

Vegetation Condition Scale*

E = Excellent (=Pristine of BushForever) Pristine or nearly so; no obvious signs of damage caused by the activities of European man.
VG = Very Good (= Excellent of BushForever) Some relatively slight signs of damage caused by the activities of European man. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds such as **Bidens bipinnata* or **Malvastrum americanum*, or occasional vehicle tracks.
G = Good (= Very Good of BushForever) More obvious signs of damage caused by the activities of European man, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or by selective logging. Weeds as above, possibly plus some more aggressive ones such as **Cenchrus* spp.
P = Poor (= Good of BushForever) Still retains basic vegetation structure or ability to regenerate to it after very obvious impacts of activities of European man, such as grazing, partial clearing (chaining) or frequent fires. Weeds as above, probably plus some more aggressive ones such as **Cenchrus* spp.
VP = Very Poor (= Degraded of BushForever) Severely impacted by grazing, very frequent fires, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species including very aggressive species.
D = Completely Degraded (= Completely Degraded of BushForever) Areas that are completely or almost completely without native species in the structure of their vegetation; i.e. areas that are cleared or 'parkland cleared' with their flora comprising weed or crop species with isolated native trees or shrubs.

Based on Trudgen M.E. (1988). A Report on the Flora and Vegetation of the Port Kennedy Area. Unpublished report prepared for Bowman Bishaw and Associates, West Perth

Appendix 6

Vascular Flora Species List

*Denotes introduced (weed) species.

Family: Acanthaceae

Dicladanthera forrestii
Dipteracanthus australasicus subsp. *australasicus*
Rostellularia adscendens var. *clementii*

Family: Amaranthaceae

Alternanthera denticulata
Alternanthera nana
Amaranthus cuspidifolius
Amaranthus undulatus
Gomphrena canescens subsp. *canescens*
Gomphrena cunninghamii
Gomphrena kanisii
Ptilotus astrolasius
Ptilotus calostachyus
Ptilotus fusiformis
Ptilotus nobilis subsp. *nobilis*
Ptilotus obovatus var. *obovatus*
Ptilotus polystachyus
Ptilotus rotundifolius

Family: Apocynaceae

Cynanchum pedunculatum

Family: Araliaceae

Trachymene oleracea subsp. *oleracea*

Family: Asteraceae

**Bidens bipinnata*
Centipeda minima subsp. *macrocephala*
Chrysocephalum apiculatum
**Flaveria trinervia*
Helichrysum luteoalbum
Pentalepis trichodesmoides subsp. *hispida* Priority 2
Peripleura arida
Pluchea dentex
Pluchea rubelliflora
Pterocaulon sphacelatum
Rutidosis helichrysoides subsp. *helichrysoides*
**Sigesbeckia orientalis*
**Sonchus oleraceus*
Streptoglossa decurrens

Family: Boraginaceae

Ehretia saligna var. *saligna*
Heliotropium cunninghamii
Heliotropium pachyphyllum
Trichodesma zeylanicum var. *zeylanicum*

Family: Brassicaceae

Lepidium muelleri-ferdinandii

Family: Campanulaceae

Wahlenbergia tumidifructa

Family: Capparaceae

Capparis lasiantha
Capparis spinosa var. *nummularia*

Family: Caryophyllaceae

Polycarpaea holtzei
Polycarpaea longiflora

Family: Chenopodiaceae

Dysphania rhadinostachya subsp. *inflata*
Dysphania rhadinostachya subsp. *rhadinostachya*
Enchylaena tomentosa var. *tomentosa*
Maireana georgei
Maireana melanocoma
Maireana planifolia x *villosa*
Maireana triptera
Salsola australis
Sclerolaena cornishiana
Sclerolaena densiflora

Family: Cleomaceae

Cleome viscosa

Family: Convolvulaceae

Bonamia erecta
Convolvulus clementii
Convolvulus remotus
Duperreya commixta
Evolvulus alsinoides var. *decumbens*
Evolvulus alsinoides var. *villosicalyx*
Ipomoea muelleri
Operculina aequisepala
Polymeria ambigua

Family: Cucurbitaceae

**Cucumis melo* subsp. *agrestis*
Cucumis variabilis

Family: Cyperaceae

Bulbostylis barbata
Bulbostylis turbinata
Cyperus vaginatus
Fimbristylis simulans
Lipocarpha microcephala
Schoenoplectus subulatus

Family: Elatinaceae

Bergia pedicellaris
Bergia trimera

Family: Euphorbiaceae

Adriana tomentosa var. *tomentosa*
Euphorbia australis var. *erythrantha*
Euphorbia australis var. *subtomentosa*
Euphorbia biconvexa
Euphorbia coghlanii
Euphorbia trigonosperma

Family: Fabaceae

Acacia ampliceps
Acacia ancistrocarpa
Acacia atkinsiana
Acacia bivenosa
Acacia citrinoviridis
Acacia coriacea subsp. *pendens*
Acacia exilis
Acacia inaequilatera
Acacia maitlandii
Acacia marramamba
Acacia orthocarpa
Acacia pyrifolia

Family: Fabaceae (cont.)

Acacia pyrifolia var. *morrisonii*
Acacia pyrifolia var. *pyrifolia*
Acacia sclerosperma subsp. *sclerosperma*
Acacia synchronicia
Acacia tenuissima
Acacia tetragonophylla
Acacia tumida var. *pilbarensis*
Acacia victoriae var. *victoriae*
Crotalaria medicaginea var. *neglecta*
Cullen leucanthum
Glycine canescens
Indigofera colutea
Indigofera monophylla
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301) Priority 3
Isotropis atropurpurea
Petalostylis labicheoides
Rhynchosia minima
Senna artemisioides subsp. *helmsii*
Senna artemisioides subsp. *oligophylla* x *S. artemisioides* subsp. *helmsii*
Senna artemisioides subsp. *oligophylla*
Senna glaucifolia
Senna glutinosa subsp. *glutinosa*
Senna glutinosa subsp. *glutinosa* x *Senna stricta*
Senna glutinosa subsp. *pruinosa*
Senna glutinosa subsp. *luerssenii* x *Senna stricta*
Senna glutinosa subsp. x *luerssenii*
Senna notabilis
Senna sp. Meekatharra (E. Bailey 1-26)
Senna stricta
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186) PN
**Vachellia farnesiana*
Vigna lanceolata var. *lanceolata*

Family: Goodeniaceae

Goodenia forrestii
Goodenia lamprosperma
Goodenia microptera
Goodenia nuda Priority 4
Goodenia stobbsiana
Goodenia triodiophila

Family: Gyrostemonaceae

Codonocarpus cotinifolius

Family: Loranthaceae

Amyema sanguinea var. *sanguinea*

Family: Lythraceae

Ammannia baccifera

Family: Malvaceae

Abutilon aff. *Lepidum*
Abutilon amplum
Abutilon fraseri subsp. *fraseri*
Abutilon otocarpum
Abutilon sp. Dioicum (A.A. Mitchell PRP 1618) PN
Abutilon sp. Pilbara (W.R. Barker 2025)
Androcalva luteiflora
Corchorus crozophorifolius
Corchorus lasiocarpus subsp. *parvus*
Gossypium australe

Family: Malvaceae (cont.)
- *Gossypium robinsonii*
- *Gossypium sturtianum* var. *sturtianum*
- *Hibiscus sturtii* var. *grandiflorus*
- **Malvastrum americanum*
- *Melhania oblongifolia*
- *Sida* aff. *fibulifera*
- *Sida arsiniata*
- *Sida clementii*
- *Sida fibulifera*
- *Sida* sp. spiciform panicles (E. Leyland s.n. 14/8/90)
- *Sida* sp. verrucose glands (F.H. Mollemans 2423)
- *Triumfetta clementii*
- *Waltheria indica*

Family: Marsileaceae
- *Marsilea hirsuta*

Family: Molluginaceae
- *Glinus lotoides*
- *Mollugo molluginea*

Family: Myrtaceae
- *Corymbia hamersleyana*
- *Eucalyptus camaldulensis* subsp. *refulgens*
- *Eucalyptus leucophloia* subsp. *leucophloia*
- *Eucalyptus victrix*
- *Eucalyptus* sp.
- *Melaleuca glomerata*

Family: Nyctaginaceae
- *Boerhavia coccinea*
- *Boerhavia repleta*
- *Boerhavia* sp.

Family: Oleaceae
- *Jasminum didymum* subsp. *lineare*

Family: Papaveraceae
- **Argemone ochroleuca* subsp. *ochroleuca*

Family: Phrymaceae
- *Mimulus gracilis*
- *Peplidium* sp. Fortescue Marsh (S. van Leeuwen 4865) Priority 1

Family: Phyllanthaceae
- *Notoleptopus decaisnei* var. *decaisnei*
- *Notoleptopus decaisnei* var. *orbicularis* (A.B. Craig 428)
- *Phyllanthus erwinii*
- *Phyllanthus exilis*
- *Phyllanthus maderaspatensis*

Family: Plantaginaceae
- *Stemodia grossa*

Family: Poaceae
- *Aristida contorta*
- *Aristida holathera* var. *holathera*
- *Bothriochloa ewartiana*
- **Cenchrus ciliaris*
- **Cenchrus setiger*
- *Chrysopogon fallax*
- *Cymbopogon ambiguus*
- *Cymbopogon procerus*
- *Cymbopogon* sp.
- *Dichanthium sericeum* subsp. *humilius*

Family: Poaceae (cont.)
- *Digitaria brownii*
- *Digitaria ctenantha*
- *Elytrophorus spicatus*
- *Enneapogon caerulescens*
- *Enneapogon lindleyanus*
- *Enneapogon polyphyllus*
- *Enneapogon robustissimus*
- *Enteropogon ramosus*
- *Eragrostis cumingii*
- *Eragrostis eriopoda*
- *Eragrostis leptocarpa*
- *Eragrostis tenellula*
- *Eriachne aristidea*
- *Eriachne mucronata*
- *Eriachne pulchella*
- *Eriachne tenuiculmis*
- *Eulalia aurea*
- *Paraneurachne muelleri*
- *Paspalidium clementii*
- **Setaria verticillata*
- *Sporobolus australasicus*
- *Themeda triandra*
- *Triodia angusta*
- *Triodia epactia*
- *Triodia longiceps*
- *Triodia wiseana*
- *Triraphis mollis*

Family: Portulacaceae
- *Calandrinia ptychosperma*
- **Portulaca oleracea/intraterranea*

Family: Proteaceae
- *Grevillea berryana*
- *Grevillea pyramidalis* subsp. *leucadendron*
- *Grevillea wickhamii* (sterile material)
- *Hakea lorea* subsp. *lorea*

Family: Rubiaceae
- *Oldenlandia crouchiana*
- *Oldenlandia galioides*
- *Synaptantha tillaeacea* var. *tillaeacea*

Family: Santalaceae
- *Santalum lanceolatum*

Family: Sapindaceae
- *Dodonaea lanceolata* var. *lanceolata*

Family: Scrophulariaceae
- *Eremophila longifolia*

Family: Solanaceae
- *Nicotiana occidentalis* subsp. *occidentalis*
- *Solanum diversiflorum*
- *Solanum lasiophyllum*

Family: Surianaceae
- *Stylobasium spathulatum*

Family: Violaceae
- *Hybanthus aurantiacus*

Family: Zygophyllaceae
- *Tribulus astrocarpus*

Family: Zygophyllaceae (cont.)

Tribulus suberosus
**Tribulus terrestris*
Zygophyllum eichleri
Zygophyllum iodocarpum

Appendix 7

Raw Data Collected from the Study Area

Brockman 4 Riparian Vegetation Survey Site BRV01

Described by: BECA Date: 25-August 2013 Type: Quadrat 50 x 50 m

MGA Zone 50 524080 mE 7504873 mN 117.234217 E -22.562660 S

Habitat Floodplain.

Soil Loamy sand with a large gravel content (>2mm).

Rock Type Continuous lag gravel.

Vegetation *Indigofera* sp. Bungaroo Creek (S. van Leeuwen 4301) scattered tall shrubs over *Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186) low shrubland over *Triodia epactia* very open hummock grassland over *Eriachne mucronata* very open tussock grassland with *Eriachne pulchella*, (*Aristida holathera* var. *holathera*) open bunch grassland.

Veg Condition Very Good (**Cenchrus ciliaris*, **Malvastrum americanum*).

Fire Age No sign of recent fire.

Species	Cover (%)	Height (cm)	Specimen
Acacia ancistrocarpa	+	130	
Acacia pyrifolia var. *pyrifolia*	+	220	BRV01-20
Alternanthera nana	+	50	=BRV17-31
Amaranthus cuspidifolius	+	40	BRV01-06
Aristida contorta	+	10	
Aristida holathera var. *holathera*	3	30	BRV01-19
Cenchrus ciliaris	+	40	
Chrysopogon fallax	+	80	
Cleome viscosa	+	20	
Corchorus crozophorifolius	+	20	
Corchorus lasiocarpus subsp. *parvus*	+	30	BRV01-05
Cucumis variabilis	+	110	
Cymbopogon ambiguus	+	90	BRV01-09
Cynanchum pedunculatum	+	10	BRV01-14
Enneapogon lindleyanus	+	40	=BRV15-16
Enneapogon polyphyllus	+	40	BRV01-18
Eriachne aristidea	+	30	BRV01-17
Eriachne mucronata	3	40	
Eriachne pulchella	25	10	
Eriachne tenuiculmis	+	20	BRV01-15
Eucalyptus sp.	+	350	
Euphorbia australis var. *subtomentosa*	+	1	BRV01-02
Evolvulus alsinoides var. *villosicalyx*	+	30	
Gomphrena kanisii	+	10	
Goodenia microptera	+	30	BRV01-21
Goodenia nuda	+	10	BRV01-04
Grevillea wickhamii	+	120	
Heliotropium cunninghamii	+	20	BRV01-13
Indigofera monophylla	+	50	BRV01-12
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	1	220	BRV01-08
Jasminum didymum subsp. *lineare*	+	120	
Malvastrum americanum	+	90	
Melhania oblongifolia	+	10	
Phyllanthus exilis	+	20	BRV01-22
Pluchea dentex	+	30	BRV01-11
Polycarpaea longiflora	+	20	
Pterocaulon sphacelatum	+	40	BRV01-23
Ptilotus astrolasius	+	20	
Ptilotus nobilis subsp. *nobilis*	+	20	
Salsola australis	+	40	
Sida arsiniata	+	20	BRV01-16
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)	+	120	BRV01-10
Solanum diversiflorum	+	40	
Stemodia grossa	+	50	
Synaptantha tillaeacea var. *tillaeacea*	+	5	BRV01-07
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)	12	80	
Themeda triandra	+	80	
Trachymene oleracea subsp. *oleracea*	+	70	
Trichodesma zeylanicum var. *zeylanicum*	+	80	
Triodia epactia	12	70	BRV01-01

Species	Cover (%)	Height (cm)	Specimen
Waltheria indica	+	60	

Brockman 4 Riparian Vegetation Survey Site BRV02

Described by: BECASVPC Date: 27-August 2013 Type: Quadrat 50 x 50 m

MGA Zone 50 522203 mE 7504263 mN 117.215973 E -22.568196 S

Habitat Broad (ill-defined) creek bed.

Soil Coarse, gravelly loamy sand.

Rock Type Riverstones. Mix of ironstone, quartz and basalt. Sub-angular-rounded 2-200 mm.

Vegetation *Eucalyptus victrix* low woodland over *Melaleuca glomerata, Acacia citrinoviridis* tall open shrubland over mixed herbs.

Veg Condition Very Good (**Cenchrus ciliaris*, old cow pats and old tyre tracks).

Fire Age No sign of recent fire.

Species	Cover (%)	Height (cm)	Specimen
Acacia citrinoviridis	1	300	
Acacia pyrifolia	+	70	
Alternanthera denticulata	+	5	BRV02-04
Bergia pedicellaris	+	5	BRV02-03
Bergia trimera	+	10	BRV02-05
Boerhavia coccinea	+	2	=BRV20-01
Cenchrus ciliaris	+	40	
Centipeda minima subsp. *macrocephala*	+	10	=BRV17-07
Chrysopogon fallax	+	60	
Cleome viscosa	+	20	
Corchorus crozophorifolius	+	40	
Corchorus lasiocarpus subsp. *parvus*	+	50	BRV02-14
Crotalaria medicaginea var. *neglecta*	+	20	
Cucumis variabilis	+	60	
Elytrophorus spicatus	+	7	BRV02-01
Enneapogon caerulescens	+	20	BRV02-15
Eragrostis cumingii	+	25	
Eragrostis tenellula	+	8	
Eriachne pulchella	+	15	
Eriachne tenuiculmis	+	35	
Eucalyptus victrix	25	500	
Eulalia aurea	+	120	
Euphorbia australis var. *subtomentosa*	+	3	BRV02-16
Evolvulus alsinoides var. *villosicalyx*	+	10	
Fimbristylis simulans	+	10	
Gomphrena canescens subsp. *canescens*	+	20	BRV02-07
Gomphrena cunninghamii	+	10	
Goodenia lamprosperma	+	25	=BRV17-01
Gossypium australe	+	120	
Heliotropium cunninghamii	+	15	BRV02-02
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	+	150	
Lipocarpha microcephala	+	8	BRV02-09
Marsilea hirsuta	+	4	BRV02-11
Melaleuca glomerata	3	380	
Mollugo molluginea	+	3	
Oldenlandia galioides	+	5	BRV02-10
Peplidium sp. Fortescue Marsh (S. van Leeuwen 4865)	+	1	BRV02-13
Phyllanthus exilis	+	8	BRV02-08
Phyllanthus maderaspatensis	+	30	
Pluchea rubelliflora	+	40	=BRV20-04
Polycarpaea longiflora	+	10	
Pterocaulon sphacelatum	+	30	=BRV19-12
Rhynchosia minima	+	50	
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)	+	60	
Sigesbeckia orientalis	+	10	BRV02-12
Stemodia grossa	+	120	
Synaptantha tillaeacea var. tillaeacea	+	5	
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)	+	60	BRV02-06
Themeda triandra	+	100	
Trichodesma zeylanicum var. *zeylanicum*	+	15	
Triodia epactia	+	60	
Wahlenbergia tumidifructa	+	15	=BRV17-22

Species	Cover (%)	Height (cm)	Specimen
Waltheria indica	+	40	

Brockman 4 Riparian Vegetation Survey Site BRV05

Described by: SVPC Date: 27-August 2013 Type: Quadrat 50 x 50 m

MGA Zone 50 516561 mE 7504815 mN 117.161082 E -22.563279 S

Habitat Bed (and portion of bank) of minor ephemeral creek.

Soil Red-brown sand.

Rock Type Riverstones.

Vegetation *Eucalyptus camaldulensis* subsp. *refulgens, E. victrix* open forest over *Acacia citrinoviridis* scattered low trees over *Androcalva luteiflora, Indigofera* sp. Bungaroo Creek (S. van Leeuwen 4301) tall open shrubland over *Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186) scattered shrubs over *Eulalia aurea, *Cenchrus ciliaris, Themeda triandra, Chrysopogon fallax* very open tussock grassland.

Veg Condition Good (**Cenchrus* spp. and old cow pats).

Fire Age No sign of recent fire.

Species	Cover (%)	Height (cm)	Specimen
Acacia bivenosa	+	300	
Acacia citrinoviridis	2	400	
Acacia pyrifolia var. pyrifolia	+	210	BRV05-04
Adriana tomentosa var. *tomentosa*	+	80	BRV05-13
Alternanthera nana	+	15	BRV05-07
Androcalva luteiflora	2	280	
Aristida contorta	+	20	
Bonamia erecta	+	60	
Cenchrus ciliaris	2	80	
Chrysopogon fallax	0.5	140	
Cleome viscosa	+	25	
Corchorus crozophorifolius	+	100	
Corchorus lasiocarpus subsp. *parvus*	+	40	BRV05-05
Cullen leucanthum	+	100	BRV05-12
Digitaria brownii	+	70	
Dipteracanthus australasicus subsp. *australasicus*	+	30	
Enneapogon caerulescens	+	30	
Enneapogon robustissimus	+	60	BRV05-08
Eriachne pulchella	+	12	
Eriachne tenuiculmis	+	30	
Eucalyptus camaldulensis subsp. *refulgens*	20	1200	
Eucalyptus victrix	15	1000	
Eulalia aurea	5	120	
Euphorbia australis var. *subtomentosa*	+	10	BRV05-03
Euphorbia biconvexa	+	15	BRV05-02
Evolvulus alsinoides var. *decumbens*	+	15	
Evolvulus alsinoides var. *villosicalyx*	+	15	
Glycine canescens	+	120	BRV05-14
Gomphrena canescens subsp. *canescens*	+	10	BRV05-11
Gomphrena cunninghamii	+	20	
Goodenia nuda	+	30	BRV05-10
Gossypium robinsonii	+	110	
Heliotropium cunninghamii	+	20	BRV05-06
Hybanthus aurantiacus	+	25	
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	2	210	
Jasminum didymum subsp. *lineare*	+	120	
Melhania oblongifolia	+	35	
Phyllanthus maderaspatensis	+	20	
Pluchea rubelliflora	+	25	BRV05-09
Ptilotus obovatus var. *obovatus*	+	50	
Ptilotus rotundifolius	+	7	
Rhynchosia minima	+	20	
Stemodia grossa	+	30	
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)	1	100	BRV05-01
Themeda triandra	0.5	90	
Triodia epactia	+	70	
Waltheria indica	+	70	

Brockman 4 Riparian Vegetation Survey Site BRV06

Described by: BECA Date: 27-August 2013 Type: Quadrat 50 x 50 m

MGA Zone 50 514840 mE 7504419 mN 117.144353 E -22.566875 S

Habitat Braided creek bed.

Soil Coarse gravelly loamy sand.

Rock Type Continuous lag gravel of sub-angular to rounded ironstone/quartz/basalt coarse fragments, 2-300mm.

Vegetation *Eucalyptus victrix* low open woodland over *Acacia citrinoviridis* scattered tall shrubs over *Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186) low open shrubland over *Pluchea rubelliflora, Goodenia lamprosperma, Stemodia grossa* very open herbland over *Eulalia aurea, Eriachne tenuiculmis, *Cenchrus ciliaris* tussock grassland.

Veg Condition Very Good (**Cenchrus ciliaris*, some evidence of cattle).

Fire Age Very long unburnt.

Notes Grass layer is actually taller than the low shrub layer.

Species	Cover (%)	Height (cm)	Specimen
Acacia ancistrocarpa	+	260	
Acacia bivenosa	+	150	
Acacia citrinoviridis	1	250	
Acacia pyrifolia	+	60	
Alternanthera nana	+	25	=BRV17-31
Amaranthus cuspidifolius	+	50	=BRV20-03
Boerhavia coccinea	+	10	=BRV20-01
Cenchrus ciliaris	1	50	
Centipeda minima subsp. *macrocephala*	+	5	BRV17-07
Cleome viscosa	+	40	
Corchorus crozophorifolius	+	50	
Crotalaria medicaginea var. *neglecta*	+	15	BRV06-07
Cucumis variabilis	+	30	
Dipteracanthus australasicus subsp. *australasicus*	+	10	=BRV17-20
Eragrostis tenellula	+	10	
Eriachne pulchella	+	10	
Eriachne tenuiculmis	2	50	
Eucalyptus sp.	+	200	
Eucalyptus victrix	8	900	
Eulalia aurea	6	70	BRV06-05
Euphorbia australis var. *subtomentosa*	+	3	BRV06-06
Euphorbia biconvexa	+	30	BRV06-03
Evolvulus alsinoides var. *villosicalyx*	+	5	
Gomphrena canescens subsp. *canescens*	+	20	BRV06-10
Goodenia lamprosperma	3	40	=BRV17-01
Heliotropium cunninghamii	+	10	BRV06-02
Hybanthus aurantiacus	+	25	
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	+	140	
Jasminum didymum subsp. *lineare*	+	140	
Malvastrum americanum	+	30	
Phyllanthus exilis	+	20	BRV06-01
Phyllanthus maderaspatensis	+	30	
Pluchea rubelliflora	4	60	=BRV20-04
Rhynchosia minima	+	5	
Rutidosis helichrysoides subsp. *helichrysoides*	+	40	BRV06-08
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)	+	90	BRV06-04
Stemodia grossa	1	60	
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)	5	90	
Themeda triandra	+	40	
Triodia epactia	+	60	BRV06-09
Waltheria indica	+	40	

Brockman 4 Riparian Vegetation Survey Site BRV07

Described by: BECA Date: 25-August 2013 Type: Quadrat 50 x 50 m

MGA Zone 50 512259 mE 7503610 mN 117.119250 E -22.574202 S

Habitat Floodplain.

Soil Sandy clay loam.

Rock Type Scattered ironstone fragments, sub-angular to rounded, 2-50 mm.

Vegetation *Acacia citrinoviridis, A. pyrifolia* var. *morrisonii* tall shrubland over *Ptilotus obovatus* var. *obovatus* scattered low shrubs over *Triodia epactia* scattered hummock grasses over **Cenchrus ciliaris, *C. setiger* open tussock grassland.

Veg Condition Very Poor (**Cenchrus* spp., high cattle activity).

Fire Age No sign of recent fire.

Notes Heavy grazing.

Stand of *A. citrinoviridis* in SE corner that has not been burnt for over 10 years.

Species	Cover (%)	Height (cm)	Specimen
Abutilon aff. *lepidum*	+	20	BRV07-15
Abutilon otocarpum	+	5	BRV07-06
Abutilon sp. Pilbara (W.R. Barker 2025)	+	15	BRV07-29
Acacia citrinoviridis	15	550	
Acacia pyrifolia var. *morrisonii*	5	350	BRV07-03
Alternanthera nana	+	5	=BRV16-13
Androcalva luteiflora	+	170	
Boerhavia coccinea	+	2	BRV07-31
Cenchrus ciliaris	15	30	
Cenchrus setiger	4	20	
Codonocarpus cotinifolius	+	60	BRV07-02
Convolvulus clementii	+	5	BRV07-17
Corchorus crozophorifolius	+	70	
Corchorus lasiocarpus subsp. *parvus*	+	30	BRV07-21
Dipteracanthus australasicus subsp. *australasicus*	+	10	=BRV17-20
Duperreya commixta	+	400	
Dysphania rhadinostachya subsp. *rhadinostachya*	+	10	BRV07-28
Enneapogon lindleyanus	+	10	=BRV15-16
Enneapogon polyphyllus	+	10	BRV07-12, 19
Eriachne pulchella	+	10	BRV07-16
Euphorbia australis var. *subtomentosa*	+	5	BRV07-14
Evolvulus alsinoides var. *decumbens*	+	10	
Evolvulus alsinoides var. *villosicalyx*	+	10	
Goodenia forrestii	+	20	=BRV16-03
Goodenia lamprosperma	+	20	=BRV17-01
Goodenia nuda	+	10	BRV07-10
Gossypium australe	+	10	BRV07-32
Gossypium robinsonii	+	250	
Hibiscus sturtii var. *grandiflorus*	+	10	BRV07-01
Hybanthus aurantiacus	+	30	
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	+	120	
Jasminum didymum subsp. *lineare*	+	80	
Malvastrum americanum	+	40	
Melhania oblongifolia	+	10	
Notoleptopus decaisnei var. *orbicularis* (A.B. Craig 428)	+	10	BRV07-05
Pentalepis trichodesmoides subsp. *hispida*	+	80	BRV07-24
Phyllanthus maderaspatensis	+	10	
Polycarpaea longiflora	+	10	
Polymeria ambigua	+	1	BRV07-22
Portulaca oleracea/intraterranea	+	1	
Pterocaulon sphacelatum	+	40	BRV07-33
Ptilotus obovatus var. *obovatus*	1	70	
Ptilotus polystachyus	+	20	BRV07-30
Sclerolaena cornishiana	+	5	=BRV12-16
Senna artemisioides subsp. *helmsii*	+	40	BRV07-26
Senna artemisioides subsp. *oligophylla*	+	40	BRV07-25
Senna glutinosa subsp. x *luerssenii*	+	130	BRV07-23
Sida aff. *fibulifera*	+	5	BRV07-09

Species	Cover (%)	Height (cm)	Specimen
Sida arsiniata	+	40	BRV07-07
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)	+	20	BRV07-04
Solanum lasiophyllum	+	30	BRV07-13
Sporobolus australasicus	+	15	
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)	+	40	
Triodia epactia	1	40	BRV07-08, 18
Triraphis mollis	+	10	BRV07-27
Triumfetta clementii	+	20	BRV07-20
Waltheria indica	+	30	
Zygophyllum eichleri	+	3	BRV07-11

Brockman 4 Riparian Vegetation Survey Site BRV08

Described by: BECA Date: 23-August 2013 Type: Quadrat 50 x 50 m

MGA Zone 50 513245 mE 7503955 mN 117.128843 E -22.571079 S

Habitat Floodplain.

Soil Coarse gravelly sandy loam.

Rock Type Continuous lag gravel of sub-angular to rounded ironstone.

Vegetation *Acacia citrinoviridis, A. pyrifolia* tall shrubland over *Indigofera* sp. Bungaroo Creek (S. van Leeuwen 4301) scattered shrubs over *Triodia epactia* very open hummock grassland over **Cenchrus ciliaris* open tussock grassland.

Veg Condition Not recorded.

Fire Age No sign of recent fire.

Species	Cover (%)	Height (cm)	Specimen
Abutilon aff. *lepidum*	+	80	BRV08-10
Acacia citrinoviridis	11	400	
Acacia pyrifolia	2	220	
Alternanthera nana	+	5	=BRV17-31
Androcalva luteiflora	+	220	
Aristida contorta	+	10	
Aristida holathera var. *holathera*	+	30	BRV08-03
Boerhavia coccinea	+	10	BRV08-14
Bulbostylis barbata	+	15	
Cenchrus ciliaris	25	60	
Cenchrus setiger	+	30	
Cleome viscosa	+	30	
Corchorus crozophorifolius	+	100	
Corchorus lasiocarpus subsp. *parvus*	+	80	BRV08-23
Crotalaria medicaginea var. *neglecta*	+	10	BRV08-05
Cucumis variabilis	+	80	
Duperreya commixta	+	260	
Enneapogon lindleyanus	+	30	=BRV15-16
Enneapogon polyphyllus	+	20	BRV08-01, 19
Eriachne aristidea	+	10	
Eriachne pulchella	+	10	BRV08-04
Eulalia aurea	+	120	BRV08-16
Euphorbia australis var. *subtomentosa*	+	5	BRV08-02
Euphorbia trigonosperma	+	40	BRV08-09
Evolvulus alsinoides var. *decumbens*	+	10	
Evolvulus alsinoides var. *villosicalyx*	+	10	
Gomphrena canescens subsp. *canescens*	+	20	BRV08-20
Goodenia nuda	+	15	BRV08-07
Goodenia triodiophila	+	20	
Gossypium australe	+	15	BRV08-12
Hibiscus sturtii var. *grandiflorus*	+	35	BRV08-21
Hybanthus aurantiacus	+	10	
Indigofera monophylla	+	40	BRV08-11
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	1	120	BRV08-24
Jasminum didymum subsp. *lineare*	+	60	
Malvastrum americanum	+	10	
Melhania oblongifolia	+	30	
Notoleptopus decaisnei var. *decaisnei*	+	20	
Petalostylis labicheoides	+	220	
Phyllanthus maderaspatensis	+	10	
Pluchea dentex	+	50	BRV08-08
Polycarpaea longiflora	+	10	
Polymeria ambigua	+	1	BRV08-13
Pterocaulon sphacelatum	+	BRV08-22	
Ptilotus astrolasius	+	100	
Ptilotus obovatus var. *obovatus*	+	70	
Senna artemisioides subsp. *oligophylla x* subsp. *helmsii*	+	60	BRV08-06
Senna glaucifolia	+	130	BRV08-18
Senna notabilis	+	40	
Sida arsiniata	+	40	BRV08-15
Sporobolus australasicus	+	15	

Species	Cover (%)	Height (cm)	Specimen
Stemodia grossa	+	40	
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)	+	30	
Themeda triandra	+	80	
Triodia epactia	8	40	BRV08-23
Waltheria indica	+	30	

Brockman 4 Riparian Vegetation Survey Site BRV09

Described by: BECA Date: 24-August 2013 Type: Quadrat 50 x 50 m

MGA Zone 50 510878 mE 7503063 mN 117.105817 E -22.579147 S

Habitat Floodplain.

Soil Light clay, scattered ironstone.

Rock Type Scattered ironstone.

Vegetation *Acacia citrinoviridis, A. pyrifolia*, (*Gossypium robinsonii*) tall open scrub over *Indigofera* sp. Bungaroo Creek (S. van Leeuwen 4301) scattered shrubs over *Triodia epactia* open hummock grassland over **Cenchrus ciliaris, Eriachne tenuiculmis* very open tussock grassland.

Veg Condition Good (**Cenchrus ciliaris*, **Malvastrum americanum*).

Fire Age Very long unburnt.

Notes Cattle pad next to through site.

Species	Cover (%)	Height (cm)	Specimen
Abutilon aff. *lepidum*	+	40	BRV09-18
Abutilon fraseri subsp. fraseri	+	15	BRV09-02
Acacia citrinoviridis	18	450	
Acacia pyrifolia	25	350	
Acacia sclerosperma subsp. *sclerosperma*	+	220	BRV09-01
Alternanthera nana	+	10	=BRV17-31
Androcalva luteiflora	+	180	
Aristida contorta	+	10	
Boerhavia sp.	+	1	
Capparis lasiantha	+	50	
Cenchrus ciliaris	7	60	
Cenchrus setiger	+	40	
Chrysopogon fallax	+	60	
Cleome viscosa	+	20	
Corchorus crozophorifolius	+	100	
Corymbia hamersleyana	+	500	
Cymbopogon ambiguus	+	60	BRV09-13
Dipteracanthus australasicus subsp. *australasicus*	+	5	=BRV17-20
Duperreya commixta	+	400	
Enneapogon caerulescens	+	10	BRV09-06
Enneapogon polyphyllus	+	20	
Eragrostis cumingii	+	10	BRV09-17, 22
Eriachne aristidea	+	10	BRV09-14
Eriachne pulchella	+	10	BRV09-09
Eriachne tenuiculmis	5	30	
Euphorbia australis var. *subtomentosa*	+	1	BRV09-05
Euphorbia coghlanii	+	30	BRV09-11
Evolvulus alsinoides var. *decumbens*	+	10	
Gomphrena cunninghamii	+	10	BRV09-19
Gomphrena kanisii	+	10	
Goodenia triodiophila	+	15	
Gossypium australe	+	120	
Gossypium robinsonii	2	400	
Hibiscus sturtii var. *grandiflorus*	+	10	BRV09-16
Hybanthus aurantiacus	+	60	
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	1	120	BRV09-20
Jasminum didymum subsp. *lineare*	+	300	
Malvastrum americanum	+	40	
Melhania oblongifolia	+	40	
Paraneurachne muelleri	+	30	
Phyllanthus maderaspatensis	+	10	
Polycarpaea longiflora	+	10	
Pterocaulon sphacelatum	+	30	BRV09-21
Ptilotus fusiformis	+	20	BRV09-12
Ptilotus nobilis subsp. *nobilis*	+	10	
Ptilotus obovatus var. *obovatus*	+	40	
Rhynchosia minima	+	120	
Sida aff. *fibulifera*	+	10	BRV09-07
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)	+	40	BRV09-10

Species	Cover (%)	Height (cm)	Specimen
Sida sp. verrucose glands (F.H. Mollemans 2423)	+	10	BRV09-23
Solanum lasiophyllum	+	30	
Sporobolus australasicus	+	15	
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)	+	40	
Themeda triandra	+	80	BRV09-03
Triodia epactia	12	60	BRV09-04
Triraphis mollis	+	15	BRV09-08
Waltheria indica	+	30	

Brockman 4 Riparian Vegetation Survey Site BRV10

Described by: BECA Date: 27-August 2013 Type: Quadrat 50 x 50 m

MGA Zone 50 509934 mE 7502569 mN 117.096637 E -22.583620 S

Habitat Braided creek line, mostly bank features but some good channels through site.

Soil Coarse gravelly loamy sand.

Rock Type Continuous lag gravel of sub-angular to rounded ironstone/quartz/basalt coarse fragments, 2-250 mm diameter.

Vegetation *Acacia citrinoviridis, A. pyrifolia* tall open shrubland over *Corchorus crozophorifolius, Indigofera* sp. Bungaroo Creek (S. van Leeuwen 4301) open shrubland over *Eriachne pulchella* very open bunch grassland.

Veg Condition Very Good (**Cenchrus ciliaris, *Malvastrum americanum*).

Fire Age Very long unburnt.

Notes Some cattle scats and tracks evidence.

Highly eroded site: number of channels with approx. 1m relief from high points of bank, number of the larger shrubs have their roots exposed at the micro bank edges, typical near creekline features.

Species	Cover (%)	Height (cm)	Specimen
Acacia citrinoviridis	7	600	
Acacia pyrifolia	1	250	
Alternanthera nana	+	10	BRV10-05
Boerhavia coccinea	+	10	=BRV20-01
Cenchrus ciliaris	+	40	
Cleome viscosa	+	40	
Corchorus crozophorifolius	7	160	
Cucumis variabilis	+	10	
Duperreya commixta	+	40	
Enchylaena tomentosa var. *tomentosa*	+	50	BRV18-10
Eriachne mucronata	+	50	
Eriachne pulchella	2	20	
Eriachne pulchella	+	10	BRV10-03
Eucalyptus camaldulensis subsp. *refulgens*	+	700	
Eulalia aurea	+	80	
Euphorbia australis var. *subtomentosa*	+	10	BRV10-04
Euphorbia trigonosperma	+	20	BRV10-02
Evolvulus alsinoides var. *decumbens*	+	10	
Hybanthus aurantiacus	+	50	
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	1	170	
Jasminum didymum subsp. *lineare*	+	50	
Malvastrum americanum	+	40	
Phyllanthus maderaspatensis	+	25	
Ptilotus calostachyus	+	120	
Ptilotus nobilis subsp. *nobilis*	+	20	
Rhynchosia minima	+	10	
Sporobolus australasicus	+	20	
Stemodia grossa	+	40	
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)	+	30	
Themeda triandra	+	60	
Triodia epactia	+	50	BRV10-01
Waltheria indica	+	50	

Brockman 4 Riparian Vegetation Survey Site BRV12

Described by: BECA Date: 24-August 2013 Type: Quadrat 50 x 50 m

MGA Zone 50 507795 mE 7502120 mN 117.075836 E -22.587686 S

Habitat Floodplain.

Soil Light clay with scattered ironstone and quartz fragments.

Rock Type Scattered ironstone and quartz fragments.

Vegetation *Acacia sclerosperma* subsp. *sclerosperma, A. citrinoviridis, A. synchronicia, Stylobasium spathulatum* tall shrubland over *Triodia epactia* very open hummock grassland over **Cenchrus ciliaris* very open tussock grassland.

Veg Condition Good (**Cenchrus ciliaris*).

Fire Age No sign of recent fire.

Notes High level of cattle grazing; many cattle tracks.
Most of the **Cenchrus ciliaris* is grazed to 10 cm.

Species	Cover (%)	Height (cm)	Specimen
Acacia citrinoviridis	11	400	
Acacia pyrifolia	+	200	
Acacia sclerosperma subsp. *sclerosperma*	20	260	
Acacia synchronicia	2	250	BRV12-01
Acacia tetragonophylla	+	130	
Boerhavia coccinea	+	10	BRV12-04
Capparis lasiantha	+	30	
Cenchrus ciliaris	7	40	
Cleome viscosa	+	10	
Corchorus crozophorifolius	+	20	
Duperreya commixta	+	110	
Euphorbia australis var. *subtomentosa*	+	5	BRV12-09, 13
Evolvulus alsinoides var. *villosicalyx*	+	5	
Goodenia forrestii	+	10	BRV12-06
Gossypium robinsonii	+	220	
Gossypium sturtianum var. *sturtianum*	+	180	BRV12-10
Hakea lorea subsp. *lorea*	+	360	
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	+	160	BRV12-17
Malvastrum americanum	+	10	
Portulaca oleracea/intraterranea	+	1	BRV12-03
Pterocaulon sphacelatum	+	20	BRV12-19
Ptilotus obovatus var. *obovatus*	+	40	
Santalum lanceolatum	+	250	BRV12-02
Sclerolaena cornishiana	+	10	BRV12-16
Senna artemisioides subsp. *oligophylla*	+	40	BRV12-15
Senna artemisioides subsp. *oligophylla x* subsp. *helmsii*	+	30	BRV12-05
Sida fibulifera	+	10	BRV12-07
Solanum lasiophyllum	+	10	BRV12-12
Sporobolus australasicus	+	10	
Stylobasium spathulatum	1	240	
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)	+	40	
Tribulus astrocarpus	+	1	
Tribulus terrestris	+	1	BRV12-11, 18
Triodia epactia	3	50	BRV12-08
Zygophyllum iodocarpum	+	1	BRV12-14

Brockman 4 Riparian Vegetation Survey Site BRV13

Described by: BECA Date: 25-August 2013 Type: Quadrat 62.5 x 40 m

MGA Zone 50 504481 mE 7501942 mN 117.043597 E -22.589311 S

Habitat Incised creek with islands.

Soil Gravelly loamy sand with ironstone fragments (with some quartz, basalt); outcropping.

Rock Type Ironstone fragments (with some quartz, basalt); outcropping.

Vegetation *Eucalyptus victrix* low woodland over *E. camaldulensis* subsp. *refulgens* low open woodland over *Melaleuca glomerata* tall shrubland over **Cenchrus ciliaris* open tussock grassland.

Veg Condition Good (**Cenchrus ciliaris, *Malvastrum americanum, *Vachellia farnesiana, *Sonchus oleraceus, *Argemone ochroleuca* subsp. *ochroleuca*).

Fire Age No sign of recent fire.

Notes Quadrat a bit skewed to fit in creekline; consider when re-scoring in future.

Species	Cover (%)	Height (cm)	Specimen
Abutilon amplum	+	160	BRV13-08
Acacia pyrifolia	+	170	
Acacia sclerosperma subsp. *sclerosperma*	+	400	=BRV16-05
Alternanthera nana	+	10	=BRV17-31
Amaranthus undulatus	+	20	BRV13-01
Argemone ochroleuca subsp. *ochroleuca*	+	30	
Boerhavia coccinea	+	20	BRV13-05
Cenchrus ciliaris	11	60	
Centipeda minima subsp. *macrocephala*	+	5	=BRV17-07
Cleome viscosa	+	20	
Corchorus crozophorifolius	+	20	
Cucumis variabilis	+	150	
Cymbopogon sp.	+	80	
Cyperus vaginatus	+	80	
Enneapogon lindleyanus	+	40	=BRV15-16
Eragrostis tenellula	+	20	
Eucalyptus camaldulensis subsp. *refulgens*	5	750	
Eucalyptus victrix	15	1500	
Eulalia aurea	+	60	
Euphorbia biconvexa	+	10	BRV13-07
Evolvulus alsinoides var. *decumbens*	+	20	
Goodenia lamprosperma	+	20	=BRV17-01
Gossypium robinsonii	+	190	
Helichrysum luteoalbum	+	10	BRV13-03
Heliotropium pachyphyllum	+	10	BRV13-04
Hybanthus aurantiacus	+	30	
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	+	160	
Jasminum didymum subsp. *lineare*	+	200	
Malvastrum americanum	+	40	
Melaleuca glomerata	13	350	=BRV17-10
Notoleptopus decaisnei var. *orbicularis* (A.B. Craig 428)	+	10	BRV13-06
Phyllanthus maderaspatensis	+	10	
Phyllanthus maderaspatensis	+	15	
Pluchea rubelliflora	+	40	BRV13-02
Ptilotus nobilis subsp. *nobilis*	+	30	
Rhynchosia minima	+	30	
Senna artemisioides subsp. *oligophylla*	+	180	BRV13-09
Sonchus oleraceus	+	10	
Sporobolus australasicus	+	10	
Stemodia grossa	+	30	
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)	+	50	
Themeda triandra	+	60	
Triodia epactia	+	40	
Vachellia farnesiana	+	250	
Vigna lanceolata var. *lanceolata*	+	20	=BRV17-35
Wahlenbergia tumidifructa	+	10	=BRV17-22
Waltheria indica	+	60	

Brockman 4 Riparian Vegetation Survey Site BRV14

Described by: BECA Date: 23-August 2013 Type: Quadrat 50 x 50 m

MGA Zone 50 502670 mE 7502870 mN 117.025976 E -22.580925 S

Habitat Floodplain/bank between two arms of creek.

Soil Grading from coarse gravelly sandy loam to a light clay.

Rock Type Discontinuous lag gravel of ironstone and quartz sub-angular to rounded.

Vegetation *Acacia citrinoviridis*, (*A. pyrifolia*) tall shrubland over *Ptilotus obovatus* var. *obovatus* scattered low shrubs over *Triodia epactia* very open hummock grassland over **Cenchrus ciliaris* open tussock grassland.

Veg Condition Good (**Cenchrus ciliaris*).

Fire Age Very long unburnt.

Notes Fire age: 5-10 years.

Species	Cover (%)	Height (cm)	Specimen
Abutilon fraseri subsp. *fraseri*	+	20	BRV14-04
Acacia citrinoviridis	33	320	
Acacia pyrifolia	1	220	
Acacia tetragonophylla	+	210	
Alternanthera nana	+	20	BRV14-02
Cenchrus ciliaris	20	60	
Cleome viscosa	+	20	
Codonocarpus cotinifolius	+	250	BRV14-08
Corchorus crozophorifolius	+	80	
Cucumis melo subsp. *agrestis*	+	200	
Dipteracanthus australasicus subsp. *australasicus*	+	20	=BRV17-20
Duperreya commixta	+	320	
Enneapogon polyphyllus	+	10	BRV14-07
Eulalia aurea	+	20	
Euphorbia australis var. *subtomentosa*	+	5	BRV14-10
Goodenia forrestii	+	20	BRV14-05
Goodenia lamprosperma	+	20	=BRV17-01
Gossypium robinsonii	+	300	
Gossypium sturtianum var. *sturtianum*	+	240	BRV14-06
Hakea lorea subsp. *lorea*	+	300	
Hybanthus aurantiacus	+	40	
Jasminum didymum subsp. *lineare*	+	60	
Ptilotus obovatus var. *obovatus*	1	60	
Senna artemisioides subsp. *oligophylla*	+	120	BRV14-03
Senna artemisioides subsp. *oligophylla x* subsp. *helmsii*	+	60	BRV14-09
Sida fibulifera	+	10	BRV14-11
Triodia epactia	2	60	BRV14-01

Brockman 4 Riparian Vegetation Survey Site BRV15
Described by: BECA Date: 23-August 2013 Type: Quadrat 50 x 50 m
MGA Zone 50 501895 mE 7502562 mN 117.018438 E -22.583713 S
Habitat Braiding creekline.
Soil Coarse gravelly sandy loam with riverstones.
Rock Type Riverstone.
Vegetation *Eucalyptus victrix* woodland over **Cenchrus ciliaris* scattered tussock grasses.
Veg Condition Good (**Malvastrum americanum*, **Cenchrus ciliaris*, **Argemone ochroleuca* subsp. *ochroleuca*).
Fire Age Not recorded.

Species	Cover (%)	Height (cm)	Specimen
Acacia pyrifolia	+	40	
Acacia sclerosperma subsp. *sclerosperma*	+	190	=BRV16-05
Alternanthera nana	+	10	=BRV16-13
Amaranthus undulatus	+	40	BRV15-08
Argemone ochroleuca subsp. *ochroleuca*	+	10	
Bergia trimera	+	1	BRV15-11
Boerhavia coccinea	+	10	BRV15-12
Cenchrus ciliaris	1	40	
Cenchrus setiger	+	10	
Cleome viscosa	+	30	
Convolvulus clementii	+	10	BRV15-13
Corchorus crozophorifolius	+	15	
Cucumis variabilis	+	10	
Cymbopogon procerus	+	60	BRV15-07
Duperreya commixta	+	100	
Enneapogon lindleyanus	+	10	BRV15-16
Eragrostis cumingii	+	10	BRV15-10
Eragrostis tenellula	+	10	BRV15-15
Eriachne mucronata	+	40	
Eriachne pulchella	+	10	BRV15-02
Eucalyptus victrix	12	1400	BRV15-01
Eulalia aurea	+	60	BRV15-06
Euphorbia biconvexa	+	10	BRV15-04
Evolvulus alsinoides var. *decumbens*	+	10	
Evolvulus alsinoides var. *villosicalyx*	+	10	
Gomphrena canescens subsp. *canescens*	+	10	BRV15-03
Goodenia forrestii	+	20	=BRV16-03
Goodenia lamprosperma	+	30	=BRV17-01
Gossypium robinsonii	+	40	
Hybanthus aurantiacus	+	20	
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	+	60	
Jasminum didymum subsp. *lineare*	+	180	
Malvastrum americanum	+	60	
Phyllanthus maderaspatensis	+	10	BRV15-09
Pluchea rubelliflora	+	30	=BRV17-34
Polycarpaea longiflora	+	20	
Pterocaulon sphacelatum	+	60	=BRV17-29
Ptilotus astrolasius	+	40	
Ptilotus nobilis subsp. *nobilis*	+	10	
Rhynchosia minima	+	10	
Sonchus oleraceus	+	20	
Sporobolus australasicus	+	10	
Stemodia grossa	+	20	
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)	+	60	BRV15-14
Vachellia farnesiana	+	40	
Vigna lanceolata var. *lanceolata*	+	1	=BRV17-35
Waltheria indica	+	60	

Brockman 4 Riparian Vegetation Survey Site BRV16

Described by: BECA Date: 22-August 2013 Type: Quadrat 50 x 50 m

MGA Zone 50 500399 mE 7502411 mN 117.003880 E -22.585079 S

Habitat Floodplain.

Soil Self mulching light clay.

Rock Type Ironstone and quartz fragments.

Vegetation *Acacia citrinoviridis*, (*Hakea lorea* subsp. *lorea, A. pyrifolia* var. *pyrifolia*) tall open scrub over **Cenchrus ciliaris* closed tussock grassland.

Veg Condition Very Poor (**Cenchrus ciliaris, *Malvastrum americanum*).

Fire Age No sign of recent fire.

Notes Cattle and donkeys in area.

Species	Cover (%)	Height (cm)	Specimen
Acacia citrinoviridis	40	420	BRV16-14a
Acacia pyrifolia var. *pyrifolia*	1	220	=BRV17-15
Acacia sclerosperma subsp. *sclerosperma*	+	140	BRV16-04, 05
Acacia victoriae subsp. *victoriae*	+	80	BRV16-15
Alternanthera nana	+	10	=BRV17-31
Alternanthera nana	+	10	BRV16-13
Boerhavia repleta	+	1	BRV16-11
Cenchrus ciliaris	75	60	
Chrysopogon fallax	+	90	
Cleome viscosa	+	40	
Convolvulus clementii	+	2	BRV16-12
Cucumis variabilis	+	80	
Dichanthium sericeum subsp. *humilius*	+	10	BRV16-16
Duperreya commixta	+	140	
Dysphania rhadinostachya subsp. *inflata*	+	10	BRV16-08
Glycine canescens	+	20	BRV16-17
Goodenia forrestii	+	10	BRV16-03
Goodenia microptera	+	4	BRV16-10
Hakea lorea subsp. *lorea*	1	500	BRV16-14b
Jasminum didymum subsp. *lineare*	+	40	
Malvastrum americanum	+	30	
Pluchea rubelliflora	+	2	BRV16-18
Portulaca oleracea/intraterranea	+	1	BRV16-06
Pterocaulon sphacelatum	+	30	BRV16-02
Ptilotus nobilis subsp. *nobilis*	+	10	
Ptilotus obovatus var. *obovatus*	+	50	
Rhynchosia minima	+	30	
Sida fibulifera	+	3	BRV16-07
Sporobolus australasicus	+	10	
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)	+	40	BRV16-09
Tribulus astrocarpus	+	1	
Triodia epactia	+	50	BRV16-01

Brockman 4 Riparian Vegetation Survey Site BRV17

Described by: BECA Date: 22-August 2013 Type: Quadrat 50 x 50 m

MGA Zone 50 498200 mE 7501500 mN 116.982486 E -22.593309 S

Habitat Incised creekline with island.

Soil 2.5YR 2.5/4 dark reddish brown sandy clay loam.

Rock Type Ironstone with coarse fragments of 2-300 mm sub-angular to sub-rounded.

Vegetation *Eucalyptus camaldulensis* subsp. *refulgens* woodland over *Melaleuca glomerata, Acacia citrinoviridis* tall shrubland over *Cyperus vaginatus* very open sedgeland over **Cenchrus ciliaris, *C. setiger* tussock grassland.

Veg Condition Good to Poor (**Cenchrus ciliaris, *C. setiger, *Bidens bipinnata, *Vachellia farnesiana, *Malvastrum americanum, *Argemone ochroleuca* subsp. *ochroleuca*).

Fire Age No sign of recent fire.

Notes Cattle and donkeys in area.

Species	Cover (%)	Height (cm)	Specimen
Abutilon amplum	+	70	BRV17-12
Acacia citrinoviridis	9	700	BRV17-11, 38
Acacia coriacea subsp. *pendens*	+	500	BRV17-32b
Acacia pyrifolia var. *pyrifolia*	+	90	BRV17-15
Alternanthera nana	+	20	BRV17-06, 31
Argemone ochroleuca subsp. *ochroleuca*	+	10	
Bidens bipinnata	+	10	
Boerhavia coccinea	+	5	BRV17-23
Bothriochloa ewartiana	+	15	BRV17-39
Cenchrus ciliaris	25	60	
Cenchrus setiger	10	60	
Centipeda minima subsp. *macrocephala*	+	5	BRV17-07
Cleome viscosa	+	10	
Corchorus crozophorifolius	+	60	
Crotalaria medicaginea var. *neglecta*	+	20	BRV17-26
Cucumis variabilis	+	10	BRV17-09
Cyperus vaginatus	9	100	BRV17-32a
Dichanthium sericeum subsp. *humilius*	+	15	BRV17-05
Dipteracanthus australasicus subsp. *australasicus*	+	10	BRV17-20
Duperreya commixta	+	10	
Enneapogon lindleyanus	+	60	BRV17-36
Enteropogon ramosus	+	60	BRV17-18
Eragrostis cumingii	+	5	BRV17-02
Eragrostis tenellula	+	10	BRV17-03
Eriachne mucronata	+	40	
Eriachne pulchella	+	20	BRV17-24
Eucalyptus camaldulensis subsp. *refulgens*	25	1400	BRV17-37
Eulalia aurea	+	90	BRV17-08
Euphorbia coghlanii	+	10	BRV17-25
Evolvulus alsinoides var. *decumbens*	+	10	BRV17-13
Evolvulus alsinoides var. *villosicalyx*	+	10	BRV17-21
Glycine canescens	+	15	BRV17-28
Goodenia lamprosperma	+	10	BRV17-01
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	+	30	BRV17-19
Jasminum didymum subsp. *lineare*	+	250	
Lepidium muelleri-ferdinandii	+	5	BRV17-16
Malvastrum americanum	+	40	
Melaleuca glomerata	15	450	BRV17-10
Melhania oblongifolia	+	20	
Pluchea rubelliflora	+	40	BRV17-34
Pterocaulon sphacelatum	+	10	BRV17-29
Ptilotus obovatus var. *obovatus*	+	40	
Rhynchosia minima	+	10	
Rostellularia adscendens var. *clementii*	+	10	BRV17-17
Sida fibulifera	+	10	BRV17-04
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)	+	40	BRV17-27
Sporobolus australasicus	+	10	
Stemodia grossa	+	10	BRV17-14
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)	+	30	BRV17-33

Species	Cover (%)	Height (cm)	Specimen
Triumfetta clementii	+	40	BRV17-30
Vachellia farnesiana	+	160	
Vigna lanceolata var. *lanceolata*	+	10	BRV17-35
Wahlenbergia tumidifructa	+	20	BRV17-22
Waltheria indica	+	40	

Brockman 4 Riparian Vegetation Survey Site BRV18

Described by: BECA Date: 26-August 2013 Type: Quadrat 50 x 50 m

MGA Zone 50 497451 mE 7500179 mN 116.975195 E -22.605236 S

Habitat Floodplain, near drainage bank.

Soil Sandy loam.

Rock Type Ironstone, basalt, quartz discontinuous lag gravel, sub-angular to rounded 2-200 mm diameter.

Vegetation *Eucalyptus camaldulensis* subsp. *refulgens* scattered trees over *Acacia citrinoviridis, Hakea lorea* subsp. *lorea* tall open scrub over **Cenchrus ciliaris, *C. setiger* open tussock grassland.

Veg Condition Poor (**Cenchrus ciliaris, *Malvastrum americanum*, presence of cattle).

Fire Age Very long unburnt.

Notes Cattle pads, grazed heavily.

A lot of cattle/donkey pads throughout the site.

Species	Cover (%)	Height (cm)	Specimen
Abutilon sp. Pilbara (W.R. Barker 2025)	+	10	BRV18-04
Acacia citrinoviridis	40	600	
Acacia pyrifolia	+	160	
Acacia sclerosperma subsp. *sclerosperma*	+	200	
Alternanthera nana	+	10	=BRV16-13
Aristida contorta	+	20	BRV18-17
Boerhavia coccinea	+	20	BRV18-07
Capparis lasiantha	+	40	
Cenchrus ciliaris	20	40	
Cenchrus setiger	1	10	
Cleome viscosa	+	30	
Corchorus crozophorifolius	+	40	
Cucumis variabilis	+	40	
Dicladanthera forrestii	+	20	BRV18-14
Dipteracanthus australasicus subsp. *australasicus*	+	10	=BRV17-20
Dodonaea lanceolata var. *lanceolata*	+	60	=BRV19-06
Duperreya commixta	+	160	
Dysphania rhadinostachya subsp. *rhadinostachya*	+	10	=BRV20-06
Ehretia saligna var. saligna	+	230	BRV18-15
Enchylaena tomentosa var. *tomentosa*	+	15	BRV18-10
Enneapogon lindleyanus	+	40	=BRV15-16
Eriachne mucronata	+	40	
Eriachne pulchella	+	20	
Eucalyptus camaldulensis subsp. *refulgens*	2	1200	
Euphorbia australis var. *subtomentosa*	+	15	BRV18-08
Euphorbia coghlanii	+	20	BRV18-02
Evolvulus alsinoides var. *decumbens*	+	10	
Evolvulus alsinoides var. *villosicalyx*	+	10	
Glycine canescens	+	150	BRV18-01
Goodenia forrestii	+	10	BRV18-06
Goodenia lamprosperma	+	20	=BRV17-01
Goodenia nuda	+	20	BRV18-03
Hakea lorea subsp. *lorea*	2	500	
Hybanthus aurantiacus	+	10	
Indigofera colutea	+	5	BRV18-09
Lepidium muelleri-ferdinandii	+	10	=BRV19-11
Malvastrum americanum	+	20	
Melhania oblongifolia	+	15	
Peripleura arida	+	15	BRV18-11
Petalostylis labicheoides	+	220	
Phyllanthus maderaspatensis	+	15	
Polymeria ambigua	+	10	BRV18-12
Pterocaulon sphacelatum	+	40	=BRV19-12
Ptilotus obovatus var. *obovatus*	+	40	
Rhynchosia minima	+	5	
Santalum lanceolatum	+	280	=BRV12-02
Sida aff. *fibulifera*	+	10	BRV18-05
Sida clementii	+	40	BRV18-16

Species	Cover (%)	Height (cm)	Specimen
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)	+	25	BRV18-13
Solanum diversiflorum	+	20	
Solanum lasiophyllum	+	10	
Sporobolus australasicus	+	10	
Stylobasium spathulatum	+	40	
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)	+	10	
Triodia epactia	+	30	BRV18-18
Vigna lanceolata var. *lanceolata*	+	5	

Brockman 4 Riparian Vegetation Survey Site BRV19

Described by: BECA Date: 26-August 2013 Type: Quadrat 50 x 50 m

MGA Zone 50 496079 mE 7498943 mN 116.961849 E -22.616398 S

Habitat Wide creek bed with islands.

Soil Coarse sand.

Rock Type River wash lag gravel of ironstone, quartz, basalt fragments from 2-200 mm.

Vegetation *Eucalyptus camaldulensis* subsp. *refulgens, E. victrix* woodland over *Melaleuca glomerata, Acacia citrinoviridis, Petalostylis labicheoides* tall open scrub over **Cenchrus ciliaris, *C. setiger* very open tussock grassland.

Veg Condition Good (**Malvastrum americanum, *Vachellia farnesiana, *Argemone ochroleuca* subsp. *ochroleuca, *Cenchrus ciliaris, *C. setiger*).

Fire Age No sign of recent fire.

Species	Cover (%)	Height (cm)	Specimen
Acacia citrinoviridis	8	600	
Acacia coriacea subsp. *pendens*	+	400	BRV19-05
Acacia pyrifolia	+	230	
Acacia sclerosperma subsp. *sclerosperma*	+	280	=BRV16-05
Alternanthera nana	+	10	=BRV17-31
Amaranthus cuspidifolius	+	40	=BRV20-03
Amyema sanguinea var. *sanguinea*	+	800	BRV19-10
Argemone ochroleuca subsp. *ochroleuca*	+	40	
Bulbostylis barbata	+	20	BRV19-09
Capparis spinosa var. *nummularia*	+	40	BRV19-07
Cenchrus ciliaris	3	30	
Cenchrus setiger	1	30	
Cleome viscosa	+	40	
Convolvulus remotus	+	1	BRV19-04
Corchorus crozophorifolius	+	120	
Cucumis variabilis	+	70	
Cymbopogon ambiguus	+	80	=BRV20-08
Cyperus vaginatus	+	120	
Dipteracanthus australasicus subsp. *australasicus*	+	30	=BRV17-20
Dodonaea lanceolata var. *lanceolata*	+	120	BRV19-06
Duperreya commixta	+	250	
Eriachne mucronata	+	40	
Eucalyptus camaldulensis subsp. *refulgens*	18	1600	
Eucalyptus victrix	7	1500	
Euphorbia australis var. *subtomentosa*	+	10	BRV19-03
Euphorbia trigonosperma	+	30	=BRV20-02
Evolvulus alsinoides var. *decumbens*	+	10	
Evolvulus alsinoides var. *villosicalyx*	+	10	
Goodenia forrestii	+	20	=BRV16-03
Goodenia lamprosperma	+	30	=BRV20-07
Indigofera colutea	+	20	BRV19-01
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	+	160	
Ipomoea muelleri	+	5	=BRV20-11
Jasminum didymum subsp. *lineare*	+	120	
Lepidium muelleri-ferdinandii	+	15	BRV19-11
Malvastrum americanum	+	60	
Melaleuca glomerata	33	400	
Petalostylis labicheoides	2	220	
Phyllanthus maderaspatensis	+	30	
Pluchea rubelliflora	+	40	=BRV20-04
Pterocaulon sphacelatum	+	70	BRV19-12
Rhynchosia minima	+	20	
Sida aff. *fibulifera*	+	20	BRV19-08
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)	+	40	
Triodia wiseana	+	30	BRV19-02
Vachellia farnesiana	+	310	
Waltheria indica	+	40	

Brockman 4 Riparian Vegetation Survey Site BRV20

Described by: BECA Date: 26-August 2013 Type: Quadrat 50 x 50 m

MGA Zone 50 492419 mE 7497583 mN 116.926226 E -22.628678 S

Habitat Wide creek bed.

Soil Coarse sand.

Rock Type River wash lag gravel of ironstone, quartz and basalt fragments from 2mm-200mm.

Vegetation *Eucalyptus victrix* woodland over *Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186) scattered low shrubs over *Pluchea rubelliflora* very open herbland over *Eriachne pulchella* very open bunch grassland.

Veg Condition Very Good (**Cenchrus ciliaris, *Argemone ochroleuca* subsp. *ochroleuca*).

Fire Age No sign of recent fire.

Notes No signs of cattle/donkey.

Species	Cover (%)	Height (cm)	Specimen
Acacia citrinoviridis	+	300	
Acacia pyrifolia	+	160	
Alternanthera nana	+	10	BRV20-05
Amaranthus cuspidifolius	+	40	BRV20-03
Argemone ochroleuca subsp. *ochroleuca*	+	60	
Boerhavia coccinea	+	10	BRV20-01
Cenchrus ciliaris	+	30	
Cenchrus setiger	+	30	
Cleome viscosa	+	40	
Corchorus crozophorifolius	+	70	
Cucumis variabilis	+	50	
Cymbopogon ambiguus	+	50	BRV20-08
Cyperus vaginatus	+	80	
Dysphania rhadinostachya subsp. *rhadinostachya*	+	20	BRV20-06
Eriachne mucronata	+	40	
Eriachne pulchella	2	10	
Eucalyptus victrix	20	1200	
Euphorbia trigonosperma	+	20	BRV20-02
Goodenia lamprosperma	+	40	BRV20-07
Heliotropium cunninghamii	+	10	BRV20-10
Heliotropium pachyphyllum	+	10	BRV20-09
Ipomoea muelleri	+	1	BRV20-11
Melaleuca glomerata	+	250	
Phyllanthus maderaspatensis	+	20	
Pluchea rubelliflora	4	40	BRV20-04
Polycarpaea longiflora	+	15	
Ptilotus nobilis subsp. *nobilis*	+	50	
Sporobolus australasicus	+	10	
Stemodia grossa	+	30	
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)	2	60	
Triodia epactia	+	20	

Brockman 4 Riparian Vegetation Survey Site BRVR-CBA
Described by: BECA Date: 24-August 2013 Type: Relevé
MGA Zone 50 508905 mE 7502376 mN 117.086631 E -22.585291 S
Habitat Incised creek bed (~30m wide) curving.
Soil Not recorded.
Rock Type Not recorded.
Vegetation *Eucalyptus victrix* woodland.
Veg Condition Very Good (**Cenchrus ciliaris*).
Fire Age No sign of recent fire.
Notes **Cenchrus* cover in bed is +/-1% but much higher on banks.
A lot of juvenile *Eucalyptus* sp.

Species	Cover (%)	Height (cm)	Specimen
Acacia pyrifolia	+		
Cenchrus ciliaris	+		
Centipeda minima subsp. *macrocephala*	+		
Corchorus crozophorifolius	+		
Eragrostis tenellula	+		
Eucalyptus sp.	+		
Eucalyptus victrix	20		
Evolvulus alsinoides var. *villosicalyx*	+		
Goodenia lamprosperma	+		=BRV17-01
Gossypium robinsonii	+		
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	+		
Phyllanthus maderaspatensis	+		
Pluchea rubelliflora	+		=BRV17-34
Rhynchosia minima	+		
Stemodia grossa	+		
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)	+		
Wahlenbergia tumidifructa	+		=BRV17-22

Brockman 4 Riparian Vegetation Survey Site BRVR-SA

Described by: SVPC Date: 28-August 2013 Type: Relevé

MGA Zone 50 525479 mE 7505741 mN 117.247814 E -22.554724 S

Habitat Ill-defined creekline.

Soil Red-brown sand.

Rock Type Riverstones (continuous).

Vegetation *Eucalyptus victrix, Corymbia hamersleyensis* open woodland over *Acacia tumida* var. *pilbarensis, A. pyrifolia* (var. not determined), *A. citrinoviridis* tall open shrubland over *Triodia epactia* very open hummock grassland over *Themeda triandra*, (*Chrysopogon fallax*) very open tussock grassland.

Veg Condition Very Good (**Malvastrum americanum*, **Cenchrus ciliaris*).

Fire Age No sign of recent fire.

Notes Low number of scats.

Relevé ends near small track.

Species	Cover (%)	Height (cm)	Specimen
Acacia ancistrocarpa	+	70	
Acacia citrinoviridis	1	280	
Acacia pyrifolia	1	150	
Acacia tumida var. *pilbarensis*	1	250	
Alternanthera denticulata	+	10	=BRV02-04
Androcalva luteiflora	+	180	
Boerhavia coccinea	+	15	=BRV20-01
Bulbostylis barbata	+	10	
Cenchrus ciliaris	+	50	
Chrysopogon fallax	0.5	110	
Cleome viscosa	+	30	
Corchorus lasiocarpus subsp. *parvus*	+	45	=BRV02-14
Corymbia hamersleyana	3	800	
Cucumis variabilis	+	16	
Cymbopogon ambiguus	+	110	
Dichanthium sericeum subsp. *humilius*	+	15	
Digitaria brownii	1	60	
Enneapogon caerulescens	+	30	
Enneapogon polyphyllus	+	15	
Eragrostis cumingii	+	15	
Eragrostis tenellula	+	25	
Eremophila longifolia	+	150	
Eriachne pulchella	+	20	
Eriachne tenuiculmis	+	30	
Eucalyptus victrix	2	1300	
Evolvulus alsinoides var. *villosicalyx*	+	10	
Goodenia forrestii	+	25	
Goodenia triodiophila	+	30	BRVR-SA02
Gossypium australe	+	120	
Gossypium robinsonii	+	250	
Grevillea pyramidalis subsp. *leucadendron*	+	200	
Hakea lorea subsp. *lorea*	+	210	
Heliotropium cunninghamii	+	20	BRVR-SV03
Hibiscus sturtii var. *grandiflorus*	+	20	BRVR-SA09
Hybanthus aurantiacus	+	25	
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	+	220	
Jasminum didymum subsp. *lineare*	+	250	
Malvastrum americanum	+	35	
Melhania oblongifolia	+	25	
Mollugo molluginea	+	20	
Phyllanthus maderaspatensis	+	10	
Pluchea dentex	+	25	BRVR-SA01
Polycarpaea longiflora	+	25	
Pterocaulon sphacelatum	+	50	BRVR-SA05
Ptilotus astrolasius	+	30	
Ptilotus obovatus var. *obovatus*	+	90	
Senna artemisioides subsp. *oligophylla*	+	120	BRVR-SA06
Setaria verticillata	+	20	

Species	Cover (%)	Height (cm)	Specimen
Sida aff. *fibulifera*	+	40	BRVR-SA07
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)	+	160	
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)	+	40	=BRV02-06
Themeda triandra	7	60	
Trachymene oleracea subsp. *oleracea*	+	110	BRVR-SV08
Trichodesma zeylanicum var. *zeylanicum*	+	40	
Triodia epactia	6	40	BRVR-SA04
Waltheria indica	+	45	

Appendix 8

Records of Conservation Significant Flora and Introduced (Weed) Species from the Study Area

Records of Priority flora within the study area.

Species	Conservation Status	Easting	Northing	Number of Individuals
Goodenia nuda	Priority 4	524106	7504851	1
Goodenia nuda	Priority 4	516577	7504786	1
Goodenia nuda	Priority 4	512290	7503593	1
Goodenia nuda	Priority 4	513267	7503928	1
Goodenia nuda	Priority 4	497466	7500148	1
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	498217	7501449	20
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	498184	7501456	12
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	498124	7501461	7
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	499061	7501858	2
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	499326	7501954	1
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	499353	7501996	50-100
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	500779	7502415	40
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	501929	7502542	12
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	502334	7502695	6
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	502550	7502813	9
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	502597	7502803	7
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	503001	7502367	9
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	503384	7502361	18
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	503666	7502161	1
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	503736	7502118	2
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	503894	7502077	2
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	504005	7502089	27
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	504234	7502057	7
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	497827	7501060	1
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	498171	7501484	2
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	499982	7502104	1
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	501224	7502611	1
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	502339	7502702	1
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	504492	7501901	2
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	504515	7501995	20
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	504515	7502079	10
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	504542	7502077	6
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	504563	7501949	30+
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	504569	7501861	2
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	504677	7501796	10
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	504671	7501779	6
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	504643	7501798	8
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	504776	7501736	55
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	504791	7501769	1
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	505234	7501837	5
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	505866	7501862	6
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	506095	7501934	1
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	506531	7501737	18

Species	Conservation Status	Easting	Northing	Number of Individuals
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	506844	7501583	4
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	507203	7501638	2
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	507428	7501780	10
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	507921	7501920	1
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	508108	7501941	1
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	508892	7502362	13
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	509123	7502537	1
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	509217	7502486	15
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	509378	7502319	5
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	509446	7502309	2
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	509550	7502335	1
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	509566	7502397	1
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	509879	7502426	10
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	509885	7502458	48
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	510247	7502842	7
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	517056	7504742	20
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	517173	7504564	16
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	517129	7504459	15
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	517259	7504293	5
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	517398	7504253	17
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	517801	7504371	8
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	518211	7504137	10
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	519109	7503568	14
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	519555	7503451	3
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	519654	7503441	11
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	520743	7504147	3
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	521012	7504223	2
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	521312	7504340	4
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	521403	7504285	5
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	522357	7504224	10
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	522440	7504194	20
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	522512	7504133	10
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	522620	7504070	4
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	522661	7504074	8
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	522668	7504095	7
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	523141	7504436	14
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	489599	7497581	1
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	489750	7497621	10
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	489978	7497760	2
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	490238	7497756	14
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	490342	7497781	4
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	490875	7497687	20
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	491404	7497723	3
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	492348	7497436	9

Species	Conservation Status	Easting	Northing	Number of Individuals
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	492651	7497365	3
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	492952	7497242	4
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	493002	7497167	5
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	494911	7498562	5
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	495057	7498594	5
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	495086	7498664	4
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	495170	7498779	6
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	495462	7498851	1
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	495524	7498916	2
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	495850	7498898	10
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	496565	7499265	13
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	525695	7506594	2
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	525608	7506554	3
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	525459	7506357	8
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	525372	7506220	12
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	510810	7502993	8
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	510812	7502925	2
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	510952	7502959	3
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	511310	7503338	15
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	511890	7503310	5
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	512136	7503379	1
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	512340	7503753	1
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	512536	7503614	15
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	512950	7503759	5
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	513391	7503811	8
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	513473	7504080	6
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	513428	7504208	1
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	513528	7504292	3
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	514026	7504447	40
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	515562	7504437	3
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	515530	7504598	1
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	515878	7504880	10
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	516005	7504937	4
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	516352	7504932	5
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	516551	7504820	9
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	516543	7504781	8
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	510606	7504787	50
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	516784	7504774	1
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	497799	7500812	40
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	497764	7500815	6
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	522203	7504263	6
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	510878	7503063	73
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	513245	7503955	33
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	514840	7504419	19

Species	Conservation Status	Easting	Northing	Number of Individuals
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	516561	7504815	40
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	524080	7504873	11
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	509934	7502569	108
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	507795	7502120	2
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	501895	7502562	6
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	498200	7501500	1
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	496032	7498924	135
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Priority 3	525490	7506172	26
Pentalepis trichodesmoides subsp. *hispida*	Priority 2	512290	7503593	1
Peplidium sp. Fortescue Marsh (S. van Leeuwen 4865)	Priority 1	522229	7504240	1

Records of introduced (weed) species within the study area.

Species	Common Name	Easting	Northing	Number of Individuals
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	489487	7497512	50
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	489707	7497747	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	489750	7497621	50
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	489978	7497760	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	490342	7497781	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	490346	7497637	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	490899	7497627	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	491404	7497723	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	491752	7497648	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	492277	7497608	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	492430	7497546	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	492952	7497242	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	492979	7497060	1000's
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	493916	7497238	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	494096	7498062	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	494184	7498342	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	494911	7498562	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	495057	7498594	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	495524	7498916	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	495850	7498898	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	496032	7498924	187
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	496062	7498909	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	496225	7498956	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	496890	7499468	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	496996	7499532	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	497117	7499597	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	497362	7499842	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	497465	7500148	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	497508	7499940	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	497531	7500937	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	497592	7499958	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	497609	7500297	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	497627	7500866	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	497799	7500812	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	497827	7501060	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	497869	7501188	150+
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	497898	7501138	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	497908	7500500	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	497988	7501377	2
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	498016	7501404	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	498171	7501484	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	498200	7501500	55
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	498223	7501479	20-30

Species	Common Name	Easting	Northing	Number of Individuals
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	498228	7501450	150+
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	498336	7501479	50+
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	498513	7501512	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	498623	7501582	5
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	498673	7501720	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	498727	7501713	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	499147	7501880	50
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	499282	7501925	100+
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	499358	7501998	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	499982	7502104	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	499984	7502106	50+
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	500196	7502077	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	500385	7502379	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	500411	7502128	80
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	500714	7502328	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	501224	7502611	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	501448	7502738	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	501454	7502766	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	501895	7502562	230
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	501914	7502535	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	501929	7502542	200+
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	502339	7502702	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	502597	7502803	100+
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	502654	7502837	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	502675	7502674	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	502706	7502983	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	502762	7502772	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	502920	7502458	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	503001	7502367	50
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	503384	7502361	1000+
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	503470	7502326	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	503666	7502161	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	504005	7502089	100+
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	504481	7501942	450
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	504492	7501901	15
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	504504	7501908	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	504515	7502079	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	504563	7501949	100+
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	504569	7501861	80
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	504671	7501779	40
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	504677	7501796	20
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	504791	7501769	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	504847	7501713	200+
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	504981	7501719	1,000's. Dense cover

Species	Common Name	Easting	Northing	Number of Individuals
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	505234	7501837	100's. Dense cover since last point
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	505564	7501847	1000's
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	505866	7501862	1000's
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	506148	7501885	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	506623	7501743	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	506797	7501642	15
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	507428	7501780	100
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	507812	7502091	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	507863	7501901	Dense cover
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	508333	7502143	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	508487	7502354	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	508570	7502401	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	508905	7502376	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	509056	7502385	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	509550	7502335	100's
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	509566	7502397	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	509854	7502461	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	509941	7502535	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	510133	7502896	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	510247	7502842	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	510472	7502912	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	510555	7502928	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	510807	7503004	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	510870	7503032	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	511165	7503224	75
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	511197	7503199	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	511682	7503254	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	512101	7503379	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	512288	7503594	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	512688	7503581	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	512762	7503537	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	512952	7503761	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	513266	7503927	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	513391	7503811	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	513428	7504208	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	513473	7504080	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	513936	7504436	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	514480	7504406	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	514822	7504375	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	514864	7504394	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	515026	7504363	50
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	515533	7504561	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	515562	7504437	20-30
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	515632	7504701	20-30

Species	Common Name	Easting	Northing	Number of Individuals
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	516361	7504933	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	516363	7504953	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	516543	7504781	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	516568	7504786	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	516843	7504837	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	516861	7504833	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	517014	7504774	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	517056	7504742	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	517088	7504669	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	517529	7504308	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	517962	7504360	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	518159	7504135	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	518987	7503722	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	519109	7503568	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	519555	7503451	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	519654	7503441	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	520127	7503715	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	520416	7503875	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	520743	7504147	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	521997	7504181	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	522230	7504240	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	522668	7504095	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	523141	7504436	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	523384	7504775	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	524095	7505030	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	524104	7504851	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	525214	7505895	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	525490	7506172	20-30
**Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	526205	7506728	20-30
**Bidens bipinnata*	Bipinnate Beggartick	498200	7501500	1
**Cenchrus ciliaris*	Buffel Grass	489487	7497512	10
**Cenchrus ciliaris*	Buffel Grass	489707	7497747	10
**Cenchrus ciliaris*	Buffel Grass	489978	7497760	10
**Cenchrus ciliaris*	Buffel Grass	490342	7497781	20-30
**Cenchrus ciliaris*	Buffel Grass	490346	7497637	50-70
**Cenchrus ciliaris*	Buffel Grass	490899	7497627	50-70
**Cenchrus ciliaris*	Buffel Grass	491404	7497723	50-70
**Cenchrus ciliaris*	Buffel Grass	491752	7497648	50-70
**Cenchrus ciliaris*	Buffel Grass	492277	7497608	50-70
**Cenchrus ciliaris*	Buffel Grass	492395	7497536	10
**Cenchrus ciliaris*	Buffel Grass	492430	7497546	50-70
**Cenchrus ciliaris*	Buffel Grass	492952	7497242	50-70
**Cenchrus ciliaris*	Buffel Grass	493916	7497238	50-70
**Cenchrus ciliaris*	Buffel Grass	494096	7498062	50-70

Species	Common Name	Easting	Northing	Number of Individuals
*Cenchrus ciliaris	Buffel Grass	494184	7498342	5
*Cenchrus ciliaris	Buffel Grass	494911	7498562	50-70
*Cenchrus ciliaris	Buffel Grass	495057	7498594	50-70
*Cenchrus ciliaris	Buffel Grass	495524	7498916	50-70
*Cenchrus ciliaris	Buffel Grass	495850	7498898	50-70
*Cenchrus ciliaris	Buffel Grass	496062	7498909	50-70
*Cenchrus ciliaris	Buffel Grass	496225	7498956	50-70
*Cenchrus ciliaris	Buffel Grass	496890	7499468	50-70
*Cenchrus ciliaris	Buffel Grass	496996	7499532	50-70
*Cenchrus ciliaris	Buffel Grass	497117	7499597	50-70
*Cenchrus ciliaris	Buffel Grass	497362	7499842	50-70
*Cenchrus ciliaris	Buffel Grass	497451	7500179	4000
*Cenchrus ciliaris	Buffel Grass	497465	7500148	50-70
*Cenchrus ciliaris	Buffel Grass	497508	7499940	50-70
*Cenchrus ciliaris	Buffel Grass	497531	7500937	50-70
*Cenchrus ciliaris	Buffel Grass	497592	7499958	50-70
*Cenchrus ciliaris	Buffel Grass	497609	7500297	50-70
*Cenchrus ciliaris	Buffel Grass	497627	7500866	50-70
*Cenchrus ciliaris	Buffel Grass	497696	7500074	40-50
*Cenchrus ciliaris	Buffel Grass	497799	7500812	20-30
*Cenchrus ciliaris	Buffel Grass	497827	7501060	20-30
*Cenchrus ciliaris	Buffel Grass	497898	7501138	20-30
*Cenchrus ciliaris	Buffel Grass	497908	7500500	50-70
*Cenchrus ciliaris	Buffel Grass	498016	7501404	20-30
*Cenchrus ciliaris	Buffel Grass	498077	7501434	50
*Cenchrus ciliaris	Buffel Grass	498171	7501484	10
*Cenchrus ciliaris	Buffel Grass	498200	7501500	2500
*Cenchrus ciliaris	Buffel Grass	498204	7501453	40-50
*Cenchrus ciliaris	Buffel Grass	498223	7501479	50-70
*Cenchrus ciliaris	Buffel Grass	498513	7501512	10
*Cenchrus ciliaris	Buffel Grass	498623	7501582	40-50
*Cenchrus ciliaris	Buffel Grass	498673	7501720	10
*Cenchrus ciliaris	Buffel Grass	498727	7501713	10
*Cenchrus ciliaris	Buffel Grass	499147	7501880	20
*Cenchrus ciliaris	Buffel Grass	499358	7501998	10
*Cenchrus ciliaris	Buffel Grass	499982	7502104	20-30
*Cenchrus ciliaris	Buffel Grass	500196	7502077	50-70
*Cenchrus ciliaris	Buffel Grass	500354	7502392	7500
*Cenchrus ciliaris	Buffel Grass	500385	7502379	50-70
*Cenchrus ciliaris	Buffel Grass	500714	7502328	50-70
*Cenchrus ciliaris	Buffel Grass	501224	7502611	20-30
*Cenchrus ciliaris	Buffel Grass	501448	7502738	50-70
*Cenchrus ciliaris	Buffel Grass	501454	7502766	50-70
*Cenchrus ciliaris	Buffel Grass	501895	7502562	80

Species	Common Name	Easting	Northing	Number of Individuals
*Cenchrus ciliaris	Buffel Grass	501914	7502535	50-70
*Cenchrus ciliaris	Buffel Grass	502339	7502702	10
*Cenchrus ciliaris	Buffel Grass	502619	7502854	2000
*Cenchrus ciliaris	Buffel Grass	502654	7502837	50-70
*Cenchrus ciliaris	Buffel Grass	502675	7502674	50-70
*Cenchrus ciliaris	Buffel Grass	502706	7502983	50-70
*Cenchrus ciliaris	Buffel Grass	502762	7502772	50-70
*Cenchrus ciliaris	Buffel Grass	502920	7502458	50-70
*Cenchrus ciliaris	Buffel Grass	503470	7502326	50-70
*Cenchrus ciliaris	Buffel Grass	503666	7502161	50-70
*Cenchrus ciliaris	Buffel Grass	504481	7501942	1200
*Cenchrus ciliaris	Buffel Grass	504492	7501901	10
*Cenchrus ciliaris	Buffel Grass	504504	7501908	50-70
*Cenchrus ciliaris	Buffel Grass	504515	7502079	50-70
*Cenchrus ciliaris	Buffel Grass	504542	7502077	500
*Cenchrus ciliaris	Buffel Grass	504671	7501779	50-70
*Cenchrus ciliaris	Buffel Grass	504791	7501769	20-30
*Cenchrus ciliaris	Buffel Grass	505564	7501847	10
*Cenchrus ciliaris	Buffel Grass	506148	7501885	50-70
*Cenchrus ciliaris	Buffel Grass	506623	7501743	50-70
*Cenchrus ciliaris	Buffel Grass	507428	7501780	50-70
*Cenchrus ciliaris	Buffel Grass	507795	7502120	40-50
*Cenchrus ciliaris	Buffel Grass	507812	7502091	50-70
*Cenchrus ciliaris	Buffel Grass	508333	7502143	50-70
*Cenchrus ciliaris	Buffel Grass	508487	7502354	50-70
*Cenchrus ciliaris	Buffel Grass	508570	7502401	10
*Cenchrus ciliaris	Buffel Grass	508905	7502376	50-70
*Cenchrus ciliaris	Buffel Grass	509056	7502385	50-70
*Cenchrus ciliaris	Buffel Grass	509566	7502397	50-70
*Cenchrus ciliaris	Buffel Grass	509854	7502461	50-70
*Cenchrus ciliaris	Buffel Grass	509934	7502569	80
*Cenchrus ciliaris	Buffel Grass	509941	7502535	50-70
*Cenchrus ciliaris	Buffel Grass	510133	7502896	2
*Cenchrus ciliaris	Buffel Grass	510247	7502842	50-70
*Cenchrus ciliaris	Buffel Grass	510472	7502912	50-70
*Cenchrus ciliaris	Buffel Grass	510555	7502928	50-70
*Cenchrus ciliaris	Buffel Grass	510807	7503004	2
*Cenchrus ciliaris	Buffel Grass	510870	7503032	50-70
*Cenchrus ciliaris	Buffel Grass	510878	7503063	150
*Cenchrus ciliaris	Buffel Grass	511165	7503224	2
*Cenchrus ciliaris	Buffel Grass	511197	7503199	100-120
*Cenchrus ciliaris	Buffel Grass	511682	7503254	50-70
*Cenchrus ciliaris	Buffel Grass	512101	7503379	50-70
*Cenchrus ciliaris	Buffel Grass	512259	7503610	200

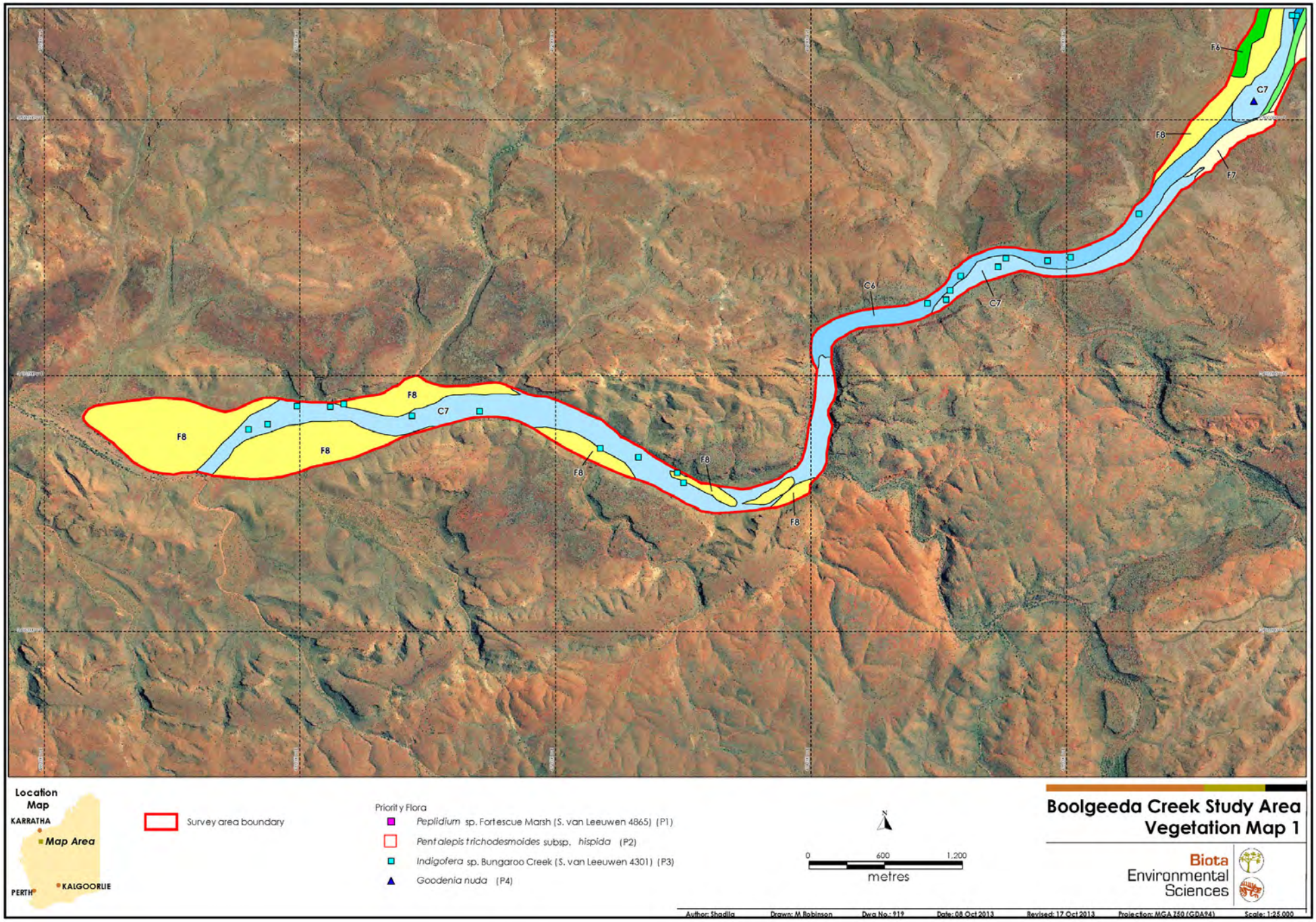
Species	Common Name	Easting	Northing	Number of Individuals
*Cenchrus ciliaris	Buffel Grass	512288	7503594	50-70
*Cenchrus ciliaris	Buffel Grass	512688	7503581	50-70
*Cenchrus ciliaris	Buffel Grass	512762	7503537	50-70
*Cenchrus ciliaris	Buffel Grass	512952	7503761	20-30
*Cenchrus ciliaris	Buffel Grass	513245	7503955	40-50
*Cenchrus ciliaris	Buffel Grass	513266	7503927	50-70
*Cenchrus ciliaris	Buffel Grass	513391	7503811	2
*Cenchrus ciliaris	Buffel Grass	513428	7504208	20-30
*Cenchrus ciliaris	Buffel Grass	513473	7504080	50-70
*Cenchrus ciliaris	Buffel Grass	513936	7504436	50-70
*Cenchrus ciliaris	Buffel Grass	513979	7504498	40-50
*Cenchrus ciliaris	Buffel Grass	514480	7504406	50-70
*Cenchrus ciliaris	Buffel Grass	514822	7504375	50-70
*Cenchrus ciliaris	Buffel Grass	514840	7504419	50
*Cenchrus ciliaris	Buffel Grass	514864	7504394	50-70
*Cenchrus ciliaris	Buffel Grass	515533	7504561	50-70
*Cenchrus ciliaris	Buffel Grass	515562	7504437	3
*Cenchrus ciliaris	Buffel Grass	515632	7504701	50-70
*Cenchrus ciliaris	Buffel Grass	516361	7504933	50-70
*Cenchrus ciliaris	Buffel Grass	516363	7504953	2
*Cenchrus ciliaris	Buffel Grass	516543	7504781	20-30
*Cenchrus ciliaris	Buffel Grass	516561	7504815	40-50
*Cenchrus ciliaris	Buffel Grass	516568	7504786	50-70
*Cenchrus ciliaris	Buffel Grass	516843	7504837	20-30
*Cenchrus ciliaris	Buffel Grass	516861	7504833	10
*Cenchrus ciliaris	Buffel Grass	517014	7504774	50-70
*Cenchrus ciliaris	Buffel Grass	517056	7504742	1
*Cenchrus ciliaris	Buffel Grass	517088	7504669	50-70
*Cenchrus ciliaris	Buffel Grass	517529	7504308	50-70
*Cenchrus ciliaris	Buffel Grass	517962	7504360	50-70
*Cenchrus ciliaris	Buffel Grass	518159	7504135	50-70
*Cenchrus ciliaris	Buffel Grass	518987	7503722	50-70
*Cenchrus ciliaris	Buffel Grass	519109	7503568	20-30
*Cenchrus ciliaris	Buffel Grass	519555	7503451	20-30
*Cenchrus ciliaris	Buffel Grass	519654	7503441	10
*Cenchrus ciliaris	Buffel Grass	520127	7503715	50-70
*Cenchrus ciliaris	Buffel Grass	520416	7503875	50-70
*Cenchrus ciliaris	Buffel Grass	520743	7504147	50-70
*Cenchrus ciliaris	Buffel Grass	521997	7504181	50-70
*Cenchrus ciliaris	Buffel Grass	522203	7504263	40-50
*Cenchrus ciliaris	Buffel Grass	522230	7504240	500
*Cenchrus ciliaris	Buffel Grass	522357	7504224	2
*Cenchrus ciliaris	Buffel Grass	522668	7504095	50-70
*Cenchrus ciliaris	Buffel Grass	523141	7504436	1

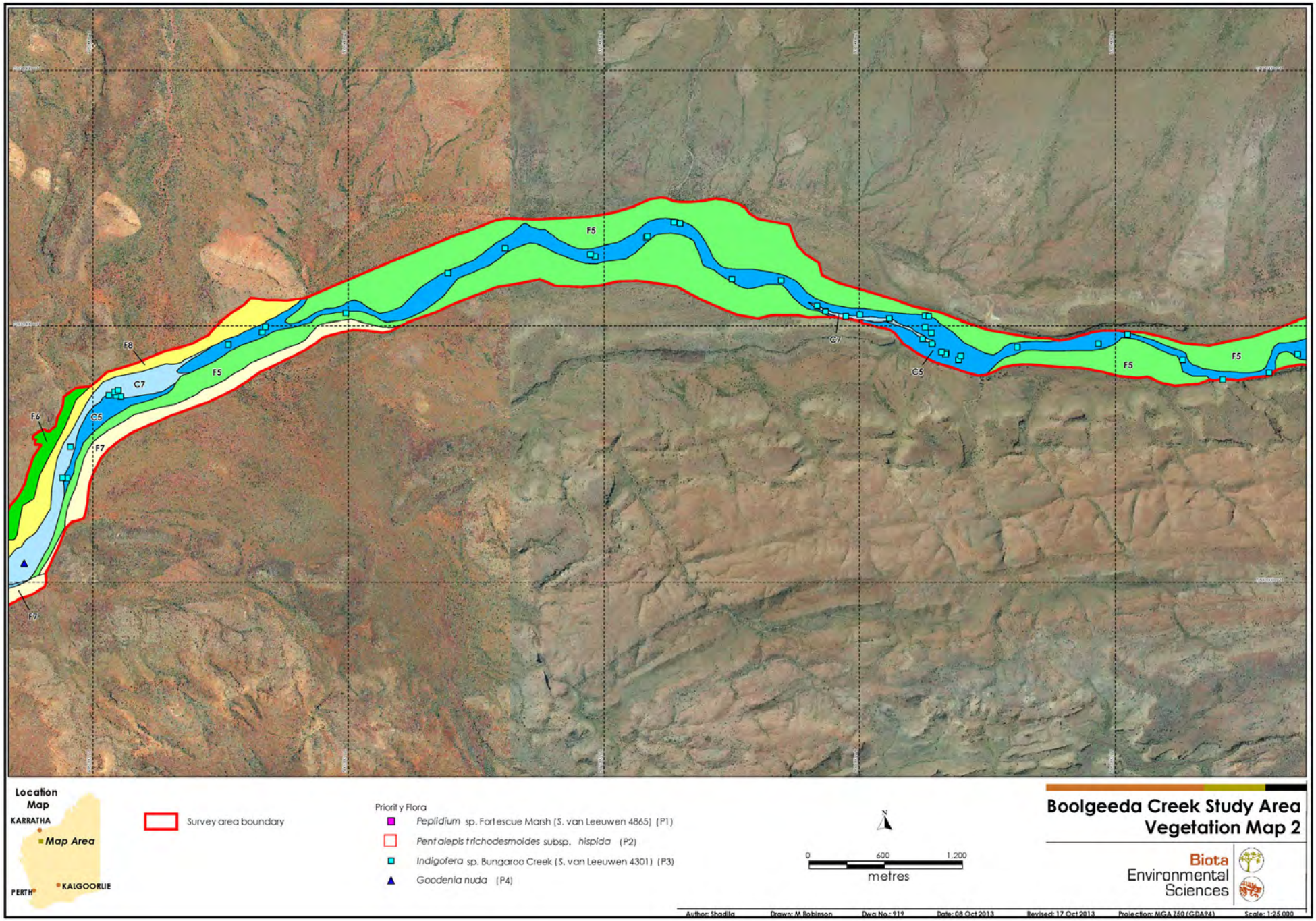
Species	Common Name	Easting	Northing	Number of Individuals
**Cenchrus ciliaris*	Buffel Grass	523384	7504775	1
**Cenchrus ciliaris*	Buffel Grass	524080	7504873	40-50
**Cenchrus ciliaris*	Buffel Grass	524095	7505030	50-70
**Cenchrus ciliaris*	Buffel Grass	524104	7504851	50-70
**Cenchrus ciliaris*	Buffel Grass	525214	7505895	40-50
**Cenchrus ciliaris*	Buffel Grass	525490	7506172	21
**Cenchrus ciliaris*	Buffel Grass	526205	7506728	40-50
**Cenchrus setiger*	Birdwood Grass	492395	7497536	2
**Cenchrus setiger*	Birdwood Grass	497451	7500179	150
**Cenchrus setiger*	Birdwood Grass	498200	7501500	1000
**Cenchrus setiger*	Birdwood Grass	501895	7502562	1
**Cenchrus setiger*	Birdwood Grass	504515	7502079	40
**Cenchrus setiger*	Birdwood Grass	512259	7503610	70
**Cenchrus setiger*	Birdwood Grass	516543	7504781	45
**Cucumis melo* subsp. *agrestis*	Ulcardo Melon	502670	7502870	NA
**Flaveria trinervia*	Speedy Weed	506095	7501934	1
**Flaveria trinervia*	Speedy Weed	507863	7501901	1
**Malvastrum americanum*	Spiked Malvastrum	496032	7498924	6
**Malvastrum americanum*	Spiked Malvastrum	497451	7500179	18
**Malvastrum americanum*	Spiked Malvastrum	497898	7501138	11
**Malvastrum americanum*	Spiked Malvastrum	498016	7501404	5
**Malvastrum americanum*	Spiked Malvastrum	498200	7501500	100
**Malvastrum americanum*	Spiked Malvastrum	498204	7501453	2
**Malvastrum americanum*	Spiked Malvastrum	498513	7501512	1
**Malvastrum americanum*	Spiked Malvastrum	499147	7501880	1
**Malvastrum americanum*	Spiked Malvastrum	499982	7502104	1
**Malvastrum americanum*	Spiked Malvastrum	500354	7502392	320
**Malvastrum americanum*	Spiked Malvastrum	501454	7502766	7
**Malvastrum americanum*	Spiked Malvastrum	501895	7502562	33
**Malvastrum americanum*	Spiked Malvastrum	503736	7502118	1
**Malvastrum americanum*	Spiked Malvastrum	504481	7501942	12
**Malvastrum americanum*	Spiked Malvastrum	504569	7501861	2
**Malvastrum americanum*	Spiked Malvastrum	504643	7501798	2
**Malvastrum americanum*	Spiked Malvastrum	504677	7501796	1
**Malvastrum americanum*	Spiked Malvastrum	504791	7501769	3
**Malvastrum americanum*	Spiked Malvastrum	506423	7501808	1
**Malvastrum americanum*	Spiked Malvastrum	506797	7501642	1
**Malvastrum americanum*	Spiked Malvastrum	507795	7502120	1
**Malvastrum americanum*	Spiked Malvastrum	509378	7502319	1
**Malvastrum americanum*	Spiked Malvastrum	510878	7503063	1
**Malvastrum americanum*	Spiked Malvastrum	512259	7503610	13
**Malvastrum americanum*	Spiked Malvastrum	512847	7503531	300+
**Malvastrum americanum*	Spiked Malvastrum	513245	7503955	1
**Malvastrum americanum*	Spiked Malvastrum	513391	7503811	1

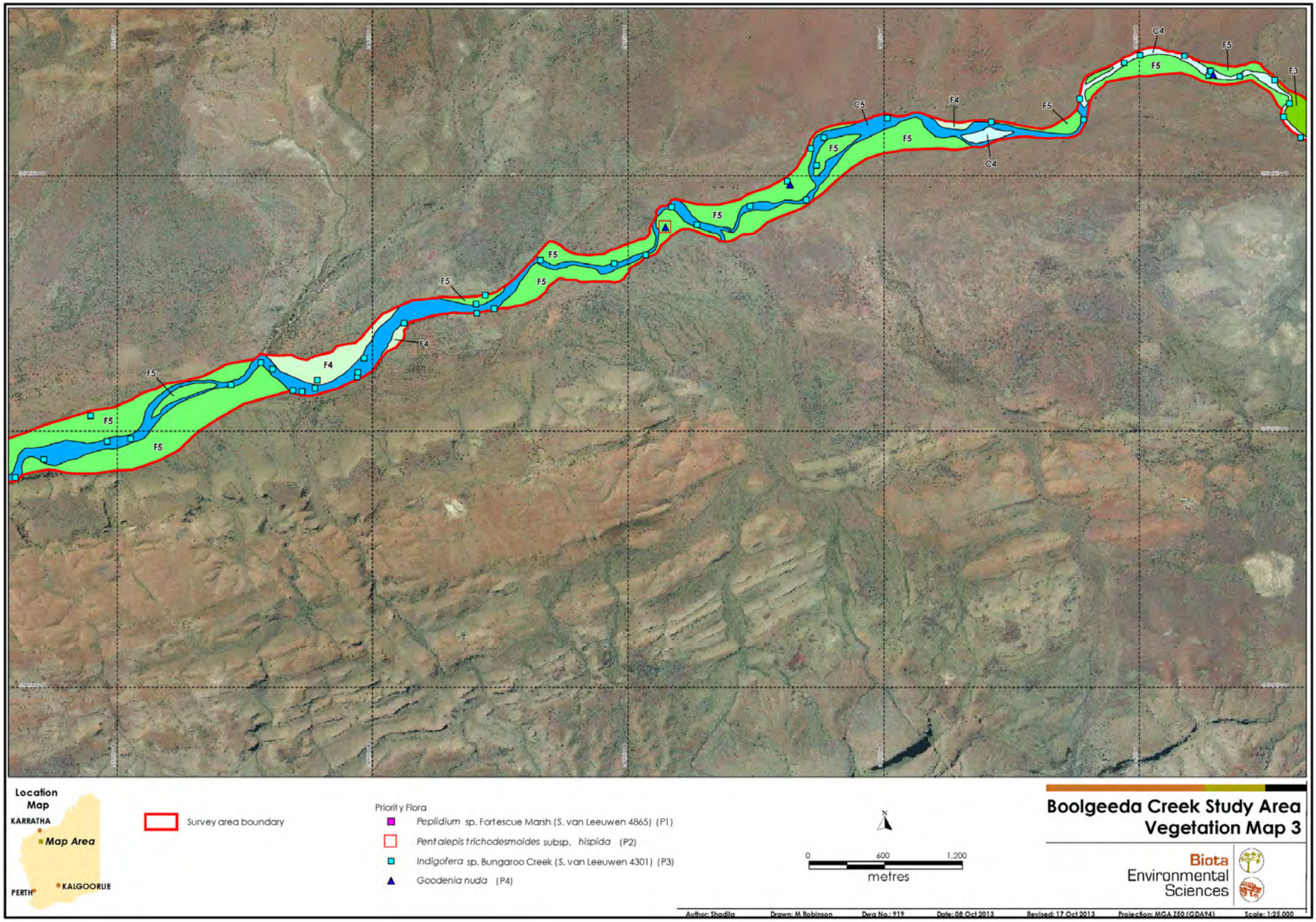
Species	Common Name	Easting	Northing	Number of Individuals
**Malvastrum americanum*	Spiked Malvastrum	514840	7504419	5
**Malvastrum americanum*	Spiked Malvastrum	522512	7504133	18
**Malvastrum americanum*	Spiked Malvastrum	522620	7504070	50+
**Malvastrum americanum*	Spiked Malvastrum	522661	7504074	20
**Malvastrum americanum*	Spiked Malvastrum	524080	7504873	1
**Malvastrum americanum*	Spiked Malvastrum	525490	7506172	11
**Portulaca oleracea/intraterranea*	Purslane	500354	7502392	1
**Portulaca oleracea/intraterranea*	Purslane	507795	7502120	1
**Portulaca oleracea/intraterranea*	Purslane	512259	7503610	3
**Setaria verticillata*	Whorled Pigeon Grass	525479	7505741	4
**Sigesbeckia orientalis*	Indian weed	522203	7504263	NA
**Sonchus oleraceus*	Common Sowthistle	499147	7501880	2
**Sonchus oleraceus*	Common Sowthistle	501895	7502562	1
**Sonchus oleraceus*	Common Sowthistle	504481	7501942	3
**Sonchus oleraceus*	Common Sowthistle	505653	7501847	1
**Sonchus oleraceus*	Common Sowthistle	508892	7502362	5
**Tribulus terrestris*	Caltrop	507795	7502120	NA
**Vachellia farnesiana*	Mimosa Bush	494184	7498342	1
**Vachellia farnesiana*	Mimosa Bush	496032	7498924	4
**Vachellia farnesiana*	Mimosa Bush	497508	7499940	1
**Vachellia farnesiana*	Mimosa Bush	498077	7501434	2
**Vachellia farnesiana*	Mimosa Bush	498200	7501500	10
**Vachellia farnesiana*	Mimosa Bush	499061	7501858	1
**Vachellia farnesiana*	Mimosa Bush	501895	7502562	1
**Vachellia farnesiana*	Mimosa Bush	503736	7502118	2
**Vachellia farnesiana*	Mimosa Bush	504341	7501987	4
**Vachellia farnesiana*	Mimosa Bush	504481	7501942	3
**Vachellia farnesiana*	Mimosa Bush	504643	7501798	6
**Vachellia farnesiana*	Mimosa Bush	504677	7501796	1
**Vachellia farnesiana*	Mimosa Bush	505866	7501862	1
**Vachellia farnesiana*	Mimosa Bush	506300	7501872	10
**Vachellia farnesiana*	Mimosa Bush	506844	7501583	1
**Vachellia farnesiana*	Mimosa Bush	508892	7502362	2

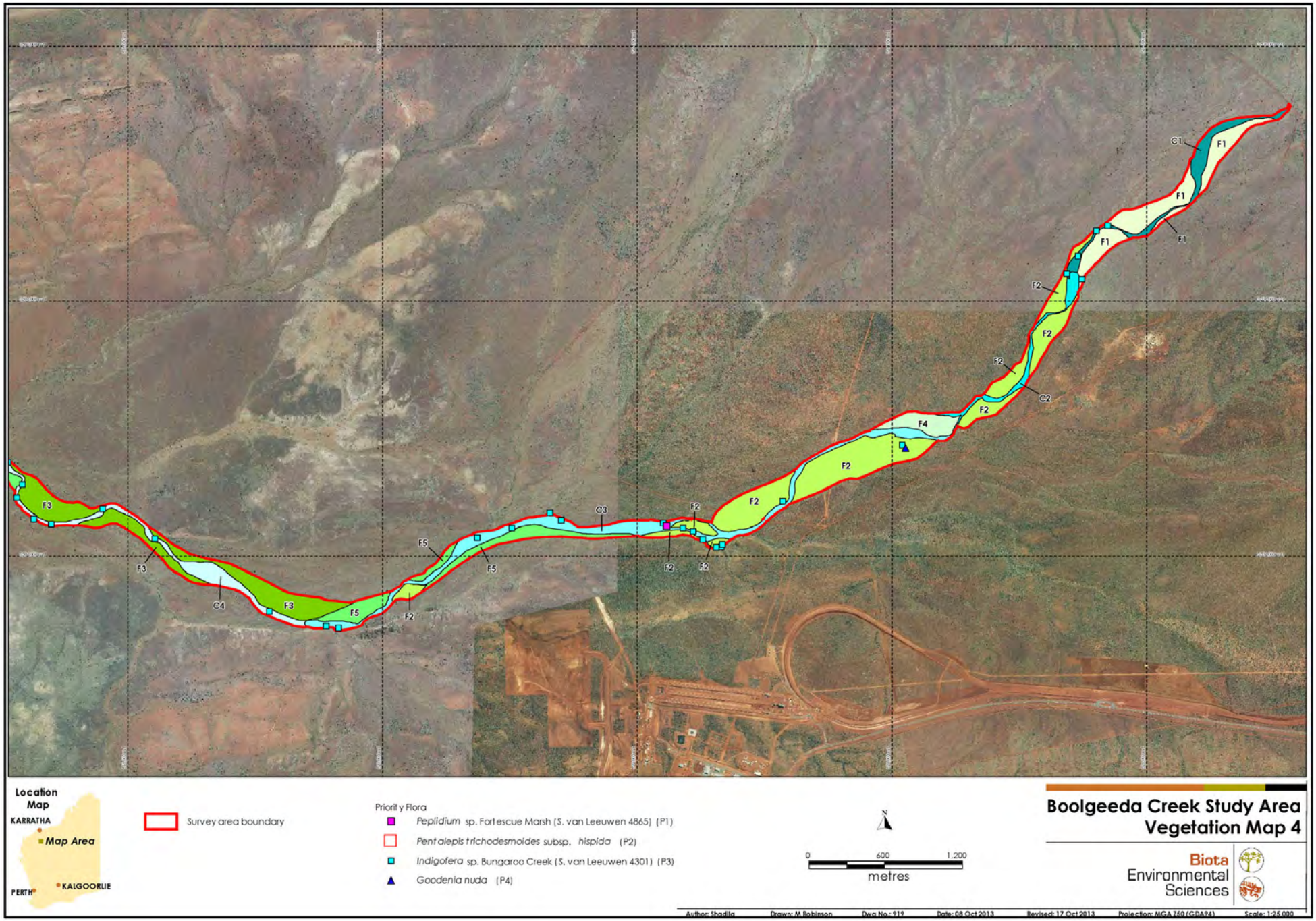
Appendix 9

Distribution of Conservation Significant Flora within the Study Area


F6
C7
F8
F7
C6
C7
F8
C7
F8
F8
F8
F8
F8
Location Map
KARRATHA
Map Area
PERTH
KALGOORLIE
Survey area boundary
Priority Flora
Peplidium sp. Fortescue Marsh (S. van Leeuwen 4865) (P1)
Pentalepis trichodesmoides subsp. hispida (P2)
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301) (P3)
Goodenia nuda (P4)
N
0
600
1,200
metres
Boolgeeda Creek Study Area
Vegetation Map 1
Biota Environmental Sciences
Author: Shadila
Drawn: M Robinson
Dwg No.: 919
Date: 08 Oct 2013
Revised: 17 Oct 2013
Projection: MGA 50 (GDA94)
Scale: 1:25,000

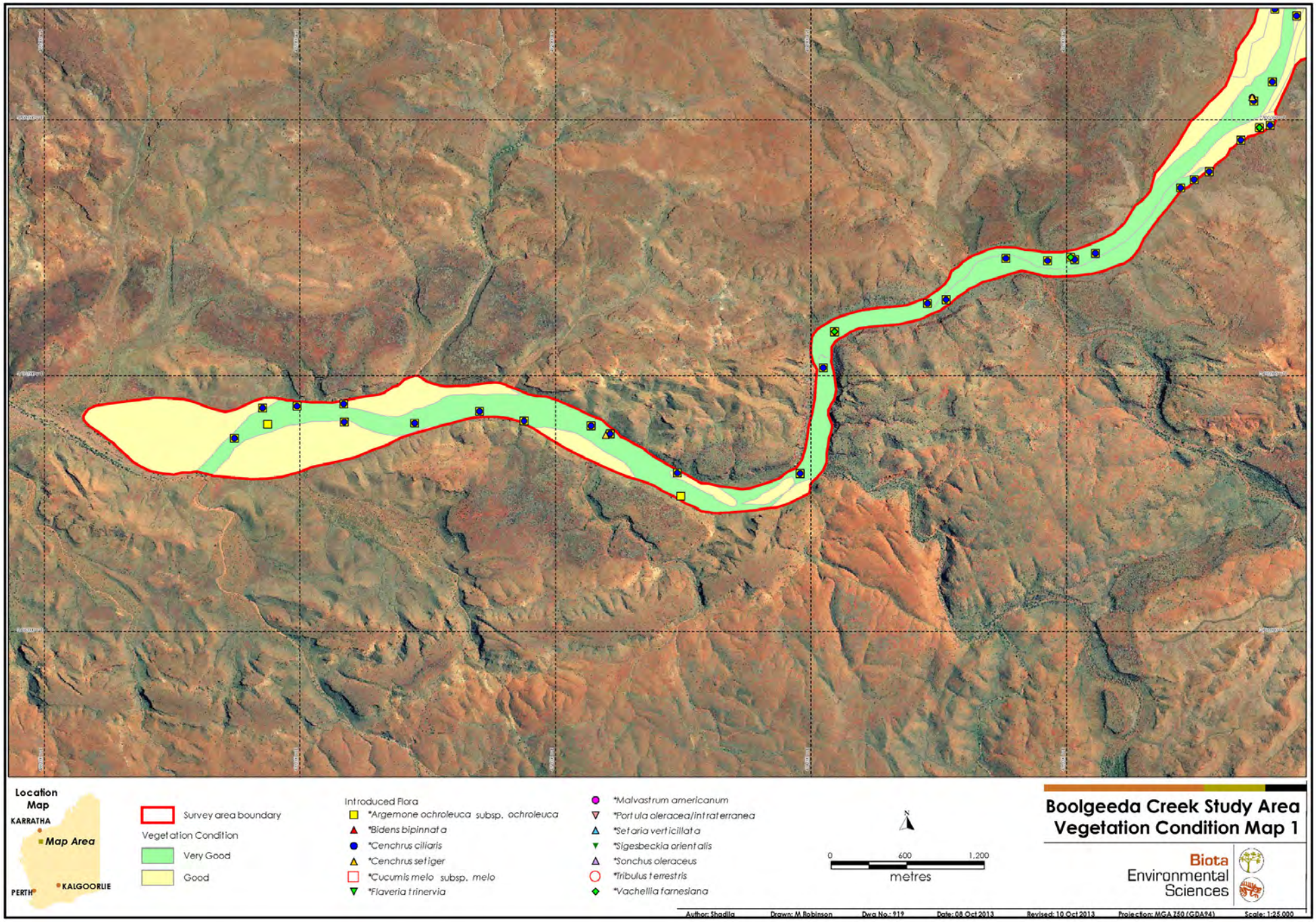

F5
F8
C7
F5
F6
C5
F7
F7
C7
C5
F5
F5
Location Map
KARRATHA
Map Area
PERTH
KALGOORLIE
Survey area boundary
Priority Flora
Peplidium sp. Fortescue Marsh (S. van Leeuwen 4865) (P1)
Pentalepis trichodesmoides subsp. hispida (P2)
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301) (P3)
Goodenia nuda (P4)
N
0
600
1,200
metres
Boolgeeda Creek Study Area
Vegetation Map 2
Biota Environmental Sciences
Author: Shadila
Drawn: M Robinson
Dwg No.: 919
Date: 08 Oct 2013
Revised: 17 Oct 2013
Projection: MGA 750 (GDA94)
Scale: 1:25,000

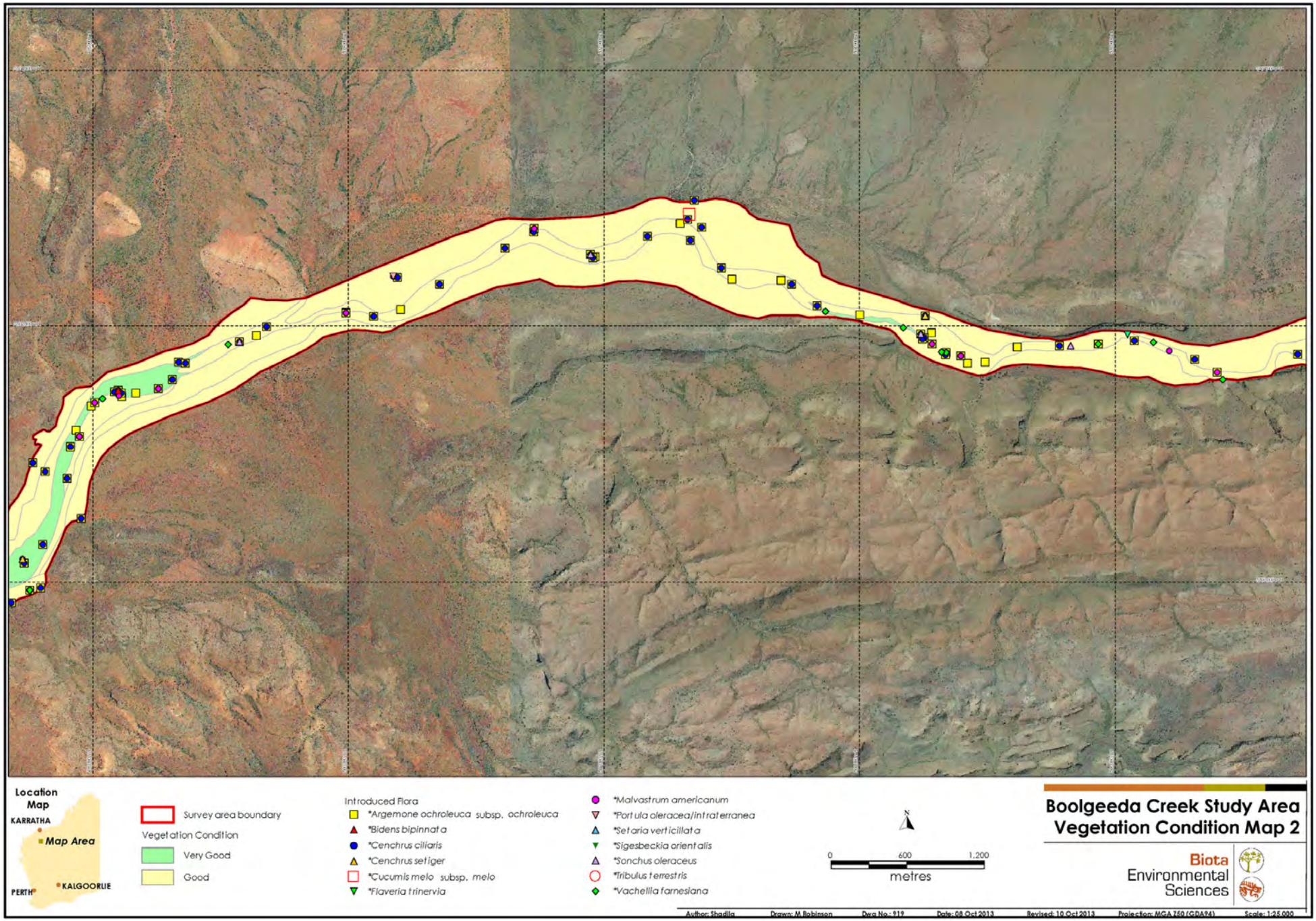

C4
F5
F3
C5
F4
F5
C4
F5
F5
F5
F5
F5
F5
F4
F4
F5
F5
F5
Location Map
KARRATHA
Map Area
PERTH
KALGOORLIE
Survey area boundary
Priority Flora
Peplidium sp. Fortescue Marsh (S. van Leeuwen 4865) (P1)
Pentalepis trichodesmoides subsp. hispida (P2)
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301) (P3)
Goodenia nuda (P4)
N
0
600
1,200
metres
Boolgeeda Creek Study Area
Vegetation Map 3
Biota Environmental Sciences
Author: Shadila
Drawn: M Robinson
Dwg No.: 919
Date: 08 Oct 2013
Revised: 17 Oct 2013
Projection: MGA Z50 (GDA94)
Scale: 1:25,000

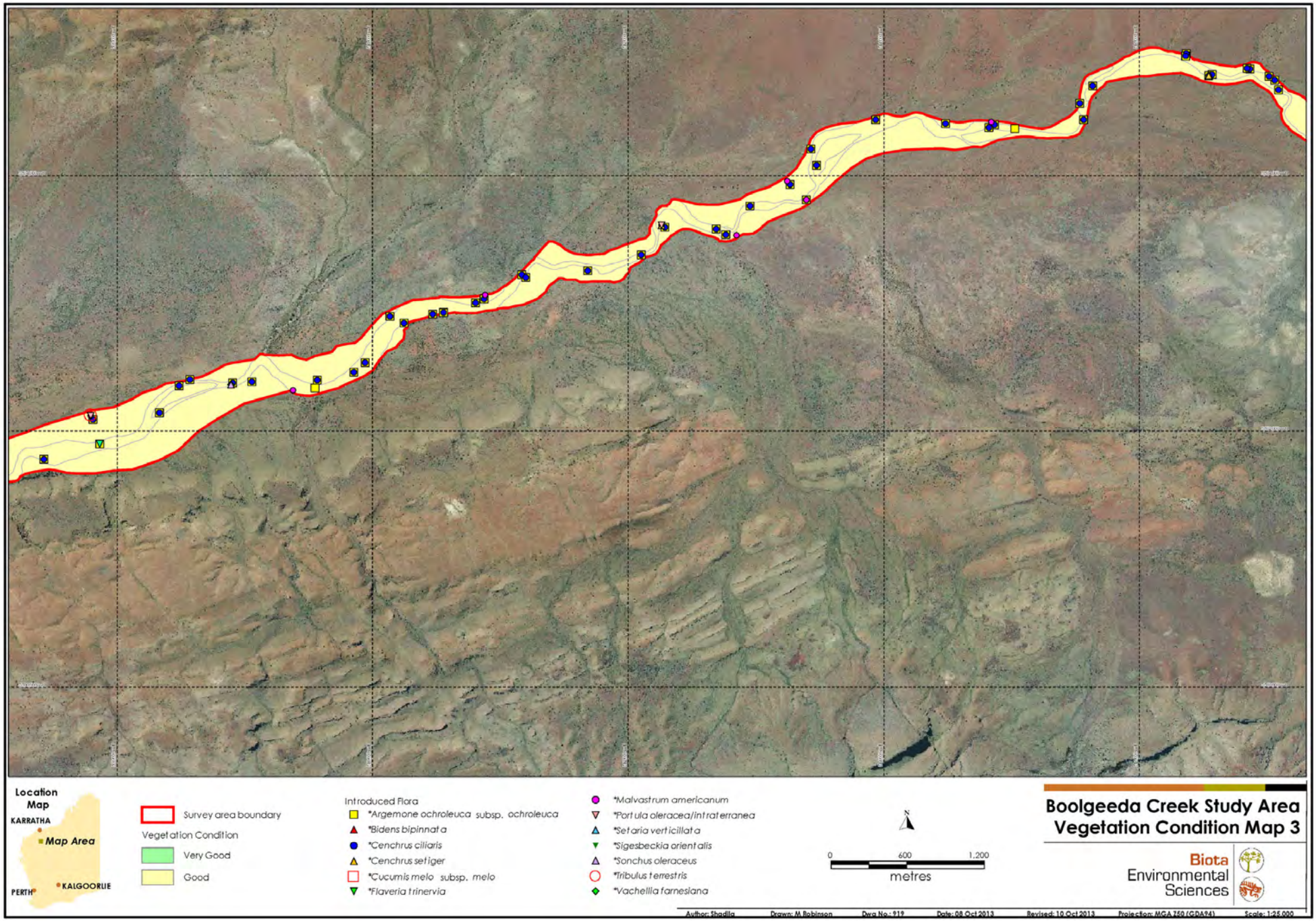

C1
F1
F1
F1
F1
F2
F2
F2
C2
F2
F4
F2
F2
C3
F2
F2
F2
F2
F5
F5
F3
F3
C4
F3
F5
F2
Location Map
KARRATHA
Map Area
PERTH
KALGOORLIE
Survey area boundary
Priority Flora
Peplidium sp. Fortescue Marsh (S. van Leeuwen 4865) (P1)
Pentalepis trichodesmoides subsp. hispida (P2)
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301) (P3)
Goodenia nuda (P4)
N
0
600
1,200
metres
Boolgeeda Creek Study Area
Vegetation Map 4
Biota Environmental Sciences
Author: Shadila
Drawn: M Robinson
Dwg No.: 919
Date: 08 Oct 2013
Revised: 17 Oct 2013
Projection: MGA 50 (GDA94)
Scale: 1:25,000

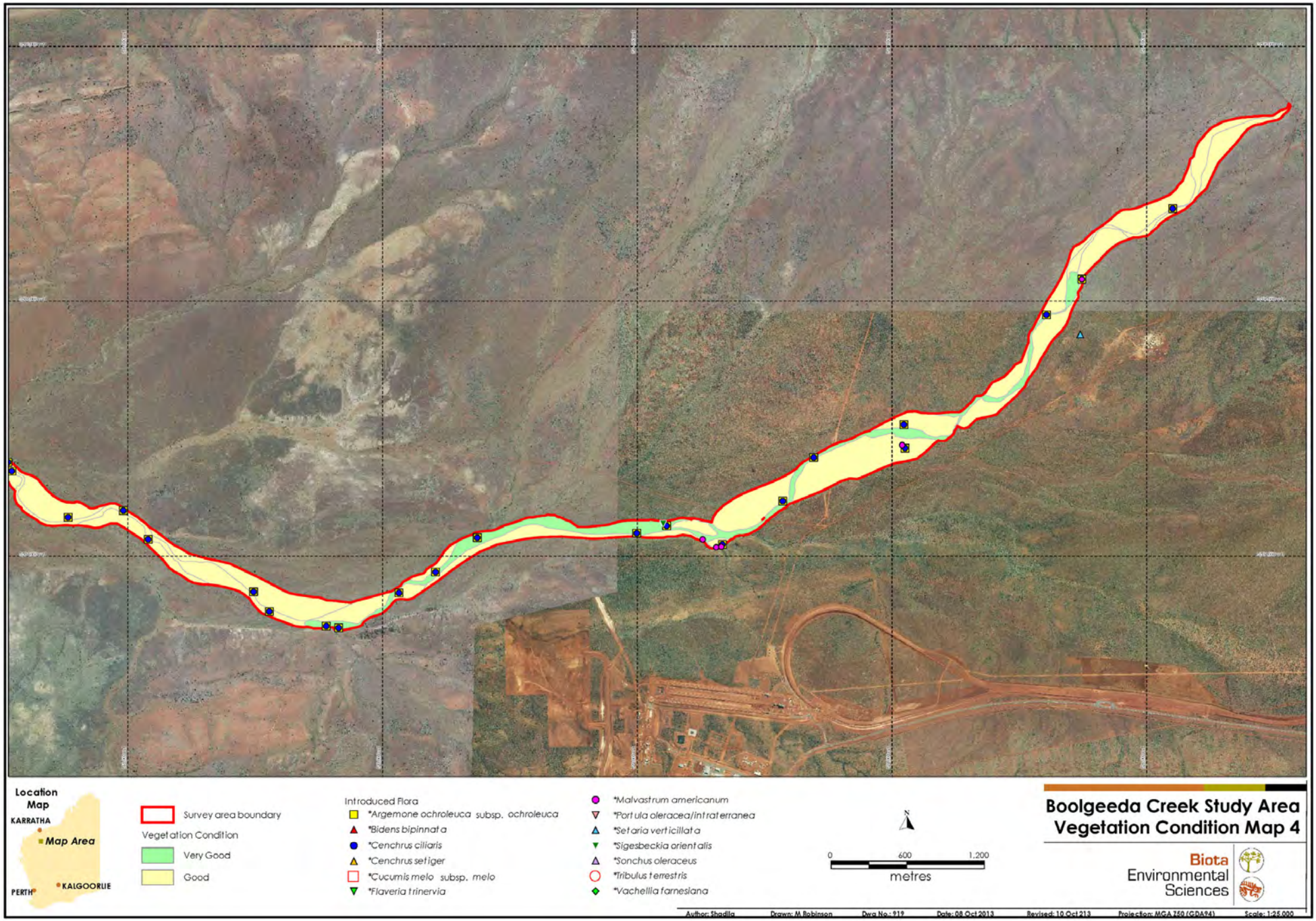
Appendix 10

Vegetation Condition Map and Distribution of Introduced (Weed) Species within the Study Area


Location Map
KARRATHA
Map Area
PERTH
KALGOORLIE
Survey area boundary
Vegetation Condition
Very Good
Good
Introduced Flora
*Argemone ochroleuca subsp. ochroleuca
*Bidens bipinnata
*Cenchrus ciliaris
*Cenchrus setiger
*Cucumis melo subsp. melo
*Flaveria trinervia
*Malvastrum americanum
*Portula oleracea/intraterranea
*Setaria verticillata
*Sigesbeckia orientalis
*Sonchus oleraceus
*Tribulus terrestris
*Vachellia farneseana
0
600
1,200
metres
Boolgeeda Creek Study Area
Vegetation Condition Map 1
Biota
Environmental
Sciences
Author: Shadila
Drawn: M Robinson
Dwg No.: 919
Date: 08 Oct 2013
Revised: 10 Oct 2013
Projection: MGA Z50 (GDA94)
Scale: 1:25,000


Location Map
KARRATHA
Map Area
PERTH
KALGOORLIE
Survey area boundary
Vegetation Condition
Very Good
Good
Introduced Flora
*Argemone ochroleuca subsp. ochroleuca
*Bidens bipinnata
*Cenchrus ciliaris
*Cenchrus setiger
*Cucumis melo subsp. melo
*Flaveria trinervia
*Malvastrum americanum
*Portula oleracea/intraterranea
*Setaria verticillata
*Sigesbeckia orientalis
*Sonchus oleraceus
*Tribulus terrestris
*Vachellia farneseana
0
600
1,200
metres
Boolgeeda Creek Study Area
Vegetation Condition Map 2
Biota
Environmental
Sciences
Author: Shadila
Drawn: M Robinson
Dwg No.: 919
Date: 08 Oct 2013
Revised: 10 Oct 2013
Projection: MGA Z50 (GDA94)
Scale: 1:25,000


Location Map
KARRATHA
Map Area
PERTH
KALGOORLIE
Survey area boundary
Vegetation Condition
Very Good
Good
Introduced Flora
*Argemone ochroleuca subsp. ochroleuca
*Bidens bipinnata
*Cenchrus ciliaris
*Cenchrus setiger
*Cucumis melo subsp. melo
*Flaveria trinervia
*Malvastrum americanum
*Portula oleracea/intraterranea
*Setaria verticillata
*Sigesbeckia orientalis
*Sonchus oleraceus
*Tribulus terrestris
*Vachellia farnesiana
N
0
600
1,200
metres
Boolgeeda Creek Study Area
Vegetation Condition Map 3
Biota
Environmental
Sciences
Author: Shadila
Drawn: M Robinson
Dwg No.: 919
Date: 08 Oct 2013
Revised: 10 Oct 2013
Projection: MGA 250 (GDA94)
Scale: 1:25,000


Location Map
KARRATHA
Map Area
PERTH
KALGOORLIE
Survey area boundary
Vegetation Condition
Very Good
Good
Introduced Flora
*Argemone ochroleuca subsp. ochroleuca
*Bidens bipinnata
*Cenchrus ciliaris
*Cenchrus setiger
*Cucumis melo subsp. melo
*Flaveria trinervia
*Malvastrum americanum
*Portula oleracea/intraterranea
*Setaria verticillata
*Sigesbeckia orientalis
*Sonchus oleraceus
*Tribulus terrestris
*Vachellia farnesiana
0
600
1,200
metres
Boolgeeda Creek Study Area
Vegetation Condition Map 4
Biota
Environmental
Sciences
Author: Shadila
Drawn: M Robinson
Dwg No.: 919
Date: 08 Oct 2013
Revised: 10 Oct 213
Projection: MGA 750 (GDA94)
Scale: 1:25,000