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GOLDEN WEST RESOURCES LIMITED

WILUNA WEST IRON ORE PROJECT

SUPPLEMENT TO EPA REFERRAL DOCUMENT

Document produced to support the referral of this proposal to the Environmental Protection Authority (EPA) under Section 38(1) of the Environmental Protection Act 1986

Prepared for: ***Golden West Resources Limited***

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EXECUTIVE SUMMARY

Golden West Resources Limited ('GWR') proposes to develop an Iron Ore mining operation at Wiluna West. The Wiluna West Project ('Project) is 100% owned and managed by GWR, with the exception of Mining Lease 53/1078 and Exploration Licence 53/1089. GWR has a Joint Venture agreement with the owners of these tenements, Jindalee Resources with GWR having an 80% holding and Jindalee Resources having a 20% holding. The Project comprises 170 km² of tenements covering a 45 km strike of the Joyners Find Greenstone belt.

The Project is located approximately 700 kilometres northeast of Perth and 40 kilometres southwest of Wiluna in the north-eastern Goldfields of Western Australia.

This document has been produced to accompany the Environmental Protection Authority (EPA) referral form under Section 38(1) of the Environmental Protection Act 1986 to assist the EPA in determining the level of assessment for this project.

A summary of the main elements of the proposed Project is provided in the following table.

ELEMENT	DESCRIPTION
Life of Project	15 years
Size of Ore body	130 Mt
Mining method	Open pit
Mine operation	Continuous
Depth of pits	50 – 160 m
Depth to water table	30 – 60 m
Total area of disturbance	2600 ha (maximum)
Ore mining rate (peak)	10 Mtpa
Total waste rock	600 Mt
Dewatering rate (approximate)	0.5-1.0 GL/year
Power generation	Diesel powered generator plants
Fuel supply	Diesel (possible natural gas conversion)
Operating hours	24hrs per day, 7 days per week
Construction	2 years
Construction commencement (anticipated)	2013

A summary of the potential environmental impacts and the environmental management measures proposed to mitigate those impacts are provided in the following table.

SUMMARY OF ENVIRONMENTAL IMPACTS

ASPECT	PROJECT COMPONENT	POTENTIAL ENVIRONMENTAL IMPACT	ENVIRONMENTAL MANAGEMENT
Conservation of biodiversity	▪ Project is within the Eastern Murchison IBRA subregion. ▪ Project located within Wiluna West Priority Ecological Community (PEC) ▪ 2600 ha (max) of native vegetation clearing. ▪ 14 Priority species recorded in the project area: o *Beyeria lapidicola* (P1) o *Eremophila ?anomala* (P1) o *Eremophila congesta* (P1) o *Ptilotus chrysocomus* (P1) o *Calytrix uncinata* (P3) o *Eremophila arachnoides subsp. arachnoides* (P3) o *Homalocalyx echinulatus* (P3) o *Maireana prosthecochaeta* (P3) o *Olearia mucronata* (P3) o *Prostanthera ferricola* (P3) o *Ptilotus luteolus (P3)* o *Sauropus ramosissimus* (P3) o *Sida picklesiana* (P3) o *Tribulus adelacanthus (P3)* ▪ No TEC listed within the project area	▪ Adverse impact on flora species of conservation significance ▪ Adverse impacts on significant vegetation communities	▪ Rehabilitation of disturbed areas ▪ Avoid areas where known Priority Flora occur as much as practicable. ▪ Limit clearing to only that required. ▪ During the site induction, employees and contractors will be made aware of the location of the Priority flora in the surrounding areas and the importance of not disturbing these habitats.
Landform	▪ Excavation of open pits ▪ Construction of waste dumps and associated infrastructure ▪ Construction of mine infrastructure	▪ Temporary and permanent changes to landforms from mining operations ▪ Increased ponding through alteration in topography that increase retention of rainwater and runoff ▪ Impacts to drainage	▪ A project soils and landform survey will be completed. ▪ Minimise the disturbance footprint ▪ Progressive rehabilitation of landforms

ASPECT	PROJECT COMPONENT	POTENTIAL ENVIRONMENTAL IMPACT	ENVIRONMENTAL MANAGEMENT
Soils	▪ Construction of open pits and waste dumps. ▪ Construction of crushing and screening plant and associated mine infrastructure	▪ Increased soil erosion due to clearing activities ▪ Changes in soil structure ▪ Reduced viability of seeds due to inappropriate stockpiling activities	▪ A project soils and landform survey will be completed. ▪ Stripping of all available vegetation and topsoil and stockpiling for use in rehabilitation works. ▪ Minimisation of clearing to only that required.
Groundwater	▪ Dewatering of the pits will be via in-pit sumps and used for dust suppression and in the processing plant. ▪ Additional water supply for the project is expected to be sourced from the mining leases.	▪ Contamination of groundwater from chemical or hydrocarbon spills ▪ Drawdown of aquifer	▪ All chemicals and hydrocarbons will be stored in constructed areas (bunded) in accordance with the relevant Australian Standards and DMP/DEC guidelines. ▪ Ongoing water investigation studies to determine quantities of water for dewatering and mine uses. ▪
Surface hydrology	▪ Storm water runoff from crushing and screening plant ▪ Alteration to surface flows by project structures.	▪ Alteration of natural drainage. ▪ Stormwater from waste dumps, ROM, fines stockpile, wash down bay and workshops flowing into surrounding environment ▪ Contamination of groundwater from chemical or hydrocarbon spills	▪ All hydrocarbons and chemicals will be stored in adequately bunded facilities ▪ Sites with the potential to have contaminated runoff will be designed to collect and store surface runoff and stormwater so that each site is a closed runoff system
Vegetation and Flora	▪ 2600ha of native vegetation clearing ▪ 29 vegetation groups were recorded during the flora survey ▪ 14 Priority species recorded in the project area: o *Beyeria lapidicola* (P1) o *Eremophila ?anomala* (P1) o *Eremophila congesta* (P1) o *Ptilotus chrysocomus* (P1) o *Calytrix uncinata* (P3) o *Eremophila arachnoides subsp. arachnoides* (P3) o *Homalocalyx echinulatus* (P3) o *Maireana prosthecochaeta* (P3)	▪ Fragmentation of vegetation communities ▪ Removal of or Priority flora ▪ Disturbance to threatened flora communities ▪ Dust deposition on surrounding vegetation resulting from clearing of vegetation ▪ Spread of weeds through soil and vehicle movements	▪ No DRF have been recorded in the project area ▪ Progressive rehabilitation will be undertaken when areas become available • Water trucks will be used on an as required basis to reduce dust generation. • Weed hygiene measures will be implemented • Protection of Priority species whenever and wherever possible. • Approval from Director General of DEC prior to removal/destruction of any Priority species.

ASPECT	PROJECT COMPONENT	POTENTIAL ENVIRONMENTAL IMPACT	ENVIRONMENTAL MANAGEMENT
	o *Olearia mucronata* (P3) o *Prostanthera ferricola* (P3) o *Ptilotus luteolus (P3)* o *Sauropus ramosissimus* (P3) o *Sida picklesiana* o *Tribulus adelacanthus (P3)* ▪ Wiluna West PEC consists of six plant communities. ▪ Six weed species recorded – these species not listed as 'Declared Weeds' by Department of Agriculture & Food		• During the site induction, employees and contractors will be made aware of the location of the Priority flora in the surrounding areas and the importance of not disturbing these communities.
Terrestrial fauna	▪ Clearing of fauna habitat for the mine and associated infrastructure ▪ Seven fauna species of conservation significance were recorded during the spring surveys (2005/06/07/11): ▪ Mulgara (*Dasycercus cristicauda)* ▪ Long-tailed Dunnart (*Sminthopsis longicaudata*). ▪ Malleefowl (*Leipoa ocellata)* ▪ Australian Bustard (*Ardeotis australis*) ▪ Peregrine Falcon (*Falco peregrinus*) ▪ White-browed Babbler (*Pomatostomus superciliosus*) ▪ Crested Bellbird (*Oreoica gutturalis*) ▪ In addition, eleven species of conservation significance have the potential to occur at the project area.	▪ Loss of fauna habitat ▪ Loss of fauna of conservation significance ▪ Road kills ▪ Increase in feral animals due to mine development	▪ Fauna habitat not restricted to the project area. ▪ Targeted malleefowl mound surveys completed. Five active mounds recorded - two located in proposed disturbance area. ▪ EPBC referral will be submitted to the Commonwealth for impacts on the Malleefowl. ▪ Additional targeted assessment for Malleefowl mounds will be undertaken prior to disturbance. ▪ Fauna egress materials will be provided in all ponds and dams at site ▪ Site induction will include section on potential species of conservation significance and to report all sightings to environmental personnel. ▪ All staff will be required to obey all speed limits and be prohibited from off-road driving. ▪ Putrescible waste hygiene measures will be implemented to reduce the likelihood of feral animals being attracted to the area.

ASPECT	PROJECT COMPONENT	POTENTIAL ENVIRONMENTAL IMPACT	ENVIRONMENTAL MANAGEMENT
Short Range Endemic (SRE) Fauna	▪ No SRE were recorded during the 2006 survey. ▪ A juvenile *Conothele* species, a mygalomorph spider was recorded during this survey. As species identification was not possible, its conservation significance was not determined. ▪ The 2011 survey recorded a total of 24 invertebrates comprising three spiders, eight pseudoscorpions and 13 scorpions were collected during this survey and vouchered at the Western Australian Museum.	▪ Reduction of SRE-preferred habitat. ▪ Loss of SRE species	▪ Results indicate that the spiders were either juvenile or female and therefore could not be identified to species and that the pseudoscorpions require taxonomic revision (Burger et al. 2012). ▪ Therefore, it was not possible to determine if any of the specimens submitted where SREs. ▪ Thirteen scorpions were also vouchered and none were identified as SREs. ▪ Project will not result in the removal of all BIF habitat.
Subterranean Fauna	▪ Presence of stygofauna and troglofauna in aquifers	▪ Reduction of subterranean fauna habitat ▪ Loss of subterranean fauna of conservation significance	▪ All stygofauna collected in the project area were regional in extent. ▪ None of the troglofauna taxa collected in other areas of the project showed any obvious troglomorphisms and are not considered likely to be obligate subterranean species (troglobites) that may be "sSRE whose habitat and distribution is directly dependent on the subsurface habitat of the BIF. ▪ GWR intend to undertake additional subterranean fauna surveys for new water source area.
Crushing and screening	▪ Crushing and screening of ore	▪ Dust ▪ Surface and groundwater contamination	▪ Dust collection and water spray systems incorporated ▪ All plant runoff directed to an environmental dam ▪ All hydrocarbons and chemicals will be stored in bunded facilities in accordance with DMP and DEC guidelines and Australian Standards.

ASPECT	PROJECT COMPONENT	POTENTIAL ENVIRONMENTAL IMPACT	ENVIRONMENTAL MANAGEMENT
Dust	▪ Clearing and construction activities ▪ Mining activities i.e. blasting and digging ▪ Crushing and stockpiling of ore ▪ Vehicle traffic on access and haul roads	▪ Accumulation of dust on flora and fauna habitat ▪ Reduction in visibility ▪ Contamination of surface waters	▪ Use of water trucks on an as required basis during clearing, construction and mining ▪ Regular use of water carts on access and haul roads ▪ Vehicle speed will be restricted on all access and haul roads ▪ Crusher will have water sprays to reduce dust generation
Noise	▪ Construction of the mine and associated infrastructure ▪ Mining operations ▪ Blasting operations ▪ Crushing and screening operations	▪ Increase in noise levels adjacent to the operation ▪ Inconvenience to surrounding land holders and residents	▪ Mining operations will comply with the noise regulations under: ▪ *Mines Safety and Inspection Act 1994,* ▪ *Mines Safety and Inspection Regulations 1995* ▪ *Environmental Protection (Noise) Regulations 1997* ▪ No receptors occur within 25 km of the project area, except the project accommodation village.
Odour	▪ No sources of odour anticipated	▪ The project is not anticipated to generate odour	▪ None required
Gaseous emissions	▪ Diesel generators ▪ Explosives used in blasting ▪ Machinery and equipment use	▪ Release of greenhouse gases.	▪ All vehicles and equipment will be regularly serviced ▪ Air and ground gaseous emissions will be measured and reported annually as required under NPI and NGERS. ▪ Rehabilitation of land disturbance ▪ All employees will be educated on energy saving practices during daily activities in the site induction

ASPECT	PROJECT COMPONENT	POTENTIAL ENVIRONMENTAL IMPACT	ENVIRONMENTAL MANAGEMENT
Acid Rock Drainage (ARD)	▪ Mining and removal of sulphidic waste rock ▪ No Potentially Acid Forming (PAF) rock is anticipated to be mined.	▪ Generation of ARD ▪ Contamination of soil, surface and ground water	▪ Development of an ARD site procedure in case PAF material is identified ▪ Mine induction training of personnel for the identification of PAF materials in conjunction with site geologists. ▪ Training of mining personnel for the removal and encapsulation of PAF rocks in accordance with site procedure. ▪ A provisional location for PAF encapsulation (if encountered) will be included within the waste dump design or spreading of PAF material thoughout the waste rock dump to provided contact with neutralising materials.
Waste materials (Industrial & domestic/putrescible)	▪ Generation of waste material during construction and operation	▪ Surface water contamination ▪ Groundwater contamination ▪ Soil contamination ▪ Encouragement of feral animals	▪ Domestic waste will be removed periodically by a contracted service provider ▪ Industrial waste, inert waste and recyclable waste will be collected and transported off-site for disposal, resale or recycling. ▪ Industrial waste will be stored in a designated collection area onsite including bunded areas (for hazardous materials) or drip trays. ▪ Sewage will be collected and treated in septic tanks and leach drains or 2 stage treatment plant (e.g. village) . ▪ Waste hydrocarbon will be stored on-site in tank(s) and removed by a licensed contractor to a recycling plant. ▪ An interceptor system will be used to remove hydrocarbons from equipment washdown facilities, refuelling areas and power generation station, with collected hydrocarbon pumped to the waste oil tank(s).

ASPECT	PROJECT COMPONENT	POTENTIAL ENVIRONMENTAL IMPACT	ENVIRONMENTAL MANAGEMENT
Dangerous Goods & Hazardous substances	▪ Diesel fuel ▪ Other petroleum products used in vehicle and service maintenance ▪ Explosives magazine	▪ Surface water contamination ▪ Groundwater contamination ▪ Soil contamination ▪ Death of vegetation and fauna	▪ The diesel storage tanks will be contained within a concrete bunded facility and will be built in accordance with the Australian Dangerous Goods Code and AS1940: "The storage and handling of flammable and combustible liquids" ▪ All chemicals will be stored in accordance with DMP and DEC requirements ▪ GWR will ensure that suppliers meet statutory requirements for transport of dangerous goods ▪ Spill response equipment will be located in the vicinity of all work areas ▪ All waste hydrocarbons and hydrocarbon contaminated materials will be collected and stored in bulk containers and removed off site by a licensed operator for recycling ▪ Explosives will be stored in accordance with Dangerous Goods Safety Act 2004
Aboriginal Heritage	▪ Construction of mine and associated infrastructure ▪ Two registered Aboriginal sites, 18 Aboriginal heritage site	▪ Disturbance to archaeological or ethnographic sites	▪ GWR has an agreed Heritage Management Plan for the project. ▪ All known Aboriginal heritage sites will be clearly flagged to prevent disturbance or either relocated to the satisfaction to the local Central Desert Land Council (under a Section 18 approval). ▪ Inclusion of Aboriginal heritage awareness in site induction programs to aid in identification and preservation of any possible heritage sites. ▪ All employees and contractors will be made aware of the location of the sites in order to avoid disturbance to these sites. All staff will be made aware to report any potential

ASPECT	PROJECT COMPONENT	POTENTIAL ENVIRONMENTAL IMPACT	ENVIRONMENTAL MANAGEMENT
			Aboriginal sites. ▪ Ongoing consultation with Indigenous land owners and the Central Desert Land Council
European Heritage	▪ Construction of mining and associated infrastructure	▪ Removal of structures of heritage significance	▪ No European heritage sites identified.
Decommissioning and Rehabilitation	▪ Rehabilitation and closure of the mine and associated infrastructure	▪ Rehabilitated areas with minimal vegetation growth ▪ Erosion of landforms ▪ Invasion by weeds ▪ Landform instability	▪ GWR will develop a Closure Plan ▪ Rehabilitation to agreed land use ▪ Consultation with stakeholders ▪ Only use local native plant species in rehabilitation ▪ All project infrastructure will be removed at closure.

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CD containing vegetation and fauna reports (hard copies available on request)

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1.0 INTRODUCTION

1.1 BACKGROUND

Golden West Resources Limited (GWR) have identified eight iron ore deposits over the two Banded Iron Formation (BIF) ridges (Ridges B and C as classified by GWR) at their Wiluna West Project ('Project'). Mineralization on the two ridges is quite distinctive with the B ridge typically consisting of three significant sub-parallel mineralized bands with a cumulative width of ~35 m over a strike length of ~14 km. Unit C has a maximum width exceeding 150 m. However, mineralization is far more localized and appears to be structurally controlled. The area of mineralisation is over a cumulative strike length of 25 km for both ridges.

The Project global resource was updated on 24th May 2011 to 130 Mt @ 60% Fe, with 54% of this Resource falling in the Measured and Indicated categories and estimating a low level of contaminants with the combined key contaminants SiO_2 and Al_2O_3 as being 9.5% and phosphorus 0.06%.

GWR received approval to develop the John William Doutch (JWD) open pit within the Joyners Find (JF) ore deposit, located in the southern end of ridge B from the Department of Mines and Petroleum (DMP) on 11 April 2012.

GWR propose to develop eight additional deposits at the Project. Two of the deposits, Bowerbird and Joyners Find are located on Ridge B and the remaining six (C1 – C5 and CR) are located on Ridge C.

1.2 LOCATION

The Project is located approximately 700 kilometres northeast of Perth and 40 kilometres west of Wiluna in the north-eastern Goldfields of Western Australia (Figure 1).

1.3 TENURE

The tenure of the project is summarised in Table 1 and presented in Figure 2. All of the tenements, with the exception of M53/1078 and E53/1089 are 100% owned and operated by GWR.

Mining Lease 53/1078 and Exploration Licence 53/1089 are owned by GWR 80% and Jindalee Resources Limited 20% subject to the terms of a Joint Venture agreement.

The proposed mining project is located on Lake Way Pastoral Lease within the Wiluna Shire.

Although the list above includes an Exploration Licence, conversion to Mining Leases or other suitable tenements will be undertaken following further project design.

Table 1 – Land tenure of proposed project area

AREA	HOLDER	DATE GRANTED	EXPIRY DATE	AREA
M53/971	Golden West Resources Ltd	25/01/2002	24/01/2023	9.72 ha
M53/972	Golden West Resources Ltd	25/01/2002	24/01/2023	9.72 ha
M53/1016	Golden West Resources Ltd	30/01/2006	29/01/2027	617.45 ha
M53/1017	Golden West Resources Ltd	30/01/2006	29/01/2027	808.7 ha
M53/1018	Golden West Resources Ltd	30/01/2006	29/01/2027	593.6 ha
M53/1078	Golden West Resources Ltd and Jindalee Resources Limited	01/02/2007	31/01/2028	745.65 ha
M53/1087	Golden West Resources Ltd	23/09/2010	22/09/2031	10,848 ha
L53/115	Golden West Resources Ltd	11/07/2002	7/04/2023	32.5 ha
L53/146	Golden West Resources Ltd	10/08/2006	09/08/2027	51.8 ha
L53/147	Golden West Resources Ltd	21/05/2009	20/05/2030	286.00 ha
L53/148	Golden West Resources Ltd	10/08/2006	09/08/2027	147.00 ha
L53/154	Golden West Resources Ltd	23/09/2010	22/09/2031	2165.00 ha
E53/1089	Golden West Resources Ltd and Jindalee Resources Limited	04/03/2004	03/03/2013	6 BL

1.4 OBJECTIVES

GWR proposes to develop an iron ore mining operation at their Wiluna West tenements.

This document has been produced to accompany the Environmental Protection Authority (EPA) referral form under Section 38(1) of the Environmental Protection Act 1986 to assist the EPA in determining the level of assessment for this project.

Relevant data for Golden West Resources are:

Address: Suite 2, 138 Main Street
OSBORNE PARK WA 6017
PO Box 260
OSBORNE PARK WA 6917
Telephone: 08 9201 9202
Facsimile: 08 9201 9203
ABN: 54 102 622 051
Directors: Gary Lyons – Non-Executive Chairman
Michael Wilson – Executive Director
Chin An Lau – Non-Executive Director
Tien Seng Law – Non-Executive Director
Kong Leng Lee – Non-Executive Director
Mark Pitts – Company Secretary
Craig Ferrier – Executive General Manager

Project Contact: Paul Leidich – Study Manager

Relevant data for Jindalee Resources are:

Address:	18 Kings Park Road WEST PERTH WA 6005 PO Box 1033 WEST PERTH WA 6872
Telephone:	08 9321 7550
Facsimile:	08 9321 7950
ABN:	52 064 121 133
Directors:	Mark Scott – Non-Executive Director Lindsay Dudfield – Managing Director

1.5 EXISTING FACILITIES

The project has an existing accommodation camp located on L53/115 and access roads to the major deposit on L53/146 and L53/147. Numerous access roads for exploration access exist at the Project.

Previous and historic (1938-1941, 2003) mining infrastructure is located at Joyners Find (M53/971 & M53/972) and other sites on M53/1016, M53/1018 and M53/1017.

There are also two production water bores with one located on the B and C ridge. These were installed for groundwater aquifer testing and are not being used at the present time.

2.0 EXISTING ENVIRONMENT

2.1 CLIMATE

The nearest official meteorological station is located at Wiluna, approximately 40 km northeast of the project area. Recordings of the local climatic conditions commenced at Wiluna in 1898 (Bureau of Meteorology, 2011). Relevant temperature, rainfall, wind, evaporation and humidity data for Wiluna is summarised in Table 2.

Mean annual maximum temperature is 29ºC and mean annual minimum 14.3ºC. Daily maxima above 35ºC are usual from December to February. Diurnal temperature variations are commonly high throughout the year.

The area is semi arid and has an average annual rainfall of 256.3 mm. Most of the rain falls from January to March but the amount varies greatly both seasonally and annually. The highest daily rainfall recorded is 124 mm.

The average wind speeds at Wiluna throughout the year vary from 8.1 – 12.9 km/h in the morning to 8.5 -13.2 km/h in the afternoon (Figures 3 and 4).

Evaporation is high and the average mean daily evaporation rate is 6.6 mm (annual rate 2,409 mm).

Humidity levels vary considerably both daily and yearly. The mean monthly 9.00 am relative humidity varies from a low of 30% in November and December to a high of 63% in July. The mean monthly 3.00 pm relative humidity varies from a low of 19% in October, November and December to a high of 42% in June.

Table 2 - Climate averages for Wiluna

STATISTIC ELEMENT	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Mean maximum temperature (Degrees C)	37.9	36.6	34	29.2	23.8	19.9	19.4	21.8	26.3	30.2	34	36.8	29.2
Highest temperature (Degrees C)	46.9	46.8	44	40	37.2	32.2	29	33.4	37.5	42.9	43.3	46.9	46.9
Lowest maximum temperature (Degrees C)	18.5	18.7	15.8	16.7	11.1	12	10.3	10.1	12.3	13	16.2	20.2	10.1
Mean minimum temperature (Degrees C)	22.9	22.1	19.6	15.1	10	6.8	5.4	6.8	9.9	13.8	17.8	21.1	14.3
Lowest temperature (Degrees C)	8.3	12.1	9.4	3.9	-0.6	-2	-2.2	-2.3	1.2	4.2	4.4	8.3	-2.3
Highest minimum temperature (Degrees C)	33.6	32.2	29.4	25.5	22	18.9	15.5	18.7	23	27.4	27.9	30.5	33.6
Mean rainfall (mm)	35.2	38.3	35.3	29.1	25.3	23.9	15.2	10.3	4.6	7.1	10.5	21.6	256.3
Highest rainfall (mm)	231.9	271.6	234.9	527.1	142	108.5	149	67.4	71.1	88.6	63.8	161.4	712.1
Lowest rainfall (mm)	0	0	0	0	0	0	0	0	0	0	0	0	48.8
Highest daily rainfall (mm)	82.3	124.6	76.2	57.5	69.2	68.3	73.5	42.4	25.6	78.2	37.4	112.8	124.6
Mean number of days of rain	4.3	4.4	4.5	3.9	4	4.8	4	2.8	1.6	1.8	2.6	3.5	42.2
Mean daily evaporation (mm)	11	9.5	7.8	5.6	3.7	2.5	2.6	3.7	5.7	7.9	9.3	10.1	6.6
Mean 9am relative humidity (%)	35	40	41	47	55	65	63	52	40	33	30	30	44
Mean 9am wind speed (km/h)	12.4	11.8	10.7	9.6	8.7	8.1	8.5	10.5	12.4	12.9	12.7	12	10.9
Mean 3pm relative humidity (%)	23	26	27	30	35	42	38	31	24	19	19	19	28
Mean 3pm wind speed (km/h)	10.9	10.6	9.3	8.5	9	9.9	9.9	11.2	13.2	12.7	12.3	10.5	10.7

2.2 REGIONAL SETTING

The Interim Biogeographic Regionalisation for Australia (IBRA) divides the Australian continent into 85 bioregions and 403 subregions (Department of the Environment, Water, Heritage and the Arts, 2008). The project is located within the Murchison Region and is characterised by undulating hills, with occasional ranges of low hills and extensive sand plains in the eastern half. The principal soil type is shallow earthy loam overlying red-brown hardpan, shallow stony loams on hills and red earthy sands on sand plains (Beard, 1990).

The Wiluna West Iron Ore Project tenements are located within the Eastern Murchison IBRA subregions.

2.3 LAND SYSTEMS

The Wiluna-Meekatharra area, covering 25,000 square miles, has been mapped and described in 48 land systems, based on recurring patterns of topography, soils and vegetation (Mabbut et al. 1958).

The land systems in which the Wiluna West project area occurs are the Dural, Glengarry, Yanganoo, Bullimore, Gabanintha, Sherwood and Fisher land systems.

2.3.1 Dural Land System

Comprising the northern portion of M53/1087 below the Yanganoo Land System. This land system comprises strongly undulating terrain on weathered mudstone and basalt. Soils are shallow gravelly and stony soils on stable crests and mainly shallow red earths on the lower slopes. Vegetation comprises open mulga with mallee, Spinifex and annual grasses and mulga groves with sparse grasses (Mabbut et al., 1958).

2.3.2 Glengarry Land System

Comprising the northern portion of M53/1087 and M53/1016 and is described as sandstone plateaux with shallow stony soils and mainly dense mulga and shrubs, feathertop Spinifex and other perennial grasses on the uplands. Red earthy soils and dense mulga comprise the drainage floors (Mabbut et al., 1958).

2.3.3 Yanganoo Land System

This land system comprises the northern portion of M53/1087 just below the Bullimore Land System and is described as upper tributary plains with gradients above 1 in 500. Soils are predominantly red earths with sandy soils on margins and vegetation prominent mulga groves (Mabbut et al., 1958).

2.3.4 Bullimore Land System

Comprising the northern portion of M53/1087, this land system consists of sand plain with scattered dunes. Soils are deep red sandy soils and comprising Spinifex with mulga and mallee vegetation (Mabbut et al., 1958).

2.3.5 Gabanintha Land System

This land system is encompassed within M53/1087, M53/1016, M53/1017, M53/1018, M53/1078, M53/971 and M53/972 and is described as Whitestone (with some greenstone) hill ranges forming higher tracts in most of the hill belts. It is composed of parallel ridges, with rocky crests formed by haematitic jaspilite and with stony slopes eroded on schist (Mabbut et al., 1958).

The soils are generally outcrops with adjacent stony soils and shallow reddish earths and sands. The vegetation is predominantly open mulga (*Acacia aneura*) with sparse shrubs and grasses (Mabbut op. cit.).

2.3.6 Sherwood Land System

Comprising the south eastern part of M53/1087, this land system consists of plains on shallow stony soils and alluvial plains formed by moderate dissection of weathered granitic rock.

This system is dominated by shallow stony soils on hardpan or rock with mulga and soft spinifex (Mabbut op. cit.).

2.3.7 Fisher Land System

Located on the western edge of the proposed C3 pit and waste dump, the Fisher land system comprises undulating terrain on weathered schists, stable crests on shallow gravely soils and stepped crests and lower slopes on shallow red earths. (Mabbut op. cit.).

2.4 GEOLOGY

2.4.1 Wiluna West Geology

The Wiluna West project extends 45 km in strike over the Joyners Greenstone Belt, near the northern margin of the Yilgarn Craton. The Joyner's Find Greenstone Belt is a narrow (5 km to 10 km) north-south striking greenstone belt comprising low ridges of BIF (in the central and eastern portion) intercalated with mafic and ultramafic schists with minor chert and clastic sediment horizons.

The majority of the units within the Joyners Find Greenstone Belt are north to north-north easterly trending, sub-vertical to steep westerly dipping. Folds developed during the D2 deformation event are observed in the BIF ridges as tight to isoclinal folds oriented north-south with west dipping axial planes. The BIF ridges are variably deformed and intensely folded.

Two regional dextral shear zones are recognised; the Joyners Find Shear Zone (JSZ) strikes to the north through the centre of the belt and is parallel to the lithological strike; and the Brilliant Shear Zone (BSZ) which is oriented north-northwest (50° to the lithological strike).

High grade hematite mineralisation occurs within three main BIF ridges (Units A, B and C) with grade occurrences of up to 69% Fe (Figures 5 and 6). Iron mineralisation occurs within BIFs surrounded by inter-bedded mafic and ultramafic schist units. Unit B and Unit C have been drill tested by GWR for hematite mineralisation. To date no drilling has been undertaken by GWR on the A Ridge due to expected limited mineralisation potential. The two main ridges show distinctive mineralisation styles with B ridge showing a much lower proportion of remnant bedding and generally a significantly higher portion of haematite especially in the top 20 m. Mineralisation of the B ridge is also much more continuous along strike occurring semi-continuously for over 15 km. The mineralisation on the C ridge typically occurs in a series of pods of up to 20 Mt separated by poorly or un-mineralised BIF.

These pods appear to be controlled by structural deformation and are generally confined to the western side of the formation.

2.4.2 Banded Iron Formations (BIF)

The BIF ranges of the Yilgarn Craton in the Midwest region of Western Australia are isolated ancient ranges set in a predominately flat landscape. They form a relatively small proportion of the total land area of the region and may act as unique habitat for flora and fauna due to different geology, soils and landforms to the majority of land in the region (Figure 7).

The Wiluna West project is located within the Wiluna West BIF. The Department of Environment and Conservation (DEC) has completed a three-year strategic regional flora and vegetation survey of key BIF ranges through the Midwest and Goldfields and has

described the BIF ridges in the Yilgarn Craton as ranges that appear to be refugial habitats with localised species and vegetation communities (DEC, 2007).

2.5 SOILS

The soils in the project area are predominantly shallow stony earthy loams on M53/971, M53/972, M53/1016, M53/1017, M53/1018 and M53/1078 (Ashton, 2001). The soils on M53/1087 comprise: red earthy sands, natural red earths and shallow earthy loams, shallow earthy loams underlain by red-brown hardpan and shallow stony earthy loams.

Soils on E53/1089 are red earthy sands.

Soils on L53/148 are shallow earthy loams underlain by a red brown hardpan and shallow stony earthy loams.

Soils on L53/154 are shallow earthy loams underlain by a red brown hardpan and red earthy sands.

Soils on L53/147 are shallow earthy loams underlain by a red brown hardpan, red earthy sands and shallow neutral red earths and shallow earthy loams.

The soils on L53/115 and L53/146 comprise shallow earthy loams underlain by a red brown hardpan and shallow stony earthy loams.

A project soil and landform survey will be conducted in late 2012 or early 2013 by Keith Lindbeck & Associates (KLA).

2.6 SURFACE HYDROLOGY

2.6.1 Regional Surface Hydrology

The region is characterised by undulating areas of sandplain and granite outcrop with northerly trending ridges controlled by the strike of the greenstone belts, and by low-lying broad alluviated valleys containing playa lakes (Aquaterra 2008).

The drainage system of the Wiluna West area comprises two large south-easterly trending palaeodrainages. The Carey and Raeside Palaeodrainages extend from a regional divide in the west of the area and drain towards the Eucla Basin. These palaeodrainages have low gradients and frequently contain small to very large playa lakes, such as Lake Way. The playa lakes are normally dry, floored by mud or salt crystals, and are commonly fringed by sand and gypsum dunes that prevent the flow of surface runoff between the lakes. These lakes occasionally become inundated during intense rainfall events and during rare cyclonic events (Aquaterra 2008).

The Lake Way drainage system lies approximately 30 km to the east of the project area, whilst Lake Mason is approximately 95 km south-southwest of the Project (Figure 8).

2.6.2 Project Hydrology

There is no surface water of significance, lakes or swamps in the project area.

Figure 9 shows the ephemeral watercourses that flow in a northerly direction through the Bowerbird area (M53/1017). The water course becomes ill-defined prior to leaving the mining tenement. This watercourse is a broad ephemeral and ill-defined drainage line and only flows following heavy rainfall.

2.7 GROUNDWATER

2.7.1 Regional Groundwater

The main aquifer in the Wiluna West area is the mineralised BIF, which exhibits a transmissivity of up to 1.4 m/d and forms a 'strip aquifer' of two parallel sub-vertical zones of enhanced permeability compared to surrounding mafic and ultramafic schists. The aquifer exhibits both horizontal and vertical anisotropy, with high preferential permeability developed in the blocky BIF and differential fracturing along the BIF contacts. Storage in the BIF aquifer will be determined as part of future investigations.

In addition to the BIF aquifer, several palaeochannels and palaeo-tributary channels lie in the vicinity of the Project, including the Lake Way, Ward Well, Abercromby and Carey channels. These areas form contingency targets for water exploration should dewatering be insufficient to supply water for the mine life.

2.7.2 Project Groundwater

In the Project area the aquifer exhibits both horizontal and vertical anisotropy. Horizontally, the bedded banded iron and ultramafic formations create significant regional aquifer anisotropy, with high preferential permeability developed in the blocky BIF and differential fracturing along the contacts of the BIF (Figure 3). Vertically, the diagrammatic cross section below summarises the three main aquifer zones in a fratcured rock profile:

- The ***upper saprolite*** (also known as the pallid zone; the smectite zone; or the zone of strong oxidation) refers to the zone where the rock has undergone complete chemical decomposition into heavy textured clay minerals, which may display remnant rock textures. The upper saprolite is mostly unsaturated, but can form a slow seepage zone where water is present. In the Project area the upper saprolite is typically up to 25m thick.
- The transition into ***lower saprolite*** (the zone of joint oxidation) is characterised by a change from heavy textured clay to soft, decomposed, friable rock 60–110 m thick. The open blocky jointing in the lower saprolite zone is typically the most reliable water target in a fractured rock environment. Morgan (2009) describe intersecting the first water strike within the Project area around 50 to 115 metres with the water in the bore then rising to a static water level (SWL) around 35 to 55 m below ground level. The base of lower saprolite is generally reported between 70 to 135 below ground surface.
- The zone of broken fresh rock between the lower saprolite and the hard fresh rock can also contain open water bearing defects, particularly within faults, shears and joints. These structures are mostly tighter than in the Lower saprolite and rock effects tend to close with depth, so the prospects of obtaining significant water bearing fractures diminishes beyond 145 metres depth. This zone of broken fresh rock is referred to as ***saprock.***

Finally, the locally weathered profile and surficial alluvials in the John William Doutch project area may also provide some water, but these yields are expected to be low (Aquaterra, 2008).

Groundwater levels recorded in the exploration holes over all deposits at Wiluna West Project area show that the regional groundwater flow direction is in a general easterly direction toward Lake Way, although there may be some localized variations around the B and C ridges.

Two groundwater survey programs have been undertaken to date to define the groundwater resources in the mining lease areas (KH Morgan & Associates, 2007; 2008). One program was located in the northern portion of ML53/1087 and the other within the mining areas on B and C ridges. A water investigation study is currently being undertaken and will be completed in the 2012–2013 financial year.

Analysis of groundwater samples taken from the northern portion of M53/1087 are displayed in Table 3.

Table 3 - Results of groundwater analysis

	Unit	GWWE01	GWWE02	GWWE03	GWWE04	GWWE05
TDS Evap	mg/L	1085	1472	1093	1011	1496
TDS Cond	mg/L	1065	1472	1093	1011	1496
EC	mS/cm	1.67	2.27	1.66	1.56	2.24
pH		7.7	7.8	7.9	8.1	7.6
Ca	mg/L	56.99	89.40	59.94	56.24	93.10
Mg	mg/L	42.28	71.90	45.65	43.89	80.23
Na	mg/L	212.2	224.7	197.4	186.0	240.2
K	mg/L	30.9	39.9	29.2	25.7	30.9
Cl	mg/L	292	479	306	284	386
HCO^3	mg/L	209	160	197	198	214
SO4	mg/L	180.6	242.7	176.9	167.1	252.2
$N\text{-}NO^3$	mg/L	13.3	9.7	12.4	9.0	5.8
F	mg/L	1.2	0.9	0.8	1.5	0.5
Si	mg/L	34.95	14.47	32.45	24.73	18.42
SiO^2	mg/L	74.8	31.0	69.4	52.9	39.4
S	mg/L	66.3	81.0	59.1	55.8	84.2
P	mg/L	0.1	0.1			
B	mg/L	0.84	0.75	0.76	0.64	0.89
Ba	ug/L	29.62	56.43	32.26	35.09	36.01
Sr	ug/L	495.96	811.81	523.43	485.23	722.52
Fe Total	mg/L	0.20	0.19	0.50	1.55	0.38
Mn	mg/L	0.03	0.07	0.04	0.02	0.14
Pb	mg/L				0.04	
Al	mg/L			0.02	0.12	0.20
Br	mg/L	1.82	2.81	1.79	1.71	2.85

Groundwater was slightly brackish with total salinity ranging from 1011-1496mg/L TDS. The value for pH ranged from 7.6 to 8.1 and the five sampled sites showed similar characteristics.

The groundwater tends to be higher in magnesium relative to calcium, suggesting deposition of carbonates. The concentration of sodium plus potassium tends to be higher than that of chloride. These higher levels indicate dissolution of silicate or ion recharge within the regolith. This reaction could result from rainfall recharge factors. Sulphate is high when compared to bicarbonate, a feature of mature water.

Water exploration drilling and test pumping in the project area was conducted in 2008 and involved the sampling of 11 sites including two test production bores. The results of this work was utilised to develop a Hydrologeological Scoping Study (Pennington Scott 2012) to clarify the potential of the mine dewatering to be able to supply all the project water uses and to develop an water investigation program to confirm this.

Groundwater quality in nearby paleochannel areas is expected to be brackish with total salinity < 5000 mg/L and pH 7 (Gray et al., 2009).

2.8 VEGETATION AND FLORA

2.8.1 Regional Vegetation

The Wiluna West project is located within the Austin botanical district in the Eremaean Province and lies within the East Murchison IBRA sub-region which covers an area of 211,350 ha.

Vegetation throughout this area is Mulga woodlands often rich in ephemerals, hummock grasslands, saltbush shrublands and *Halosarcia* shrublands

The Wiluna West project area is located within four vegetation groups as described by Beard (1979):

- Low mulga woodland; *Acacia aneura* (Vegetation association 18).
- Sparse low woodland; mulga, discontinuous in scattered groups (Vegetation association 29)
- Hummock grasslands, shrub steppe; mulga and *Eucalyptus kingsmillii* over hard Spinifex (Vegetation association 107).
- Shrublands; mulga and *Acacia quadrimarginea* scrub (Vegetation association 202).

A summary of the current extent and representation of these associations in DEC managed lands is presented in Table 4 (Government of Western Australia 2011).

Table 4 - Extent of Vegetation Associations at the Wiluna West Project area

Vegetation Group	Current Extent (ha)	% Original Extent Remaining	Area in Reserves (ha)	% in DEC Managed Lands
18	19,843,823	99.76	1,250,896	6.30
29	7,900,200	99.95	412,848	5.23
107	2,813,995	99.95	324,942	11.55
202	448,343	99.96	98,537	21.98

2.8.2 Wiluna West Vegetation

2.8.2.1 Summary

A number of vegetation and flora surveys have been undertaken at the Wiluna West Project (which have been provided to both the Department of Mines and Petroleum (DMP) and DEC). These include:

- Vegetation & flora survey undertaken on M53/1016 and L53/148 – Botanica Consulting, September 2005 (Jim's Seeds, Weeds and Trees 2005).
- Vegetation and flora survey of the haul road from the project site to the Northern Goldfields Highway – Botanica Consulting, September 2005.
- Vegetation & flora survey of 92 20m x 20m quadrats on Units A, B & C – Botanica Consulting, July 2006.
- Vegetation & flora survey of 50 20m x 20m quadrats on Units A, B & C – DEC, August 2006.
- Vegetation and flora survey of the Bowerbird project and related haul road – Botanica Consulting, March-April 2007 (Botanica Consulting 2007a).

- Flora and Vegetation Survey of Four Proposed Gravel Pits (no longer to be utilised) – on M53/1087 and at intersection of L53/148 and Ullala Road - Botanica Consulting, April 2007 (Botanica Consulting, 2007b).
- Flora survey and mapping of vegetation on Ridges A, B & C – Botanica Consulting, 24 February- 1 March 2008 (Botanica Consulting 2008a).
- Vegetation survey (largely to map native vegetation communities of project area - 12,647 ha) – Recon Environmental, March-June 2009.
- Targeted regional searches for *Sida picklesiana* (formerly *Sida* sp. Wiluna (A Markey and S Dillon 4126)) - Keith Lindbeck & Associates (in conjunction with WA Herbarium), August 2010.
- Variety of targeted Priority flora surveys for proposed exploration within E53/1114, E53/1116, E53/1173, M53/1016, M53/1017, M53/1018, M53/1078) – Botanica Consulting, Keith Lindbeck & Associates 2007 to 2011.
- Targeted Priority flora survey of the three deposits that will be mined in the first 10 years of operations (C3, C4, Bowerbird) - Native Vegetation Solutions, November 2011.

A copy of these survey reports is included on the attached CD.

The results of these surveys (aside from L53/147 and L53/148 presented in Section 2.8.4) were utilised (and largely superceded) in the vegetation survey undertaken by Recon Environmental in 2009 study (refer to Section 2.8.2.3).

A summary of the relevant studies is provided in the following sections.

2.8.2.2 Botanica Consulting Quadrat survey

Botanica undertook a study of the flora and vegetation communities at the Project in June-July 2006. They established 92 20m x 20m quadrats and recorded a total of 96 flora taxa of which one was an introduced weed species.

Four vegetation groups were recorded by Botanica (2006);

- Mulga low woodlands (Community 1).
- Hummock grassland (Community 2 - mulga and *Eucalyptus kingsmillii* over hard Spinifex).
- *Aluta maisonneuvei ssp auriculata* shrubland (Community 3).
- Mulga with *Acacia burkitti* shrubland (Community 4).

These vegetation groups identified by Botanica have been superceded by more recent vegetation mapping (refer to Section 2.8.2.3).

2.8.2.3 DEC quadrat survey

The DEC (Markey and Dillon 2007) undertook a study of the flora and vegetation communities at the Project (referred to as 'Herbert Lukin Range') in August 2006. They established 50 20m x 20m quadrats and recorded a total of 192 flora taxa of which only two were introduced weed species.

The study identified six community types that were correlated with topographic position, slope and substrate type:

TYPE 1: found on crests and steeper upper slopes; described as a sparse open tall shrubland of *Acacia aneura cf. var. microcarpa*, *Grevillea berryana* and less commonly, *Acacia quadrimarginea* over *Eremophila latrobei* subsp. *latrobei*, *Prostanthera campbellii*, above *Ptilotus obovatus*, *Sida* sp. Golden *calyces glabrous*, *Sida* sp. *Excedentifolia*,

Ptilotus schwartzii, Cheilanthes brownii, with *Eriachne helmsii*, *E. mucronata*, and *Monachather paradoxus*.

TYPE 2: located on flat summit surfaces on ridge tops, and on the undulating pediments and valley floors off the main ridges. It encompasses mosaics of *Acacia* over *Triodia* grasslands or low myrtaceous-*Eremophila* shrublands, with isolated mallees of *Eucalyptus kingsmillii* subsp. *kingsmillii*.

TYPE 3: usually found on pediments, lower slopes and slightly low outcrops of weathered BIF and other metasediments, quartz and ultramafic lithologies, usually obscured by colluvium. It consists of *Acacia aneura*, and less frequently *Acacia balsamea* and *A. cuthbertsonii* subsp. *cuthbertsonii* tall open shrublands over shrubs including *Scaevola spinescens*, *Senna artemisioides* subsp. *helmsii*, *Eremophila flabellata*, and scattered *Maireana convexa*, *M. georgei*, and *Ptilotus obovatus*.

TYPE 4: consists of a tall open shrubland of *Acacia aneura* and *A. tetragonophylla*, occasionally with isolated emergent trees of *Acacia pruinocarpa*, over a mosaic of shrubland and chenopods.

TYPE 5: found on lower slopes, pediments and valley flats. It is a tall *Acacia aneura* shrubland often with a canopy of *A. pruinocarpa* over *Eremophila forrestii*, *E. latrobei*, *Senna* spp., *Eremophila flabellata*, *Rhagodia eremaea*, *Sida ectogama*, *Ptilotus obovatus*, with *P. schwartzi*i, *Sida* sp. *Excedentifolia* and *Monachather paradoxa*.

TYPE 6: generally located mid-slope, associated with massive haematite-enriched outcrops; it can be summarized as consisting of *Acacia aneura* cf. var. *microcarpa* and occasionally *A. pruinocarpa* over *Eremophila latrobei* subsp. *latrobei*, *Dodonaea petiolaris*, *Eremophila flabellata*, *Sida* sp. Wiluna, (Markey and Dillon 4126) [*Sida picklesiana* (ms) (Markey *et al.* 2011) and less frequently *Ptilotus rotundifolius*, *Eremophila jucunda* subsp. *jucunda, Harnieria kempeana* subsp. *muelleri*.

The DEC survey focused more on the Ridges and uplands in the area (14 quadrats on Community Type 1; 14 quadrats on Community Type 2), than the plains between the ridges (Community Type 4 with two quadrats).

Of the 92 quadrats installed at the project by Botanica, 23 of these GWR quadrats were used in the DEC survey resulting in a total of 119 quadrats installed across the project area.

2.8.2.4 Vegetation mapping

Recon Environmental ('Recon') was commissioned in March 2009 by GWR to map native vegetation communities, identify significant vegetation communities and record the location of any Priority flora or Declared Rare Flora within the Project Area. The flora and vegetation assessment was conducted in accordance with Guidance Statement No. 51 *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (Environmental Protection Authority, 2004).

The vegetation survey covered an area of 12,647 ha and was conducted over 64 days from March to June 2009. The assessment included detailed records made at 143 sample sites (of a minimum area of 20 x 20m). Recon identified 29 vegetation communities within the Project area (

This map is included in the folder in Appendix 1

Figure 10, Table 5).

The vegetation communities on the BIF were grouped into six main types following Markey and Dillon's (2007) descriptions of the communities (based on floristic composition) at the project. The remaining 11 vegetation communities or habitats tend to be found downslope from the hills and ridges on the surrounding plains which was not surveyed by the DEC.

Table 5 - Vegetation units identified at the project

Vegetation Unit	Vegetation Type	Description	DEC Community
SIMS-B	Stony Ironstone Mulga Shrublands on rocky slopes and crests, frequently on BIF	SIMS-B can be described as an *Acacia aneura* var. *microcarpa* shrubland with *Grevillea berryana* occurring on rocky outcrops usually on banded iron formation (BIF).	Type 1
ASET	Acacia shrubland over Eremophila and Triodia	ASET is a mixed Acacia shrubland generally comprised of *Acacia aneura* over mid to low shrubs including *Eremophila punctata*, *E. latrobei*, *E. forrestii*, over *Triodia melvillei*.	Type 2
LOMS	Low Open Myrtaceae Shrubland	LOMS is a low open shrubland, usually dominated by *Aluta maisonneuvei* subsp. *auriculata*, and tending to have very sharp boundaries with the surrounding Acacia shrublands.	Type 2
SIMS-C	Stony Ironstone Mulga Shrublands on rocky slopes and crests	SIMS-C is a commonly occurring upland habitat associated with ironstone or laterite; dominated by *Acacia aneura* var. *microcarpa*.	Type 2
UAET	Undulating lateritic slopes of Acacia over low Eremophila and Triodia	Low shrubland occurring on undulating lateritic low hills dominated by *Eremophila jucunda* subsp. *jucunda* and *Triodia melvillei* with scattered tall shrubs of Acacia aneura.	Type 2
SUAE	Stony undulating slopes of *Acacia rhodophloia* over Eremophila and low shrubs	Shrubland dominated by *Acacia rhodophloia* frequently over *Eremophila jucunda* subsp. *jucunda* with *E. latrobei* subsp. *latrobei* and *E. punctata*, and also *Aluta maisonneuvei* subsp. *auriculata*	Type 2
SAEC	Stony *Acacia rhodophloia* and *Eremophila congesta* (P1) Shrubland occurring on crests	It is a shrubland dominated by *Acacia rhodophloia* over *Eremophila congesta* (P1) with *E. latrobei* subsp. *latrobei* and *E. punctata*, and on occasion *Triodia melvillei* only occurring on the crests of hills	Type 2
OALS	Open Acacia Shrubland on ironstone or laterite over low scattered shrubs	OALS is a varying habitat generally dominated by *Acacia quadrimarginea* and/or *A. balsamea* (P4) and frequently occurs on lateritic low rises; low outcrops of weathered BIF; rough quartz slopes; and upper breakaway surfaces.	Type 3
OALS-S	Open Acacia Shrubland on ironstone or laterite over low scattered shrubs – southern C Ridge	Generally dominated by *Acacia quadrimarginea* with *Acacia aneura* over *Scaevola spinescens*, *Eremophila latrobei* subsp. *latrobei*, *Ptilotus obovatus* and *E. flabellata*	Type 3
AXSI	Acacia Mixed Shrubland on Stony Ironstone Slopes	Generally dominated by *A. balsamea* (P4) with *Acacia cuthbertsonii* subsp. *cuthbertsonii* and *A. aneura* above *Scaevola spinescens*, E*remophila latrobei* subsp. *latrobei*, *Ptilotus obovatus* and *Senna artemisioides* subsp. *helmsii*	Type 3
SXSS	Scattered Mixed Shrubland on Low Stony Rises	SXSS is an open, scattered shrubland dominated by Acacia species occurring on stony ironstone.	Type 3
SAES	Stony Acacia Eremophila Shrubland	An open *Acacia aneura* shrubland on stony red earth over scattered *Eremophila* spp., *Sida ectogama*, *Ptilotus obovatus*, and *P. schwartzii*	Type 4

Vegetation Unit	Vegetation Type	Description	DEC Community
DRAS	Drainage Tract Acacia Shrubland	Scattered to close tall shrubland, sometimes woodland with understorey development inversely related to upper storey cover	Type 4
USCS	Upland Small Chenopod Species Shrubland	Open Acacia aneura shrubland on stony red earth over scattered *Ptilotus obovatus*, *Maireana* spp., *Sclerolaena* spp., and *Tecticornia* spp.	Type 4
SIME	Stony Ironstone Mulga with *Eremophila forrestii* Shrubland	Commonly occurring mulga shrubland dominated by *Acacia aneura* var. *microcarpa*, above *Eremophila forrestii* often with *E. punctata*, *E. flabellata* and *E. jucunda* subsp. *jucunda*	Type 5
SMEC	Stony Slopes Mulga *Eremophila congesta* (P1) Shrubland	Occurs along the lower slopes of hills in the north and east of the survey area and is dominated by *Acacia aneura* var. *microcarpa* above *Eremophila congesta* (P1), often with emergent *Acacia pruinocarpa*	Type 5
MSET	Mulga Shrubland over *Eremophila forrestii* and Triodia	MSET occurs on the lateritic soils, it is dominated by *Acacia aneura* var. *microcarpa*, above *Eremophila forrestii* often with *E. jucunda* subsp. *jucunda* over *Triodia melvillei*	Type 5
SIMS-M	Stony Ironstone Mid-slope Mulga Shrubland	A mid-slope habitat associated with iron rich outcrops dominated by *Acacia aneura* var. *microcarpa*, with scattered *A. pruinocarpa*	Type 6
BCLS	Breakaway Footslope Chenopod Low Shrubland	Generally comprised of a low scattered shrubland generally dominated by chenopod species	NS
BRXS	Breakaway Mixed Shrublands	Generally a scattered *Acacia* spp. shrubland above *Eremophila* spp., *Ptilotus obovatus*, with *Scaevola spinescens*, and often with emergent *Eucalyptus carnei* near the footslope edges of the breakaway scarp	NS
CBKW	Creek Bank Woodland or Shrubland	Creek beds are characteristically between 20 and 50m wide and up to 4m deep, incised into hardpan. The vegetation fringing the creeklines often consists of a moderately close mulga woodland or tall shrubland	NS
MUWA	Mulga Wanderrie Grassy Shrubland	MUWA is generally a scattered mulga shrubland over wanderrie grasses	NS
HPMD	Hardpan Plain Mulga Woodland - Drainage	Mulga woodland with a poorly developed low and mid shrub strata occupying the lowest part of the landscape	NS
HPMS	Hardpan Plain Mulga Shrubland	Usually a scattered to moderately close tall mulga shrubland with a well developed low and mid shrub strata	NS
MUBW	Hardpan Plain Mulga & Bowgada Shrubland	Scattered to moderately close tall shrubland (*Acacia 113 ramulosa*), but it is occasionally dominated by mid shrub (*Acacia 113 ramulosa*, with *Eremophila forrestii*) or tree strata	NS
GRMU	Hardpan Plain Mulga Grove	Mulga groves are often moderately close to closed tall shrublands, or less frequently low woodlands	NS
SAMA	Sandplain Mallee Spinifex Hummock Grasslands	SAMA occurs on deep red sandy soils and consists of Triodia grasslands interspersed with mallee	NS
SAMU	Sandplain Mulga Spinifex Hummock Grassland	SAMU occurs as a scattered tall mulga shrubland over a hummock grass (Triodia) stratum	NS
SASP	Sandplain Spinifex Hummock Grassland	SASP consists of a Triodia grassland, where the hummock grass layer generally dominates in terms of projected foliar cover and biomass	NS

NS – community not surveyed by the DEC

The survey did not record any Threatened Ecological Communities (TEC's) as defined by the EPBC Act (1999) or the Department of Environment and Conservation (Recon 2010).

A copy of the survey report is attached as Appendix 1.

2.8.3 Wiluna West Priority Ecological Community (PEC)

The Wiluna West BIF are listed as a Priority Ecological Community (PEC) due to its vegetation complexes. The community is listed as Priority 1 described by DEC as "ecological communities with apparently few, small occurrences, all or most not actively managed for conservation.

The tentative Wiluna West PEC boundary as defined by DEC covers an estimated area of 23,156 ha (Figure 11). The project area represents 11.2% of the total area of the PEC.

Based on mapping undertaken by Botanica (2008) the A, B and C BIF ridges occurring at site covers an area of approximately 518 ha.

Based on the results of their vegetation survey, Recon (2010) have suggested a more definitive outline for the PEC which is restricted largely to the BIF ridges. However, this amended PEC boundary (and that made by the DEC) does not take into account the BIF ranges occurring south of the Ullala Road. This area, which encompasses approximately 714 ha (of which half is exposed on the surface) and extends 20 km, had been burnt prior to the surveys undertaken by Botanica, DEC and Recon. Thus, only a small section at the northern end was surveyed. GWR considers it logical that the vegetation communities occurring within the project area likely also extend into this area, as is apparent from the limited vegetation mapping undertaken at the northern extent of this ridge (

This map is included in the folder in Appendix 1

Figure 10).

An assessment of the impact of the project on the BIF and BIF outwash communities is provided in Section 5.3.1.

2.8.4 Vegetation survey – L53/147 & L53/148

A vegetation survey of L53/148 (proposed access road) was undertaken by Botanica (formerly Jim's Seeds, Weeds and Trees) in September 2005. The survey recorded three vegetation groups:

- Mulga woodland
- Mulga creekline
- Rocky Breakaway (JSWT 2006).

The 'Rocky Breakaway' vegetation group was considered to have local significance by Botanica due to the presence of three Priority flora species *Ptilotus chrysocomus* (P1), *Maireana prosthecochaeta* (P3) and *Calytrix uncinata* (P3). These species are not restricted to this habitat type or the project area.

A copy of this report is included on the attached CD (App 1.6).

The northern section (7 km) of L53/147 (northern access road to Magellan) has not been surveyed in detail. However, the route has been inspected by KLA and this northern section comprises predominantly Vegetation associations 23 and 26 (as described by Recon (2010)): Hardpan mulga plain – drainage and Hardpan mulga plain. The southern section of L53/147 was surveyed by Recon (2010) and includes Vegetation associations 23, 26 and 28: Hardpan mulga plain – drainage; Hardpan mulga plain; and Sandplain Mulga spinifex hummock grassland respectively.

2.8.5 PATN Analysis

As part of their assessment, the DEC used PATN to identify the vegetation groups occurring at the project. The groups identified by the DEC were utilised as a basis for Recon in their vegetation mapping.

2.8.6 Flora

A total of 279 native taxa from 120 genera and 41 families have been recorded in the Wiluna West project area. Families of native species with greatest representation included *Fabaceae* (45 taxa), *Poaceae* (23 taxa), *Chenopodiaceae* (19 taxa), *Scrophulariaceae* (16 taxa), and *Malvaceae* (15 taxa). The most common genera were *Acacia* (23), *Eremophila* (16), *Senna* (14), *Maireana* (11), and *Ptilotus* (10) (Recon 2010).

No plant taxa located in the Wiluna West area are gazetted as Declared Rare Flora (DRF) pursuant to subsection 2 of section 23F of the Wildlife Conservation Act (1950). No plant taxa listed as Threatened pursuant to Schedule 1 of the EPBC Act (1999) were located in the Wiluna West area (Recon 2010).

2.8.7 Priority Flora

A total of 14 Priority flora species have been recorded at Wiluna West to date based on work undertaken by Botanica, KLA and Recon and are listed in Table 6 and shown in Figures 12 and 13. A smaller section of BIF south of the Ullala Road has also recorded numerous Priority flora (Figure 14).

Targeted survey work for Priority flora undertaken to date has largely been restricted to the impact areas.

Table 6 – Priority flora recorded at Wiluna West

Species	Conservation Code	# records at project (to date)	# plants recorded at Project to date
Beyeria lapidicola	P1	1	pnd
Eremophila ?anomala	P1	2	pnd
Eremophila congesta	P1	120	4406*
Ptilotus chrysocomus	P1	17	782*
Calytrix uncinata	P3	73	1207*
Eremophila arachnoides subsp. arachnoides	P3	5	305
Homalocalyx echinulatus	P3	118	>19,000*
Maireana prosthecochaeta	P3	5	pnd
Olearia mucronata	P3	5	pnd
Prostanthera ferricola	P3	10	pnd
Ptilotus luteolus	P3	1**	pnd
Sauropus ramosissimus	P3	1	pnd
Sida picklesiana	P3	101	3277* (4419 regionally)
Tribulus adelacanthus	P3	1	pnd

Pnd – population size not determined
* - not all population sizes determined
** - species has not been recorded since 2006

A targeted Priority flora survey of the three deposits that will be mined in the first 10 years of operations (C3, C4, Bowerbird) was undertaken by Native Vegetation Solutions (NVS 2012) in November 2011.

The survey recorded six Priority species: *Eremophila congesta* (P1), *Ptilotus chrysocomus* (P1), *Calytrix uncinata* (P3), *Homocalyx echinulatus* (P3), *Prostanthera ferricola* (P3) and *Sida picklesiana* (P3) (Table 7).

Table 7 - Results of targeted Priority flora survey by NVS in November 2011

SPECIES	RATING	C3	C4	BB	TOTAL	regional no.	% impacted
Eremophila congesta	P1		9	26	35	>2000	1.75
Ptilotus chrysocomus	P1			657	657	782	0*
Homocalyx echinulatus	P3	974		548	1522	>2000**	76.1
Prostanthera ferricola	P3	5			5	400	1.25
Calytrix uncinata	P3			13	13	>2000	0.65
Sida picklesiana	P3			1077	1077	4419	24.4

* - infrastructure relocated to avoid this population

** - GWR records have ~>19,000 plants recorded, the impact estimated at ~8%

The impact calculation was based on the original proposed location of mining infrastructure. The original plan has since been modified to eliminate the high impact areas to an insignificant level. Further assessment of the impact of the project on Priority flora is provided in Section 5.3.2.

2.8.8 Weeds

Six introduced weed species have been recorded at the project to date:

- *Portulaca oleracea** (pigweed, purslane). Located in the DRAS habitat
- *Tribulus terrestris** (caltrop) One record of this species in the SAES habitat
- *Anagallis arvensis* var. *caerulea** (blue pimpernel) Recorded in the SAES habitat.
- *Cuscuta epithymum** (lesser dodder) Recorded by Botanica in earlier surveys of the Joyner's Find area.
- *Citrullus lanatus** (afghan melon, pie melon). One record of this species on the current survey adjacent to a main access track near an abandoned water point.
- *Bidens bipinnata** (beggar's tick)). Located in drainage lines and floodplains in the current survey area; occurring extensively in parts of the HPMD habitat and often found in the DRAS habitat.

No Declared Plants pursuant to Section 37 of the *Agriculture and Related Resources Protection Act, 1976,* as listed by the Agriculture Protection Board (2007), were observed within the survey area (Recon, 2010).

2.9 THREATENED ECOLOGICAL COMMUNITIES

No TEC are located in the project area (based on DEC searches and the results of the vegetation surveys.

In addition to the Wiluna West PEC, two additional PEC's were revealed from the DEC Threatened Ecological Communities (TEC's) database as having the potential to occur in the project area:

- "Millbillillie: Bubble calcrete groundwater assemblage type on Carey palaeodrainage on Millbillillie Station" PEC (P1).
- "Bubble Well calcrete groundwater calcrete assemblage type on Carey palaeodrainage on Millbillillie Station" PEC (P1).

These communities are not known to occur in the project area.

2.10 FAUNA

2.10.1 Terrestrial Fauna

Four Level 2 fauna surveys have been undertaken at the Project:

- 31 October – 9 November 2005 - M53/1016 and L53/148 (Ninox 2006).
- 15 – 24 September 2006 – B ridge from Joyners Find deposit to Bowerbird deposit (Ninox 2007).
- 23 - 31 October 2007 – 'C' Ridge (Ninox 2008).
- 9 – 18 November 2011 – C3, C4 and Bowerbird deposit area (KLA 2012) (Figure 15).

A copy of all the relevant fauna reports are provided on the attached CD.

These surveys were undertaken in accordance with the Environmental Protection Authority's (EPA) Position Statement No 3 "*Terrestrial Biological Surveys as an Element of Biodiversity Protection*" (EPA 2002) and Guidance Statement No. 56 "Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia" (EPA 2004b).

A total of 71 bird, 27 mammal, two frog and 40 reptile species were recorded at the project during the Level 2 surveys (Ninox, 2006, 2007, 2008; KLA 2012*)*.

Overall, seven fauna species of conservation significance have been recorded at the Project (Ninox, 2006, 2007, 2008; KLA 2012*)*:

- Mulgara (*Dasycercus cristicauda* or *blythii)* – refer to section below.
- Long-tailed Dunnart (*Sminthopsis longicaudata*) – captured west of Bowerbird in 2011 survey.
- Malleefowl (*Leipoa ocellata*) – details provided in following section.
- Australian Bustard (*Ardeotis australis*) - recorded in 2005, 2006 surveys
- Peregrine Falcon (*Falco peregrinus*) - seen flying over camp in 2006 survey.
- White-browed Babbler (*Pomatostomus superciliosus*) – recorded during the 2011 survey.
- Crested Bellbird (*Oreoica gutturalis*) – recorded during the 2011 survey.

Further targeted survey work for the Mulgara and Malleefowl has been undertaken at the project and is summarised in the following sections.

Mulgara

Four individual Mulgara were recorded in spinifex sandplain during the 2007 fauna survey. In April 2009, seven indigenous Martu elders completed a targeted Mulgara survey and identified four old burrows, four active burrows and three areas with recent tracks. The spinifex sandplain area is located north of the proposed mining area. A section of L53/147 crosses a section of sandplain, in the event a haul road is constructed this is the only area occurring on sandplain. (Figure 15).

Malleefowl

Malleefowl were first recorded at the project (on the C ridge) in 2006 (Ninox 2007). As well as records collected during the fauna surveys, numerous targeted searches have been undertaken which include:

- Targeted search along the C ridge, Traditional owners and GWR exploration staff, May 2008 - recorded one active mound, numerous old inactive mounds and tracks at various locations along C ridge.
- Audit of status of known malleefowl mounds in the C3, C4 and Bowerbird areas, November 2011, KLA – 1 active mound, 22 inactive mounds, 5 inactive
- Targeted search along the B and C ridges at grid spacings of 100m, was undertaken by Traditional owners with GWR exploration staff, in 2012 – 5 active mounds, 54 inactive mounds (one recently active mound, the remaining recorded as very old-old) (Figure 16).

The active mounds recorded to date at the project are all located west of the C ridge. Of the five active mounds recorded, only one is located on the BIF (Figure 15).

The work to date has also identified eleven other fauna species of conservation significance as having the potential to occur in the region (Table 8)).

Table 8 - Conservation significant terrestrial fauna potentially occurring in area

SPECIES	COMMON NAME	CONSERVATION SIGNIFICANCE				PREVIOUS RECORD
		EPBC	WCA	DEC	IUCN Red List	
RETILES						
Liopholis kintorei	Great Desert Skink	Vulnerable				
MAMMALS						
Bilby, Dalgyte	*Macrotis lagotis*		S1		Vulnerable	1984 Wiluna
Rhinonicteris aurantius	Orange (Pibara) Leafnosed-bat	Vulnerable				-
AVIFAUNA						
Apus pacificus	Fork-tailed Swift	Migratory				-
Ardea modesta	Great Egret	Migratory				-
Burhinus grallarius	Bush Stone-curlew			P4		1979 Wiluna 2009 Yeelirrie
Charadrius veredus	Oriental Plover	Migratory Wetland species				-
Polytelis alexandrae	Princess Parrot	Vulnerable				-
Merops ornatus	Rainbow Bee-eater	Migratory				-
Amytornis striatus subsp. *striatus*	Striated Grasswren			P4		1984 Sandstone-Wiluna Road
Acanthiza iredalei iredalei	Slender-billed Thornbill	Vulnerable				-

A gecko *Diplodactylus ?squarrosus* was recorded on L53/148 during the 2005 fauna survey. A very similar gecko has been captured from Lorna Glen Station, 160 km north-west of Wiluna, and while various individuals consider the species recorded to be Diplodactylus stenodactylus, there are others who consider that it may be a genetically distinct form of *Diplodactylus squarrosus* (Ninox 2006). GWR is currently following up with the current status of this species.

Many of these species have a wide distribution and/or their preferred habitat is not present or limited to the proposed disturbance area. Further discussion on the potential impact of the project on these species is provided in Section 5.4.1.

2.10.2 Short-Range Endemics (SRE)

Two invertebrate surveys have been undertaken at the project and are summarised below.

2.10.2.1 2006 SRE survey

A survey for Short Range Endemics (SRE) invertebrates was conducted by ATA Environmental ('ATA' – now Coffey Environments) from 2 - 6 October 2006.

Discussions were held with Dr Mark Harvey from the Western Australian Museum prior to the survey, who advised that an intensive hand search was sufficient for the project area and no wet pitfall trapping was required.

The survey included searches at 25 sites over Ridges B and C (Figure 17). Searching was conducted on the eastern slopes at the top of the ridge and progressing down in a transect to the flat plains. Searching was conducted under rocks and other debris lying on the ground, or, amongst grasses, leaf litter and at the base of trees.

No SRE were recorded during the survey (ATA Environmental, 2007). Ten spiders from the families Lycosidae, Miturgidae, Gnaphosidae, Zodariidae, Ctenizidae and Sparassidae were collected during the survey (ATA, 2006). The spider species recorded are common and widespread and do not have conservation significance.

A juvenile *Conothele* species, a mygalomorph spider was recorded during the survey on Ridge C (approximately 1 km west of C4). As mature males are required for species identification, the conservation significance of this species cannot be determined. Notwithstanding this, this species has a scattered occurrence throughout favoured habitat (unlike other species which aggregate in large numbers in pockets of habitat).

2.10.2.2 2011 SRE survey

The Level 2 Spring fauna survey conducted in November 2011 (KLA 2012) included a targeted SRE survey. Invertebrate groups targeted during the survey were those considered most likely to potentially contain SRE taxa including:

- Mygalomorphae (trapdoor spiders);
- Diplopoda (millipedes);
- Pseudoscorpionida (pseudoscorpions); and
- Pulmonata (land snails).

In accordance with generic advice from the Office of the EPA (OEPA), 10 m x 10 m quadrats were established and up to one hour was spent searching for invertebrates in each of these quadrats. A total of ten quadrats were established with five within 50 m of each of the BIF sites and five within 50 m of the vertebrate trapping sites. Searches were conducted primarily on the south-eastern aspect within the landscape including at the bases of trees, rocks and in gullies *etc.* and included searching under rocks, under bark, under logs, in hollows of logs and in other leaf litter and debris lying on the ground.

In addition to the above searches, a collection of leaf litter and soils was collected from each quadrat and transferred back to Perth for examination. Collections were made from shadowed moist areas, for example, from the south eastern aspect of the bases of tree trunks, large rocks or overhanging rocks etc

Searches were also conducted for invertebrates during the spotlighting surveys.In addition to generally searching for SRE's during spotlighting forays, a 390nm Ultraviolet Lantern was used to detect and collect scorpions that fluoresce under UV light.

A total of 24 invertebrates comprising three spiders, eight pseudoscorpions and 13 scorpions were collected during this survey and vouchered at the Western Australian

Museum (8). Only two specimens were collected from soil samples and the remainder from pitfall traps and visual searches (Table 9) (KLA 2012).

Results indicate that the spiders were either juvenile or female and therefore could not be identified to species and that the pseudoscorpions require taxonomic revision (Burger *et al.* 2012). Therefore, it was not possible to determine if any of the specimens submitted where SREs (Burger *et al.* 2012). Thirteen scorpions were also vouchered (8) and none were identified as SREs (Volschenk 2012).

Table 9 - Identifications of specimens collected during survey, mode of collection and SRE status

Order	Family	Genus	Species	Total number collected			SRE status
				Pitfall Trap	Visual searching	Soil samples	
Araneae	Zodariidae				1		no comment
	Barychelidae	*Aurecocyrpta*	`sp female`		1		Currently not possible to say if it represents SRE
	Idiopidae	*Eucyrtops*	`sp juv`		1		Currently not possible to say if it represents SRE
Pseudoscorpiones	Olpiidae	*Beierolpium*	`sp. 8/3`		3		Possibly SRE but full taxonomic revision required
		Beierolpium	`sp. juv.`			1	unable to determine
		Indolpium			2	1	unlikely to represent SRE
		Austrohorus			1		Currently not possible to say if it represents SRE
Scorpiones	Buthidae	*IIsometroides*	'goldfields1'	3			Not an SRE
		Lychas	'annulatus'	1	1		Not an SRE
			jonesae	1	3		Not an SRE
			'splendens'	3	1		Not an SRE

2.10.3 Subterranean Fauna

Surveys for stygofauna and troglofauna were undertaken by Subterranean Ecology in May and July 2007. For stygofauna, the survey effort involved 35 sample events spread across 19 sites while troglofauna sampling involved 57 traps deployed in 29 drill holes in the Bowerbird, C3 and C4 deposits (Figure 18).

The survey was undertaken in accordance with EPA (2003) Guidance for the assessment of environmental factors (in accordance with the Environmental Protection Act 1986) *Consideration of Subterranean fauna in groundwater and caves during environmental impact assessment in Western Australia. No. 54.* (current at the time of the survey).

The following summary is taken from Subterranean Ecology (2007).

Stygofauna was detected at three (16 %) of the 19 sites sampled and comprised representatives of two common groundwater taxa known in the Yilgarn, namely *Bathynellacea*, and *Oligochaeta*. The two species of stygofauna identified were found only within the colluvium aquifer to the north of the main haematite ridges identified as potential mining sites. No stygofauna was detected within the Haematite/BIF areas.

Troglofauna was collected from 83% (24 of the 29) holes sampled. A total of 493 specimens comprising 12 morpho-species were collected. The invertebrate specimens comprised 12 taxa belonging to *Acarina* (3 morpho-species), *Collembola* (2), and *Lepidoptera* (2). None of the taxa collected showed any obvious troglomorphisms and are not considered likely to be obligate subterranean species (troglobites) that may be short range endemics (SRE's) whose habitat and distribution is directly dependent on the subsurface habitat of the BIF.

2.11 CONSERVATION RESERVES

There are no conservation reserves or DEC managed lands in the project area.

2.12 ABORIGINAL HERITAGE

As part of its Native Title agreement GWR, and the Tarlpa people have a Letter Agreement executed on the 10th April 2010 and a Mining Agreement executed on the 28th July 2010 to develop a Heritage Management Plan (HMP). The objective of the HMP is to provide a clear and agreed management strategy in relation to all cultural heritage issues affected by the proposed Wiluna West project. Central Desert Native Title Services (CDNTS) have managed the process which included additional survey work and consultation meetings with the native tile claimants to ensure that all heritage issues were noted. The HMP is now in the final stages of negotiation.

Survey work completed to date

GWR commissioned Eureka Archaeological Research and Consulting ('Eureka') to undertake an archaeological survey of ridge units B and C from 26-31 March 2006 and 19-21 June 2006. An additional survey of the proposed Bowerbird and Joyners Find project site and the Bowerbird haul road was undertaken by Eureka from 26-30 April 2006 and 19-22 June 2006.

The surveys recorded 15 archaeological sites and 20 isolated artefacts (Brown & Ryan, 2006; Harrison et al, 2006).

As part of the HMP CNDTS undertook a detailed archaeological survey in May and June 2010 over the above previously identified archaeological sites to a Section 18 standard. These sites were assessed as having a low level of archaeological significance (CDC 2011). The only exception was three rock shelters (Site ID 24647, 24648 and 24649) which require further investigation. As these are located east of the proposed disturbance this is not considered an issue (Figure 19). GWR has received advice from the CDC and the Traditional owners that they do not have an issue with disturbance of the archaeological sites as they are of low significance.

A Section 18 to clear these archaeological sites from the register will be applied for in late 2012.

Department of Indigenous Affairs (DIA) Sites

The Aboriginal Heritage Inquiry System maintained by the Department of Indigenous Affairs (DIA) lists two registered sites and 18 heritage sites within the Project area as being lodged. These sites are shown on Figure 19.

The registered sites resulting from the DIA search are:

- Site ID 24581 - refers to a mythological site whose buffer intersects M53/971, M53/972, L53/146, M53/1078 and M53/1087. A Section 18 hearing by the ACMC committee in 2012 found that there was no site and the area was cleared for any future disturbance however, the site is still listed on the DIA system.
- Site ID 15637 – refers to an artefact scatted located on L53/147 (Figure 19). The site is listed with open access and no restrictions. The site will not interfere with the planned road access inside the license.

The 18 heritage sites lodged in the database comprise three mythological sites and 15 archaeological sites (DIA 2012). The 15 archaeological sites are the subject of the above survey work and it is anticipated they will be cleared in early 2013. The mythological sites are associated with the previous registered site 24581 and an application will be made to the DIA to have these removed from the register.

There are no registered sites located on L53/115, L53/148 and E53/1089.

2.13 EUROPEAN HERITAGE

A number of former gold mine shafts, pits and tailings are located in the project area, in particular M53/1016, M53/1017 and M53/1018 (Figure 20). Archaeological finds associated with these sites suggest they were occupied between approximately 1920 and 1950 (Harrison et al, 2006).

3.0 DESCRIPTION OF MINING OPERATIONS

A summary of the project is presented in Table 10.

Table 10 - Summary of proposed Wiluna West project

ELEMENT	DESCRIPTION
Life of Project	15 years
Size of Orebody	130 Mt
Mining method	Open pit
Mine operation	Continuous
Depth of pits	50 – 160 m
Depth to water table	30 – 60 m
Total area of disturbance	2600 ha
Ore mining rate (peak)	10 Mtpa
Total waste rock	600 Mt
Dewatering rate (approximate)	0.5-1.0 GL/year
Power generation	Diesel generator plants (possible conversion to natural gas)
Fuel supply	Diesel
Operating hours	24hrs per day, 7 days per week
Construction	2 years
Construction commencement (anticipated)	2013

A plan of the proposed project is provided as Figure 21.

3.1 MINING OPERATIONS

GWR proposes to develop the Wiluna West Project to mine and process approximately 100 million tonnes of direct shipping ore (DSO) over 15 years. The mine will be a designed for a nominal 7 -10 Mt/annum operation. The actual output will be determined by the export Port being used. It is envisioned that the production will be from 1 to 3 Mt/yr initially shipping out of the port of Esperance and then moving to 7 to 10 Mt/yr shipping out of the port of Oakajee.

Mining will occur on two main BIF ridges, B Ridge and C Ridge. The ROM ore from the pits will be transported to a central processing facility, located approximately at the centroid of the major deposits in the two ridges.

The processing area will comprise facilities for unloading/tipping, screening, secondary crushing, stockyards and transport load-out. Other key items of infrastructure include an administration and workshop buildings, accommodation village and interconnecting roads.

Fresh water produced from pit dewatering activities will be utilised in mine processing activities.

3.1.1 Mine Dewatering

At present the minimum required mine dewatering rate is expected to range from around 0.5 to 1.0 GL per year. These rates were determined by numerical modelling based on early hydrogeological investigations and are sensitive to the hydraulic parameters in the ultramafic rocks that surround the BIF aquifer.

As the Project will require water supply in excess of the minimum dewatering rate, advanced dewatering will be used to ensure supply during the first phase of the Project, and dewatering volumes will be matched to Project demand.

To refine dewatering rates and durations, GWR will run an investigation program in the 2012–2013 financial year to:

- test the permeability of the ultramafic materials to better define likely lateral inflows to the BIF 'strip aquifer';
- assess the storage parameters of the BIF aquifer;
- remodel the aquifers with the new parameters to assess the number of bores and volumes that will be abstracted during dewatering; and
- undertake environmental studies to assess impacts of taking this water.

3.1.2 Waste Rock

Approximately 600Mt of waste rock is expected to be generated from the mining operation. The location of the waste rock dumps are shown in Figure 21.

Due to the presence of a gold resource existing alongside the BIF and with the knowledge of the importance of retaining as much ridge line as possible for biodiversity and conservation reasons, GWR propose to locate the waste rock dumps for the project adjacent to the ridges in the swales to the east and west of active pits. The waste dumps will be constructed to a maximum height that will mirror the height of the ridges in the area.

Preliminary and final designs of the waste dumps will be undertaken in the oncoming months.

3.1.3 Waste Characterisation

GWR evaluated the waste chemical analysis from 2000 drillholes located in the main mining areas to characterise the waste and low grade materials expected to be exposed to oxidation. Waste rock samples were targeted as these contain the highest sulphur levels and would have the highest propensity to generate acidic runoff. Waste material with sulphur content below 0.3% is regarded as non-acid forming due to the sulphur level being too low to result in acid generation.

A total of 75,600 waste samples were recorded in the proposed mining areas. The average of the samples was 0.04% (Table 11) with 1.9% of the samples recorded values greater than 0.3%. Given the continuity of the ore these samples are considered representative of the waste material Based on the analysis the waste produced from the project is considered non-acid producing (S<0.3). The areas that had results greater that the 0.3% were isolated cases and would be mixed in with the rest of the waste to end up with average level of approximately 0.04%.

Table 11 – Waste characterisation samples

	#Schist	# BIF	Combined
# samples	41,000	34,600	75,600
# >0.3%	1021	392	1413
% >0.3%	2.5%	1.1%	1.9%
Average	**0.05%**	**0.03%**	**0.04%**

Based on these results no Potentially Acid Forming (PAF) rock is anticipated to be mined during the proposed mining operation.

3.2 CRUSHING AND SCREENING

Ore will be treated by way of an on-site crushing, screening and stockpiling process plant located approximately at the centroid of the major deposits in the two ridges. This crushing and screening operation will operate at a throughput of 1700 t/hr.

Primary crushed ore will be transferred to the product screens were it will be sized into three streams to create a lump, fines and an oversize product. The lump and fines will report to product stockpiles and the oversize ore will be sent to a secondary crusher before being returned to the screens to be separated into lump and fines and then sent to the product stockpile.

3.3 TRANSPORT

The ore will be loaded from the product stockpiles via front end loaders into transportation vehicles for shipment to either Oakajee or Esperance ports.

Initially, the ore will be transported along the Sandstone-Wiluna Road (Ulalla Road) and Goldfields Highway to connect with Leonora rail to Esperance.

Thereafter a dedicated private haul road or railroad will be used to transport the ore from the mine site to Weld Range where it will connect with the Oakajee rail system to Oakajee Port (refer to Section 3.10 – Product Export).

Products will be unloaded at the port and stored, prior to being loaded onto iron ore shipping vessels with existing iron ore ship-loading facilities.

3.4 INFRASTRUCTURE

3.4.1 Buildings

Various buildings will be constructed at the Wiluna West site, including administration and general amenities supporting the operation, workshops and accommodation village (Figure 21).

3.4.2 Project roads

Access roads will be constructed within the project area to connect infrastructure and the accommodation village.

Roads to be constructed include mining haul roads, service roads and access roads.

3.5 RESOURCE REQUIREMENTS

3.5.1 Power

Power for the project will be supplied by on-site diesel generator plants. Each of the four main sites for the project (administration, processing, accommodation village and workshop) will have its own independent power generation system.

3.5.2 Water

Water will be required for processing, dust suppression and the mine camp (potable). Engenium (2012) evaluated the DSO Project water balance and concluded that based on the current concept, ore processing is expected to require between 1.5 and 2.1 GL of water per year over a 15 year period. This estimate is consistent with other water usage from other DSO operations (Department of Water 2011).

Water supply for phase 1 of the operation will be supplied by advanced dewatering of mining areas. The volume of water available for dewatering will be determined as part of the 2012–2013 investigation program. If dewatering is not sufficient for later phases, GWR has identified contingency supplies in surrounding palaeochannels. If required, the palaeochannels would be explored and developed during the first phase of mining (

3.5.3 Fuel supply

Diesel fuel will be required for construction, mining, operations and road haulage activities and will be stored in bunded bulk fuel facilities.

Diesel fuel will be stored and distributed at the accommodation village from self bunded tanks with road tanker unloading stations and fuel management systems.

3.5.4 Explosives

The ANFO and high explosives storage will be strategically located to service the operating pits.

3.6 WASTE DISPOSAL

3.6.1 Industrial and domestic waste

Industrial waste will be collected and transported off-site for disposal, resale or recycling or, disposed of in the active face of the WRD.

All domestic waste will be removed periodically by a contracted service provider to a licenced landfill.

3.6.2 Sewage

Sewage plants will be installed at all the major facilities.

Isolated areas will be serviced by septic tanks systems.

3.7 HAZARDOUS MATERIALS

Bulk diesel storage tanks complete with pumps, valves and piping will be installed in a bunded area to provide fuel. A concrete apron and spillage containment system will be set up adjacent to the tanks for vehicle refuelling and tank re-filling.

All bulk hydrocarbons will be stored in concrete bunded areas adjacent to the workshop. Storage areas will be capable of containing 110% of the largest container stored and 25% of the aggregate of all containers stored.

The washdown bay will include a hydrocarbon separator to remove hydrocarbon contaminating the washdown water via a water/oil interceptor system which will be located next to the wash down pad. The “cleaned” water will then be available for recycling through the washdown bay. Collected oil will be pumped to the waste oil tank.

Waste oil will be stored in a tank and removed from site for recycling by a licensed collection service.

3.8 ACCESS ROADS

Access to the site will be via the north access road located 20km from Wiluna on the Goldfields Highway to the northern entrance of the site, or via the south located 27km along the Sandstone-Wiluna Road to the southern entrance of the site.

3.9 PRODUCT EXPORT

GWR has two options for the export of product from the Project: Oakajee and Esperance.

Oakajee

The Project has been modelled by Oakajee Port and Rail (OP&R) as a potential user of the proposed port and northern rail infrastructure accessing the line near Weld Range. It is proposed that ore from the Wiluna West mine would be delivered by one of the following alternatives:

- Existing public roads
- A combination of private access road and public roads
- A dedicated private haul road
- A rail "spur" line from the Weld Range rail line to the Wiluna West mine.

Delivery of product to the Oakajee will depend on the development of the proposed rail and port to a capacity to accommodate up to 10mtpa of Wiluna West ore over and above the contracted capacity for other users.

Esperance

Transport of ore to Esperance would be via public road to Leonora and public rail from Leonora to Esperance.

GWR has entered into a Capacity Reservation Deed with the Esperance Port Authority (July 2012 concerning the reservation of capacity in relation to facilities to be constructed as part of the proposed increase in export capacity at the Port of Esperance (New Facilities). The arrangements reserve capacity for GWR to export 3 million tonnes per annum utilising the New Facilities. GWR's right to access the Port or utilise any reserved capacity is dependent on the Company entering into a New Facilities Agreement on terms that are acceptable to the respective parties (including a future operator of the proposed New Facilities).

In January 2012 the West Australian Government through the Minister for Transport announced its decision to increase the Esperance port capacity by up to 20 million tonnes per annum in a staged plan. The Company has continued to advance discussions with interested parties in the planned increase of Esperance Port capacity. This has included Department of Transport (DoT), infrastructure groups, and other industry players.

In June 2012 the DoT and Esperance Ports Sea and Land (EPSL) advertised a market sounding in relation to the development plans and to support identification and selection of a proponent(s). GWR remains actively engaged in activities related to the proposed port development and has raised with EPSL and DoT the need to consider the impact of tonnage from the Wiluna West mine (and others) in their development plans and environmental permit requirements. It is understood that environmental requirements has been included in a contract for a reference design recently let by the EPSL as part of the planned port upgrade.

3.10 WORKFORCE

The workforce for the project construction is estimated to be approximately 200 persons, with an ongoing operations workforce of 350 persons comprising Company staff and contractor personnel on a rotating shift basis.

4.0 CONSULTATION UNDERTAKEN

Consultation has been undertaken with:

- Department of Environment and Conservation (DEC)
- Office of the Environmental Protection Authority (OEPA)
- Department of Mines and Petroleum (DMP)
- Department of Indigenous Affairs (DIA)
- Department of Water (DoW)
- Shire of Wiluna
- Main Roads
- Ingenious owners (Martu)
- Central Desert Native Title Services (CDNTS)
- Geraldton Port
- Esperance Port
- Department of Transport
- Oakajee Port & Rail
- Chamber of Minerals and Energy
- Geraldton Iron Ore Alliance (GIOA)
- Yilgarn Iron Producers Association (YIPA)
- Wildlflower Society
- Conservation Council of WA
- Wilderness Society of WA
- Malleefowl Preservation Group.

Table 12 summarises the consultation undertaken with regard to the project to date.

4.1 ENVIRONMENTAL AGENCIES CONSULTED ABOUT THE PROJECT

4.1.1 Office of the Environmental Protection Authority (OEPA)

On 20 February 2012, GWR met with the OPEA to discuss the Wiluna West Project. Attending were:

Present: Dr Paul Vogel, Chairman, EPA

Mr Mark Jefferies, Manager, Mining and Industrial Branch, Office of the EPA (OEPA)

Messrs Craig Ferrier, Mick Wilson, Paul Leidich from Golden West Resources

Keith Lindbeck, Environmental Consultant

GWR presented an overview of the proposed Wiluna West 10Mt project. In the presentation GWR highlighted the number of environmental studies that had been completed to date and the results from them. The presentation was well received.

The Chairman and Mark J raised the following points:

1. Metalliferous drainage at neutral pH – looking at ARD was correct but must include neutral drainage for such elements as selenium, etc.
2. Ensure that the studies investigate the cumulative impacts and compare to the regional environment.
3. Contact DEC to ensure they are happy with the lack of autumn fauna surveys (as with the DMP)
4. Contact DEC to obtain comment on the impact of the project on the PEC
5. Contact DoW to discuss availability of groundwater for the project and potential impact on other users.
6. Discuss clearing permit requirements with DMP
7. Discuss implications of export through the Port of Esperance with the DoT.

GWR has since this meeting engaged all the above agencies to discuss the points raised.

4.1.2 Department of Eenvironment and Conservation (DEC)

Many ongoing meetings and discussions have been conducted since the start of the project . Relevant meetings with the DEC to discuss the project include:

14 February 2006

- Site visit with Dr Neil Gibson of the BIF ranges. As a result of this site meeting, a quadrat based sampling methodology was obtained by Jim's Seeds, Weeds and Trees from Dr. Gibson.

23 May 2007

- Project briefing in Kalgoorlie.

6 November 2008

- Project briefing to:
    - David Pickles (Natural Resource Management Officer – Goldfields)
    - Sandra Thomas (Environmental Management Branch (EMB)).

  Briefing outlined the results of the biophysical surveys undertaken to date at the project.

  DEC raised concern over adequacy of 2006 SRE survey (based on timing of survey). Further work suggested. Subsequent survey work has been undertaken by GWR.

April and August 2010

Consulation with the DEC regarding the flora species *Sida picklesiana (*formerly *Sida sp. Wiluna*). The species was first recorded by the DEC in the 2006 quadrat survey and later given a Priority 1 rating.

Discussions were undertaken with the Curator and staff of the Western Australian Herbarium (WA Herbarium) regarding two undetermined specimens showing superficial similarities to this species (considered a new taxon at this time). Further survey work undertaken by KLA (in conjunction with the WA Herbarium) which recorded additional populations of the species extending up to 200km from the GWR project (This species has subsequently been downgraded to a Priority 3 species).

21 February 2012 and 9 March 2012

Correspondence with David Pickles (letter), DEC seeking advice on the requirement for autumn fauna survey at the project (as three Spring fauna surveys have been undertaken previously). This followed on from advice from the Native Vegetation Branch, DMP (see Section 4.3) that they did not believe a survey was required but that they would seek advice from the DEC.

Email correspondence received from Sandra Thomas, EMB, DEC advising that: *"Based on the available information, an Autumn fauna survey does not appear to be required.."*

26 June 2012

Correspondence to David Pickles (letter), providing results of the SRE 2011 survey for their information and comment on the adequacy of the survey. No response has been received to date.

28 August 2012

Meeting with GWR and DEC.

Present were:

- Sandra Thomas, DEC
- Val English, DEC
- Julie Futter, DEC
- Daniel Coffey, DEC
- Craig Ferrier Executive, General Manger, GWR
- Mick Wilson, Executive Director, GWR
- Keith Lindbeck, Principal, KLA.

GWR provided an update on the project and advice sought from the DEC on the impact of the project on the Wiluna West PEC. DEC outlined the information they require (vegetation and flora data) to enable them to make their assessment on the impact of the project. This information has been provided to the DEC with this referral document.

4.1.3 Department of Mines and Petroleum (DMP)

27 January 2012 and 30 January 2012

Advice from the Native Vegetation Branch (NVB), DMP (Ryan Mincham) sought regarding the requirement for an Autumn fauna survey (given the three previous trapping surveys have been undertaken in Spring) at the project.

The NVB (Ryan Mincham) advised that the DMP "*would agree that the level of information gathered to date would be sufficient for submitting a clearing permit application. The requirement for further survey in autumn would not be a requirement at this stage, however, DMP is likely to consult with DEC on the proposal for advice in relation to….".*

4.1.4 Department of Water (DoW)

On 20 June 2012, GWR met with the Department of Water (DoW) Swan-Avon Regional Office, responsible for water licensing in the Goldfield Region. Attending from the DoW were:

- Yolanda Brookes, Manager Goldfields Water Licensing, DoW
- Chris O'Boy, Regional Hydrogeologist, DoW
- James MacIntosh, Program Manager Land Use Planning, DoW

- Tina Taraborrelli, Licensing Officer, DoW.

GWR presented a summary of the project, hydrogeological investigations and the proposed water supply and dewatering strategy. The strategy for water licensing was presented as follows:

- further investigations of permeability and storage to refine dewatering rates;
- implementation of monitoring program;
- refinement and recalibration of numerical modelling;
- hydrogeological assessment, including impact assessment;
- preparation of operating strategy, 5C licence application and associated advertising.

The DoW was supportive of the proposed approach noting that all key DoW requirements had been addressed. It was agreed that analysis of the geological data would be undertaken to ensure that future site investigations were representative of the hydrogeological units being targeted. The DoW indicated that the proposed time frames for licensing and supporting studies were reasonable.

4.2 OTHER STAKEHOLDERS WITH POTENTIAL INVOLVEMENT WITH THE PROJECT

GWR has also actively engaged other groups that will actively support the project or will be potentially affected by it. The main groups that have been in discussions with GWR are:

- Native title claimants and their advisor council (CDNTS)
- Local government
- Department of Transport
- Infrastructure providers
- Conservation and preservation societies.

5.0 ENVIRONMENTAL FACTORS, MANAGEMENT STRATEGIES AND FURTHER WORK

5.1 ENVIRONMENTAL MANAGEMENT PLAN

GWR has developed an Environmental Management Plan (EMP) for the approved JWD project that outlines the objectives, performance indicators and required actions to achieve the objectives and the responsibilities for actions for the development of the Project. This EMP will be updated to include all aspects of the larger project.

5.2 DISTURBANCE

Aim

The aim is to minimise disturbance to, and encourage regrowth of, native vegetation.

Potential Impact

Disturbance to ground surface can initiate land degradation if control mechanisms are not implemented. This may also result in over clearing.

Environmental Management Strategy

The project will result in a maximum of 2600 ha of disturbance of native vegetation (Table 12).

Table 12 – Estimate of disturbance required for development of project

INFRASTRUCTURE	DISTURBANCE AREA (ha)
PITS	760
WASTE ROCK DUMP	1,500
ORE PROCESSING	50
OFFICES, WORKSHOP	140
ROADS	150
TOTAL	**2600**

Clearing of vegetation for the project will be guided by the following principles:

- Minimising the clearing profile.
- Before clearing commences, the areas to be cleared will be well-defined and clearly marked so that over-clearing will be avoided.
- Clearing operators will be supervised by GWR Environmental staff.
- Construction of associated infrastructure away from BIF to minimise impacts.
- Flagging of significant vegetation, fauna habitat or Aboriginal heritage sites that are to be avoided.
- Protecting all vegetation outside of the clearing profile.
- Rehabilitating disturbed areas not required for ongoing maintenance.
- Cleaning down of machinery to reduce weed and disease introduction and spread.
- Induction of employees to ensure disturbance is confined to areas identified clearly in the field.

- Collect and correctly stockpiling cleared vegetative material for later use in rehabilitation works. Cleared vegetation stockpiles will be located surrounding the waste dump upslope from the topsoil stockpiles.
- Progressively rehabilitate completed areas as soon as practicable.
- Only use local native plant species.

There is minimal topsoil available in the ridge areas. Most of the material cleared from this area will be scrub. The topsoil on the slopes below the vertical ridge will be easier to remove and pushed down the slopes. Topsoil stockpiles will be located adjacent to and within the footprint of disturbance (outside any perimeter access roads to ensure that vehicles do not drive on the topsoil stockpiles). The stockpiles will be located and constructed to minimise erosion from rainfall, wind and contamination from brackish dust suppression water.

Vegetation stockpiles will be immediately upslope of the topsoil stockpiles to minimise surface water run-on to the topsoil. This stockpiling arrangement will allow minimal handling and transport of both vegetation and topsoil, hence maintaining integrity and minimising soil losses.

The clearance of vegetation and topsoil under the footprint of the waste rock stockpiles will be a gradual process, conducted as required in advance of the growing toe of the waste dumps. This will minimise the length of time topsoil is stored.

5.3 VEGETATION AND FLORA

5.3.1 Vegetation

Aim

GWR aims to avoid or minimise impacts to areas of significant vegetation. Maintain the abundance, species diversity, geographic distribution and productivity of vegetation communities.

Potential Impact

Clearing of significant vegetation communities. Restriction in extent of vegetation communities.

Environmental Management Strategy

The Wiluna West BIF is listed as a PEC due to its vegetation complexes. Markey & Dillon (2007) study state that "*Despite the low altitudinal separation (15–30 m) between the hills around the Herbert Lukin Ridge Joyners Find and the surrounding outwash plains, the floristic communities on rocky upland sites were significantly dissimilar to the lower slope and outwash communities*…:

The DEC (2007) report examining biodiversity values and conservation requirements of these BIF ranges summarises the more arid ranges surveyed by DEC in 2006 (including Robinson Range, Booylgoo Range, Wiluna West (Joyner's Find Hills), Cashmere Downs, Bulga Downs and Wolla Wolla / Gullewa) stating that preliminary results suggest while each of the systems surveyed appear floristically distinct from one other (in line with the 2005 survey results and confirming Beard's large scale mapping work), "*the ranges appear less diverse with fewer geographically restricted vegetation units than those surveyed in 2005*" (including Jack Hills, Weld Range, Koolanooka Hills, Mt Karara / Mungada Ridge/Blue Hills, Minjar / Gnows Nest, Warriedar Hill / Pinyalling, Mt Gibson).

This is supported by Gibson et al. (2007) who state "*The degree of endemism and number of DRF and Priority Flora vary considerably between the BIF ranges. On current data some ranges (such as Helena and Aurora Range, Koolanooka Hills, Mt Jackson, Mt Gibson and Karara) have much higher conservation significance than others*."

Based on their survey, Recon (2010) considers the upland communities, in particular the communities associated with BIF and BIF endemic flora (*Beyeria lapidicola* (P1) and *Prostanthera ferricola* (P3)), are of regional significance due to the restricted distribution of the BIF endemic species; and resulting from the limited distribution of the plant assemblages of these habitats (SIMS-B and SIMS-M). Based on the current design approximately 50% of SIMS-B habitat will be disturbed. No disturbance is planned in the SIMS-M habitat.

The SIME habitat was identified by Recon (2010)as being of regional significance due to the presence of BIF endemic flora (*Beyeria lapidicola* (P1)). While Recon (2010) considered this habitat significant due to the presence of Malleefowl mounds in this habitat, targeted malleefowl surveys undertaken have revealed they are not restricted to this habitat type. Approximately 49% of this community will be directly impacted.

GWR has undertaken a preliminary assessment of the percentage of each vegetation unit identified on the BIF and surrounds that will be impacted by the project (

Table 13).

There are six vegetation groups with >30% of their area to be directly impacted (mapped by Recon 2010). An assessment of the area to be directly impacted minus the WRD area (of which there is some flexibility in location) reveals the communities with the greatest impact (32-52%) area are the SIMS-B, ASET and LOMS (Table 13). The remaining vegetation groups all have >16% directly impacted. Where vegetation communities are considered significant, GWR will redesign the WRD location to reduce the impact on these communities wherever possible.

It is important to note that the above calculations are based only on the project area mapped in Recon (2010) survey. As described previously, the BIF located south of Ullala Road has not been surveyed in its entirety.

No TEC will be impacted by the project.

The vegetation at the project is not remnant vegetation of an area that has been extensively cleared.

Management measures to be implemented by GWR relative to vegetation include:

- Development and implementation of 'Permit to Clear' procedures.
- Areas to be cleared will be clearly marked prior to clearing commencing so that over-clearing will be avoided.
- Collecting and correctly stockpiling vegetative material and topsoil for later use at selected sites.
- Ensuring all staff and contractors attend compulsory environmental inductions to be advised of environmental management responsibilities (including Priority species management) and to raise awareness about the vegetation and flora at the site and the habitat it provides for fauna.
- GWR personnel will provide information to construction and operations staff at toolbox meetings as well as regular (bi-monthly) presentations at site meetings.
- Supervision of vegetation clearing activities by the Environmental staff.
- Restricting traffic to established roads and parking areas so as not to disturb vegetation.
- Limiting clearing of vegetation to the minimum necessary to implement the project.
- Progressively rehabilitate completed areas as soon as practicable.
    - Using only local provenance seed in rehabilitation activities.

Table 13 - Significant vegetation communities at the project

Comm. Type	Habitat	Level of Signif.	Assessment (from Recon 2010)	Total area mapped (ha)	% of mapped area to be impacted by (mining area)	% of mapped area to be impacted minus WRD area
1	SIMS-B	Regional	Mostly this habitat is restricted in distribution to the Wiluna West PEC. Presence of Significant & Priority Flora, including BIF endemic flora.	255	55	**51**
2	ASET	Regional	Occurs within the PEC Presence of Priority Flora, including BIF endemic flora.	368	65	**52**
2	LOMS	Regional	Occurs within the PEC. Presence of Significant & Priority Flora, including BIF endemic flora.	107	39	**32**
2	SIMS-C	Regional	Occurs within the PEC. Presence of Significant & Priority Flora, including BIF endemic flora.	874	Nil	Nil
2	UAET	Local	Occurs within the PEC. Presence of Significant Flora	260	16	12
2	SUAE	Local	Occurs within the PEC.	273	25	11
2	SAEC	Local	Presence of Priority Flora.	51	11	2
3	OALS	Local	Occurs within the PEC. Presence of Significant & Priority Flora.	732	6	6
3	OALS-S	Local	Presence of Significant & Priority Flora.	71	37	7
3	AXSI	Local	Occurs within the PEC. Presence of Significant Flora.	53	Nil	Nil
3	SXSS	Local	Occurs within the PEC. Presence of Priority Flora.	92	29	4
4	SAES	Local	Occurs within the PEC. Presence of Priority Flora.	2617	26	7
4	DRAS	Local	Occurs within the PEC. Presence of Priority Flora.	828	15	2
4	USCS	Local	Occurs within the PEC.	523	49	11
5	SIME	Regional	Occurs within the PEC. Presence of Malleefowl and Priority Flora, including BIF endemic flora.	742	19	4
5	SMEC	Local	Presence of Priority Flora.	319	35	11
5	MSET	Local	Occurs within the PEC.	1080	3	3
6	SIMS-M	Regional	Restricted to within the PEC. Presence of Significant & Priority Flora.	97	42	16
Breakaways	BCLS	Local	Presence of Priority Flora.	44	6	1
Breakaways	BRXS	Local	Presence of Significant & Priority Flora.	48	25	1

In summary GWR will minimise the disturbance of native vegetation by:

Avoid	Avoid disturbance of significant vegetation where practicable.
Minimise	Minimise the impact on native vegetation by staying within the existing disturbance footprint.
Rectify	Rehabilitate disturbed areas on completion of mining.
Reduce	Ongoing monitoring and auditing of rehabilitated sites for a minimum of three years following completion of mining activities.

5.3.2 Flora

Aim

GWR aims to minimise the impact on flora of conservation significance and protect Declared Rare and Priority Flora within the provisions of the Wildlife Protection Act 1950.

Potential Impact

Removal or impact to Priority flora species.

Environmental Management Strategy

No DRF have been recorded in the project area.

Fourteen Priority flora have been recorded in the project area surveyed to date and it is anticipated that removal of some of the species may be required. Tables 14 and 15 provide a preliminary assessment of the impact of the project on Priority flora as a result of the project.

- ***Eremophila congesta***

Family: Scrophulariaceae

Conservation Status: Priority 1 – Poorly known taxa.

Known records: *Eremophila congesta* is a regional endemic species (a regional endemic being defined as being restricted to an area within a 100 km radius) (Markey & Dillon 2007). It is only known from the Wiluna area where it occurs on lateritic outcrops and hilly areas in *Acacia* shrubland.

Occurrence at site: There are numerous records of this species at the project. The largest and densest populations (of approximately 2000-3000 individuals) are located northeast of the BIF ridges. The proposed camp and access road to the camp are located in the vicinity of these populations. There are records of this species in the C4 pit area and in infrastructure at Bowerbird. While this species was recorded in the SIMS-B, SIMS-C and SUAE habitats (i.e. BIF related habitats), it does not occur in large numbers in these communities (Recon 2010). It is estimated there are between 50-100 individual plants located in the proposed disturbance area.

Potential Impacts: The project will require the removal of up to 100 individuals. This represents approximately 5% of the recorded populations at site (based on a population of 2000, of which there are more known). This species is not restricted to BIF and is not restricted to the project area (numerous records east of Magellan site) thus the conservation significance of this species will not be impacted.

- ***Ptilotus chrysocomus***

  Family: Amaranthaceae

  Conservation Status: Priority 1 – Poorly known taxa.

  Known records: Species only recorded in two locations: Blue Hill Station, south of Carnarvon Range and at the Wiluna West Project (Recon 2010).

  Occurrence at site: This species is not uncommon in the footslopes associated with rocky breakaways (not BIF) located at site. There are 17 records of this species at site and one is located in the proposed area of disturbance (C3 pit – population number not defined). These are predominantly located away from the BIF and areas of proposed infrastructure. A large population of approximately 657 individuals is located between the Bowerbird and C3 pits and will not be impacted. Within the wider Wiluna West Project it is estimated that a total population of 782 plants exists.

  Potential Impacts: GWR has designed the infrastructure to avoid impact to this species. Only one population of this species will be impacted and although the population number has not been defined, it is not expected to impact the conservation significance of this species.

- ***Beyeria lapidicola***

  Family: Euphoribiaceae

  Conservation Status: Priority 1 – Poorly known taxa.

  Known records: Five collections from three locations are known of *Beyeria lapidicola*: Weld Range (220km west of project); Bulga Downs Station (220km southeast of project); and the one record east of C2 (see below). All three populations occur on crests, hill slopes and steep escarpments of outcropping banded iron formation as stated by Markey and Dillon (2007) known to occur on BIF.

  Occurrence at site: There is one record of this species at the project on the eastern side of the C ridge in the SIMS-B and SIME habitats (Recon 2010). This record is located east of the proposed pit at C2. The number of individuals has not been determined although Recon (2010) noted that the species was scattered along the BIF footslope at this location.

  Potential Impacts: Before this area is mined additional targeted surveys will be undertaken to confirm the population size and the impact area. Once known if the area is impacted by the proposed mining infrastructure GWR will redesign the layout so that ed there is minimal impact on the population. These species will be flagged off prior to any disturbance for protection.

- ***Eremophila ?anomala***

  Family: Scrophulariaceae

  Conservation Status: Priority 1 – Poorly known taxa.

  Known records: Only previously known from a small area northeast of Paroo homestead (Recon 2010).

  Occurrence at site: The species tentatively identified as *Eremophila ?anomala* requires flowering material to confirm the identification. The two tentative records are located: east

of the northeastern corner of the C3 waste dump; and 650m east of the Bowerbird north waste dump.

Potential Impacts: The identity of this species has not been confirmed, however, the known records of this species at site are located outside of the proposed disturbance area.

- ***Calytrix uncinata***

  Family: Myrtaceae

  Conservation Status: Priority 3 – Poorly known taxa.

  Known records: This species is known to occur on a varying range of substrates from white or red sand, sandy clay, granite or sandstone breakaways and rock rises (WAHERB 2012) and has been recorded from Wiluna to Mt Magnet.

  Occurrence at site: There are 118 records of the species at site with the majority concentrated around the Joyners Find area. The population numbers at 41 of these has not been determined (10 of which will be impacted), however, based on the current data there are 1207 recorded individuals based on 73 of these records.

  Potential Impacts: This species is not restricted to the project area. It is anticipated the project will require removal of approximately 400 individuals plants. This is not expected to impact the conservation significance of this species.

- ***Eremophila arachnoides subsp. arachnoides***

  Family: Scrophulariaceae

  Conservation Status: Priority 3 – Poorly known taxa.

  Known records: This species is known to occur on shallow loam over limestone and has been recorded from Sandstone to Meekatharra.

  Occurrence at site: There are five populations of this species recorded at site totalling approximately 305 individuals. The species are located east of Bowerbird and south of Joyners Find and are not located in the proposed disturbance area.

  Potential Impacts: This species is recorded outside of the proposed disturbance area and will not be directly impacted.

- ***Homalocalyx echinulatus***

  Family: Myrtaceae

  Conservation Status: Priority 3 – Poorly known taxa.

  Known records: This species is known to occur on laterite, breakaways and sandstone hills (WAHERB 2012) and has been recorded from Wiluna to Mt Magnet and north to Newman. The species is recorded as having an isolated to sparse occurrence.

  Occurrence at site: There are numerous records of this species with the largest populations occurring at C3 and C4. It has been estimated there are in excess of 19,000 plants at site. A large population of approximately 10,000 plants has been recorded in the vicinity of the current proposed plant site. The final plant site will be located to have

minimal impact on this species. This species was also recorded on the BIF located south of Ullala Road.

Potential Impacts: Based on the current site layout it is estimated that approximately 50% of the plants located at site will require removal. As the species is not restricted to the project and a significant number of plants will not be impacted, there is not anticipated to be any impact to the conservation significance of this species.

- ***Maireana prosthecochaeta***

  Family: Chenopodiaceae

  Conservation Status: Priority 3 – Poorly known taxa.

  Known records: This species is known to occur on laterite, hills and saline soils (Recon 2010) and has been recorded from Wiluna to Mt Magnet and north to Newman.

  Occurrence at site: There are five records of this species at site, all of which are located on the footslopes associated with breakaways in the BCLS habitat (Recon 2010). None of these records are located in the proposed area of disturbance.

  Potential Impacts: This species is located outside of the disturbance area, thus there will be no impact to the conservation significance of this species.

- ***Olearia mucronata***

  Family: Asteraceae

  Conservation Status: Priority 3 – Poorly known taxa.

  Known records: This species is known to occur on shallow drainage channels and is recorded from Newman and west of Leonora.

  Occurrence at site: There are five records of this species at three different locations: Joyners Find, north of Joyners Find and east of Bowerbird. It was observed in low numbers in the DRAS, SIMS-M and BRXS habitats (Recon 2010). The populations at Joyners Find are located within the proposed pit disturbance area.

  Potential Impacts: This species is not restricted to the project and although the project will require removal of the Joyners Find populations, it is not expected to impact the conservation significance of this species.

- ***Prostanthera ferricola***

  Family: Lamiaceae

  Conservation Status: Priority 3 – Poorly known taxa.

  Known records: Currently known from the Murchison (MUR) and Gascoyne (GAS) IBRA regions of the Eremaean Botanical Province. This species is known to occur on banded ironstone and basalt, shallow red-brown skeletal sandy loam soils and occurs from the Wiluna to Meekatharra and west to Mt Magnet.

  Occurrence at site: There are 10 records of this species which are restricted to the C3 area. Approximately half of these are located within the proposed C3 pit area. The population size has not been quanitfied.

Potential Impacts: Based on the available data it is estimated approximately 50% of the plants of this species will be impacted by the proposed project. As the species is not restricted to the project area, and the project will not remove all plants, there is not expected to be any impact to the conservation significance of this species.

- ***Ptilotus luteolus***

  Family: Amaranthaceae

  Conservation Status: Priority 3 – Poorly known taxa.

  Known records: This species is known to occur in red sandy soils on stony hills and screes (Recon 2010). It has been recorded in the Carnarvon, Gascoye and Murchison IBRA regions.

  Occurrence at site: There is only one record of this species at site which was recorded by the DEC in 2006. This record is located on the proposed waste dump between Joyners Find and C2. Despite extensive searching, this species has not been found since the initial recording in 2006.

  Potential Impacts: As the species has not been recorded since 2006 (despite active searching) there are no known impacts to this species.

- ***Tribulus adelacanthus***

  Family: Zygophyllaceae

  Conservation Status: Priority 3 – Poorly known taxa.

  Known records: This species is known to occur in red sandy soils on stony hills and screes (Recon 2010).

  Occurrence at site: There is only one record of this species at site which was recorded by the DEC in 2006. This record is located 460m northeast of the proposed plant area.

  Potential Impacts: This species is located outside of the proposed disturbance area and will not be directly impacted.

- ***Sauropus ramosissimus***

  Family: Phyllanthaceae

  Conservation Status: Priority 3 – Poorly known taxa.

  Known records: This species is known to occur in red sandy soils on stony hills and screes (Recon 2010). It is known from the Gascoyne, Gibson Desert, Great Victoria Deser and Murchison IBRA regions (WA Herbarium 2012).

  Occurrence at site: There is only one record of this species at site located 10m southeast of the Joyners Find pit.

  Potential Impacts: This species is located outside of the proposed disturbance area and will not be directly impacted.

- ***Sida picklesiana***

Family: Malvaceae

Conservation Status: Priority 3 – Poorly known taxa.

Known records: This species is known to occur in red sandy soils on stony hills and screes (Recon 2010). It is known from the Gascoyne and Murchison IBRA regions from locations near Wiluna, Mt Keith and Doolgunna Station (Markey *et al.* 2011). Targeted regional survey work undertaken by KLA in accordance with the WA Herbarium (KLA 2010) recorded 30 new populations of the taxon in the region were identified, totaling 4440 plants.

Occurrence at site: There are numerous records of this species concentrated at Bowerbird (1077 individuals), Joyners Find and south of Joyners Find (2,100+ individuals). Of the 2,100 recorded at Joyners Find, approximately 650 will be impacted (based on survey work undertaken to date). In addition the species was recorded south of the Ullala Road.

Potential Impacts: Approximately 1750 individual will be removed which represents approximately 39% of the recorded population. Targeted survey work over the entire project area for this species has not been undertaken and it is believed the number of plants occurring at site.The majority of the populations found for this species have been on open plains with ironstone and/or quartz gravels, and records of this taxon on these different substrates show that it is not a habitat specialist as may have been deduced from its original recording by DEC on BIF. It is therefore reasonable to assume that its distribution is greater than originally thought as these three habitat types are widespread and common throughout the Murchison.

The population records gathered by KLA (in conjunction with the WA Herbaium) have been collected mostly by following existing tracks and roads in the region. This limited form of searching has yielded significant results for the amount of time expended, which is perhaps an indication of the distribution and abundance of this taxon.

Table 14 - Targeted Priority Flora survey for first 10 Years of mining disturbance

SPECIES	RATING	C3	C4	BB	TOTAL	regional no.	% impacted
Homocalyx echinulatus	P3	974		548	1522	>19,000	***76.1****
Prostanthera ferricola	P3	5			5	400	***1.3***
Eremophila congesta	P1		9	26	35	>2000	***1.8***
Calytrix uncinata	P3			13	13	>2000	***0.7***
Ptilotus chrysocomus	P1			0	0	782	***0****
Sida picklesiana	P3			1077	1077	4419	***24.4***

* The impact for this area is large but when considered over the whole project area the impact is estimated at <8%

** GWR relocated location of waste dump to avoid this population recorded at Bowerbird

Table 15 - Priority flora to be impacted by the project

Species	Conservation Code	# records at project (to date)	# plants at Project
Beyeria lapidicola	P1	1	pnd
Eremophila ?anomala	P1	2	pnd
Eremophila congesta	P1	120	4406*
Ptilotus chrysocomus	P1	17	782*
Calytrix uncinata	P3	73	1207*
Eremophila arachnoides subsp. arachnoides	P3	5	305
Homalocalyx echinulatus	P3	118	>19,000*
Maireana prosthecochaeta	P3	5	pnd
Olearia mucronata	P3	5	pnd
Prostanthera ferricola	P3	10	pnd
Ptilotus luteolus	P3	1**	pnd
Sauropus ramosissimus	P3	1	pnd
Sida picklesiana	P3	101	3277* 4419 (regionally)
Tribulus adelacanthus	P3	1	pnd

Pnd – population size not determined
* - not all population sizes determined
** - species has not been recorded since 2006

Beyeria lapidicola (P1) and *Prostanthera ferricola* (P3) are BIF endemic species – only known to occur on BIF. *Beyeria lapidicola* is particularly of significance due to it's limited distribution in WA (only known from three other BIF ranges as shown in Florabase (WAHERB 2012)); and despite extensive searches at the project it is only known from one location.

Further targeted survey work to assess the number of plants to be impacted will be undertaken and the proposed mining infrastructure will be redesigned so that there is minimal impact on these species.

Removal of these plants in the survey area is likely to have a moderate impact on this species.

Studies undertaken to date have provided a good indication of Priority Flora distribution in the survey area. Most of the significant species that have been identified in the Project area are not limited or restricted to the BIF; and that all species of Priority flora identified in the survey area are found in other areas outside of the limit of survey. It is believed that further targeted Priority flora survey work outside of the impact area (survey work has focused on the deposit areas) would increase the known occurrence of these species.

Management measures will be implemented to reduce the potential for indirect impacts (i.e. dust) to flora resulting from the project

The project is not expected to impact the conservation significance of the Priority flora species located at site which are not limited to the project area.

During the site induction, employees and contractors will be made aware of the location of the Priority flora in the surrounding areas and the importance of not disturbing these habitats.

In summary GWR will minimise the disturbance of native flora by:

Avoid	Avoid areas where known Priority Flora occur as much as practicable.
Minimise	Limit clearing to only that required.
Rectify	Rehabilitate areas of disturbance
Reduce	Ongoing monitoring and auditing of rehabilitated sites for a minimum of three years following completion of mining activities.

Further Work Planned

Further targeted Priority flora surveys to assess the Priority flora to be impacted by mining operations Years 10+ (Joyners Find, C1 and C2).

5.3.3 Weed species

Aim

GWR aims to prevent introduction and spread of weed species within the project area.

Potential Impact

Introduction of weed species as a result of clearing activities as well as machinery and vehicle movements.

Environmental Management Strategy

Six weed species were recorded at the project site:

- *Portulaca oleracea* (pigweed, purslane)
- *Tribulus terrestris* (caltrop)
- *Anagallis arvensis* var. *caerulea* (blue pimpernel)
- *Cuscuta epithymum* (lesser dodder)
- *Citrullus lanatus* (afghan melon, pie melon)
- *Bidens bipinnata* (beggar's tick).

These species are not listed as Declared Weeds by the DAF (2007).

Disturbed areas are highly susceptible to weed invasion and GWR will implement management measures to ensure that the development does not increase weed establishment:

- Identification of weed infestations or areas susceptible to infestation adjacent to or within the proposed disturbance area.
- Restriction of vehicular access to designated tracks.
- Ensure vehicles that access the project site are free from soil and vegetation prior to arrival.
- Eradication of weeds where necessary by the following approved control mechanisms.
- All staff will be advised of potential weed species during the induction process and advised to report any incidence of weed establishment.

- Regular monitoring/maintenance of the mine area and roads for the establishment of weed species will be undertaken during construction and operation.

In summary GWR will minimise the potential for weed establishment by:

Avoid	Avoid areas where weed infestations are known to occur.
Minimise	Ensuring all vehicles and equipment is clean prior to arriving at site. Clean down of equipment between weed-free and weed-prone areas. Use of existing tracks where practicable to reduce the potential for weed spread.
Rectify	Eradication of any weed infestations in liaison with DEC and Department of Agriculture & Food.
Reduce	Ongoing monitoring and auditing of rehabilitated sites for a minimum of three years after site decommissioning.

5.4 FAUNA

5.4.1 Terrestrial Fauna

Aim

To protect all fauna species. GWR aims to protect all fauna species occurring in the project area, and where unavoidable, incur the least amount of damage to fauna and fauna habitat.

Potential Impact

Loss of fauna species of conservation significance and other indigenous fauna species.

Loss of fauna habitat.

Road kill.

Environmental Management Strategy

The habitats present in the project area are not restricted to the project area and are regionally widespread. Based on the results of the fauna surveys, none of the habitats surveyed within the project area appear to have any particular conservation significance (Ninox, 2005, 2006, KLA 2012).

Seven fauna species of conservation significance were recorded during the four fauna surveys:

- Mulgara
- Long-tailed Dunnart
- Malleefowl
- Peregrine Falcon
- Australian Bustard
- White-browed babbler
- Crested Bellbird.

The following section outlines the potential impact and environmental management strategies for each of these species:

- ***Dasycercus cristicauda*** **Crest-tailed Mulgara, Minyiminyi**

  Family: Dasyuridae

  There is currently some uncertainty on the taxonomic status of Mulgara in Western Australia but it is believed that the Mulgara previously considered to be *Dasycercus cristicauda,* are actually *Dasycercus blythi* (Brush-tailed Mulgara). *D. blythi* is listed as a Priority 4 species, Taxa in need of monitoring, on the DEC Threatened and Priority Fauna Database.

  Distribution: The Crest-tailed Mulgara is a medium-sized (60-158 g) carnivorous marsupial that was formerly assumed to be widespread but patchy in sandy regions of arid central Australian and Western Australia (Menkhorst and Knight 2011). In recent times, it has been found in the southern Simpson Desert where the borders on the Northern Territory, Queensland and South Australia converge, and in the Tirari and Strzelecki Deserts of South Australia (van Dyck and Strahan 2008).

  Likelihood of occurrence: Mulgara were captured in 2007 at Wiluna and 2009 at Yeelerrie. However, given the taxonomic confusion, it is likely that these Mulgara were Brush-tailed Mulgara *Dasycercus blythi* rather than the Crest-tailed Mulgara. The preferred habitat for this species is located north of the proposed mining area. In the event that a haul road along L53/147 is utilised, the occurrence of this species will be investigated to confirm the identity of this species and, if required, a referral to the Commonwealth under the EPBC Act 1999 will be submitted.

  Potential Impacts: Given the above, and the conservation status of the Crest-tailed Mulgara is not likely to be altered by the proposed mining activity in the survey areas.

- **Long-tailed Dunnart *Sminthopsis longicauda***

  Family: Dasyuridae

  Conservation Status: Priority 4 - Taxa in need of monitoring on the DEC Threatened and Priority Database.

  Distribution: This species is patchily distributed but can be locally common. It is found in the Pilbara, Murchison, Northeastern Goldfields, Ashburton and Gibson Desert regions of Western Australia. It is also found in small areas in the Northern Territory (McKenzie *et al.* 2008).

  Ecology: The Long-tailed Dunnart, a nocturnal species, prefers rocky habitats that support low open woodlands or *Acacia* shrublands with an understorey of Spinifex (McKenzie *et al.* 2008). It is the only dunnart with a tail at least twice the length of its head and body combined with a terminal tuft of long hairs (Menkhorst and Knight 2011). The main diet of this species is arthropods and it appears to be a spring-summer breeder (van Dyck and Strahan 2008)

  Likelihood of occurrence: Two individuals were captured during the Spring survey immediately west of Bowerbird. There have been no other recordings of this species in the Wiluna area.

  Potential Impacts: Recent surveys conducted in the Goldfields suggest that the distributional range of the Long-tailed Dunnart is far greater than previously mapped, and that they are present in low abundance over an extensive part of Western Australia, excluding the southern portion of the state (Terrestrial Ecosystems 2011, KLA 2012). Further, the habitat favoured by this Dunnart is not limited to rugged rocky landscapes that support a low open woodland or shrubland of *Acacias* with an understory of spinifex hummock and (occasionally) perennial grasses and cassias

(Burbidge *et al.* 2008), but that they are also found in flat open mulga woodland with a limited understory of vegetation (Terrestrial Ecosystems 2011). The Dunnarts recorded during this survey were captured in open *Acacia* shrubland with occasional eucalypts

Given the above, the conservation status of this species is not likely to be altered by the proposed mining activity in the survey areas.

- **Malleefowl *Leipoa ocellata***

Family: Megapodidae

Conservation Status: Schedule 1: Rare and likely to become extinct under the Western Australian *Wildlife Conservation Act 1950*

Distribution: The Malleefowl was once broadly distributed across the southern half of the Australian continent, but has undergone significant range reduction and now occupy semi-arid regions of southern Australia where mallee eucalypts form the dominant vegetation (Birds Australia 2012).

Ecology: The Malleefowl is a large, ground-dwelling bird that roosts in trees but rarely flies. The species is omnivorous and typically has a large home range in woodlands or shrublands that have a deep layer of leaf litter which is used in building nesting mounds. Mounds are up to one metre in height and 3 m to 5 m in diameter. Breeding occurs from September to April and chicks emerge independently, approximately seven weeks after hatching.

Clearing of habitat, fox predation and the degradation of habitat by fire and overgrazing by feral livestock has reduced Malleefowl numbers considerably.

Likelihood of occurrence: The most recent records of Malleefowl on the DEC Threatened and Priority Fauna Database include one in 2006 and one in 2007 both within the Wiluna area. Anecdotally Malleefowl are known to occur in the area. During the Level 2 survey, two Malleefowl were seen at the southern section of C Ridge in the area of the one active mound (Section 5.5.1.1). Twenty-two inactive mounds were also recorded. Recent survey work undertaken by the Traditional owners recorded five active mounds and 54 inactive mounds.

Potential Impacts: Five active malleefowl mounds have been recorded, two of which are located within the area proposed for disturbance. While breeding Malleefowl are more sedentary, radio-tracking studies have shown that over the course of a year adults may range over one to several square kilometre, and also that there may be considerable overlap in home-ranges (Benshemesh 2007). While the proposed disturbances are likely to have some impact on habitat availability for the local Malleefowl, the component vegetation associations are not limited but are extensive locally. Therefore, it is not likely that the proposed mining activities will alter the conservation classification of the Malleefowl. Specific management measures with regard to the Malleefowl will be developed and a referral to the Commonwealth under the EPBC Act 1999 will be submitted for the potential impact on the malleefowl. A targeted Malleefowl survey will be completed prior to clearing.

- ***Falco peregrinus* Peregrine Falcon**

Family: Falconidae

Conservation Status: Schedule 4: Fauna that is in need of special protection under the Western Australian *Wildlife Conservation Act 1950*

Distribution: The Peregrine Falcon is uncommon but widespread in distribution. Moderately common within the higher aspects of the Stirling Ranges but tends to be uncommon in the hilly northwest Kimberley (Johnstone *et al*. 1998).

Ecology: This species inhabits cliff faces such as those along the coast, near rivers and ranges. The Peregrine Falcon can also be seen around wooded watercourses and lakes. It nests on ledges in cliffs as well as granite outcrops and quarries and also makes use of mine pits. This Falcon feeds almost entirely on birds including sea birds and some parrot species (Johnstone *et al*. 1998).

Likelihood of occurrence: This species is associated with cliffs and ranges and is unlikely to occur within the area proposed for clearing.

Potential Impacts: The conservation status of this species is not likely to be altered by the proposed extraction activity in the survey area.

- ***Ardeotis australis*** **Australian Bustard**

Family: Otitidae

Conservation Status: Priority Four: Taxa in need of monitoring on DEC Threatened and Priority Fauna Database.

Distribution: The Australian Bustard occurs over much of Western Australia, with the exception of the more heavily wooded southern portion of the State (Johnstone and Storr 1998). Its wider distribution includes eastern Australia and New Guinea.

Ecology: The Australian Bustard is a large ground-dwelling bird known to occur in open or lightly wooded country. It is nomadic and ranges over very large areas, largely dependent on rainfall and hence food availability. Although not flightless, Bustards spend the greater proportion of time on the ground.

Likelihood of occurrence: The Australian Bustard is not uncommon in the Goldfields, albeit scarce. The DEC Threatened and Priority Fauna Database list two dated sightings (1978 and 1982) near Wiluna and a more recent recording at Yeelerrie in 2009. Given the range and mobility of this species, it is likely to avoid disturbance and moved to less disturbed areas.

Potential Impacts: The conservation status of this species is not likely to be altered by the proposed mining activity in the survey areas.

- ***Pomatostomus superciliosis ashbyi*** **White-browed Babbler (western wheatbelt)**

Family: Pomatostomidae

Conservation Status: Priority Four on DEC Threatened and Priority Fauna Database

Distribution: The White-browed Babbler is endemic to mainland Australia and occurs mainly in the arid and semi-arid zones south of the Tropic of Capricorn. Scattered populations are found in outback Northern Territory and Western Australia, particularly in the south-western corner of Western Australia.

Ecology: The White-Browed Babbler is a gregarious bird that travels in flocks and has a strong community affinity. It is found in dry sclerophyll woodlands with a shrubby understorey, mulga, acacias, mallee, cypress pine scrubs, timber, scrub along watercourses and saltbush, and forages on or near the ground for insects and seeds.

Likelihood of occurrence: The White-browed Babbler was both seen and heard during the survey. The only recording of the species on the DEC Threatened and Priority Fauna Database was in 1978 near Wiluna. This species also appears on both the Western Australian Museum and Birds Australia lists as having been recorded for the area.

Potential Impacts: Advice from the OEPA indicates that the conservation status of this species refers to the western populations particularly in the agricultural zone where clearing and fragmentation of native vegetation has impacted on this species habitat. Given the locality of this project area and the large, intact and undisturbed bushland locally, the conservation status of this species is not likely to be altered by the proposed mining activity in the survey areas.

- ***Oreoica gutturalis gutturalis*** **Crested Bellbird (southern)**

  Family: Pachycephalidae

  Conservation Status: Priority Four on DEC Threatened and Priority Fauna Database

  Distribution: The distributional range of the Crested Bellbird extends across the greater part of the State but not the wetter regions (north and west Kimberley, Darling Range and deep South-West).

  Ecology: This sedentary and solitary species inhabits the drier mallee woodlands and heaths of the southern parts of Western Australia. It forages mainly on the ground, primarily for insects, and breeds from March through to December across the State.

  Likelihood of occurrence: The Crested Bellbird was seen and heard during the reconnaissance survey and throughout the Level 2 survey.

  Potential Impacts: The Crested Bellbird (southern) is listed as a Priority 4 species on the DEC Threatened and Priority Fauna database for the Goldfields, Midwest, Wheatbelt and South Coast. While the Wiluna West areas falls within the Goldfields region, the conservation classification refers principally to areas where the preferred habitat of the Crested Bellbird has been disturbed, particularly by clearing of native vegetation and resultant fragmentation. The area proposed to be impacted is relatively undisturbed and large tracts of undisturbed native vegetation are present and will remain intact adjacent to the mining operations. The large home range and mobility of the Crested Bellbird strongly suggests that its conservation classification will not be compromised by the proposed mining activities at Wiluna.

In addition to these four species, eleven fauna species of conservation significance could potentially occur at the project and the potential impacts of the project on these species are summarised in the following sections.

The following 11 fauna species have not been recorded in the project area but have the potential to occur in the project region. The following section outlines the potential impact of the project on these species.

- **Great Desert Skink *Egernia kintorei***
  The Great Desert Skink is also known colloquially as the Tjakura, Warrama or Mulyamiji

  Family: Scincidae

  Conservation Status: Vulnerable under EPBC Act 1999
  "The Recovery Plan for the Great Desert Skink (*Egernia kintorei*) 2001-2011" (McAlpin 2001) is available online at :

http://www.environment.gov.au/biodiversity/threatened/publications/recovery/great-desert-skink/index.html#11

Distribution: Historically, the Great Desert Skink was recorded from widely scattered localities across the western deserts region (McAlpin 2001). The current distribution consists of seven sparsely distributed, isolated populations, with three occurring in Western Australia in the Great Sandy Desert, the Gibson Desert and the Great Victoria Desert (Storr *et al.* 1999).

Ecology: The Great Desert Skink is a large burrowing skink that is crepuscular to nocturnal. It excavates large complex multi-entranced communal burrow systems and uses at least one large external latrine (Wilson and Swan 2010). Up to ten individuals may inhabit one burrow system. Females give birth to from one to seven live young in early summer. Young Desert Skinks grow rapidly and during good seasons reach sexual maturity in their second year (McAlpin 2001).

The Great Desert Skink's occupy a variety of habitats within the western deserts region with potentially suitable habitat extending over tens of thousands of hectares. However, sandplain vegetated by spinifex and scattered shrubs seems to be the habitat type most widely used (Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) 2012). Great Desert Skinks are omnivorous, eating a wide range of invertebrates (principally termites) and also any vertebrates small enough to be swallowed.

Likelihood of occurrence: While the EPBC 1999 Protected Matters Search Tool suggests this species may occur in the survey area, the site appears to be at the southwestern extent of its range. Further, there is no preferred habitat within the survey area. An area to the north of Wiluna West Project area does comprise some Spinifex sandplains. However, this area is up to 10 km from the proposed disturbance and is not proposed to be disturbed in the short or long term.

Potential Impacts: Given that this species is not likely to be present in the area proposed for disturbance, the conservation status of the Great Desert Skink is not likely to be altered by the proposed mining activity in the survey areas.

- ***Macrotis lagotis*** **Bilby, Dalgyte**

Family: Thylacomyidae

Conservation Status: Vulnerable under the EPBC Act 1999
The "National recovery plan for the Greater Bilby (*Magrotis lagotis*) (Pavey 2006) is available online at: http://www.environment.gov.au/biodiversity/threatened/publications/m-lagotis.html.
The Bilby is also listed on the IUCN Red List of Threatened species (IUCN 2012).

Distribution: The distribution of the Bilby formerly extended throughout the arid and semi-arid areas of Australia (Menkhorst and Knight 2011). The species now occurs in two separate geographic areas: one extending from the western deserts region (Tanami, Great Sandy and Gibson) of the Northern Territory and Western Australia to the Pilbara and Kimberley regions, and the second in southwestern Queensland (Pavey 2006). In Western Australia, the Bilby population is highly fragmented with species occurring in the Gibson Desert and Great Sandy Desert bioregions, the Dampierland bioregion and in the Central Kimberley and Ord-Victoria Plains bioregions (Pavey 2006).

Ecology: The Bilby is mostly solitary and constructs long, deep burrow systems for daytime shelter (Menkhorst and Knight 2011). Habitat favoured by Bilbies include

mulga shrubland on stony plains, along the lower slopes of ranges, in sandplains and in sand dune systems (Pavey 2006). Bilbies emerge from their burrows well after dark to forage in topsoil for arthropods, tubers and fungi, leaving numerous pits to 10 cm deep. Litters of two occur mostly from March to May but can occur at all times if conditions are good.

Likelihood of occurrence: The area proposed for disturbance appears to be southwest of the known distribution of the Bilby. Further there have been no recent recordings of the Bilby in the area. No Bilbies or evidence of their presences was recorded during the survey.

The greatest threats to the Bilby include altered fire regimes, grazing of rabbits and livestock, in addition to the trampling effect of the ungulate hooves, predation by foxes and feral dogs and cats and long periods of drought. The areas proposed for disturbance at Wiluna West have been subject to almost all of the threats to varying degrees over time. The likelihood of the Bilby residing or persisting in the area is small.

Potential Impacts: The conservation status of this species is not likely to be altered by the proposed mining activity in the survey areas.

- ***Rhinonicteris aurantius* (Pilbara form) Pilbara Leafnosed-bat**

Family: Hipposideridae

Conservation Status: Vulnerable under EPBC Act 1999
"Approved Conservation Advice for *Rhinonicteris aurantius* (Pilbara form) (Pilbara Leaf-nosed Bat)(Threatened Species Scientific Committee 2008) is available online at: http://www.environment.gov.au/biodiversity/threatened/species/pubs/66887-conservation-advice.pdf

Distribution: The Pilbara Leafnosed-bat is known only from the Pilbara and Gascoyne regions of Western Australia in Barlee Range Nature Reserve (Threatened Species Scientific Committee 2008). While the Pilbara Leafnosed-bat appears morphologically similar to the northern form (Orange Leafnosed-bat), is separated from these other populations by ~400 km of desert, and has small magnitude differences in the size of the noseleaf, forearm and rostral part of the skull (Threatened Species Scientific Committee 2008).

Ecology: The Pilbara Leafnosed-bat roosts in caves and abandoned, deep and partially flooded mines that trap pockets of warm, humid air. It may also occupy smaller, less complex mines for part of the year (Van Dyck and Strahan, 2008).

The Pilbara Leafnosed-bat hunts through riparian vegetation in gorges, and over hummock grassland and sparse tree and shrub savannah (Threatened Species Scientific Committee 2008).

Likelihood of occurrence: The current known distribution of the Pilbara Leafnosed-bat does not include the areas proposed for disturbance at Wiluna West. Anabat detectors were located in all areas proposed for disturbance and while the presence of five species of bats was identified, the calls of the Pilbara Leanosed-bat were not recorded or identified. The presence of this species is, therefore, not likely to occur in the Wiluna West area.

Potential Impacts: The conservation status of this species is not likely to be altered by the proposed mining activity in the survey areas.

- ***Apus pacificus*** **Fork-tailed Swift**

  Family: Apodidae

  Conservation Status: Migratory Marine under EPBC Act 1999
  This species is also listed in the CAMBA, JAMBA and ROKAMBA agreements.

  Distribution: The Fork-tailed Swift breeds in northeast and mid-east Asia and winters in south New Guinea and Australia (Johnstone and Storr 1998). It is a visitor to most parts of Western Australia beginning to arrive in the Kimberley in late September, the Pilbara and Eucla in November and in the southwest in mid-December. It leaves in late April. While it is common in the Kimberley, it is uncommon near the northwest, west and southeast coasts and rare or scare elsewhere.

  Ecology: The Fork-tailed Swift does not breed in Australia. It is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher. They probably roost aerially, but are occasionally observed to land (Higgins 1999). The species food items within Australia are not well known, however, the species is known to be insectivorous. Studies have recorded the Swift eating small bees, wasps, termites and moths.

  Likelihood of occurrence: Given the ecology of this species, the swift may include the area within its aerial forays and migratory path.

  Potential Impacts: There are no significant threats to the Fork-tailed Swift in Australia. Potential threats include habitat destruction and predation by feral animals (DSEWPaC 2012). Due to the wide range of this species, the conservation status is unlikely to be altered by the disturbance associated with the proposed mining activity.

- **Great Egret** ***Ardea alba modesta***

  Family: Ardeidae

  Conservation Status: Migratory Species under the EPBC Act 1999

  Distribution: The Great Egret has been recorded across much of Western Australia but avoids the driest regions of the western and central deserts (McKilligan 2005).

  Ecology: The Great Egret, also known as the White Egret is common to very common in well-watered Kimberley flatlands and scarce to moderately common elsewhere. Preferred habitat includes shallow freshwaters and shallow saltwaters, and rarely dry pastures.

  Likelihood of occurrence: Given the preferred habitat of this species, it is not likely to occur within the survey area.

  Potential Impacts: The conservation status of this species is not likely to be altered by the proposed mining activity in the survey areas.

- ***Burhinus grallarius*** **Bush Stone-curlew**

  Family: Burhinidae

  Conservation Status: Priority Four: Taxa in need of monitoring on DEC Threatened and Priority Fauna Database.

Distribution: The Bush Stone-curlew occupies much of the western part of Western Australia, and is also found in eastern Australia and New Guinea (Johnstone and Storr 1998). It is common to uncommon in subhumid and semiarid zones and near coast in arid zones and is rare to uncommon and locally extinct further south.

Ecology: The Bush Stone-curlew is a well camouflaged, ground nesting bird that inhabits lightly wooded open woodlands. Its nest is a slight or no depression on the ground and eggs are laid from July to January.

Likelihood of occurrence: The DEC Threatened and Priority Fauna Database lists two sightings of this species with one in 1979 and the other in 2009 in Yeelerrie. Given the lack of preferred habitat, it is not likely that this species would utilise the *Acacia* shrublands and BIF areas within survey area.

Potential Impacts: The conservation status of this species is not likely to be altered by the proposed mining activity in the survey areas.

- ***Charadrius veredus* Oriental Plover**

  Family: Charadriidae

  Conservation Status: Migratory Wetland Species under the EPBC Act 1999. Also included in JAMBA and ROKAMBA agreements..

  Distribution: This species is a migrant from Mongolia and Russia that usually inhabits semi-arid areas in the northern half of Western Australia and occasionally along the south coast. It prefers open grasslands, claypans or gibberstone plains in semi-arid regions inland and is seen less often on marine, tidal mudflats typically used by other plovers (Morcombe 2003).

  Ecology: On arrival in Australia the Oriental Plover does occupy coastal habitats such as estuarine mudflats and sandbanks, on sandy or rocky ocean beaches or nearby reefs, or in near-coastal grasslands before dispersing further inland where they then inhabit flat open semi-arid or arid grasslands where the grass is short and sparse, and interspersed with hard bare ground (DSEWPaC 2012).

  Likelihood of occurrence: Given the lack of preferred habitat, the Oriental Plover is not likely to utilize the area of proposed disturbance.

  Potential Impacts: The conservation status of this species is not likely to be altered by the proposed mining activity in the survey areas.

- ***Potytelis alexandrae* Princess Parrot**

  Family: Psittacidae

  Conservation Status: Vulnerable under EPBC Act 1999

  Distribution: Little is known about the Princess Parrot even to the exact extent of its geographical distribution. However, it is confined to arid regions of Western Australia, the Northern Territory, and South Australia and it is believed that the population is mainly concentrated in the Great Sandy, Gibson, Tanami and Great Victoria Deserts, and in the central ranges (DSEWPaC 2012).

  Ecology: The Princess Parrot inhabits sand dunes and sand flats in the arid zone of western and central Australia (DSEWPaC 2012). It occurs in open savanna woodlands and shrublands that usually consist of scattered stands of *Eucalyptus*, *Casuarina* or

Allocasuarina trees; an understorey of shrubs such as *Acacia* (especially *A*. *aneura*), *Cassia*, *Eremophila*, *Grevillea*, *Hakea* and *Senna*; and a ground cover dominated by *Triodia* species. It is also known to frequent *Eucalyptus* or *Allocasuarina* trees in riverine or littoral areas.

Likelihood of occurrence: Due to the paucity of information about this species, accurate estimates of it conservation significance and likelihood of occurrence are difficult to make. However, the Princess Parrot is not listed on the DEC Threatened Fauna database or the Birds Australia database for the area surveyed and has not been vouchered at the Western Australia Museum for this area. The Wiluna West Project area also appears to be south of the known distributional range of the species. Therefore the Princess Parrot is not likely to utilize the area proposed for mining activity.

Potential Impacts: Based on the limited information to date on this species, its conservation status is not likely to be altered by the proposed mining activity in the survey areas

- **Rainbow Bee-eater *Merops ornatus***

Family: Meropidae

Conservation Status: Migratory under EPBC Act 1999

Distribution: The Rainbow Bee-eater is distributed across much of mainland Australia, and is a common summer migrant to southern Australia. They range from scarce to common across their range depending on suitable habitat and breeding grounds.

Ecology: Rainbow Bee-eaters are very social birds and when not breeding roost together in large groups in dense understorey or large trees. They generally migrate south at the beginning of spring and breed from November to January. They require open areas with loamy soft soils soft enough for nest tunneling yet firm enough to support the tunnel.

Likelihood of occurrence: The Rainbow Bee-eater usually migrates south in late September early October and north from February to April (Johnstone and Storr 1998). While the Bee-eater is not included in the species list from the Western Australian Museum or from Birds Australia as having been recorded from this area, and it was not seen or heard during the survey, it would not be unexpected for the Rainbow Bee-eater to use this area within its migratory path.

Potential Impacts: The conservation status of this species is not likely to be altered by the proposed mining activity in the survey areas.

- **Striated Grasswren *Amytornis striatus striatus***

Family: Maluridae

Conservation Status: Priority Four: Taxa in need of monitoring on DEC Threatened and Priority Fauna Database.

Distribution: The Striated Grasswren occurs across the eastern deserts of Western Australia including much of the Gibson, Great Sandy and Great Victoria deserts, with isolated populations between Wiluna and Meekatharra, and another near Queen Victoria Spring (Johnstone and Storr 2004). It is locally common but generally scarce.

Ecology: Like many Grasswrens, the Straited Grasswren is elusive and shy. Its preferred habitat is mainly spinifex habitat with or without lows shrubs and herbage, on sandy or loamy plains and also found amongst bushy *Acacia* on sandridges and interdunes usually with spinifex (Johnstone and Storr 2004).

Likelihood of occurrence: The Striated Grasswren is not included in the species list from the Western Australian Museum or from Birds Australia as having been recorded from this area, nor was it seen or heard during the survey. Further, as there is no preferred habitat in the areas proposed for disturbance, it is not likely to occur in the area.

Potential Impacts: The conservation status of this species is not likely to be altered by the proposed mining activity in the survey areas.

- ***Acanthiza iredalei iredalei*** **Slender-billed Thornbill**

  Family: Acanthizidae

  Conservation Status: Vulnerable under EPBC Act 1999

  Distribution: The Slender-billed Thornbill is sparsely distributed in disjunct populations across the southern arid and semi-arid portion of Western Australia and western South Australia.

  Ecology: The preferred habitat for this species includes chenopod shrublands, treeless or sparsely wooded flatlands and saline flats associated with salt lakes. The Thornbill forages mainly on the ground and in low vegetation, increasing its vulnerability to predation by cats and foxes.

  Likelihood of occurrence: Given the absence of preferred habitat for this species, it is not likely to be present in the area proposed for disturbance. None were identified during the comprehensive survey.

  Potential Impacts: The conservation status of this species is not likely to be altered by the proposed mining activity in the survey areas.

The preferred habitats and distributional ranges for the majority of the above species do not occur within the project area. Habitats that may be impacted by the development are not likely to affect the conservation status of these species.

It is considered unlikely that the disturbance and removal of native vegetation as proposed will alter the conservation status of any of these species.

Management measures will include:

- Fauna egress means will be provided in all HDPE lined ponds and dams at site
- Site induction will include sections on potential species of conservation significance and to report all sightings to environmental personnel.
- All staff will be required to obey all speed limits and be prohibited from off-road driving.
- Putrescible waste hygiene measures will be implemented to reduce the likelihood of feral animals being attracted to the area.

In summary, GWR will reduce the impact on native fauna by:

Avoid	Avoid significant fauna habitat. Avoidance of any active Malleefowl mounds.
Minimise	Minimising vegetation clearing and impacts to fauna habitat.
Rectify	Progressive rehabilitation of disturbed areas following mining activities.
Reduce	Ongoing monitoring and auditing of rehabilitated sites for a minimum of three years following site decommissioning.

5.4.2 Subterranean fauna

Aim

To protect all subterranean fauna species. Prevent any impact on the conservation significance of any stygofauna or troglofauna in the area.

Potential Impact

Reduce extent of occurrence of subterranean fauna species.

Environmental Management Strategy

The stygofauna recorded comprised representatives of two common groundwater taxa known in the Yilgarn, namely Bathynellacea, and Oligochaeta. These two species were found only within the colluvium aquifer to the north of the BIF ridges. No stygofauna was detected within the BIF areas (Subterranean Ecology 2007).

None of the troglofauna taxa collected in other areas of the project showed any obvious troglomorphisms and are not considered likely to be obligate subterranean species (troglobites) that may be SRE's whose habitat and distribution is directly dependent on the subsurface habitat of the BIF.

Although sampling has not been undertaken at C1, C2 and Bowerbird, it is expected that similar invertebrate communities are present in the deposit areas given the continuity of the geology (i.e. subterranean fauna habitat). This is supported by the very similar invertebrate communities shared between the C ridge and Bowerbird sampling sites (Subterranean Ecology 2007).

Further work planned

GWR will undertake subterranean fauna surveys for new water source areas as required by the EPA Guideline documents in conjunction with consultation with the DEC.

5.4.3 Short Range Endemics (SRE's)

Aim

GWR aims to prevent any impact on the conservation significance of any SRE fauna in the project area, and where unavoidable, incur the least amount of damage to SRE preferred habitat.

Potential Impact

Clearing vegetation for mining operations has the potential to cause some mortality of SRE species within the disturbance area and reduce preferred SRE habitat. It is

anticipated that of the total area proposed to be disturbed, very little SRE preferred habitat will be disturbed.

Environmental Management Strategy

No SRE were recorded during the 2006 survey.

A juvenile *Conothele* species, a mygalomorph spider was recorded during the survey on Ridge C (approximately 1 km west of the deposit). As mature males are required for species identification, the conservation significance of this species cannot be determined. Notwithstanding this, this species has a scattered occurrence throughout favoured habitat (unlike other species which aggregate in large numbers in pockets of habitat).

Additional surveys were undertaken during the 2011 Level 2 survey. In spite of recent rainfall, there was little to no composting of leaf litter due to the long-term lack of average rainfall. It was, therefore, not surprising that only two specimens were collected from the soil/litter samples.

In relation to mygalomorph spiders, the best taxonomic features in their identification are found within the genitalia of males. Males are known to 'run' during rainfall events or immediately after in search of females. While more than average rainfall was recorded immediately prior to the survey, only three spiders were collected during the survey. Unfortunately, of the spiders identified, one was female and one was a juvenile. Therefore, it was not possible to identify them to species and, therefore, not possible to comment on their possible endemicity. While it is recognised that two of the three spiders were collectedin areas of BIF, GWR does not intend removing all BIF from the area and 40% of BIF (this refers to BIF outcropping) will remain. This figure does not take into account the area of BIF south of Ullala Road which would also comprise suitable habitat. Similarly, the vegetation proposed to be disturbed is not limited to the areas proposed for disturbance. It is unlikely, therefore, that the spiders collected and present in the C3, C4 and Bowerbird area and the remaining BIF are limited to these areas and are likely to be found elsewhere.

Three genera of pseudoscorpions were collected (Family: Olpiidae). Of these, *Indolpium* spp. are not likely to represent SREs, whereas both *Autrohorus* spp. and *Beierolpium* `sp. 8/3` require systematic revision to determine their degree of endemicity. As discussed above, while it is recognised that five of the eight pseudoscorpions were collected in areas of BIF, GWR does not intend removing all BIF from the area and large areas of BIF, and similar vegetation associations will remain. Further, all specimens collected were not confinement to discontinuous habitats. The conservation status of all these species is, therefore, not likely to be altered by the proposed mining activity in the local area.

A previous SRE survey conducted in the Wiluna Project area netted ten spiders of which only one (*Conothele* sp., Family: Ctenizidae) was identified as a juvenile mygalomorph (ATA Environmental 2007) (Section 1.2). As mentioned above, it is no possible to identify the species based on juvenile features. Therefore, the conservation classification of this species was not able to be determined.

A more recent invertebrate survey was conducted at the proposed Wiluna Uranium Project, ~15-40 km from the Wiluna West Project area (Outback Ecology 2011). A total of 95 invertebrate specimens were collected in the Uranium Project area comprising 14 mygalomorph spiders, six pseudoscorpions, 34 scorpions, six slaters and 35 terrestrial snail specimens. collectively of which five were identified as putative SREs. Of these five, three were mygalomorphs (*Aname* MYG177, *Aname* MGY176 and *Kwonkan* MYG175), one was a pseudoscorpion (*Beierolpium* 'sp. 8/2') and one was a scorpion (*Urodacus* 'yeelirrie')(Outback Ecology 2011).

It is noted that large areas of habitats within the Wiluna Uranium Project area comprise salt lakes and dunes. Further, the habitats in which these putative specimens were found

comprised isolated, sheltered habitats or microhabitats. The invertebrate assemblage in these areas, therefore, is likely to be very different from that in the predominantly *Acacia* shrubland in the Wiluna West Project area.

Further work planned

Nil. However, GWR is currently awaiting advice from the DEC regarding the suitability of the SRE survey work undertaken by KLA in 2011.

5.4.4 Feral Animals

Aim

To ensure GWR activities do not cause an increase in feral animal populations in the project area.

Potential Impact

Loss of native fauna species.

Alteration of indigenous fauna habitat.

Increase in feral animal populations.

Environmental Management Strategy

The house mouse, rabbit and fox have been recorded in fauna surveys. Fox (and feral dog) predation is one of the major threats to Malleefowl. A number of management measures will be implemented to minimise any impacts on fauna from feral animals. These include:

- Prohibition on bringing pets, firearms, or traps into the project area.
- Provision of covered waste bins to contain domestic waste from crib and office facilities.
- Ensuring all domestic waste at the mine site is covered regularly so as not to attract feral animals.

During the site induction all employees and contractors will be advised to report all feral animal sightings to the Environmental Manager and feeding or sheltering of native animals will be prohibited.

5.5 SURFACE WATER

Aim

Ensure that surface water does not become contaminated and adversely impact local vegetation.

Potential Impact

Contamination of surface water runoff due to mining activities in the area.

Areas that have the potential to be accessed by surface water or have the potential to have contaminated outflows will be bunded and separated from “natural” surface flows.

Environmental Management Strategy

An ephemeral watercourse, flowing in northerly direction is located in the Bowerbird area.

There is no other surface water of significance, lakes or swamps in the proposed project area.

Impacts on surface water quality will be minimised by constructing bunds around mine infrastructure areas where fuels, oils, sediment or other potential contaminants are utilised.

In addition, working and processing sites will be designed to collect and store surface runoff and stormwater so the site is a closed runoff system.

The management measures described in Section 5.12 for hydrocarbons and dangerous goods will prevent any potential contamination of surface water.

5.6 GROUNDWATER

Aim

Maintain the quality of groundwater to ensure that existing and potential uses, including ecosystem maintenance are protected.

Potential Impact

Lowering of localised groundwater levels.

There are potential impacts to groundwater quality resulting from mining activities relating to migration of pollutants from the surface and mining operations into the groundwater system through infiltration.

Environmental Management Strategy

A hydrogeological review by Aquaterra suggests that the main impact from dewatering of the open pits on local groundwater will be the development of a large cone of depression in the watertable around the project. However, the background permeabilities of the surrounding basement rock are low, resulting in low predicted inflow rates and a cone of drawdown that is not expected to be radially extensive.

It is considered unlikely that groundwater level drawdown from mine dewatering will significantly impact any existing users in the vicinity of the project area.
The management measures described in Section 5.12 for hydrocarbons and dangerous goods will prevent any potential contamination of groundwater.

Further work planned

Once supplementary water supplies have been identified, the potential effects upon others users in the area will be assessed.

Detailed hydrological studies are currently being completed for the project area.

5.7 ACID ROCK DRAINAGE (ARD)

Aim

Prevent contamination to surrounding environment resulting from Potentially Acid Forming (PAF) waste rock and ARD.

Potential Impact

Contamination of soils, surface water and groundwater.

Environmental Management Strategy

Materials with chemical compositions of medium to high sulphur levels are known to form acidic solutions when oxidised from fresh rock over a period of time with exposure to the atmosphere and in contact with water. GWR completed testwork on various metallurgical

core samples to characterise the waste and low grade materials expected to be exposed to oxidation. Waste rock samples were targeted as these contain the highest sulphur levels and would have the highest propensity to generate acidic runoff. Waste material with sulphur content below 0.3% is regarded as non-acid forming due to the sulphur level being too low to result in acid generation.

GWR evaluated the waste chemical analysis from 2000 drillholes located in the main mining areas to characterise the waste and low grade materials expected to be exposed to oxidation. Waste rock samples were targeted as these contain the highest sulphur levels and would have the highest propensity to generate acidic runoff. Waste material with sulphur content below 0.3% is regarded as non-acid forming due to the sulphur level being too low to result in acid generation.

A total of 75,600 waste samples were recorded in the proposed mining areas. The average of the samples was 0.04% with 1.9% of the samples recorded values greater than 0.3%. Based on the analysis the waste produced from the project is considered non-acid producing (S<0.3). The areas that had results greater that the 0.3% were isolated cases and would be mixed in with the rest of the waste to end up with average level of approximately 0.04%.

Based on these results no Potentially Acid Forming (PAF) rock is anticipated to be mined during the proposed mining operation.

Management initiatives for PAF include:

- Development of an ARD site procedure in case PAF material is identified
- Mine induction training of personnel for the identification of PAF materials in conjunction with site geologists.
- Training of mining personnel for the removal and encapsulation of PAF rocks in accordance with site procedure.
- A provisional location for PAF encapsulation (if encountered) will be included within the waste dump design, alternatively, the low volume of PAF if encountered will be dispersed within the WRD's to enable contact with neutralising materials to occur.

Further work planned

Assessment of the potential for neutral metalliferous drainage will be undertaken.

5.8 DUST

Aim

Ensure that dust does not adversely affect the environment or health, welfare and amenity of nearby land users.

Potential Impact

Generation of dust from mining operations, vehicle movement and during ore transport.

Environmental Management Strategy

Water trucks will be utilised on all local mine site roads and during open pit operations to control dust.

Water sprays will be included in the crusher design to minimise the generation of dust.

Restriction of vehicle speeds will be required in high risk dust generation areas.

5.9 NOISE

Aim

Ensure that noise generated by the project has no adverse impacts on local residents or communities.

Potential Impact

Excessive noise generated by mining and haulage activity.

Noise will be generated by power generation, mobile equipment, machinery blasting and ore haulage.

Environmental Management Strategy

Adverse noise impacts on communities from mining activity are expected to be minimal due to the remote location of the project and absence of nearby residential facilities (the nearest resident is located further than 25 km from the project).

All mining operations will comply with the noise regulations under the Mines Safety and Inspection Act 1994, Mines Safety and Inspection Regulations 1995 and the Environmental Protection (Noise) Regulations 1997.

5.10 EROSION

Aim

GWR aims to minimise any potential effects operations will have to increase accelerated erosion.

Potential Impact

The erosion of soil, subsequent sedimentation and loss of vegetation within the project area.

Environmental Management Strategy

GWR believes the management measures they will implement in regard to clearing, dust and surface drainage will result in minimal erosion.

During the operation phase, areas of high erosion potential will be identified by GWR Environmental staff and site specific erosion control measures will be implemented.

Disturbed sites will be rehabilitated as soon as they become available.

5.11 WASTE PRODUCTS

Aim

To develop waste reduction and re-use of resources to protect the environment.

Potential Impact

Contamination of soil and groundwater.

Introduction of feral animals.

Various wastes will be generated by the project. These include:

- General domestic and office refuse.
- Industrial wastes.
- Hydrocarbon wastes.
- Sewage effluent.

Environmental Management Strategy

- Domestic waste will be removed periodically by a contracted service provider .
- Industrial waste, inert waste and recyclable waste will be collected and transported off-site for disposal, resale or recycling.
- Industrial waste will be stored in a designated collection area onsite including bunded areas (for hazardous materials) or drip trays.
- Sewage will be treated in septic tanks and leach drains or designated treatment plants.

Disposal of waste hydrocarbons and hazardous chemicals is addressed in Section 5.12.

5.12 DANGEROUS GOODS AND HAZARDOUS SUBSTANCES

Aim

Minimise the potential for hazardous goods used on the project to have an effect on the environment.

To prevent disposal/discharge of any hydrocarbons or chemicals to the environment.

Potential Impact

There is the potential for incorrect storage of dangerous and hazardous substances to result in the contamination of soil, surface water, groundwater and death of vegetation and fauna.

Environmental Management Strategy

Hydrocarbon storage areas and workshops will be bunded in accordance with DMP and DEC requirements and Australian Standards. All chemicals will be stored in accordance with DMP and DEC requirements.

GWR will ensure that suppliers meet the statutory requirements for transport of dangerous goods and will meet the same standards for storage and use. In particular, fuel and oil storage and waste oil management will be designed to practicably minimise risks of soil contamination from these products.

All explosives and toxic materials will be stored in fenced and locked site storage and used in accordance with the Mines Safety and Inspection Act 1994, the Mines Safety and Inspection Regulations 1995 and the Dangerous Goods Safety Act 2004.

Spill response equipment will be stored and immediately available in all workshops and on maintenance/service vehicles. If an inadvertent spillage of hydrocarbon occurs, the spill will be contained as much as possible by the use of the spill response equipment. In the event of a large spill, earthmoving equipment will construct earthen bunds to contain the spill.

All waste hydrocarbon and hydrocarbon contaminated materials will be collected and stored in bulk containers, bins or drums and removed from site by a licensed operator for recycling, treatment or disposal at an approved landfill.

5.13 GASEOUS ATMOSPHERIC EMISSIONS

Aim

Ensure that gaseous emissions do not adversely affect the environment or health, welfare and amenity of nearby land users.

Potential Impact

Mobile equipment emissions from engine exhausts.

Increased greenhouse gas emissions.

Decomposition of cleared vegetation and release of carbon from the soil.

Combustion of diesel fuel for mobile equipment.

Combustion of diesel fuel for power supply to the project.

Environmental Management Strategy

It is not anticipated that greenhouse gases produced from the project will impact on local or regional air quality.

As part of the National Pollutant Inventory (NPI), quantities of air and ground emissions will be estimated or measured and reported annually. This will include emissions from various activities on-site including blasting, crushing and screening, combustion, vehicle movements and wind erosion (dust).

In accordance with the *National Greenhouse and Energy Reporting Act 2007*, greenhouse gases and energy consumption above the thresholds specified under the Act, will be reported.

All vehicles and machinery will be regularly serviced to minimise the emissions of combustion gases.

Revegetation of disturbed areas will be undertaken to allow for carbon sequestration over time, therefore offsetting a proportion of the net production of $CO_{2\text{-}e}$ for clearing activities.

All employees will be educated on energy efficient practices that can be used in their daily activities and the site induction will include a section on this issue.

5.14 FIRE

Aim

GWR aims to ensure that the risk of fire caused by mining operations is negligible.

Potential Impact

Fire ignition and subsequent spread may significantly alter fauna habitat and kill fauna that cannot escape the fire front in time.

Environmental Management Strategy

Personnel will be informed of burning restrictions, fire prevention, and trained in the use of fire-fighting equipment and procedures.

The local Shire's restrictions on activities during severe fire hazard days will be observed.

Flammable material will be cleared from the working area.

5.15 REHABILITATION

The objective of the rehabilitation program at Wiluna West is to remove signs of mining and associated activities where practicable and establish a self sustaining, safe, non-eroding, stable, non-polluting environment using flora local to the area (and to encourage the return of fauna).

The rehabilitation of the project will be guided by the following principles:

- Ensuring that vegetation clearing is kept to the minimum.
- Minimising soil erosion particularly on the batters of the waste dumps.

- Collecting and correctly stockpiling vegetative material and available topsoil for later use at selected sites.
- Progressively rehabilitating completed areas as soon as practicable.
- Only using local native plant species.
- Undertaking decommissioning and closure of the site to industry leading practice principles and to statutory requirements.

5.16 WORKFORCE INDUCTION AND TRAINING

All of the workforce, both staff and contractors, will be given a comprehensive safety, occupational health, fire education and environmental inductions prior to commencing mining activities.

6.0 SOCIAL IMPACTS

6.1 ABORIGINAL HERITAGE

Aim

GWR will ensure the mining proposal complies with the requirements of the Aboriginal Heritage Act 1972.

Potential Impact

Potential disturbance of Aboriginal significance in the project area.

Management

The following management strategies are proposed with regard to Aboriginal Heritage:

- A Heritage Management Plan (HMP) is being prepared for the project in consultation with CDNTS and the traditional land owners. All operations will be undertaken in accordance with this Plan.
- Approvals to destroy or move sites will be obtained from the DIA before commencing land disturbance activities.
- All known Aboriginal heritage sites will be clearly flagged off to prevent disturbance or either relocated in accordance with HMP.
- Inclusion of Aboriginal heritage awareness in site induction programs to aid in identification and preservation of any possible heritage sites.
- All employees and contractors will be made aware of the location of the sites in order to avoid disturbance to these sites. All staff will be made aware to report any potential Aboriginal sites.
- Ongoing consultation with Traditional land owners and the CDNTS.

6.2 EUROPEAN HERITAGE

Aim

Ensure the proposal complies with the requirements of the Heritage Act of Western Australia 1990.

Potential Impact

Potential disturbance to sites of European significance within the project area.

Management

No sites of European heritage significance will be impacted by the project.

7.0 **COMPLIANCE**

GWR will comply with the provisions in applicable Acts and their Regulations which include the following but may not be restricted to the:

- Aboriginal Heritage Act 1972.
- Conservation and Land Management Act 1984.
- Environmental Protection Act 1986 (and Administrative Procedures 1993).
- Environmental Protection (Noise) Regulations 1997.
- Environmental Protection (Clearing of Native Vegetation) Regulations 2004.
- Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth).
- Heritage of Western Australia Act 1990.
- Land Administration Act 1997.
- Local Government Act 1995.
- Local Government (Miscellaneous Provisions) Act 1960.
- National Greenhouse and Energy Reporting Act 2007 (Commonwealth).
- Native Title Act 1973 (Commonwealth).
- Occupation Safety and Health Act 1984.
- Petroleum Act 1967.
- Rights in Water and Irrigation Act 1914.
- Wildlife Protection Act 1950.
- Dangerous Goods Safety Act 2004.
- Mining Act 1978 and Regulations 1981.
- Mines Safety and Inspection Act 1994 and Regulations 1995.

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FIGURES

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Figure 1 - Location of the Wiluna West Project

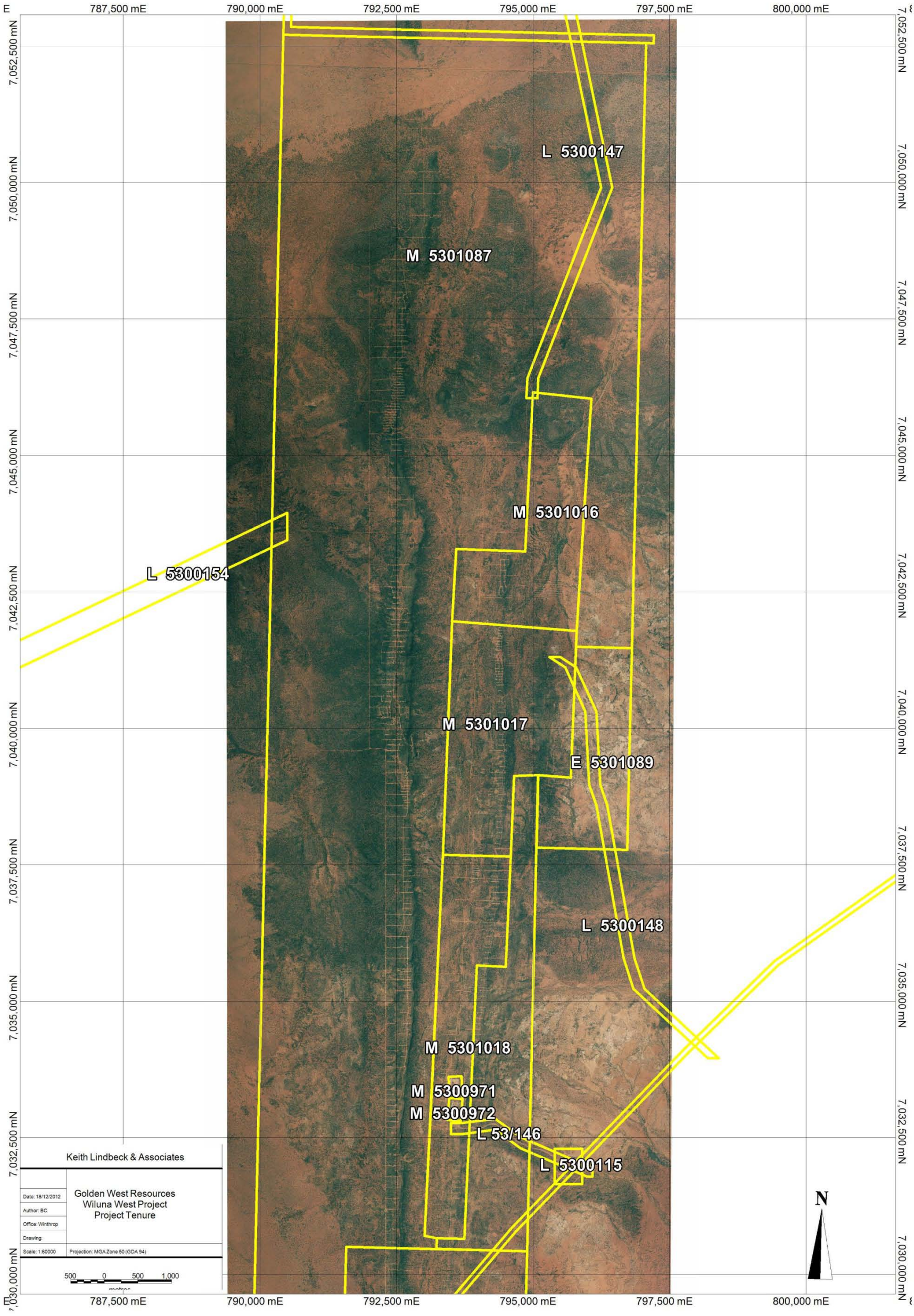

Figure 2 - Tenure of the proposed Wiluna West Project area

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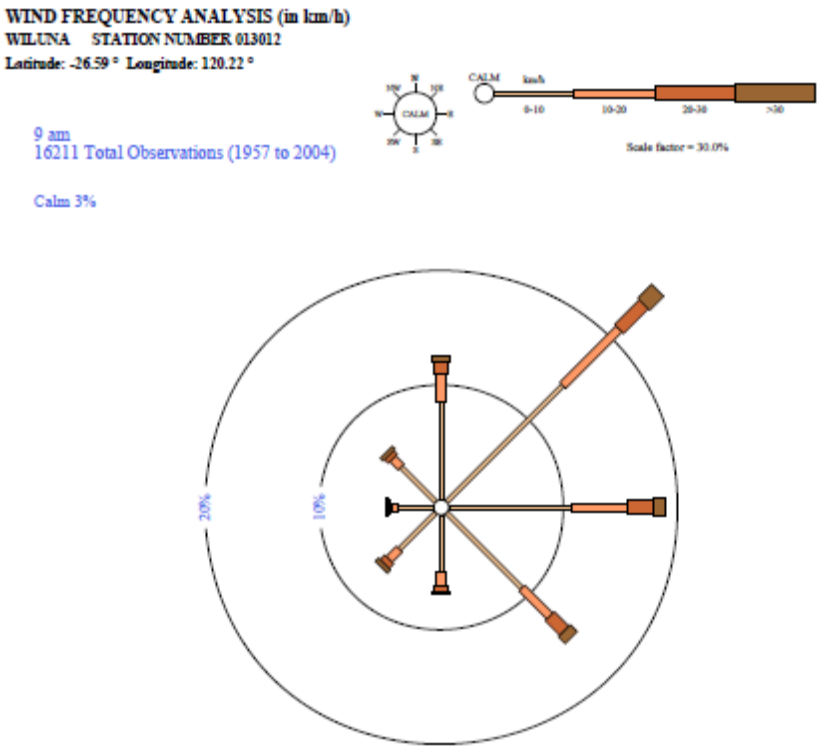

Figure 3 – Wiluna annual 9am wind roses

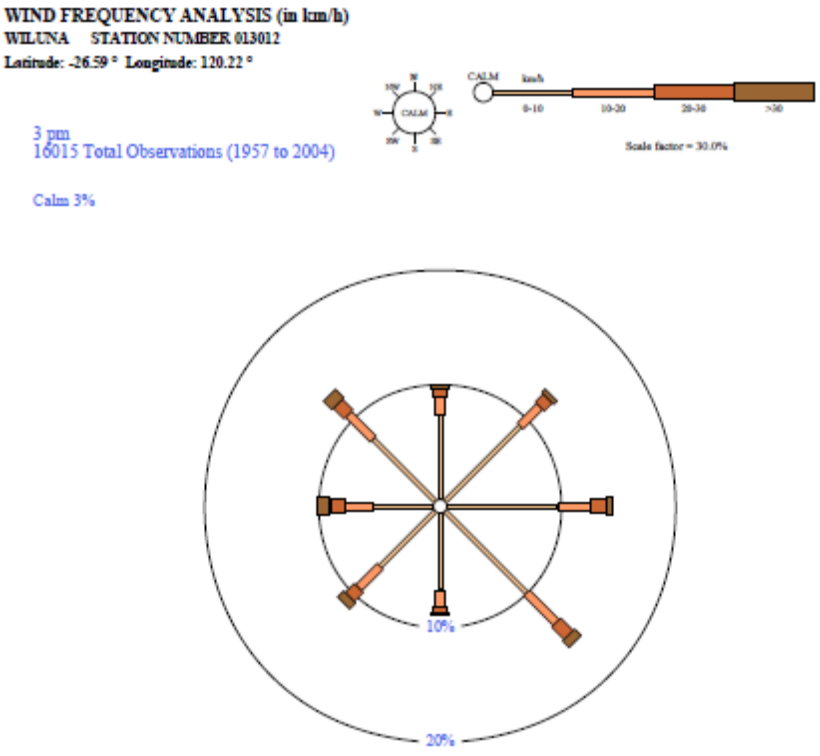

Figure 4 – Wiluna annual 3pm wind roses

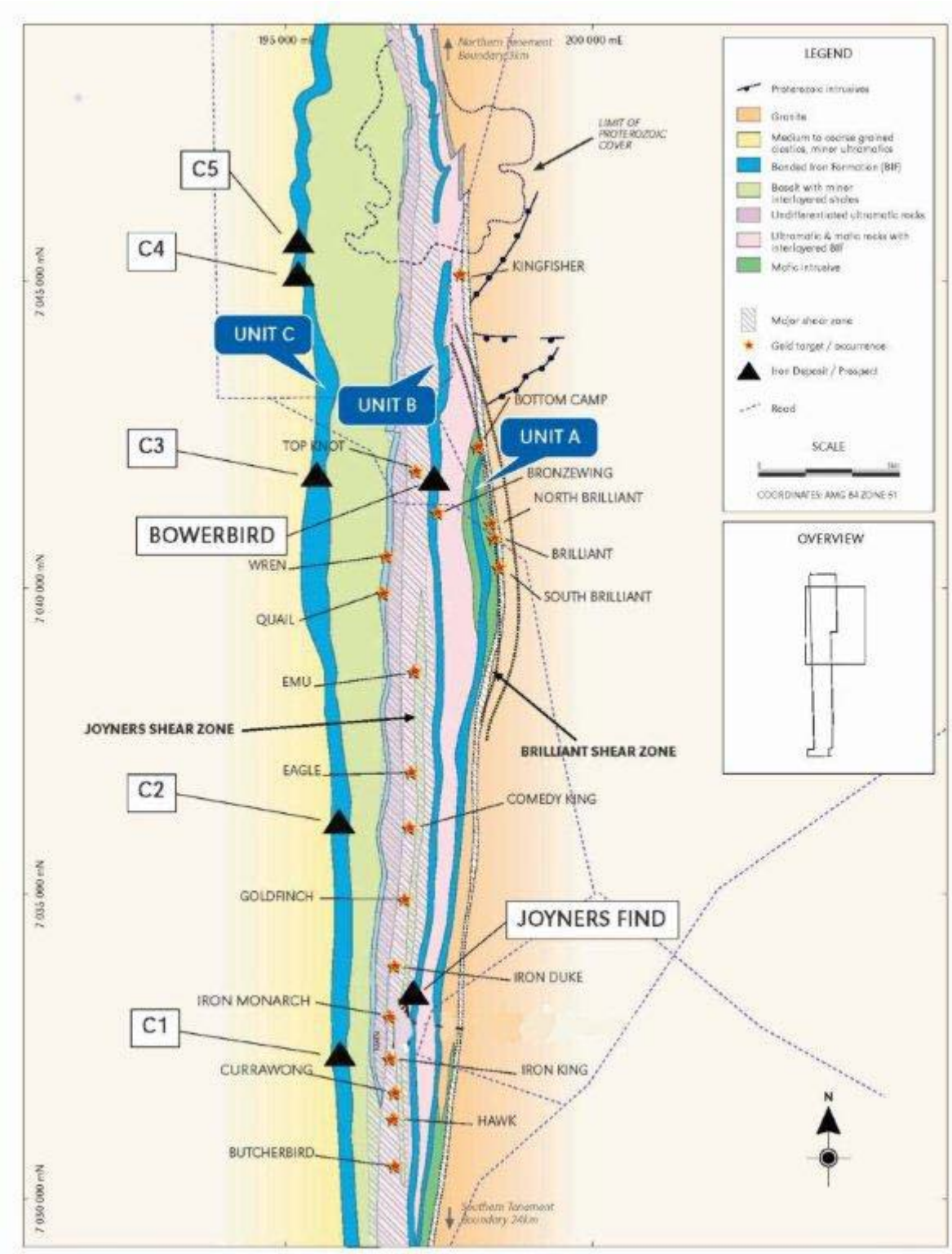

Figure 5 - Regional geology of the Wiluna West project

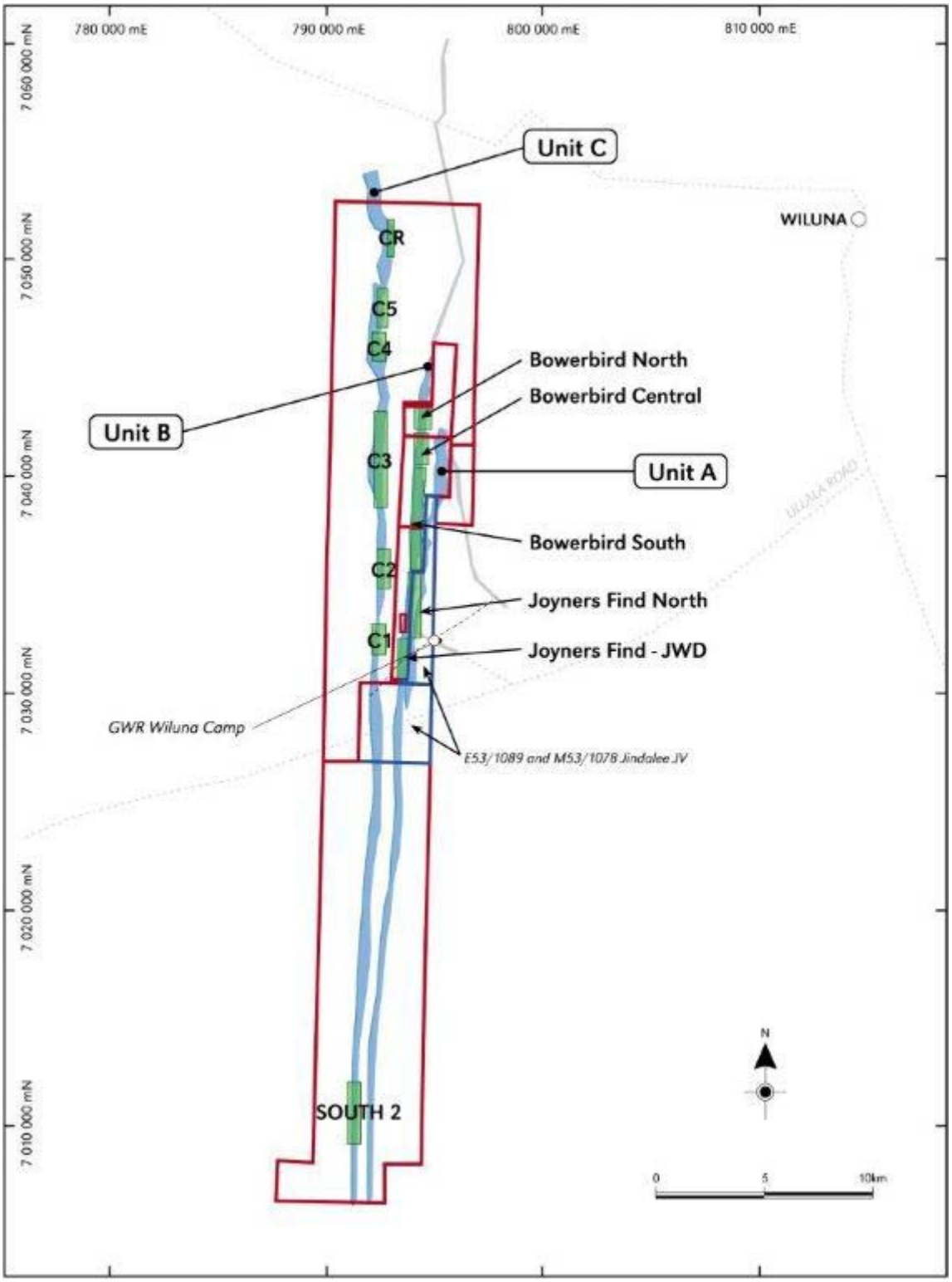

Figure 6 - Geological Units at Wiluna West

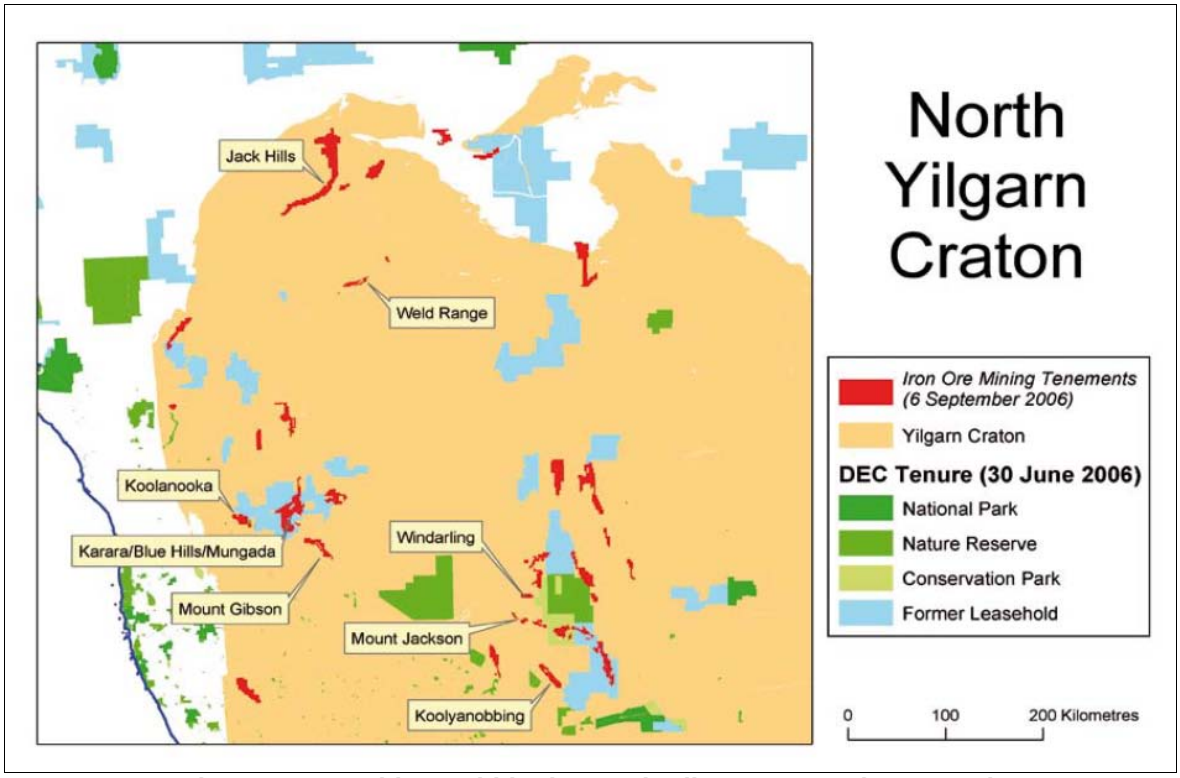

Figure 7 - BIF Ridges within the North Yilgarn Craton (DEC 2007)

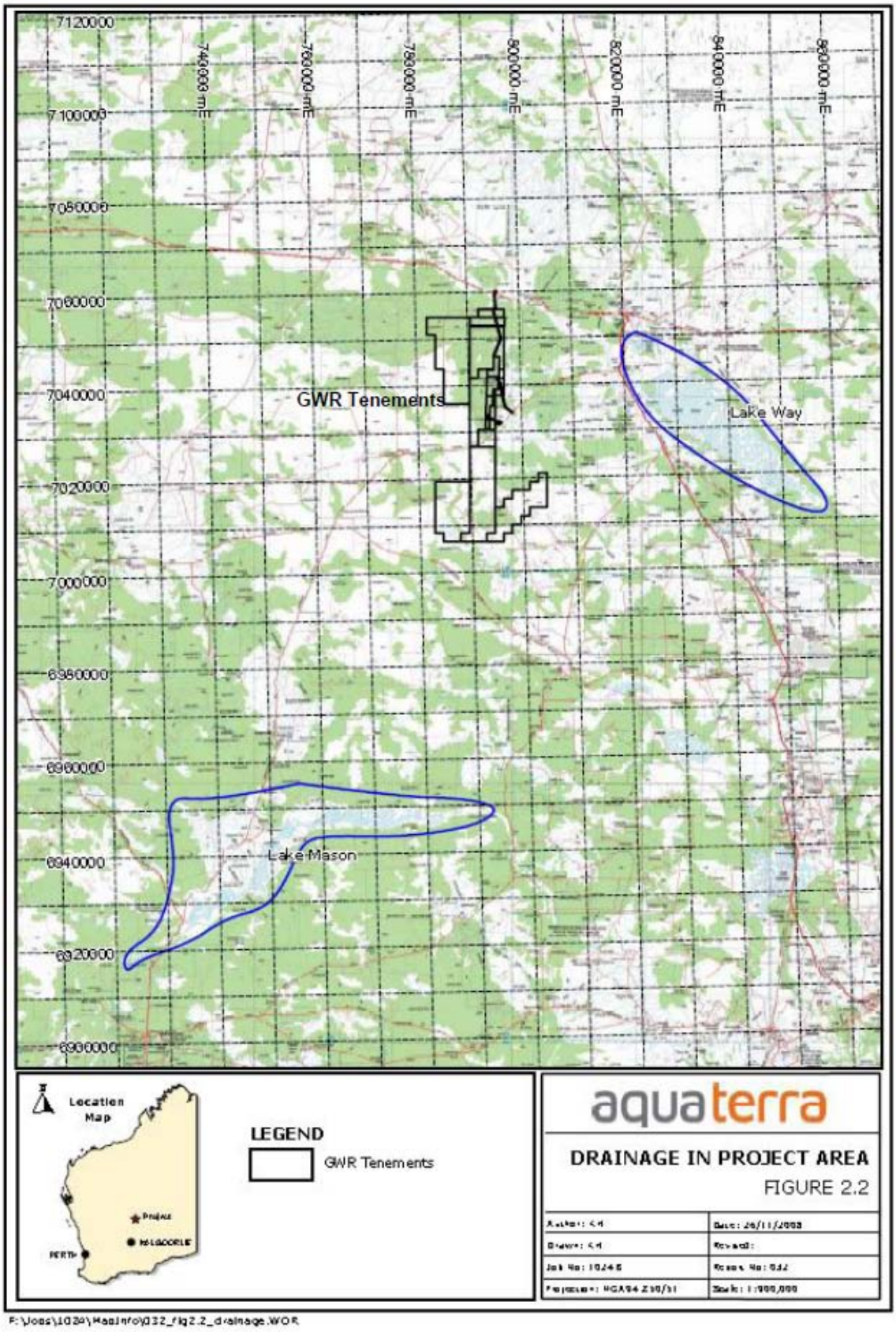

Figure 8 - Major Drainage Areas surrounding GWR's Tenements

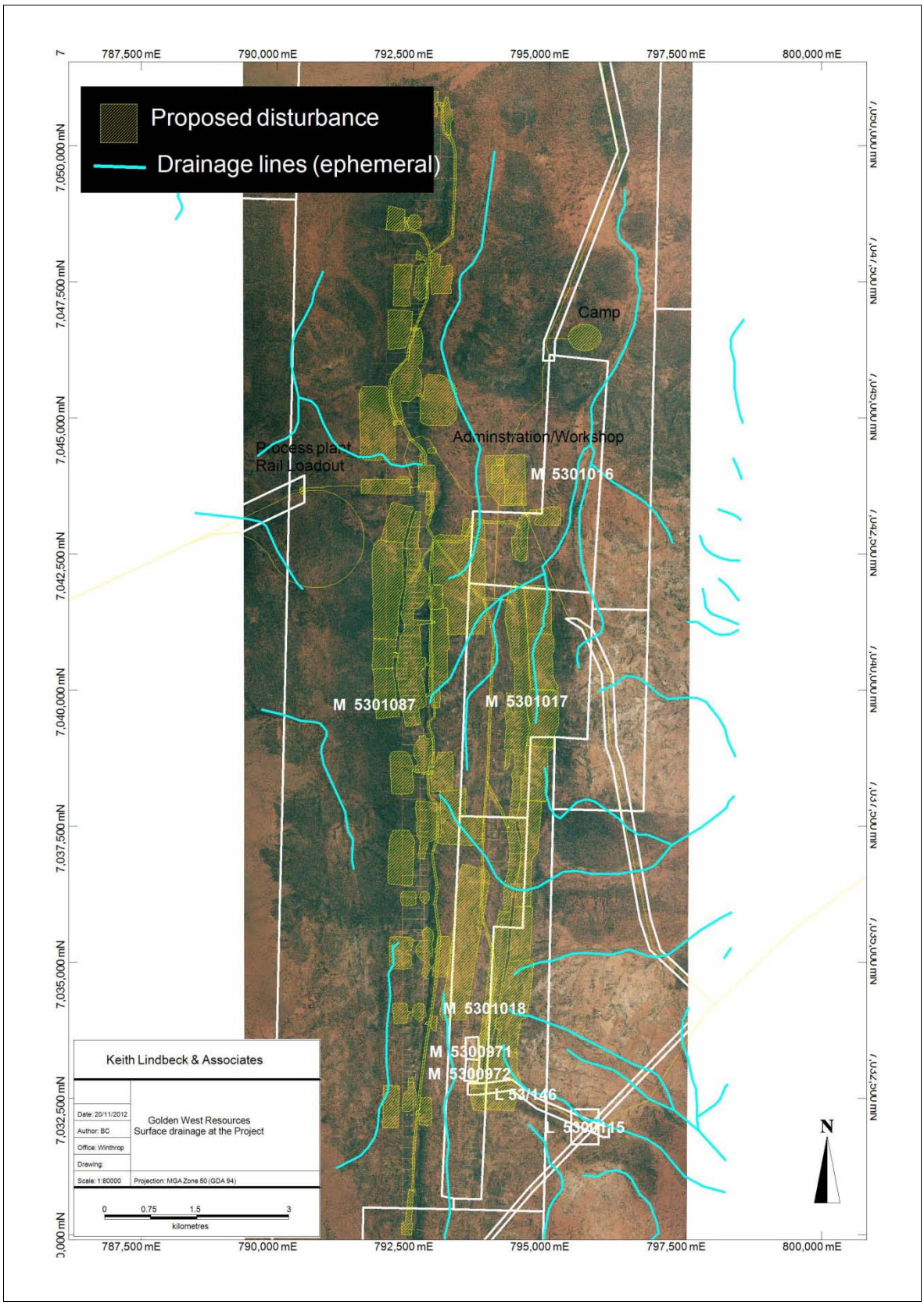

Figure 9 - Surface drainage at Wiluna West project

This map is included in the folder in Appendix 1

Figure 10 - Vegetation Communities at Wiluna West Project

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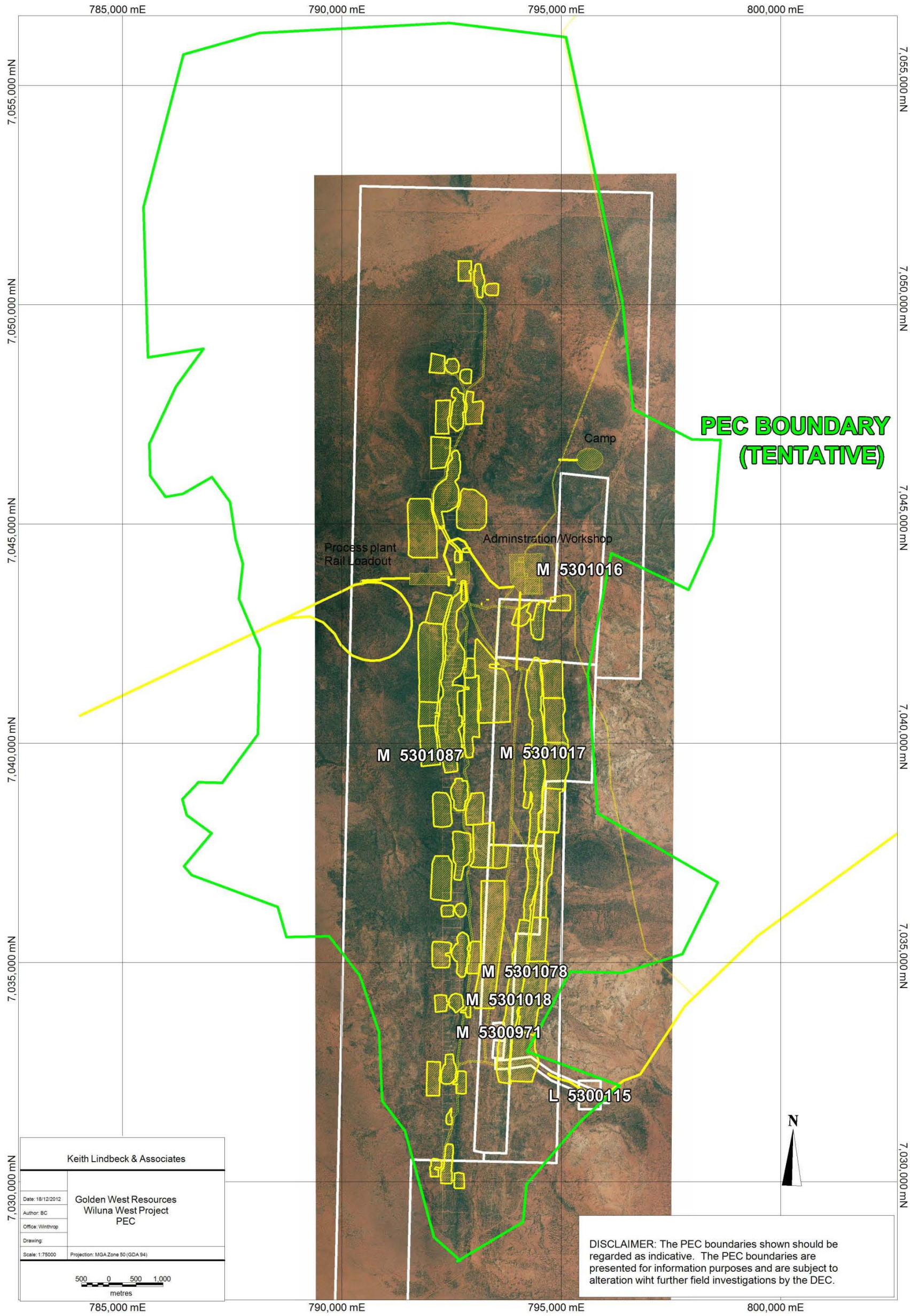

Figure 11 - Wiluna West PEC (tentative boundary as provided by DEC). Yellow shade dareas represent proposed disturbance.

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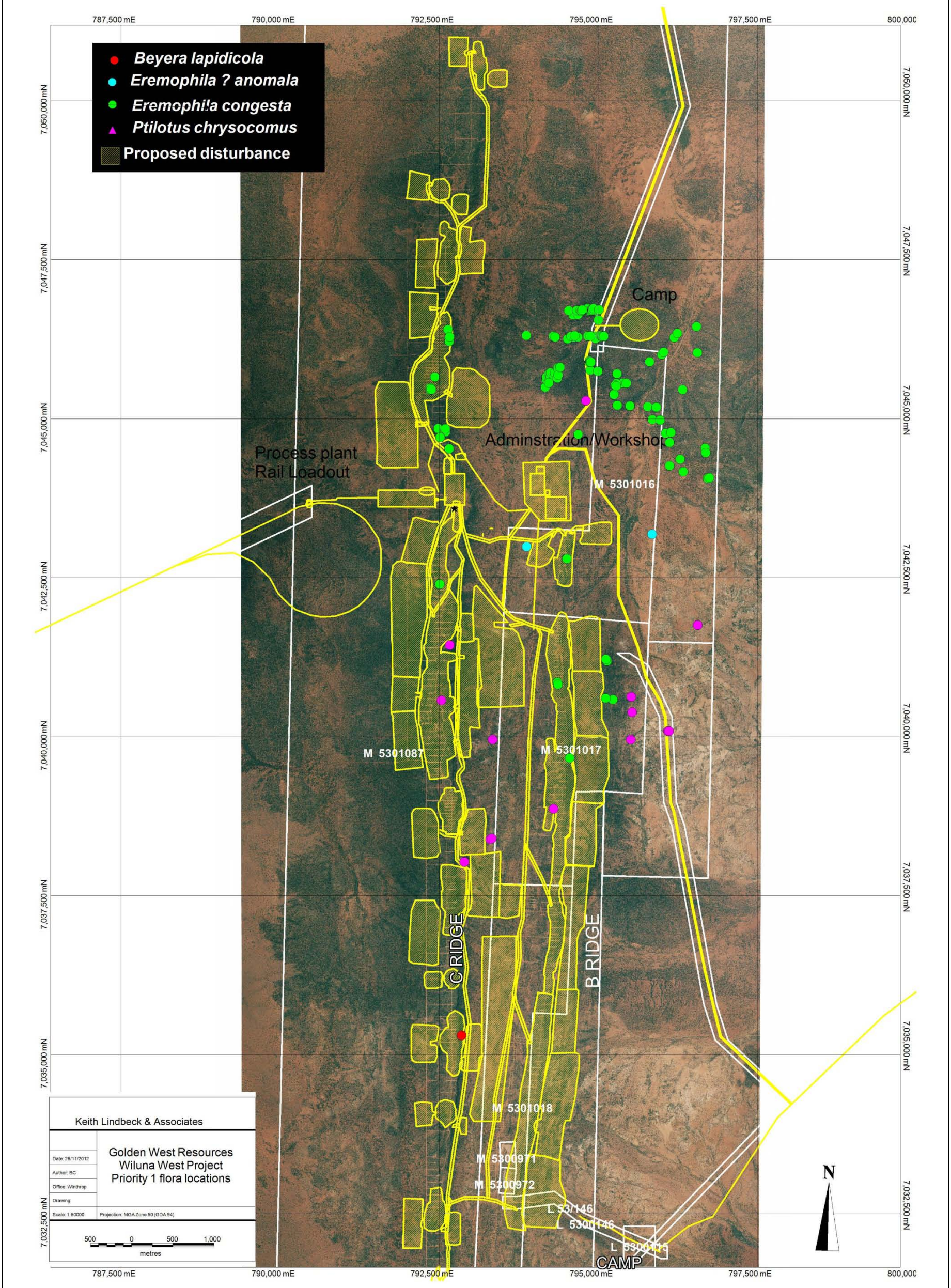

Figure 12 - Location of Priority 1 flora at Wiluna West

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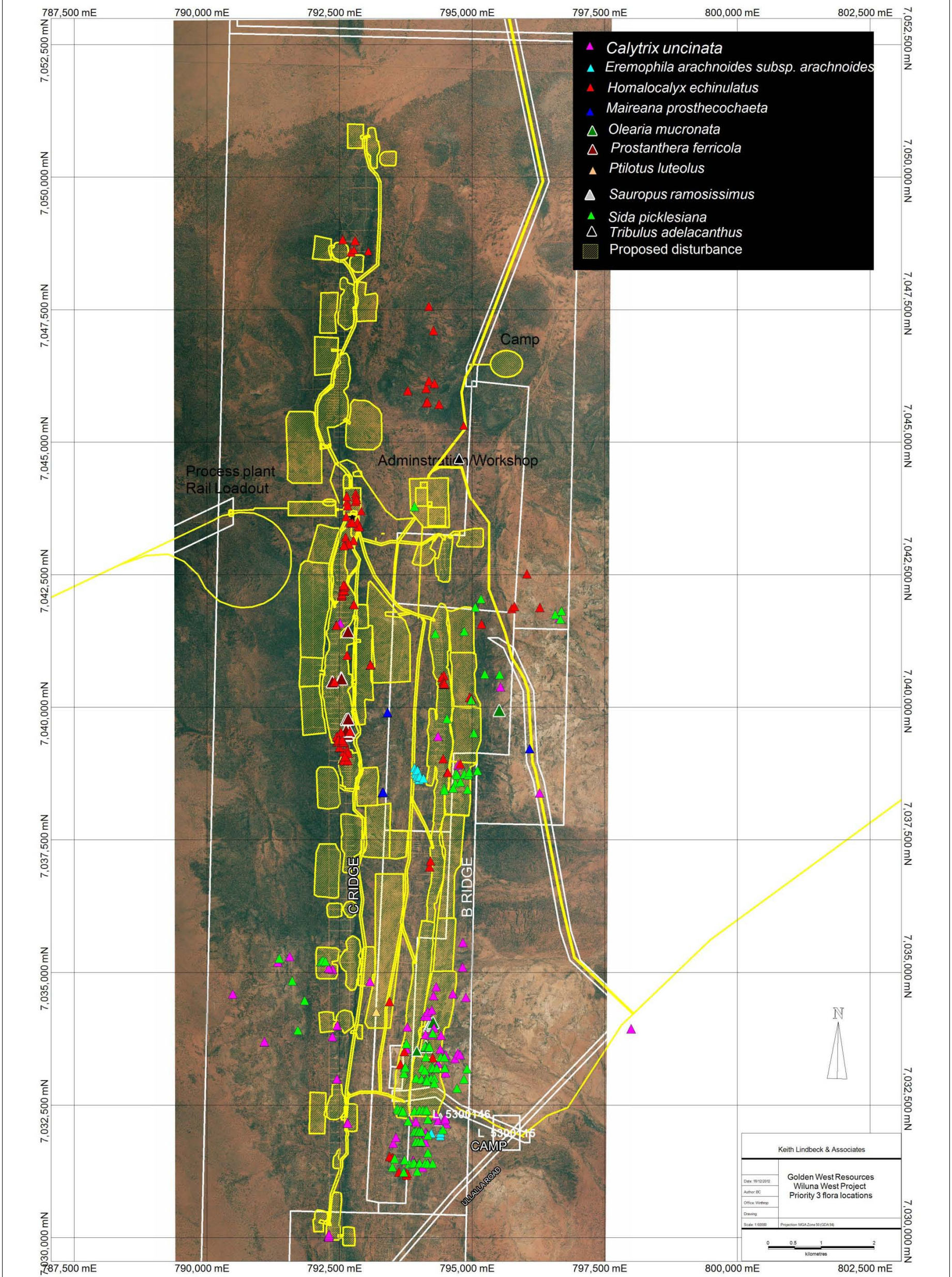

Figure 13 - Location of Priority 3 flora at Wiluna West

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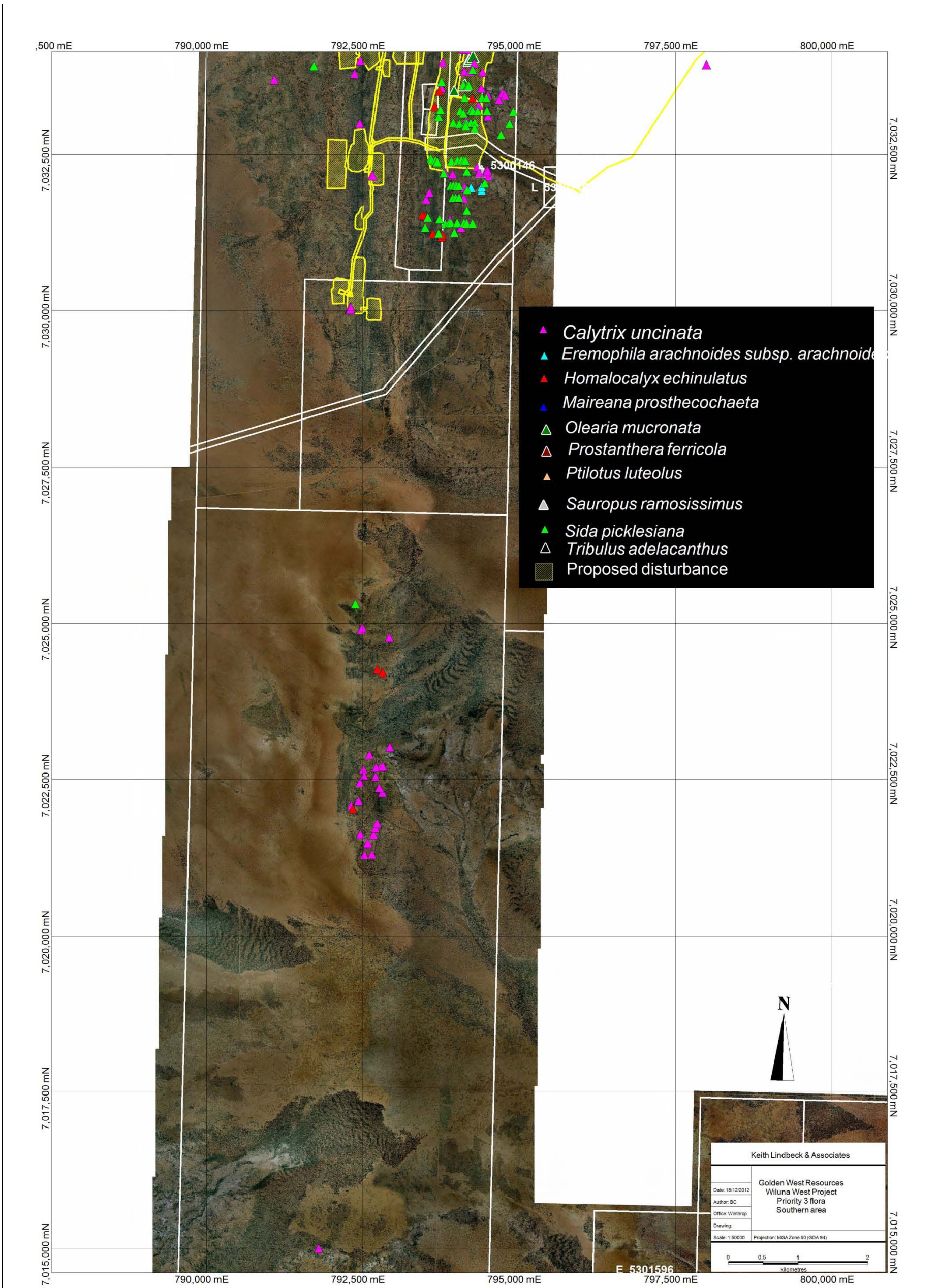

Figure 14 - Location of Priority flora on the BIF south of project

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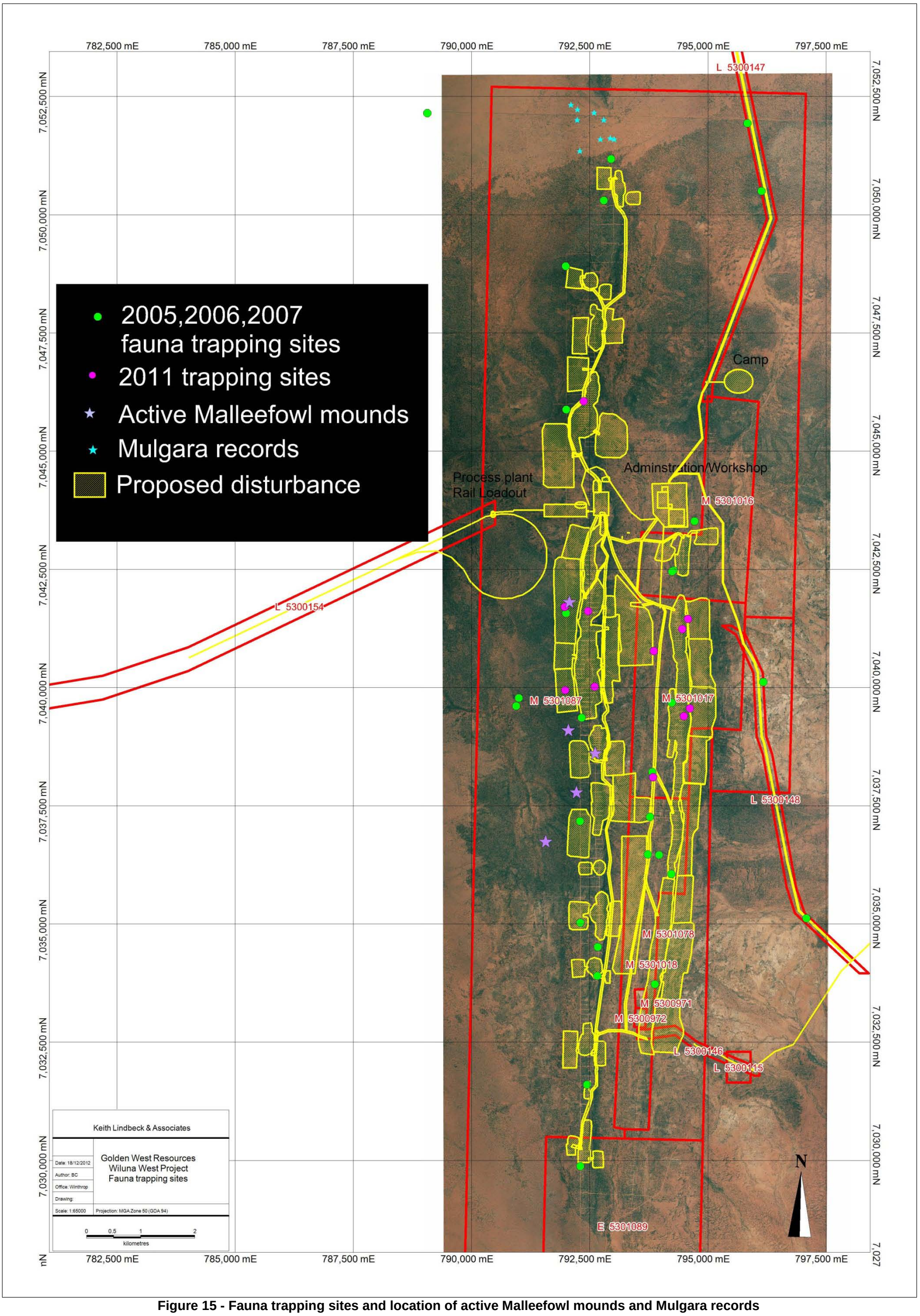

Figure 15 - Fauna trapping sites and location of active Malleefowl mounds and Mulgara records

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Figure 16 - Targeted malleefowl survey area

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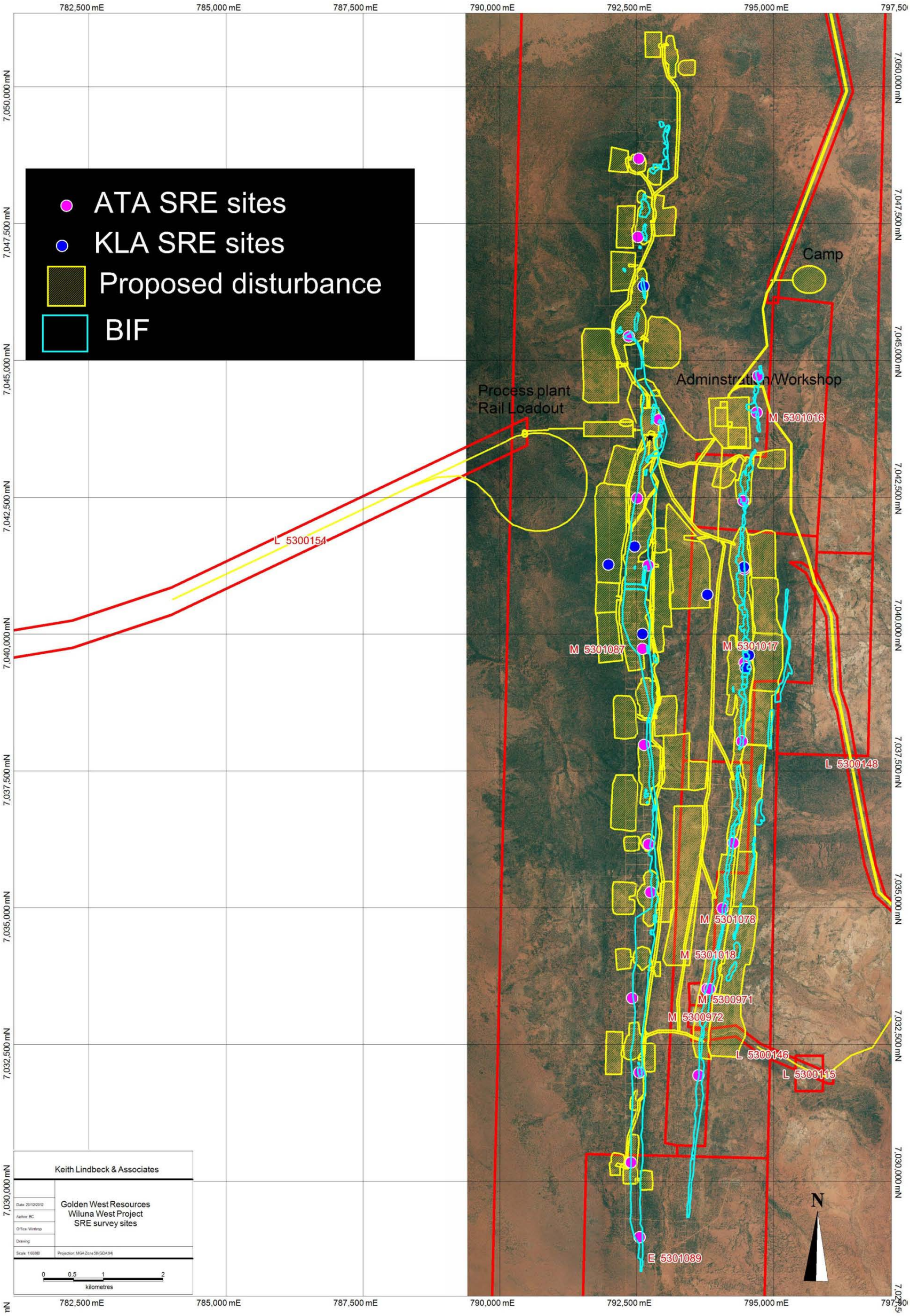

Figure 17 - Location of SRE sampling sites with outcrops of BIF overlain

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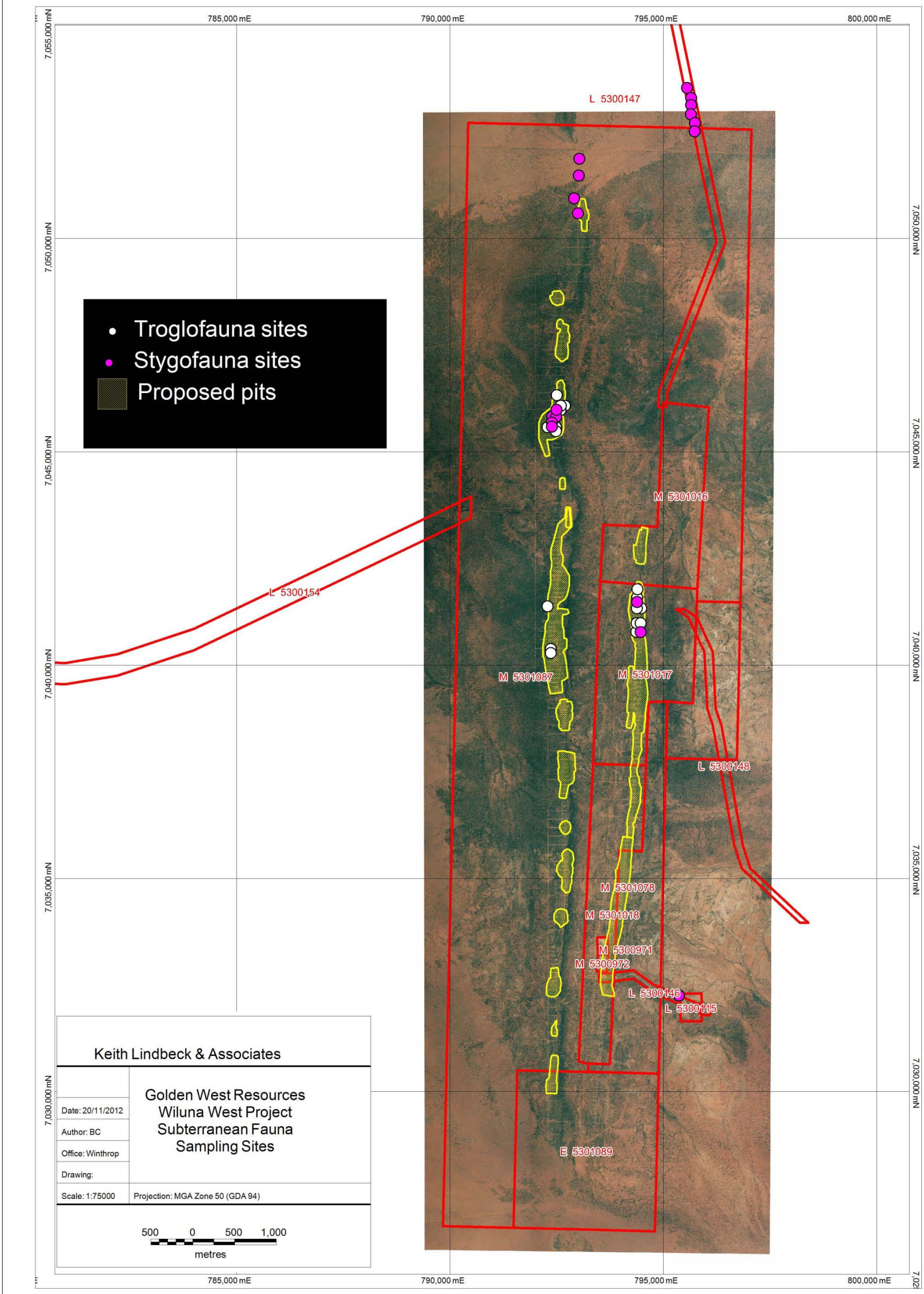

Figure 18 - Subterranean fauna sampling undertaken at the project to date

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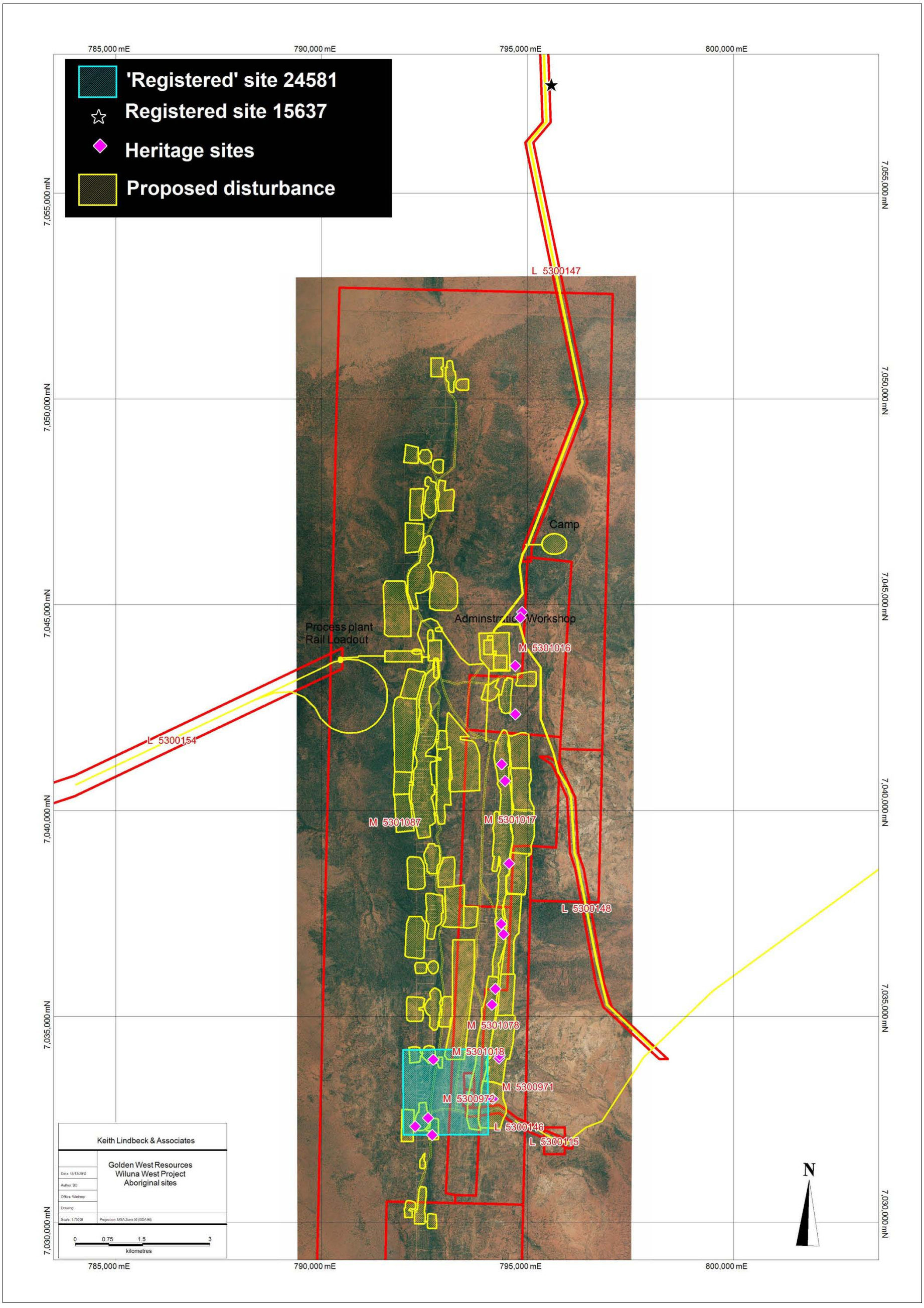

Figure 19 - Aboriginal Sites at Wiluna West

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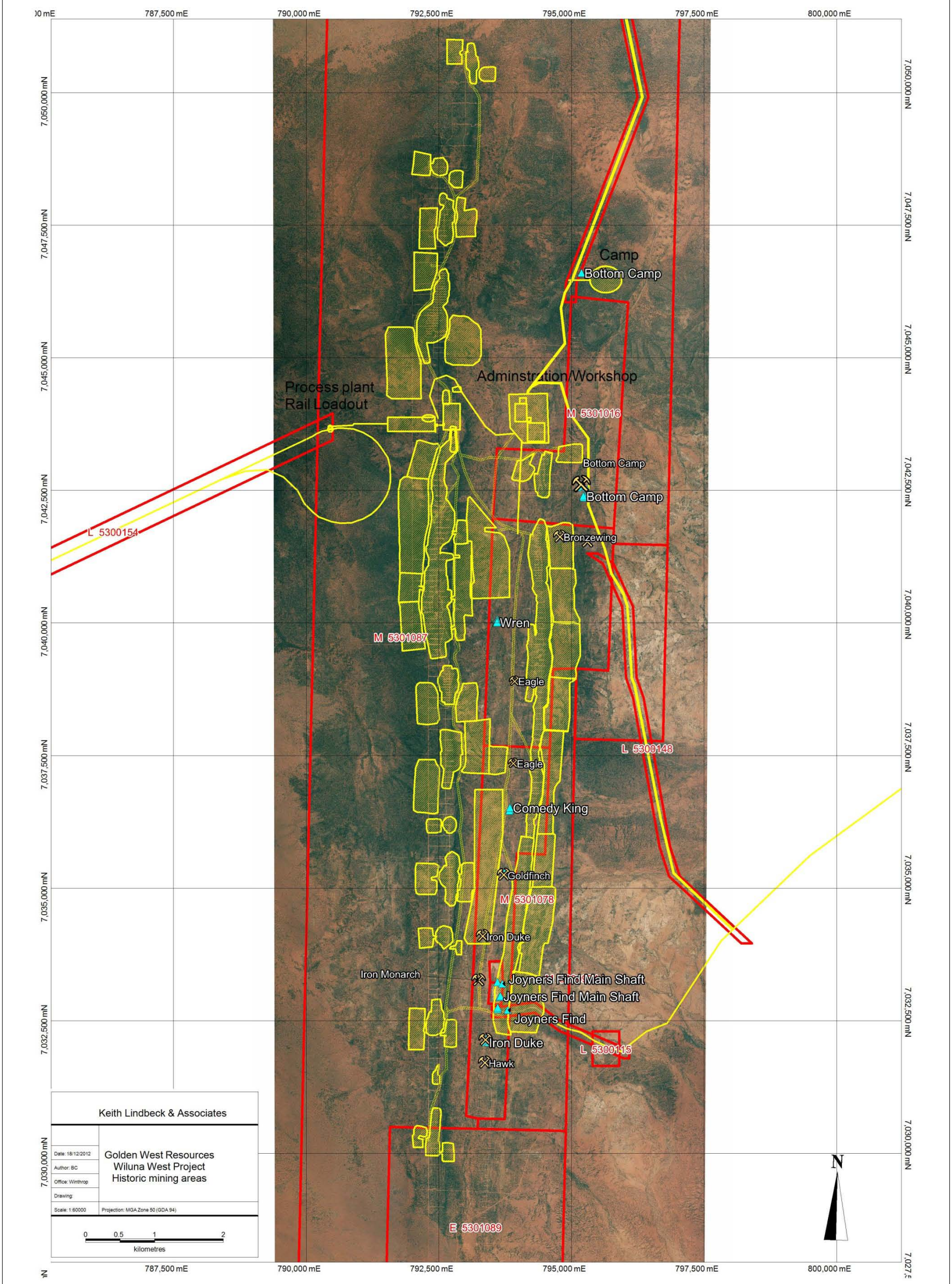

Figure 20 - Historic mining areas at the project

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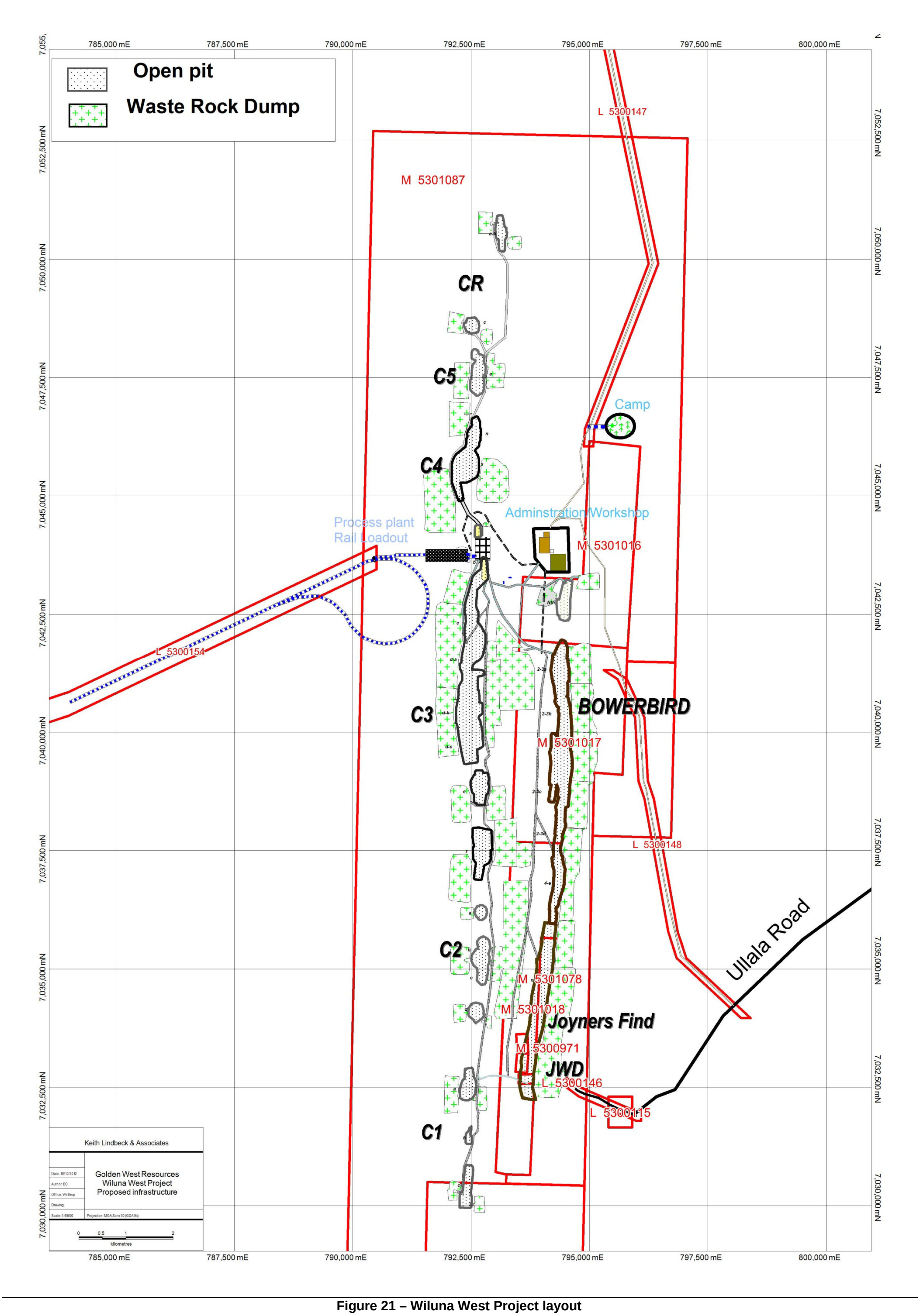

Figure 21 – Wiluna West Project layout

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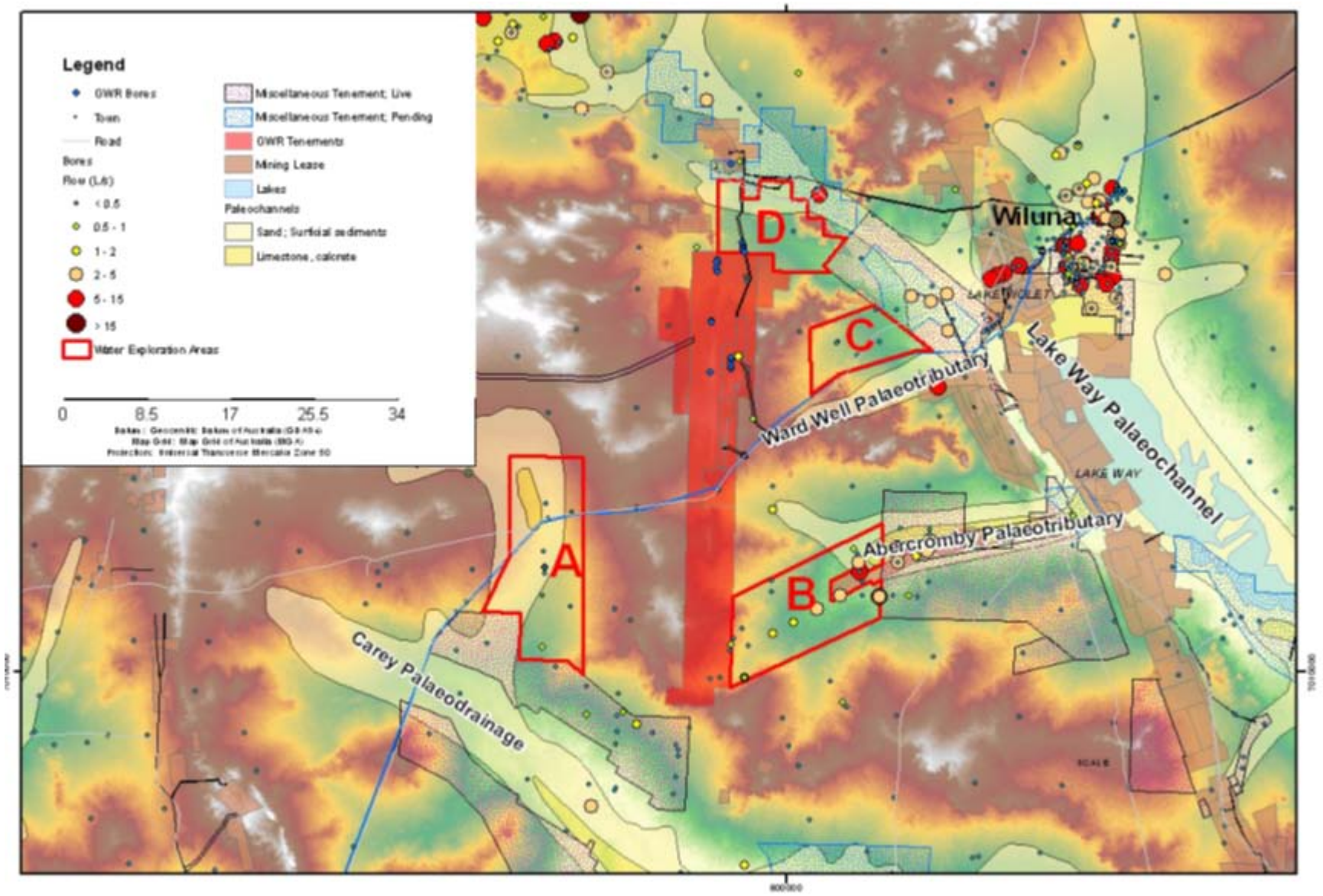

Figure 22 - Potential palaeochannel resources

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APPENDIX 1 – RECON VEGETATION SURVEY REPORT

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ATTACHMENT 1 – CD CONTAINING VEGETATION AND FAUNA REPORTS

(list on following page)

VEGETATION AND FLORA

App 1.1: Vegetation & flora survey undertaken on M53/1016 and L53/148 – Botanica Consulting, September 2005.

App 1.2: Vegetation and flora survey of the haul road from the project site to the Northern Goldfields Highway – Botanica Consulting, September 2005.

App 1.3: Vegetation & flora survey of 92 20m x 20m quadrats on Units A, B & C – Botanica Consulting, July 2006.

App 1.4: Vegetation and flora survey of the Bowerbird project and related haul road – Botanica Consulting, March-April 2007.

App 1.5: Flora and Vegetation Survey of Four Proposed Gravel Pits (no longer to be utilised) – on M53/1087 and at intersection of L53/148 and Ullala Road - Botanica Consulting, April 2007.

App 1.6: Flora survey and mapping of vegetation on Ridges A, B & C – Botanica Consulting, 24 February- 1 March 2008.

App 1.7: Targeted regional searches for Sida picklesiana (formerly Sida sp. Wiluna (A Markey and S Dillon 4126)) - Keith Lindbeck & Associates (in conjunction with WA Herbarium), August 2010.

App 1.8: Targeted Priority flora survey of the three deposits that will be mined in the first 10 years of operations (C3, C4, Bowerbird) - Native Vegetation Solutions, November 2011.

Variety of targeted Priority flora surveys for proposed exploration within E53/1114, E53/1116, E53/1173, M53/1016, M53/1017, M53/1018, M53/1078) – Botanica Consulting, Keith Lindbeck & Associates 2007 to 2011 can be provided on request.

TERRESTRIAL FAUNA

App 2.1: GWR 2005 Fauna Report, Ninox 2006
App 2.2: GWR 2006 Fauna Report, Ninox 2007
App 2.3: GWR 2007 Fauna Survey Results, Ninox 2008
App 2.4: GWR 2011 Fauna Report, KLA 2012

SRE

App 3.1: Revised SRE survey results, ATA 2007

SUBTERRANEAN FAUNA

App 4.1: Wiluna West Stygofauna Report, Subterranean Ecology 2007