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Draft EIS - Appendix J Archaeological Report Mine Site

Western Desert Resources Limited
Roper Bar Iron Ore Project



2012



**WESTERN DESERT RESOURCES LIMITED –
ROPER BAR IRON ORE PROJECT
ARCHAEOLOGICAL SURVEY REPORT**

A report for VDM Consulting & EcOz Environmental Services



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Cover photo: Retouched chert flake – spear point (Background scatter 2)

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EXECUTIVE SUMMARY

This report details an archaeological survey for Western Desert Resources Limited – Roper Bar Area, Northern Territory. The consultant was required to identify and record any archaeological sites or artefacts likely to be impacted by the proposed construction of an iron ore mine. Six archaeological background scatters of stone artefacts and three isolated stone artefacts were found. The development proposes to mine the sandstone ridges in Area E (north and south), Area F (east and west) and to produce a spoil dump east of a tributary (referred to in this report as Towns Creek) of Towns River in Area F (east). Mining will not impact on the finds, but the spoil heap between Area E (north) and area E (south), should avoid encroaching upon Towns Creek as delineated in this report.

Summary of recommendations

Background scatter (BS)	Centroid		Description	Comments	Significance	Recommendations
	Easting	Northing				
BS01	509642	8324593	6 artefact	Less than 50 metres in area	Moderate	Leave in situ.
BS02	511465	8325880	1 artefact	Less than 10 metres in area	Low	Leave <i>in situ</i> .
BS03	511329	8325703	2 artefacts	Less than 30 metres in area	Low	Leave <i>in situ</i> .
BS04	506918	8324992	10 artefacts	Less than 100 metres in area	Moderate	Leave <i>in situ</i> .
BS05	507729	8325989	4 artefacts	Less than 30 metres in area	Low	Leave <i>in situ</i> .
BS06	507580	8325854	5 artefacts	Less than 30 metres in area	Low	Leave <i>in situ</i> .
Isoliths (Iso)						
	Easting	Northing	Recommendations			
Wpt 33	506629	8324802	Leave <i>in situ</i> .			
Wpt 34	506538	8324692	Leave <i>in situ</i> .			
Wpt 35	506228	8324788	Leave <i>in situ</i> .			

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1.0. INTRODUCTION

1.1 Background and consultancy brief

An iron ore mine is proposed at the Western Desert Resources Limited's (WDRL) Roper Bar lease, approximately 60 km southeast of the Roper River. An archaeological survey was required for the mine site, an area 4.5km² (Area F) and 20km² (Area E) (Fig. 1). The survey was conducted for six days from 14 to 19 October 2011, by two archaeologists, Douglas Hobbs and Silvano Jung (Principal). The consultancy brief was to:

- Identify any prescribed archaeological objects or places as defined under the *Northern Territory Heritage Conservation Act (1991)*, and any historic sites located within the proposed mine that may be impacted upon during the course of construction of the proposed WDRL mine.
- Assess the nature, distribution and significance of these materials and discuss possible constraints to the works posed by the presence of archaeological and historic sites and an indication of what sites are likely to be the most sensitive in this respect.
- Present a final report including a summary of survey results, determination of significance of sites and the likely impact of the proposed development, and recommendations regarding management strategies or mitigation procedures as appropriate under the *Northern Territory Heritage Conservation Act (1991)*.

1.2 Location of the proposed WDRL – Roper Bar iron ore mine

The proposed WDRL – Roper Bar iron ore mine lies approximately 18km off the Savannah Way via an established access track, which begins just after crossing Towns River. The whole Roper Bar project area lies between the Roper and Limmen Bight Rivers. Figure 2 details the two survey areas covered in this report. The track log is shown, indicating the areas covered by both vehicle and pedestrian transects.

1.3 Environmental setting - brief description

The Towns River dominates the region to the north of Area E. Access to Area E is through Wade's Crossing. The Towns River has high-energy flows during the wet season (Fig. 3). It was not flowing at the time of the survey. Small tributaries of the Towns River (referred to here as Towns Creek) cross through Area E (north) to Area E (south) and these are characterised by low-energy water flows, producing billabongs and lagoons.

Apart from Towns River, Area E contains a ring of sandstone ridges that have been uplifted. These sandstone ridges contain the ore deposits, targeted by WDRL, and are about 25 metres high. Figures 4 and 5 show the nature of these ridges in Area E north and Area S south respectively. The centre of Area E is flat, low-lying floodplain, with patches of swamp mahogany and open woodland. Towns Creek runs virtually through the middle of Area E. WDRL intend to use the area to the west of Towns Creek as a lay-down or spoil heap area for mining operations. That area is flat and contains no significant creeks.

Area F (west) is adjacent to the exploration camp and is relatively flat, with open woodland. A 1.5km long airstrip has been constructed, running diagonally across the area's western boundary. A sandstone ridge occurs to the south of Area F (west), which is similar to the pronounced ridges in Area E (see Fig. 6). No water sources occur in Area F (west) and soil is deeper, as attested by large tree (>30cm in trunk diameter at chest height) populations, with an understory of ferns and buffel grass (Fig. 7).

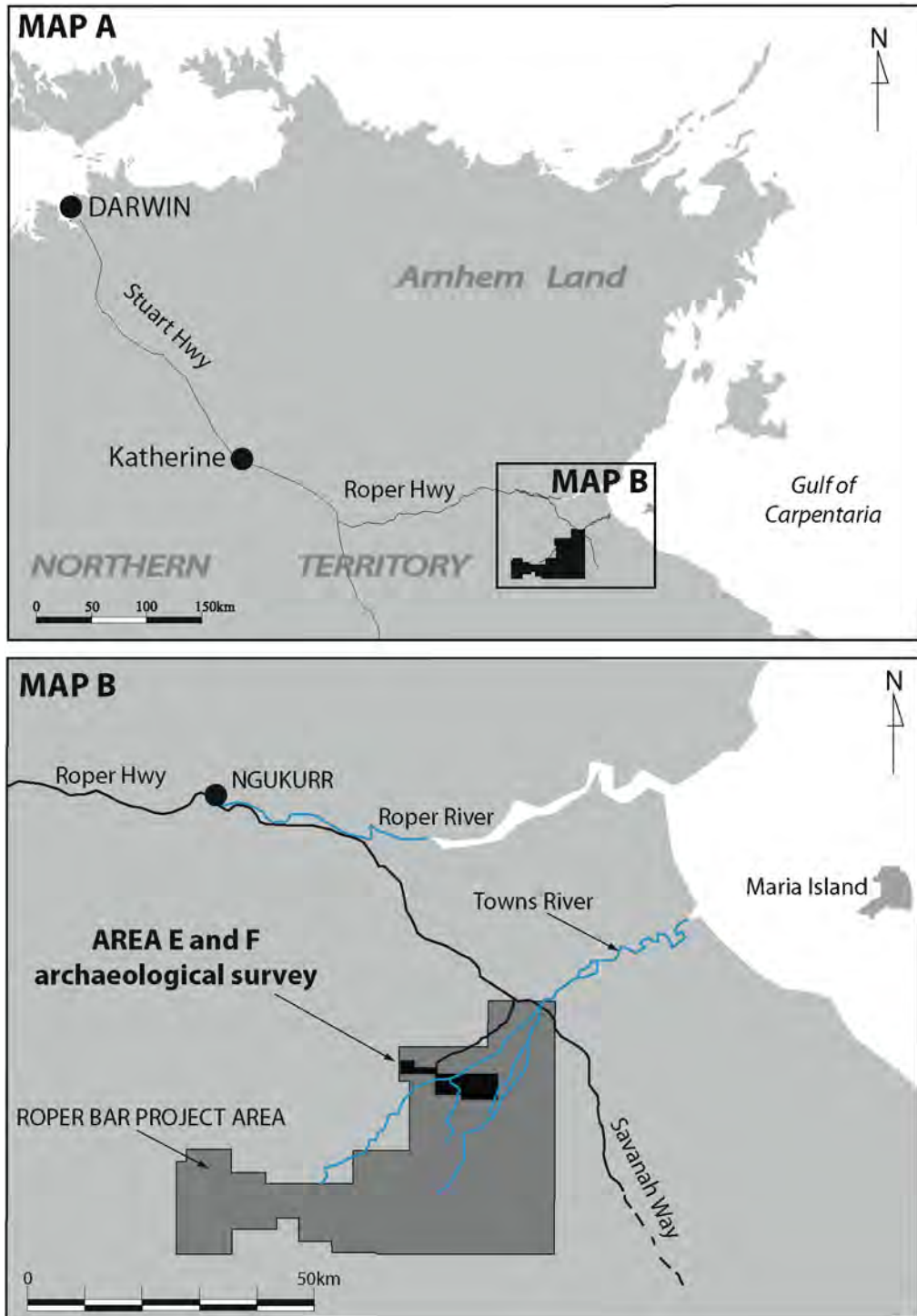


Figure 1. Location map of the study area (Map A), and Map B, showing survey area within the larger Roper Bar Project Area.

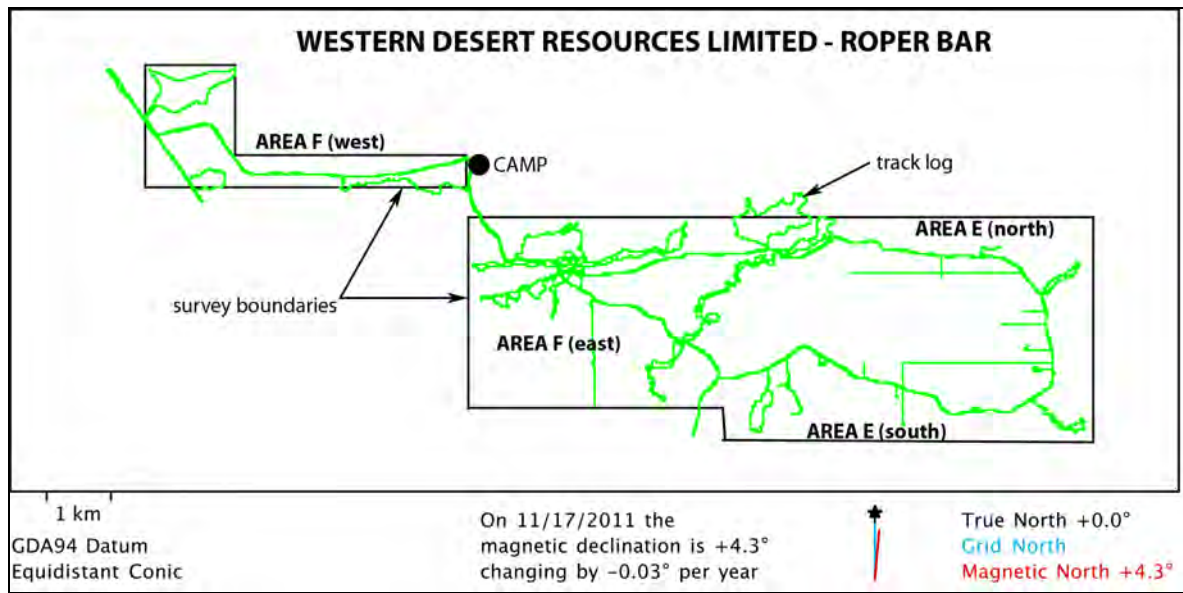


Figure 2. Map showing track log of the survey area.



Figure 3. Towns River, to the north of Area E.



Figure 4. Sandstone ridge in Area E north.



Figure 5. Sandstone ridge in Area E south, looking north towards Towns Creek.



Figure 6. Sandstone ridge in Area F west.



Figure 7. Tall canopy in Area F west.

1.3.1 Geology

The geology of the WDRL – Roper Bar is dominated by an enclosure of ore bodies within sandstone ridges that fringe a colluvial and alluvial floodplain. The Towns River runs through the northern margins of Area E (north) and Area F (east). Area F (west) is almost completely composed of alluvial sands, with a small outcrop of sandstone on its southern boundary. Towns Creek, which contains archaeological material, runs predominately through Area F (east), although its northern section skirts the sandstone ridges in Area E (north). From Figure 8, it is evident that chert and quartz, materials used in stone tool production, do not occur naturally in the survey area.

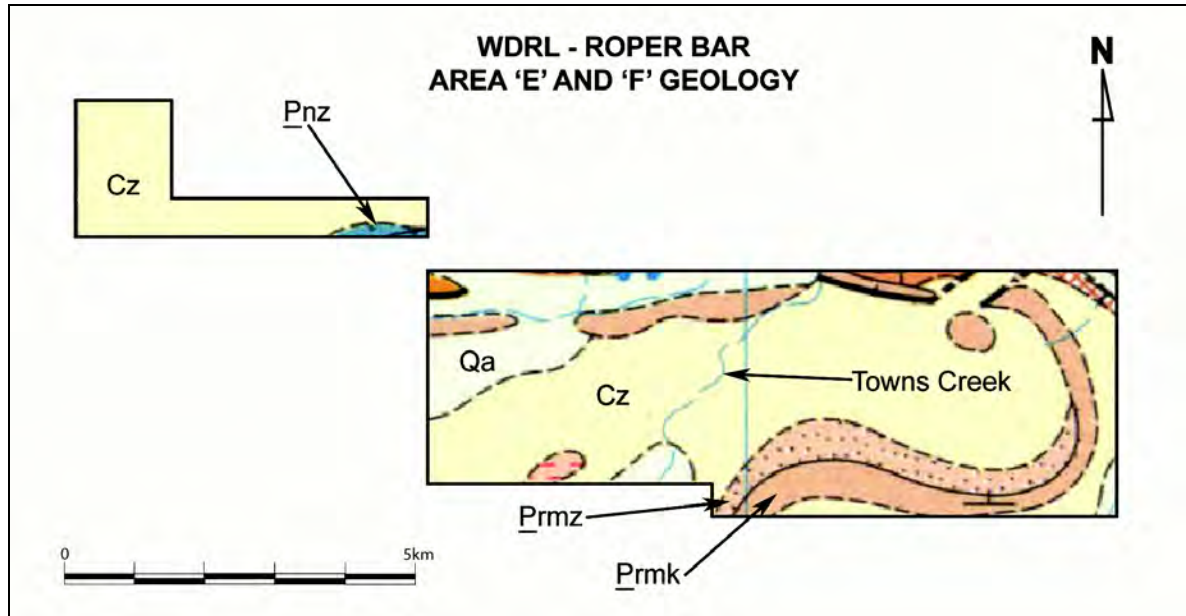


Figure 8. Geological map of the survey area. Key: **Qa** - Gravel, sand, silt: alluvium. **Cz** - Undifferentiated alluvial, colluvial and eluvial deposits: unconsolidated gravel, sand, silt, clay, ferruginous cemented detritus, minor calcrete, silcrete and ferricrete. **Prnz** - Ferruginous sandstone, sandy ironstone and hematitic shale interbedded with micaceous sandstone and mudstone, and beds of silicified ferruginous ooids. **Prmk** - Mainly fine-grained sandstone, in places ferruginous; thin-bedded to flaggy with some interbedded coarse-grained sandstone and minor conglomerate. **Prnz** - Dololite, stromatolitic and cross-bedded; dolomitic, lithic and feldspathic sandstone; dolarenite; dolomitic mudstone and muddy dololite frequently containing evaporite pseudomorphs; conical, large columnar, stratiform and domal stromatolites; diagnostic silicified ooid beds; common pink ?tuffaceous mudstone (After MOUNT YOUNG 1:250 000 Geological Map And Notes 1993 SD 53-15).

2.0. HERITAGE LEGISLATIVE FRAMEWORK

2.1. Northern Territory legislation

There are two kinds of heritage sites protected under the *NT Heritage Conservation Act (1991)*, declared and prescribed places and objects. The Act places legal constraints on owners of private property, local government and the Crown:

- Places or objects listed on the Northern Territory Heritage Register are declared heritage places and objects that are protected under section 33 of the Act, and
- Prescribed archaeological places and objects, which may or may not be declared, are protected under sections 29 and 39 of the Act.

It is an offence under the Act to damage, destroy, alter or carry out work of any sort on declared or prescribed sites without the written consent of the Minister or Minister's delegate.

2.1.1. Declared heritage places and objects

Categories, which describe the status of each site on the Northern Territory Heritage Register database, are listed in Table 1.

Table 1. Site status on the Northern Territory Heritage Register database

Status	Description
D	Declared heritage place.
NR	Not recommended. HAC* determined that the place did not meet heritage assessment criteria and did not hold sufficient value to warrant declaration under the act.
RF	Refused by the Minister. HAC* recommended for declaration and Minister refused to do so.
P	Proposed. HAC* has determined that the place warrants declaration under the Act but has not yet made its recommendations to the minister.
RV	Revoked. Declaration as a heritage place pursuant to Section 26(1) of the Act is revoked.
N	Nominated. HAC* has yet to complete its assessment of the heritage value of the place.

*Heritage Advisory Council

The Northern Territory Heritage Register contains places that possess special significance for the Northern Territory and have been recognized for a wide range of natural and cultural values. As a result it includes places that have been deemed significant because of their environmental and/or cultural characteristics. For the purposes of the current report, only places of historic or archaeological significance have been included.

2.1.2. Prescribed archaeological places and objects

Most archaeological places and objects are listed in the *Heritage Conservation Regulations (1999)* as prescribed places and objects. The Heritage Branch – Northern Territory Government (Formerly Heritage Conservation Services, Department of Natural Resources Environment and the Arts (NRETA) holds the Archaeological Sites Register. Included in this register are the protected prescribed sites that consist of all archaeological sites and objects pertaining to the past occupation by Aboriginal people. Any historic sites listed on this register do not indicate that these sites are protected or hold legal significance under the *NT Heritage Conservation Act (1991)*.

3.0 PREVIOUS RESEARCH

3.1 Literature review

A review of previous archaeological studies of the study area indicates that no sites have been recorded, which is most likely to be a factor of lack of surveys done in the area, rather than a lack of archaeology. The archaeological site register at the Heritage Branch, Northern Territory Government, however, lists many sites around the area, mainly along the Roper River, at nearby Mountain Creek and the Limmen Bight River.

A plot of these sites is shown in Figure 9. The meta-data for the archaeological sites plot is missing. The data was lost when the archaeology sites files were transferred from the Museum and Art Gallery of the Northern Territory to the Heritage Branch in the mid 1990s (Bensley, D. pers. comm., 28 October 2011). No correlation exists between recorded sites in Figure 9 to actual archaeological field reports. Data for those sites, however, is presented in Appendix 1. The closest site to the study area is Mountain Creek Waterhole (a rock art site), which is some 40km away.

The WDRL- Roper Bar project is situated on the former St Vidgeon Station. A biological survey was conducted at the station by King and McKean (1982), which also recorded two archaeological sites. These sites are called Mountain Creek Waterhole Cave near the old St Vidgeon billabong, most likely the same site as Mountain Creek Waterhole identified in the Heritage Branch review. The other site is called Rocky Bar, another rock art site on the Hodgson River. The exact location for these sites is not recorded in the King and McKean (1982) report, but neither of these sites will be impacted upon by the proposed development. Appendix 2 and 3 contain maps of the previous VDM/ECoz fauna and land systems surveys respectively, which show roughly the main access areas covered in this report.



Figure 9. Limmen Bight area - archaeological sites – red dots (Courtesy Heritage Branch, NT Government).

4.0 METHODS

4.1 Survey methods

The survey method utilised in the fieldwork consisted of a systematic survey of all creeks and rivers in Areas E and F and spot checks along sandstone ridges in both Areas E and F. The alluvial nature of the country between Area E north and south is not conducive to the preservation of archaeology. The availability of water is a crucial factor in these areas and archaeological sites were predicted to occur in association with water sources. River/creek banks and beds were surveyed for any evidence of past human occupation. High areas overlooking the flood plain basin in Area E were also surveyed to determine if any ceremonial ground and or stone arrangements exist, as these site types most likely occur in higher country, often associated with areas that have an exceptional view.

4.1.1 Identification of archaeological material

Stone artefacts, including tools and debitage, the by product of manufacture, are identified on the following criteria after McCarthy (1976) Holdaway and Stern (2004):

- Bulb of percussion
- Eralure scar (on the ventral surface)
- Point of force application (PFA) and associated ring crack
- Termination types (eg. feathered, stepped, hinged, plunge)
- Flake scars (dorsal scars and ridges)
- Cores (identified by the presence of negative flake scars)
- Hammer stones (identified by the presence of end-crushing on pebble stones)
- Retouch (reworking of flake margins)
- Raw material type
- Grinding stones (very smooth wear on upper surface)

List of artefact type abbreviations:

- A – axe
- C – core
- CP – core piece
- F – flake
- FP – flake piece
- RTF – retouched flake

List of artefact type abbreviations:

- F – Flake
- SC – Single platform core
- RTF – Retouched flake
- F – flake
- FP – flake piece
- RTF – retouched flake

- GS – Grindstone/Grinding plate
- X – Axe/wasted cobble
- CT – Core tool
- CF – Core fragment
- A – Adze
- B – Blade
- S – Scrapper
- M – Manuport
- An – Anvil
- TS – Topstone
- HS – Hammerstone
- Z – Other eg., ceremonial

4.1.2 *Definition of archaeological sites*

4.1.2.1 *Historical Sites*

Historical sites in north Australia are those that have physical evidence of European and non-European activities. These range from Macassan sites to military sites of World War II. These sites may overlap with Aboriginal heritage sites.

4.1.2.2 *Aboriginal Heritage Sites*

Aboriginal archaeological sites can be classified by six main types: 1) stone knapping sites, including quarries, 2) background scatters, including isoliths, 3) stone arrangements, such as mounds, walls, fish traps or stone motifs, 4) shell middens, 5) burials and 6) rock art sites.

Burke and Smith (2004:63) define an archaeological site as ‘any place that contains the physical evidence of past human activity. Australia, however, has what has been referred to as a background scatter of stone artefacts, which refers to low-density artefact scatters that either represent singular knapping events (‘dinner-time’ camps or ‘hunting camps’), or larger sites that have been buried or disturbed. To differentiate this site type from larger sites that may contain thousands of artefacts, the term Archaeological Site (AS) is used to describe home-camps or quarries ie., places where people have been returning to for millennia, as opposed to sites that have very low artefact densities that represent sporadic visits ie., background scatters (BS).

5.0 RESULTS

5.1 Archaeology

Six background scatters and three isoliths were found during the survey. The background scatters ranged from between 1 and 10 artefacts, all of which represent low levels of past human activities in the area. The results of the archaeology indicate that WDRL – Roper Bar was used only as a transiting area and or for sporadic exploitation by humans. Water is a critical factor in this environment and the distribution of finds indicates that is also a key indicator as to where archaeological sites are most likely to be found. Figure 10. plots the finds from the field survey, all of which are in association with water sources.

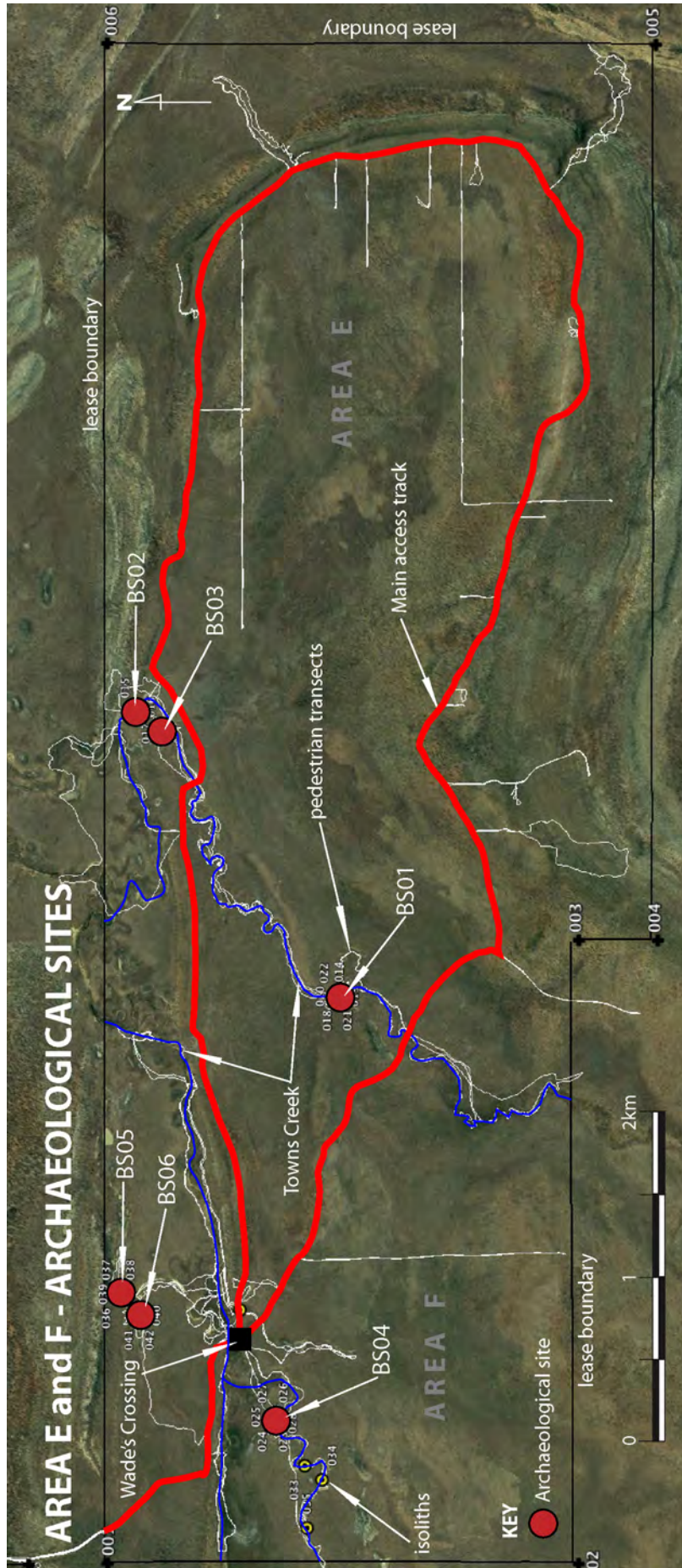


Figure 10. Map showing distribution of archaeological background scatters (BS) (after Google Earth).

5.1.1 Background Scatter 1 (BS01)

Following on from the predictive model for site location, Towns Creek was surveyed on both banks and the creek bed. The creek is the most distinctive unit zone in Area E and F (east) and as predicted, some archaeological material was found on the creek's bank. BS01 is a low-density artefact scatter on flat, laterised ground, only a few metres from Towns Creek (Fig. 11). The seven artefacts found at the site are listed in Table 5.1 and consist typically of small chert and silcrete flakes and cores. Ground surface visibility (GSV) was 60% and Ground integrity was 95%.



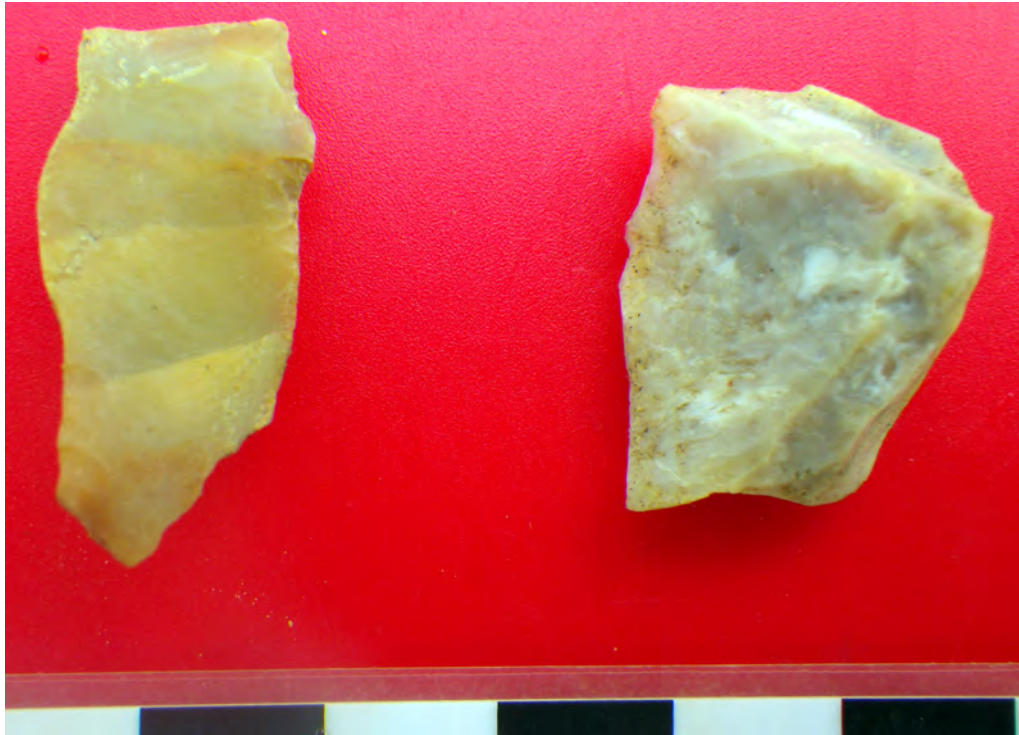
Figure 11. BS01 context view. Towns Creek tributary to the right of frame (scale in 20cms).

Table 5.1 Stone artefacts and waypoint numbers BS01

Format: UTM M/D/Y H:M:S 9.50 hrs Datum[121]: WGS 84

Photo scale in 1cms



Wpt Name	Artefact description	Date	Zone	Zone	Easting	Northing
13	F(C)	10/15/2011	53	L	509644	8324586
14	F(C)	10/15/2011	53	L	509644	8324582



WPT 13 and 14 (left and right respectively)

18	F(C)	10/17/2011	53	L	509641	8324591
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19	F(C)	10/17/2011	53	L	509641	8324593
						
20	F(S)	10/17/2011	53	L	509642	8324593
						

21	FP(C)	10/17/2011	53	L	509642	8324594
						
22	FP(C)	10/17/2011	53	L	509636	8324612
Not photographed						

5.1.2 Background Scatter 2 (BS02)

BS02 was found in alluvial soils at the base of the sandstone ridge in Area E north (Fig. 12). The site consists of only one find, a chert core (Table 5.2). The core is heavily reduced and has been rotated, which is a curation technique to utilise as much of the resource as possible. GSV was 35% and GI was 95%. Given the site's location, adjacent to a water filled billabong and the low GSV, it is quite likely more artefacts lie in the immediate area. The site was, hence, classified as a BS, rather than as an isolith.



Figure 12. BS02 context view showing proximity of the scatter to a billabong (scale in 25cms).

Table 5.2 Stone artefacts and waypoint numbers BS02

Format: UTM M/D/Y H:M:S 9.50 hrs Datum[121]: WGS 84						
Photo scale in 1cms						
Wpt Name	Artefact description	Date	Zone	Zone	Easting	Northing
15	C(C)	10/17/2011	53	L	511466	8325881



5.1.3 Background Scatter 3 (BS03)

One of the most spectacular formal tool types found during the survey was at BS03 – a unifacially retouched flake on both margins, producing a distinctive spear point. Very few formal tools were found in the overall survey. The site is characterised by only two finds, the second a chert flake piece, but a more extensive search of the area may reveal more finds (Table 5.3). The site is on flat ground in open woodland country, adjacent to an ephemeral creek, approximately 200m from BS03 (Fig. 13). GSV was 85% and GI 95%.



Figure 13. BS03 context view showing location of spear tip to nearby creek (scale in 25cm).

Table 5.3 Stone artefacts and waypoint numbers BS03

Format: UTM M/D/Y H:M:S 9.50 hrs Datum[121]: WGS 84

Photo scale in 1cms

Wpt Name	Artefact description	Date	Zone	Zone	Easting	Northing
16	RTF(C) – unifacial retouched point	10/17/2011	53	L	511343	8325715



17	FP(C)	10/17/2011	53	L	511330	8325704
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5.1.4 Background Scatter 4 (BS04)

BS04 was found on a tributary of Towns River, southwest of Wade’s crossing. It was the first site encountered in a series of billabongs on the western margins of Area F (east) (see Fig. 10 and Figs 14 to 16). The site is a low-density artefact scatter, but one which had the highest density of artefacts in the whole survey ie., ten artefacts (Table 5.4). It lies on the banks of a billabong on flat ground in open woodland with some riparian vegetation up to the water’s edge.

Edible fresh water mussels, crabs and land snails lie in association with the artefacts, but whether or not the faunal remains are archaeological is yet to be determined, as no discernable midden was found (Fig. 17). Some of the artefacts were buried. The burial of artefacts may be indicative of a higher density of *in situ*. subsurface finds. The site’s billabong is part of a low energy waterway, with no scouring of banks, as per Towns River, just 300m to the north.

The site contains the only other finds of formal tool types ie., stone points. Waypoints (Wpts) 30 and 31 are unifacially retouched flakes on single and both margins respectfully. Wpt 26 is the largest flake found during the survey, @480L x 520W mm.



Figure 14. BS04 context view of the billabong, looking east. Artefacts were also found in the foreground.

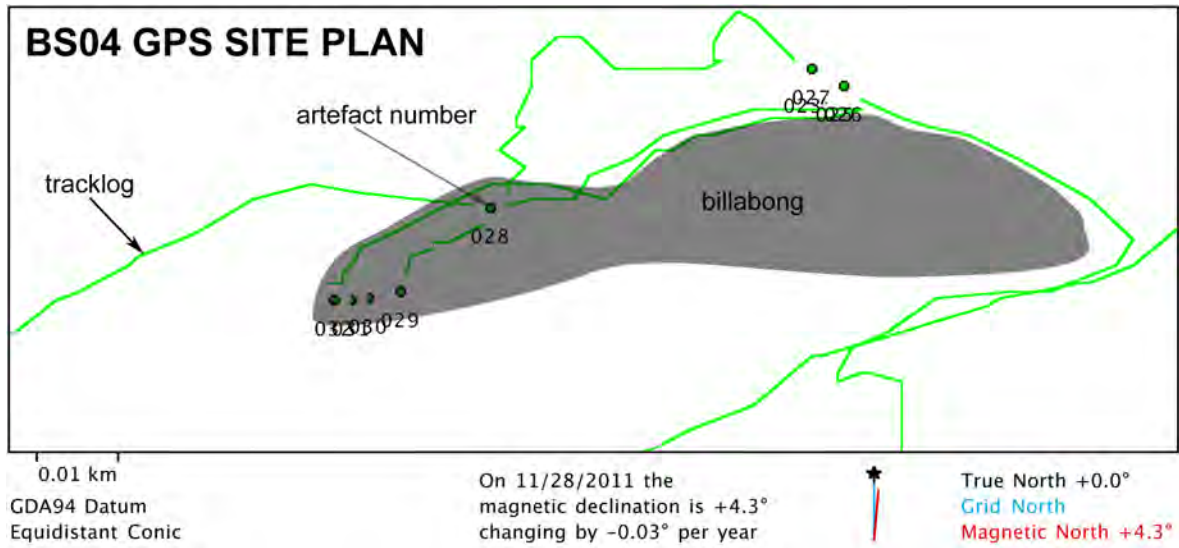


Figure 15. BS04 GPS site plan of finds in the billabong.



Figure 16. BS04. Concentration of artefacts marked by the ranging pole (scale in 25cm).



Figure 17. Fresh water mussels at BS04.

Table 5.4 Stone artefacts and waypoint numbers BS04

Format: UTM M/D/Y H:M:S 9.50 hrs Datum[121]: WGS 84

Photo scale in 1cms

Wpt Name	Artefact description	Date	Zone	Zone	Easting	Northing
23	F(QZ)	10/18/2011	53	L	506938	8325004



24	F(S)	10/18/2011	53	L	506939	8325005
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25	F(QZ) buried	10/18/2011	53	L	506942	8325003
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28	F(C)	10/18/2011	53	L	506900	8324988
						
29	RTF(QZ)	10/18/2011	53	L	506889	8324978
						





5.1.5 Background Scatter 5 (BS05)

Low-density artefact scatter in creek, south of the sandstone ridge, Area E (north). The finds were eroding from the bank where the ranging pole is placed in Figure 18. The four artefacts found are listed in Table 5.5. Floodplain, open woodland, flat country. GSV 45%, GI 95%.



Figure 18. BS05 context view. Sandstone ridge in the background (scale in 25cms).

Table 5.5 Stone artefacts and waypoint numbers BS05

Format: UTM M/D/Y H:M:S 9.50 hrs Datum[121]: WGS 84

Photo scale in 1cms

Wpt Name	Artefact description	Date Time	Zone	Zone	Easting	Northing
36	FP(C)	10/19/2011	53	L	507731	8326002



37	FP(S)	10/19/2011	53	L	507731	8326001
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38	FP(QZ)	10/19/2011	53	L	507731	8325979
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39	F(QZ)	10/19/2011	53	L	507729	8325978
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5.1.6 Background Scatter 6 (BS06)

Continuing the survey north of Wade's Crossing, more billabongs were found. One of the largest, BS06, is approximately 200m downstream from BS05 (Fig. 19). The billabong measures 250 x 50m, with the site in the billabong's southeast corner. BS06 is a low-density artefact scatter at the very edge of the billabong, with four artefacts recorded (Table 5.6). Riparian, open woodland, flat, buffel grass. GSV 80%, GI 95%.



Figure 19. BS06 context view, adjacent to large billabong (scale in 25cm). Ranging pole marks the location of finds.



Figure 20. BS06 lagoon track log showing location of site (After Google Earth).

Table 5.6 Stone artefacts and waypoint numbers BS06

Format: UTM M/D/Y H:M:S 9.50 hrs Datum[121]: WGS 84

Photo scale in 1cms

Wpt Name	Artefact description	Date	Zone	Zone	Easting	Northing
40	FP(C)	10/19/2011	53	L	507592	8325856



41	F(C)	10/19/2011	53	L	507591	8325857
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42	C(C) x1, FP(C) x1	10/19/2011	53	L	507591	8325857
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43	C(C)	10/19/2011	53	L	507630	8325216
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5.1.7 *Isoliths*

Three isoliths were recorded, all of which were found in the billabong system to the southwest of Wade's Crossing. The first, Wpt 33, is a manuport with evidence of grinding and end crushing, made of a conglomerate not local to the area (Table 5.7). The finds may all be associated with BS04, suggesting the that that site may extend right along the billabong system in various densities of artefacts.

Table 5.7 Stone artefacts and waypoint numbers – Isoliths

Format: UTM M/D/Y H:M:S 9.50 hrs Datum[121]: WGS 84						
Photo scale in 1cms						
Wpt Name	Artefact description	Date	Zone	Zone	Easting	Northing
33	AN(CON) manuport	10/18/2011	53	L	506629	8324802

34	FP(C) broken/buried	10/18/2011	53	L	506539	8324692
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35	FP(C)	10/18/2011	53	L	506229	8324789
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6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

The archaeological survey conducted for this report covered all of the major creek systems in Area E, which were predicted to be the main occupation areas by Aboriginal people in the past. Area F (east and west) was also inspected, but no archaeology was found in Area F (west). Six background scatters and three isoliths were discovered in Area E (north) and Area F (east) along the fringes of several tributaries of Towns Creek, but none of these sites will be impacted upon by the proposed works at Western Deserts Limited – Roper Bar operations.

The main mining activity on the Roper Bar lease will focus on the sandstone ridges. It appears that from the results of this survey, Aboriginal people, who preferred flat areas adjacent to low-energy creeks, did not exploit those ridges. High-energy areas along the banks of Towns River are not conducive to the preservation of archaeological sites and its banks have been heavily eroded by water action.

Given that no significant archaeological sites were discovered ie., sites with more 50 artefacts, the background scatters found in this report are a significant archaeological resource in their own right, as they are the only material evidence of human occupation in the area. These background scatters indicate that people in the past were most likely using the WDRL – Roper Bar area for sporadic visits and that the main areas of occupation were along the Roper and Limmen Bight Rivers. The following recommendations arise from this report:

6.2 Recommendations

6.2.1 Recommendation 1 – Background scatters and isoliths

- BS01 to BS03 – in Towns Creek, Area E and Area F (east) limit extent of spoil heap area to 100m east of Towns Creek (Fig. 21 and Appendix 4).
- BS04 to BS06 – in Towns Creek, west and north of Wade’s Crossing. Leave *in situ.*, no mining activity planned for those locations.
- Isoliths – in Towns Creek, west of Wade’s Crossing. Leave *in situ.*, no mining activity planned for those locations.

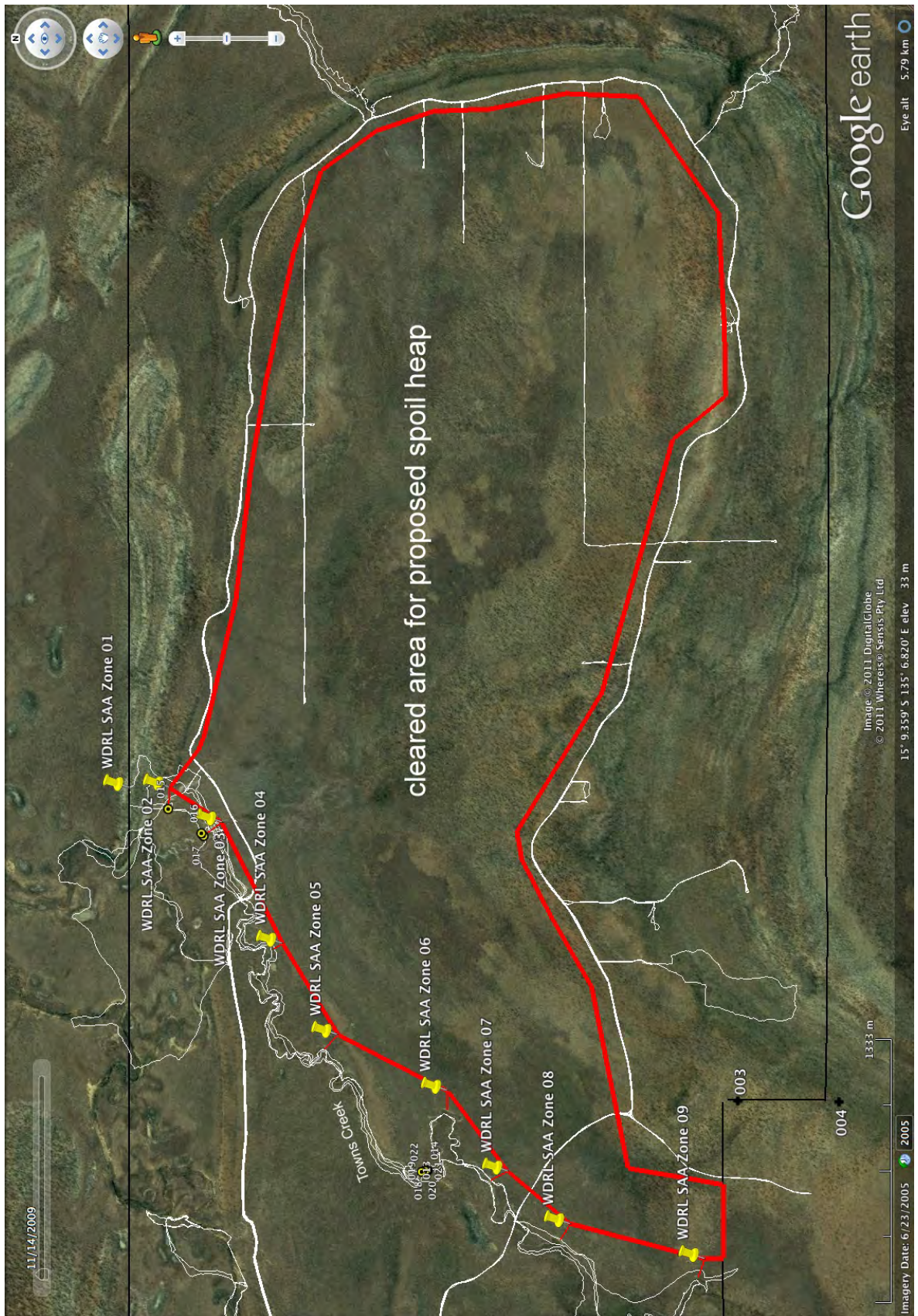


Figure 21. Map of cleared area for spoil heap in Area E and Area F (east) (After Google Earth).

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APPENDIX 1. Table of previously recorded archaeological sites within and in the vicinity of the study area

Site name	Easting	Northing	Zone	No map Sheet	Map sheet	Site type	Contents	Comments
Yilbindjila	546892	8278062	53	5965	Mantungula	stone artefact scatter, rock art, Unrestricted mythological site	artefact scatter, paintings	Cultural deposit. Site transferred from MAGNT.
Yilbindjila II	546892	8278062	53	5965	Mantungula	Isolated nonstone artefact, rock art	painting	Site transferred from MAGNT.
McLaughlin site	549574	8265252	53	5965	Mantungula	Isolated stone artefact, rock art	stone artefact, paintings	Cultural deposit. Site transferred from MAGNT. Collection No. AA85.38
McLaughlin site	551389	8262501	53	5965	Mantungula	Stone artefact scatter, rock art	artefact scatter, painting	Site transferred from MAGNT.
McLaughlin site	551389	8262501	53	5965	Mantungula	rock art	paintings	Cultural deposit. Site transferred from MAGNT.
Wunganda	550100	8271800	53	5965	Mantungula	Unrestricted mythological site		Site transferred from MAGNT.
Wanadjina Cave	545000	8282500	53	5965	Mantungula	Rock art, grindstone portable	paintings	Cultural deposit. Site transferred from MAGNT.
McLaughlin site	547700	8275500	53	5965	Mantungula	Skeletal remains, stone arrangement	skeletal remains, stone arrangement	Site transferred from MAGNT.
Bargu	547300	8278200	53	5965	Mantungula	Stone artefact scatter, quarry, Restricted anthropological site, grindstone portable	artefact scatter, quarry	Site transferred from MAGNT.
Barrguwirridji	544206	8289957	53	5967	Towns	Unrestricted mythological site		Site transferred from MAGNT.
Yalayagamirra	545145	8295437	53	5967	Towns	Stone arrangement, Unrestricted mythological site	stone arrangement	Site transferred from MAGNT.
Wamungguwarr I	546200	8305000	53	5967	Towns	Isolated stone artefact, Restricted anthropological site, ceremonial ground	stone artefact	Site transferred from MAGNT.
Nambinambi	532600	8297100	53	5967	Towns	Restricted anthropological site		Site

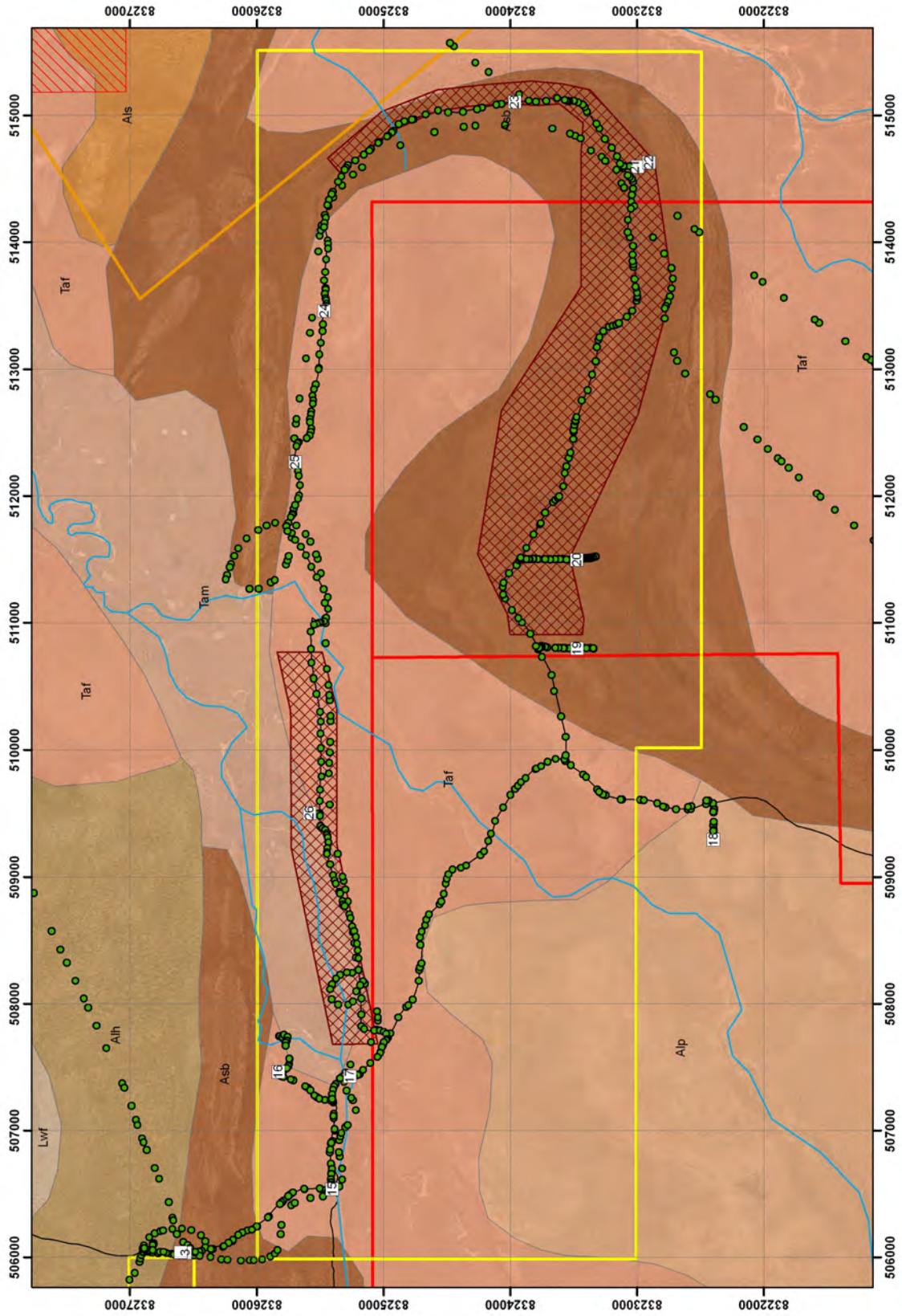
								transferred from MAGNT.
Igamawowulu	542700	8288200	53	5967	Towns	Ceremonial ground		Site transferred from MAGNT.
Marrangkalba Island	542400	8289000	53	5967	Towns	Unrestricted mythological site		Site transferred from MAGNT.
Yalaya Lagamirra I	543700	8296600	53	5967	Towns	Stone artefact scatter, Unrestricted mythological site	artefact scatter	Site transferred from MAGNT.
Nandirrani	542900	8293000	53	5967	Towns	Unrestricted mythological site		Site transferred from MAGNT.
Wuluburru	543300	8303200	53	5967	Towns	Stone artefact scatter	artefact scatter	Site transferred from MAGNT.
Marangkalbawawulu Island	547700	8304000	53	5967	Towns	Unrestricted mythological site		Site transferred from MAGNT.
Mandarran Wawulu	544600	8305000	53	5967	Towns	Unrestricted mythological site		Site transferred from MAGNT.
Warurrkuyibkanyi	544500	8307700	53	5967	Towns	Ceremonial ground, Restricted anthropological site		Site transferred from MAGNT.
Gurduwarruwawulu	538000	8305000	53	5967	Towns	Unrestricted mythological site		Site transferred from MAGNT.
Djarrinya	548500	8306600	53	5967	Towns	Restricted anthropological site		Site transferred from MAGNT.
Wamungku	547700	8308300	53	5967	Towns	Ceremonial ground, Unrestricted mythological site		Site transferred from MAGNT.
Yinkarri	548500	8308000	53	5967	Towns	Unrestricted mythological site		Site transferred from MAGNT.
Djargulwawulu	550000	8309800	53	5967	Towns	Unrestricted mythological site		Site transferred from MAGNT.
Wirriwumal	545400	8305600	53	5967	Towns	Ceremonial ground.		Site transferred from MAGNT.
Djarbukundji	545300	8303000	53	5967	Towns	Unrestricted mythological site		Site transferred from MAGNT.
Djowunda	544700	8293000	53	5967	Towns	Unrestricted mythological site		Site transferred from MAGNT.
Walarri	542500	8301500	53	5967	Towns	Unrestricted mythological site		Site transferred from MAGNT.
Lorella Spring	568800	8261200	53	6066	Tawallah Range	Rock art, Unrestricted mythological site	paintings	Site transferred from MAGNT.
Yuludjurrungka	557800	8307200	53	6067	Mount Young	Quarry, Unrestricted mythologic	quarry	Pigment quarry. Site transferred from MAGNT.

						site		
Buybuy:Yula	558600	8302200	53	6067	Mount Young	Unrestricted mythological site		Site transferred from MAGNT.
Nawundulbi	567500	8301000	53	6067	Mount Young	Unrestricted mythological site		Site transferred from MAGNT.
Warugi	553700	8312100	53	6067	Mount Young	Unrestricted mythological site		Site transferred from MAGNT.
Warragulwuwirriyaka	556100	8312800	53	6067	Mount Young	Unrestricted mythological site		Site transferred from MAGNT.
Wulugurarra	555300	8313600	53	6067	Mount Young	Unrestricted mythological site		Site transferred from MAGNT.
Namanuwal	559500	8315400	53	6067	Mount Young	Restricted anthropological site		Site transferred from MAGNT.
Lamarra Spring	554600	8316500	53	6067	Mount Young	Shell midden, Unrestricted mythological site, ceremonial ground.	midden	Site transferred from MAGNT.
Ngamaramarra	558500	8315200	53	6067	Mount Young	Unrestricted mythological site		Site transferred from MAGNT.
Wulagularra	559000	8316900	53	6067	Mount Young	Ceremonial ground, Unrestricted mythological site		Site transferred from MAGNT.
Nangarrubu	558400	8317500	53	6067	Mount Young	Shell midden, stone arrangement, Unrestricted mythological site	midden, stone arrangement	Site transferred from MAGNT.
Nyamiyibgandji	558500	8317000	53	6067	Mount Young	Unrestricted mythological site		Site transferred from MAGNT.
Ngawimarra	560300	8317400	53	6067	Mount Young	Unrestricted mythological site		Site transferred from MAGNT.
Yurndi	561900	8318100	53	6067	Mount Young	Unrestricted mythological site		Vegetation clearance. Site transferred from MAGNT.
Wudjulawawulu	562100	8318200	53	6067	Mount Young	Shell midden, stone arrangement, Unrestricted mythological site	midden, stone arrangement	Site transferred from MAGNT.
Ngugkayankanda	563400	8316700	53	6067	Mount Young	Stone artefact scatter, Unrestricted mythological site	artefact scatter	Site transferred from MAGNT.
Rrudi [camping place]	564800	8318100	53	6067	Mount Young	Anthropological site		Site transferred from MAGNT.
Bugungawawulu	564000	8318900	53	6067	Mount Young	Unrestricted mythological site		Site transferred from

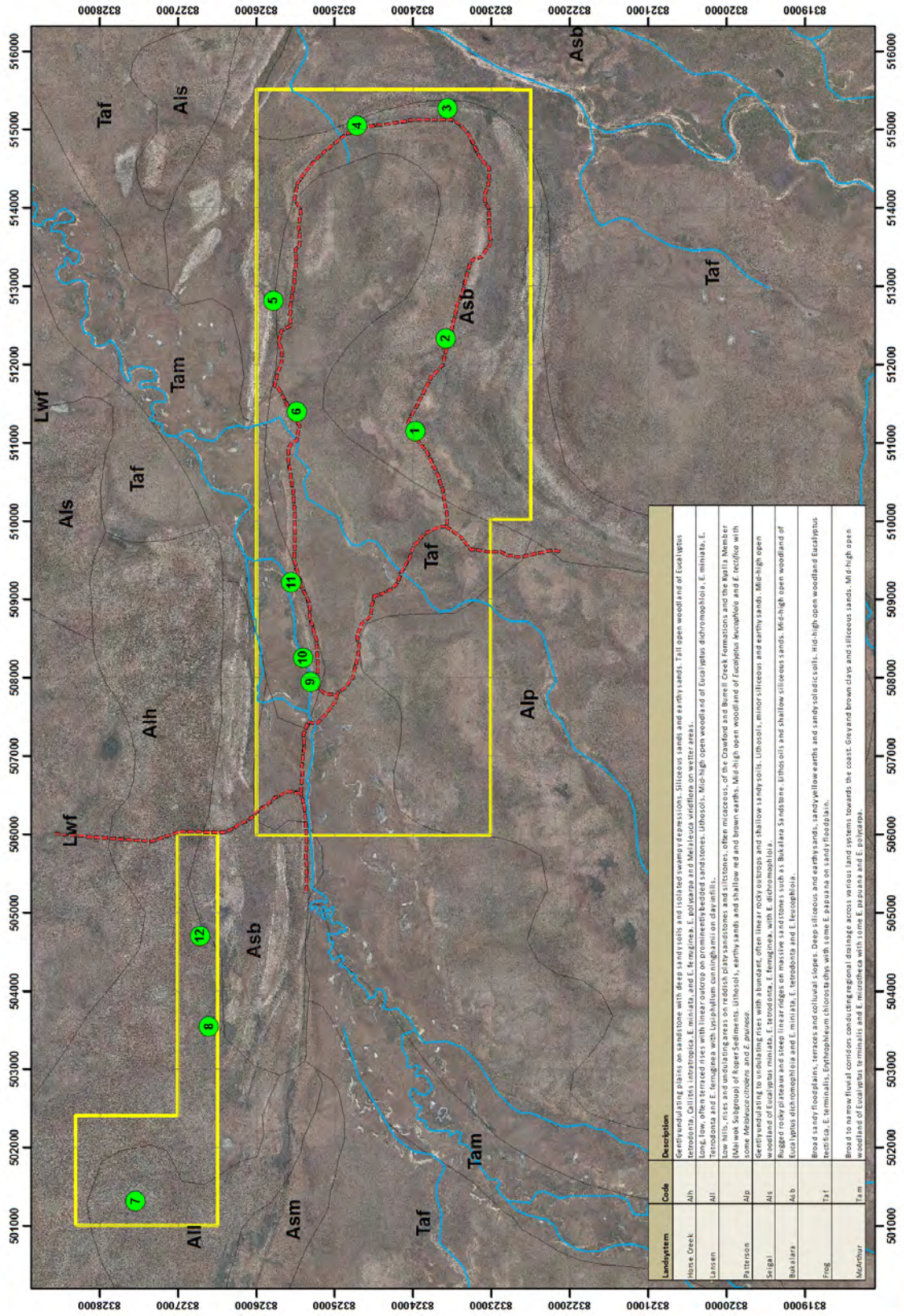
								MAGNT.
Djambuyalawawulu	564500	8318500	53	6067	Mount Young	Ceremonial ground, Unrestricted mythological site		Site transferred from MAGNT.
Minidji	567000	8316000	53	6067	Mount Young	Unrestricted mythological site		Site transferred from MAGNT.
Wayuyurridjarri	576000	8326700	53	6067	Mount Young	Well		Site transferred from MAGNT.
Nguwa	574200	8324000	53	6067	Mount Young	Ceremonial ground, Unrestricted mythological site		Site transferred from MAGNT.
Mundjindji	573500	8326000	53	6067	Mount Young	Unrestricted mythological site		Site transferred from MAGNT.
Wunabari	578400	8324800	53	6067	Mount Young	Unrestricted mythological site, ceremonial ground, grinding place non-portable	grinding hollows / grooves	Grinding hollow. Site transferred from MAGNT.
Nyangulidji	578300	8323300	53	6067	Mount Young	Unrestricted mythological site		Site transferred from MAGNT.
Walgandjawalgari	577700	8328400	53	6067	Mount Young	other		Vegetation clearance. Site transferred from MAGNT.
Gurndandawawulu	584500	8331100	53	6067	Mount Young	Fishtrap, stone arrangement, Unrestricted mythological site	stone arrangement	Site transferred from MAGNT.
Wirrimakuwarra	584800	8330900	53	6067	Mount Young	Unrestricted mythological site		Site transferred from MAGNT.
Riarrkul	584700	8330700	53	6067	Mount Young	Unrestricted mythological site		Site transferred from MAGNT.
Larradbarimbul	584500	8330700	53	6067	Mount Young	Unrestricted mythological site		Site transferred from MAGNT.
Ngawaguwagu	583700	8330800	53	6067	Mount Young	Stone arrangement, anthropological site other	stone arrangement	Site transferred from MAGNT.
Wunubari II	578700	8324500	53	6067	Mount Young	Ceremonial ground, Restricted anthropological site		Site transferred from MAGNT.
Walingandu Cave	578100	8324900	53	6067	Mount Young	shell midden, skeletal remains, isolated nonstone artefact, rock art, Unrestricted mythological site	midden, skeletal remains, painting	Cultural deposit. Site transferred from MAGNT.
Yilagala	576500	8286500	53	6067	Mount Young	Unrestricted mythological site		Site transferred from MAGNT.

Wurludjudjuni area	572000	8329700	53	6067	Mount Young	Unrestricted mythological site		Site transferred from MAGNT.
Wanbirrangka	570800	8325700	53	6067	Mount Young	Unrestricted mythological site		Site transferred from MAGNT.
Djankuyalawawulu area	567800	8322700	53	6067	Mount Young	Well, Unrestricted mythological site, ceremonial ground.		Site transferred from MAGNT.
Wulkulyi	562200	8312000	53	6067	Mount Young	Anthropological site		Tree. Site transferred from MAGNT.
Wirringanku	566000	8309700	53	6067	Mount Young	Stone artefact scatter, Unrestricted mythological site, ceremonial ground.	artefact scatter	Site transferred from MAGNT.
Wurrindjiwundja	573000	8322000	53	6067	Mount Young	Unrestricted mythological site		Site transferred from MAGNT.
Wunubari III	578800	8324900	53	6067	Mount Young	Shell midden, Unrestricted mythological site, grindstone portable, ceremonial ground.	midden	Site transferred from MAGNT.
Yulubandu	576500	8321500	53	6067	Mount Young	Unrestricted mythological site		Site transferred from MAGNT.
Nawiniwarra Island	571500	8326500	53	6067	Mount Young	Unrestricted mythological site		Site transferred from MAGNT.

APPENDIX 2. Map of fauna survey plan (after VDM/EcOz).



APPENDIX 3. Land system survey (after VDM/EcOz).



APPENDIX 4.**GPS coordinates for western limit of the proposed spoil dump in Area E.**

Coordinate name	Easting	Northing	Zone	Datum
WDRL 01	511572	8326067	53	WGS84
WDRL 02	511574	8325870	53	WGS84
WDRL 03	511397	8325605	53	WGS84
WDRL 04	510785	8325304	53	WGS84
WDRL 05	510325	8325027	53	WGS84
WDRL 06	510045	8324478	53	WGS84
WDRL 07	509637	8324172	53	WGS84
WDRL 08	509373	8323862	53	WGS84
WDRL 09	509198	8323189	53	WGS84