Biota Environmental Sciences

A Vegetation and Flora Survey of the White Quartz Road Corridor, near Tom Price




Prepared for

Pilbara Iron Company

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1.0 Summary

1.1 Background to this Study

Hamersley Iron Pty Ltd proposes to develop the Brockman Syncline 4 (BS4) iron ore deposit, approximately 60 km west-north-west of Tom Price, WA. Access to the BS4 deposit and exploration camp from Tom Price is via shire gravel roads for some 21 km, following which vehicles utilise a gravel track known locally as the "White Quartz Road".

The White Quartz Road currently has extensive sections of narrow roadway, including some on sharp curves and crests. To improve safety for current and future users, Hamersley Iron intends to upgrade the White Quartz Road. Improvements will range from minor widening to complete realignment of some sections.

In order to determine if there are any significant flora or vegetation issues that could be impacted by the proposed development, Biota Environmental Sciences was commissioned to undertake a botanical survey within a corridor surrounding the White Quartz Road.

1.2 Methodology

A total of 56 person days were spent surveying the project area at various times between the 30th of May 2005 and the 23rd of June 2006. The survey included:

- description and mapping of vegetation types;
- establishment of 20 floristic survey quadrats;
- recording of populations of flora of conservation significance and weeds; and
- collation of a list of all vascular flora observed in the study area.

Data from the floristic survey quadrats was included in a pattern analysis carried out using a numeric classification procedure within the PATN software package.

1.3 Vegetation

Thirty-nine (39) vegetation types were defined for the White Quartz Road corridor. Broadly, these included:

- patches of Mulga (various forms of *Acacia aneura*) and Snakewood (*A. xiphophylla*) tall shrublands over various species of spinifex on plains and stony hills;
- hummock grasslands of *Triodia* species (mainly *T. wiseana*) with a variable shrub overstorey on low stony hills;
- hummock grasslands of *Triodia longiceps* and/or *T. angusta* on calcareous plains; and
- tall shrublands of mixed species (usually dominated by *Acacia*), often with an overstorey of *Eucalyptus* or *Corymbia*, in creeklines.

None of the vegetation types identified are Threatened Ecological Communities under either Federal or State legislation.

One vegetation type was considered to have high conservation significance:

- EcAciMgCv (riverine vegetation dominated by River Gums *Eucalyptus camaldulensis*): this vegetation comprises an "ecosystem at risk" (Kendrick 2003), has a small area of representation in the study area and in the broader locality, and occurs in the largest surface

drainage features for the study area. Pools of free water within this habitat may also be of importance to mobile fauna species.

Six vegetation types were considered to be of moderate conservation significance:

- ElAbTloTa, ElMeAeTloTa and EsMeAeTlo (hummock grasslands of *Triodia longiceps* and/or *T. angusta* with an overstorey of *Eucalyptus leucophloia, E. socialis, Acacia bivenosa, A. exilis* and/or *Melaleuca eleuterostachya*): these units comprised the main vegetation types within which the Priority 1 species *Ptilotus* sp. Brockman (E. Thoma & A. Joder ET & AJ 145) was found to occur.
- AxSCdTa (low woodlands of Snakewood over low open samphire shrublands): given the restricted distribution of one of the dominant species (*Sclerostegia disarticulata*) in this unit in the Pilbara region, this vegetation is likely to have a small area of representation in the region.
- AanReTwTbr (vegetation of rocky quartz ridges): although the areas of these ridges sampled during the current study did not appear to support any particular species restricted to this habitat, this habitat is of interest given the distinct geology and the small area of representation in the locality.
- AanTe (creekline vegetation dominated by Mulga which is in very good condition): this vegetation is particularly susceptible to degradation through repeated fires, grazing, and invasion by weeds.

The remainder of the vegetation types identified are considered to be of low conservation significance, representing units that are likely to be widely distributed and relatively well represented in the locality.

1.4 Flora

The 2,303 ha White Quartz Road corridor contained some 364 native species of vascular flora from 142 different genera and 53 families. This included four species listed as Priority flora by the Department of Environment and Conservation:

- *Ptilotus* sp. Brockman (E. Thoma & A. Joder ET & AJ 145) (Priority 1): 172 records spread throughout the corridor;
- *Abutilon trudgenii* ms. (Priority 3): 24 records throughout the central corridor;
- *Rostellularia adscendens* var. *latifolia* (Priority 3): 1 record from the eastern end of corridor; and
- *Sida* sp. Wittenoom (W.R. Barker 1962) (Priority 3): 68 records from throughout the eastern two-thirds of the corridor.

The study area also contained eight introduced flora species:

- Mexican Poppy **Argemone ochroleuca* subsp. *ochroleuca*: 11 records from a creek system towards the western end of the corridor;
- Buffel Grass **Cenchrus ciliaris*: 103 records from throughout the corridor;
- Whorled Pigeon Grass **Setaria verticillata*: 1 record from the western end of the corridor;
- Beggars Ticks **Bidens bipinnata*: 7 records from throughout the corridor;
- Ulcardo Melon **Cucumis melo* subsp. *agrestis*: 1 record from the eastern end of the corridor;
- Spiked Malvastrum **Malvastrum americanum*: 33 records from throughout the corridor;
- Pyramid-flower **Melochia pyramidata*: 1 record towards the western end of the corridor; and
- Mimosa Bush **Vachellia farnesiana*: 1 record from the creekline at the eastern end of the corridor.

Mexican Poppy is a Declared Plant for the Pilbara region according to the *Agriculture and Related Resources Protection Act 1976*, however control is only required where populations occur outside creeklines. Buffel Grass is considered to be a serious environmental weed.

1.5 Management Recommendations

The following management measures are recommended to minimise disturbance to the flora and vegetation of the White Quartz Road corridor:

- Clearing areas should be kept to the minimum necessary for safe construction of the road upgrade, particularly in the areas supporting the Priority 1 *Ptilotus* sp. Brockman and the species of interest *Josephinia* sp. Borrow pits should be located so as to minimise clearing of vegetation supporting Priority flora, and impact to vegetation of drainage lines. Project laydown areas should utilise existing cleared areas wherever possible.
- Clearing limits should be strictly adhered to in the field. Earth-moving equipment should be equipped with the standard Pilbara Iron GPS systems with the clearing area uploaded onto the device to avoid unnecessary clearing. Wherever appropriate, scrub-rolling should be used rather than grading in order to minimise ground disturbance and retain as much vegetation as possible.
- Strict weed hygiene protocols should be adhered to for the duration of the construction phase of the project. Earth-moving equipment should be washed down prior to entry to site and periodically during the construction of the road, to avoid spreading invasive species further. Any topsoil retained should be used within the area from which it was gathered.
- All efforts should be made to reduce the risk of bushfires. No fires should be deliberately started within the project area, and vehicles and heavy machinery should be parked on cleared ground to avoid hot engine parts causing combustion of spinifex hummocks.
- The road level should be maintained as close as possible to the natural ground level to reduce erosion of the roadway during heavy rainfall events.

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2.0 Background to the Project

2.1 The Proposed Development

Hamersley Iron Pty Ltd proposes to develop the Brockman Syncline 4 (BS4) iron ore deposit, approximately 60 km west-north-west of Tom Price, WA. A small exploration camp currently exists on site on the northern side of the BS4 range. Access to this camp from Tom Price is via shire gravel roads for some 21 km, following which vehicles utilise a gravel track known locally as the "White Quartz Road" (see Figure 2.1).

The White Quartz Road currently has extensive sections of narrow roadway, including some on sharp curves and crests. To improve safety for current users, and bearing in mind that development of the BS4 mine will necessitate a larger workforce and consequently additional traffic along this access road, Hamersley Iron intends to upgrade the White Quartz Road. Improvements will range from minor widening to complete realignment of some sections.

2.2 The Current Botanical Study

In order to determine if there are any significant flora or vegetation issues that could be impacted by the proposed development, Biota Environmental Sciences Pty Ltd (Biota) was commissioned to undertake a botanical survey within a corridor surrounding the White Quartz Road.

2.2.1 Study Area

The study area comprised a corridor of some 38 km in length by between 500 and 800 m in width surrounding the existing White Quartz Road alignment (see Figure 2.1).

2.2.2 Aim of this Study

The purpose of this report is to provide baseline vegetation and flora data for use in the environmental impact assessment of the White Quartz Road upgrade.

As such, the aims of the underlying study were to:

- provide detailed baseline information regarding vegetation and flora values of the study area. This incorporated a desktop review of available information, together with a field study (utilising techniques generally accepted as standard for the region) which addressed: description and mapping of vegetation types occurring in the study area; identification of any vegetation types of particular conservation significance; cataloguing of the flora present within the study areas; and collation of information regarding any rare flora or other flora of conservation interest;
- place the information from the study area in regional context by comparison with available data from other localities; and
- provide management recommendations to minimise impact to vegetation types and flora species of particular conservation significance within the study area.

The vegetation and flora survey of the White Quartz Road was planned and implemented as far as practicable according to the Environmental Protection Authority (EPA) Position Statement No. 3 "Terrestrial Biological Surveys as an Element of Biodiversity Protection" (EPA 2002) and Guidance Statement No. 51 "Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia" (EPA 2004).

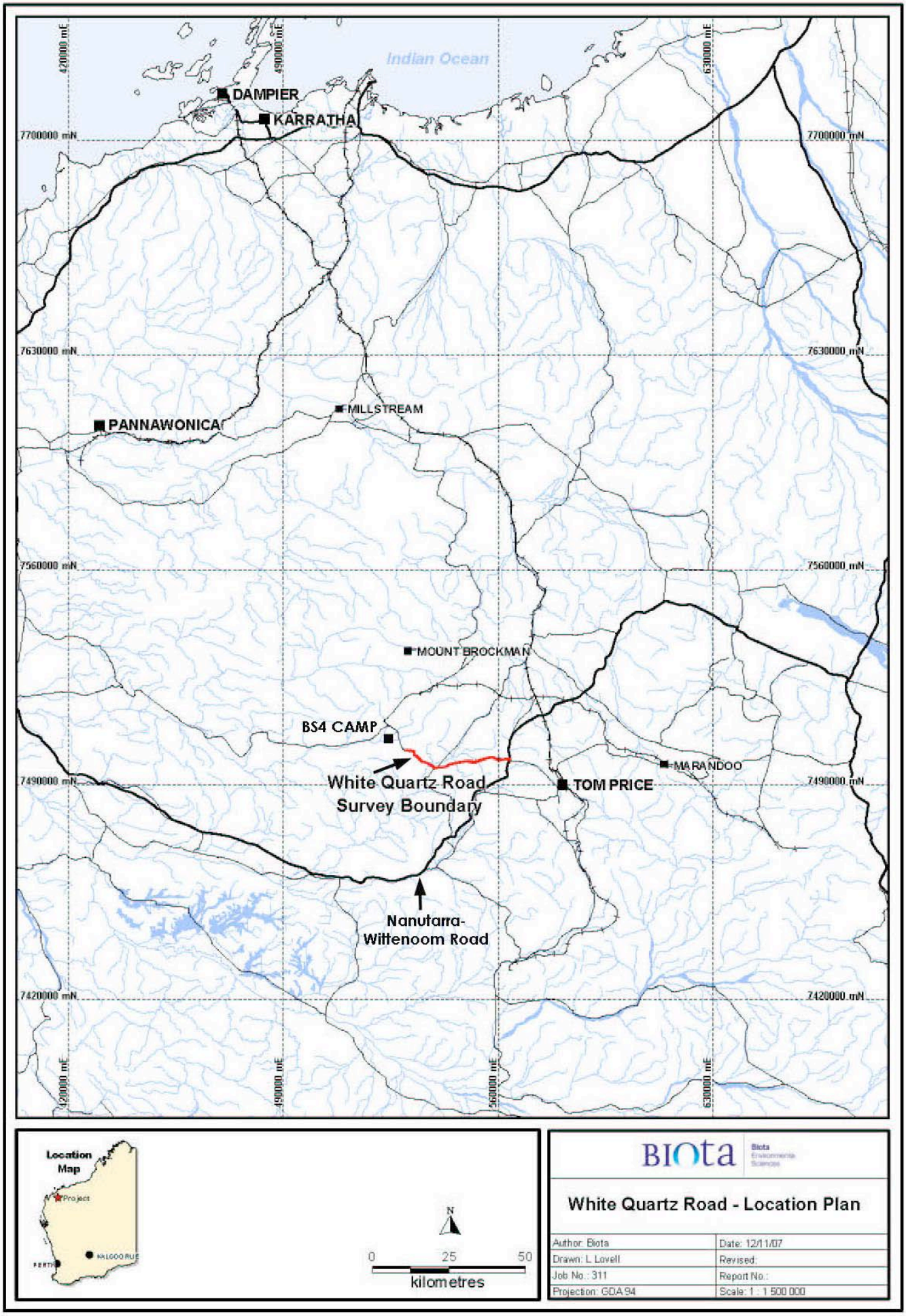

Figure 2.1: Location of the White Quartz Road in relation to Tom Price and Brockman Syncline 4.

2.3 Regional Context of the Study Area

2.3.1 Major Physiographic Units

There are four main physiographic units within the Fortescue district, as identified by Beard (1975):

- Abydos Plain: extending from Cape Preston east to Pardoo Creek, and south to the Chichester Range: including alluvial plains, low stony hills and granite outcrops; comprising largely granitic soils, with alluvial sands on the coastal portion;
- Chichester Plateau: a plateau of mainly basalts, with included siltstone, mudstone, shale, dolomite and jaspilite; forming a watershed between numerous rivers flowing north through the Abydos Plain to the coast, and the Fortescue drainage on the southern side of the range;
- Fortescue Valley: occupying a trough between the Chichester and Hamersley Plateaux; the eastern portion drains into the Fortescue Marshes; and
- Hamersley Plateau: rounded hills and ranges, mainly of jaspilite and dolomite with some shale, siltstone and volcanics.

The White Quartz Road corridor lies towards the western end of the Hamersley Plateau, and landforms in the area share characteristics of this physiographic unit.

2.3.2 Pilbara IBRA Bioregion

The interim Bioregional Regionalisation of Australia (IBRA) is a classification method applied over the Australian continent by the Department of Environment and Heritage (see Environment Australia 2000). There are 85 bioregions in Australia, with 404 sub-regions.

The Pilbara bioregion contains four sub-regions, based largely on the work of Beard (1975; see Section 2.3.1): the Roebourne, Chichester, Fortescue Plains and Hamersley subregions (Environment Australia 2000). The White Quartz Road survey area is contained within the Hamersley subregion, which is described on a broad scale as: "Mountainous area of Proterozoic sedimentary ranges and plateaux, dissected by gorges (basalt, shale and dolerite). Mulga low woodland over bunch grasses on fine textured soils in valley floors, and *Eucalyptus leucophloia* over *Triodia brizoides* on skeletal soils of the ranges" (Environment Australia 2000).

As a whole, the Pilbara bioregion is now recognized as a significant centre of biodiversity within Western Australia. A combination of altitude, geology, climate and geographical location has ensured a high rate of speciation over many millions of years (see van Leeuwen and Bromilow 2002 for more information). In addition, the Pilbara is located in a transitional zone between the Eyrean (Central Desert) and Torresian (tropical) zones, hence the flora of this bioregion often contains elements of both regions. In recognition of this high level of diversity and endemism, the Pilbara has been nominated as one of 15 National biodiversity hotspots by the Minister for the Environment[1].

2.3.3 Conservation Reserves in the Area

Relatively few areas of the Pilbara have been set aside for conservation purposes and for this reason the Pilbara is listed as a medium priority for funding in the National Reserves Co-operative program. The closest conservation reserves to the White Quartz Road study area are:

- Karijini National Park (30 km to the east);
- Millstream-Chichester National Park (120 km to the north); and
- Mungaroona Range A-class Nature Reserve (130 km to the north-west).

1 www.deh.gov.au/minister/env/2003/mr03oct03.html

The Department of Environment and Conservation (DEC) has nominated several areas for acquisition for reserve purposes when pastoral leases become due for renewal In 2015. Such land may be added to existing conservation estates to provide a comprehensive, adequate and representative reserve system. None of these proposed pastoral exclusions are intersected by the White Quartz Road corridor.

2.3.4 Land Systems (Rangelands)

The Western Australian Department of Agriculture (Payne et al. 1988 and van Vreeswyk et al. 2004) has classified 107 Land Systems for the Pilbara bioregion (see Section 2.3.1), five of which occur in the White Quartz Road survey area (Table 2.1).

Four of the five Land Systems found in the survey area are extensively represented in the Pilbara bioregion: when the Land System areas are ranked from 1 (smallest area within the Pilbara bioregion) to 107 (greatest area), Rocklea ranked 107th, Newman 106th, Platform 92nd and Robe 76th (Table 2.2). The Rocklea Land System thus occupies the largest proportion of the Pilbara bioregion (at 16.2%), followed by Newman (11.2%), Platform (1.3%) and Robe (0.7%). In contrast, the Table Land System ranked 31st in terms of area in the Pilbara, comprising only 20,64 ha or approximately 0.1% of the total area of the Pilbara bioregion (see Table 2.1)[2].

Figure 2.2 shows the various Land Systems intersected by the survey area. The Rocklea Land System dominates the majority of the White Quartz Road corridor, with the remaining Land Systems present in only small areas. The Table Land System is not often encountered in the Pilbara, occurring only in the southern section of the Hamersley subregion, but is more abundant to the south in the Ashburton subregion of the Gascoyne bioregion. Given that the Table Land System is poorly represented in the Pilbara, areas of this Land System in the region may be significant.

Table 2.1: Land Systems intersected by the White Quartz Road corridor (descriptions from van Vreeswyk et al. 2004).

Land System	Description
Newman	Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands; occurring at the western end of the corridor
Platform	Dissected slopes and raised plains supporting hard spinifex grasslands; occurring at the westernmost end of the corridor and also towards the central section of the corridor
Robe	Low limonite mesas and buttes supporting soft spinifex (and occasionally hard spinifex) grasslands; occurring in minor areas at the western and eastern ends of the corridor
Rocklea	Basalt hills, plateaux, lower slopes and minor stony plains supporting hard spinifex (and occasionally soft spinifex) grasslands; dominating the majority of the corridor
Table	Low calcrete plateaux, mesas and lower plains supporting mulga and cassia shrublands and minor spinifex grasslands; occurring in a very small area at the easternmost end of the corridor

[2] 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 3.2.

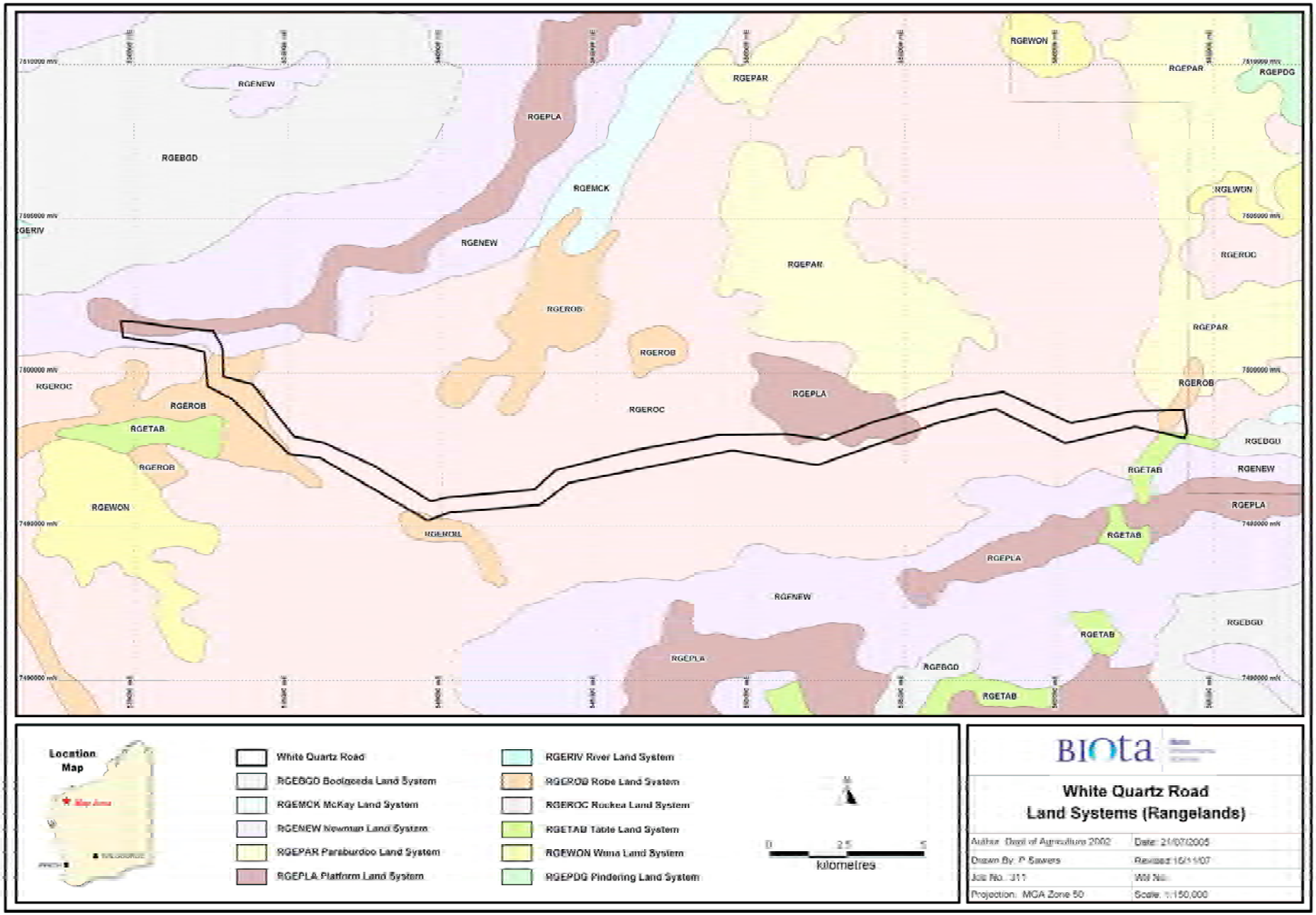

Figure 2.2: Land Systems (Rangelands) of the region including the White Quartz Road corridor (based on mapping by van Vreeswyk et al. 2004).

Table 2.2: Distribution of Land Systems within the study area and wider Pilbara bioregion (data from Payne et al. 1988 and van Vreeswyk et al. 2004).

Land System	Total Area in the Pilbara Bioregion (Rank †)	Number of Mapping Polygons in the Pilbara Bioregion	General Distribution through the Pilbara Bioregion	Amount of Land System within the White Quartz Road Corridor	
				Hectares	% of Total in Pilbara Bioregion
Newman	1,993,741 ha (106th)	321	Relatively widespread through the Hamersley Range, also occurring as a band along the Chichester Range to the north of the Fortescue Marsh; numerous occurrences	104.1	<0.01
Platform	236,336 ha (92nd)	169	Occurs predominantly in the Hamersley Range with small occurrences also in the Chichester Range	239.3	0.1
Robe	128,859 ha (76th)	251	Occurs within the central and western region of the Hamersley subregion, with a few occurrences in the Chichester subregion	250.5	0.2
Rocklea	2,881,200 ha (107th)	385	Widespread through both the Hamersley and Chichester Ranges	1,702.1	0.06
Table	20,646 ha (31st)	47	Few scattered occurrences in the south and east of the Hamersley subregion	7.2	0.03
Pilbara Total	17,800,478 ha	5636		2,303.2	

2.3.5 Geology

The White Quartz Road corridor includes a variety of different geological units. In order of decreasing area (according to the 1:500,000 scale mapping by Thorne and Trendall (2001)), these include sections of:

- Ahm – Marra Mamba Iron Formation (chert, banded iron formation, mud-stone and silt-stone metamorphosed), occurring at the western end of the corridor;
- Czx – Undivided Cainozoic Deposits (partly consolidated colluvium and alluvium, silcrete and laterite), occurring in the central and eastern sections of the corridor;
- Pt – Throssell Group (quartzitic and micaceous sandstone, siltstone, mud-stone conglomerate, stromatolitic and non-stromatolitic dolerite and dolerite conglomerate), occurring in the western and central sections of the corridor;
- Afu – Bunjinah Formation (pillowed and massive basaltic flows, basaltic breccia and basaltic volcaniclastic sandstone, minor chert, amygdaloidal basalt flows occur in upper part of formation; metamorphosed), occurring along the central to western sections of the corridor; and
- Afd – Dolerite sills and dykes, occurring in patches in the central to eastern sections of the corridor.

2.3.6 Beard's Vegetation Mapping

J.S. Beard was amongst the first to conduct large-scale vegetation mapping for Western Australia, completing a set of 1:1,000,000 scale maps in 1975. At the time, it was thought that a vegetation map was needed to establish current species distributions and to predict the possible distributions of species based on the identification of various botanical provinces (Beard 1975). Previous mapping exercises had established botanical provinces known as Northern, Eremaean and South-Western (Gardner and Bennetts 1956). Despite this, little was known about botanical sub-regions existing to the north of the South-Western province.

As defined by Beard (1975), the White Quartz Road study area lies within the Fortescue botanical district, which is a part of the larger Eremaean botanical province. For the purposes of gathering baseline botanical data for a specific area in the Pilbara, Beard's vegetation maps are generally of too broad a scale to be considered useful, however the study area contains two of Beard's broad mapping units:

- Snappy Gum *Eucalyptus leucophloia* scattered low trees over *Triodia wiseana* hummock grasslands on hills and stony plains; and
- small areas of *Acacia aneura*[3] continuous low woodland on clay plains.

2.3.7 More Detailed Botanical Studies in the Area

There appear to be only a small number of previous botanical surveys in the locality, all of which are unpublished. The DEC Pilbara Biological Survey will provide a broad overview of vegetation and floristic communities for the bioregion, however this study is still in progress and data is not yet available.

The major comparative references used for this document therefore comprise:

- vegetation and flora surveys associated with the Brockman Syncline 4 Project (adjoining the western end of the White Quartz Road corridor) (Biota 2005a, Biota 2007a);
- a regional survey for the Priority 1 species *Ptilotus* sp. Brockman (E. Thoma & A. Joder ET & AJ 145) (Biota 2007b);

3 Note that *Acacia "aneura"* is a species complex.

- a vegetation and flora survey of the Brockman 2 detritals and transport corridor, some 24 km north of the White Quartz Road (Mattiske and Associates 1990);
- a vegetation and flora survey of the Nammuldi and Silvergrass areas, near Brockman 2 (Halpern Glick Maunsell 1999); and
- a vegetation and flora survey of the Nammuldi – Mt. Lionel rail corridor (Biota in prep.).

2.3.8 Legislative and Administrative Levels of Flora Protection

While all native flora are protected under the *Western Australian Wildlife Conservation Act 1950-1979,* a number of plant species are assigned an additional level of conservation significance based on the limited number of known populations and the perceived threats to these populations (Table 2.3). Species of the highest conservation significance are designated Declared Rare Flora (DRF), either extant or presumed extinct. 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 by DEC. This is an administrative (rather than legislated) level of protection.

In addition, the presence of some flora species means that it may be necessary to refer proposals to the Federal Minister for the Environment under the Federal *Environment Protection and Biodiversity Conservation Act 1999.* In the Pilbara, only the two Declared Rare Flora species (*Lepidium catapycnon* and *Thryptomene wittweri*) are currently listed under the *EPBC Act 1999.*

Table 2.3: Categories of conservation significance for flora species (Atkins 2006).

Declared Rare Flora - Extant Taxa. Taxa that 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.
Declared Rare 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.
Priority 1 - Poorly Known Taxa. Taxa which are known from one or a few (generally <5) populations which are under threat.
Priority 2 - Poorly Known Taxa. Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under threat.
Priority 3 - Poorly Known Taxa. Taxa which are known from several populations, at least some of which are not believed to be under threat.
Priority 4 - Rare Taxa. Taxa which are considered to have been adequately surveyed and which whilst being rare, are not currently threatened by any identifiable factors.

2.3.9 Flora of Conservation Significance Previously Recorded in the Vicinity of the White Quartz Road Corridor

The DRF species *Lepidium catapycnon* has been recorded from a number of locations in the vicinity of Tom Price, but has not been recorded to date from the Brockman area.

While various Priority flora have been recorded from the Brockman locality, only three species have been recorded previously within 10 km of the current study area:

- *Ptilotus* sp. Brockman (E. Thoma & A. Joder ET & AJ 145) (Priority 1): Recorded along the White Quartz Road and further afield in the Brockman locality (see Biota 2007b);
- *Abutilon trudgenii* (Priority 3): Recorded from the Brockman Syncline 4 study area, adjoining the western end of the White Quartz Road (see Biota 2005a, 2007a); and
- *Sida* sp. Wittenoom (W.R. Barker 1962) (Priority 3): Also recorded from the Brockman Syncline 4 study area (Biota 2005a, 2007a).

3.0 Methodology

3.1 Study Team and Timing of the Surveys

The study area was visited by various botanists as follows:

- Michi Maier, Raimond Orifici, Hana Eynon and Myles Menz (all of Biota) and Brian Morgan (private consultant) searched the White Quartz Road corridor for rare flora between the 30th of May and 11th of June 2005 (44 person days were spent in total);
- Michi Maier, Raimond Orifici, Brian Morgan and Paul Hoffman (Biota) established 18 flora survey quadrats within the corridor between the 23rd and 25th of May 2006 (10 person days in total);
- Michi Maier, Brian Morgan, Paul Hoffman and Rachel Warner (Biota) established two additional flora survey quadrats on the 23rd of June 2006 (2 person days in total).

A total of 56 person days has thus been spent on botanical surveys in the study area.

3.1.1 Seasonal Conditions at the Time of the Surveys

In 2005, the rare flora searches were completed following an extended dry period, which was characterised by below average rainfall (Figure 3.1, Table 3.1), and it is probable that some ephemeral flora would not have been present at the time. In contrast, the Tom Price area received substantial and repeated rainfall events between December 2005 and April 2006 (Figure 3.1, Table 3.1). Conditions at the time of the latter field work (May and June 2006) were thus optimal for the collection of annual flora. Rainfall during the months January to March 2006, was well above average (Table 3.1), hence it is likely that an increased number of annuals were present as opposed to normal. In contrast, rainfall in 2005 was well below average (Table 3.1).

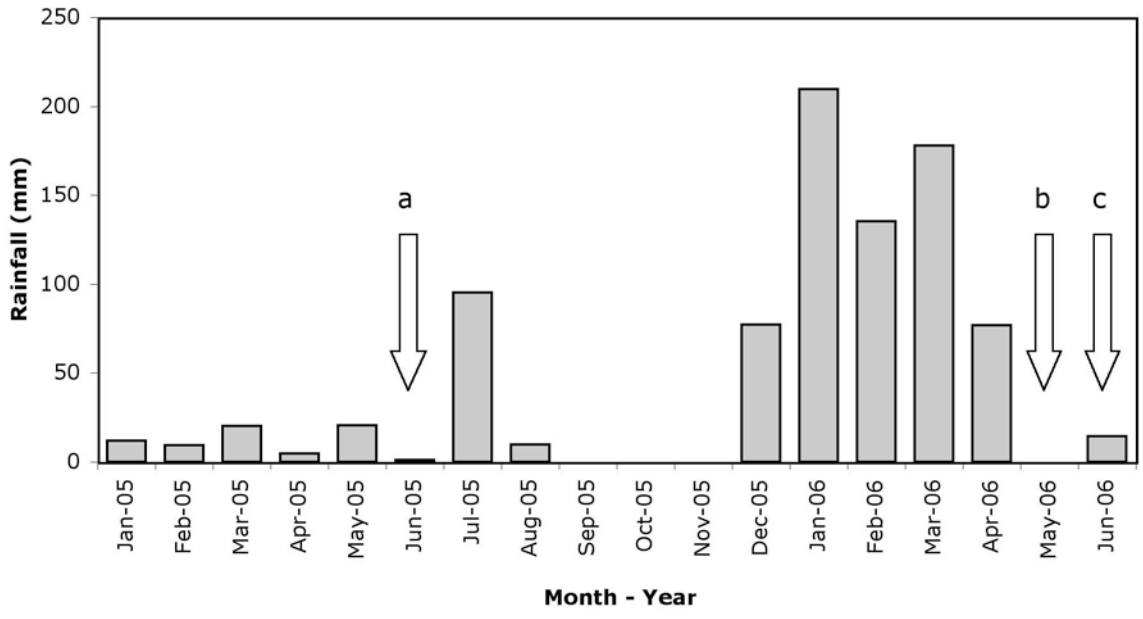

Figure 3.1: Monthly rainfall for Tom Price from January 2005 to June 2006 (data supplied by Bureau of Meteorology) and timing of botanical surveys in the study area: a = rare flora searches; b = establishment of quadrats (first round); c = establishment of quadrats (second round).

Table 3.1: Mean and total monthly rainfall (mm) between January and June for Tom Price from 2000 to present.

Year	Jan	Feb	Mar	Apr	May	Jun
2000	71.6	200.2	181.9	62.9	0.0	0.0
2001	96.0	145.7	7.2	14.2	17.1	10.7
2002	1.7	65.6	33.1	1.4	21.9	18.0
2003	41.8	45.4	50.5	20.9	3.8	44.3
2004	50.1	110.8	184.4	69.5	3.0	0.0
2005	12.0	9.5	20.2	4.6	20.4	1.2
2006	209.6	135.4	178.0	77.0	0.0	14.4
Number of Obs	28	30	30	28	28	28
Mean	81.2	93.2	61.2	30.3	23.6	28.8
Median	58.4	67.6	35.5	18.7	16.4	16.4
Lowest	1.7	1.4	2.2	0.0	0.0	0.0
Highest	231.5	335.9	201.1	135.8	90.0	128.6

3.2 Vegetation Description and Mapping

In the current study, vegetation descriptions were based on the height and estimated cover of dominant species using Aplin's (1979) modification of the vegetation classification of Specht (1970) to include a hummock grassland category (see Appendix 2). Descriptions were made at each of 20 floristic survey quadrats (see Section 3.3), and at one relevé (unbounded flora survey site comprising a similar area to a standard quadrat). Additional brief vegetation descriptions were made and vegetation boundaries were ground-truthed during the systematic foot traverses required for the rare flora searches (see Section 3.5).

The vegetation descriptions were then grouped to arrive at vegetation units that were defined on the basis of a shared suite of perennial species with a similar range of cover values. These have been listed under the main landform/habitat types in which they were found to occur. Alternative approaches could utilise another framework, such as Land System (Rangelands) mapping or geology.

The coding system for the vegetation types incorporated the dominant flora species for the type, organised from tallest strata to lowest strata. Species names were abbreviated to capital letter/s for genus, followed by lower case letter/s for species, with multiple letters used where necessary to avoid confusion (eg. ElMeAeTloTa = dominant species *Eucalyptus leucophloia* subsp. *leucophloia*, *Melaleuca eleuterostachya, Acacia exilis, Triodia longiceps* and *T. angusta*). Although this occasionally results in some large and unwieldy codes, this system at least allows for continual expansion of vegetation types while retaining original coding, allowing easier rationalisation of vegetation mapping between different studies.

To gather the spatial information, the quadrat and relevé vegetation descriptions were used together with the other mapping notes gathered in the field to prepare a draft map of vegetation, using rectified 1:20,000 scale colour digital photography as the background. Some of the vegetation units (mainly small flowlines) were frequently too small to show at the scale of mapping; only large occurrences of these were individually mapped.

The vegetation boundaries were subsequently digitised on-screen using the ArcView 3.2 package. The resulting shapefiles were "tagged" to provide each polygon with the vegetation unit code. Other point source datasets, such as locations of quadrats, weeds and priority flora, were generated into spatial data using MapInfo. These datasets were subsequently saved as separate MapInfo shapefiles.

These datasets, in conjunction with other data supplied from other organisations, were used in the production of the vegetation maps contained this report. All maps were produced using the MapInfo package.

3.3 Assessment of Floristic Survey Quadrats

The locations of the 20 detailed flora-recording quadrats were chosen to represent the range of terrestrial vegetation types occurring within the survey area. The quadrats were uniquely numbered from WQR01 to WQR20. One relevé (unbounded flora survey site) was also sampled; this was labelled WQR-RA.

Quadrats were typically 50 m x 50 m, as this size gives a good sample of flora presence in the Pilbara. It also gives a good indication of the shrub and grass layer vegetation structure for most vegetation types in the Pilbara that occur in 'uniform' habitats (eg. plains and hillslopes, where vegetation stands are typically greater than this quadrat size). Quadrat shape and/or size were adjusted as necessary to fit smaller or oddly shaped habitats (eg. flowlines).

Each quadrat was permanently marked using a steel fence dropper at one corner of the quadrat (usually the northwest corner). An optical square and measuring tapes were used to ensure that the quadrat sides were correctly positioned.

The following parameters were recorded for each quadrat:

1. Location: Location coordinates recorded in WGS84 datum (within 1-2 m of GDA94) using a hand-held Global Positioning System (GPS), to an accuracy usually within 5 m; readings were usually taken for all four corners of the quadrat;
2. Vegetation Description: Broad description based on the height and estimated cover of dominant species after Aplin's (1979) modification of the vegetation classification system of Specht (1970) (see Appendix 2);
3. Habitat: Description of landform and habitat;
4. Soil: Broad description of soil type and stony surface mantle;
5. Disturbance Details: Evidence of grazing, mining exploration activities, weed invasion, frequent fires etc. Note that fire effects are only considered as a negative impact if they are caused by repeated burning (such as that done for pastoral purposes). Fire is a natural and frequent process in the Pilbara to which the vegetation has adapted, and to class areas as being in poor condition simply because they have been recently burnt is misleading; and
6. Percentage Foliar Cover: Cover was estimated visually for each species within the quadrat (thus also generating a complete species list for the quadrat at this particular point in time). Estimates were made to the nearest percent where possible, or a range (eg. 5-10%) was used. '+' was used where only occasional individuals were present, with a cover of less than 1%.

Colour photographs of the vegetation at each site were taken using a digital camera.

3.4 Floristic Analysis of the White Quartz Road Site Data

To provide an understanding of the floristic composition of vegetation of the White Quartz Road study area in relation to the surrounding region, a pattern analysis was carried out using a numeric classification procedure within the PATN software package (Belbin 1987). The analysis was run by Mr. Ted Griffin (private consultant). The flexible UPGMA classification strategy was used, together with the Bray-Curtis site similarity measure. All other PATN settings were set to the default options, consistent with use of this software by DEC to analyse data from the Swan Coastal Plain (Gibson et al. 1994).

The analysis compared the floristic composition of the 20 quadrats and single relevé (unbounded floristic survey site) recorded in the White Quartz Road corridor with quadrats and relevés recorded in a series of survey areas from both nearby and some distance away in the Hamersley and Chichester Ranges. The dataset comprised some 960 sites (standard 50m by 50m floristic survey quadrats, or well-recorded relevés), including 21 sites from the current study area, together with 939 sites from 13 other survey areas in the Pilbara:

- 119 sites from Cape Preston, west of Dampier (Biota and Trudgen 2001); ~230 km north-west of the White Quartz Road;
- 57 sites from Mesa A and Mesa G, near Pannawonica (Biota 2005b); ~180 km north-west of the White Quartz Road;
- 87 sites from the Mesa A transport corridor (Biota 2006a); ~180 km north-west of the White Quartz Road;
- 12 sites from the Mesa J Extension, near Pannawonica (Biota 2003); ~160 km north-west of the White Quartz Road;
- 54 sites from the Bungaroo Valley, near Pannawonica (Biota 2007c); ~130 km north-west of the White Quartz Road;
- 102 sites from the West Angelas Millstream Rail Segment, extending from the Fortescue Slopes study area along the lower slopes of the Chichester Range parallel to the existing Hamersley Iron rail line, then to Barowanna Hill; ~130 km north of the White Quartz Road;
- 46 sites from a rail corridor in the Four Corners Bore area on Hamersley Station (Trudgen and Casson 1998); ~53 km north-east of the White Quartz Road;
- 2 sites from near Eight Mile Well on Hamersley Station (Trudgen and Casson 1998); ~48 km north-east of the White Quartz Road;
- 9 sites from the Nammuldi-Mt Lionel rail corridor (Biota in prep.); 25 km north of the White Quartz Road;
- 66 sites from the Brockman Syncline 4 (BS4) study area (Biota 2005a); comprising the BS4 mine area (which adjoins the western end of the White Quartz Road), together with a transport corridor from BS4 to the existing mine at Brockman 2 (~20 km north of the White Quartz Road);
- 305 sites from the core area surveyed for Robe River Iron Associates' West Angelas mine (Trudgen and Casson 1998); ~148 km east-south-east of the White Quartz Road;
- 43 sites from Hamersley Iron's Yandi Expansion area (Biota 2004a); ~185 km east of the White Quartz Road; and
- 37 sites from the Mindy Mindy area of the FMG Rail Stage B project area (Biota 2004b); ~205 km east of the White Quartz Road.

The dataset included presence/absence data (rather than estimated percent cover) for each species present at each site, as it has been shown that when undertaking analysis of large regional datasets, floristic differences between areas tend to over-ride variation arising from the inclusion of more detailed quantitative data (M. Trudgen, ME Trudgen and Associates, pers. comm.). Incompletely recorded floristic survey quadrats were excluded from the analysis, and relevés were included where the list of species recorded was believed to be a good sample of the available flora.

The combined species list of 1,024 taxa from the 14 projects was reviewed for errors and inconsistencies in nomenclature. Where there were multiple taxa that were considered likely to represent the same species, these were all referred to a single taxon identification code and thus treated as a single entity in the analysis (eg. records of *Convolvulus "angustissimus"* and *C. "clementii"* were treated as belonging to the same taxon, as were records of *Triodia epactia* and *Triodia pungens*). Where a taxon name could potentially refer to more than one entity across different projects (eg. *Euphorbia* sp., *Tephrosia* sp.), it was excluded from the analysis.

3.5 Rare Flora Searches

The entire study area was systematically traversed on foot by the survey team, with individual observers spaced between 50-70 m apart, depending on the terrain. The survey area was loaded onto Magellan hand-held GPS units to ensure that the observers were working within the exact boundaries.

Any locations of rare flora were recorded using a GPS (WGS84 datum), together with an indication of the number of individuals present, the habitat and associated plant species. Voucher specimens were also collected for lodgement with the Western Australian Herbarium, and Rare Flora Report Forms will be completed and lodged with DEC.

Locations of introduced flora were also recorded as part of this exercise, and any additional native flora species that had not been previously recorded in the area by the survey team were also noted.

All records of rare flora and weeds are presented in Appendix 5.

3.6 Specimen Collection and Identification

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 in a drying oven.

These vouchers were then identified by keying out, reference to appropriate publications, use of reference collections and comparison to the collections held at the Western Australian Herbarium. Most specimens were identified by Michi Maier, Hana Eynon, Raimond Orifici, Paul Hoffman and Rachel Warner of Biota, with assistance from Malcolm Trudgen of M.E. Trudgen and Associates for some taxa. Additional specialist taxonomists were consulted as required for assistance with difficult taxa (see Section 7.0).

Specimens will be lodged with the Western Australian Herbarium for all taxa for which suitable material is available.

3.7 Taxonomy and Nomenclature

Nomenclature was checked against the current listing of scientific names recognised by the Western Australian Herbarium and updated as necessary.

The main outdated nomenclature retained was that relating to *Cassia*. This genus is currently recognised as *Senna* (see Randell 1989), however the older *Cassia* classification (Symon 1966) was perceived to be a more realistic level of separation of the taxa (eg. with taxa such as *'glutinosa'* and *'pruinosa'* recognised at specific rather than subspecific level). A more detailed discussion is contained in Trudgen and Casson (1998), while a comparison of the nomenclature under the two classifications is presented in Appendix 4.

3.8 Data Management

All raw site data was entered into an Access database structure developed by Malcolm Trudgen (M.E. Trudgen and Associates) and Ted Griffin (private consultant) held at Biota, with species names entered following identification of the specimens.

3.9 Limitations of this Study

A number of limitations of the field surveys and subsequent conservation assessments are discussed in the following section. These are factors that must be considered when reviewing and applying the results of this study. Despite these limitations, the field surveys and the subsequent analyses are believed to give a good representation of the flora and vegetation values of the White Quartz Road corridor.

The main limitations of this study are as follows:

- Fungi and nonvascular flora (eg. algae, mosses and liverworts) were not specifically sampled, although some opportunistic records were made.
- The rare flora searches were done following an extended dry period, and it is possible that some ephemeral flora would not have been present during this survey phase. However, it is unlikely that any additional rare flora would have been recorded from the study area, and it is estimated that over 90% of the general flora species in the area would have been recorded over the three survey periods.
- Although the flora quadrats were established following substantial rainfall, they were only sampled once; additional species would probably be recorded if the sites were revisited. The species lists should therefore be taken as indicative rather than exhaustive.
- The vegetation units for this study were defined based on interpretation of aerial photography signatures combined with the site data and field mapping notes recorded during the field survey. As it was not possible to map areas outside the study area in this way, the distribution of these units outside the study area can only be inferred by their correlation with the Land Systems mapping prepared by the Department of Agriculture. This means that there is a level of uncertainty regarding the assessment of distribution of these vegetation types outside the current study area.
- The PATN floristic analysis is fundamentally limited by the data currently available for the region, which is typically patchily distributed through the Pilbara and concentrated in development areas.

4.0 Vegetation

4.1 Overview of Vegetation Types

Thirty-nine (39) vegetation types were defined for the White Quartz Road corridor (Section 4.2). Broadly, these included:

- patches of Mulga (various forms of *Acacia aneura*) and Snakewood (*A. xiphophylla*) tall shrublands over various species of spinifex on plains and stony hills;
- hummock grasslands of *Triodia* species (mainly *T. wiseana*) with a variable shrub overstorey on low stony hills;
- hummock grasslands of *Triodia longiceps* and/or *T. angusta* on calcareous plains; and
- tall shrublands of mixed species (usually dominated by *Acacia*), often with an overstorey of *Eucalyptus* or *Corymbia*, in creeklines.

4.2 Description of Individual Vegetation Types

4.2.1 Level of the Vegetation Types

The vegetation types defined for the study would each incorporate a range of structural and floristic variants. The units described are considered to range from at, to somewhat higher than, the vegetation association level, although they are not strictly defined as vegetation associations. The structural and floristic variation they include undoubtedly covers a large number of vegetation communities. The broad nature of the units defined needs to be taken into account when using them for assessing conservation value of the vegetation.

It should be noted that the description and mapping of vegetation in the study area represents a temporal "snapshot" view of the existing vegetation at the time of survey, given the often profound effects of fire on vegetation in the region.

4.2.2 Vegetation of Stony Plains

ElAanAayTeTw *Eucalyptus leucophloia* scattered low trees over *Acacia aneura*, *A. ayersiana* tall open shrubland over *Triodia epactia, T. wiseana* hummock grassland

This vegetation was recorded from two small stands at the western end of the White Quartz Road corridor, and was also recorded more widely from plains surrounding the BS4 range (Biota 2005a). Various forms of Mulga (*Acacia aneura*) were present as dominants in the overstorey strata, including *Acacia* aff. *aneura* (narrow fine veined; site 1259) and *A.* aff. *aneura* (scythe-shaped; MET 15,743). The hummock grassland was dominated by varying amounts of *Triodia epactia* and/or *T. wiseana*. Other associated species: *Acacia bivenosa, A. sibirica, A. synchronicia, Ptilotus exaltatus* var. *exaltatus*, *P. polystachyus* var. *polystachyus*. No sites from this study; sites BRO01, BRO05, BRO28 of the BS4 study, group 26/119 of the PATN analysis (Biota 2005a).

AxAanTloTa *Acacia xiphophylla, A. aneura* low woodland to tall open shrubland over *Triodia longiceps, T. angusta* open hummock grassland

This vegetation type occurred on stony plains throughout the White Quartz Road corridor (particularly those with a calcareous substrate). The most common forms of Mulga recorded included *Acacia* aff. *aneura* (grey flat recurved tips; MET 15,828), *A.* aff. *aneura* (narrow fine veined; site 1259) and *A.* aff. *aneura* (scythe-shaped; MET 15,743). Although dominated by *Triodia longiceps* and/or *T. angusta*, the hummock grassland often included scattered hummocks of *Triodia epactia* and/or *T. wiseana*. Other associated species: *Abutilon* species, *Acacia synchronicia, A. tetragonophylla, Aristida contorta, A. latifolia, Brachyachne prostrata, Bulbostylis barbata, Cassia luerssenii, C. stricta, Dactyloctenium radulans, Enchylaena tomentosa* var. *tomentosa, Enneapogon caerulescens, E. polyphyllus, Enteropogon ramosus, Eremophila*

cuneifolia, Eriachne mucronata, Gomphrena cunninghamii, G. kanisii, Goodenia muelleriana, G. tenuiloba, Hibiscus burtonii, Iseilema species*, Maireana melanocoma, M. thesioides, M. triptera, Paspalidium clementii, Porana commixta, Ptilotus exaltatus* var. *exaltatus, P. helipteroides* var. *helipteroides, Rhagodia eremaea, Sclerolaena densiflora, S. eriacantha, Sida atrovirens, S.* sp. (rugose), *Sporobolus australasicus, Trichodesma zeylanicum* var. *zeylanicum*. Site WQR06, WQR08, WQR13, WQR16 of this study; group 25/118 of the PATN analysis.

AxAanTw *Acacia xiphophylla, A. aneura* low woodland to tall open shrubland over *Eremophila cuneifolia, Rhagodia eremaea* low open shrubland over *Triodia wiseana* open hummock grassland

This vegetation type occurred in patches on stony plains throughout the White Quartz Road corridor, and was also recorded from stony plains surrounding the BS4 range (Biota 2005a). It generally occurred on areas without a calcareous substrate (in such areas, the spinifex tended to be replaced by *Triodia longiceps* and/or *T. angusta;* vegetation type AxAanTloTa). A number of forms of Mulga were recorded from this association. Other associated species: *Acacia bivenosa, A. synchronicia, Cassia* species (particularly *C. luerssenii, C. oligophylla* and *C. stricta*), *Enchylaena tomentosa* var. *tomentosa, Eriachne pulchella* subsp. *dominii, Eucalyptus leucophloia* subsp*. leucophloia, Maireana georgei, M. melanocoma,* various *Ptilotus* species including *Ptilotus obovatus* var. *obovatus, Salsola tragus*, *Solanum lasiophyllum*. Site WQR02 of this study, groups 25/115 of the PATN analysis; sites BRO19, BRO23 of the BS4 study (Biota 2005a), groups 25/118 of the PATN analysis.

AxAanTe *Acacia xiphophylla, A. aneura* low woodland to tall open shrubland over *Triodia epactia* open hummock grassland

This vegetation occurred on two areas of broad plain surrounding a creek system in the eastern section of the White Quartz Road corridor. Floristic composition was broadly similar to vegetation type AxAanTw, differing primarily in the dominance of Triodia epactia rather than T. wiseana in the hummock grassland stratum. No sites from this study.

AxAanTbrTe *Acacia xiphophylla, A. aneura* low woodland to tall open shrubland over *Triodia brizoides, T. epactia* open hummock grassland

This vegetation occurred only in a few stands on stony plains at the western end of the White Quartz Road corridor, and was more widespread in the southern BS4 project area (Biota 2005a). Floristic composition was again broadly similar to vegetation types AxAanTw and AxAanTe, differing mainly in the presence of substantial amounts of *Triodia brizoides* in the hummock grassland stratum. No sites from this study; sites BRO43 and BRO-MI of the BS4 study, groups 26/119 and 25/116 of the PATN analysis (Biota 2005a).

AxSCdTa *Acacia xiphophylla* low woodland over *Sclerostegia disarticulata* low open shrubland over *Triodia angusta* very open hummock grassland

Patches of Snakewood *Acacia xiphophylla* with an understorey primarily of samphires occurred at various points through the corridor on substrates of fine clay, however most stands were too small to be mapped. Other associated species: *Brachyachne prostrata, Bulbostylis barbata, Dactyloctenium radulans, Enneapogon caerulescens, E. polyphyllus, Enteropogon ramosus, Eremophila cuneifolia, Eriachne pulchella* subsp. *dominii, Maireana eriosphaera, Paspalidium clementii, Portulaca pilosa, Sclerolaena cuneata, Sporobolus australasicus, Triodia longiceps.* Site WQR15 of this study, group 25/118 of the PATN analysis.

AanTlo *Acacia aneura* tall open shrubland to open scrub over *Triodia longiceps* open hummock grassland

This vegetation occurred mainly on stony plains in the central and eastern sections of the White Quartz Road corridor. Small patches of *Acacia xiphophylla* were common. Other associated species: *Dysphania rhadinostachya* subsp. *rhadinostachya, Eremophila cuneifolia, E. latrobei* subsp. *filiformis, Haloragis gossei*. Most areas had been substantially burnt, hence no sites from this study were located within this vegetation type.

ElAbTloTa *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Acacia bivenosa* scattered shrubs over *Triodia longiceps, T. angusta* hummock grassland

This vegetation occurred broadly over the calcareous plains of the White Quartz Road corridor, particularly in the western and central sections. This was the main vegetation type associated with the Priority 1 *Ptilotus* sp. Brockman, along with vegetation unit ElMeAeTloTa. Other associated species: *Acacia synchronicia, Atriplex codonocarpa, Brachyachne prostrata, Bulbostylis barbata, Eriachne pulchella* subsp. d*ominii, Goodenia forrestii, Indigofera monophylla, Maireana melanocoma, Ptilotus exaltatus* var. *exaltatus, Sclerolaena cuneata, S. densiflora, S. eriacantha, Sporobolus australasicus, Streptoglossa* species. Sites WQR05 and WQR20 of this study, groups 38/170 and 25/117 of the PATN analysis respectively.

ElMeAeTloTa *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Melaleuca eleuterostachya, Acacia exilis* scattered shrubs over *Triodia longiceps, T. angusta* hummock grassland

This vegetation occurred in patches on the calcareous plains in the western and central sections of the White Quartz Road corridor. Other associated species: *Acacia bivenosa, A. synchronicia, Cassia* species, *Dysphania sphaerosperma, Enneapogon caerulescens, E. polyphyllus, Lawrencia densiflora, Maireana* species, *Sclerolaena densiflora, Sclerostegia disarticulata, Sporobolus australasicus, Stackhousia intermedia, Trachymene oleracea* subsp. *oleracea, Trichodesma zeylanicum* var. *zeylanicum, Triodia wiseana*. Site WQR04 of this study, group 25/117 of the PATN analysis.

EsMeAeTlo *Eucalyptus socialis* scattered low mallees over *Melaleuca eleuterostachya, Acacia exilis* scattered shrubs over *Triodia longiceps* hummock grassland

This vegetation occurred over two areas of stony calcareous plain at the western and eastern ends of the White Quartz Road corridor. Other associated species: *Acacia bivenosa, Heliotropium chrysocarpum, Triodia wiseana*. No sites from this study.

ElTe *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Triodia epactia* hummock grassland

This vegetation occurred in broad drainage areas and on areas of stony plain in the western section of the White Quartz Road corridor. Other associated species were sparse but included *Acacia bivenosa*. No sites from this study.

4.2.3 Vegetation of Stony Hills

ElAmTw *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Acacia maitlandii* shrubland to open heath over *Triodia wiseana* hummock grassland

This vegetation occurred on rocky hills at the western end of the White Quartz Road corridor, and was also common on the tall rocky hills within the main BS4 project area (Biota 2005a). Occasional scattered tall shrubs of *Hakea chordophylla* or *H. lorea* subsp. *lorea* were often present. Other associated species: *Acacia atkinsiana, A. exilis, A. hamersleyensis, A. marramamba, Amphipogon sericeus, Dampiera candicans, Eriachne mucronata, E. pulchella* subsp. *dominii, Indigofera monophylla, Keraudrenia nephrosperma*, *Polycarpaea* species, *Schizachyrium fragile, Triodia epactia.* Site WQR01 of this study, group 26/120 of the PATN analysis; sites BRO16, BRO29 and relevés BRO-MA, BRO-MF of the BS4 study, group 26/120 of the PATN analysis (Biota 2005a).

ElAbTw *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Acacia bivenosa* scattered shrubs over *Triodia wiseana* hummock grassland

This vegetation occurred broadly over low stony hills in the White Quartz Road corridor, particularly in the eastern third, but also in the central section. Other associated species: *Acacia maitlandii, A. sibirica* (linear form), *Cassia oligophylla, Eremophila cuneifolia, Goodenia muelleriana, Schizachyrium fragile, Stackhousia intermedia, Trachymene oleracea* subsp. *oleracea, Trichodesma zeylanicum* var. *zeylanicum*. Site WQR09 of this study, group 25/112 of the PATN analysis.

ElAaTw *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Acacia ancistrocarpa* scattered shrubs over *Triodia wiseana* hummock grassland

This vegetation occurred on two areas of low stony hills in the central section of the White Quartz Road study area. Other associated species: *Acacia exilis, A. marramamba, A. pruinocarpa, Cassia pruinosa, Ptilotus calostachyus* var. *calostachyus*. No sites from this study; Site BRO20 and relevé BRO-RB of the BS4 study, groups 26/120 and 16/70 of the PATN analysis respectively (Biota 2005a).

ElTw *Eucalyptus leucophloia* scattered low trees over *Triodia wiseana* hummock grassland

This vegetation occurred on stony hills in the western and central sections of the White Quartz Road corridor. Apart from the dominant flora, other species occurred at very low densities. Other associated species: *Acacia pruinocarpa, Bonamia media* var. *villosa, Dampiera candicans, Eriachne pulchella, Goodenia microptera, Hakea chordophylla*, *Polycarpaea longiflora, Ptilotus calostachyus, Solanum lasiophyllum, Tribulus suberosus*. No sites from this study; site BRO44 of the BS4 study, group 26/120 of the PATN analysis (Biota 2005a).

ElTwTm *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Triodia wiseana, T. melvillei* hummock grassland

This vegetation occurred on a small number of stony hills at the western end of the White Quartz Road study area, along the northern boundary of the corridor. Other associated species were sparse, but included *Dodonaea coriacea* and *Mukia maderaspatana*. No sites from this study.

ElAbTbr *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Acacia bivenosa* scattered shrubs over *Triodia brizoides* hummock grassland

This vegetation occurred on hillslopes towards the western end of the White Quartz Road corridor, and also on some areas of stony plain surrounding the narrow quartz ridges in the central section. Other associated species: *Acacia exilis, A. inaequilatera, A. synchronicia, Aristida contorta, Cassia* species, *Cymbopogon ambiguus, Enneapogon caerulescens, Eremophila cuneifolia, Eriachne mucronata, Ptilotus* species, *Triodia wiseana*. Site WQR19 of this study, group 25/117 of the PATN analysis (note that this quadrat is not overly representative of this vegetation type, being located on an interzone between this unit and vegetation type ElAbTloTa).

AanReTwTbr *Acacia aneura* tall open shrubland over *Rhagodia eremaea* open shrubland over *Triodia wiseana, T. brizoides* open hummock grassland

This vegetation occurred on narrow rocky ridges of quartz in the western third of the corridor. Some areas had a very open tussock grassland of **Cenchrus ciliaris*. Other associated species: *Acacia synchronicia, Cheilanthes brownii, Cleome viscosa, Cymbopogon ambiguus, Dipteracanthus australasicus, Enneapogon lindleyanus, Eriachne mucronata, Grevillea berryana, Oldenlandia crouchiana, Polycarpaea longiflora, Porana commixta, Ptilotus obovatus, P. rotundifolius, Senna glutinosa* subsp. *glutinosa*. No sites from this study.

AanAprTe *Acacia aneura (A. pruinocarpa)* low open forest over *Triodia epactia* hummock grassland

This association occurred on hill crests and some stony plains throughout the White Quartz Road corridor, but particularly in the eastern half. Various forms of Mulga were recorded, but the most common taxon was *Acacia aneura* (grey flat recurved tips; MET 15,828). An open shrubland of *Eremophila forrestii* was often present. Other associated species: *Acacia* aff. *aneura* (narrow fine veined; site 1259), *A. tetragonophylla, Aristida contorta,* various *Cassia* species (particularly *C. glutinosa, C. luerssenii* and *C. stricta*), *Cymbopogon ambiguus, Digitaria brownii, Enchylaena tomentosa* var. *tomentosa, Enneapogon caerulescens, E. polyphyllus, Eremophila cuneifolia, Eriachne aristidea, E. pulchella* subsp. *dominii, Evolvulus alsinoides* var. *villosicalyx, Goodenia microptera, G. muelleriana, Hibiscus burtonii, Iseilema dolichotrichum, Maireana* species (particularly *M. planifolia*), *Mukia maderaspatana, Paraneurachne muelleri, Paspalidium clementii, Porana commixta, Ptilotus* species, *Sida echinocarpa, Solanum lasiophyllum, Tribulus suberosus, Trichodesma zeylanicum* var. *zeylanicum*. Sites WQR03, WQR10 and WQR14 of this study, groups 26/119 and 25/116 of the PATN analysis.

AanTw *Acacia aneura* tall open shrubland to open scrub over *Triodia wiseana* open hummock grassland

This vegetation occurred mainly on stony hill crests in the central section of the road corridor, with another occurrence towards the eastern end. Various forms of Mulga were recorded, but again the most common taxon was *Acacia aneura* (grey flat recurved tips; MET 15,828). Scattered tall shrubs of *Acacia tetragonophylla* were typically present. Other associated species: *Aristida contorta, Brachyachne convergens, Bulbostylis barbata, B. turbinata, Cassia stricta, Cheilanthes sieberi* subsp. *sieberi, Cymbopogon obtectus, Dactyloctenium radulans, Dichanthium sericeum* subsp. *humilius, Enchylaena tomentosa* var. *tomentosa, Enneapogon caerulescens, E. polyphyllus, Eremophila cuneifolia, E. forrestii, Eriachne pulchella* subsp. *dominii, Hakea lorea* subsp. *lorea, Rhagodia eremaea, Tribulus suberosus*. Site WQR18 of this study, group 25/118 of the PATN analysis.

ElGOrDpAmTe *Eucalyptus leucophloia* scattered low trees over *Gossypium robinsonii, Dodonaea pachyneura (Acacia maitlandii)* open shrubland over *Triodia epactia* hummock grassland

This vegetation type occurred along rocky breakaways at the western end of the White Quartz Road corridor, and was also recorded from narrow gorges in the BS4 range (Biota 2005a). Other associated species: *Acacia monticola, A. pyrifolia, Cassia glutinosa, Corymbia ferriticola* subsp. *ferriticola, Cymbopogon ambiguus, Eriachne mucronata, Indigofera monophylla, Jasminum didymum* subsp. *lineare, Themeda triandra*. No sites from this study; site BRO14 and relevé BRO-MH of the BS4 study, group 7/27 of the PATN analysis (Biota 2005a).

ElAbsTw *Eucalyptus leucophloia* scattered low trees over *Acacia bivenosa* (spindly variant) tall shrubland over *Triodia wiseana* hummock grassland

This vegetation occurred broadly on low rocky hills at the eastern end of the White Quartz Road corridor. Other associated species: *Acacia exilis, A. inaequilatera, A. maitlandii, A. synchronicia, Aristida contorta, A. holathera* var. *holathera, Cassia* species (particularly *C. pruinosa*), *Corymbia hamersleyana, Dodonaea coriacea, Enneapogon caerulescens, E. polyphyllus, Eriachne mucronata, Eucalyptus gamophylla, Goodenia muelleriana, Oldenlandia crouchiana, Ptilotus* species, *Salsola tragus* subsp. *tragus, Sida echinocarpa, Solanum phlomoides, Tribulus platypterus, Trichodesma zeylanicum* var. *zeylanicum, Triodia angusta*. Site WQR07 from this study, group 25/112 of the PATN analysis.

AiAmTbrTe *Acacia inaequilatera* scattered tall shrubs over *Acacia maitlandii* open shrubland over *Triodia brizoides, T. epactia* hummock grassland

This vegetation occurred on low rocky hills in the eastern section of the White Quartz Road corridor. Other associated species: *Acacia bivenosa, A. pruinocarpa, Eremophila phyllopoda* subsp. *obliqua, Gomphrena canescens, Grevillea berryana, Ptilotus fusiformis* var. *fusiformis*. No sites from this study.

AiERcERfrTw *Acacia inaequilatera* scattered tall shrubs over *Eremophila cuneifolia, E. fraseri* open shrubland over *Triodia wiseana* hummock grassland

This vegetation occurred on low rocky hills through the western and central sections of the White Quartz Road corridor. Scattered low trees of *Eucalyptus leucophloia* or various forms of Mulga *Acacia aneura* were often present, and *Ptilotus rotundifolius* sometimes formed an open shrubland. Other associated species: *Acacia pruinocarpa, A. synchronicia, Aristida contorta, Cassia luerssenii, C. pruinosa, Cymbopogon ambiguus, Enneapogon caerulescens, E. polyphyllus, Eriachne pulchella* subsp. *dominii, Goodenia muelleriana, Gomphrena kanisii, Hakea chordophylla, Paraneurachne muelleri, Polycarpaea* species, *Ptilotus clementii, Schizachyrium fragile, Solanum horridum, S. lasiophyllum, Sporobolus australasicus, Stackhousia intermedia, Themeda triandra, Trachymene oleracea* subsp. *oleracea, Tribulus suberosus, Trichodesma zeylanicum* var. *zeylanicum*. Site WQR17 and relevé WQR-RA of this study, groups 25/117 and 25/112 of the PATN analysis respectively.

AiTw *Acacia inaequilatera* scattered tall shrubs over *Triodia wiseana* hummock grassland

This vegetation occurred over stony undulating plains and low rises in the western and eastern thirds of the White Quartz Road corridor. Other associated species: *Acacia ancistrocarpa, A.*

bivenosa, A. maitlandii, Corchorus lasiocarpus subsp. *lasiocarpus, Ptilotus rotundifolius*. No sites from this study.

AiTe *Acacia inaequilatera* scattered tall shrubs over *Triodia epactia* hummock grassland
This vegetation occurred broadly over stony undulating plains and low rises in the eastern half of the White Quartz Road corridor. Other associated species: *Acacia ancistrocarpa, A. bivenosa, A. maitlandii, A. pruinocarpa, A. synchronicia, Gomphrena canescens, Grevillea pyramidalis, Tephrosia* sp. Bungaroo Creek (ME Trudgen 11601). No sites from this study.

4.2.4 Vegetation of Creeklines

Given the small size of many of the creeklines habitats (particularly the minor flowlines), only larger stands of these vegetation types have been mapped.

EcAciMgCv *Eucalyptus camaldulensis* var. *obtusa* open forest over *Acacia citrinoviridis, Melaleuca glomerata* tall open scrub over *Cyperus vaginatus* very open sedgeland
Riverine forest dominated by River Gums *Eucalyptus camaldulensis* var. *obtusa* was only recorded from two creeklines in the White Quartz Road corridor; one in the western third of the corridor, the other at the far eastern end near the Wittenoom-Nanutarra Road. Other associated species: *Acacia coriacea* subsp. *pendens*, *Ammannia auriculata, Pluchea rubelliflora, Stemodia grossa, Typha domingensis.* No sites from this study.

AciAanTeTloCEc *Acacia citrinoviridis, A. aneura* (various forms) tall open shrubland to tall open scrub over *Triodia epactia, T. longiceps* open hummock grassland and **Cenchrus ciliaris* open tussock grassland to tussock grassland
This vegetation occurred in broad loamy flowlines and floodplains throughout the White Quartz Road corridor. Larger creeklines had scattered trees to a woodland of Coolibah *Eucalyptus victrix*. *Acacia sclerosperma* subsp. *sclerosperma* and *A. pyrifolia* were common shrubs, particularly in more degraded sections of creek (ie. those with less Triodia epactia cover and more **Cenchrus ciliaris*). Other associated species: *Acacia bivenosa, Corchorus crozophorifolius, Grevillea berryana, Ptilotus obovatus, Rhagodia eremaea, Rulingia luteiflora.* No sites from this study.

ApyTErTeCEc *Acacia pyrifolia (Stylobasium spathulatum)* tall open scrub over *Tephrosia rosea* var. *glabrior* low open shrubland over *Triodia epactia* very open hummock grassland and **Cenchrus ciliaris* open tussock grassland
This vegetation occurred on floodplains surrounding a moderate sized creekline towards the eastern end of the White Quartz Road corridor, and was broadly distributed on the floodplains of Boolgeeda Creek in the BS4 study area (Biota 2005a). The low open shrubland was mixed, including *Indigofera monophylla, Tephrosia densa* and *Waltheria indica*. Other associated species: *Acacia bivenosa, A. citrinoviridis, Alysicarpus muelleri, Cassia oligophylla, Corchorus lasiocarpus* subsp. *lasiocarpus, Crotalaria medicaginea* var. *neglecta, Enneapogon caerulescens, E. polyphyllus, Eremophila longifolia, Evolvulus alsinoides* var. *villosicalyx, Goodenia forrestii, Gossypium robinsonii, Indigofera colutea, Jasminum didymum* subsp. *lineare, Polymeria ambigua, Salsola tragus* subsp. *tragus, Sida echinocarpa, Sporobolus australasicus, Themeda triandra*. Site WQR11 of this study, group 27/126 of the PATN analysis; sites BRO10 and BRO46 of the BS4 study, group 27/126 of the PATN analysis (Biota 2005a)

AanTe *Acacia aneura* low open forest over *Triodia epactia* very open hummock grassland and mixed bunch grassland
This vegetation occurred in some minor creeklines and on plains bordering these, and was probably indicative of the vegetation which would have existed in areas supporting vegetation type AanCEc before the latter were invaded by Buffel Grass. The most common Mulga recorded was *Acacia aneura* (grey flat recurved tips; MET 15,828). Numerous annual species were observed, particularly bunch grasses, which were dominated by *Enneapogon polyphyllus* but also included *Aristida contorta, Dichanthium sericeum* subsp. *humilius, Digitaria ctenantha, Eriachne pulchella* subsp. *dominii* and *Sporobolus australasicus.* Other associated species: *Acacia*

inaequilatera, A. tetragonophylla, Alternanthera nana, Amaranthus cuspidifolius, Bulbostylis barbata, Cassia species, *Dipteracanthus australasicus, Eragrostis cumingii, E. setifolia, Eremophila forrestii* subsp. *forrestii, E. fraseri* subsp. *fraseri, E. latrobei* subsp. *filiformis, Euphorbia biconvexa, Evolvulus alsinoides* var. *villosicalyx, Flaveria australasica, Gomphrena canescens* subsp. *canescens, G. kanisii, Goodenia* species, *Maireana* species, *Paspalidium clementii, P. rarum, Ptilotus* species, *Sclerolaena densiflora, S. eriacantha, Sida* species, *Trichodesma zeylanicum* var. *zeylanicum*. Site WQR12 of this study, group 25/118 of the PATN analysis.

AanCEc *Acacia aneura* (various forms) tall open scrub over **Cenchrus ciliaris* tussock grassland

This vegetation occurred in several creeklines in the central section of the White Quartz Road corridor which appeared to be highly grazed. Scattered hummock grasses of *Triodia longiceps* or *T. epactia* were typically present amongst the dense cover of Buffel Grass **Cenchrus ciliaris*. Other species present were largely robust perennial flora capable of withstanding the heavy grazing and competitive pressure from weeds. Other associated species: *Acacia citrinoviridis, A. synchronicia, A. tetragonophylla, Dipteracanthus australasicus, Eucalyptus leucophloia* subsp. *leucophloia, Hakea lorea* subsp. *lorea, Porana commixta, Ptilotus obovatus* var. *obovatus, Rhagodia eremaea, Santalum lanceolatum, Stylobasium spathulatum.* No sites from this study.

ElCdAtuTeTw *Eucalyptus leucophloia, Corymbia deserticola* scattered low trees over *Acacia tumida* var. *pilbarensis* tall open scrub over *Triodia epactia, T. wiseana* open hummock grassland

This vegetation type occurred in flowlines at the western end of the White Quartz Road corridor, and was also recorded from flowlines through stony plains at the northern end of the BS4 rail corridor (Biota 2005a). Other associated species: *Acacia bivenosa, Corymbia hamersleyana, Digitaria brownii, Eremophila forrestii, Gossypium robinsonii, Petalostylis labicheoides, Themeda triandra*. No sites from this study; site BRO31 of the BS4 study, group 26/119 of the PATN analysis (Biota 2005a).

AmoAmAatTeTw *Acacia monticola, A. maitlandii, A. atkinsiana* tall open shrubland over *Triodia epactia, T. wiseana* open hummock grassland

This vegetation type was recorded from minor drainage lines at the western end of the White Quartz Road corridor, and was recorded from similar habitat through the BS4 range (Biota 2005a). Other associated species: *Acacia bivenosa, A. citrinoviridis, Gossypium robinsonii, Petalostylis labicheoides, Porana commixta, Rulingia luteiflora, Themeda triandra*. No sites from this study; sites BRO06, BRO11 of the BS4 study, groups 27/122 and 26/119 of the PATN analysis respectively (Biota 2005a).

PlTe *Petalostylis labicheoides* shrubland over *Triodia epactia* hummock grassland

This vegetation type occurred in some minor flowlines at the western end of the White Quartz Road corridor, and was also recorded from similar habitat through the stony hills in the southern section of the BS4 project area (Biota 2005a). Other associated species: *Acacia ancistrocarpa, A. bivenosa, A. citrinoviridis, A. monticola, Eucalyptus leucophloia, E. xerothermica*. No sites from this study.

PlAbTlo *Petalostylis labicheoides* tall open shrubland over *Acacia bivenosa* shrubland over *Triodia longiceps* open hummock grassland

This vegetation occurred in minor flowlines through calcareous plains in the western half of the White Quartz Road corridor. A dense cover of *Themeda triandra* (Kangaroo Grass) was sometimes present, along with a low open woodland of *Eucalyptus xerothermica*. Other associated species: *Stylobasium spathulatum*. No sites from this study.

ElAbsTe *Eucalyptus leucophloia* scattered low trees over *Acacia bivenosa* (spindly variant) tall shrubland over *Triodia epactia* hummock grassland

This vegetation occurred in two minor flowlines at the eastern end of the White Quartz Road corridor. Other associated species were sparse but included scattered tall shrubs of Mulga *Acacia aneura*. No sites from this study.

AaAbTlo *Acacia ancistrocarpa, A bivenosa* shrubland to open heath over *Triodia longiceps* hummock grassland

This association was typical of the numerous minor flowlines through the broad calcareous plains dominated by *Triodia longiceps*. Only three of the larger stands in the central section of the White Quartz Road corridor were mapped. Other associated species: *Acacia citrinoviridis, A. kempeana, A. sclerosperma* subsp. *sclerosperma, Stylobasium spathulatum*. No sites from this study.

AaAbTe *Acacia ancistrocarpa, A. bivenosa* shrubland to open heath over *Triodia epactia* hummock grassland

This association was typical of minor flowlines dissecting the stony undulating plains dominated by a usually sparse overstorey of *Acacia bivenosa* and *A. ancistrocarpa* over a hummock grassland of *Triodia wiseana*. The main difference in this vegetation from the surrounding plains was in the higher densities of the shrub species, the presence of Triodia epactia (indicating more moisture availability), and the presence of some typical creekline species such as *Themeda triandra*. Only two of the larger stands in the central section of the White Quartz Road corridor were mapped. No sites from this study.

AaTw *Acacia ancistrocarpa* shrubland over *Triodia wiseana* hummock grassland

This association occurred in minor flowlines through stony undulating plains dominated by *T. wiseana*, which also had substantial *Acacia ancistrocarpa* in the overstorey. These flows were typically less defined than those supporting vegetation type AaAbTe, as evidenced by the absence of *Triodia epactia* in the hummock grassland stratum. Substantial amounts of *Acacia exilis* and/or *Petalostylis labicheoides* were present in places. No sites from this study.

4.3 Conservation Significance of the Vegetation Types of the White Quartz Road Corridor

The following discussion has been prepared using Land Systems mapping for the Pilbara bioregion (Payne et al. 1988, van Vreeswyk et al. 2004), a floristic analysis of site data using PATN, and review of vegetation types defined for other areas near the White Quartz Road corridor to assist in the identification of uncommon vegetation types.

4.3.1 Vegetation Condition

The vegetation types of the study area were generally in very good condition (see Appendix 2).

Larger creeklines (particularly those with an overstorey of *Acacia citrinoviridis* or *A. aneura*) were often heavily infested with introduced Buffel Grass **Cenchrus ciliaris,* however weeds were otherwise not prominent in the study area (see Section 5.3).

Evidence of cattle and donkeys was also widespread through the area, although grazing and trampling were not pronounced except in the larger creeklines referred to above.

The only other disturbance comprised occasional vehicle tracks (of varying ages) through the area.

4.3.2 Probable Distribution of the Vegetation Types based on their Correspondence with Land Systems

The correspondence between the mapped Land Systems and the vegetation units identified within the White Quartz Road corridor was not clear-cut, with few vegetation units exclusively associated with any particular Land System. On this basis, none of the mapped vegetation units would be expected to be restricted to any Land System.

Following is a summary of the main trends identified:

- The Rocklea Land System comprises the majority of the White Quartz Road corridor, and most of the vegetation types identified within the corridor occurred at least in part on this Land System.
- The Newman Land System was associated with the stony hill vegetation types ElTw and ElAmTw.
- The Robe Land System was associated mainly with vegetation types ElTw, ElAbTbr, ElAbTloTa, ElMeAeTloTa, AxAanTloTa, AxAanTbrTe, AxAanTw and AanAprTe.
- The Platform Land System was associated mainly with vegetation types ElTw, AanAprTe, AxAanTloTa and AanTlo.
- A stand of EsMeAeTlo was associated with the single mapped area of Table LS. This Land System is probably more widespread in the corridor than the mapping would indicate.
- The vegetation types of creeklines were distributed broadly through the study area, and none would be expected to be restricted to a single Land System.

4.3.3 Probable Distribution of the Vegetation Types based on the Apparent Distribution of Floristic Community Types

The primary output of the PATN analysis was a dendrogram indicating relationships between sites on the basis of floristic composition, with sites with similar species clustering out together. Given the size of the dataset analysed, the entire dendrogram has not been reproduced here, however it is available for inspection if required.

Following generation of the dendrogram by PATN, arbitrary cut-off points were selected to generate three levels of grouping within the resultant site clusters; a 50-group level (ie. the level dividing the 960 sites into 50 groups, based on floristic composition), a 100-group level (the level dividing the 960 sites into 100 groups) and a 200-group level (the level dividing the 960 sites into 200 groups). These groups, and the vegetation types and sites from the White Quartz Road corridor within each group, are indicated in the table in Appendix 3. It is immediately apparent that the floristic groups within the White Quartz Road corridor are most similar to those delineated for the two closest study areas (BS4 and the Nammuldi-Mt Lionel rail corridor), and that strong differences in floristic composition are apparent across the region sampled by the analysis dataset. None of the floristic groups appear to be restricted to the White Quartz Road corridor.

A summary of the groups at the 50-group level that contained sites from the White Quartz Road corridor is presented in Table 4.1. Three of the groups contained sites from as far afield as Mesa A (near Pannawonica) or West Angelas (towards Newman), however group 26 contained only sites from study areas located in the Brockman locality (probably due to the presence of *Acacia exilis,* which has a relatively narrow distribution through the Hamersley Range, and hence also within the dataset used for the PATN analysis).

Table 4.1: Summary of vegetation* and broad habitat types for the floristic groups defined at the 50-group level of the PATN analysis that contained sites within the White Quartz Road corridor (*based on vegetation descriptions for the component sites).

50-group	Description of dominant vegetation types and habitats
Group 25	*Triodia wiseana, T. longiceps* and/or *T. angusta* (occasionally *T. brizoides*) hummock grasslands on stony hills and plains, usually with a sparse to open shrub overstorey of *Acacia bivenosa*, *A. inaequilatera* and/or *Eremophila* spp.; also tall shrublands of *A. xiphophylla* and/or *A. aneura* over various spinifex spp. on plains and some hills; groups 112-118 at the 200-group level.
Group 26	Stony hills with hummock grasslands of *Triodia wiseana* or *T. epactia* and an overstorey usually including *Eucalyptus leucophloia, Acacia exilis, A. pruinocarpa* and/or *A. aneura;* groups 119-120 at the 200-group level.
Group 27	Riverine vegetation and vegetation of smaller creeks and floodplains (particularly including *Eucalyptus xerothermica, Acacia pyrifolia, Tephrosia rosea* var. *glabrior, Triodia epactia* and perennial tussock grasses); groups 121-129 at the 200-group level.
Group 38	Predominantly *Acacia xiphophylla* low woodlands over mixed *Triodia* hummock grasslands; groups 166-170 at the 200-group level.

At the 100-group level, four of the six floristic groups containing sites from the White Quartz Road corridor comprised sites only from the Brockman locality (groups 57, 58, 59 and 61), again apparently due to the presence of *Acacia exilis* and the absence of some other species more common in the eastern Hamersley Range (eg. *Acacia hilliana* and *Triodia* aff. *basedowii*).

At the 200-group level, only two of the nine groups containing sites from the White Quartz Road corridor also contained sites from areas outside the Brockman locality (group 112 and 170).

On the basis of the available information, it thus appears that although none of the floristic groups recorded are restricted to the White Quartz Road corridor, most of the vegetation types are unlikely to be broadly distributed across the Pilbara, but rather should be considered to be restricted to the general Brockman locality.

4.3.4 Assessment of Vegetation Conservation Significance at the Level of the Vegetation Types Defined by this Study

None of the vegetation types occurring within the White Quartz Road corridor are listed as Threatened Ecological Communities under either the Federal *Environment Protection and Biodiversity Conservation Act 1999* or under the State listing maintained by DEC.

However, "all major ephemeral water courses" (which would correspond to vegetation type EcAciMgCv) are considered to be ecosystems at risk, principally from grazing and trampling by stock, weed invasion and large fires (see Kendrick 2003).

The floristic analysis run for the current study suggests that most of the floristic groups should be considered restricted to the Brockman locality, however this analysis was limited by a lack of additional sites in comparable habitats within the Hamersley subregion outside of the immediate Brockman locality. Whether these vegetation types are genuinely restricted in distribution or are more widely distributed through the Hamersley subregion will only be determined as further data is collected from the region for comparison.

On the basis of interpretation of the current PATN analysis along with the results of the field study, one vegetation type from the White Quartz Road corridor was considered to be of high conservation significance:

- EcAciMgCv (riverine vegetation dominated by River Gums *Eucalyptus camaldulensis*): this vegetation comprises an "ecosystem at risk" (Kendrick 2003), has a small area of representation in the study area and in the broader locality, and occurs in the largest surface drainage features for the study area. Pools of free water within this habitat may also be of importance to mobile fauna species.

Six vegetation types were considered to be of moderate conservation significance:

- ElAbTloTa, ElMeAeTloTa and EsMeAeTlo (hummock grasslands of *Triodia longiceps* and/or *T. angusta* with an overstorey of *Eucalyptus leucophloia, E. socialis, Acacia bivenosa, A. exilis* and/or *Melaleuca eleuterostachya*): these units comprised the main vegetation types within which the Priority 1 species *Ptilotus* sp. Brockman (E. Thoma & A. Joder ET & AJ 145) was found to occur; although this species is abundant in the Brockman locality, it has a relatively restricted distribution and is not known from any area of the conservation estate (see Section 5.2.2).
- AxSCdTa (low woodlands of Snakewood over low open samphire shrublands): given the restricted distribution of one of the dominant species (*Sclerostegia disarticulata*) in this unit in the Pilbara region, this vegetation is likely to have a small area of representation in the region.
- AanReTwTbr (vegetation of rocky quartz ridges): although the areas of these ridges sampled during the current study did not appear to support any particular species restricted to this habitat, this habitat is of interest given the distinct geology and the small area of representation in the locality.

- AanTe (creekline vegetation dominated by Mulga which is in very good condition): this vegetation is particularly susceptible to degradation through repeated fires, grazing, and invasion by weeds.

The remainder of the vegetation types identified are considered to be of low conservation significance, representing units that are likely to be widely distributed and relatively well represented in the locality. Note that this should not be interpreted as meaning that they are of no importance, merely that they are less significant than the other vegetation types within the White Quartz Road corridor; as their condition was typically good to excellent, these vegetation types still have conservation value.

The White Quartz Road corridor thus has moderate conservation value for overall vegetation.

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5.0 Flora

5.1 Overview of Flora

5.1.1 Species Richness

A total of 364 native vascular flora species was recorded from the White Quartz Road study area, from 142 genera and 53 families (see Appendix 4). Eight weed species were also recorded (see Section 5.3).

Although there was no systematic collection of fungi during the current survey work, the Black Powderpuff *Podaxis pistillaris* was noted in the area.

Species richness tends to vary on a logarithmic scale with the size of the study area, and is also affected by the shape of the study area (long linear corridors will tend to intersect a broader range of habitats than more regular rectangular polygons). In comparison with the White Quartz Road study area, which was some 2,303 ha in size:

- 334 taxa of native vascular flora from 141 genera and 47 families were recorded from the Mt Lionel rail corridor, 24 km to the north, which was considerably smaller in size (418 ha; Biota in prep.).
- 466 native species from 168 genera and 56 families have been recorded from the Brockman Syncline 4 study area, which adjoins the western end of the White Quartz Road and was much larger in size (12,757 ha; Biota unpubl. data).

The species richness of the White Quartz Road study area thus appears to be in the range expected for a study area of this size in the Brockman locality.

Species richness per quadrat (detailed flora recording site) ranged from 19 to 96 native taxa, with an average of 52 taxa. Sites with the highest native species richness were in Mulga woodlands (WQR08: 96 taxa; WQR12: 84 taxa) or on floodplains (WQR11: 92 taxa). Sites with the lowest native species richness were typically on gentle stony slopes or plains (WQR09: 19 taxa; WQR05: 24 taxa). The main factor driving differences in the number of species recorded in different quadrats thus seems to be habitat type. Habitats with generally good conditions (clayey or deep, well-drained soils; more readily available water) typically had more species than habitats with shallow, less favourable soils.

5.1.2 Dominant Species

The families and genera with the greatest number of native taxa within the White Quartz Road study area are shown in Table 5.1 and Table 5.2. These families and genera are those that are predominant in the vegetation of the Pilbara, and that usually have most representatives on flora lists from this region, due to their prominence in the Eremaean flora. Some of the families (eg. the Amaranthaceae, Malvaceae and Poaceae) are more species rich in the Northern flora and poorer in the Southern flora, while others (such as the Mimosaceae and Papilionaceae) are abundant in all three provinces. In contrast to these plant groups with many representatives, 19 families and 84 genera recorded during the White Quartz Road survey were represented by only a single native species (Appendix 4).

The most frequently recorded species within the study area were the perennial hummock grasses *Triodia wiseana, T. angusta, T. longiceps* and *T. epactia*; shrubs/trees such as various forms of Mulga *Acacia "aneura", A. bivenosa, A. synchronicia, A. tetragonophylla, Cassia luerssenii, C. oligophylla, C. "stricta", Enchylaena tomentosa* var. *tomentosa, Eremophila cuneifolia, Maireana georgei* and *M. melanocoma*; and annual grasses and herbs including *Aristida contorta, Bulbostylis barbata, Enneapogon caerulescens, E. polyphyllus, Eriachne pulchella* var. *dominii, Gomphrena kanisii, Goodenia forrestii, G. muelleriana, Paspalidium clementii, Polycarpaea*

corymbosa var. *corymbosa, Ptilotus exaltatus* var. *exaltatus, P. helipteroides* var. *helipteroides, Trachymene oleracea* subsp. *oleracea* and *Trichodesma zeylanicum* var. *zeylanicum*. Some of these species are commonly dominant in the vegetation of the area (eg. the hummock grasses, forms of Mulga and *Acacia bivenosa*) or at least frequently contribute to its structure (eg. *Acacia tetragonophylla*). In terms of the ephemeral flora, the annual grasses were often the dominant ground cover below areas with a Mulga overstorey, while other species had a wide environmental tolerance but usually occurred with low abundance (eg. *Bulbostylis barbata* and *Gomphrena kanisii*).

Table 5.1: Plant families with the greatest number of species within the White Quartz Road corridor.

Family	No. of Native Species
Poaceae (grass family)	50
Malvaceae (hibiscus family)	39
Mimosaceae (wattle family)	33
Chenopodiaceae (saltbush, bluebush family)	24
Amaranthaceae (mulla-mulla family)	21
Papilionaceae (pea family)	21
Caesalpiniaceae (cassia family)	20
Asteraceae (daisy family)	14
Myrtaceae (eucalypt family)	12
Euphorbiaceae (spurge family)	10
Goodeniaceae (goodenia family)	10

Table 5.2: Genera with the greatest number of species within the White Quartz Road corridor.

Genus	No. of Native Species
Acacia (wattles)	32
Cassia (cassias)	19
Ptilotus (mulla-mullas)	15
Abutilon (lantern-flowers)	13
Sida (sidas)	13
Maireana (bluebushes)	12
Hibiscus (hibiscus)	8
Eremophila (emu-flowers, poverty bushes)	7
Goodenia (goodenias)	7
Tephrosia (tephrosias)	7
Eragrostis (lovegrass)	6
Eucalyptus (eucalypts)	6
Euphorbia (spurges)	6
Triodia (spinifex)	6

5.2 Flora of Conservation Significance

5.2.1 Probability of Declared Rare Flora Occurring in the Study Area

There are currently only two Declared Rare Flora (DRF) in the Pilbara; Mountain Thryptomene *Thryptomene wittweri* and Hamersley Lepidium *Lepidium catapycnon.* Neither species was recorded from the White Quartz Road corridor during the recent surveys, despite systematic targeted searches for rare species through the entire study area. Although the rare flora searches were done following an extended dry period, both of these DRF are perennial species which would have been visible if present.

Mountain Thryptomene is only known from high-altitude mountain tops in the Pilbara, its distribution extending south into the Gascoyne and Great Victoria Desert bioregions. Given the absence of suitable habitat within the study area, this species would not be expected to occur.

Hamersley Lepidium is known from a number of locations in the vicinity of Tom Price. Although suitable habitat (low stony hills and plains) occurs within the White Quartz Road corridor, this species has not been recorded from the Brockman locality to date.

There are thus no listed Threatened Flora Species under the *EPBC Act 1999* known from the study area.

5.2.2 Priority Flora Occurring in the White Quartz Road Corridor

One Priority 1 species and three Priority three flora were recorded during the current survey (Table 5.3, Appendix 5), most of which have been recorded previously in the locality (see Section 2.3.9). Each species is discussed individually below.

Table 5.3: Priority flora recorded within the White Quartz Road corridor.

Family / Species	No. of Records (Broad Distribution within Study Area)
Priority 1	
Amaranthaceae *Ptilotus* sp. Brockman (E. Thoma & A. Joder ET & AJ 145)	172 (throughout corridor)
Priority 3	
Malvaceae *Abutilon trudgenii* ms.	24 (throughout central corridor)
Rostellularia adscendens var. *latifolia*	1 (eastern end of corridor)
Sida sp. Wittenoom (W.R. Barker 1962)	68 (throughout eastern two-thirds of corridor)

- *Ptilotus* sp. Brockman (E. Thoma & A. Joder ET & AJ 145) Priority 1

The first collection of this undescribed flora species was from the BS4 project area, by Emil Thoma and Anna Joder of Pilbara Iron. This low shrub species is very distinctive in appearance, both in habit and floral characters (see Plate 5.1).

Plate 5.1: *Ptilotus* sp. Brockman: (a) habit (shown growing next to a spinifex hummock); (b) flowering branchlet; (c) close-up of flower.

According to Mr. Rob Davis of the WA Herbarium, who specialises in this genus, *Ptilotus* sp. Brockman has a particular floral character (an elongated staminal cup) that is shared by only one other species in this genus, although it is common within the closely related genus *Gomphrena*. The majority of *Ptilotus* species produce nectar and are largely insect pollinated, although this has not been recorded in the literature to date (Rob Davis, WA Herbarium, pers. comm. 2005). Rob Davis considers that the presence of the elongated staminal cup suggests that this species may have a specific pollinator.

There were 172 records of this species comprising some 8,300 individuals from the White Quartz Road corridor (see Appendix 5). Additional survey work in the region in October 2006 identified numerous further locations for this species and extended its distribution, such that the known

range is now some 70 km by 30 km centred on Mt Brockman (Biota 2007b). The total population size, including the individuals from the White Quartz Road corridor, comprises some 16,600 individuals (Biota 2007b).

- *Abutilon trudgenii* ms. Priority 3

This low shrub species has a relatively straggly habit (see Plate 5.2) and tends to occur in recently burnt areas. Both factors probably contribute to the fact that it was poorly collected in the past, however it is now recorded routinely on surveys in the Hamersley Range.

Specimens of *A. trudgenii* are lodged at the WA Herbarium from Cane River, Hillside Station, Goldsworthy and Tom Price. However, according to the Priority Species List this species is known from other locations including Warralong, Woodstock, Point Sampson, Karratha and Pannawonica (Atkins 2006). It has also been recorded from Yanrey Station on the eastern side of the Exmouth Gulf (M. Maier, pers. obs.), west of Dampier (Biota and Trudgen 2001), and south-southeast of Port Hedland (Trudgen et al. 2002). Further inland in the vicinity of Newman, *A. trudgenii* was recorded 23 times by Trudgen and Casson (1998) during the West Angelas surveys, seven times during the initial survey of the Hope Downs rail corridor (Biota and Trudgen 2002), once during the Hamersley Range Extension to the Hope Downs rail corridor (Biota 2004c), three times during the survey of the FMG Stage A rail corridor between Port Hedland and Mindy Mindy (Biota 2004d), and four times from the FMG Stage B rail corridor and tenements (Biota 2004b). This species has been recorded recently from several areas around Pannawonica, including from Mesa A and Mesa G (46 records; see Biota 2005b), the Mesa A transport corridor (over 2,300 records from all sections of the transport corridor, the Yarraloola borefield and pipeline, and the Warramboo deposit; Biota in prep.), the Mesa J Extension (1 record; Biota 2005c), Bungaroo Valley (305 records; Biota 2007c) and Mesa L Minor (7 records; Biota 2005d).

Abutilon trudgenii ms. was recorded 24 times from the White Quartz Road corridor, with locations scattered throughout the central section of the corridor (Appendix 5).

Plate 5.2: *Abutilon trudgenii* ms.: young plant, leaf, and fruit (note pendant pedicels).

- *Rostellularia adscendens* var. *latifolia* Priority 3

This herb or low shrub has a distinct range across northern Australia. Over 18 locations have been recorded in Western Australia in both the Chichester and Hamersley subregions, including at Hamersley Station, George River, Fortescue Valley, Four Corners Bore and Eight Mile Well (M.E. Trudgen, ME Trudgen & Associates, unpublished data).

This species was recorded from a single location towards the eastern end of the White Quartz Road corridor, but given its inconspicuous habit, it is possible that it occurs more widely in the corridor.

- *Sida* sp. Wittenoom (W.R. Barker 1962) Priority 3

This low to medium-height shrub is similar in appearance to the more common *Sida echinocarpa,* but differs in some key features, including having fewer carpels to its spiny fruit, and calyx lobes that are depressed or concave in the centres (Plate 5.3). Similar to *Abutilon trudgenii, Sida* sp. Wittenoom has been poorly collected in the past but is now recorded frequently during surveys in the Hamersley Range. This species is widespread through the Pilbara bioregion, occurring in both the Hamersley and Chichester subregions. Specific records include two locations in the Hope Downs rail corridor (Biota 2004c), nine locations in the FMG Stage A rail corridor (Biota 2004d), two locations in the FMG Stage B rail corridor (Biota 2004b), 24 locations at Mesa A and Mesa G (Biota 2005b), over 3,500 records from the Mesa A transport corridor study area (from all sections of the transport corridor, the Yarraloola borefield and pipeline corridor, and the Warramboo deposit; Biota in prep.), 5 locations in the Mesa J Extension (Biota 2005c), 578 locations in the Bungaroo Valley (Biota 2007c) and 1 location at Mesa L Minor (Biota 2005d).

There were over 60 records of *Sida* sp. Wittenoom (W.R. Barker 1962) from the White Quartz Road study area, with locations scattered throughout the eastern two-thirds of the corridor. Given that *Sida* sp. Wittenoom (W.R. Barker 1962) is apparently widespread and abundant, this species should be removed from the Priority flora listing.

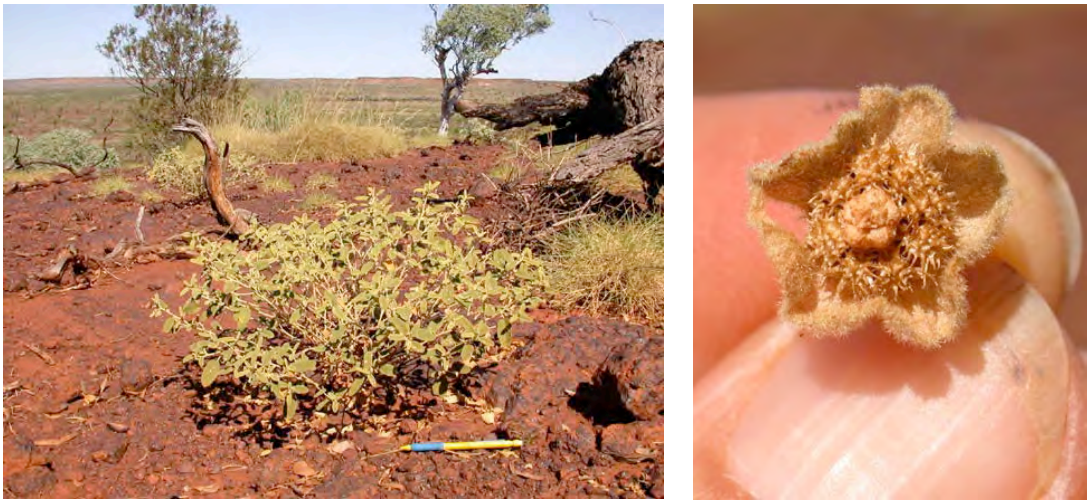

Plate 5.3: *Sida* sp. Wittenoom (W.R. Barker 1962): habit and fruit (note spiny carpels and concave calyx lobes).

5.2.3 Other Flora of Conservation Interest in the White Quartz Road Study Area

- *Indigofera monophylla*

Indigofera monophylla is a complex of undescribed taxa, which differ in habit, leaf and floral characters. The complex belongs to the large 'pea' family (Papilionaceae). Typical forms are low to moderate height shrubs, however there are taller forms to 2m in height. The variant collected from the White Quartz Road corridor is the small calyx form, which is quite common in the Pilbara.

- Malvaceae family

This large family contains many taxa which are yet to be described, or adequately collected. This is particularly the case for the genera *Abutilon, Hibiscus* and *Sida*, several undescribed taxa of which were recorded from the White Quartz Road corridor. Of these, only *Sida* sp. Wittenoom (W.R Barker 1962) is currently listed as a Priority species by DEC, and this species is considered to warrant removal from the listing (see Section 5.2.2). None of the undescribed taxa recorded from the current study area appear to be restricted in distribution.

- *Josephinia* sp.

This herbaceous species was collected from dense Mulga woodland in a creekline in the eastern third of the White Quartz Road corridor (see Appendices 1 and 5). The specimen does not appear to match any of the *Josephinia* taxa known to date from the Pilbara.

5.3 Introduced Flora (Weeds)

Eight species of weeds were recorded from the White Quartz Road corridor (Table 5.4), all of which are common and widespread weeds of the region.

According to Dr Stephen van Leeuwen (DEC Karratha), Mexican Poppy **Argemone ochroleuca* subsp. *ochroleuca* is a Declared Plant for the Pilbara under the *Agriculture and Related Resources Protection Act 1976,* however control is only required when the species occurs beyond the limits of creeklines. Buffel Grass is considered to be a serious environmental weed by DEC.

Table 5.4: Records of weed species from the White Quartz Road study area.

Family / Species	No. of Records (Broad Distribution within Study Area)
Papaveraceae	
Mexican Poppy **Argemone ochroleuca* subsp. *ochroleuca*	11 (creek system towards western end of corridor)
Poaceae	
Buffel Grass **Cenchrus ciliaris*	103 (throughout corridor)
Whorled Pigeon Grass **Setaria verticillata*	1 (western end of corridor)
Asteraceae	
Beggars Ticks **Bidens bipinnata*	7 (throughout corridor)
Cucurbitaceae	
Ulcardo Melon **Cucumis melo* subsp. *agrestis*	1 (eastern end of corridor)
Malvaceae	
Spiked Malvastrum **Malvastrum americanum*	33 (throughout corridor)
Mimosaceae	
Mimosa Bush **Vachellia farnesiana*	1 (creekline at eastern end of corridor)
Sterculiaceae	
Pyramid-flower **Melochia pyramidata*	1 (towards western end of corridor)

A brief discussion of each species follows:

- Mexican Poppy **Argemone ochroleuca* subsp. *ochroleuca* is a relatively common weed of major creeks in the Hamersley Range, where it typically occurs in open, gravelly creekbeds. This annual herb is difficult to control as it produces very large quantities of seed, and flooding of its preferred habitat can spread this seed for large distances. Mexican Poppy was recorded from 11 locations within a creek system approximately 9 km south-east of the western end of the study area. As all records were associated with creeklines, no specific control is required for this species (see above).
- Buffel Grass **Cenchrus ciliaris* was introduced by pastoralists as a fodder species. This perennial grass species has demonstrated allelopathic capacities, whereby it releases chemicals that inhibit the growth of other plants, and it is an aggressive and effective competitor with native flora. It forms dense tussock grasslands, particularly along creeklines, floodplains and in sandy coastal areas. Infestations of Buffel Grass are common throughout the Hamersley Range, particularly in major creeklines. **Cenchrus ciliaris* was recorded 103 times from locations spread throughout the White Quartz Road corridor.
- Whorled Pigeon Grass **Setaria verticillata* is a common weed of creeklines and Mulga vegetation in the Pilbara, but rarely occurs in large numbers. This species was recorded from a single location approximately 3 km east of the western end of the study area. Three individuals were recorded.
- Bipinnate Beggarticks **Bidens bipinnata* is a common weed of Mulga vegetation and creeklines of the Pilbara. This annual daisy may occur in very high densities within suitable habitat and given appropriate conditions, but on its own does not appear to cause exclusion

of native flora species. This species was recorded from seven locations scattered throughout the corridor.

- The creeper Ulcardo Melon **Cucumis melo* subsp. *agrestis* is frequently recorded in the Pilbara, typically only as scattered individuals. This species was recorded from a single location in the study area, towards the eastern end of the corridor.
- Spiked Malvastrum **Malvastrum americanum* is a common weed of Mulga vegetation, clayey substrates and creeklines. This species was recorded from 33 locations spread throughout the corridor.
- Mimosa Bush **Vachellia* (previously *Acacia) farnesiana* was recorded from the River Gum dominated creekline at the eastern end of the White Quartz Road corridor. This South American species is believed to have been introduced to Australia prior to European settlement, and is now a widespread weed of roadsides and drainage areas from the Kimberley to Carnarvon (Hussey et al. 1997).
- Pyramid-flower **Melochia pyramidata* is a widespread weed of creekline and cracking clay habitats in the Pilbara, but rarely occurs as more than scattered individuals. This species was recorded from a single location in the western end of the corridor.

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6.0 Impacts of the Proposed Upgrade of the White Quartz Road and Recommendations for Management

6.1 Probable Impacts of the Project on Flora and Vegetation

6.1.1 Clearing of Vegetation

The proposed widening and re-alignment of sections of the White Quartz Road will require some vegetation to be cleared for the immediate road area and any borrow pit locations. Other vegetation may be disturbed by activities such as parking of earthmoving equipment, grading and surveying. Clearing should be minimised along the proposed route, particularly in the areas containing the Priority 1 species *Ptilotus* sp. Brockman and the species of interest *Josephinia* sp.

6.1.2 Disturbance to Surface Drainage Systems

There are only a small number of creek crossings along the White Quartz Road, and it is expected that the upgraded road will (like the existing track) follow the natural topographic contours. There should therefore be no impact to surface drainage systems.

6.1.3 Introduction / Spread of Weeds

The White Quartz Road project area is a long narrow corridor which passes through a variety of different vegetation types. Some of these are partially degraded due to weed invasion, particularly creeklines which are infested mainly with Buffel Grass **Cenchrus ciliaris*.

Eight introduced flora species were recorded from the White Quartz Road corridor. Physical disturbance associated with the road upgrade and additional movement of vehicles along the access road may result in the introduction of additional weed species and/or the spread of the existing weed populations (particularly with respect to the dense infestations of Buffel Grass along some of the larger creeks). Management measures should be targeted at limiting the introduction and spread of weeds within the study area.

6.1.4 Fire

Fire is a natural influence on almost all Australian vegetation, and the flora species in the Brockman locality are no exception: most are adapted to cope with fires. The White Quartz Road corridor is dominated by hummock grasses and wattle species, which are typically very flammable, but are mostly well adapted to fire and recover quite quickly. However, some species (such as Mulga, *Acacia aneura*) are particularly sensitive and may be killed in a 'hot' fire or if fires occur too frequently.

The proposed upgrade of the White Quartz Road has the potential to increase the frequency and/or severity of fires. This could occur simply through additional movement of personnel through the area, or if there was an increase in the prevalence of dense pockets of Buffel Grass. Changes to the existing fire regime could cause permanent changes in floristics or leave vegetation in an early stage of succession (Biota and Trudgen 2002).

6.1.5 Erosion

The clearing of vegetation has the potential to increase the rate of erosion, and areas of fine-textured soil may be particularly at risk. This includes creeklines, and much of the preferred habitat of the Priority 1 species *Ptilotus* sp. Brockman, which favours fine-textured calcareous soils,

often on areas of low plains which become wet and boggy during heavy rainfall events. Careful construction through drainage channels and minimising clearing of vegetation should reduce the risk of erosion.

6.2 Management Recommendations

6.2.1 Vegetation Clearing Practices

Clearing areas should be kept to the minimum necessary for safe construction of the road upgrade, particularly in the areas supporting the Priority 1 *Ptilotus* sp. Brockman and the species of interest *Josephinia* sp. Borrow pits should be located so as to minimise clearing of vegetation supporting Priority flora, and impact to vegetation of drainage lines. Project laydown areas should utilise existing cleared areas wherever possible.

Clearing limits should be strictly adhered to in the field. Earth-moving equipment should be equipped with the standard Pilbara Iron GPS systems with the clearing area uploaded onto the device to avoid unnecessary clearing. Wherever appropriate, scrub-rolling should be used rather than grading in order to minimise ground disturbance and retain as much vegetation as possible.

6.2.2 Weeds/Soil Hygiene

Earthmoving equipment should be washed down prior to entry to site to minimise the potential for introduction of weeds, and also periodically during the construction of the road, to avoid spreading the existing weed infestations further. Any topsoil retained should be used within the area from which it was gathered.

6.2.3 Fire

No fires should be deliberately started within the project area, and vehicles and heavy machinery should be parked on cleared ground to avoid hot engine parts causing combustion of spinifex hummocks. Exotic species (particularly dense stands of Buffel Grass) are often more flammable than native species, so adequate weed hygiene should minimise the risk of more intense fires.

6.2.4 Erosion

Minimising clearing of vegetation should reduce the risk of increased erosion. The road level should be maintained as close as possible to the natural ground level to reduce erosion of the roadway during heavy rainfall events.

7.0 Acknowledgements

The following persons are gratefully acknowledged for their assistance with this study:

- Mr Malcolm Trudgen (ME Trudgen and Associates) assisted with determination of some problematic taxa, particularly the Malvaceae family and the *Acacia aneura* complex.
- Mr Paul Wilson (WA Herbarium) determined some of the *Maireana* specimens, and assisted with determination of *Vittadinia obovata*.
- Mr Ted Griffin (private consultant) conducted the floristic analysis.

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8.0 References

Aplin, T.E.H. (1979). The Flora. Chapter 3 *In* O'Brien, B.J. (ed.) (1979). *Environment and Science.* University of Western Australia Press.

Atkins, K.J. (2006). Declared Rare and Priority Flora List for Western Australia. Prepared by the Department of Conservation and Land Management, 30 June 2006.

Beard, J.S. (1975). *Vegetation Survey of Western Australia.* 1:100,000 Vegetation Series Map Sheet 5 - Pilbara.

Belbin, L. (1987). PATN Reference Manual (313p), Users Guide (79p), Command Manual (47p), and Example Manual (108p). CSIRO Division of Wildlife and Ecology, Lynham, ACT.

Biota Environmental Sciences (2003). Mesa J Extension Vegetation, Flora and Fauna Assessment. Unpublished report for Robe River Iron Associates, December 2003.

Biota Environmental Sciences (2004a). Yandi Expansion Vegetation and Flora Survey. Unpublished report for Hamersley Iron Pty Ltd, December 2004.

Biota Environmental Sciences (2004b). Fortescue Metals Group Stage B Rail Corridor, Christmas Creek, Mt Lewin, Mt Nicholas and Mindy Mindy Mine Areas: Vegetation and Flora Survey. Unpublished report for Fortescue Metals Group, December 2004.

Biota Environmental Sciences (2004c). Hope Downs Rail Corridor, Hamersley Range Extension – Vegetation and Flora Survey. Unpublished report for Hope Downs Management Services, January 2004.

Biota Environmental Sciences (2004d). Vegetation and Flora Survey of the Proposed FMG Stage A Rail Corridor. Unpublished report for Fortescue Metals Group, August 2004.

Biota Environmental Sciences (2005a). A Vegetation and Flora Survey of the Brockman Syncline 4 Project Area, near Tom Price. Unpublished report for Hamersley Iron Pty Ltd, July 2005.

Biota Environmental Sciences (2005b). Vegetation and Flora Survey of Mesa A and Mesa G, near Pannawonica. Unpublished report for Robe River Iron Associates, July 2005.

Biota Environmental Sciences (2005c). Mesa J Extension Rare Flora Searches. Correspondence between Michi Maier (Biota) and Ms. Fiona Bell (Pilbara Iron), 20 May 2005.

Biota Environmental Sciences (2005d). Mesa L and Mesa L Minor Rare Flora Searches. Correspondence to Ms Fiona Bell, Pilbara Iron, 20th May 2005.

Biota Environmental Sciences (2006a). A Vegetation and Flora Survey of the Proposed Mesa A Transport Corridor, Warramboo Deposit and Yarraloola Borefield. Unpublished report for Robe River Iron Associates, January 2006.

Biota Environmental Sciences (2007a). A Flora Survey of the Brockman Syncline 4 Rail and Infrastructure Corridor. Unpublished report for Pilbara Iron Pty Ltd, February 2007.

Biota Environmental Sciences (2007b). Regional Survey for *Ptilotus* sp. Brockman, *Aluta quadrata* and *Geijera* aff. *salicifolia*. Unpublished report for Pilbara Iron Pty Ltd, June 2007.

Biota Environmental Sciences (2007c). A Vegetation and Seasonal Flora Survey of the Bungaroo Trial Pit and Transport Corridor to Mesa J, near Pannawonica, and Sampling of the Broader Bungaroo Valley. Unpublished report for Robe River Iron Associates, March 2007.

Biota Environmental Sciences (in prep.). A Vegetation and Flora Survey of the Nammuldi – Mt Lionel Rail Corridor, near Tom Price. Report being prepared for Pilbara Iron Pty Ltd.

Biota Environmental Sciences (in prep.). A Vegetation and Flora Survey of the Mesa A Southern Transport Corridor, near Pannawonica. Report being prepared for Robe River Iron Associates.

Biota Environmental Sciences and M.E. Trudgen (2001). Austeel Biological Survey Phase I. Unpublished report no. ES974691A100 prepared for Austeel Pty Ltd, February 2001

Biota Environmental Sciences and M.E. Trudgen (2002). Hope Downs Rail Corridor, Port Hedland to Weeli Wolli Creek – Vegetation and Flora Survey. Unpublished report prepared for Hope Downs Management Services, February 2002.

Environment Australia (2000). *Revision of the Interim Biogeographic Regionalisation for Australia (IBRA) and Development of Version 5.1, Summary Report.* Environment Australia, November 2000.

Environmental Protection Authority (2002). *Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection.* Environmental Protection Authority, March 2002.

Environmental Protection Authority (2004). *Guidance Statement No. 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia.* Environmental Protection Authority, June 2004.

Gardner, C.A. and H.W. Bennetts (1956). *The Toxic Plants of Western Australia.* Western Australian Newspapers Ltd, Perth, Western Australia

Gibson, N., B. Keighery, G. Keighery, A. Burbidge and M. Lyons (1994). *A floristic survey of the southern Swan Coastal Plain.* Department of Conservation and Land Management, Perth.

Halpern Glick Maunsell (1999). Nammuldi / Silvergrass Soils, Vegetation and Flora Survey. Unpublished report prepared for Hamersley Iron Pty Ltd, February 1999.

Hussey, B.M.J., G.J. Keighery, R.D. Cousens, J. Dodd and S.G. Lloyd (1997). *Western Weeds: A guide to the weeds of Western Australia.* Plant Protection Society of Western Australia.

Kendrick P. (2003). Pilbara 3 (PIL3 – Hamersley subregion). In May J.E. and N.L. McKenzie (Eds.) (2004). A Biodiversity Audit of Western Australia's Biogeographical Subregions in 2002. Department of Conservation and Land Management, Western Australia.

Mattiske, E.M. and Associates (1990). Flora and Fauna Survey Brockman 2 Detritals and Proposed Transport Corridor. Unpublished report prepared for Hamersley Iron Pty Ltd.

Payne, A.L., A.A. Mitchell and W.F. Hoffman (1988). *An inventory and condition survey of rangelands in the Ashburton River catchment, Western Australia.* Western Australian Department of Agriculture, Technical Bulletin No. 62, June 1988.

Randell, B.R. (1989). Revision of the Cassiinae in Australia. 2. *Senna* Miller Sect. Psilorhegma (J. Vogel) Irwin and Barneby. *J. Adelaide Bot. Gard.* 12(2): 165-272.

Specht, R.L. (1970). Vegetation. *In The Australian Environment.* 4th edn (Ed. G.W. Leeper). Melbourne. *Cited in* Aplin, T.E.H. (1979). The Flora. Chapter 3 *In* O'Brien, B.J. (ed.) (1979). *Environment and Science.* University of Western Australia Press.

Symon, D.E. (1966). A revision of the genus *Cassia* L. Caesalpiniaceae in Australia. *Trans. Roy. Soc. S. Australia* 90: 73-146.

Thorne, A.M. and A.F. Trendall (2001). *Geology of the Fortescue Group, Pilbara Craton, Western Australia.* Geological Survey of Western Australia, Bulletin 144.

Trudgen, M.E., B.R. Morgan and E.A. Griffin (2002). A flora and vegetation survey of the proposed mine areas and access road for the Panorama project. Volumes 1-3. Unpublished report prepared for Astron Environmental by M.E. Trudgen and Associates

Trudgen, M.E. and N. Casson (1998). Flora and vegetation surveys of Orebody A and Orebody B in the West Angela Hill area, an area surrounding them, and of rail route options considered to link them to the existing Robe River Iron Associates rail line. Unpublished report for Robe River Iron Associates.

van Leeuwen, S. and B Bromilow (2002). Botanical Survey of Hamersley Range Uplands. National Reserve System Project N709 Final Report – May 2002. Unpublished report prepared by the Department of Conservation and Land Management.

van Vreeswyk, A.M.E., A.L. Payne, K.A. Leighton and P. Hennig (2004). *An inventory and condition survey of the Pilbara region, Western Australia.* Department of Agriculture Technical Bulletin No. 92, December 2004.

Appendix 1

Vegetation of the White Quartz Road Corridor, Including Mapping of Flora of Conservation Interest and Weeds

Vegetation of Stony Plains

ElAanAayTeTw	*Eucalyptus leucophloia* scattered low trees over *Acacia aneura, A. ayersiana* tall open shrubland over *Triodia epactia, T. wiseana* hummock grassland
AxAanTloTa	*Acacia xiphophylla, A.aneura* low woodland to tall open shrubland over *Triodia longiceps, T. angusta* open hummock grassland
AanAprTe/AxAanTloTa	Mosaic
AanTw/AxAanTloTa	Mosaic
AanTlo/AxAanTloTa	Mosaic
AxAanTw	*Acacia xiphophylla, A.aneura* low woodland to tall open shrubland over *Eremophila cuneifolia, Rhagodia eremae* low open shrubland over *Triodia wiseana* open hummock grassland
AxAanTe	*Acacia xiphophylla, A.aneura* low woodland to tall open shrubland over *Triodia epactia* open hummock grassland
AanAprTe/AxAanTe	Mosaic
AxAanTbrTe	*Acacia xiphophylla, A.aneura* low woodland to tall open shrubland over *Triodia brizoides, T. epactia* open hummock grassland
AxSCdTa	*Acacia xiphophylla* low woodland over *Sclerostegia disarticulata* low open shrubland over *Triodia angusta* very open hummock grassland
AanTlo	*Acacia aneura* tall open shrubland to open scrub over *Triodia longiceps* open hummock grassland
AanTlo/AxAanTloTa	Mosaic
ElAbTloTa	*Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Acacia bivenosa* scattered shrubs over *Triodia longiceps, T. angusta* hummock grassland
ElTw/ElAbTloTa	
ElMeAeTloTa	*Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Melaleuca eleuterostachya, Acacia exilis* scattered shrubs over *Triodia longiceps, T.angusta* hummock grassland
EsMeAeTlo	*Eucalyptus socialis* scattered low mallees over *Melaleuca eleuterostachya, Acacia exilis* scattered shrubs over *Triodia longiceps* hummock grassland
ElTe	*Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Triodia epactia* hummock grassland

Vegetation Mapping for White Quartz Road corridor

Legend Sheet 1 of 3

BIOta

Vegetation of Stony Hills

ElAmTw	*Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Acacia maitlandii* shrubland to open heath over *Triodia wiseana* hummock grassland
ElAbTw	*Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Acacia bivenosa* scattered shrubs over *Triodia wiseana* hummock grassland
ElAaTw	*Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Acacia ancistrocarpa* scattered shrubs over *Triodia wiseana* hummock grassland
ElTw	*Eucalyptus leucophloia* scattered low trees over *Triodia wiseana* hummock grassland
ElTw/ElAbTloTa	Mosaic
ElTwTm	*Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Triodia wiseana, T. melvillei* hummock grassland
ElAbTbr	*Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Acacia bivenosa* scattered shrubs over *Triodia brizoides* hummock grassland
AanReTwTbr	*Acacia aneura* tall open shrubland over *Rhagodia eremaea* open shrubland over *Triodia wiseana, T. brizoides* open hummock grassland
AanAprTe	*Acacia aneura (A. prunocarpa)* low open forest over *Triodia epactia* hummock grassland
AanAprTe/AxAanTe	Mosaic
AanAprTe/AxAanTloTa	Mosaic
AanTw	*Acacia aneura* tall open shrubland to open scrub over *Triodia wiseana* open hummock grassland
AanTw/AxAanTloTa	Mosaic
ElGOrDpAmTe	*Eucalyptus leucophloia* scattered low trees over *Gossypium robinsonii, Dodonaea pachyneura (Acacia maitlandii)* open shrubland over *Triodia epactia* hummock grassland
ElAbsTw	*Eucalyptus leucophloia* scattered low trees over *Acacia bivenosa* (spindly variant) tall shrubland over *Triodia wiseana* hummock grassland
AiAmTbrTe	*Acacia inaequilatera* scattered tall shrubs over *Acacia maitlandii* open shrubland over *Triodia brizoides, T. epactia* hummock grassland
AiAmTbrTe	*Acacia inaequilatera* scattered tall shrubs over *Eremophila cuneifolia, E. fraseri* open shrubland over *Triodia wiseana* hummock grassland
AiTw	*Acacia inaequilatera* scattered tall shrubs over *Triodia wiseana* hummock grassland
AiTe	*Acacia inaequilatera* scattered tall shrubs over *Triodia epactia* hummock grassland

Vegetation Mapping for White Quartz Road corridor

Legend Sheet 2 of 3

BIOta

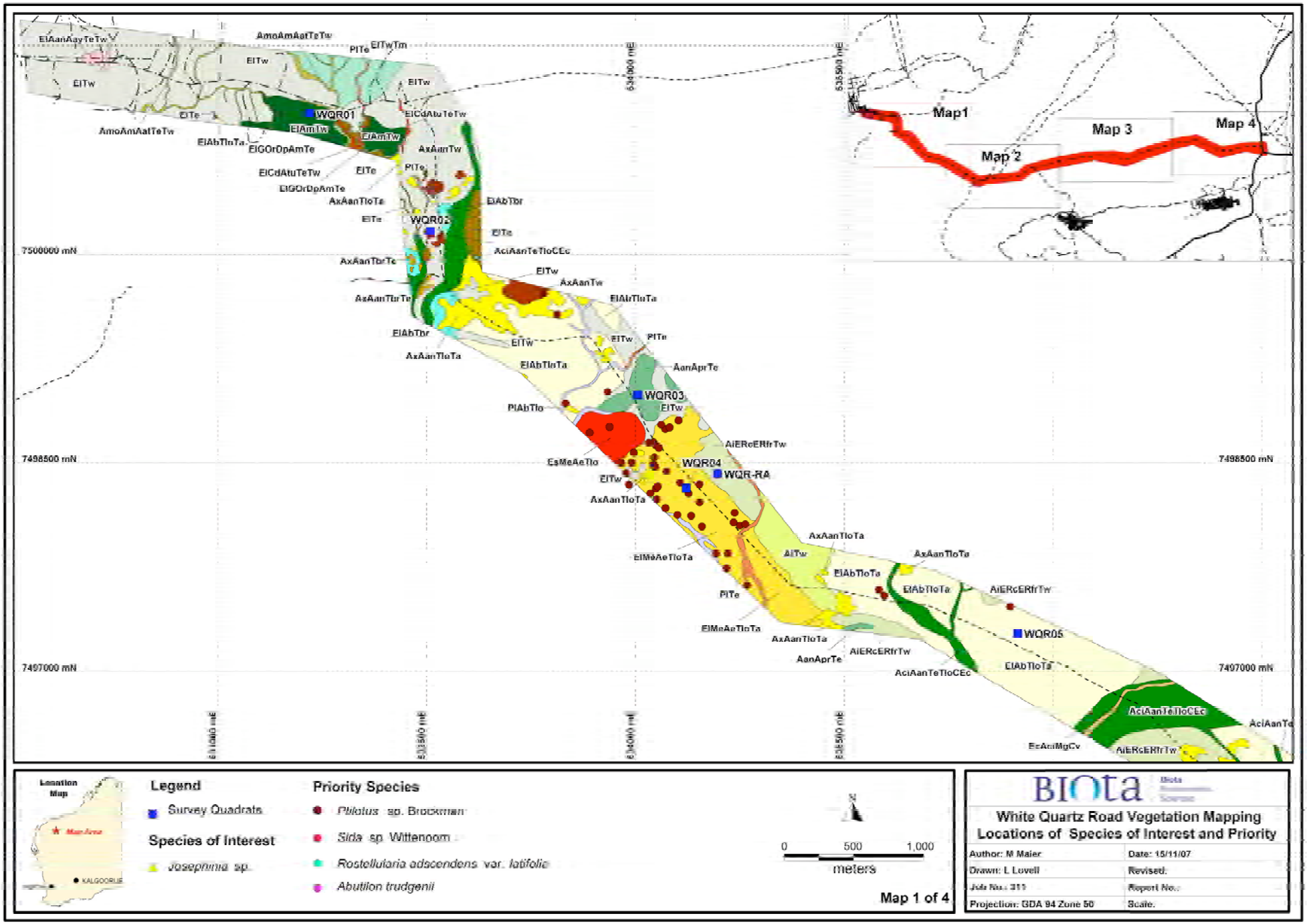
Vegetation of Creek lines

EcAciMgCv	*Eucalyptus camaldulensis* var. *obtusa* open forest over *Acacia citrinoviridis, Malaleuca glomerata* tall open scrub over *Cyperus vaginatus* very open sedgeland
AciAanTeTloCEc	*Acacia citrinoviridis, A. aneura* (various forms) tall open shrubland to tall open scrub over *Triodia epactia, T. longiceps* open hummock grassland and **Cenchrus ciliaris* open tussock grassland to tussock grassland
ApyTErTeCEc	*Acacia pyrifolia (Stylobasium spathulatum)* tall open scrub over *Tephrosia rosea* var. *glabrior* low open shrubland over *Triodia epactia* very open hummock grassland and **Cenchrus ciliaris* open tussock grassland
AanCec	*Acacia aneura* low open forest over *Triodia epactia* very open hummock grassland and mixed bunch grassland
AanTe	*Acacia aneura* (various forms) tall open scrub over **Cenchrus ciliaris* tussock grassland
ElCdAtuTeTw	*Eucalyptus leucophloia, Corymbia deserticola* scattered low trees over *Acacia tumida* var *pilbarensis* tall open scrub over *Triodia epactia, T. wiseana* open hummock grassland
AmoAmAatTeTw	*Acacia monticola, A. maitlandii, A. atkinsiana* tall open shrubland over *Triodia epactia, T. wiseana* open hummock grassland
PlTe	*Petalostylis labicheoides* shrubland over *Triodia epactia* hummock grassland
PlAbTlo	*Petalostylis labicheoides* tall open shrubland over *Acacia bivenosa* shrubland over *Triodia longiceps* open hummock grassland
ElAbsTe	*Eucalyptus leucophloia* tall open shrubland over *Acacia bivenosa* (spindly variant) tall shrubland over *Triodia epactia* hummock grassland
AaAbTlo	*Acacia ancistrocarpa, A bivenosa* shrubland to open heath over *Triodia longiceps* hummock grassland
AaAbTe	*Acacia ancistrocarpa, A bivenosa* shrubland to open heath over *Triodia epactia* hummock grassland
AaTw	*Acacia ancistrocarpa* shrubland over *Triodia wiseana* hummock grassland

Vegetation Mapping for White Quartz Road corridor

Legend Sheet 3 of 3

BIOta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WQR03
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WQR-RA
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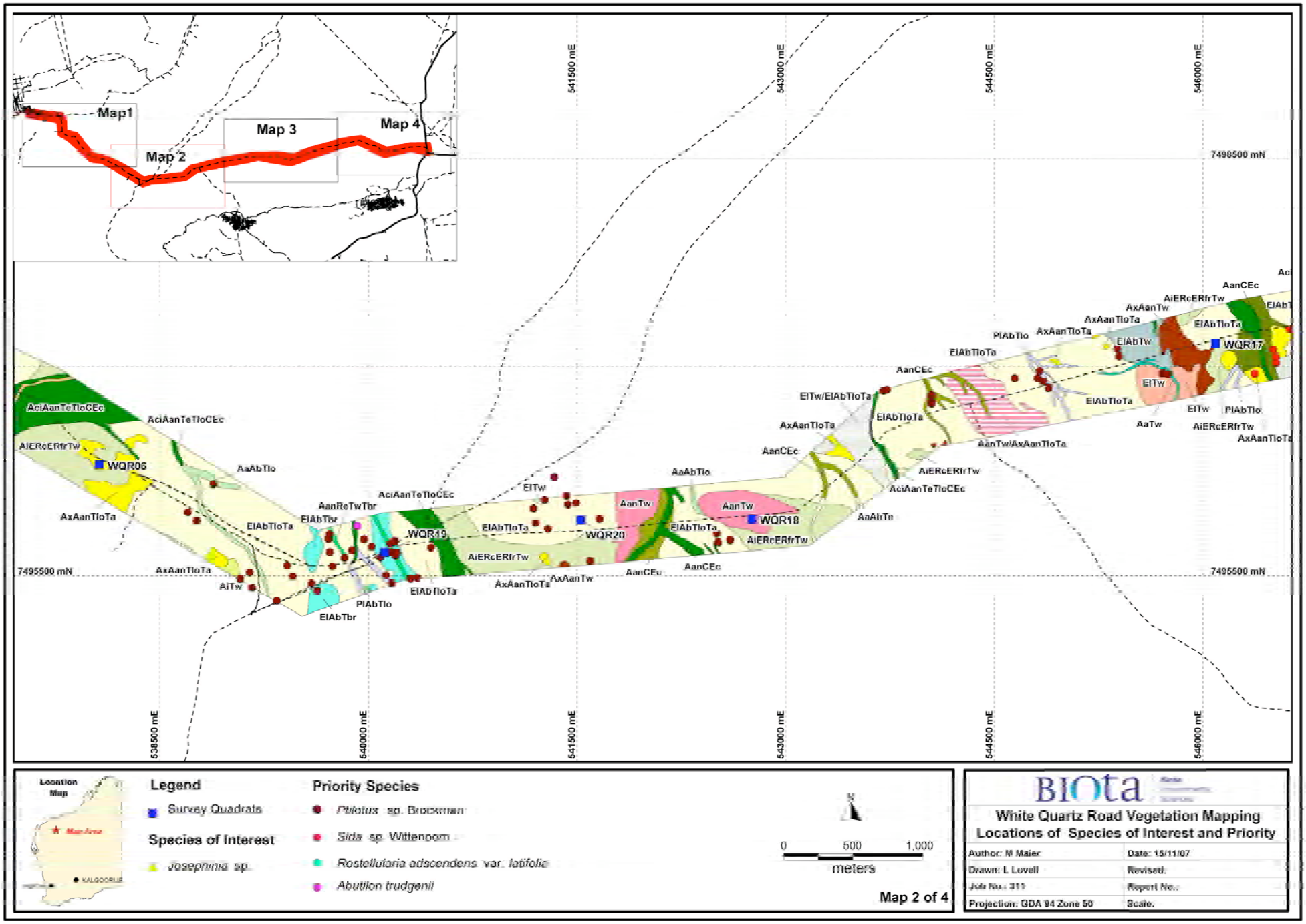
638000 mE
639500 mE
Location Map
Legend
Survey Quadrats
Species of Interest
Josephinia sp.
Priority Species
Phlebalus sp. Brockman
Sida sp. Wittenoom
Rostellularia adscendens var. latifolia
Abutilon trudgenii
0 500 1,000
meters
Map 1 of 4
BIOta
White Quartz Road Vegetation Mapping
Locations of Species of Interest and Priority
Author: M Maier
Date: 15/11/07
Drawn: L Lovell
Revised:
Job No.: 311
Report No.:
Projection: GDA 94 Zone 50
Scale: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AxAanTloTa
ElAbTloTa
ElAbTbr
AanReTwTbr
AiTw
PlAbTlo
AanCEc
ElTw/ElAbTloTa
AxAanTw
AaTw
AanTw/AxAanTloTa
AnAlrTr
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Location Map
KALGOORLIE
Legend
Survey Quadrats
Species of Interest
Josephinia sp.
Priority Species
Ptilotus sp. Brockman
Sida sp. Wittenoom
Rostellularia adscendens var. latifolia
Abutilon trudgenii
0
500
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meters
Map 2 of 4
BIOta
White Quartz Road Vegetation Mapping
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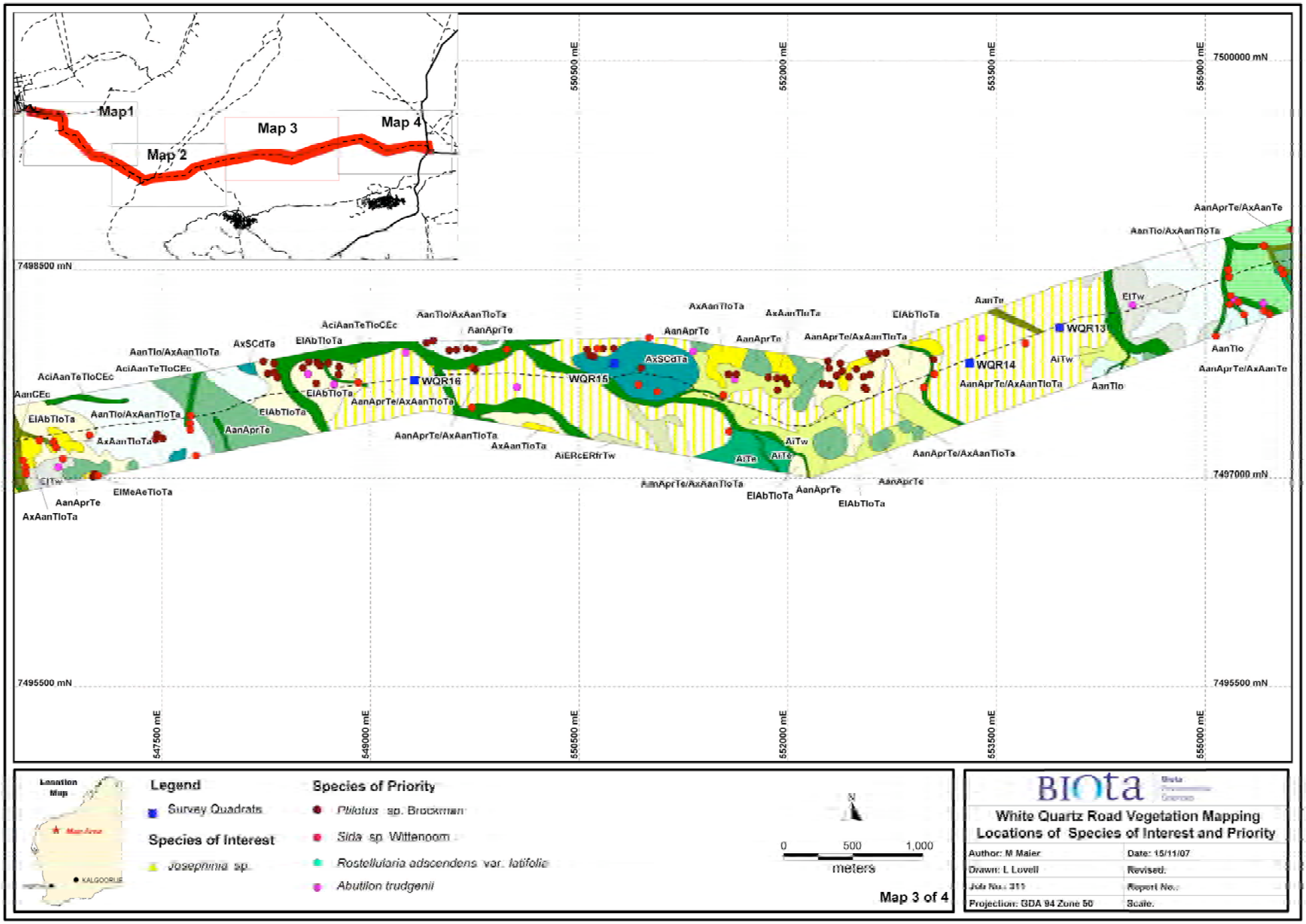
Scale: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549000 mE
WQR13
WQR14
WQR15
WQR16
AanAprTe/AxAanTe
AanTlo/AxAanTloTa
AxAanTloTa
ElAbTloTa
AanTe
ElTw
AanTlo
AiTw
AxSCdTa
AciAanTeTloCEc
AanCEc
AanAprTe
AanAprTe/AxAanTloTa
AiERcERfrTw
AiTe
ElMeAeTloTa
Location Map
Legend
Survey Quadrats
Species of Interest
Josephinia sp.
Species of Priority
Phlebus sp. Brockman
Sida sp Wittenoom
Rostellularia adscendens var. latifolia
Abutilon trudgenii
N
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meters
Map 3 of 4
BIOta
White Quartz Road Vegetation Mapping
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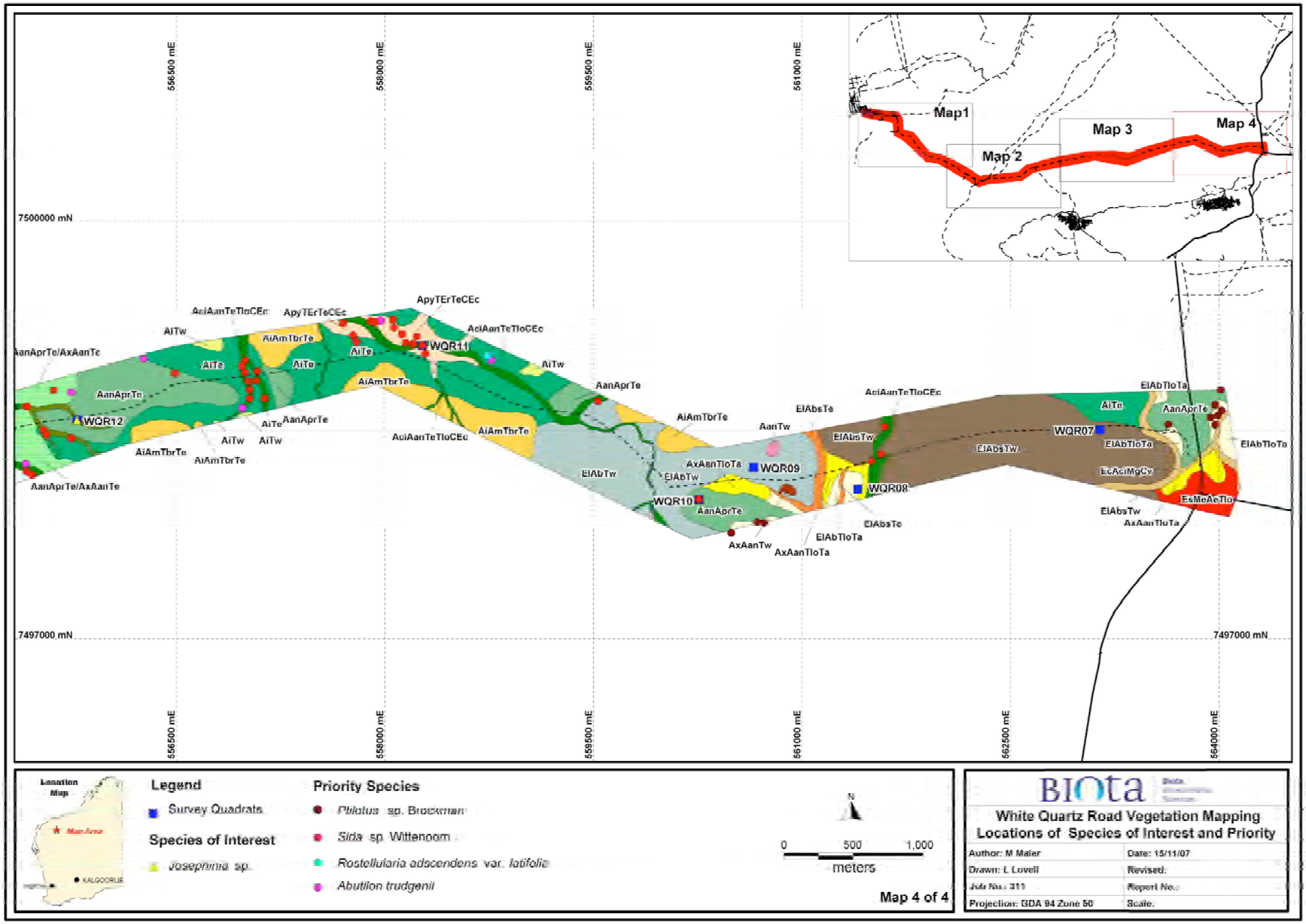
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Map 3
Map 4
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WQR09
WQR10
WQR08
WQR07
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AciAanTeTloCEc
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AiAmTbrTe
AanAprTe
AanAprTe/AxAanTe
AxAanTloTa
AxAanTw
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ElAbsTe
ElAbsTw
ElAbTloTa
AiAmTbrTe
EcAciMgCv
EsMeAcTlo
Location Map
Mt Tom Price
KALGOORLIE
Legend
Survey Quadrats
Species of Interest
Josephinia sp.
Priority Species
Phlebus sp. Brockman
Sida sp. Wittenoom
Rostellularia adscendens var. latifolia
Abutilon trudgenii
N
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meters
Map 4 of 4
BIOta
White Quartz Road Vegetation Mapping
Locations of Species of Interest and Priority
Author: M Maier
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Drawn: L Lovell
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Job No.: 311
Report No.:
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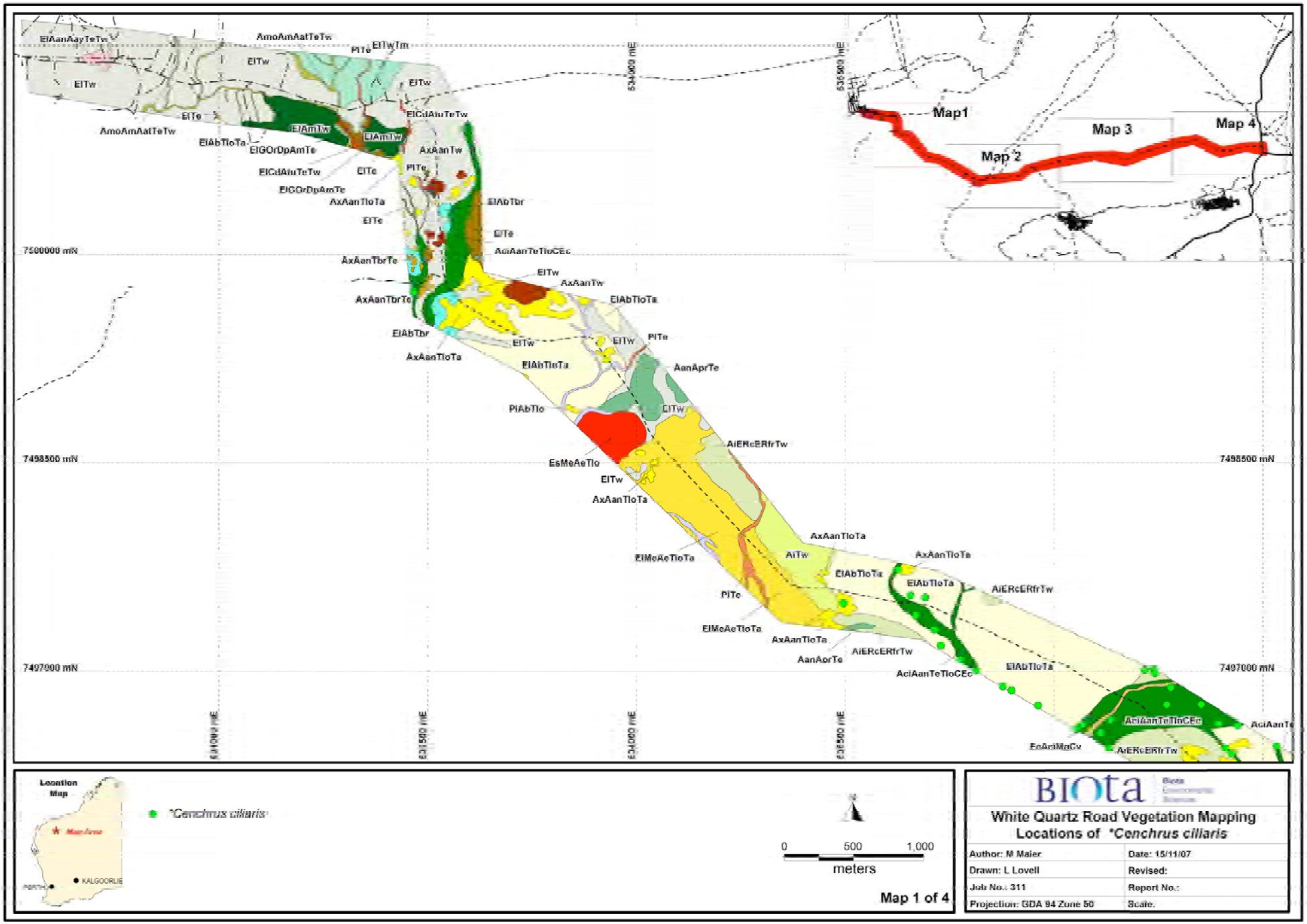
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Map 3
Map 4
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634000 mE
635500 mE
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Location Map
*Cenchrus ciliaris
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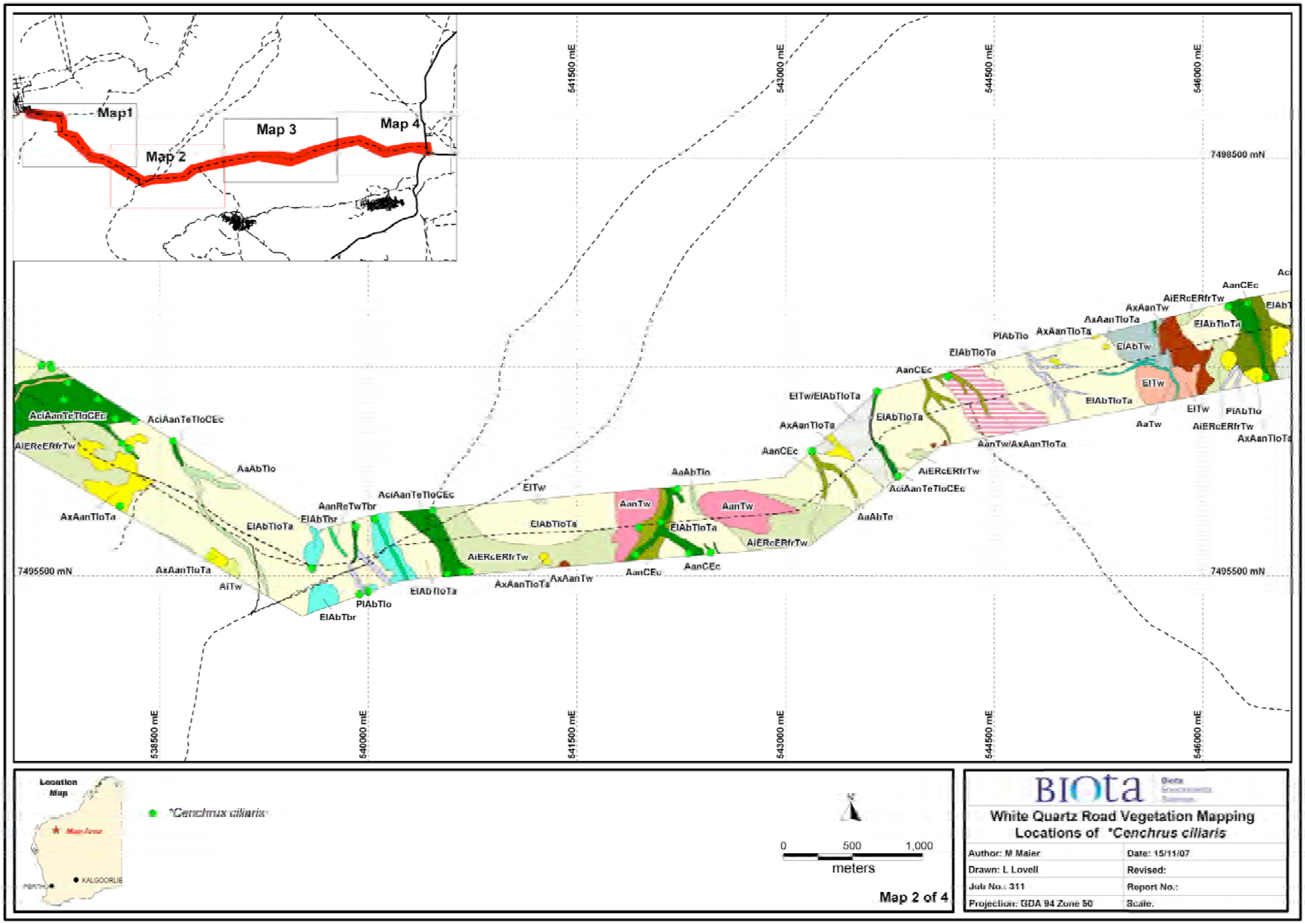
meters
Map 1 of 4
BIOta
White Quartz Road Vegetation Mapping
Locations of *Cenchrus ciliaris
Author: M Maier
Date: 15/11/07
Drawn: L Lovell
Revised:
Job No.: 311
Report No.:
Projection: GDA 94 Zone 50
Scale: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Location Map
*Cenchrus ciliaris
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Map 2 of 4
BIOta
White Quartz Road Vegetation Mapping
Locations of *Cenchrus ciliaris
Author: M Maier
Date: 15/11/07
Drawn: L Lovell
Revised:
Job No.: 311
Report No.:
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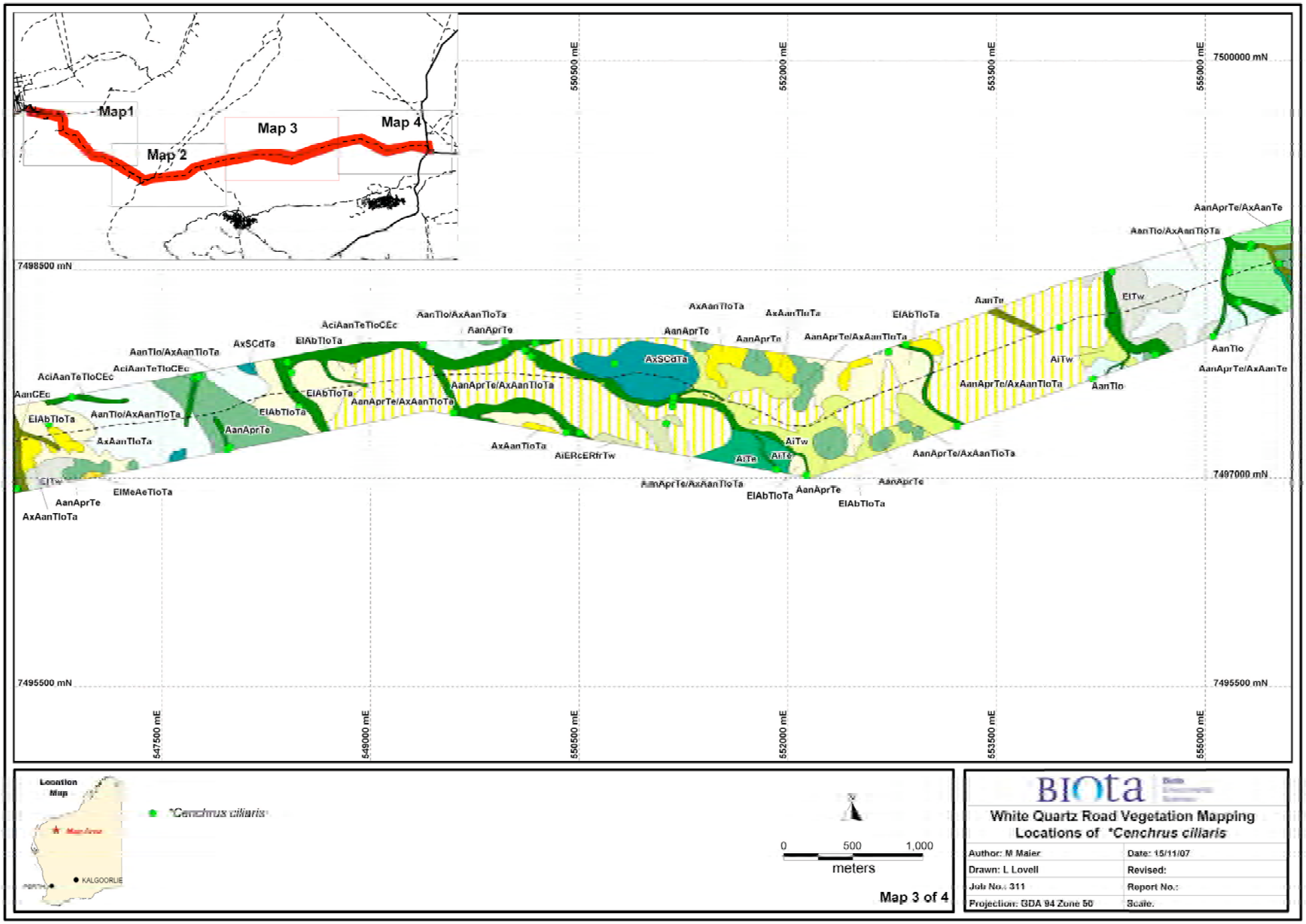
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AciAanTeTloCEc
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Location Map
*Cenchrus ciliaris
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Map 3 of 4
BIOta
White Quartz Road Vegetation Mapping
Locations of *Cenchrus ciliaris
Author: M Maier
Date: 15/11/07
Drawn: L Lovell
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Job No.: 311
Report No.:
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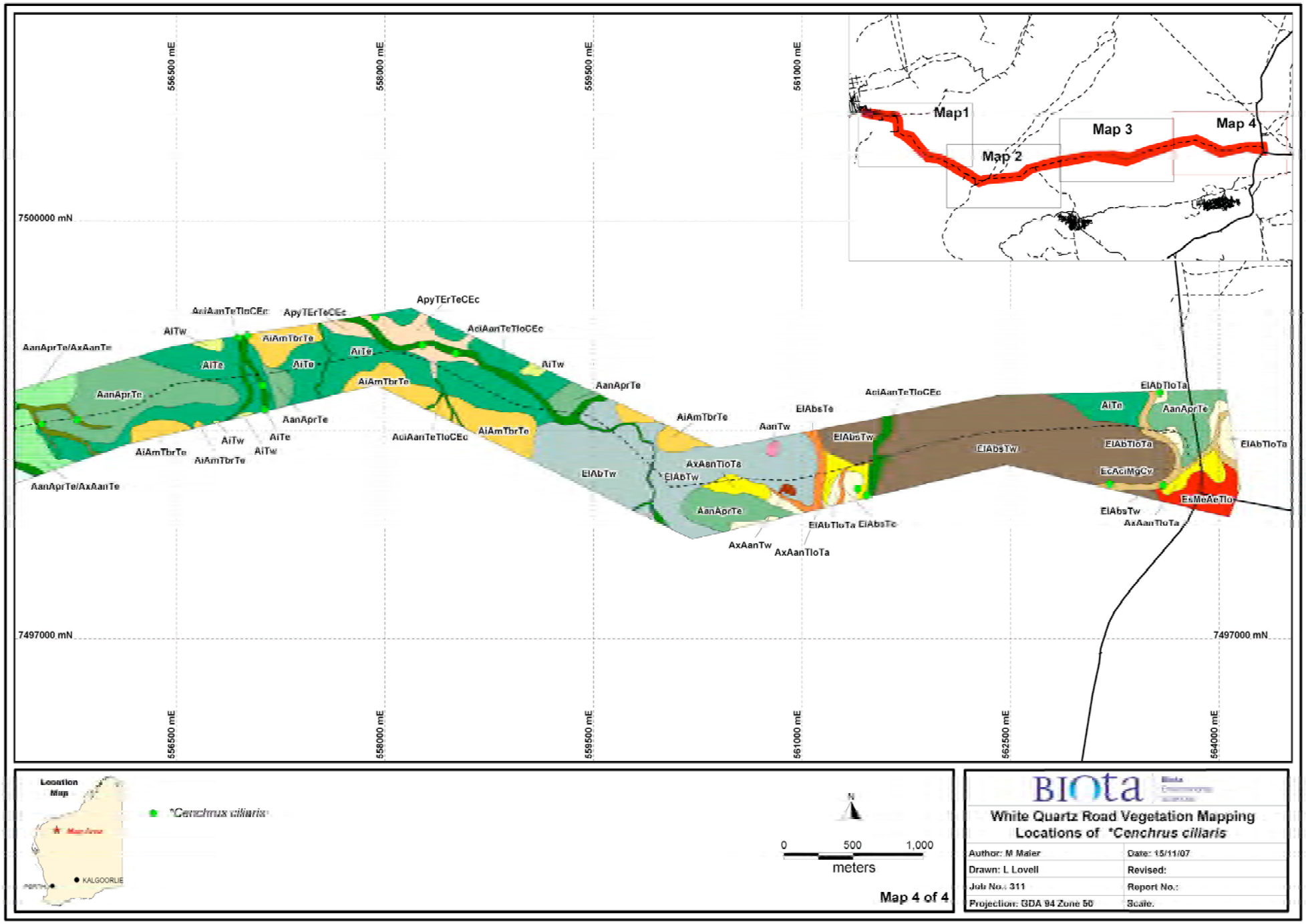
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Map 4
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AxAanTloTa
ElAbTw
ElAbsTe
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EcAciMgCv
EsMeAeTlo
AxAanTw
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Location Map
*Cenchrus ciliaris
Mt Tom Price
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Map 4 of 4
BIOta
White Quartz Road Vegetation Mapping
Locations of *Cenchrus ciliaris
Author: M Maier
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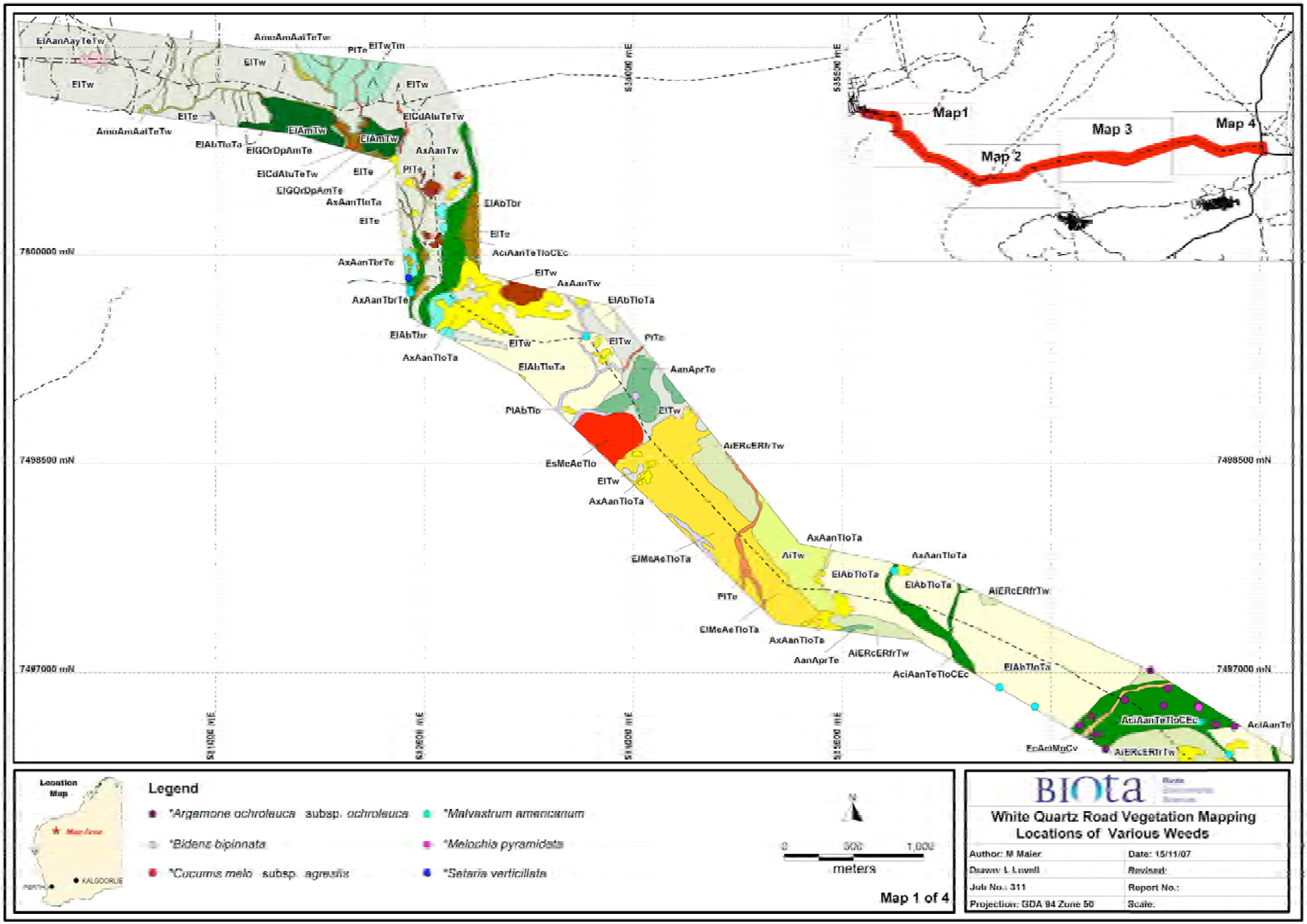
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Map 2
Map 3
Map 4
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*Bidens bipinnata
*Cucumis melo subsp. agrestis
*Malvastrum americanum
*Melochia pyramidata
*Setaria verticillata
0 500 1,000
meters
Map 1 of 4
BIOta
White Quartz Road Vegetation Mapping
Locations of Various Weeds
Author: M Maier
Date: 15/11/07
Drawn: L Lowell
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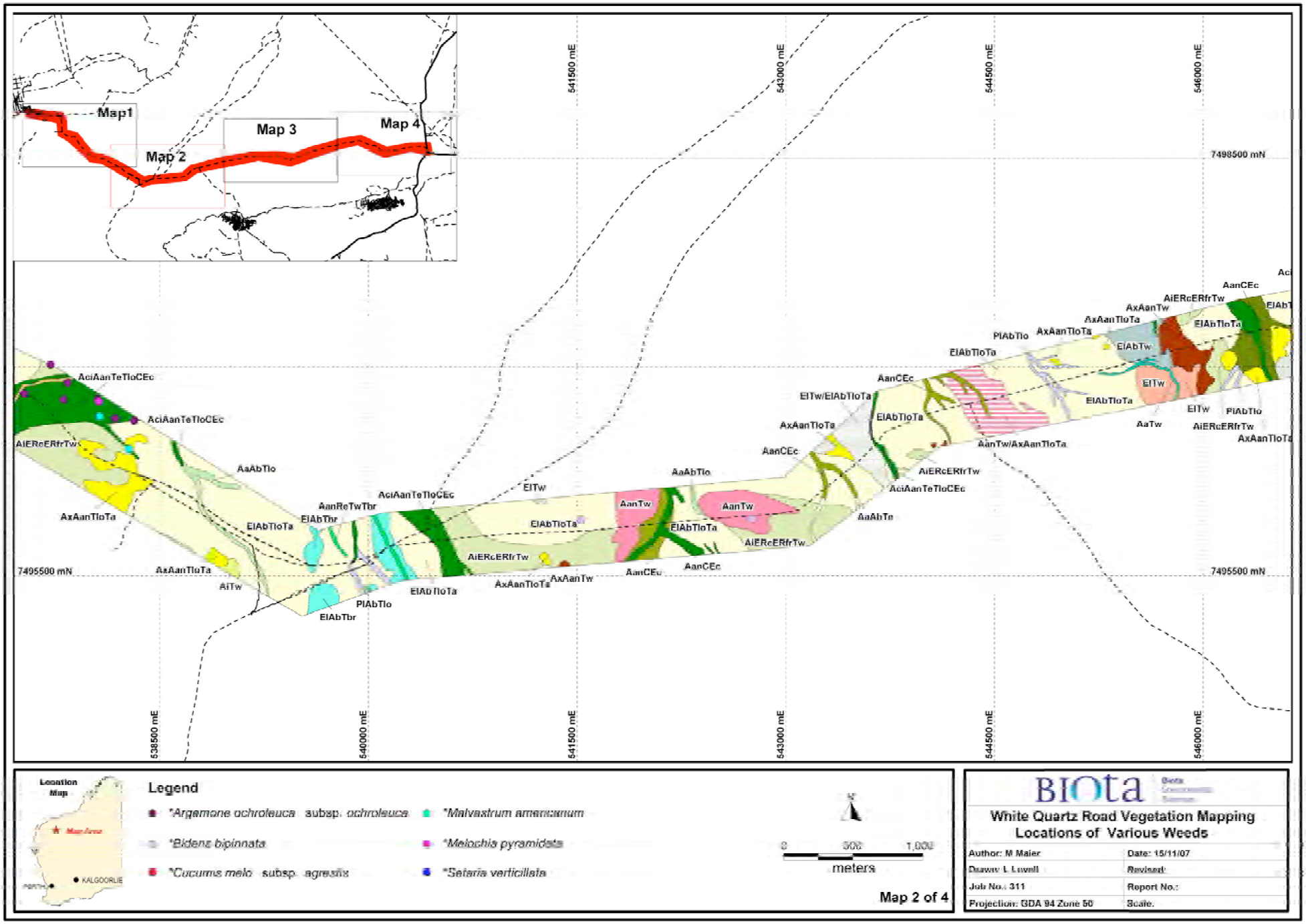
Scale: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AxAanTw
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*Cucumis melo subsp. agrestis
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*Melochia pyramidata
*Setaria verticillata
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meters
Map 2 of 4
BIOta
White Quartz Road Vegetation Mapping
Locations of Various Weeds
Author: M Maier
Date: 15/11/07
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Job No.: 311
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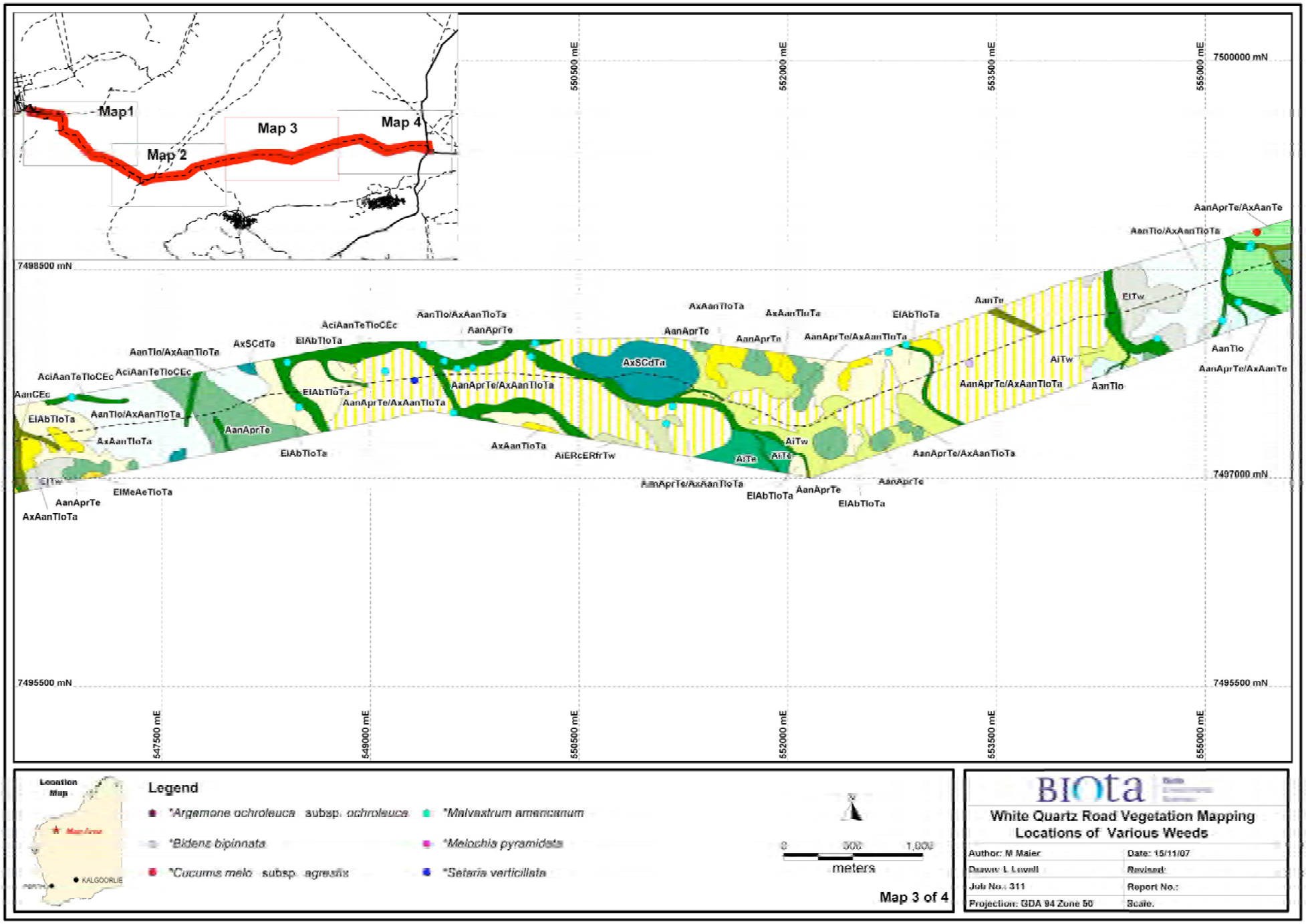
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AanTlo/AxAanTloTa
AxAanTloTa
ElAbTloTa
AanTe
ElTw
AanTlo
AiTw
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ElMeAeTloTa
Location Map
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Map 3 of 4
BIOta
White Quartz Road Vegetation Mapping
Locations of Various Weeds
Author: M Maier
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Job No.: 311
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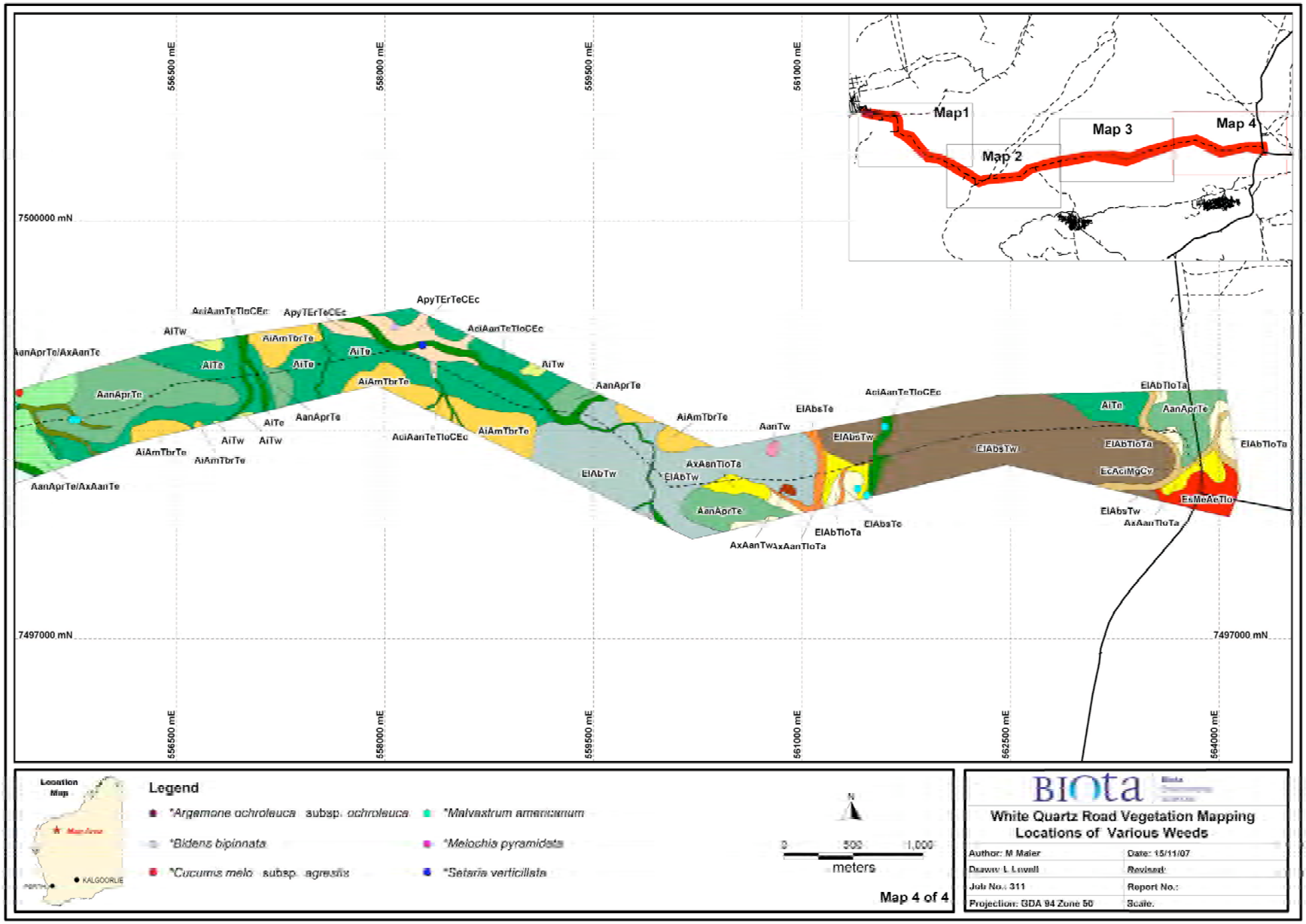
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Map 4
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KALGOORLIE
PERTH
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meters
Map 4 of 4
BIOta
White Quartz Road Vegetation Mapping
Locations of Various Weeds
Author: M Maier
Date: 15/11/07
Drawn: L Lowell
Revised:
Job No.: 311
Report No.:
Projection: GDA 94 Zone 50
Scale:

Appendix 2

Raw Data from Quadrats Assessed in the White Quartz Road Corridor

Vegetation Structural Classification and Condition Scale used for the current survey

Vegetation Structural Classes*

Stratum	70-100% cover	30-70% cover	10-30% cover	2-10% cover	<2% cover
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 / sedgeland / herbland	Tussock grassland / sedgeland / herbland	Open tussock grassland / sedgeland / herbland	Very open tussock grassland / sedgeland / herbland	Scattered tussock grasses / sedges / herbs

* Based on 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; 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 **Ursinia anthemoides* or **Briza* spp., 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 **Ehrharta* 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 **Ehrharta* 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; ie. 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.

White Quartz Road Site WQR01

Described by	MM	Date	23/05/2006	Type	Q	30 x 80 m
Location	49.7 km west-north-west of Tom Price townsite, 16.4 km south of Mount Brockman in the Pilbara region of W.A.					
MGA Zone	50	531661 mE	7501014 mN			
Habitat	Upper slope of stony hill, North aspect, gentle to moderate slope					
Soil Type	Red-brown skeletal clay loam with continuous surface layer of pebbles, stones and some outcropping rocks					
Rock Type	Ironstone					
Vegetation	*Hakea lorea* subsp. *lorea* scattered tall shrubs over *Acacia maitlandii* open heath over *Triodia wiseana* hummock grassland					
Veg Condition	Excellent					
Fire Age	> 5 years since last fire					
Notes	Quadrat shape adjusted to fit between small flows with dense *Acacia monticola*. ?Active pebble-mouse mound @ 531659, 7500990 (1 or 2 open holes)					

White Quartz Road Site WQR02

Described by	RO	Date	23/05/2006	Type	Q	50 x 50 m
Location	48.6 km west-north-west of Tom Price townsite, 17.3 km south of Mount Brockman in the Pilbara region of W.A.					
MGA Zone	50	532527 mE	7500165 mN			
Habitat	Hillslope, upper slope and crest area					
Soil Type	Red skeletal, fine clay with fine ironstone dust and ironstone pebbles on surface.					
Rock Type	Ironstone					
Vegetation	*Eucalyptus leucophloia, Acacia* aff. *aneura* (grey flat recurved tips; MET 15,828), *A. xiphophylla* low open woodland over *Maireana georgei, M. melanocoma* scattered low shrubs over *Triodia wiseana* hummock grassland					
Veg Condition	Excellent					
Fire Age	No evidence of recent fire					

White Quartz Road Site WQR03

Described by	MM	Date	23/05/2006	Type	Q	50 x 50 m
Location	47 km west-north-west of Tom Price townsite, 18.7 km south-south-east of Mount Brockman in the Pilbara region of W.A.					
MGA Zone	50	534017 mE	7498991 mN			
Habitat	Crest of broad, stony ridge/hill					
Soil Type	Red-brown clay loam with continuous surface layer of "buckshot" and ironstone					
Rock Type	Ironstone					
Vegetation	*Acacia* aff. *aneura* (grey flat recurved tips; MET 15,828), *(A. pruinocarpa)* low open forest over *Eremophila forrestii* open shrubland over *Triodia epactia* hummock grassland					
Veg Condition	Very Good (to Excellent – only a single plant of **Bidens*)					
Fire Age	No evidence of recent fire					

White Quartz Road Site WQR04

Described by	RO	Date	23/05/2006	Type	Q	40 x 60 m
Location	46.6 km west-north-west of Tom Price townsite, 19.4 km south-south-east of Mount Brockman in the Pilbara region of W.A.					
MGA Zone	50	534365 mE	7498319 mN			
Habitat	Mildly sloping drainage (sluggish) plain- loamy area. Mildly saline soil likely as evidenced by presence of halophytes.					
Soil Type	Light brown loamy clay or clayey loam more likely surrounded by hills					
Rock Type	White quartzite, calcrete and some ironstone pebbles					
Vegetation	*Melaleuca eleuterostachya* scattered shrubs over *Triodia angusta, T. wiseana* closed hummock grassland					
Veg Condition	Excellent					
Fire Age	No evidence of recent fire					
Notes	Quadrat dimensions are 40 m running E-W and 60 m running N-S.					

White Quartz Road Site WQR05

Described by	RO	Date	23/05/2006	Type	Q	50 x 50 m
Location	44.2 km west-north-west of Tom Price townsite, 21.0 km south-south-east of Mount Brockman in the Pilbara region of W.A.					
MGA Zone	50	536746 mE	7497275 mN			
Habitat	Mildly/gently undulating, loamy plain					

Soil Type	Red alluvial clay
Rock Type	Ironstone and quartz with some chert
Vegetation	*Acacia bivenosa* open shrubland over *Triodia angusta* closed hummock grassland
Veg Condition	Excellent
Fire Age	No evidence of recent fire

White Quartz Road Site WQR06

Described by	MM	Date	23/05/2006	Type	Q	50 x 50 m
Location	42.6 km west-north-west of Tom Price townsite, 22.3 km south-south-east of Mount Brockman in the Pilbara region of W.A.					
MGA Zone	50	538065 mE	7496298 mN			
Habitat	Crest of low stony ridge/hill; east aspect, gentle slope.					
Soil Type	Orange-brown clay to clay-loam with scatters of quartz and ?dolerite					
Rock Type	pebbles and stones. Also a continuous surface layer of ?dolerite rocks further upslope.					
Vegetation	*Acacia xiphophylla (A.* aff. *aneura* (grey flat recurved tips; MET 15,828)) low woodland over *Triodia longiceps* hummock grassland and *Sporobolus australasicus* very open annual grassland					
Veg Condition	Very good - excellent					
Fire Age	No evidence of recent fire					

White Quartz Road Site WQR07

Described by	RO	Date	24/05/2006	Type	Q	50 x 50 m
Location	18.7 km north-west of Tom Price townsite, 37.4 km south-east of Mount Brockman in the Pilbara region of W.A.					
MGA Zone	50	563144 mE	7498502 mN			
Habitat	North facing rocky mid-slope.					
Soil Type	Skeletal clay loam, with rocky surface crust.					
Rock Type	Granite/Ironstone/Quartz.					
Vegetation	*Acacia bivenosa* (wispy/weeping form), *Cassia pruinosa* open shrubland over *Triodia wiseana, (T. angusta)* hummock grassland					
Veg Condition	Excellent.					
Fire Age	Burnt 1-2 years ago.					

White Quartz Road Site WQR08

Described by	MM	Date	24/05/2006	Type	Q	50 x 45 m
Location	20.2 km north-west of Tom Price townsite, 36 km south-east of Mount Brockman in the Pilbara region of W.A.					
MGA Zone	50	561400 mE	7498076 mN			
Habitat	Stony plain.					
Soil Type	Red-brown clay loam (quite clayey) with continuous surface layer of ironstone pebbles					
Rock Type	Ironstone.					
Vegetation	*Acacia* aff. *aneura* (grey flat recurved tips; MET 15,828), *A. xiphophylla* low woodland over *Maireana triptera, Rhagodia eremaea, Eremophila cuneifolia* low open shrubland over *Triodia angusta, (T. epactia, T. longiceps)* open hummock grassland					
Veg Condition	Very good. Some scattered weeds.					
Fire Age	No evidence of recent fire.					
Notes	SW corner shifted to avoid flowline vegetation.					

White Quartz Road Site WQR09

Described by	BRM	Date	24/05/2006	Type	Q	50 x 50 m
Location	20.9 km north-west of Tom Price townsite, 35.4 km south-east of Mount Brockman in the Pilbara region of W.A.					
MGA Zone	50	560651 mE	7498232 mN			
Habitat	Gentle, south to south-east facing lower slope of low ridge					
Soil Type	Brown pebbly, cobbly clay loam.					
Vegetation	*Acacia bivenosa* tall shrubland over *Cassia oligophylla, Eremophila cuneifolia* scattered low shrubs over *Triodia wiseana* hummock grassland					
Veg Condition	Excellent.					
Fire Age	4-5 years since last fire					

White Quartz Road Site WQR10

Described by	BRM	Date	24/05/2006	Type	Q	63 x 37 m
Location	21.2 km north-west of Tom Price townsite, 35.2 km south-east of Mount Brockman in the Pilbara region of W.A.					

MGA Zone	50 560258 mE 7498001 mN
Habitat	Steep NW facing rocky mid-upper slope of low ridge (up to base of breakaway)
Soil Type	Red-brown thin loamy sand. Gravelly, pebbly to cobbly.
Rock Type	Ironstone
Vegetation	*Acacia* aff. *aneura* (grey flat recurved tips; MET 15,828), *(A. rhodophloia, A. xiphophylla)* low open forest over *Cassia glutinosa, Eremophila cuneifolia* scattered shrubs over *Triodia epactia* hummock grassland
Veg Condition	Excellent
Fire Age	7-10 years since last fire
Notes	Quadrat shape altered to fit *T. epactia* community growing on specific contour zone.

White Quartz Road Site WQR11

Described by	RO	Date	24/05/2006	Type	Q	50 x 50 m
Location	23.5 km north-west of Tom Price townsite, 33 km south-east of Mount Brockman in the Pilbara region of W.A.					
MGA Zone	50 558270 mE 7499110 mN					
Habitat	Broad, alluvial and colluvial floodplain between a hill and a narrowly defined and incised drainage line.					
Soil Type	Alluvial and colluvial loamy clay to loam.					
Rock Type	Some quartzite, ironstone (?) and chert.					
Vegetation	*Acacia pyrifolia, (Stylobasium spathulatum)* tall open scrub over *Indigofera monophylla* (small calyx form), *Tephrosia densa, T. rosea* var. *glabrior, Waltheria indica* low open shrubland over *Triodia epactia* very open hummock grassland and **Cenchrus ciliaris* open tussock grassland.					
Veg Condition	Good: presence of Buffel grass and evidence of grazing by cattle.					
Fire Age	3-4 years since last fire					

White Quartz Road Site WQR12

Described by	MM	Date	24/05/2006	Type	Q	50 x 50 m
Location	25.7 km west-north-west of Tom Price townsite, 31.2 km south-east of Mount Brockman in the Pilbara region of W.A.					
MGA Zone	50 555785 mE 7498573 mN					
Habitat	Stony plain					
Soil Type	Red-brown clay loam (quite clayey) with continuous surface layer of gravel, pebbles and stones.					
Rock Type	? Dolerite					
Vegetation	*Acacia* aff. *aneura* (grey flat recurved tips; MET 15,828) low open forest over *Triodia epactia* very open hummock grassland and *Enneapogon polyphyllus, (Dichanthium sericeum* subsp. *humilius, Sporobolus australasicus, Aristida contorta, Eriachne pulchella* subsp. *dominii*) annual grassland.					
Veg Condition	Very good; 3 weed species but only scattered individuals of each.					
Fire Age	No evidence of recent fire					

White Quartz Road Site WQR13

Described by	BRM	Date	25/05/2006	Type	Q	50 x 50 m
Location	27.3 km west-north-west of Tom Price townsite, 30 km south-east of Mount Brockman in the Pilbara region of W.A.					
MGA Zone	50 553953 mE 7498083 mN					
Habitat	Flat crest of low rise on very gently undulating plain					
Soil Type	Red-brown pebbly, cobbly sandy loam					
Rock Type	Quartz predominantly with ironstone pebbles					
Vegetation	*Acacia xiphophylla, (A.* aff. *aneura* (narrow fine veined; site 1259)) low woodland over *Cassia luerssenii* scattered shrubs over *Eremophila cuneifolia, Cassia 'stricta'* scattered low shrubs over *Triodia angusta* hummock grassland and *Eriachne pulchella* subsp. *dominii, Brachyachne prostrata* very open annual grassland					
Veg Condition	Excellent					
Fire Age	Mostly 7-10 years since last fire					

White Quartz Road Site WQR14

Described by	PH	Date	25/05/2006	Type	Q	50 x 50 m
Location	27.8 km west-north-west of Tom Price townsite, 29.8 km south-east of Mount Brockman in the Pilbara region of W.A.					
MGA Zone	50 553307 mE 7497825 mN					
Habitat	Crest of low stony hill, draining to the east and west					

Soil Type	Red-brown clay loam with surface crust of pebbles and cobbles
Rock Type	Ironstone and quartz
Vegetation	*Acacia* aff. *aneura* (grey flat recurved tips; MET 15,828) low open forest over *Acacia tetragonophylla, Cassia luerssenii, C. stricta* tall shrubland over *Eremophila cuneifolia* open shrubland over *Triodia epactia* hummock grassland and *Eriachne pulchella* subsp. *dominii* open annual grassland
Veg Condition	Very good. Some signs of cattle disturbance
Fire Age	5 years since last fire

White Quartz Road Site WQR15

Described by	RO	Date	25/05/2006	Type	Q	50 x 50 m
Location	30.3 km west-north-west of Tom Price townsite, 27.9 km south-east of Mount Brockman in the Pilbara region of W.A.					
MGA Zone	50	550754 mE	7497822 mN			
Habitat	Gently undulating, stony clay plain (elevated at 529 m)					
Soil Type	Red fine clay with a small amount of loam present and pebbles/cobbles on surface					
Rock Type	quartzite, sedimentary ironstone/Banded Iron Formations; ? Granite					
Vegetation	*Acacia xiphophylla* low woodland over *Sclerostegia disarticulata* low open shrubland over *Triodia angusta* very open hummock grassland and mixed very open annual grassland.					
Veg Condition	Excellent, some evidence of cattle grazing in area. Only 1 Buffel Grass plant.					
Fire Age	No evidence of recent fire					
Notes	Area likely to be mildly saline as evidenced by presence of some halophytic species.					

White Quartz Road Site WQR16

Described by	BRM	Date	25/05/2006	Type	Q	50 x 50 m
Location	31.8 km west-north-west of Tom Price townsite, 26.9 km south-east of Mount Brockman in the Pilbara region of W.A.					
MGA Zone	50	549317 mE	7497702 mN			
Habitat	Very gently sloping NW facing low stony rise on valley floor					
Soil Type	Red-brown gravelly, pebbly (cobbly) loamy clay					
Vegetation	*Acacia xiphophylla* low open forest over *Cassia luerssenii, Rhagodia eremaea* scattered shrubs over *Eremophila cuneifolia, Scaevola spinescens* (broad form) scattered low shrubs over *Triodia angusta* hummock grassland					
Veg Condition	Very good to excellent. Some signs of cattle					
Fire Age	>7 years since last fire					

White Quartz Road Site WQR17

Described by	PH	Date	25/05/2006	Type	Q	60 x 40 m
Location	34.9 km west-north-west of Tom Price townsite, 25.2 km south-south-east of Mount Brockman in the Pilbara region of W.A.					
MGA Zone	50	546088 mE	7497165 mN			
Habitat	Stony hill crest, sloping in all directions but major slope in quadrat is to the east					
Soil Type	Red-brown shallow clay loam; stony surface crust					
Rock Type	Quartz and Ironstone					
Vegetation	*Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Acacia synchronicia, Cassia pruinosa* scattered tall shrubs over *Eremophila cuneifolia* scattered low shrubs over *Triodia wiseana (T. angusta)* hummock grassland					
Veg Condition	Very good. Some signs of grazing by cattle/donkeys					
Fire Age	>7 years since last fire					
Notes	Quadrat size to fit vegetation community. Quadrat borders Snakewood to the west.					

White Quartz Road Site WQR18

Described by	MM	Date	25/05/2006	Type	Q	50 x 50 m
Location	38.1 km west-north-west of Tom Price townsite, 24.5 km south-south-east of Mount Brockman in the Pilbara region of W.A.					
MGA Zone	50	542757 mE	7495905 mN			
Habitat	stony crest of low hill; gentle south west slope					
Soil Type	Red-brown clay loam with continuous surface layer of pebbles and stones					
Rock Type	Dolerite					
Vegetation	*Acacia* aff. *aneura* (grey flat recurved tips; MET 15,828) low open woodland over *Acacia tetragonophylla* scattered tall shrubs over *Triodia wiseana* hummock grassland					
Veg Condition	Very good. Occasional weeds and signs of donkeys.					
Fire Age	No evidence of recent fire					

White Quartz Road Site WQR19

Described by	BRM	Date	23/06/2006	Type	Q	60 x 40 m
Location	40.6 km west-north-west of Tom Price townsite, 23.5 km south-south-east of Mount Brockman in the Pilbara region of W.A.					
MGA Zone	50	540116 mE	7495664 mN			
Habitat	Gentle south-west facing mid-upper slope of a low ridge					
Soil Type	Silty loamy sand					
Rock Type	Quartz					
Vegetation	*Eucalyptus leucophloia* subsp. *leucophloia* low open woodland over *Melaleuca eleuterostachya* scattered shrubs over *Triodia wiseana (T. angusta, T. brizoides)* hummock grassland with *Sclerolaena densiflora* scattered herbs					
Veg Condition	Excellent					
Fire Age	3-4 years since last fire					

White Quartz Road Site WQR20

Described by	MM	Date	23/06/2006	Type	Q	50 x 50 m
Location	39.1 km west-north-west of Tom Price townsite, 23.9 km south-south-east of Mount Brockman in the Pilbara region of W.A.					
MGA Zone	50	541528 mE	7495897 mN			
Habitat	Very gentle east facing rocky hill slope					
Soil Type	Red-brown fine grained clay loam with rocky ironstone crust					
Rock Type	Ironstone and quartz					
Vegetation	*Acacia synchronicia* scattered shrubs over *Triodia angusta (T. longiceps)* hummock grassland					
Veg Condition	Excellent					
Fire Age	5-7 years since last fire					

White Quartz Road Site WQR-RA

Described by	RO	Date	23/05/2006	Type	R	relevé
Location	46.4 km west-north-west of Tom Price townsite, 19.2 km south-south-east of Mount Brockman in the Pilbara region of W.A.					
MGA Zone	50	534589 mE	7498424 mN			
Habitat	Hillcrest and upper slopes					
Soil Type	Red skeletal clay with rocky/pebbly ironstone surface					
Rock Type	Ironstone					
Vegetation	*Acacia inaequilatera* scattered tall shrubs over *Ptilotus rotundifolius* open shrubland over *Triodia wiseana* hummock grassland					
Veg Condition	Excellent					
Fire Age	No evidence of recent fire					
Notes	Relatively complete relevé - can include in an analysis.					

NB. Numbers = estimated % foliar cover; + = scattered individuals only, <1%; nc = no cover recorded.

Species	WQR 01	WQR 02	WQR 03	WQR 04	WQR 05	WQR 06	WQR 07	WQR 08	WQR 09	WQR 10	WQR 11	WQR 12	WQR 13	WQR 14	WQR 15	WQR 16	WQR 17	WQR 18	WQR 19	WQR 20	WQR -RA
Abutilon amplum											+										
Abutilon cryptopetalum								+													
Abutilon dioicum						+								+							
Abutilon fraseri								+				+									
Abutilon lepidum			+					+				+					+	+	+	+	
Abutilon aff. lepidum (1) (MET 15 352)												+	nc			+					
Abutilon aff. lepidum (2) (MET 15 970)											+	+									
Abutilon macrum								+													
Abutilon otocarpum (acute leaf form)								+													
Abutilon oxycarpum subsp. prostratum								+													
Acacia ancistrocarpa			+								+										nc
Acacia aff. aneura (grey flat recurved tips; MET 15,828		4	40-50			1		10		25	+	60		40				10			
Acacia aff. aneura (narrow fine veined; site 1259)			<1							+			1-2	+	nc	+					
Acacia aff. aneura (scythe-shaped; MET 15,743)								+				+	+								
Acacia bivenosa		<1	+	+	3				10-15		1-2				nc		+		+	+	+
Acacia bivenosa (wispy/weeping form)							2-3	<1													
Acacia citrinoviridis											1-2										
Acacia exilis	+	+	+																	+	
Acacia inaequilatera							+				+	+									1-2
Acacia maitlandii	40								+												
Acacia marramamba	1																				
Acacia pruinocarpa			2				+														+
Acacia pyrifolia		+									30-35										
Acacia rhodophloia										5											
Acacia sibirica		+																			
Acacia sibirica (linear form)									+					+							
Acacia synchronicia		+		<1	+		+	+							+	+	>1		+	+	
Acacia tenuissima								+													
Acacia tetragonophylla				+		+		+				+	+	10	nc	+		<1	+		
Acacia xiphophylla		1-2				15		10		5			20-25		25-30	35-40					
Acrachne racemosa											<1										
Alternanthera nana								+			<1	+									
Alysicarpus muelleri											1-2										
Amaranthus cuspidifolius												+									
Amaranthus undulatus											+										
Amphipogon sericeus	+	+																			
Amyema sp. Fortescue (M.E. Trudgen 5358)						+															
Aristida contorta		+	+	+		+	+	+		+	<1	2	1	+	+	+		+			+
Aristida holathera var. holathera	+		+			+	+				+			+							
Aristida aff. ?inaequiglumis												+						+			

Species	WQR 01	WQR 02	WQR 03	WQR 04	WQR 05	WQR 06	WQR 07	WQR 08	WQR 09	WQR 10	WQR 11	WQR 12	WQR 13	WQR 14	WQR 15	WQR 16	WQR 17	WQR 18	WQR 19	WQR 20	WQR -RA
Aristida latifolia								+					+			+					
Atriplex bunburyana						+															
Atriplex codonocarpa					+	+									+					+	
*Bidens bipinnata			+					+				+		+				+		+	
Boerhavia coccinea						+		+			+						+				
Brachyachne convergens																		+			
Brachyachne prostrata					1	+		+					1-2		1-2	<1				+	
Bulbostylis barbata	+				+			+				+	+	1	<1	+		+	+	+	
Bulbostylis turbinata																		+			
Capparis lasiantha								+		+											
Cassia glutinosa	+	+								+									+		
Cassia glutinosa x luerssenii				+							<1										
Cassia helmsii			+								+	+					+				+
Cassia luerssenii		+	+			+	+	+			+	+	1-2	5-8	nc	+			+		
Cassia luerssenii x stricta		+		+								+		+						+	
Cassia notabilis		nc								+		+						+		+	
Cassia oligophylla		+				+			+		1	+						+	+		+
Cassia oligophylla x helmsii			+																		
Cassia aff. oligophylla (thinly sericeous) x helmsii			+										+								
Cassia ? oligophylla x				+			1														
Cassia pruinosa	+	1		+			3										3		+		1-2
Cassia pruinosa x luerssenii	+										+										
Cassia sp. Karijini (MET 10,392)						+	+														
Cassia stricta		+	+	+				+		+			+	2		+					
*Cenchrus ciliaris								+			10-15	+	+		+						
Cheilanthes sieberi subsp. sieberi			+					+				+	+					+			
Chloris pumilio															+						
Chrysopogon fallax								+			<1										
Cleome viscosa								+			+										
Codonocarpus cotinifolius									nc				+								
Convolvulus angustissimus subsp. angustissimus											+										
Corchorus lasiocarpus subsp. lasiocarpus							+				1-2	+									
Corchorus lasiocarpus subsp. parvus									+								+		+		
Corchorus tridens												+						+			
Crotalaria medicaginea var. neglecta											1	+						+			
Cullen pogonocarpum												+					+				
Cymbopogon ambiguus			+	+			+	+		+				+					+		+
Cymbopogon obtectus																		+			
Dactyloctenium radulans						+		+				+			1-2	+		+	+		
Dampiera candicans	+																				
Dichanthium sericeum subsp. humilius						+						3-5						+			
Digitaria brownii			+					+						+							

Species	WQR 01	WQR 02	WQR 03	WQR 04	WQR 05	WQR 06	WQR 07	WQR 08	WQR 09	WQR 10	WQR 11	WQR 12	WQR 13	WQR 14	WQR 15	WQR 16	WQR 17	WQR 18	WQR 19	WQR 20	WQR -RA
Digitaria ctenantha								+			+	2									
Dipteracanthus australasicus subsp. australasicus						+						+									
Dodonaea petiolaris														+							
Dysphania kalpari			+																		
Dysphania rhadinostachya subsp. rhadinostachya								+			+			+							
Dysphania sphaerosperma				+													+				
Enchylaena tomentosa var. tomentosa			+			+		+					+		+	+		+	+		
Enneapogon caerulescens			+	<1		+	+	+	+	+	1	+	+	+	<1	+	+	+	+	+	+
Enneapogon lindleyanus								+							+						
Enneapogon polyphyllus			+	+		+	+	+		+	2	60	+	+	1-2	+		+		+	+
Enteropogon ramosus						+		+					+		1-2						
Eragrostis cumingii												+									
Eragrostis setifolia												+									
Eragrostis xerophila						+									+			+			
Eremophila cuneifolia			+			+	+	1	+	+		+	1	3	1	+	<1	+	+	+	+
Eremophila forrestii subsp. forrestii		+	3-4									+		+		+		+			
Eremophila fraseri subsp. fraseri												+									+
Eremophila latrobei subsp. filiformis												+		+							
Eremophila longifolia											<1				+						
Eremophila phyllopoda subsp. obliqua								+						+							
Eriachne aristidea		+	+			+				+	+			+	+						
Eriachne mucronata	+					+	1	+		+	<1	+	+	+							
Eriachne pulchella subsp. dominii	3	1	+		<1			+		+		1-2	3-5	20	<1			+		+	+
Eriachne tenuiculmis											<1										
Eucalyptus leucophloia subsp. leucophloia	+	2-3		<1													+		2-3		
Eucalyptus victrix											+				nc						
Euphorbia aff. australis var. 1 (MET 12 337)		+	+					+						+							
Euphorbia biconvexa								+			+	+	+	+							
Euphorbia coghlanii							+														
Euphorbia tannensis subsp. eremophila (Hamersley form)	+										+						+	+			
Euphorbia sp. (BPBS10-50)				+							<1						+		+		
Evolvulus alsinoides var. decumbens								+		+											
Evolvulus alsinoides var. villosicalyx	+	+	+		+	+	+	+		+	1-2	+		+				+	+		
Fimbristylis dichotoma								+													
Flaveria australasica											<1	+							+		
Gompholobium karijini	+																				
Gomphrena canescens subsp. canescens											+	+									
Gomphrena cunninghamii	+		+			+		+			+		+					+		+	
Gomphrena kanisii						+	+	+			+	+	+	+	+	+	+	+	+	+	
Goodenia forrestii			+		+			+			1	+		+			+	+		+	
Goodenia microptera	+		+					+		+	1						+		+	+	
Goodenia muelleriana			+	+		+	+	+	+	+	<1	+					+		+		+

Species	WQR 01	WQR 02	WQR 03	WQR 04	WQR 05	WQR 06	WQR 07	WQR 08	WQR 09	WQR 10	WQR 11	WQR 12	WQR 13	WQR 14	WQR 15	WQR 16	WQR 17	WQR 18	WQR 19	WQR 20	WQR -RA
Goodenia stobbsiana	+																				
Goodenia tenuiloba								+			+	+	nc	+			+	+			
Gossypium australe (Burrup Peninsula form)											<1										
Gossypium australe (Whim Creek form)					+		+														
Gossypium robinsonii			+								<1										
Hakea chordophylla																					+
Hakea lorea subsp. lorea	+																				
Heliotropium chrysocarpum					+														+		
Heliotropium cunninghamii											<1										
Heliotropium heteranthum																		+			
Heliotropium inexplicitum																			+		
Hibiscus burtonii			+			+		+				+	nc	+	nc						
Hibiscus aff. coatesii (MET 16,542)										+	+								+		
Hibiscus aff. coatesii (site 664)			+																		
Hibiscus gardneri						+								+							
Hibiscus platychlamys								+			+										
Hibiscus sturtii var. aff. grandiflorus			+					+				+	+					+	+	+	
Hybanthus aurantiacus											<1										
Indigofera colutea											1-2	+									
Indigofera monophylla (small calyx form)	+		+		+		+				2-4							+		+	+
Iseilema dolichotrichum	+		+				nc				+	+	+			+	+			+	
Iseilema eremaeum				+		+		+		+				+	+			+			+
Iseilema vaginiflorum						+												+			
Jasminum didymum subsp. lineare			+					+			1										
Josephinia sp.												+									
Lawrencia densiflora				+	+														+		
Lepidium phlebopetalum								+			+										
Lepidium pholidogynum				+						+									+		
Leptopus decaisnei var. decaisnei			+			+	+	+			+	+					+	+			
Maireana carnosa															+				+		
Maireana eriosphaera															<1						
Maireana georgei		<1		+						+		+		+		+	+	+	+	+	
Maireana melanocoma		<1	+	+	+			+				+	+	+			+	+		+	
Maireana planifolia			+					+				+									
Maireana planifolia x villosa			+																		
Maireana platycarpa															+						
Maireana thesioides													+	+		+					
Maireana ?trichoptera				<1				+													
Maireana triptera								3-5								+					
Maireana villosa			+																		
*Malvastrum americanum								+			1	+									
Melaleuca eleuterostachya				2															<2	+	

Species	WQR 01	WQR 02	WQR 03	WQR 04	WQR 05	WQR 06	WQR 07	WQR 08	WQR 09	WQR 10	WQR 11	WQR 12	WQR 13	WQR 14	WQR 15	WQR 16	WQR 17	WQR 18	WQR 19	WQR 20	WQR -RA
Melaleuca glomerata																					
Melhania sp. Turee Creek (MJ1-35)							+				+										
Mollugo molluginis														+							
Mukia maderaspatana			+							+	+	+		+				+			+
Oldenlandia crouchiana	+			+			+		+	+				+			+				
Paraneurachne muelleri			+				+	+		+	+	+							+		+
Paspalidium clementii			+			+		+		+		+	+	+	1	+	+	+	+		
Paspalidium constrictum								+													
Paspalidium rarum												+									
Petalostylis labicheoides			+																		
Phyllanthus erwinii								+				+	+					+			
Phyllanthus maderaspatensis											+										
Pluchea rubelliflora											+										
Polycarpaea corymbosa var. corymbosa	+	+		+	<1							+		+	+	+		+	+		+
Polycarpaea holtzei	+	+			+									+				+	+		<1
Polycarpaea longiflora	+	+	+									+									+
Polygala aff. isingii	+								+					+				+			
Polymeria ambigua							+				3-5	+									
Porana commixta	+		+	+		+		+					+	+	nc	+			+		
Portulaca oleracea		+			+			+			<1	+				+					
Portulaca pilosa								+				+			<1				+		
Psydrax latifolia		+																			
Psydrax suaveolens										+			+	+		+					
Pterocaulon sphaeranthoides								+		+	<1	+		+			+			+	
Ptilotus aervoides								+									+				
Ptilotus astrolasius var. astrolasius		nc	+				+												+		
Ptilotus auriculifolius			+								+							+			
Ptilotus calostachyus var. calostachyus	+							+		+									+		
Ptilotus clementii							+	+	+								+		+		+
Ptilotus exaltatus var. exaltatus	+	+	+	+	<1	+	+	+		+	1	+	+	+	+	+	+		+	+	
Ptilotus fusiformis var. fusiformis											+		+								
Ptilotus gomphrenoides var. gomphrenoides												+									
Ptilotus helipteroides var. helipteroides		+	+	+		+		+			+	+	+			+	+	+			
Ptilotus murrayi var. murrayi															+						
Ptilotus obovatus var. obovatus		+	+				+	+			<1						+		+		
Ptilotus polystachyus var. polystachyus			+																		
Ptilotus rotundifolius				+			+							+			1			+	10
Ptilotus schwartzii var. schwartzii		+	+					+					nc	+							
Ptilotus sp. Brockman (E. Thoma & A. Joder ET & AJ 145)				+															nc		
Rhagodia eremaea			+			+		1								+		+	+		
Rhyncharrhena linearis			+											+							
Rhynchosia minima			+					+			1	+						+			

Species	WQR 01	WQR 02	WQR 03	WQR 04	WQR 05	WQR 06	WQR 07	WQR 08	WQR 09	WQR 10	WQR 11	WQR 12	WQR 13	WQR 14	WQR 15	WQR 16	WQR 17	WQR 18	WQR 19	WQR 20	WQR -RA
Salsola tragus subsp. tragus				+		+	+	+			2-3	+							+		+
Scaevola spinescens													+								
Scaevola spinescens (broad form)															+	+					
Schizachyrium fragile	+								+												+
Sclerolaena cuneata					+	+									2				+		
Sclerolaena densiflora				+	1-2	+						+				+	+		+	+	
Sclerolaena eriacantha		+				+		2-3				+	+		+	+	+	+	+	+	
Sclerostegia disarticulata				1											4-6				+		
*Setaria verticillata											+					+					
Sida atrovirens								+		+			+	+		+					
Sida echinocarpa			+	+			+	+		+	<1	+					+	+	+		+
Sida aff. echinocarpa (MET 15,350)																			+		
Sida aff. fibulifera (MET 16,494)						+						+									
Sida aff. fibulifera (oblong; MET 15 220)								+			<1								+		
Sida aff. fibulifera (site 1394)			+					+				+						+			
Sida pilbarensis	+																				
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)								+													
Sida sp. Wittenoom (W.R. Barker 1962)										+	<1										
Sida sp. (rugose)			+			+	nc	+				+	+					+	+	+	+
Solanum diversiflorum											+						+				
Solanum horridum																		+			
Solanum lasiophyllum		+	+				+	+		+	+			+			+				
Sporobolus actinocladus															+						
Sporobolus australasicus			+	<1	1-2	5-10	+	1	+		2-3	+	+		2-3	+	+	+	+	+	<1
Stackhousia intermedia				<1			1		+								+		+		+
Stemodia grossa				+																	
Streptoglossa bubakii											+						+			+	
Streptoglossa decurrens					+						+										
Streptoglossa liatroides																				+	
Striga curviflora							+														
Stylobasium spathulatum											5-7										
Swainsona leeana																	+				
Swainsona maccullochiana									+			+						+			
Tephrosia aff. clementii (8) (HD106)																			+		
Tephrosia aff. clementii (9) (HD284-6)																		+			
Tephrosia densa											2-3										
Tephrosia rosea var. glabrior											1-2										
Themeda triandra								+			<1										<1
Trachymene oleracea subsp. oleracea	+	+		+					+	+				+				+		+	+
Tragus australianus						+					+	+				+					
Tribulus astrocarpus			+																		
Tribulus hirsutus								+													

Species	WQR 01	WQR 02	WQR 03	WQR 04	WQR 05	WQR 06	WQR 07	WQR 08	WQR 09	WQR 10	WQR 11	WQR 12	WQR 13	WQR 14	WQR 15	WQR 16	WQR 17	WQR 18	WQR 19	WQR 20	WQR -RA
Tribulus macrocarpus	+																				
Tribulus platypterus							+														
Tribulus suberosus			+							+		+		+			+	+			+
Trichodesma zeylanicum var. zeylanicum		nc	+	<1		+	+	+	+	+	+	+	+	+		+	+	+		+	+
Triodia angusta		<1		50-55	65-75	+	20	5-8		+			30-40	1-2	7-10	35-40	3-4		10	35	
Triodia brizoides		+																	10		
Triodia epactia	<1	1	45					2		35-40	8-10	10		40		+					
Triodia longiceps						50		1					+						+	10	
Triodia wiseana	30-45	50-60	1	25-30	+	+	55		35-40				+				60	50-60	20		65-70
Tripogon loliiformis								+							+			+	+		
Triraphis mollis											+										
Triumfetta clementii											<1	+		+							
Vittadinia arida			+					+			+	+									
Vittadinia obovata																				+	
Vittadinia virgata																		+			
Waltheria indica											2-3										

Appendix 3

Summary Table of Floristic Groups from PATN Analysis

gp 50	gp 100	gp 200	Cape Preston (Biota & Trudgen 2001)	Mesa A / Mesa G (Biota 2005b)	Mesa A Transport Corridor (Biota 2006a, in prep.)	Mesa J Extension (Biota 2003)	Bungaroo Valley (Biota 2007c)	Millstream Rail (Trudgen)	Mt Lionel (Biota in prep.)	Brockman Syncline 4 (Biota 2005a)	White Quartz Road (Biota, this study)	Eight Mile Well (Trudgen & Casson 1998)	Four Corners Bore (Trudgen & Casson 1998)	West Angelas (Trudgen & Casson 1998)	Yandi Expansion (Biota 2004a)	FMG Rail Stage B (Biota 2004b)	
1	1	1												7			
	2	2												2			
2	3	3						6									
		4						1									
		5						3									
3	4	6												1			
		7						2									
	5	8	2														
	6	9						1									
4	7	10												12			
		11												1			
		12												23			
		13												8			
	8	14												8			
		15								1				1			
		16												3			
		17												2			
5	9	18											1		7	9	
		19													8	3	
6	10	20												18			
		21												6			
	11	22												2			
		23												2			
7	12	24												2			
		25												2			
	13	26											1	1			
	14	27								7							
	15	28												9			
8	16	29												10			
	17	30												3			
		31												1			
	18	32												4			
		33												2			
	19	34												1		1	
		35														1	
9	20	36												2			
	21	37								1							
	22	38												1			
		39												2			
10	23	40												3			
		41												1			
		42												1			
	24	43												2			
		44												1			
11	25	45												2			
		46												1			
	26	47												2		1	
		48						1						1			
	27	49						3									
		50						2									
	28	51												1			
		52						1									
	29	53						2									
		54						3									
12	30	55						20									
	31	56						8									
		57						9									
13	32	58		1	1			9									
		59			1			3									
		60			1		1										
		61		3													
	33	62			1			1									
14	34	63												1			
		64					3						1				
		65											1				
	35	66								3							
15	36	67											5				
		68											2				
		69														1	
16	37	70			1					1			2				
		71		2	1	3	1	1									
	38	72		1		1								1			
	39	73			2											1	
		74		1	1												
	40	75		7													
		76		2													
	41	77		4	1												
		78		5													
17	42	79		8	1												
		80		4													
		81			5												
18	43	82												5			
		83												13			
		84												6			
		85												2			
19	44	86												10			
		87												5			
		88												4			
	45	89												27			
		90												7			
		91												7			
20	46	92												1			
		93												1			
	47	94												2			
		95												2			
	48	96												1			
21	49	97												8			
		98												9			
	50	99												3			
22	51	100												8			
		101												3			
	52	102												12			
		103											2	2			
23	53	104											8				
		105											4				
		106											1				
		107											3				
24	54	108										2	1				
		109											2				
	55	110											4				
		111											1				
25	56	112									3			1			ElAbsTw (WQR07), ElAbTw (WQR09), AlERcERfrTw (WQR-RA)
		113								3							
		114								1							
		115								3	1						AxAanTw (WQR02)
	57	116								1	2						AanAprTe (WQR10, WQR14)
		117								1	4						ElAbTloTa (WQR20), ElMeAeTloTa (WQR04), ElAbTbr (WQR19), AlERcERfrTw (WQR17)
		118							1	2	7						AxAanTloTa (WQR06, WQR08, WQR13, WQR16), AxSCdTa (WQR15), AanTe (WQR12), AanTw (WQR18)
26	58	119							4	10	1						AanAprTe (WQR03)
	59	120							3	17	1						ElAmTw (WQR01)
27	60	121												6			
		122								2				2			
		123												1			
		124								1				3			
	61	125								1				1			
		126								9	1						ApyTErTeCEc (WQR11)
		127													8	4	
	62	128													1	2	
		129													6		
28	63	130						5									
		131						1									
		132						3									
29	64	133								2							
		134													7	1	
	65	135													3		
		136													1		
30	66	137											2				
	67	138											2				
		139			1	5	1										
	68	140				2										2	
31	69	141					3										
	70	142	4														
32	71	143		1													
		144		1													
33	72	145		2	6	1											
		146			2		3										
	73	147					15										
		148					3										
34	74	149			2			1									
		150			6												
	75	151					11										
35	76	152			6		1										
		153			15												
		154		1	6												
		155			3												
	77	156		8	7												
		157			3												
36	78	158			1		5	1									
		159			6												
		160			1		1										
	79	161					1										
		162														1	
		163		1			2										
37	80	164													1	8	
		165														2	
38	81	166											2				
		167			1			1									
		168			3			1									
	82	169						2									
		170						2			1						ElAbTloTa (WQR05)
39	83	171						3									
		172						1									
40	84	173						3									
		174						1									
		175						1									
41	85	176	4														
		177							1								
	86	178	6														
		179	1														
	87	180	2														
42	88	181	2														
	89	182	2														
		183	1														
43	90	184	2														
		185	2														
44	91	186	1														
45	92	187	4														
46	93	188											1				
		189					2										
	94	190		1	1		1								1		
47	95	191	10														
48	96	192	11														
		193	2														
49	97	194	11														
		195	13														
	98	196	15														
	99	197	5														
		198	13														
50	100	199	10														
		200			1												

Colour-coding as follows: vegetation of creeklines; stony hills and plains; calcareous plains; Mulga/Snakewood vegetation

Appendix 4

List of Vascular Flora Recorded from the White Quartz Road Corridor

NB. * denotes introduced species

Comparison of *Cassia* versus *Senna* nomenclature:

Cassia glaucifolia	–	*Senna glaucifolia*
Cassia glutinosa	–	*Senna glutinosa* subsp. *glutinosa*
Cassia hamersleyensis	–	*Senna hamersleyensis*
Cassia helmsii	–	*Senna artemisioides* subsp. *helmsii*
Cassia luerssenii	–	*Senna glutinosa* subsp. x *luerssenii*
Cassia notabilis	–	*Senna notabilis*
Cassia oligophylla	–	*Senna artemisioides* subsp. *oligophylla*
Cassia pruinosa	–	*Senna glutinosa* subsp. *pruinosa*
Cassia stricta	–	*Senna stricta*
Cassia sp. Karijini (MET 10 392)	–	*Senna* sp. Karijini (ME Trudgen 10 392)
Cassia sp. Meekatharra (E. Bailey 1-26)	–	*Senna* sp. Meekatharra (E. Bailey 1-26)

ACANTHACEAE (325)
Dicladanthera forrestii
Dipteracanthus australasicus subsp. *australasicus*
Rostellularia adscendens var. *latifolia*
ADIANTACEAE (007)
Cheilanthes brownii
Cheilanthes sieberi subsp. *sieberi*
AIZOACEAE (110)
Trianthema triquetra
AMARANTHACEAE (106)
Alternanthera nana
Amaranthus cuspidifolius
Amaranthus undulatus
Gomphrena canescens subsp. *canescens*
Gomphrena cunninghamii
Gomphrena kanisii
Ptilotus aervoides
Ptilotus astrolasius var. *astrolasius*
Ptilotus auriculifolius
Ptilotus calostachyus var. *calostachyus*
Ptilotus clementii
Ptilotus exaltatus var. *exaltatus*
Ptilotus fusiformis var. *fusiformis*
Ptilotus gomphrenoides var. *gomphrenoides*
Ptilotus helipteroides var. *helipteroides*
Ptilotus murrayi var. *murrayi*
Ptilotus obovatus var. *obovatus*
Ptilotus polystachyus var. polystachyus
Ptilotus rotundifolius
Ptilotus schwartzii var. *schwartzii*
Ptilotus sp. Brockman (E. Thoma & A. Joder ET & AJ 145)
APIACEAE (281)
Trachymene oleracea subsp. *oleracea*
ARALIACEAE (280)
Astrotricha hamptonii
ASCLEPIADACEAE (305)
Rhyncharrhena linearis
Sarcostemma viminale subsp. *australe*
ASTERACEAE (345)
**Bidens bipinnata*
Centipeda minima subsp. *macrocephala*
Chrysocephalum apiculatum
Flaveria australasica
Helichrysum gilesii
Pluchea ferdinandi-muelleri
Pluchea rubelliflora
Pterocaulon sphaeranthoides
Rhodanthe margarethae
Streptoglossa bubakii
Streptoglossa decurrens
Streptoglossa liatroides
Vittadinia arida
Vittadinia obovata
Vittadinia virgata
BORAGINACEAE (310)
Heliotropium chrysocarpum
Heliotropium cunninghamii
Heliotropium heteranthum
Heliotropium inexplicitum
Heliotropium tanythrix
Trichodesma zeylanicum var. *zeylanicum*
BRASSICACEAE (138)
Lepidium pedicellosum
Lepidium phlebopetalum
Lepidium pholidogynum
Lepidium platypetalum
CAESALPINIACEAE (164)
Cassia glaucifolia
Cassia glutinosa
Cassia glutinosa x *luerssenii*
Cassia glutinosa x *stricta*
Cassia hamersleyensis x sp. Karijini (MET 10 392)
Cassia helmsii
Cassia luerssenii
Cassia luerssenii x *stricta*
Cassia notabilis
Cassia oligophylla
Cassia oligophylla x *helmsii*
Cassia aff. *oligophylla* (thinly sericeous)
Cassia aff. *oligophylla* (thinly sericeous) x *helmsii*
Cassia ? oligophylla x
Cassia pruinosa

Cassia pruinosa x *luerssenii*
Cassia stricta
Cassia sp. Karijini (MET 10,392)
Cassia sp. Meekatharra (E. Bailey 1-26)
Petalostylis labicheoides
CAPPARACEAE (137A)
Capparis lasiantha
Capparis spinosa var. *nummularia*
Capparis umbonata
Cleome viscosa
CARYOPHYLLACEAE (113)
Polycarpaea corymbosa var. *corymbosa*
Polycarpaea holtzei
Polycarpaea longiflora
CHENOPODIACEAE (105)
Atriplex bunburyana
Atriplex codonocarpa
Dysphania kalpari
Dysphania rhadinostachya subsp. *rhadinostachya*
Dysphania sphaerosperma
Enchylaena tomentosa var. *tomentosa*
Maireana carnosa
Maireana eriosphaera
Maireana georgei
Maireana melanocoma
Maireana planifolia
Maireana planifolia x *villosa*
Maireana platycarpa
Maireana pyramidata
Maireana thesioides
Maireana ?trichoptera
Maireana triptera
Maireana villosa
Rhagodia eremaea
Salsola tragus subsp. *tragus*
Sclerolaena cuneata
Sclerolaena densiflora
Sclerolaena eriacantha
Sclerostegia disarticulata
CONVOLVULACEAE (307)
Bonamia media var. *villosa*
Bonamia rosea
Convolvulus angustissimus subsp. *angustissimus*
Evolvulus alsinoides var. *decumbens*
Evolvulus alsinoides var. *villosicalyx*
Ipomoea muelleri
Polymeria ambigua
Porana commixta
CUCURBITACEAE (337)
**Cucumis melo* subsp. *agrestis*
Mukia maderaspatana
CYPERACEAE (032)
Bulbostylis barbata
Bulbostylis turbinata
Cyperus vaginatus
Fimbristylis dichotoma
Schoenoplectus subulatus
EUPHORBIACEAE (185)
Adriana urticoides var. *urticoides*
Euphorbia aff. *australis* var. 1 (MET 12 337)
Euphorbia biconvexa
Euphorbia careyi
Euphorbia coghlanii
Euphorbia tannensis subsp. *eremophila* (Hamersley form)
Euphorbia sp. (BPBS10-50)
Leptopus decaisnei var. *decaisnei*
Phyllanthus erwinii
Phyllanthus maderaspatensis
FRANKENIACEAE (236)
Frankenia magnifica
GOODENIACEAE (341)
Dampiera candicans
Goodenia cusackiana
Goodenia forrestii
Goodenia lamprosperma
Goodenia microptera
Goodenia muelleriana
Goodenia stobbsiana
Goodenia tenuiloba
Scaevola spinescens
Scaevola spinescens (broad form)
GYROSTEMONACEAE (108)
Codonocarpus cotinifolius
HYDROCHARITACEAE (029)
Vallisneria nana
LAURACEAE (131)
Cassytha capillaris
LOBELIACEAE (340)
Lobelia heterophylla
LORANTHACEAE (097)
Amyema fitzgeraldii
Amyema preissii
Amyema sp. Fortescue (M.E. Trudgen 5358)
Lysiana casuarinae
LYTHRACEAE (265)
Ammannia auriculata
MALVACEAE (221)
Abutilon amplum
Abutilon cryptopetalum
Abutilon dioicum
Abutilon aff. *dioicum* (WW10-4)
Abutilon fraseri
Abutilon aff. *fraseri* (1)
Abutilon lepidum
Abutilon aff. *lepidum* (1) (MET 15 352)
Abutilon aff. *lepidum* (2) (MET 15 970)
Abutilon macrum
Abutilon otocarpum (acute leaf form)
Abutilon oxycarpum subsp. *prostratum*
Abutilon trudgenii
Gossypium australe (Burrup Peninsula form)
Gossypium australe (Whim Creek form)
Gossypium robinsonii

Gossypium sturtianum
Hibiscus burtonii
Hibiscus aff. *coatesii* (MET 16,542)
Hibiscus aff. *coatesii* (site 664)
Hibiscus gardneri
Hibiscus platychlamys
Hibiscus sturtii var. aff. *campylochlamys* (site 1398)
Hibiscus sturtii var. aff. *grandiflorus*
Hibiscus sp.
Lawrencia densiflora
**Malvastrum americanum*
Sida atrovirens
Sida echinocarpa
Sida aff. *echinocarpa* (MET 15,350)
Sida aff. *fibulifera* (MET 16,494)
Sida aff. *fibulifera* (oblong; MET 15 220)
Sida aff. *fibulifera* (site 1394)
Sida aff. *fibulifera* var. L
Sida pilbarensis
Sida pilbarensis (ferruginous form)
Sida sp. Shovelanna Hill (S. van Leeuwen 3842)
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)
Sida sp. Wittenoom (W.R. Barker 1962)
Sida sp. (rugose)
MENISPERMACEAE (122)
Tinospora smilacina
MIMOSACEAE (163)
Acacia ancistrocarpa
Acacia aneura (flat curved; MET 15 548)
Acacia aff. *aneura* (grey flat recurved tips; MET 15,828
Acacia aff. *aneura* (long, flat, recurved; FMR 35.3)
Acacia aff. *aneura* (narrow fine veined; site 1259)
Acacia aff. *aneura* (scythe-shaped; MET 15,743)
Acacia atkinsiana
Acacia ayersiana
Acacia bivenosa
Acacia bivenosa (wispy/weeping form)
Acacia citrinoviridis
Acacia coriacea subsp. *pendens*
Acacia exilis
Acacia inaequilatera
Acacia aff. *inaequilatera* (little phyllode form)
Acacia kempeana
Acacia maitlandii
Acacia marramamba
Acacia monticola
Acacia pachyacra
Acacia pruinocarpa
Acacia pyrifolia
Acacia rhodophloia
Acacia sclerosperma subsp. *sclerosperma*
Acacia sericophylla
Acacia sibirica
Acacia sibirica (linear form)
Acacia synchronicia
Acacia tenuissima
Acacia tetragonophylla
Acacia tumida var. *pilbarensis*
Acacia xiphophylla
Neptunia dimorphantha
**Vachellia farnesiana*
MOLLUGINACEAE (110A)
Glinus lotoides
Mollugo molluginis
MORACEAE (087)
Ficus brachypoda
MYOPORACEAE (326)
Eremophila cuneifolia
Eremophila exilifolia
Eremophila forrestii subsp. *forrestii*
Eremophila fraseri subsp. *fraseri*
Eremophila latrobei subsp. *filiformis*
Eremophila longifolia
Eremophila phyllopoda subsp. *obliqua*
MYRTACEAE (273)
Corymbia deserticola subsp. *deserticola*
Corymbia ferriticola subsp. *ferriticola*
Corymbia hamersleyana
Eucalyptus camaldulensis var. *obtusa*
Eucalyptus gamophylla
Eucalyptus leucophloia subsp. *leucophloia*
Eucalyptus socialis
Eucalyptus victrix
Eucalyptus xerothermica
Melaleuca bracteata
Melaleuca eleuterostachya
Melaleuca glomerata
NYCTAGINACEAE (107)
Boerhavia coccinea
Boerhavia gardneri
OLEACEAE (301)
Jasminum didymum subsp. *lineare*
PAPAVERACEAE (135)
**Argemone ochroleuca* subsp. *ochroleuca*
PAPILIONACEAE (165)
Alysicarpus muelleri
Crotalaria medicaginea var. *neglecta*
Cullen leucochaites
Cullen pogonocarpum
Gompholobium karijini
Indigofera colutea
Indigofera monophylla (small calyx form)
Indigofera rugosa
Isotropis atropurpurea
Rhynchosia minima
Swainsona leeana
Swainsona maccullochiana
Templetonia egena
Tephrosia aff. *clementii* (8) (HD106)
Tephrosia aff. *clementii* (9) (HD284-6)

Tephrosia densa
Tephrosia rosea var. *glabrior*
Tephrosia supina
Tephrosia aff. *supina* (HD133-20)
Tephrosia sp. Bungaroo Creek (M.E. Trudgen 11601)
Vigna lanceolata var. *lanceolata*
PEDALIACEAE (318)
Josephinia sp.
POACEAE (031)
Acrachne racemosa
Amphipogon sericeus
Aristida contorta
Aristida holathera var. *holathera*
Aristida aff. *?inaequiglumis*
Aristida latifolia
Brachyachne convergens
Brachyachne prostrata
**Cenchrus ciliaris*
Chloris pumilio
Chrysopogon fallax
Cymbopogon ambiguus
Cymbopogon obtectus
Dactyloctenium radulans
Dichanthium sericeum subsp. *humilius*
Digitaria brownii
Digitaria ctenantha
Enneapogon caerulescens
Enneapogon lindleyanus
Enneapogon polyphyllus
Enteropogon ramosus
Eragrostis cumingii
Eragrostis eriopoda
Eragrostis leptocarpa
Eragrostis setifolia
Eragrostis tenellula
Eragrostis xerophila
Eriachne aristidea
Eriachne mucronata
Eriachne pulchella subsp. *dominii*
Eriachne tenuiculmis
Iseilema dolichotrichum
Iseilema eremaeum
Iseilema vaginiflorum
Paraneurachne muelleri
Paspalidium clementii
Paspalidium constrictum
Paspalidium rarum
Schizachyrium fragile
**Setaria verticillata*
Sporobolus actinocladus
Sporobolus australasicus
Themeda triandra
Tragus australianus
Triodia angusta
Triodia brizoides
Triodia epactia
Triodia longiceps
Triodia melvillei
Triodia wiseana
Tripogon loliiformis
Triraphis mollis
POLYGALACEAE (183)
Polygala aff. *isingii*
PORTULACACEAE (111)
Portulaca cyclophylla
Portulaca oleracea
Portulaca pilosa
PROTEACEAE (090)
Grevillea berryana
Hakea chordophylla
Hakea lorea subsp. *lorea*
RUBIACEAE (331)
Oldenlandia crouchiana
Psydrax latifolia
Psydrax suaveolens
SANTALACEAE (092)
Anthobolus leptomerioides
Santalum lanceolatum
Santalum spicatum
SAPINDACEAE (207)
Atalaya hemiglauca
Dodonaea coriacea
Dodonaea pachyneura
Dodonaea petiolaris
SCROPHULARIACEAE (316)
Stemodia grossa
Striga curviflora
SOLANACEAE (315)
Nicotiana occidentalis subsp. *occidentalis*
Solanum diversiflorum
Solanum horridum
Solanum lasiophyllum
Solanum phlomoides
Solanum sturtianum
STACKHOUSIACEAE (202)
Stackhousia intermedia
STERCULIACEAE (223)
Keraudrenia nephrosperma
Melhania sp. Turee Creek (MJ1-35)
**Melochia pyramidata*
Rulingia luteiflora
Waltheria indica
SURIANACEAE (160)
Stylobasium spathulatum
TILIACEAE (220)
Corchorus crozophorifolius
Corchorus lasiocarpus subsp. *lasiocarpus*
Corchorus lasiocarpus subsp. *parvus*
Corchorus tridens
Triumfetta clementii
Triumfetta maconochieana
TYPHACEAE (020)
Typha domingensis
VIOLACEAE (243)
Hybanthus aurantiacus

ZYGOPHYLLACEAE (173)
Tribulus astrocarpus
Tribulus hirsutus
Tribulus macrocarpus
Tribulus platypterus
Tribulus suberosus

Appendix 5

Locations of Priority Flora and Weeds within the White Quartz Road Corridor

Priority Flora

Records of *Abutilon trudgenii* from the White Quartz Road corridor

Easting (WGS84)	Northing (WGS84)	Recorded by	Date	No. of Inds/Cover
539920	7495856	MM	1/6/05	x6
546757	7497077	MM	2/6/05	x2
547506	7497285	MM	2/6/05	x1 (+ 2 x dead)
548551	7497748	MM	3/6/05	x1
548738	7497673	RO	6/6/05	x20
549254	7497902	MM	3/6/05	x1
550053	7497652	RO	6/6/05	x1
550927	7497670	RO	6/6/05	x1
551319	7497911	MM	3/6/05	x1
551618	7497708	RO	6/6/05	x1
553394	7498006	MM	4/6/05	x1
553707	7497968	RO	6/6/05	x5 (dead)
554478	7498244	RO	6/6/05	x1
555214	7498277	MM	4/6/05	x1
555417	7498257	MM	4/6/05	x2
555563	7498465	RO	6/6/05	x1
555617	7498788	MM	4/6/05	x2
555743	7498443	MM	4/6/05	x1
555743	7498773	MM	4/6/05	x2
556265	7499014	MM	4/6/05	x5
556974	7498659	MM	4/6/05	x2
557026	7498728	MM	4/6/05	x6 (dead)
557970	7499288	MM	4/6/05	x5
558766	7499005	MM	5/6/05	

Records of *Ptilotus* sp. Brockman from the White Quartz Road corridor

Easting (WGS84)	Northing (WGS84)	Recorded by	Date	No. of Inds/Cover
533344	7499718	MM	31/5/05	x15
533439	7499568	MM	31/5/05	x15
533499	7498928	MM	31/5/05	x20
533671	7498719	MM	31/5/05	x13
533800	7499011	RO	6/6/05	x30
533814	7498760	MM	31/5/05	x1
533898	7498500	MM	31/5/05	x20
533933	7498427	MM	31/5/05	x20
533953	7498345	MM	31/5/05	x20+
533972	7498502	MM	31/5/05	x19
533988	7498574	MM	31/5/05	x25
534095	7498645	RO	6/6/05	x10
534107	7498282	MM	31/5/05	x20
534128	7498489	MM	31/5/05	x2
534132	7498647	RO	6/6/05	x30
534136	7498540	RO	6/6/05	x1
534141	7498471	MM	31/5/05	x20
534147	7498317	MM	31/5/05	x1
534148	7498625	RO	6/6/05	x10
534153	7498238	MM	31/5/05	x15
534160	7498332	MM	31/5/05	x50+
534168	7498610	RO	6/6/05	x16
534185	7498776	RO	6/6/05	x80
534214	7498746	RO	6/6/05	x20+
534215	7498176	MM	31/5/05	scattered
534223	7498440	MM	31/5/05	x80+
534245	7498757	RO	6/6/05	x20+
534301	7498127	MM	31/5/05	scattered
534309	7498806	MM	31/5/05	x15
534320	7498358	MM	31/5/05	100s

Easting (WGS84)	Northing (WGS84)	Recorded by	Date	No. of Inds/Cover
534365	7498319			scattered
534381	7498281	MM	31/5/05	scattered
534400	7498121	MM	31/5/05	x20+; scattered
534459	7498347	RO	6/6/05	x2
534460	7498218	MM	31/5/05	scattered
534477	7498044	MM	31/5/05	x50+
534579	7497849	MM	31/5/05	scattered
534654	7497744	MM	31/5/05	scattered
534663	7497849	MM	31/5/05	scattered
534705	7498074	RO	6/6/05	x10
534712	7498143	MM	31/5/05	
534751	7498051	RO	6/6/05	x15
534789	7498061	MM	31/5/05	x100+
534802	7497621	MM	31/5/05	x5
535748	7497589	RO	6/6/05	x60
535787	7497548	RO	6/6/05	x60
536692	7497468	MM	1/6/05	x5
538702	7495953	MM	1/6/05	x100+
538766	7495893	MM	1/6/05	x100+
538885	7496155	MM	1/6/05	x1
539078	7495477	MM	1/6/05	x30+
539146	7495522	MM	1/6/05	x30; cont all up N side of hills to S
539163	7495413	MM	1/6/05	x30+
539341	7495320	MM	1/6/05	x300+; another 200+ to S outside study area
539416	7495573	RO	6/6/05	x3
539456	7495493	MM	1/6/05	x100
539592	7495442	MM	1/6/05	x100
539631	7495392	MM	1/6/05	x100
539713	7495763	MM	1/6/05	x15
539719	7495794	MM	1/6/05	x15
539722	7495667	MM	1/6/05	x15
539741	7495568	RO	6/6/05	x2
539827	7495626	RO	6/6/05	x1
539880	7495680	MM	1/6/05	x15
539968	7495758	MM	1/6/05	x7
540023	7495706	MM	1/6/05	x3
540086	7495628	RO	6/6/05	x2
540116	7495664			scattered
540126	7495501	MM	1/6/05	x50
540129	7495660	RO	6/6/05	x30
540158	7495730	RO	6/6/05	x6
540164	7495666	RO	6/6/05	x5
540167	7495443	MM	1/6/05	x50
540188	7495740	MM	1/6/05	x2
540190	7495747	RO	6/6/05	x5
540195	7495641	MM	1/6/05	x50
540206	7495660	RO	6/6/05	x5
540303	7495478	MM	1/6/05	x100
540352	7495484	MM	1/6/05	x100
540451	7495700	MM	1/6/05	x100
541186	7495980	MM	1/6/05	x200
541202	7495878	MM	1/6/05	x200
541268	7496042	MM	1/6/05	x200
541290	7495834	RO	6/6/05	x8
541336	7496206	MM	1/6/05	x200
541425	7496073	MM	1/6/05	x200
541435	7496008	MM	1/6/05	x200
541494	7496019	MM	1/6/05	x50
541594	7495605	MM	1/6/05	x5
541661	7495906	MM	1/6/05	x20

Easting (WGS84)	Northing (WGS84)	Recorded by	Date	No. of Inds/Cover
542504	7495799	MM	2/6/05	x30
542514	7495736	MM	2/6/05	x100
542600	7495753	MM	2/6/05	x70
543700	7496829	MM	2/6/05	x8
543727	7496836	MM	2/6/05	x11
544048	7496735	RO	6/6/05	x7
544048	7496753	MM	2/6/05	x10
544048	7496796	MM	2/6/05	x1
544645	7496917	MM	2/6/05	x30+
544810	7496917	MM	2/6/05	x20
544825	7496968	MM	2/6/05	x10
544850	7496894	RO	6/6/05	x12
544889	7496848	RO	6/6/05	x19
545381	7497129	MM	2/6/05	
545395	7497075	MM	2/6/05	x50
545706	7496953	MM	2/6/05	x20
545746	7496946	MM	2/6/05	
547006	7497010	MM	2/6/05	x20
547016	7497028	MM	2/6/05	
547041	7497017	MM	2/6/05	
547454	7497278	MM	2/6/05	x30
547467	7497316	MM	2/6/05	x1
547506	7497285	MM	2/6/05	x30
548230	7497839	MM	2/6/05	x30
548261	7497752	MM	2/6/05	x50
548306	7497761	MM	2/6/05	x50
548307	7497824	MM	2/6/05	x30
548331	7497723	MM	2/6/05	x30
548514	7497793	MM	3/6/05	x20
548556	7497835	MM	3/6/05	x20
548610	7497681	MM	3/6/05	x20
548616	7497832	MM	3/6/05	x20
548638	7497808	MM	3/6/05	x20
548697	7497827	MM	3/6/05	x70
548770	7497743	MM	3/6/05	x70
548775	7497798	MM	3/6/05	x70
549402	7497972	MM	3/6/05	x20
549452	7497990	MM	3/6/05	x20
549565	7497919	MM	3/6/05	x10
549619	7497923	MM	3/6/05	x10
549691	7497932	MM	3/6/05	x25
549741	7497925	MM	3/6/05	x25
549754	7497781	RO	6/6/05	x4
550557	7497924	MM	3/6/05	x25+
550575	7497882	MM	3/6/05	x25+
550607	7497874	MM	3/6/05	x25+
550672	7497932	MM	3/6/05	x25+
550749	7497933	MM	3/6/05	x3
550946	7497791	RO	6/6/05	x5
551572	7497747	MM	3/6/05	x20
551628	7497747	MM	3/6/05	x20
551860	7497722	MM	3/6/05	x1
551923	7497718	RO	6/6/05	x20
551926	7497633	RO	6/6/05	x60
551974	7497717	RO	6/6/05	x20
551994	7497681	RO	6/6/05	x20
552250	7497680	MM	3/6/05	x25
552288	7497842	MM	3/6/05	x10
552297	7497790	MM	3/6/05	x6
552303	7497671	MM	3/6/05	x7

Easting (WGS84)	Northing (WGS84)	Recorded by	Date	No. of Inds/Cover
552350	7497736	MM	3/6/05	x12
552378	7497825	MM	3/6/05	x2
552392	7497768	MM	3/6/05	x6
552441	7497728	MM	3/6/05	x70
552493	7497784	MM	3/6/05	x70
552544	7497729	MM	3/6/05	x20
552549	7497650	RO	6/6/05	x10
552564	7497638	MM	3/6/05	x70
552588	7497897	MM	3/6/05	x100
552592	7497745	MM	3/6/05	x20
552609	7497860	MM	3/6/05	x50
552647	7497891	MM	3/6/05	x6
552704	7497902	MM	3/6/05	x6
553047	7497852	MM	3/6/05	x20
560491	7497762	MM	5/6/05	x50+
560677	7497838	MM	5/6/05	x20+
560727	7497832	MM	5/6/05	x20+
563634	7498542	MM	5/6/05	x4
563938	7498592	HE	6/6/05	x50+
563971	7498539			x20
563971	7498682	RO	6/6/05	x50+
563989	7498606	HE	6/6/05	x50+
564011	7498791	BM	6/6/05	x17
564017	7498642	ET	6/6/05	x50+

Records of *Rostellularia adscendens* var. *latifolia* from the White Quartz Road corridor

Easting (WGS84)	Northing (WGS84)	Recorded by	Date	No. of Inds/Cover
558737	7499035	MM	5/6/05	scattered

Records of *Sida* sp. Wittenoom from the White Quartz Road corridor

Easting (WGS84)	Northing (WGS84)	Recorded by	Date	No. of Inds/Cover
546370	7496949	MM	2/6/05	x10
546504	7497124	RO	6/6/05	x2
546521	7497074	MM	2/6/05	x2
546524	7497030	MM	2/6/05	scattered
546620	7497270	RO	6/6/05	x5
546724	7497260	RO	6/6/05	x10
546738	7497221	RO	6/6/05	x30
546789	7497136	MM	2/6/05	x10
546981	7497307	RO	6/6/05	x10
547041	7497017	MM	2/6/05	x4
547704	7497390	RO	6/6/05	x19
547705	7497345	MM	2/6/05	x10
547709	7497448	RO	6/6/05	x1
547746	7497161	MM	2/6/05	x15
548480	7497478	MM	2/6/05	x10
548912	7497686	RO	6/6/05	x6
549730	7497506	MM	3/6/05	x1
549734	7497794	MM	3/6/05	x4
549980	7497924	MM	3/6/05	x1
550629	7497931	MM	3/6/05	x5
550927	7497670	RO	6/6/05	x2
551001	7498010	MM	3/6/05	x1
551062	7497620	RO	6/6/05	x10
551536	7497596	RO	6/6/05	x5
551576	7497334	RO	6/6/05	x20
552977	7497650	RO	6/6/05	x1
553054	7497748	MM	3/6/05	x1
553707	7497968	RO	6/6/05	x50
555077	7498021	MM	4/6/05	x3
555166	7498498	RO	6/6/05	x1

Easting (WGS84)	Northing (WGS84)	Recorded by	Date	No. of Inds/Cover
555172	7498446	RO	6/6/05	x10
555176	7498249	MM	4/6/05	x3
555183	7498310	RO	6/6/05	x1
555240	7498262	MM	4/6/05	x1
555279	7498175	MM	4/6/05	x3
555422	7498202	MM	4/6/05	scattered
555424	7498671	MM	4/6/05	x1
555463	7498178	MM	4/6/05	scattered
555547	7498498	RO	6/6/05	scattered
555563	7498465	RO	6/6/05	scattered
555617	7498788	MM	4/6/05	x1
555743	7498443	MM	4/6/05	x5
556490	7498909	MM	4/6/05	x5
556973	7498961	RO	6/6/05	x80
556994	7498916	RO	6/6/05	x20
556995	7499003	MM	4/6/05	x70
557015	7498852	RO	6/6/05	x30
557026	7498728	MM	4/6/05	x6
557026	7498794	MM	4/6/05	x10
557072	7498854	RO	6/6/05	scattered
557082	7498923	RO	6/6/05	x1
557134	7498727	MM	4/6/05	x3
557699	7499269	MM	4/6/05	x10
557772	7499182	MM	4/6/05	x50+
557796	7499135	MM	4/6/05	x1
557896	7499285	MM	4/6/05	x1
557928	7499277	MM	4/6/05	x20
558059	7499294	MM	4/6/05	x20
558067	7499237	MM	4/6/05	x20+
558122	7499190	MM	4/6/05	x50
558149	7499128	RO	6/6/05	x1
558203	7499121	RO	6/6/05	x10
558230	7499175	MM	4/6/05	x50
558270	7499110			scattered
558290	7499050	RO	6/6/05	x1
559532	7498709	MM	5/6/05	scattered
560258	7498001			scattered
561498	7498277	MM	5/6/05	x3
561567	7498326	MM	5/6/05	x1
561595	7498525	MM	5/6/05	x1

Other Species of Conservation Interest

Records of **Josephinia* sp. from the White Quartz Road corridor

Easting (WGS84)	Northing (WGS84)	Recorded by	Date	No. of Inds/Cover
555785	7498573	MM	24/5/6	scattered

Weeds

Records of **Argemone ochroleuca* subsp. *ochroleuca* from the White Quartz Road corridor

Easting (WGS84)	Northing (WGS84)	Recorded by	Date	No. of Inds/Cover
537205	7496620	MM	1/6/05	1
537290	7496688	MM	1/6/05	1
537333	7496557	MM	1/6/05	1
537392	7496451	MM	1/6/05	1
537529	7496807	RO	6/6/05	scattered
537715	7497016	MM	1/6/05	scattered
537808	7496764	MM	1/6/05	scattered
537838	7496888	MM	1/6/05	scattered
538055	7496765	MM	1/6/05	scattered
538181	7496627	MM	1/6/05	scattered
538317	7496612	MM	1/6/05	scattered

Records of **Bidens bipinnata* from the White Quartz Road corridor

Easting (WGS84)	Northing (WGS84)	Recorded by	Date	No. of Inds/Cover
534017	7498991			scattered
541528	7495897			scattered
542757	7495905			scattered
553307	7497825			scattered
555785	7498573			scattered
558076	7499241	MM	4/6/05	scattered
561400	7498076			scattered

Records of **Cenchrus ciliaris* from the White Quartz Road corridor

Easting (WGS84)	Northing (WGS84)	Recorded by	Date	No. of Inds/Cover
532403	7499732	MM	31/5/05	scattered
535486	7497493	MM	4/6/05	scattered
535875	7497732	MM	31/5/05	30%
535968	7497548	MM	31/5/05	30%
536006	7497403	MM	31/5/05	30%
536075	7497533	MM	31/5/05	30%
536138	7497300	MM	31/5/05	30%
536186	7497189	MM	1/6/05	2%
536326	7497087	MM	1/6/05	30%
536436	7497007	MM	1/6/05	30%
536631	7496896	MM	1/6/05	scattered
536693	7496866	MM	1/6/05	scattered
536884	7496758	MM	1/6/05	scattered
537161	7496587	MM	1/6/05	scattered
537205	7496620	MM	1/6/05	70%
537333	7496557	MM	1/6/05	40%
537392	7496451	MM	1/6/05	40%
537405	7496656	MM	1/6/05	70%
537650	7497010	MM	1/6/05	scattered
537715	7497016	MM	1/6/05	scattered
537723	7496989	MM	1/6/05	scattered
537808	7496764	MM	1/6/05	scattered
537838	7496888	MM	1/6/05	scattered
538055	7496765	MM	1/6/05	scattered
538181	7496627	MM	1/6/05	scattered
538216	7495998	MM	1/6/05	scattered
538229	7496450	MM	1/6/05	scattered
538278	7496411	MM	1/6/05	scattered
538317	7496612	MM	1/6/05	50-70%
538597	7496465	MM	1/6/05	scattered
539592	7495553	MM	1/6/05	scattered
539910	7495850	MM	1/6/05	30%
539936	7495365	MM	1/6/05	5

Easting (WGS84)	Northing (WGS84)	Recorded by	Date	No. of Inds/Cover
540000	7495384	MM	1/6/05	5%
540048	7495906	MM	1/6/05	scattered
540462	7495966	MM	1/6/05	30%
540566	7495512	MM	1/6/05	30%
540673	7495528	MM	1/6/05	30%
540694	7495528	MM	1/6/05	30%
540718	7495527	MM	1/6/05	30%
540723	7495528	MM	1/6/05	30%
541923	7495651	MM	1/6/05	30%
541945	7495844	MM	1/6/05	scattered
542108	7495883	MM	2/6/05	dense
542221	7496120	MM	2/6/05	40%
542305	7495659	MM	2/6/05	30%
542462	7495664	MM	2/6/05	30%
543191	7496394	MM	2/6/05	2-10%
543659	7496823	MM	2/6/05	50%
543807	7496212	MM	2/6/05	30%
544166	7496931	MM	2/6/05	50%
546182	7497432	MM	2/6/05	dense
546325	7497458	MM	2/6/05	dense
546454	7496924	MM	2/6/05	40%
546687	7497385	MM	3/6/05	dense
546853	7497579	MM	2/6/05	2-10%
547731	7497718	MM	2/6/05	60%
547768	7497724	MM	2/6/05	60%
547969	7497205	MM	2/6/05	20%
547990	7497220	MM	2/6/05	20%
548402	7497832	MM	2/6/05	dense
548431	7497758	MM	2/6/05	dense
548487	7497509	MM	2/6/05	dense
549380	7497957	MM	3/6/05	dense
549595	7497468	MM	3/6/05	90%
549964	7497979	MM	3/6/05	scattered
550108	7497918	MM	3/6/05	dense
550154	7497873	MM	3/6/05	scattered
550182	7497967	MM	3/6/05	scattered
550406	7497327	MM	3/6/05	dense
550506	7497324	MM	3/6/05	dense
550754	7497822			scattered
551126	7497390	MM	3/6/05	2
551171	7497516	MM	3/6/05	scattered
551174	7497552	MM	3/6/05	dense
551179	7497581	MM	3/6/05	dense
551914	7497061	MM	3/6/05	scattered
552133	7497019	MM	3/6/05	dense
552724	7497907	MM	3/6/05	dense
552850	7497960	MM	3/6/05	dense
553217	7497375	MM	3/6/05	dense
553953	7498083			scattered
554191	7497712	MM	4/6/05	dense
554330	7498485	MM	4/6/05	open
554641	7497887	MM	4/6/05	dense
555056	7498017	MM	4/6/05	open
555172	7498485	MM	4/6/05	open
555240	7498262	MM	4/6/05	scattered
555322	7498654	MM	4/6/05	dense
555330	7498681	MM	4/6/05	dense
555531	7498541	MM	4/6/05	scattered
555785	7498573			scattered
556945	7499165	MM	4/6/05	dense

Easting (WGS84)	Northing (WGS84)	Recorded by	Date	No. of Inds/Cover
557012	7499180	MM	4/6/05	dense
557120	7498821	MM	4/6/05	open
557137	7498648	MM	4/6/05	open
557932	7499311	MM	4/6/05	scattered
558270	7499110			10-15%
558510	7499051	MM	5/6/05	scattered
561400	7498076			scattered
561465	7498030	MM	5/6/05	scattered
563213	7498114	MM	5/6/05	scattered
563572	7498769	MM	5/6/05	dense
563598	7498103	MM	5/6/05	dense

Records of **Cucumis melo* subsp. *agrestis* from the White Quartz Road corridor

Easting (WGS84)	Northing (WGS84)	Recorded by	Date	No. of Inds/Cover
555372	7498769	MM	4/6/05	scattered

Records of **Malvastrum americanum* from the White Quartz Road corridor

Easting (WGS84)	Northing (WGS84)	Recorded by	Date	No. of Inds/Cover
532386	7499839	MM	31/5/05	scattered
532398	7499751	MM	31/5/05	scattered
532403	7499732	MM	31/5/05	scattered
533665	7499417	RO	6/6/05	scattered
535875	7497732	MM	31/5/05	scattered
536631	7496896	MM	1/6/05	scattered
536884	7496758	MM	1/6/05	scattered
538069	7496643	MM	1/6/05	scattered
538278	7496411	MM	1/6/05	scattered
546853	7497579	MM	2/6/05	scattered
548402	7497832	MM	2/6/05	scattered
548487	7497509	MM	2/6/05	scattered
549106	7497768	RO	6/6/05	scattered
549380	7497957	MM	3/6/05	scattered
549530	7497842	MM	3/6/05	scattered
549595	7497468	MM	3/6/05	scattered
549625	7497787	RO	6/6/05	scattered
549736	7497794	MM	3/6/05	scattered
550154	7497873	MM	3/6/05	scattered
550182	7497967	MM	3/6/05	scattered
551126	7497390	MM	3/6/05	scattered
551171	7497516	MM	3/6/05	scattered
552724	7497907	MM	3/6/05	scattered
552850	7497960	MM	3/6/05	scattered
554656	7498001	MM	4/6/05	scattered
555123	7498134	MM	4/6/05	scattered
555172	7498485	MM	4/6/05	scattered
555240	7498262	MM	4/6/05	scattered
555322	7498654	MM	4/6/05	scattered
555330	7498681	MM	4/6/05	scattered
555754	7498573	RO	6/6/05	scattered
555785	7498573			scattered
558270	7499110			scattered
561400	7498076			scattered
561465	7498030	MM	5/6/05	scattered
561595	7498525	MM	5/6/05	scattered

Records of **Melochia pyramidata* from the White Quartz Road corridor

Easting (WGS84)	Northing (WGS84)	Recorded by	Date	No. of Inds/Cover
538063	7496751	MM	1/6/05	scattered

Records of **Setaria verticillata* from the White Quartz Road corridor

Easting (WGS84)	Northing (WGS84)	Recorded by	Date	No. of Inds/Cover
532386	7499839	MM	31/5/05	scattered
549317	7497702			scattered
558270	7499110			scattered

Records of **Vachellia farnesiana* from the White Quartz Road corridor

Easting (WGS84)	Northing (WGS84)	Recorded by	Date	No. of Inds/Cover
563293	7498105	MM	5/6/05	scattered