

Native Vegetation Clearing Permit – Supporting Report

Flora, Vegetation and Fauna Habitat Assessment at
Southern Fortescue Borefield

17 May 2018

RTIO-HSE-0323877



Hamersley Iron Pty Limited

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Executive Summary

Rio Tinto, on behalf of Hamersley Iron Pty Limited, is proposing to drill and replace a number of monitoring and production bores at the Southern Fortescue Borefield. The study area is approximately 751 ha in size and was surveyed between 6 and 9 of March 2018 by Rio Tinto Botanists, Hayden Ajduk and Natalie Murdock.

A total of twelve vegetation units were described for the study area. One vegetation unit was described from the low hills and slopes one unit from gullies, three units from the drainage lines and seven units from the undulating plains.

None of the vegetation units occurring within the study area are listed as Threatened Ecological Communities under either the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* or under Western Australian listings. None of the vegetation units occurring within the study area are listed as Priority Ecological Communities.

A total of 245 taxa from 130 genera representing 45 families were recorded during the survey. The number of taxa recorded by the current study appears consistent with what was expected when compared with previous surveys in the Marandoo locality

No species of Threatened Flora were recorded during the study, or were expected to occur within the study area. Two species of Priority flora were recorded during the survey: *Aristida jerichoensis* subsp. *subspinulifera* (Priority 3) and *Goodenia nuda* (Priority 4). An additional Priority 3 species, *Rhagodia* sp. Hamersley (M. Trudgen 17794) has previously been recorded from in the study area but was not recorded during this survey.

The proposed works is unlikely to affect the conservation significance of the three Priority flora species recorded from the study area, due to their broad distributions across the Pilbara and the small scale of the study area.

A further seven priority listed species were considered to have 'Potential' to occur within the study area based on desktop and field observations. The timing and seasonal conditions during the survey were considered optimal for the detection of these taxa however several of the taxa are small cryptic annual species and may have been overlooked in the field.

It is unlikely the Proposal will negatively impact on the conservation status of any of these species on either a local or bioregional scale.

A total of six broad fauna habitat types were recorded within the study area: 'Mulga Plain'; 'Stony Plain'; 'Low Hill and Slope'; 'Minor Drainage Lines'; 'Creek Lines'; and 'Gully'. These fauna habitats are not considered to be restricted at a local or regional level.

Secondary evidence in the form of old and recently active mounds of the Priority 4 species *Pseudomys chapmani* (Western pebble mound mouse) were recorded within the study area. No active mounds were recorded during the survey.

A further conservation significant species, *Apus pacificus* (Fork-tailed Swift) was considered 'Likely' to occur within the study area based on desktop and field observations. The Fork-tailed Swift may forage in the study area as a part of a larger

range however it is not considered to be dependent on habitat within the study area due to its highly mobile and predominately aerial behaviour.

It is unlikely the Proposal will negatively impact on the conservation status of any of the Western pebble mound mouse or Fork-tailed Swift on either a local or bioregional scale.

The Proposal was assessed against the 10 clearing principles as defined in Schedule 5 (Principles for Clearing Native Vegetation) of the *Environmental Protection Act 1986*. Assessment against the Principles concluded clearing may be at variance with one of the clearing principles, *Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.*

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1. Introduction

1.1 Project background and study area location

Rio Tinto, on behalf of Hamersley Iron Pty Limited (the **Proponent**), is proposing to drill and replace a number of monitoring and production bores at the Southern Fortescue Borefield (the **Proposal**). Approval for clearing of native vegetation associated with the Proposal is required via a Native Vegetation Clearing Permit (**NVCP**) under Section 51A of the *Environmental Protection Act 1986* (**EP Act**).

Vegetation, flora and fauna assessments at Southern Fortescue Borefield (the **study area**) were required to address the 10 Clearing Principles as part of the NVCP application process.

The study area covers approximately 751 ha of partially disturbed ground and intact native vegetation and is located approximately 30 km northeast of Tom Price, within the Pilbara region of Western Australia (**WA**) (Figure 1-1).

1.2 Scope of survey

This report describes the methodology employed for the flora, vegetation and fauna habitat assessment of the study area, and documents the results of the survey. In particular, this report identifies vegetation, flora and fauna habitats of conservation significance relevant to the study area.

This report is intended as a supporting document for an NVCP application by Rio Tinto and has been prepared based on a review of existing information for the study area, combined with a site field survey. A summary of key information pertaining to the survey is provided in Table 1-1.

Table 1-1: Summary of key information for flora, vegetation and fauna

Author	Survey / investigation name	Study area, survey type and timing	Study standard guidance and limitations
Mattiske (1992)	Flora and Vegetation: Marandoo Project Area	Quadrats May, June, August, and September 1991	-
Biota (2008a)	Marandoo Mine Phase 2 Project Vegetation and Flora Survey	2,540 ha Quadrats and Relevés March and May 2008	EPA Guidance Statement No. 51 (EPA 2004a)
Biota (2008b)	Marandoo Mine Phase 2 Seasonal Fauna Survey	5,000 ha Trapping March, April and November 2007	EPA Guidance Statement No. 56 (EPA 2004b)
Biota (2011)	A single Phase Fauna Survey of the Southern Fortescue Borefield	706 ha Trapping May 2011	EPA Guidance Statement No. 56 (EPA 2004b) EPA Guidance Statement No. 20
Rio Tinto (2011)	Flora and Vegetation Assessment of the Southern Fortescue Borefields	132 ha Relevés June 2011	EPA Guidance Statement No. 51 (EPA 2004a)

This report includes a description of the:

- Local environment of the study area including flora, vegetation, fauna habitats, geology, landforms, and hydrology;
- Methods employed during the field survey;
- Locations and populations of conservation listed flora, including photographs and mapping;
- Vegetation associations occurring in the study area, an assessment on their condition and conservation significance for the locality and sub-region, including mapping;
- Fauna habitats present, assessment of their significance for the locality and sub-region, including mapping; and
- Potential impacts of the Proposal on the local environment through application of the 10 clearing principles, as outlined in Schedule 5 of the EP Act.

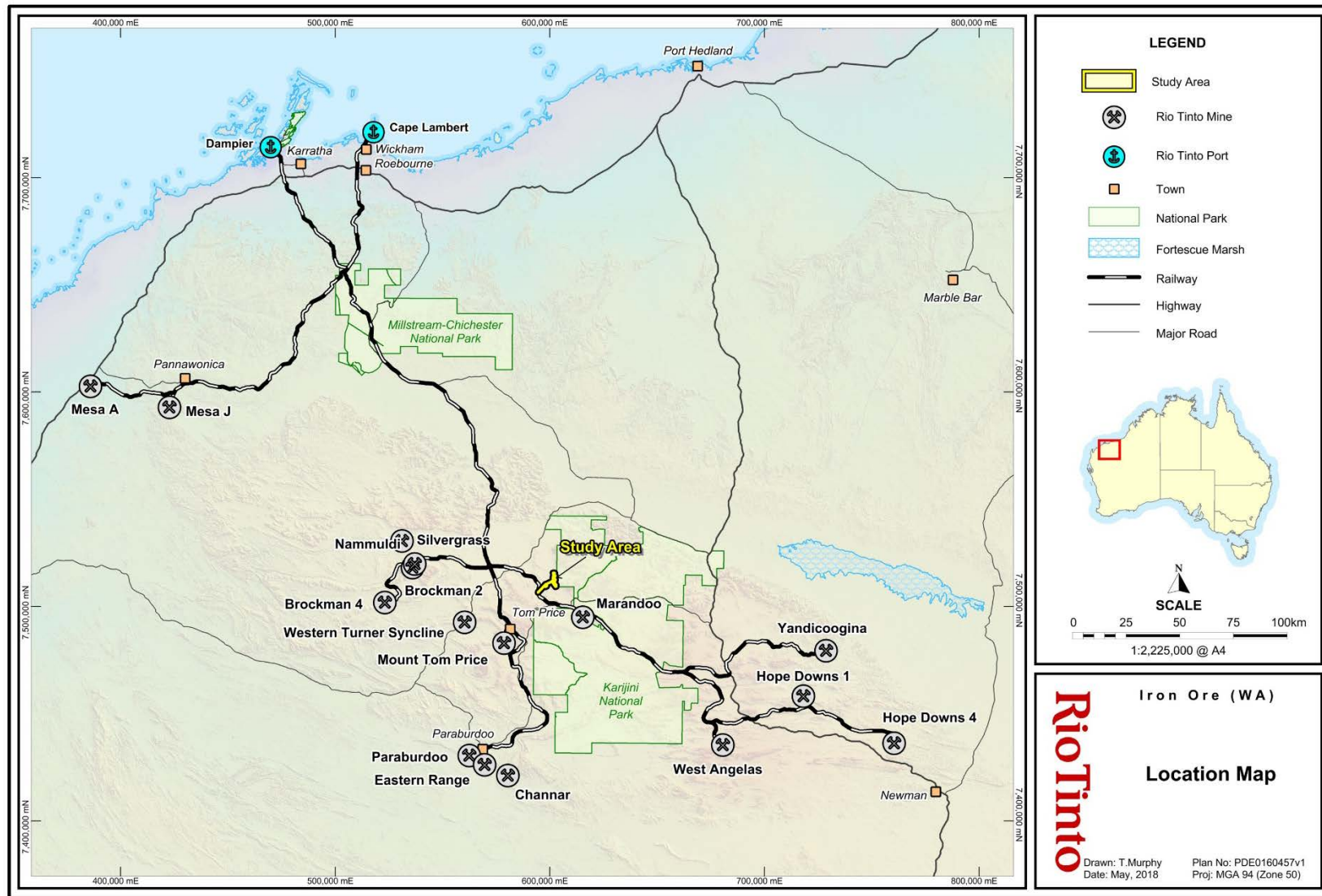


Figure 1-1: Location of the study area

1.3 Limitations

Limitations of the current survey of the study area are summarised in Table 1-2.

Table 1-2: Constraints and limitations of the current study

Constraint	Limitation
Sources of information	The Pilbara bioregion has been relatively well surveyed, with increasing biological survey work occurring due to the resource expansion in the region. Numerous flora and fauna surveys have been conducted in the wider region and many within the Marandoo locality. Therefore, a suitable number of survey reports were available for contextual information. Sources of information were not considered a limitation in this assessment.
Scope of works	The survey requirements of a targeted terrestrial flora, vegetation and fauna survey for a NVCP application were met. No quadrat sampling or fauna trapping was undertaken, however, relevés were undertaken to record the vegetation associations in addition to foot traverses of the study area.
Completeness of survey	The study area was fully surveyed to the satisfaction of an equivalent reconnaissance survey. No additional surveys were deemed necessary for the purpose of this assessment. Fungi and non-vascular flora (algae, mosses and liverworts) were not sampled.
Intensity of survey	The study area was surveyed by targeted traverses on foot. Habitats with potential to support conservation listed species were searched. All vegetation and fauna habitat types were inspected.
Timing, weather, season, cycle	The survey was conducted during March 2018. Conditions encountered during the survey were regarded as optimal, with above average rainfall in the preceding three months. It is likely most annual species would have been present at the time of survey.
Disturbances	The study area was predominately disturbed with existing bore infrastructure, tracks and cattle grazing. Some minor sections of the study area had recently been burnt however the majority of the study area had an old fire age.
Resources	The biologists undertaking the surveys and subsequent reports as part of the studies were suitably qualified to identify flora and fauna. Hayden Ajduk (field studies and report writing) has more than eight years of experience as a botanist/biologist in Western Australia, with significant experience working in the Pilbara. Natalie Murdock, (field studies) has more than ten years of experience as a botanist in Western Australia, with significant experience working in the Pilbara. Steven Dillon, from the Western Australian Herbarium, completed the plant specimen identifications. There were no limitations noted in reports cited in the desktop assessment due to resourcing.
Accessibility / remoteness	The study area was accessed by vehicle and on foot. The study area was adequately traversed on foot. No parts of the study area were inaccessible.

1.4 Climate

The closest Bureau of Meteorology (**BoM**) weather station providing long term climate data is Wittenoom (5026), located approximately 45 km to the north east of the study area. Rainfall and temperature data from the Wittenoom is presented in Figure 1-22 (BoM 2018).

The regional climate is semi-arid to semi-tropical with a summer rainfall season and relatively dry winter season, which varies in frequency and volume from year to year. The summer wet months extend from November to April when temperatures can exceed 47°C. The remainder of the year is moderate to warm with a continental effect resulting in low minimum temperatures, below 10°C, in June and July. The closest data for Pan evaporation rates are in Port Hedland, which averages 3,500 mm per annum (Luke *et al.* 1987), exceeding annual rainfall averages.

Annual rainfall is variable with tropical lows producing large regional rainfall events (between 100 mm and 200 mm in a few days) to isolated thunderstorm events in the dry (winter) season. For Wittenoom the mean annual rainfall for the period 1951 to 2018 is 462.3 mm, with most precipitation occurring between January and March, coinciding with the cyclone season. Wittenoom received significant rainfall in the three months preceding the survey (Figure 1-2).

Maximum temperatures reflected a warm summer to winter period (BoM 2018). Temperatures recorded preceding the survey were within expected ranges and generally followed mean maximum temperatures (Figure 1-2).

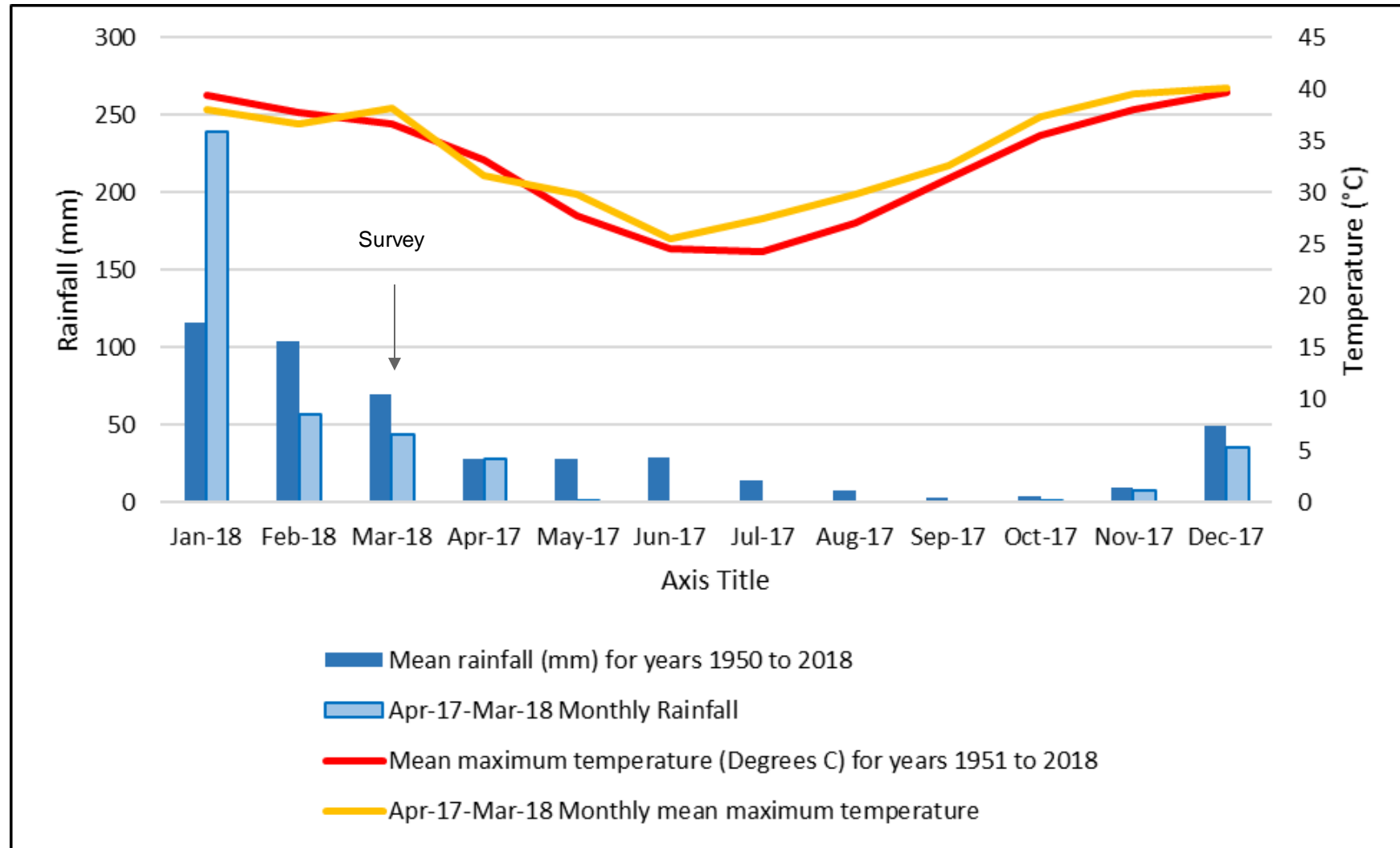


Figure 1-2: Rainfall and Temperatures at Wittenoom, April 2017 – March 2018

1.5 Geology and soils

The study area was comprised of four major geological units based on 1:250,000 scale map series (Figure 1-3). These geological units were:

- Qw: Alluvium and colluvium - red-brown sandy and clayey soil;
- Czc: Eluvium. Residual deposits of boulders and cobbled in clay; gilgais;
- AHm: Marra Mamba Formation-Chert, ferruginous chert and banded iron with minor shale; jaspilite with pronounced 'pinch and swell' structures, small occurrences of manganese; and
- Qa: Alluvium - unconsolidated silt, sand, aeolian sand, red loamy sand in drifts and fixed self dunes and gravel.

1.6 Surface hydrology and groundwater

The study area lies within the Southern Fortescue River catchment basin and the Southern Fortescue Water Reserve (DWER 2018c). The study area contains two unnamed major creek lines and numerous small, minor ephemeral drainage lines, likely to flow after significant rainfall. No major rivers intersect the study area.

1.7 Land systems

Land system (rangeland) mapping is based on regional patterns in topography, soils and vegetation (Christian and Stewart 1953). The most recent land system mapping of the Pilbara bioregion, in which the study area lies, was completed by van Vreeswyk *et al.* (2004). The mapping classifies the Pilbara region into 102 land systems.

The study area is located within four of the 102 Land Systems described for the Pilbara Bioregion by van Vreeswyk *et al.* (2004) and Payne *et al.* (1988). The Land Systems and their extent within the study area are presented below in Table 1-3 and Figure 1-4.

- Boolgeeda Land System - Stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands or mulga shrublands;
- Jurrawarrina Land System - Hardpan plains and alluvial tracts supporting mulga shrublands with tussock and spinifex grasses;
- Newman Land System - Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands; and
- Parburdoo Land System - Basalt derived stony gilgai plains and stony plains supporting snakewood and mulga shrublands with spinifex, chenopods and tussock grasses.

Table 1-3: Land Systems occurring within the study area and their representation in the Pilbara bioregion

Land System (Map code)	Total area (ha) in Pilbara bioregion	Area (ha) in study area	Proportion (%) of study area	Study area proportion (%) of land system extent
Boolgeeda (BGD)	774,800	646.3	86	0.08
Jurrawarrina (JUR)	66,400	17.1	2	0.03

Newman (NEW)	1,458,000	72.5	10	0.005
Paraburdoo (PAR)	56,500	15.3	2	0.03

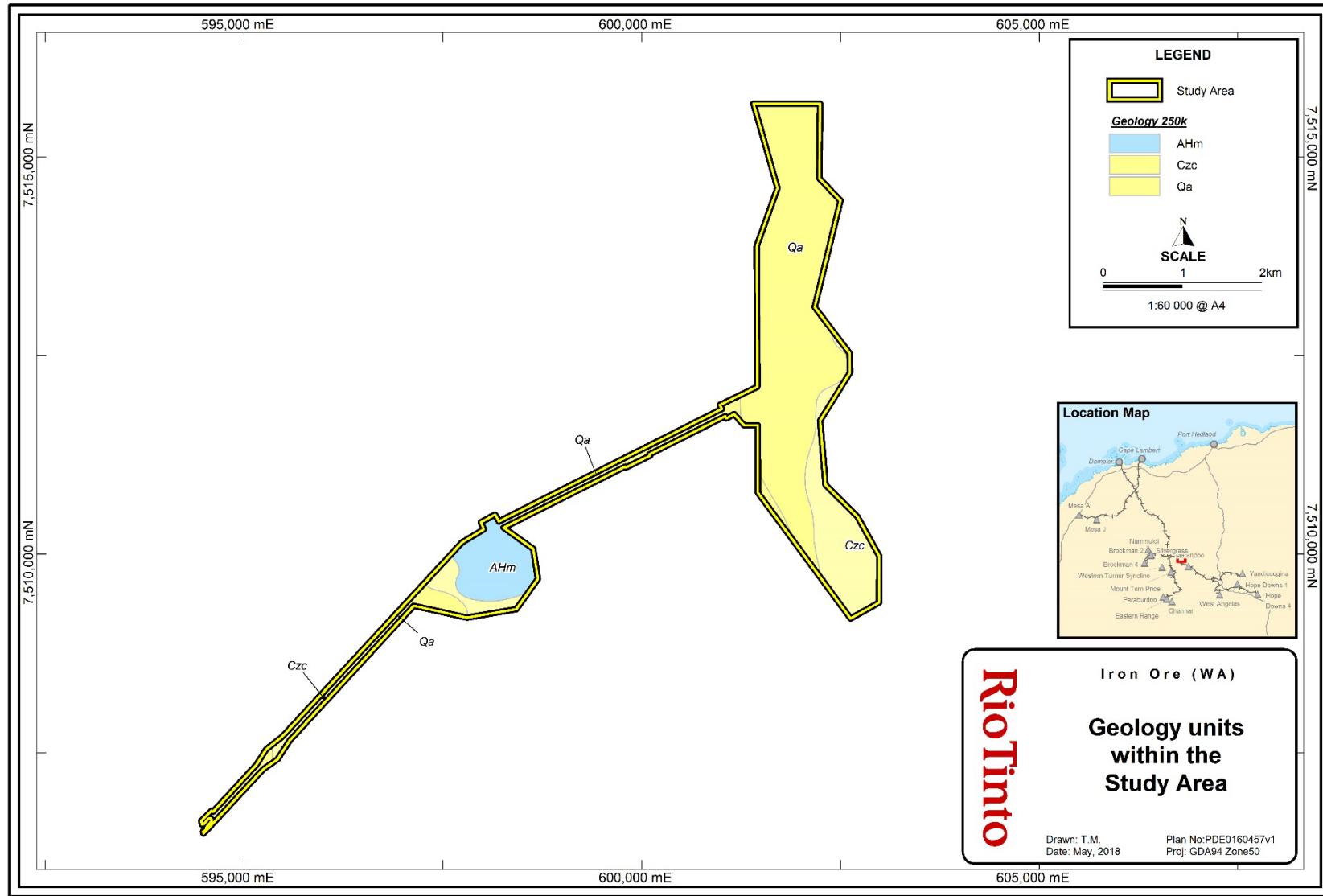


Figure 1-3: Geology within the study area

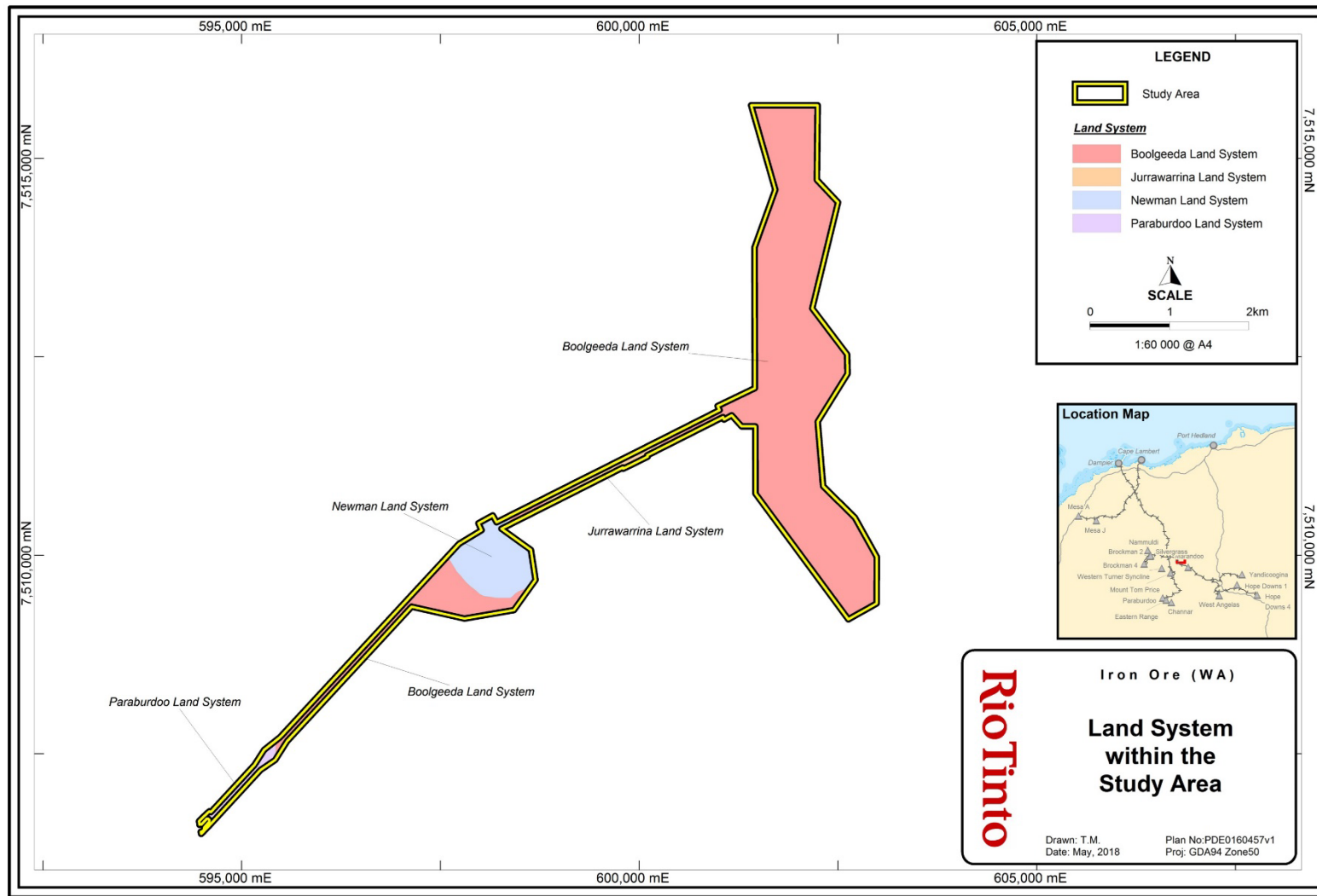


Figure 1-4: Land systems within the study area

1.8 Vegetation

1.8.1 IBRA bioregions and subregions

The Interim Biogeographic Regionalisation of Australia (**IBRA7**) recognises 89 bioregions (DotEE 2018a). The study area is located in the Pilbara (**PIL**) bioregion as defined by IBRA. The Pilbara bioregion has been further subdivided into four subregions: Chichester (**PIL1**); Fortescue Plains (**PIL2**); Hamersley (**PIL3**); and Roebourne (**PIL4**).

The study area falls within the Hamersley sub-region and is described by Kendrick (2001) 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. The climate is Semi-desert tropical, average 300 mm rainfall, usually in summer cyclonic or thunderstorm events. Winter rain is not uncommon. Drainage into either the Fortescue (to the north), the Ashburton to the south, or the Robe to the west.'*

1.8.2 Beard's regional vegetation mapping

Vegetation type and extent has been mapped at a regional scale by Beard (1975), who categorised vegetation into broad vegetation associations. Based on this mapping at a scale of 1:1,000,000, the Department of Agriculture and Food WA (**DAFWA**) has compiled a list of vegetation extent and types across WA (Shepherd *et al.* 2002). The study area falls within the three vegetation associations mapped by Beard (Figure 1-5):

- Hamersley 18 (a1Li) - Low woodland; mulga (*Acacia aneura*);
- Hamersley 29 a1Lp) - Sparse low woodland; mulga, discontinuous in scattered groups; and
- Hamersley 82 (e16Lr t3Hi) - Hummock grasslands, low tree steppe; snappy gum over *Triodia wiseana*.

Given the broad nature of Beard's mapping; these vegetation associations are only broadly applicable to the vegetation types occurring in the study area.

1.8.3 Pre-European vegetation extent

The pre-European and current extent of native vegetation associations in Western Australia has been interpreted by Shepherd *et al.* (2002) using data from Beard's (1975) regional vegetation mapping and other vegetation mapping, as well as satellite imagery and orthophoto interpretation.

Shepherd *et al.* (2002) identified the Pilbara bioregion as having largely intact native vegetation owing to the lack of intensive agricultural land use practices. Although the native vegetation remains widespread and largely intact, the floristic composition and structural characteristics have almost certainly changed since European settlement by grazing and altered fire regimes (Shepherd *et al.* 2002).

Table 1-4 and Figure 1-5 present the pre-European and current extent of the three Beard mapping units across their range, as well as their extent in the study area.

Table 1-4: Beard's mapping unit occurring within the study area, its current and pre-European extent within the Pilbara bioregion and its extent across the study area

Beard's mapping unit (Shepherd vegetation association)	Pre-European extent (ha)[^]	Current extent (ha)[^]	Extent (ha) within study area / (Proportion of current extent)
Hamersley 18	676,556.7	672,424	499.40(0.07)
Hamersley 29	1,133,219.8	1,132,939.2	123.03 (0.01)
Hamersley 82	2,563,583.2	2,550,899.0	128.74 (0.005)

[^]Government of Western Australia (2017)

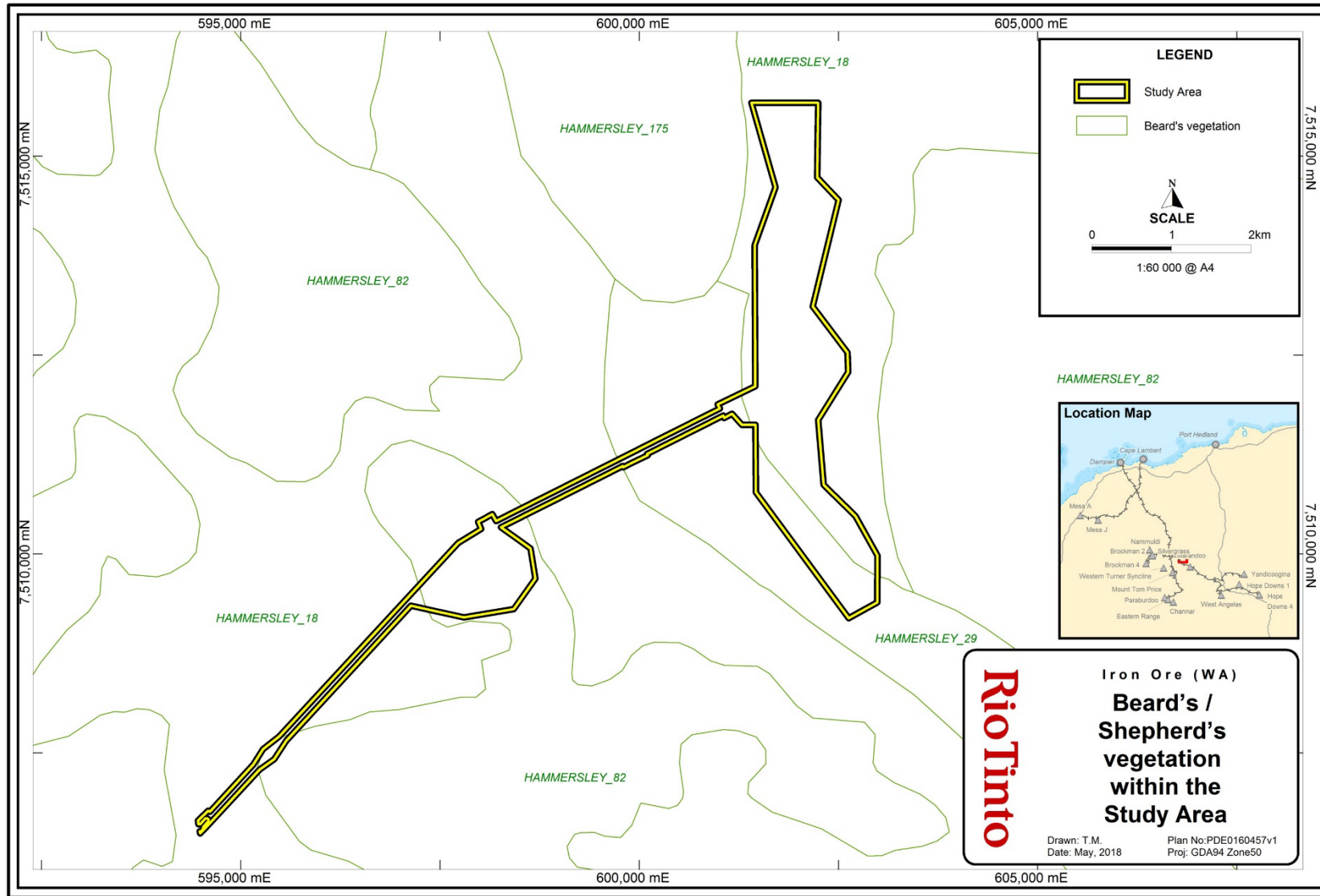


Figure 1-5: Beard's / Shepherd's vegetation associations in proximity to the study area

1.9 Conservation areas and environmentally sensitive areas

Environmentally Sensitive Areas (**ESAs**) are defined in the *Environmental Protection (Environmentally Sensitive Areas) Notice 2005* under section 51B of the WA State EP Act. ESAs include areas declared as: World Heritage; included on the Register of the National Estate; defined wetlands; vegetation containing rare (Threatened) flora; Threatened Ecological Communities (**TEC**); and Bush Forever sites.

The western boundary of Karijini National Park and the Hamersley Range National Park (1977 boundary) lies outside, in close proximity to a small section of the study area. This area was listed on the Register of the National Estate (RNE) for its natural heritage values (DWER 2018b). While this is no longer the current name for the existing Karijini National Park, it is still classified as an ESA, as are all items that were on the RNE at the time the current ESA notice was gazetted on 8 April 2005 (DWER 2018b). The Proposal is not expected to impact the environmental values of Karijini National Park or the RNE area.

No TECs have been recorded within 20 km of the study area. The Proposal is not expected to impact the environmental values of any TECs.

1.10 Priority ecological communities

Priority Ecological Communities (**PECs**) are possible TECs that do not meet survey criteria or are not adequately defined for the TEC list by the Department of Biodiversity, Conservation and Attractions (**DBCA**), and are ranked as Priorities 1, 2 and 3 (1 being the highest).

The nearest PEC to the study area was the '*Brockman Iron cracking clay communities of the Hamersley Range*'. The boundary of this Priority 3 Ecological Community is located 3.3 km to the west of the study area (Figure 1-6). The Proposal is not expected to impact the environmental values of this PEC, or any others.

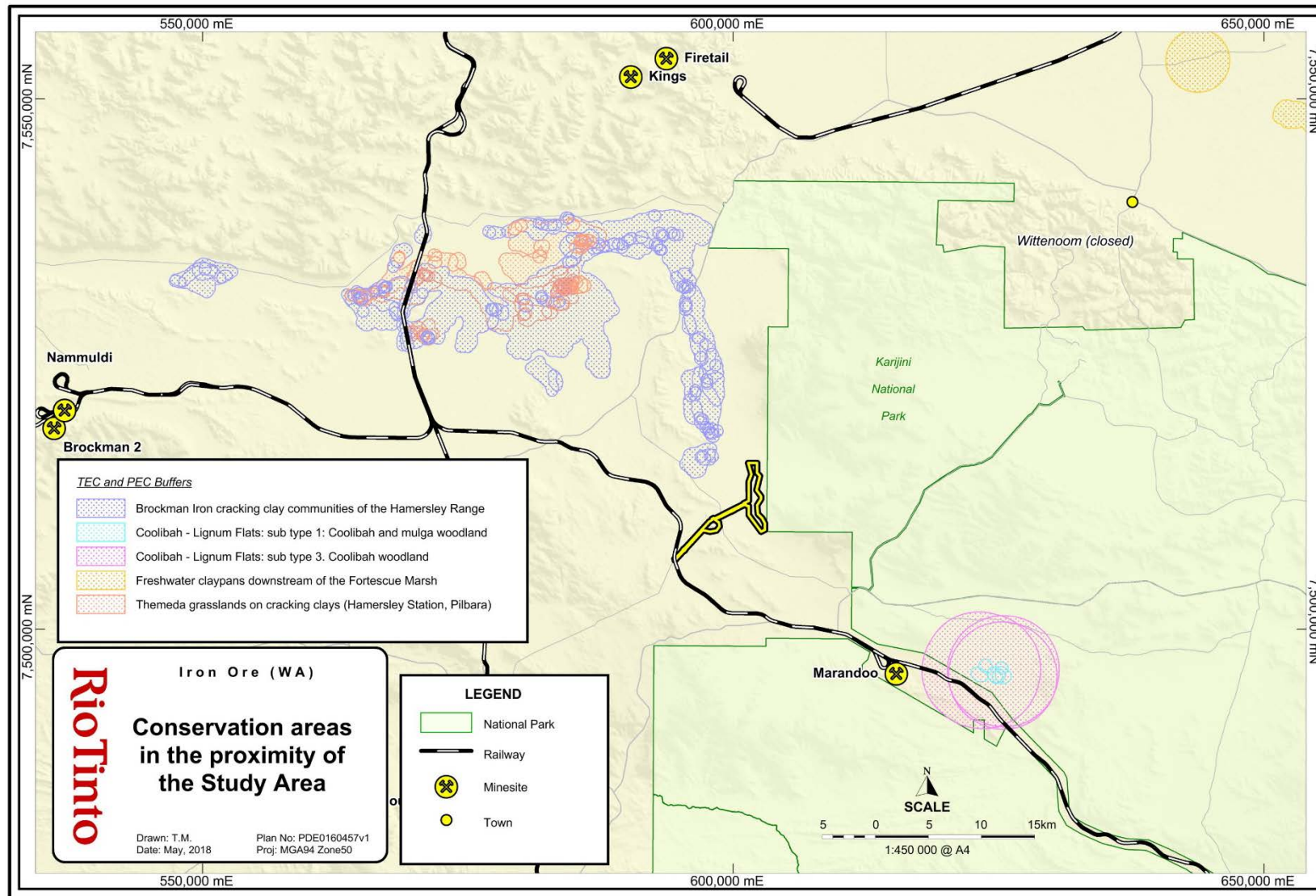


Figure 1-6: Conservation areas in proximity to the study area

2. Methodology

2.1 Literature review

Early systematic flora survey work in the Pilbara bioregion was undertaken by Burbidge (1959) and Beard (1975). These surveys involved the mapping of broad floristic formations and vegetation associations across the bioregion. More recently, DAFWA conducted a regional inventory of flora, vegetation, vegetation condition, and land resources of the bioregion (van Vreeswyk *et al.* 2004). In addition, DBCA undertook a comprehensive regional survey of the Pilbara (DEC 2011) which included counting, sampling, documenting, and mapping the way plant communities are distributed in relation to soil, climate, landforms and geology within the Pilbara.

Over recent decades there has been an expansion of resource development projects occurring within the Pilbara. As a result, there has been an increase in site-specific ecological surveys to fulfil the statutory requirements of the EP Act, the State *Wildlife Conservation Act 1950 (WC Act)*, and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*.

Numerous flora, vegetation and fauna surveys have previously been conducted within and surrounding the study area (Figure 2-1 and Figure 2-2). The findings of these surveys, in addition to the database searches, form the desktop study to determine conservation significant species that are known to, or may occur within the study area, as well as the flora, vegetation associations, ecosystems and fauna habitats.

2.1.1 Flora and vegetation

Three previous flora and vegetation surveys have been utilised as part of this flora and vegetation desktop assessment: Matiske (1992), Biota (2008a) and Rio Tinto (2011).

These reports have been consulted as part of the literature review to determine conservation significant species that may occur within the study area, as well as flora, vegetation units and ecosystems. A summary of the findings of each report primarily used in the desktop review is presented in Table 2-1.

A review of additional published and unpublished reports of relevance to the area was also conducted prior to completing the survey and report. These reports comprised mostly regional scale reports such as the Department of Agriculture Land Systems mapping (van Vreeswyk *et al.* 2004).

2.1.2 Fauna and fauna habitat

Two previous fauna survey report was utilised as part of the fauna desktop assessment: Biota (2008b) and Biota (2011).

These report were reviewed as part of the literature review to determine conservation significant species that may occur within the study area and fauna habitats. A summary of the findings is presented in Table 2-2.

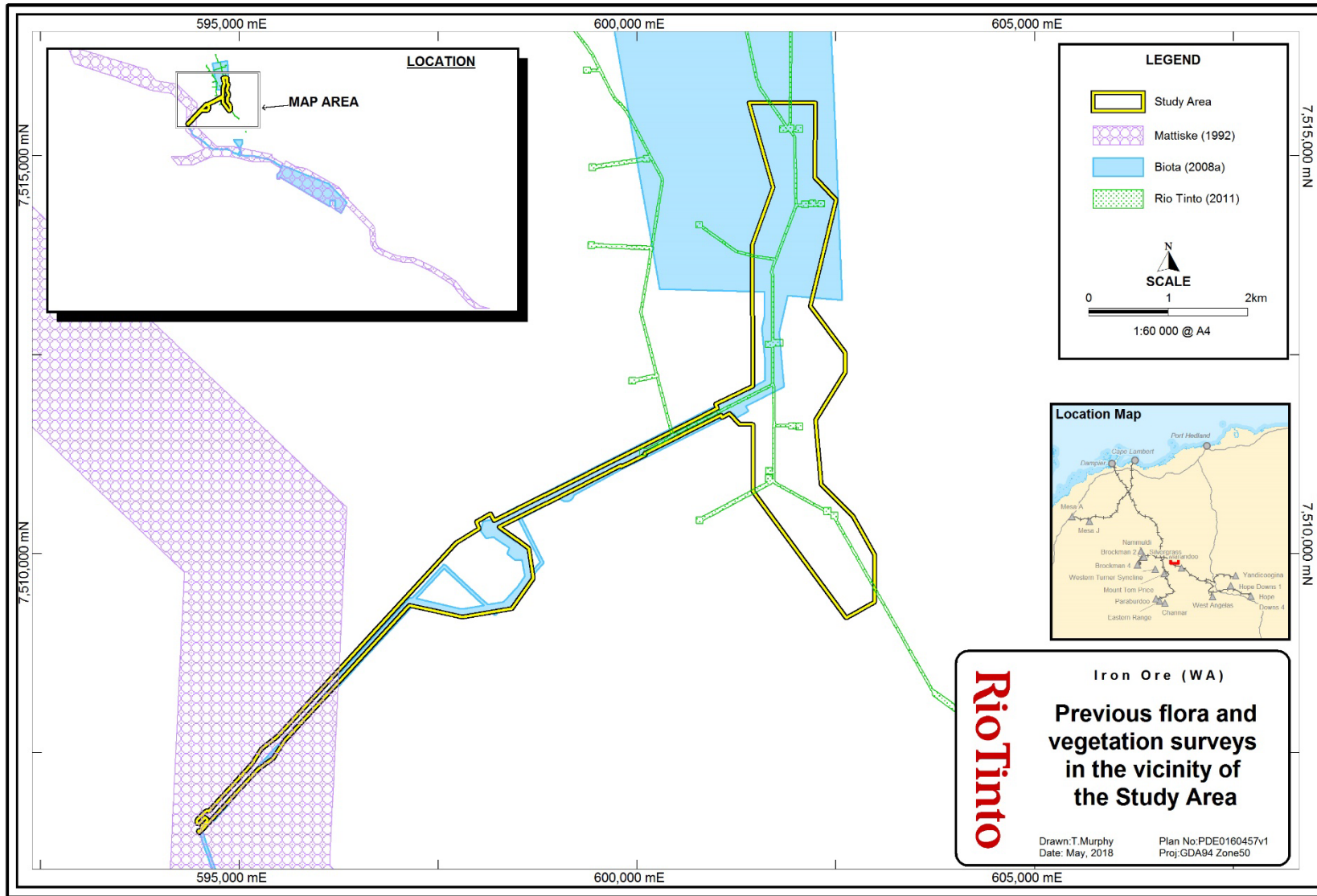


Figure 2-1: Previous flora and vegetation surveys in the vicinity of the study area

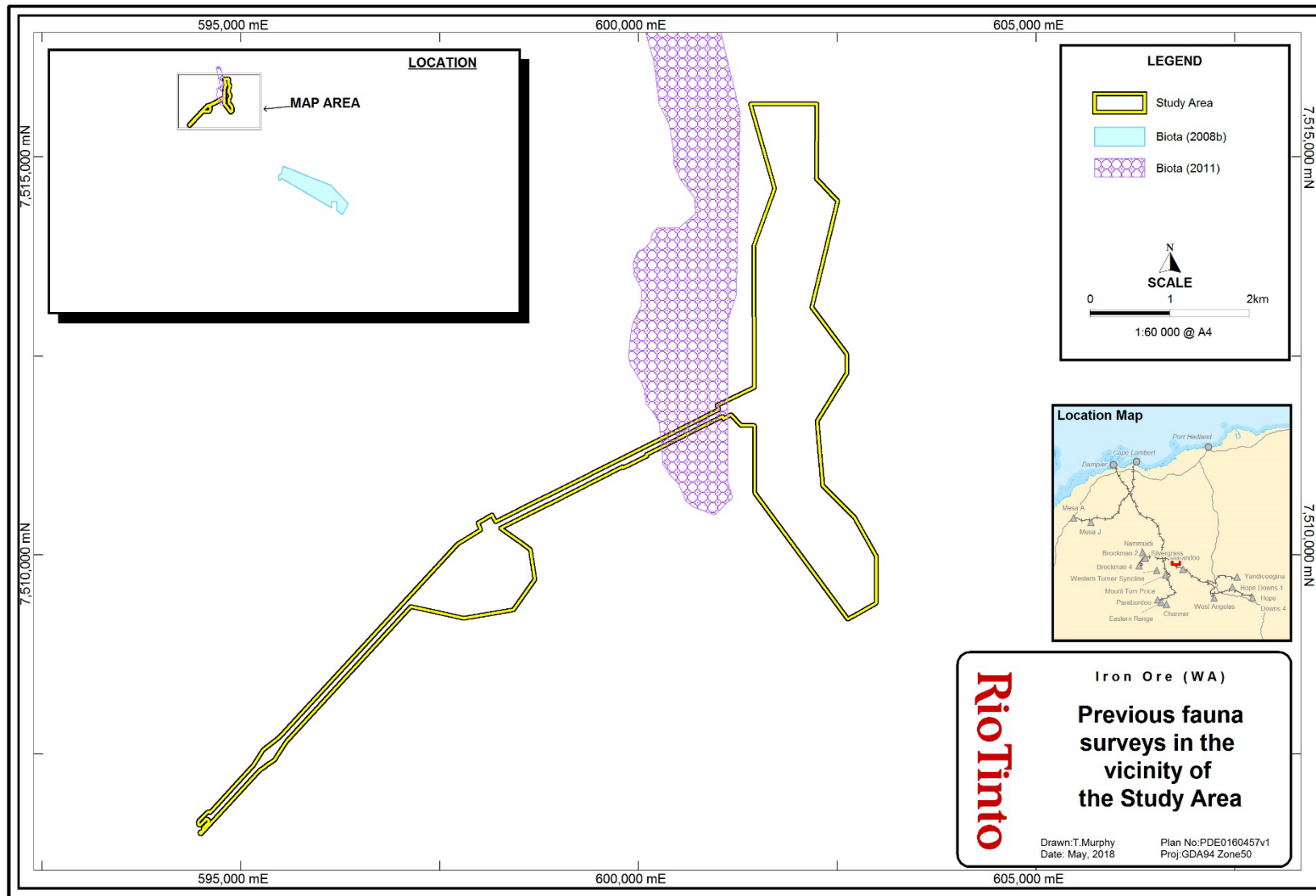


Figure 2-2: Previous fauna surveys in the vicinity of the study area

Table 2-1: Summary of previous flora and vegetation reports utilised for the desktop assessment

Report and level of survey	Size (ha)	Number of taxa	Conservation listed flora	Weeds	Vegetation of significance
Mattiske (1992), Flora and Vegetation: Marandoo Project Area	-	462	<i>Dicladanthera glabra</i> (P2) <i>Eremophila magnifica</i> subsp. <i>magnifica</i> (P4) <i>Eremophila magnifica</i> subsp. <i>velutina</i> (P3) <i>Olearia mucronata</i> (P3) <i>Acacia dawweana</i> (P3) <i>Acacia effusa</i> (P3)	-	No TECs or PECs
Biota (2008a), Marandoo Mine Phase 2 Project Vegetation and Flora Survey	2,540 ha	537	<i>Calotis latiuscula</i> (P3) <i>Goodenia lyrata</i> (P3) <i>Josephinia</i> sp. Marandoo (M.E. Trudgen 1554) (P1) <i>Rhagodia</i> sp. Hamersley (M. Trudgen 17794) (P3) <i>Indigofera ixocarpa</i> (P2) <i>Eremophila magnifica</i> subsp. <i>magnifica</i> (P4)	* <i>Bidens bipinnata</i> , * <i>Sigesbeckia orientalis</i> , * <i>Sonchus oleraceus</i> , * <i>Bassia scoparia</i> , * <i>Cucumis melo</i> subsp. <i>Agrestis</i> , * <i>Euphorbia hirta</i> , * <i>Euphorbia peplus</i> , * <i>Malvastrum americanum</i> , * <i>Vachellia farnesiana</i> , * <i>Bougainvillea</i> sp., * <i>Cenchrus ciliaris</i> , * <i>Cenchrus setiger</i> , * <i>Chloris virgata</i> , * <i>Cynodon dactylon</i> , * <i>Echinochloa colona</i> , * <i>Setaria verticillata</i> , * <i>Acetosa vesicaria</i> , * <i>Datura leichhardtii</i> , * <i>Solanum nigrum</i>	No TECs or PECs
Rio Tinto (2011), Flora and Vegetation Assessment of the Southern Fortescue Borefields	132 ha	185	<i>Calotis latiuscula</i> (P3) <i>Goodenia nuda</i> (P4)	* <i>Bidens bipinnata</i> , * <i>Cenchrus ciliaris</i> , * <i>Cenchrus setiger</i> , * <i>Citrullus lanatus</i> , * <i>Datura leichhardtii</i> , * <i>Echinochloa colona</i> , * <i>Flaveria trinervia</i> , * <i>Malvastrum americanum</i> , * <i>Sigesbeckia orientalis</i> , * <i>Solanum nigrum</i> , * <i>Vachellia farnesiana</i>	No TECs or PECs

Table 2-2: Summary of previous fauna habitat reports utilised for the desktop assessment

Report and level of survey	Size (ha)	Number of taxa	Conservation listed fauna	Fauna habitat	Fauna habitat of significance
Biota (2008b), Marandoo Mine Phase 2 Seasonal Fauna Survey	5,000	Herpetofauna 51 Avifauna 47 Bats 7 Non-volant Mammals 13	Northern Quoll (<i>Dasyurus hallucatus</i>) (T) Western Pebble-mound mouse (<i>Pseudomys chapmani</i>) (P4) Ghost Bat (<i>Macroderma gigas</i>) (T)	Small drainage line Stony hillslope Flat outwash plains Rocky gorges	None recorded
Biota (2011) A single Phase Fauna Survey of the Southern Fortescue Borefield	706	Herpetofauna 24 Avifauna 33 Bats 4 Non-volant Mammals 4	None Recorded	Plain – <i>Acacia</i> spp. Shrubland over <i>Triodia</i> sp. Hummock Plain – <i>Acacia aneura</i> (mulga) trees over <i>Themeda</i> sp. Grassland Plain – <i>Acacia aneura</i> (mulga) trees over <i>Acacia</i> spp. Shrubland over <i>Triodia</i> sp. hummock	None recorded