Appendix J
Heritage and Archaeology Assessment

PACIFIC **ALUMINIUM**

Environmental Impact Statement

for the proposed Katherine to Gove Gas Pipeline

Archaeology and Historic Heritage

Prepared for: Eco Logical Australia on behalf of Pacific Aluminium

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EXECUTIVE SUMMARY

This report was prepared for Eco Logical Australia on behalf of Pacific Aluminium for the heritage component of an EIS for Alcan Gove Pty Ltd's proposed Katherine to Gove Gas Pipeline (KGGP). The current proposal follows the same route from south of Katherine to the Gove Peninsula as the previously proposed Trans Territory Pipeline (TTP).

The fieldwork for the heritage component of the TTP pipeline was carried out in 2003 and 2004 and the report was completed in 2004 by Begnaze Pty Ltd. Consequently Eco Logical Australia contracted Begnaze to update the 2004 report by including only the information, findings and assessments relevant to KGGP and to assess the relevance of any new recordings of archaeological or historic sites that have been documented since 2004.

In 2003 the consultant was engaged to identify and record any archaeological and historic sites that may be impacted upon by the construction of the proposed Trans Territory Pipeline. The report (Begnaze 2004) included a description of the findings, and recommendations were made for the mitigation of disturbances to any archaeological or historic sites that may be disturbed during the design, construction and operational phases of the project. Where possible, recommendations were made in the field to realign the pipeline around identified archaeological sites

Background research was carried out to find any previously recorded archaeological and heritage sites in the area of the proposed development. Subsequently two field surveys were carried out in late 2003 and in the middle of 2004. The surveys consisted of vehicle transects as near as possible to the proposed pipeline alignment and regular pedestrian transects, both random and purposive were made along the proposed route. There are two sections of the pipeline corridor that were not surveyed at all.

Seventeen archaeological sites, four historic sites and 54 background scatters were located during the survey. Of these, nine sites and 24 background scatters are located within 100 metres of the centre line of the proposed pipeline route and there is potential for these to be disturbed during the construction of the pipeline. At this stage of the project, only two specific recommendations have been made, one for the Northern Australian Railway, and one for the 47 background scatters. This was necessary as the exact location of the remaining identified sites relative to the pipeline alignment is not known. It is anticipated that detailed recommendations for specific sites will be made after the survey teams have pegged the exact route.

There is one recommendation for ensuring the protection of unidentified archaeological material located during the final design stage. It is recommended that an archaeologist should be present during the pegging of the majority of the pipeline alignment. There are two sections where there is a very low potential the presence of archaeological material and where it is thought the presence of an archaeologist is unnecessary. It is possible that during the construction stage subsurface archaeological material may be located. It is recommended that response mechanisms are set up to ensure that this material is protected.

During the operational stage it is recommended that the exact location of sites are not revealed to anyone who will be working along the pipeline alignment as some sites may be particularly sensitive to constant visits.

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1.0. INTRODUCTION

Eco Logical Australia Pty Ltd has been engaged by Pacific Aluminium to prepare EIS documentation for the proposed Katherine to Gove Gas Pipeline (KGGP) on behalf of the proponent (Alcan Gove Pty Ltd). The KGGP is proposing to follow part of the route previously proposed by Alcan Gove Pty Ltd for the Trans Territory Pipeline (TTP). The cultural heritage component of the draft EIS for the TTP proposal was written by Begnaze Pty Ltd and was released for community comment in November 2004 but the proposal did not proceed and the EIS was therefore not completed.

At the end of 2012 Eco Logical Australia Pty Ltd contracted Begnaze to re-present these reports in the draft EIS for the KGGP in a form that is updated and specifically relates to the part of the pipeline route now proposed for the KGGP, excluding information and data (except for the purpose of local and regional context discussion) on sections of the original TTP not part of the KGGP.

The following report is based on Begnaze's 2004 report *Environmental Impact Statement for the proposed Trans Territory Underground Gas Pipeline: Report on Archaeology and Historic Heritage*. *A draft Report* (Begnaze 2004a).

The preliminary survey for TTP was carried out to define a suitable 100 metre wide pipeline corridor route in which the 30 metre pipeline alignment could be located.

To ensure that archaeological and historic sites and objects are not damaged or destroyed during the proposed development and are protected within the terms of the *NT Heritage Act 2012*, the aims of the archaeological and cultural heritage project are:

1. To locate and record archaeological and historic objects or places identified during the 2003 and 2004 surveys and during background research.
2. To assess the nature, distribution and cultural significance of the materials that may be impacted by the project within a regional, Territory and national context.
3. To provide recommendations for the management of particular archaeological or historic places or objects to ensure there is no loss of heritage values.
4. To provide recommendations for generalised mitigation procedures and management of prescribed archaeological places and objects to ensure there is no loss of heritage values.
5. To carry out mitigation and conservation strategies designed to minimise loss of heritage values to the Northern Territory.

The aim for the 2003-4 survey team was to identify a 100 metres wide pipeline alignment within the already identified 10 kilometres wide corridor. Consequently the area surveyed by the archaeological team was not necessarily the precise 30 metre wide pipeline alignment. The archaeological team influenced the selection of the 30 metre corridor, however variations to the selected route may reveal archaeological material not found by the archaeological team.

2.0. HERITAGE LEGISLATIVE FRAMEWORK

2.1. Northern Territory legislation

A new act, the *Heritage Act 2011* which protects heritage places and objects came into effect on 1st October 2011. It replaces the *Heritage Conservation Act* which had been in operation since 1991. Cultural heritage places protected by the new *Heritage Act* include a wide range of structures and places associated with non-indigenous settlement that have been assessed by the Heritage Council as a heritage place or object and then declared as a Heritage Place or Object by the Minister. All Aboriginal and Macassan sites and objects are automatically protected.

It is an offence under the *Heritage Act* to damage, destroy, alter or carry out work of any sort on heritage places and objects without the written consent of the Minister or Minister's delegate and places legal constraints on owners of private property, local government and the Crown.

The *Heritage Act* includes a mechanism to protect a class of place or object that is considered to possess important aspects of the Territory's heritage but are difficult to list individually, such as places and objects associated with the Overland Telegraph Line or World War II aircraft wrecks.

The *Heritage Act* can also provide provisional protection to a place or object after the Heritage Council has assessed it as having heritage significance and before the public and interested persons have been given time to respond.

2.2. Commonwealth legislation

The Commonwealth Government protects heritage sites under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the *Environment and Heritage Legislation Amendment Act (No 1) 2003* and places legal constraints on archaeological and historic sites. There are two lists, the *World Heritage List* and the *National Heritage List* that may be relevant to this study. It is available on the internet at www.environment.gov.au/heritage/.

The *World Heritage List* protects places that are important to and belong to everyone, irrespective of where they are located. They have universal value that transcends the value they hold for a particular nation.

The National Heritage List protects places of exceptional natural and cultural significance with penalties for any breaches. Approval from the Minister of Sustainability, Environment, Water, Population and Communities is needed before any sites are disturbed. This list commenced on 1st January 2004.

3.0. ENVIRONMENTAL SETTING

As the proposed pipeline crosses many types of terrains, the environmental background data has been divided into three sections that correspond to the three land system surveys that have been documented over the area that the pipeline alignment traverses. These districts consist of Tipperary (Speck *et al*. 1961), Roper (Aldrich and Wilson 1992), and Arnhem Land (Lynch and Wilson 1998). Below are the boundaries between the three regions used for this report and the distances given along the pipeline are measured from 132.336^0 N -14.6032^0 S (0KP).

- Tipperary and Roper. The boundary is at the Stuart Highway. Length of the proposed pipeline over the Tipperary region is 27 kms.
- Roper and Arnhem Land. The boundary is at the boundary between the Mainoru Pastoral Lease and the Arnhem Land Aboriginal Land Trust River and 242 kms from the starting point. The length of the proposed pipeline over the Roper region is 217 kilometres and over the Arnhem Land region is 359 kilometres.

The pipeline transects the Northern Territory in an east west direction between the latitudes of -14.60^0S and -12.19^0S. This area is part of what is generally described as the Top End. The region experiences two main seasons, the wet season between November and April with the majority of rain coming from monsoons from the north or local storms, and the dry season between May and October. The average rainfall from the east to west coast of the Top End varies between 950mm to 2100 mm per year.

The following sections describe in more detail the three regions over which the pipeline is located. In all regions the pipeline alignment crosses major rivers, some of which may only consist of a series of waterholes in the dry season and many ephemeral creeks and watercourses.

3.1. Tipperary Region

Only 27 kilometres of the pipeline corridor lies in the Tipperary region and exits the region at the Stuart Highway just north of Cutta Cutta Caves. The pipeline alignment crosses minor ephemeral tributaries of the King River and is located on a plain that is relatively stable because of the gentle slopes and sandy mantles. This stability is seen in the presence of mature soils, protected by the vegetation even in peak flooding periods (Wright 1965:60)

The terrain in the Tipperary region is either gently undulating or level plains of red soils and limestone, soft sandstone or laterite low rises (Aldrich and Wilson 1992). The geological structural entity of the Daly River Basin consists of deeply weathered older and younger plains where there are Middle-Cambrian limestone, sandstone and siltstone overlying the Lower Cambrian basalt and Upper Proterozoic sandstone, siltstone and greywacke (Speck *et al.* 1961).

The pipeline corridor crosses two major geomorphic regions of the plateaux and the plains. Southeast and southwest of Katherine is the Northern Plains characterised by stony plains and undulating terrain of relatively unweathered limestone, sandstone and siltstone. The Eastern Low Plateaux in the area where the pipeline alignment crosses the Stuart Highway is gently undulating with discontinuous rocky escarpments up to 20 metres.

3.1.1. Environmental factors affecting the archaeological visibility.

While the majority of the Tipperary region consists of undulating or level plains there are areas of low rocky ridges, rocky outcrops, stony plains and eroding red soils near creeks where archaeological material will be more likely to be found on the surface.

3.2. Roper District

Four major rivers or creeks; Beswick Creek, the Waterhouse River, Flying Fox Creek, and Mainoru Rivers cross the pipeline alignment. The majority of the pipeline alignment crosses the physiographic units of the Dissected Gulf Fall and the sandstone Roper geologic group where almost the entire old Tertiary surface has been eroded leaving broad valleys lying between sandstone strike ridges and hilly dissected country (Aldrich and Wilson 1992). The western section of the pipeline is on the Daly River province described in Section 3.1. Between Flying Fox Creek and the Mainoru River the pipeline crosses the Redcliff Pound geological group that contains small sills of dolerite.

The majority of the pipeline route in the Tipperary region is located on sandy undulating plains that have linear sandstone ridges lying across the direction of drainage. There are siltstone and stony laterite outcrops on other upper slopes. These areas of broad shallow valleys have slow to moderate erosion and sediment removal.

Between KP 100 and KP 120 approximately 20 kilometres east of Beswick, the pipeline route is located on the low hills and foot slopes of the Arnhem Land escarpment where the lateritic clay on the sandstone cap rock has been incised. This area has rapid erosion and sediment removal. The area between Bukalorkmi and Flying Fox Creek consists of broad or narrow fluvial corridors and gently undulating plains where there is very slow erosion and sediment removal.

As the land in this area has been used for cattle stations there will be many areas, especially around water ways where the landscape will have been degraded and disturbed.

3.2.1. Environmental factors affecting the archaeological visibility

There is only a low potential for locating archaeological material on the majority of the pipeline route that crosses either broad plains or floodplains where sediments are deposited. The areas that have more potential are stony hills, ridges and outcrops and around any dolerite outcrops that may have been used in the past as a source of raw material for the manufacture of stone artefacts. The disturbance by cattle particularly around waterways will impact upon the spatial integrity of any archaeological material located in these areas. There will be a higher potential for locating artefacts along the major waterways.

3.3. Arnhem Land District

The major tectonic unit over which the pipeline crosses the Arnhem Land district is the McArthur Basin where there are depositions of immense volumes of sediments (Lynch and Wilson 1998). Along the western coast near the Gove Peninsula is a small area of the Arnhem Block that exposes the oldest rocks in Arnhem Land, the Basement Granites.

There are four geological regions, the Roper Group consisting of quartz sandstone, siltstone and shale with dolerite sills common. This group is located over the most westerly section of the Arnhem Land region to the Goyder River. The second major group is the Cretaceous Sediments consisting of a series of sandstones, claystones, mudstones and siltstones covered by extensive laterisation. This geological region is located between the Goyder River to just west of the Mitchell Ranges and also a larger area east of the ranges to near

the Gove Peninsula. There are two minor groups, the Ritarango Beds of the Mitchell Ranges made up of quartz sandstone, and the Basement Granites located west of the Mitchell Ranges and adjacent to the coast near the Gove Peninsula.

In central Arnhem Land the alignment crosses several larger rivers of the Wilton River, the Annie Creek system and the Goyder River. Between the Goyder and the Badalngarrnirri River, a distance of 60 kilometres, there are very few creeks but there are several waterholes and lakes in the vicinity of the pipeline route. Creeks and rivers are more common in eastern Arnhem Land, the larger ones being the Buckingham River, Boggy Creek, the Cato River, Giddy Creek and the Latram River.

The western area of the Arnhem Land region consists mainly of either deep, sandy soil plains and isolated swampy depressions or undulating sandy slopes, rises and low hills of sandstone. Between Annie Creek area and the Mitchell Ranges the pipeline crosses either the sandy plains of the Queue land system or the usually stony plains and rises of the Mululu land system that also contains outcrops of sandstone, siltstone and laterite.

Between the Mitchell Ranges and the Gove Peninsula there are also large areas of the Queue land system and the red soil plains on laterite of the Kay land systems. Nearer Gove in the Giddy land system the plains are on weathered granite with occasional granite and laterite outcrops, the Cato land system of bauxitic plateaux and rises and the Gove land system of bauxitic gravel plains.

3.3.1. Environmental factors affecting the archaeological visibility

The majority of the pipeline route in the western and central areas of Arnhem Land crosses sandy plains where any stone artefacts discarded in the past would have been quickly covered. There is a higher potential for locating artefacts on stony or gravel plains and rises and near water courses in the non sandy areas.

4.0. CULTURAL SETTING

4.1. Introduction

The data sources used for this section have been compiled from four principle sources:

1. The Northern Territory Heritage Register and the Archaeological Sites Register maintained by the NT Heritage Branch, (NT Department of Planning and Environment).
2. The World Heritage and National Heritage Lists and the Register of the National Estate – Archive, maintained by the Australian Heritage Council (Commonwealth Department of Heritage, Sustainability, Environment, Water, Population and Communities).
3. The register of significant places maintained by the National Trust of Australia (Northern Territory Branch).

In addition to these sources, published and unpublished documents and reports describing Northern Territory historic places were used. These documents are held by the State Library of the Northern Territory, the Darwin office of the National Trust, the Heritage Branch (DIPE) and the Northern Territory Museum.

4.2. Historic background

A large part of the pipeline route is located on Aboriginal lands that have had only sporadic or minor European intrusions as access has been restricted to non-Aboriginals. Access to Arnhem Land has been restricted since 1931 when the Arnhem Land Aboriginal Reserve was declared. The remoteness of some areas in Arnhem Land meant that there were groups of Arnhem Land Aboriginals leading traditional lives until much later than areas around European settlements. Even in the late 1930s there were still Aboriginals who had not seen a European (Buck 1995). The pipeline alignment extends through Arnhem Land from Mainoru Station pastoral lease to the Gove Peninsula.

In the Katherine area significant European activity commenced in January 1871, when construction teams for the Overland Telegraph Line reached the King River. A repeater site was constructed near the present Katherine township and was used as a depot for the line crews and in time became a nucleus for the development of the pastoral and mining industries.

The establishment of Springvale Station on the Katherine River in 1878 prompted a flurry of pastoral development over the next two decades. By 1880 the majority of the large cattle stations had started, however most of them in the Top End were unsuccessful. For example Florida Station in eastern Arnhem Land on the Goyder River was abandoned in 1893 because of Aboriginal resistance and because the country was unsuitable for cattle (Powell 1996:113). Other pastoral stations established in the late nineteenth century and located close to the pipeline alignment include Beswick, and Mataranka while Mainoru was not established until 1918 (Gleeson and Richards 1985). The physical remains of the early days of the cattle stations include isolated wooden yards for holding cattle. These structures are often placed near natural water (Thorley 2002).

During the period of pastoral expansion Aboriginal inhabitants started to leave their traditional life style and work on the stations. It was also a time when there was a number of violent conflicts because of the loss of access by Aboriginals to resources and the pollution of waterholes by cattle. The Aboriginals fought back by cattle spearing at waterholes and the pastoralists retaliated by denying access to the water holes by patrolling these areas and shooting Aborigines (McGrath 1987). Disputes with pastoralists were still occurring as late as 1968 when the Rembarrnga people walked from Mainoru Station to the Bulman Waterhole

after the new American owners on Mainoru Station wanted to remove the Aboriginal workers and their families from the property.

Permanent European occupation of the Gove Peninsula did not begin until 1935 with the establishment of a Methodist Mission at Yirrkalla (Cole 1980:90-91) although early missions had been established on the north coast of Arnhem Land at Milingimbi and Maningrida. This contact with Europeans led to a gradual decline in the reliance on hunting and gathering activities as the Aboriginal population concentrated in these centres (Altman 1995:57).

Geological surveys in 1952 and 1954 proved the existence of high-grade bauxite deposits at Gove Peninsula resulting in the construction of the Nabalco mines and Nhulunbuy township in 1968. The other major development at Gove was the construction of the ELDO (European Launcher Development Organization) Down Range Tracking Station, south of Gove Airport. Following its construction in 1966 the facility was used to track guided missiles launched from Woomera in South Australia. The newly formed Dhuphuma Aboriginal and Transitional College acquired the buildings when the station closed in 1980 (Cole 1980:99).

Mining was also an important activity in the Katherine region following the discovery of tin at Maranboy in 1913. A small settlement including a hospital, market gardens and a stamp battery was established on the field which became the Northern Territory's major tin producer and operated with fluctuating success until the early 1960s (Harlow 1997). The Bulman lead and zinc deposits were discovered and briefly worked in 1910, again in 1925 and the early 1950s (Roberts and Plumb 1963).

The pipeline alignment also crosses the North Australian Railway extension from Katherine to Birdum that was completed in 1929 (Powell 1996:148). A single wire telegraph line was also erected from Katherine to the Maranboy tin mines in 1924 (Leonard 1981). Between 1873 and 1899 the original wood poles, which had a tendency to be damaged by white ants, were gradually replaced with the iron Oppenheimer poles.

During World War II numerous military airstrips and camps were constructed along the Stuart Highway and around Gove. The Manbullo airstrip is located 15 kilometres south west of Katherine and the proposed pipeline alignment is located just north of the airstrip. It was built in 1942 by the US 43rd Engineer Regiment and operational use ended in July 1944 when the RAAF's No 24 Squadron of B-24 Liberators moved to Fenton airfield. In the Gove area a large base was established by RAAF 13 Squadron to fly bombing missions to the Aru Islands and patrol the shipping lanes between Thursday Island and Darwin (Powell 1988).

4.3. The distribution of historic sites.

In broad historical terms, European activity along the proposed pipeline alignment has been concentrated along the Stuart Highway in the Katherine area and on the Gove Peninsula. The proposed pipeline alignment will cross any remains of the North Australian Railway, and the Overland Telegraph line south of Katherine. The only known World War II or mining historic sites located in the vicinity of the alignment are Manbulloo Airstrip and the Maranboy tin mine. Any historic sites on areas that are, or were pastoral leases in the past are most likely in the form of individual graves of Europeans, cattle yards or outstations.

4.4. Ethnographic background

The ethnographic information used in this report does not include information on the different Aboriginal groups that live in the area that the pipeline alignment covers. The ethnographic data is examined to assess Aboriginal subsistence strategies and their material culture that were identified during the post-contact period.

The earliest research in northern Australia on Aboriginal subsistence strategies and material culture was carried out by Basedow (1907), Foelsche (1882) Thomson (1983), Spencer (1914) and Stanner (1933a 1933b). Their observations describe general information regarding Aboriginal life including the various weapons and other implements used during the contact period in the Top End.

Basedow (1907) and Foelsche (1882) give early accounts of subsistence activities in the Top End of Australia. They describe swamps and lagoons as being focal points of subsistence activities providing sources of fish, geese, ducks, turtles, crocodiles and their eggs, shellfish and the roots of water lilies and rushes. Away from the lagoons, wallabies, snakes, goannas and other small game were hunted. Stanner (1933a 1933b), an anthropologist who worked in the Daly River region in the 1930s noted that seasonal factors were a key determinant on camp locations, types of residential grouping, the degree of mobility and the nature of subsistence activities. This influence of seasonal factors was also noted by Altman (1987), Hiatt (1964) and Meehan (1982) in the coastal areas of northwest Arnhem Land.

In Arnhem Land mobility in the wet season was low and people gathered in large groups to co-operate in subsistence production during the hardest time of the annual cycle, although Tindale (1925-6) during a visit to upper reaches of the Roper River, noted that during the wet season food was plentiful but travel was uncomfortable resulting in camps being occupied for up to 4 to 5 weeks. The people dispersed into smaller groups across their country when freshwater was readily available and came together again in the late dry season near permanent water and used this time for ceremonies. Thomson (1983) mentioned several important ceremonies that were held in the late dry season during October and November, even though bush food was scarce and quite inadequate for the needs of large groups. An example of the importance of freshwater as a limiting factor in mobility over the country was given by Thomson (1983:75) when he was unable to locate anyone who knew the country between Mainoru Station and the Goyder River as the area consisted of dry sand ridges. This implies that the area was not used often because of the lack of water.

In eastern Arnhem Land Thomson (1983:90,93,105-107) also recorded the consumption of honey, lizards, snakes and their eggs, fresh water molluscs and fifty different plants either fruit, tubers or roots of which the cycad nut was most important. Some of the vegetable foods were processed using two stones to grind to a paste. Thomson also observed the use of the scapula of a red kangaroo as a knife to slice yams and the construction of different types of fish traps using saplings, mud and grass built across creeks.

The earliest recorded visits by foreigners, besides explorers, to the north Australian coast were the Macassan trepangers who had arrived in the area by the early 1700s (MacKnight 1972, 1976). The Aborigines received metal axes and other goods in return for items such as tortoise shell, pearl-shell, pearl, and sandalwood (Baker 1984:7). The Macassan trips continued until 1907 when the visits were terminated by the government. After the European contact the Aboriginal tools were being made less from stone and more from glass and metal although Warner (1969:450) observed that the technique of grinding stone axes was still known in the late 1920s.

Over the Top End there were numerous systems of exchange of goods observed by Berndt (1951) and Stanner (1934). Items transferred in the exchanges included ochre, hair belts, human hair for twine, dilly bags, boomerangs, pearl and baler and shell, armbands, girdles, wax, fish nets and lines, spears, spear throwers, stone knives, feathered string, and European goods. Mitchell (1994) concluded that there was an increase in trade and ceremonies among Aboriginal groups in northern Arnhem Land stimulated by foreign goods such as iron, cloth and tobacco introduced by the Macassan trepangers. The Macassans are

also thought to have introduced diseases that decimated the population and disrupted the social stability of the region (Mitchell 2000).

The only items likely to survive in the archaeological record are shell fish hooks, hearths containing cooking stone or termites nests, stone tools such as spear heads, axes, and shells used either in the manufacture of implements or large shells such as *Melo amphora*, used as water vessels Brockwell (1995). After the arrival of Europeans the raw materials used in the manufacture of these items were substituted with iron, porcelain, glass and wire.

4.5. Archaeological background

There has been very little archaeological research carried out in the regions where the pipeline is to be located. Much of the pipeline route crosses isolated areas where access remains difficult.

Early archaeological research in the vicinity of the pipeline alignment concentrated around the Katherine region. This research tended to examine individual sites rather than explore how the archaeological record can be used to interpret past Aboriginal regional subsistence strategies. The number of recorded archaeological and historic sites outside of the Tipperary region is very small, reflecting the lack of archaeological research carried out in these areas and the absence of European involvement in Aboriginal lands.

In the Katherine district Macintosh (1951) excavated a rock shelter at Tandandjal Cave near Beswick south east of Katherine. Reay (1962) examined the rock art around the town of Katherine, Katherine Gorge and Kintore Caves and Chaloupka has recorded many rock art sites (the reports now held at MAGNT) on the Arnhem Land plateau.

Descriptions of the more recent archaeological research have been divided into the three regions that the proposed pipeline alignment crosses. This information, together with the conclusions from the environmental and ethnographic background is then used to discuss the expected distribution of archaeological sites along the pipeline route.

4.5.1. Tipperary Region

Archaeological research in this region has been focused in two areas, the Daly River Basin and the Tindal RAAF Base. In the Daly River area there have been two archaeological investigations by Guse (2001) who examined the distribution of Aboriginal archaeological material in the Daly Basin and Thorley (2002) who identified land units where significant archaeological and heritage places and objects were likely to occur. The majority of the artefact scatters located during Thorley's (2002) and Guse's (2001) surveys were on highly eroded, older levee banks or gullies and on plains in heavily eroded areas. This suggests that the visibility of archaeological material is highly dependent on the exposure of subsurface material through erosion.

Thorley (2002) concluded that in the Tipperary region:

- The dominant raw material for stone artefacts are red brown and buff coloured chert. (Thorley 2002:35)
- The artefact scatters consist of small quantities of debitage (Thorley 2002:36).
- Flat to undulating terrain away from watercourses will have very little archaeological potential (Thorley 2002:32).
- In low lying areas, or minor drainage floors, stone artefacts will only be located after there has been at least 50cm of erosion.

Hughes (1983) carried out the archaeological base line study for the original environmental impact assessment for the Tindal RAAF base located approximately 6 kilometres north of the pipeline corridor. This was followed by a systematic survey by Hughes and Baker (1983). They located 46 sites that included stone artefact scatters, fourteen rock shelters, two quarries, six rock art sites and two non-Aboriginal sites. The majority of sites were the rock shelters with occupational debris. Sites were often associated with major creeks, rock outcrops and sinkholes that provided either shelter, water and food resources or raw material for the manufacture of stone artefacts. Consequently there is a higher likelihood for the location of archaeological sites in this type of environment than on the featureless plains. Isolated stone artefacts were recorded over every type of environment. The rock art sites located away from the escarpment tend to be located in isolated rock outcrops or ridges located in the plains areas.

Hughes (1983:3-61) also noted that Arndt collected about 3-4000 artefacts from 67 sites in the Katherine area of which 10% were recognisable as implements and 90% were waste flakes. The removal of all stone artefacts from some sites and the more notable artefacts from others will have a major affect for any predictions of site location and content in the Katherine area.

Further sites were identified on the RAAF Base by Crassweller (2003 and 2004) and they consisted of stone artefacts scatters, rock paintings and a petroglyph site all located around small low isolated sandstone or limestone outcrops.

4.5.2. Roper District

The nearest location to this section of the route where there has been any major archaeological research has been in Kakadu National Park 70 kilometres north of the alignment where the research examined settlement patterns and rock art studies in western Arnhem Land. Fortunately the pipeline tends to avoid escarpment country where there is a higher potential for locating rock art sites. The nearest recorded rock art sites are located on the Wilton River at Bulman Gorge approximately 10 kilometres north of the area. In the Beswick area there are two rock shelters, Tandandjal and Beswick Cave both with art. Tandandjal is located two kilometres north of the proposed pipeline and 20 kilometres east of Barunga (formerly Bamiyili). It was excavated in 1949 by Macintosh (1951) and yielded stone artefacts, bone, shell charcoal and ochre. It also contained a stone arrangement on the rock shelter floor. The material has not been analysed in detail**.** Beswick Cave is located seven kilometres from the old Beswick Homestead at the head of a gorge.

The historic sites recorded on the NT Archaeological Site Register in vicinity of the pipeline alignment in the Roper region consist of a tree blazed by the explorer and surveyor David Lindsay, Site No. 5568-0001, and two rock art sites 5468-0001 and 5770-0001. The carved tree is also on the archived Register of the National Estate and is located approximately 20 kilometres south east of Bulman and therefore will not be affected by the proposed development. The two rock art sites are also located outside the pipeline corridor between 7 and 9 kilometres north of the alignment east of Bamiyili.

4.5.3. Arnhem Land District

The majority of archaeological sites documented in Arnhem Land are coastal sites of either Aboriginal shell middens or the remains of Macassan trepanging sites consisting of stone lines, tamarind trees and pottery (Baker 1984). The earliest archaeological research in Arnhem Land occurred between 1927-28 when Warner (1969) excavated two shell middens in the Milingimbi area. Then in 1948 McCarthy and Setzler (1960) carried out research on Groote Eylandt and the coastal areas of Yirrkala and Milingimbi. There was an unsystematic collection of stone artefacts brought to the researchers by the local people including

hammerstones of various raw materials, and controlled surface examinations of several areas. Two sites were excavated in the vicinity of Yirrkala. One site Jelangbara Cave fifteen miles south of Yirrkala contained marine shell and stone artefacts manufactured from a ferruginous shale, quartzite and limonite. Artefacts consisted of unifacial and bifacial points, retouched flakes (scrapers), small unretouched flakes, mortars, abrading stones and small flakes. The other excavated site was a Macassan trepanging site at Port Bradshaw and contained tamarind trees, stone lines, cooking pits, pottery and human remains

There is only one inland site that has been described in detail for the western or south central Arnhem Land region. The Ngilipitji Quarry located in the hills near the Walker River approximately 60 kilometres south of the pipeline corridor probably consists of at least three separate quarry areas several kilometres apart. One of the quarry areas was estimated by Thomson (1983:72) to cover several hectares. The quartzite raw boulders are found embedded in the ground and are usually extracted by digging pits around the boulder and then levering the boulders from the ground. The stone is used to manufacture large stone points, blades used for circumcision ceremonies and stone axes which are circulated over a vast area (Jones and White 1988:73). Thomson (1983) had seen some of the stone points tools wrapped separately in paperbark in the Goyder and Roper River areas as well as Caledon Bay south of the Gove Peninsula.

Jones and White (1988:56,57) also mention several less important quartzite quarries, one located next to a creek crossing on the Nhulunbuy Road west of the Mitchell Ranges area and another 30 kilometres east of the Goyder River. Their exact locations are unknown.

More recent cultural heritage surveys in the Arnhem Land region have been associated with the optic fibre cable that was constructed along the Central Arnhem Highway (Bourke 2006) and surveys on Alcan Gove Pty Ltd's mine site and refinery (Earthsea Heritage 2010, Raupp *et al* 2009, Guse and Raupp 2008,Guse 2006, 2007a and b, 2008, Crassweller 2006a and b).

Bourke (2006) located three isolated stone artefacts and three stone artefact scatters in the vicinity of the Goyder and Latram River crossings. None of these sites or objects will be impacted by the project. The surveys on the Alcan mine and refinery area identified several shell middens, numerous small shell scatters, the occasional isolated stone artefact and the remains of World War II objects in the vicinity of the airport. None of these site or objects will be impacted by the development as the proposed pipeline alignment on the mine site and refinery is confined to an already disturbed area along the conveyor belt.

4.6. The distribution of archaeological material.

The above discussions of the environmental, ethnographic and archaeological background suggest that there are several common factors that may predict the presence or absence of archaeological material. The ethnographic data suggests archaeological material is more likely to be located near rivers, creeks and billabongs as they were a focal point in Aboriginal settlement patterns providing both food and water. While the majority of archaeological sites will be located less than 200 metres from either a permanent or ephemeral water source, locating these sites may be difficult. There are vast areas of the pipeline route that are located on sandy plains and it is unlikely that artefacts will remain long on the surface, even along eroding creek banks where they would be quickly covered or moved after the annual wet season floods

Only the Tipperary region has had any detailed archaeological research into site distribution patterns and several of Thorley's predictions (Thorley 2002) for locating archaeological material in the Tipperary region can be transposed to similar environments in the other three regions. He suggested that archaeological material would be scarce on the flat to undulating

terrain or on more recent levee banks. Most material would be located in the severely eroded sections of major rivers or after at least 50 centimetres of erosion has occurred along minor water courses. These findings could be useful when planning the methodology for the next stage of archaeological surveys along the pipeline.

In the area south of Katherine sites are more likely to be located along major creeks, rock outcrops and sinkholes. Rock art sites may be identified on isolated rock outcrops in this area.

There has been very little archaeological research carried out in either inland Arnhem Land or the Roper regions. As both these regions have large stretches of the pipeline route crossing sandy plains there appears to be little likelihood of identifying many sites or artefacts on the surface in this environment. Ethnographic data also suggests sandy plains were not frequently crossed by Aboriginals in the past.

In the Roper region there is an increased potential for locating artefacts in the higher rocky ground of the southern edge of the Arnhem Land escarpment and in both the Roper and Arnhem Land region the presence of dolerite outcrops may increase the potential for locating quarries. The only recorded archaeological surveys in inland Arnhem Land identified several quarries next to creeks in the Mitchell Ranges area.

As noted before the lack of archaeological material located in areas adjacent to the pipeline route does not necessarily indicate that no archaeological material exists. It may be more a reflection of the lack of archaeological field work carried out in these areas.

1.0. METHODOLOGY

The aim of the 2003 and 2004 preliminary surveys was to identify a suitable 100 metres wide pipeline corridor that avoided any cultural or environmental areas of value.

1.1. Preliminary survey 2003 and 2004

The survey group included archaeologists, environmental and flora specialists, geo-technical terrain specialists, a pipeline engineer who was plotting the route, and Aboriginal traditional owners. The geo-technical team was required to drill holes a maximum of five kilometres apart along the route to assess soil depth and structure. In reality the distances between drill holes was less than five kilometres as holes were also drilled when the geomorphology of an area changed. The flora specialists were required to note vegetation changes along the route and the traditional owners were required to identify areas of cultural significance.

Begnaze was required to carry out two archaeological undertakings. The first was to ensure that the area to be drilled by the geo-technical team contained no archaeological material that would be disturbed by the drilling. The second was to identify any archaeological sites or objects located on or near the proposed pipeline route and infrastructure such as compression stations. The findings from the survey were then used to identify archaeologically sensitive areas to be avoided, or when avoidance is not possible, to recommend alternate routes or mitigation strategies to lessen the impact of the loss or damage of archaeological and heritage places and objects.

During the 2004 field work for the pipeline alignment surveys were also carried out over eight small areas that may be cleared for construction camps and compressions stations. Further field work was carried out a few months later for all the proposed access roads and additional proposed construction camp sites. The findings from this survey are in Begnaze (2004b).

1.2. Survey procedures

The aims of the fieldwork were to locate and record any archaeological or historic objects or places in the vicinity of the proposed pipeline to ensure that the provisions of the *Heritage Act NT 2011* are not contravened. The archaeological survey was carried out as follows:

- The archaeological and heritage study identified archaeological material within the designated area by means of a survey carried out in a manner that ensured the highest possible coverage of the area.
- Any archaeological or heritage places, objects or classes of objects located during the survey were recorded in such detail as to permit independent assessment of their significance. The location of any archaeological places and objects included coordinates obtained by a Global Positioning System using GDA94 datum.
- After assessing the significance of the archaeological place or object, recommendations were made regarding compliance with the provisions of the *Heritage Act NT 2011*.

The archaeological survey of the pipeline section consisted of both vehicular and pedestrian transects. The vehicular transects were made as close as possible to the centre of the pipeline alignment and the vehicle usually traveled between 5-10 kilometres per hour. Pedestrian transect were then made over areas where archaeological material was detected.

Pedestrian transects were also made every time the survey party stopped, that is every time a hole was drilled, when the flora survey crew found vegetation of interest, when mechanical failures occurred, or when there was a location where there was a higher potential for

locating archaeological sites, such as areas adjacent to waterways, higher ground or eroded areas. This method resulted in both random and purposive pedestrian transects.

Generally the transects were made along the length of the pipeline with the two archaeologists walking in opposite direction away from the location given in the table describing the transect details (Appendix 3). The return transect to that point was made between 30 – 50 metres from the first transect. Where pedestrian transects were made in areas where there were landscape features such as creeks or hills, the transects were made either along or over these features.

Results of the pedestrian transects were individually recorded and consisted of their location, environmental context, ground surface visibility and the number of sites and isolated artefacts encountered. This allowed for the density of sites and background scatters within different environments to be accurately recorded.

The pedestrian transects made over the areas that may be used as construction camps or compressions stations consisted of parallel transects no more than 50 -100 metres apart.

The surveys were carried out by either Christine Crassweller and Helen Haritos or Silvano Jung.

The following sections contain information about fieldwork methods employed in this study including the identification and recording of archaeological sites and materials and the criteria used for the assessment of their significance.

5.2.1. Types of archaeological sites

There are six types of sites previously recorded in the region and they can broadly be defined as follows:

- *Artefact scatters.* These may contain flaked or ground artefacts and hearthstones. They occur as surface scatters of materials or as stratified deposits when there has been repeated occupations.
- *Shell middens* contain mollusc material in the form of surface scatters or mounded deposits (Gregory 1998:222), which represent the remains of human meals.
- *Stone arrangements* range from simple cairns to more elaborate arrangements. These stone arrangements were used in ceremonial activities and represent sacred or totemic sites. Other stone arrangements were constructed for route or territory markers, the walls of huts, fish traps or small walls to stop water from entering a rock shelter or to retain the floor.
- *Art sites* include stencils and paintings where material was added to the rock surfaces or engravings or poundings where the pictures or designs are produced by the removal of material from the rock surface.
- *Rockshelter sites* contain a deposit of cultural material that has built up over time and contain flaked or ground stone artefacts, faunal material and other Aboriginal cultural remains.
- *Stone quarries* are generally sites where stone for flaked or edge ground artefacts has been extracted from an outcropping source of rock.

5.2.2. Site definition

An archaeological site is defined for this survey as a concentration of artefactual material with an average density that is 5 times greater than the average density of the background scatter and there are more than five artefacts or shells which cover an area of at least 1m^2. A site will have an identifiable boundary where either artefact densities decrease to the

extent as to be classified as background scatter or, environmental features determine the boundary.

A background scatter is generally a very low density, more or less continuous distribution of isolated artefacts over the landscape.

5.2.3. Artefact identification

A requirement for a successful archaeological project involves the accurate identification of archaeological materials. For an object to be identified as a flaked object it needs to possess one or more of the following:

- a positive or negative ring crack.
- a distinct positive or negative bulb of percussion.
- a distinct eraillure scar in an appropriate position below the platform.
- definite remnants of flake scars on dorsal surface or ridges.

Stone artefacts are divided into four main types of cores, unretouched flakes, retouched flakes and flaked pieces (Hiscock 1984:128-129). They are defined as follows:

- *cores* are pieces of stone that have one or more negative flake scars and the absence of positive scars.
- *unretouched flakes* are pieces of stone that have been struck off another piece of stone and ideally possess platforms, positive bulbs of percussion, concentric ripples, ring cracks and /or eraillure scars on the ventral surface.
- *retouched flakes* are flaked flakes. They are identified by the presence of negative scars that must have been created after the ventral surface of the flake had been created. There will be either negative scars on the ventral surface or negative scars on the dorsal surface, which have been formed by the flake being hit on the ventral surface.
- *flaked piece*s are stone artefacts that have been formed by knapping but cannot be identified as either a core or a flake.

Other artefact and implement types that have been identified in the top end of the Northern Territory are listed below following characteristics outlined by McCarthy (1976) and Holdaway and Stern (2004).

- *Unifacial points* are flakes that have been retouched along the margins from one surface, either ventral or dorsal to give or enhance its pointed shape. They are sometimes symmetrical or leaf shaped.
- *Bifacial points* are retouched along both ventral and dorsal surfaces of a flake to enhance or give the artefact its pointed shape. They may have the platform removed and the proximal end rounded.
- *Edge ground axes* have been shaped by the process of flaking, pecking and polishing. They generally have only one working edge that has been ground to a sharp margin although occasionally they may have two leading edges.
- *Grindstones* are characterized by a worn and abraded surface or surfaces. There also may be a concave surface.
- *Hammerstones* have use wear on the surface in the form of abrasion, pitting, and edge fracturing with some negative scarring.
- *Manuports* are stone material that are not found naturally in an area and must have been carried in by humans.

6.0. RESULTS

6.1. Overview of archaeology and historic heritage along proposed KGGP route

The first part of the results section summarises the range and frequency of archaeological material within the pipeline corridor that were recorded during the 2003 and 2004 surveys or were identified during the background research. A more detailed description follows where the results of the surveys have been divided into the four sections that correspond to the four environmental regions used previously in the report. The section ends with a discussion on distribution of Aboriginal archaeological remains in each land system.

6.1.1. Sites recorded under Commonwealth legislation.

As at January 2013 there are no historic or archaeological sites in the vicinity of the proposed KGG Pipeline route that are recorded on or near the National Heritage List.

6.1.2. Sites recorded under Northern Territory legislation

There are twenty one Aboriginal archaeological sites recorded by the NT Heritage Branch that are located within the 10 kilometre wide pipeline corridor (this does not included the sites recorded during the 2003 /2004 pipeline survey) and the majority are over 1.5 kilometres from the proposed pipeline alignment. None of the twenty one sites and no declared heritage sites and objects will be disturbed by the development. Recently, on the Gove Peninsula, numerous sites have been recorded on the Alcan mine site and refinery. As the pipeline corridor is confined to an area adjacent to the existing Alcan conveyor belt, none of these sites will be disturbed.

6.1.3. Archaeological and heritage places and objects located during the survey

There were 343 pedestrian transects made along, or as near as possible to the pipeline alignment. Details of the transects are located in Appendix 3. The pedestrian transects covered 156 kilometres on or adjacent to the proposed pipeline corridor. This includes approximately 33 kilometres and 54 pedestrian transects that were made over the Mainoru bypass that is now not part of the proposed pipeline route and transects made over the proposed construction camps and compression stations. This produced an average of one transect every 2 kilometres along the proposed pipeline excluding the transects made along the Mainoru bypass.

There was only one incident during the inspection of the drill holes where the drilling team had to be moved away from an archaeological site and on several occasions during the surveys of the proposed pipeline, changes were made to the route to avoid archaeological sites.

Overall the 2003 and 2004 surveys identified surprisingly few historic and archaeological sites or objects in the vicinity of the pipeline and these sites are now recorded on the NT Archaeological Site Register. These consisted of 17 Aboriginal archaeological sites, 4 historic sites and 54 background scatters of isolated stone artefacts (Table 6.1.) The Aboriginal archaeological sites and the background scatters are protected under the *Heritage Act 2011*, however the historic places are not.

The most common archaeological sites were open stone artefact scatters with smaller numbers stone arrangements and one skeletal remains. The historic sites were related to World War II activities, surveying activities, the pastoral industry, the North Australian Railway and the Overland Telegraph line and were located in the vicinity of the Stuart and

Victoria Highways south of Katherine in the Roper and Tipperary regions. A summary of all historic and archaeological sites are located in Appendix 1 and a detailed description of the individual historic or archaeological sites are in Appendix 4 and the background scatters and in Appendix 2.

Table 6-1: Frequency of background scatters and site types recorded in each region

Region	B.S scatters	B.S Frequency	Total sites	Site Frequency	Artefact scatter	Skeletal remains	Stone arrang.	Historic
Tipp.	2	1/13.5km	5	1/6.7km	3			1
Roper	24	1/9.0km	7	1/31km	2	1	1	3
A/ Land	28	1/12.8Km	10	1/59.8m	5		1	
Total	54		40		15	1	2	4

Using the total distance covered by pedestrian and vehicular transects in each region, Table 6.1 also shows that in the vicinity of the pipe line corridor, both sites and background scatters were identified most frequently in the Tipperary region. This is probably related to the short distance of the pipe line route through this region. The Arnhem Land region had very low frequencies for sites, while the frequency of background scatters was relatively constant along the pipeline alignment and background scatters.

Approximately 80% of the background scatters in the Arnhem Land region contained one or two artefacts while in the Roper region 75% of background scatters contained one or two artefacts. The dominant raw material in the Tipperary, Roper and Arnhem Land regions was chert.

6.1.4. Environmental factors affecting the distribution of archaeological material

When an archaeological site or background scatter was identified during the surveys the local environment was also recorded. These environments were then reduced to five main categories:

- Within 200 metres of a source of freshwater and includes rivers, creeks, both ephemeral and permanent, billabongs and swamps
- Higher ground such as hills, rises, terraces and ridges
- Plains, including undulating and level ground on the top of plateaux
- Isolated stone outcrops
- Edges of escarpments

Table 6.2 shows that the majority (62%) of the sites and backgrounds scatters are located near water or higher ground. No archaeological sites were identified on the plains. Therefore from this it can be predicted that archaeological material will be more frequent near water or higher ground such as slopes and hills. There are a similar proportion of background scatters on the plains and higher ground. It should be noted that one site on a floodplain has been included in the 'water' category in the table below. Consequently it is predicted that sites will be rare on plains or undulating country and isolated artefacts may be located in areas where there are no landscape features.

Table 6-2: Proportion of archaeological material located near different landscape features

	Water	Higher ground	Plain	Outcrop
Sites	71%	23%	-	6%
Background scatters	65%	18%	17%	-

6.1.5. Proposed construction camps and compressions sites

The results of the surveys over the proposed construction sites in the vicinity of the Mainoru, Bulman, Buckingham River and the Gapuwiyak Road and a compression site in the vicinity of the Stuart Highway are shown in Table 6.3. Several areas were surveyed for three of the proposed campsites. All of the surveyed areas were on relatively level or gently undulating terrain and no archaeological material was identified within these areas.

Table 6-3: Details of surveys over proposed compression and construction camp sites.

General location	Kilometre Point	Pedestrian transect number (2004 survey)	Archaeological material located
Stuart Highway	20	22	none
Mainoru	190	13, 13a and b	none
East of Bulman	290	2, 3a and 3b	none
Buckingham River	440	48a and b	none
West of Gapuwiyak Rd	540	40	none

6.1.6. Archaeological visibility

The low number of archaeological sites and isolated artefacts along the pipeline corridor is probably a reflection of the type of terrain over which the pipeline route crosses. The pipeline route favours level ground and avoids, where possible, rugged terrain, escarpments, hills and areas prone to long term flooding after the wet season. The route also covers vast areas of sandy plains or undulating country, where there is less potential for locating archaeological material. During the surveys it was noted that no archaeological material was located near any water sources where the banks were sandy.

As there is a concern that surface visibility may have played a part in locating artefacts, the influence of ground visibility was assessed as a factor in detecting sites by calculating a rough guide averaging out the ground visibility for all pedestrian transects in each region in 2003 and 2004. Table 6.4. shows that ground visibility was higher in the 2003 survey that was carried out in the late dry season when much of the countryside had been burnt off. The 2004 survey was carried out between July and September after a late wet season. As a result there was a lower proportion of the proposed route where the surface had been cleared by fire. It should be noted that the very low average ground visibility for the 2004 survey in Tipperary occurs because only four transects were made over an unburnt surface.

When the average ground visibility is calculated over both years there is however only a small difference between the three regions. These figures indicate that ground visibility was low for both surveys and it is considered that the detection of isolated artefacts may have been hindered by the low visibility. However as the survey methods included targeting areas where it was predicted there would be a high probability for the presence of sites and also targeting areas within each random transects where ground visibility was higher than the surrounding area, it is considered that the low number of sites detected is not the result of low ground surface visibility.

Table 6-4: Average ground surface visibility for each region in 2003 and 2004.

Region	2003 average visibility %	2004 average visibility %	2003 & 2004 average visibility %
Tipperary	42	5	55
Roper	63	37	49
Arnhem Land	65	50	56

The following sections describe the archaeological material located within each region in more detail.

6.2. Tipperary

The survey consisted of sixteen pedestrian transects that totalled 7.360 kilometres in length in the Tipperary region. This is approximately 28% of the length of the pipeline in the Tipperary region. During this section of the survey three archaeological, one historic site and two background scatters of isolated stone artefacts were located within the Tipperary region (Tables 6.5 6.6 and 6.7.).

6.2.1. Historic site in the Tipperary region

The pipeline will cross the remains of the North Australian Railway line. However the line in the area that will be disturbed consists only of the gravel base on which the line was laid. This site is not protected by any legislation.

Table 6-5: Historic sites in the Tipperary region

Site No.	Site Name	Lat	Long	Easting	Northing	Map Sheet	Distance from pipeline alignment
23	North Australian Railway	-14.6112	132.5750	53 238760	8383285	Maranboy	0 metres

6.2.2. Aboriginal archaeological sites located in the Tipperary region

The archaeological material consisted of three stone artefact scatters and four background scatters. The stone artefact scatters were located on the banks of ephemeral creeks between 0 KP and the Stuart Highway. The stone artefacts were adjacent to the creeks and eroding out of large patches of red soil where the gentle slopes had been eroded by sheet wash.

Table 6-6: Archaeological sites located during the survey in the Tipperary region

Site No.	Lat	Long	Easting	Northing	Type	Environment	Distance from pipeline (m)
20	-14.6191	132.3962	53 219497	8382191	Stone artefact scatter	Creek	50
21	-14.6231	132.4573	53 226091	8381820	Stone artefact scatter	Creek	30
22	-14.6191	132.4923	53 229852	8382305	Stone artefact scatter	Creek	80

The majority of the stone artefact scatters ranged from relatively large to very small and their dimensions are probably linked to the size of the eroded areas where visibility of the stone artefacts is increased by the erosion. Chert was the dominant raw material and there was a very low proportion of retouched flakes at the three sites.

Table 6-7: Summary of contents of archaeological sites in the Tipperary region

Site No	Length	Width	Average density /m^2	Maximum density /m^2	Dominant raw material	Average length of flake (mm)
20	50	50	0.1	6	Chert	20
21	3	3	0.1	4	Chert	30
22	10	20	0.3	8	Chert	15

6.2.3. Background scatters in the Tipperary region

Only two background scatters were identified in the Tipperary region (Table 6.8) and both were near ephemeral creeks. The majority of artefacts were unretouched chert flakes and there was one quartz flake and a sandstone grindstone.

Table 6-8: Background scatters located during the survey in the Tipperary region

B.S No	Zone	Lat	Long	Easting	Northing	Transect (m)	Visibility %	Environment
38	53	-14.6217	132.4476	225043	8381969	240	98	Creek
39	53	-14.6233	132.4564	225990	8381800	400	90	Gentle slope near creek

The isolated artefacts in the Tipperary region have a low diversity of raw material and artefact types. Most of these artefacts were unretouched chert flakes and there was only one quartz flake, a sandstone grindstone and a chert flaked piece.

Table 6-9: Summary of isolated artefacts recorded in the Tipperary region

Type	Sandstone	Chert	Quartz	Total No.	Total %
Flake		4	1	5	72
Flaked piece		1			14
Grinding stone	1			1	14
Total No.	1	5	1	7	
Total %	14	72	14	100	100

6.2.4. Distribution of Aboriginal archaeological material in the Tipperary region

All of the site and background scatters of isolated artefacts were located adjacent to ephemeral creeks where the surface had been disturbed by erosion. These results agree with Thorley's (2002) and Kinhill's (1983) predictions that very little archaeological material will be located on the plains areas away from waterways in this region.

6.3. Roper Region

One hundred and thirty two pedestrian transect were made in the Roper region that covered 17.59 kilometres of the pipeline corridor. A total of four archaeological sites, three historic sites and twenty three background scatters were identified during the survey. None of the archaeological or historic sites located during the surveys will be disturbed by the development.

6.3.1. Historic sites in the Roper region

During the survey three possible historic sites, a cattle yard, a scarred tree and an Overland Telegraph Pole were identified in the region. None of these places or objects is protected by any legislation. All are located away from the pipeline alignment and will not be disturbed by the development. The traditional owners stated that a cattle yard called Policeman's Yard, Site 7, was the place where a policeman was speared. However no documented evidence could be located that was related to a spearing in the area. Consequently the site has been retained in the report as an historic site with no historic significance. The scarred tree, Site 33 is located approximately 2 kilometres north of the pipeline alignment on the banks of the Bukalorkmi Creek and was marked by surveyors during the 1970s as a national mapping 3rd order levelling point. While this site is relatively recent it is an unusual occurrence and represents surveying methods that are probably not used today.

The Overland Telegraph Pole, an Oppenheimer pole, may not be related to the original line which is thought to have been located west of the North Australian Railway line in the area south of Katherine. The line was perhaps related to a subsidiary line that was constructed between Katherine and Maranboy in 1920s as the wire was facing in a north south direction. If the line was a spur line from the main line it would most likely be in an east west direction.

Table 6-10: Historic sites in the Roper region

Site No.	Site Name	Lat	Long	Easting	Northing	Map Sheet	Distance from pipeline alignment
7	Policeman's yard	-14.17308	133.8142	372033	8432807	Flying Fox	6km
25	Overland Telegraph pole,	-14.6049	132.6253	244176	8384036	Manbulloo	260
33	Marked Tree	-14.4363	133.5348	342068	8403510	Flying Fox	1.2km

6.3.2. Archaeological sites in the Roper Region

Only four archaeological sites were located during the survey of the Roper region, a burial, a stone arrangement and two stone artefact scatters (Table 6.17). The traditional owners who were part of the survey team described the skeletal remains as being located on a high rocky hill approximately 350 metres from the pipeline alignment. The site was not visited to confirm its location or contents as it was outside the proposed pipeline corridor and it is highly unlikely that the pipeline would be realigned to go over the hill.

The stone arrangement, Site 30, was a one metre high cairn located on the level summit of a large quartzite outcrop located in undulating country. No other archaeological material was located in the area.

Table 6-11: Summary of archaeological sites identified in the Roper region.

Site No.	Lat	Long	Easting	Northing	Type	Environment	Metres from pipeline alignment
6	-14.0629	134.0210	53 394300	8445100	Skeletal remains	Hill	350
30	-13.84025	134.2201	53 415716	8469775	Stone arrangement	Outcrop	200
31	-13.876	134.1794	53 411326	8465836	Stone artefact scatter	Creek	180
32	-13.876	134.1657	53 409852	8465824	Stone artefact scatter	Creek	1km

The two stone artefact scatters were located approximately one kilometre apart on the banks of Horse Creek. At Site 31 all the artefacts were manufactured from dolerite and at Site 32 dolerite was the dominant raw material with smaller proportions of quartzite and silcrete. There were relatively high proportions of retouched flakes and cores at both sites.

Table 6-12: Summary of contents of the artefact scatters

Site No	Length	Width	Av. Density (/m2)	Maximum density (/m2)	Dominant raw material	Av. Length of flake (mm)
31	15	20	0.2	4	dolerite	50
32	15	5	0.1	7	dolerite	44

6.3.3. Background scatters in the Roper Region

The distribution of background scatters appears to be evenly dispersed along the pipeline alignment in the Roper region with only two areas of approximately 30 kilometres along the route that contained no identified archaeological material.

Table 6.13 is a summary of the contents of twenty three background scatters located during the surveys. The background scatter were located either adjacent to creeks (6) or in eroded area such as rocky slopes (3) or steep hills (2) and stony plains (3).

Table 6-13: Background scatters located in the Roper region

B. S No.	Zone	Lat	Long	Easting	Northing	Visibility %	Transect (m)	Environment
13	53	-14.1530	133.8562	376555	8435050	200	55	Creek
14	53	-14.1665	133.8216	372829	8433538	200	80	Creek
15	53	-14.2488	133.5277	341157	8424254	600	10	Creek
16	53	-14.5054	133.3747	324850	8395750	400	95	Creek
17	53	-14.5156	133.3466	321831	8394607	1000	95	Hill
18	53	-14.5217	133.2744	314057	8393872	300	50	Creek
19	53	-14.5891	133.0228	287000	8386200	600	95	Plain
20a	53	-14.5963	132.8695	270488	8385245	900	100	Plain
20b	53	-14.5963	132.8659	270100	8385245	1200	50	Plain
40	53	-14.6092	132.6078	242296	8383535	800	20	River
41	53	-14.6060	132.6553	247405	8383943	800	40	Creek
53	53	-13.8241	134.2391	417764	8471691	400	60	Creek
54	53	-13.8765	134.1768	411088	8465799	340	10	Creek
55	53	-13.8853	134.1713	410459	8464898	400	5	Creek
56	53	-13.8878	134.1678	410763	8464382	800	40	Creek
57	53	-13.9425	134.1423	407347	8458467	600	90	Creek
58	53	-14.1376	133.9246	383931	8436828	700	5	Creek
59	53	-14.1381	133.9220	383648	8436829	800	5	Creek
60	53	-14.1387	133.9180	383216	8436761	500	90	Creek
61	53	-14.1841	133.8760	383216	8436761	800	95	Hill
62	53	-14.2520	133.8048	371046	8424076	800	70	Plain
63	53	-14.4558	133.5264	341140	8401323	150	20	Hill
64	53	-14.4666	133.5096	339362	8400245	400	50	Creek

Table 6.20 shows that the isolated stone artefacts were manufactured from a wide range of raw materials, the most frequent being chert (36%) and dolerite (22%). The majority of the artefacts were unretouched flakes (68.75%) and there was a relatively high proportion of retouched flakes (20%) and cores (14%).

Table 6-14: Summary of isolated artefacts recorded in the Roper region

Type	Sandstone	Chert	Siltstone	Silcrete	Quartzite	Dolerite	F.G.S.	Total No.	Total %
Flake	2	11	4	1	2	7	3	30	60
Retouched flake		1	3		3	2	1	10	20
Core	1	5			1			7	14
Flaked piece		1			1			2	4
Ground axe						1		1	2
Total No.	2	18	7	1	7	11	4	50	
Total %	4	36	14	2	14	22	8		

6.3.4. Distribution of Aboriginal archaeological material in the Roper region

While there were very few archaeological sites located during the surveys there was a regular frequency of isolated artefacts located along the proposed route. There was a 34 kilometre section along the route between KP 476 and KP510 where no archaeological material was located. This is an area where the potential for locating archaeological material is low because of the environmental conditions as the area is low lying and prone to regular flooding. However there is a higher potential for sub-surface material.

6.4. The Arnhem Land Region

In the Arnhem Land region 196 pedestrian transects were made over a distance 131.06 kilometres. While 10 archaeological sites and 28 background scatters were located in the region, 4 of the sites and 8 background scatters were located during the survey along the Mainoru by-pass, which is now not part of the pipeline alignment. These have been italicised in Tables 6.15, 6.16, 6.17 below.

6.4.1. Archaeological sites in the Arnhem Land region

Nine of the ten archaeological sites located in the Arnhem Land region were stone artefact scatters and only one of the scatters was located east of the Annie Creek. Three sites were clustered around Annie Creek, one adjacent to the Horse Creek floodplain, three on the top or slopes of hills and one next to a billabong. Site 5 was an unusual site in that the stone artefacts were all manufactured from ochre and were located around a small soak on the side of a hill.

Table 6-15: Artefact scatters located during the survey in the Arnhem Land region

Site	Lat	Long	Easting	Northing	Type	Environment	Metres from pipeline
1	*-13.9361*	*134.2698*	*53 421122*	*8459215*	*Stone arrangement*	*Creek*	*12k*
2	*-13.9082*	*134.4251*	*53 437891*	*8462346*	*Stone artefact scatter*	*Flood plain*	*22k*
3	*-13.8979*	*134.4836*	*53 444203*	*8463504*	*Stone artefact scatter*	*Hill*	*24km*
4	*-13.7543*	*134.5916*	*53 455853*	*8479412*	*Stone artefact scatter*	*Billabong*	*34km*
5	*-13.3345*	*134.8054*	*53 478926*	*8525861*	*Stone artefact scatter*	*Hill*	*60*
24	-12.7031	136.0716	53 616351	8595460	Stone artefact scatter	Creek	60
26	-13.4441	134.6677	53 464023	8513730	Stone artefact scatter	Creek	140
27	-14.4459	134.668	53 464217	8513518	Stone artefact scatter	Creek	60
28	-13.4462	134.6671	53 464021	8513490	Stone artefact scatter	Billabong	20
29	-13.7124	134.3619	53 431008	8483982	Stone artefact scatter	Hill	50

Site 1 consists of two stone arrangements approximately 5 metres apart both consisting of a thin slab of sandstone lying horizontally on either a pile of smaller sandstone rocks or termite mounds at either end of the slabs. The traditional owners stated that they had been constructed during a period of buffalo shooting approximately 15 years ago and the structures were supposedly used as barbeque plates.

All the artefact scatters were small to medium sized and contained a low density of artefacts that were mainly manufactured from chert and siltstone.

Table 6-16: Summary of the stone artefact scatters in the Arnhem Land region

Site	Length	Width	Av. Density (/m2)	Maximum density (/m2)	Dominant raw material	Av. Length of flake (mm)
2	*4*	*2*	*0.5*	*6*	*Siltstone*	*30*
3	*11*	*8*	*0.2*	*3*	*Chert*	*35*
4	*15*	*6*	*0.1*	*3*	*Siltstone*	*28*
5	5	5	0.5	3	Ochre	
24	10	8	0.015	4	FGS	25
26	11	10	0.3	6	chert	35
27	5	5	0.6	12	chert	35
28	21	6	0.2	6	chert	50
29	10	5	0.05	4	chert	30

6.4.2. Background scatters in the Arnhem Land Region

The majority of the twenty eight background scatters contained one or two artefacts and were located next to a source of water and nineteen of these are located adjacent to present alignment. There are only five background scatters located between Annie Creek and the Gove Peninsula. Background Scatter 49 contained five artefacts all located on a rocky bed of Annie Creek. A high density of isolated artefacts was also noted around the stone artefacts scatters located adjacent to Annie Creek.

Table 6-17: Background scatters located in the Arnhem Land region

B. S No.	Lat	Long	Easting	Northing	Visibility %	Transect (m)	Environment
1	-13.9233	134.3323	427868	8460653	50	1000	Rocky rise
2	-13.9273	134.3542	430239	8460223	30	800	Plain
3	-13.9120	134.3944	434572	8461923	40	1200	Hill
4	-13.9123	134.4015	435344	8461893	25	600	Flood plain
5	-13.8222	134.5431	450625	8471887	20	600	Creek
6	-13.8292	134.5249	448656	8471107	95	600	Plain
7	-13.7536	134.5916	455855	8479487	90	1000	Creek
8	-13.7195	134.6081	457630	8483262	80	600	Creek
9	-13.0274	134.9764	497437	8559829	100	1200	River
10	-13.1188	134.9505	494635	8549726	30	400	River
11	-13.2735	134.8872	487778	8532618	80	500	Hill
12	-13.2986	134.8547	484260	8529841	75	800	Billabong
42	-12.6894	135.7780	584474	8597083	20	640	Plain
43	-12.6918	135.8253	589604	8596802	85	800	Plain
44	-12.6978	135.9965	608194	8596074	90	600	Gentle slope
45	-12.7067	136.0918	618540	859548	85	400	Plain
46	-12.6587	136.2834	639370	8600269	80	1600	Creek
47	-12.3304	136.7350	688661	8636300	85	800	Hill
48	-13.9515	133.9645	388148	8457396	40	400	River
49	-13.4460	134.6678	464050	8313684	75	900	Creek
50	-13.4398	134.6733	464037	8513678	75	80	Creek
51	-13.6936	134.3825	433226	8486167	15	1350	River
52	-13.7895	134.2810	422281	8475531	80	160	Creek
79	-12.4573	136.5379	667141	8622393	25	600	Stony slope
80	-12.6902	135.6883	574729	8597023	90	200	River

81	-12.6829	135.6598	571639	8597837	95	500	Rocky hill
82	-12.6173	135.8158	588603	8605133	60	600	Creek
83	-13.1234	135.1045	511328	8549178	30	1200	River

Table 6.18 shows that there is a much larger range of raw material used to manufacture stone artefacts than in the other regions. As the pipeline covers 350 kilometres in this section, this diversity is probably a reflection of the large survey area and the availability of different raw material in different areas.

Table 6-18: Summary of isolated artefacts recorded in the Arnhem Land region

Type	Sandstone	Chert	Siltstone	Mudstone	Quartzite	Dolerite	Silcrete	Quartz	FGS	Total No.	Total %
Flake	1	14	5	2	4	3	6		1	36	71
Retouched flake		1		1	2		1		1	6	12
Core		2						1		3	6
Flaked piece						1		2		3	6
Grinding stone	3									3	6
Total No.	4	17	5	3	6	4	7	3	2	51	
Total %	8	33	10	6	12	8	14	6	4		

6.4.3. Distribution of archaeological material in the Arnhem Land region

The lack of archaeological material between Annie Creek and the Gove Peninsula is probably the result of environmental factors. Much of the pipeline route in this area consists of featureless sandy plains where it is unlikely that archaeological material will remain on the surface and where there is some distance between creeks or billabongs. One of the traditional owners mentioned that a lot of the country that the pipeline crosses in central Arnhem Land is called “short cut” country as most of the trips across the country was done along the rivers rather than travelling across the plains between the rivers. There were three areas where no archaeological material was located during the survey:

- Between KP 261and 301, a distance of 40 kilometres east of the Wilton River and very few creek crossings.
- Between KP 361 and 399, a distance of 38 kilometres between the Goyder River and the Mitchell Ranges.
- Between KP 512 and 547, a distance of 35 kilometres between Boggy Creek and the Cato river. While in the western section near Boggy Creek the terrain consists of featureless plains, the section nearer the Cato River the pipeline makes several creek crossings.

Therefore there is more likelihood for locating archaeological material between Boggy Creek and the Cato River than for the other two areas.

6.5. Assessment of archaeological and heritage significance

6.5.1. Archaeological sites.

According to Sullivan and Bowdler (1984) archaeological significance means that a site or object has scientific, archaeological or research value, that is, it has the potential to assist current or future research into problems of human history or other areas of enquiry. The Australian ICOMOS Charter for the Conservation of Places of Cultural Significance, otherwise known as the Burra Charter (Maquis-Kyle and Walker 1992:73) states that the

scientific value or research potential of a place depends upon the importance of the data involved, on its rarity, quality or representativeness, and on the degree to which the place or object may contribute to further substantial information.

Therefore the significance of a site is firstly related to the intactness or integrity of a site, and the state of preservation of the archaeological material. Secondly, if the site has stratigraphic reliability then it may be possible to use the cultural material for dating which will provide a chronology extending back into the past. Thirdly, the representativeness of a site is important either because a site is unusual or because the site has research potential when taken in conjunction with other sites.

In order to effectively manage archaeological resources sites recorded during the 2003 and 2004 surveys have been ranked according to their perceived significance. It must be stressed that these assessments should be regarded as provisional and may be subject to change after additional archaeological surveys have been carried out along the pipeline route.

While there were 21 historic and archaeological sites located during the survey only eleven of these sites are listed in Table 6.19 as they are located less than 200 metres of the proposed pipeline route and have a higher potential to be disturbed during construction of the pipeline. The detailed justification for the significance assessments of each site is found in Appendix 4.

Table 6-19: Summary of the significance of sites within 200 metres of the alignment.

Site No.	Significance	Comments
5	Moderate to high	Rare site with unusual combination of archaeological material.
20	Moderate	Artefact scatter with a diversity of artefacts of different raw materials
21	Low	Small artefact scatter low diversity and density of artefacts
22	Low	Small artefact scatter low diversity and density of artefacts
23	Low to moderate	Historic railway line, no significant remains at this location
24	Low	Small artefact scatter low diversity and density of artefacts
26	Moderate	Low density of artefact scatter but with a variety of raw material and artefact types
27	Moderate	Low density of artefact scatter but with a variety of raw material and artefact types
28	Low	Artefact scatter majority of artefacts located in creek bed, highly disturbed
29	Low	Low density artefacts scatter with a diversity of stone artefacts
31	Moderate to high	Intact site with diversity of artefacts manufactured from the same raw material

A number of sites are considered to hold low levels of archaeological significance because their research potential has been greatly compromised by disturbance due to erosion. In addition the density of artefacts and diversity of artefact types in these sites is low. Several of the stone artefact scatters with low archaeological significance contained only 10 – 12 artefacts.

Sites that are likely to be valuable in answering archaeological research questions are given moderate archaeological significance. These sites contain a higher density and diversity of archaeological material and are either particularly well preserved or represent a type of archaeological site that is uncommon in the general area. As there were so very few sites located in certain areas along the pipeline route, any site located in these areas could be classed as significant on rarity alone. Nonetheless the small artefact scatters with a low density and diversity of artefacts were assessed as having low archaeological significance as their research potential would be minimal and most of the information that can be recorded from these sites has already occurred. Larger sites with a higher density of

artefacts were given a moderate significance as these sites have the potential for answering questions regarding settlement patterns, the manufacture of stone artefacts and subsistence strategies in regions where there has been very little previous archaeological research.

There were no sites considered to have a high archaeological value and there were two sites assessed as having moderate to high significance. Site 5 consists of an edge ground axe and ochre pieces scattered around a small water soak on the side of a hill. This site is distinctive because of its unusual combination of stone artefacts and has been assessed on its rarity alone. The other is Site 31 which is relatively intact and has excavation potential for further research.

6.5.2 Historic sites

There are further criteria that can be considered when assessing the significance of historic sites and these are:

- A site is associated with events, developments or cultural phases in human occupation.
- A site demonstrates a way of life, no longer practiced or in danger of being lost or of exceptional interest.
- A site provides information contributing to a broader understanding of the history of human occupation.

It should be noted that historical significance will not necessarily be equated with archaeological significance, as some events may leave nothing in the archaeological record.

The North Australian Railway, Site 23 is the only historic site located within 200 metres of the proposed pipeline route. While the North Australian railway line played a significant role in opening up the Top End the section of the line that crosses the pipeline route has been assessed as having low historic significance as the remains consist only of the gravel base on which the line was built.

6.5.3. Background scatters

All background scatters located during the surveys have been assessed as having low archaeological significance. The methods used during the survey ensured that the artefact's location, dimensions, type and raw material were documented. Consequently the isolated artefacts have little potential for contributing to further knowledge.

7.0. POTENTIAL IMPACTS AND RECOMMENDATIONS

This section describes the potential impacts that may be produced by the project on archaeological and historic sites and objects during the design, construction and operational phases of the project. Recommendations are then suggested that will help in the protection of archaeological and historical material, the mitigation of any impacts and to ensure that no offences are committed under *NT Heritage Act 2012.*

Of the 21 archaeological or historic sites identified during the survey fourteen are situated within one kilometre of the proposed pipeline alignment. While sites located over one hundred and fifty metres from the alignment are highly unlikely to be affected by the development, there are uncertainties in evaluating any impacts to sites within one hundred and fifty metres of the alignment. The difficulties arise when trying to precisely locate the archaeological sites and objects relative to a thirty metre wide corridor on a 1:100,000 map sheet from co-ordinates obtained from a hand held GPS.

Consequently when assessing the project's impacts upon the sites it was decided at this stage of the study to standardise the evaluation by predicting that any sites located within 50 metres of the alignment will most likely be destroyed, within 100 metres of the pipeline alignment will have a high probability of being disturbed and sites located between 100 and 150 metres from the pipeline may be at risk of being disturbed.

7.1. Design phase

7.1.1. Impacts

There were several instances when the proposed pipeline alignment was moved to avoid archaeological sites. If the pipeline route was in the vicinity of concentrations of background scatters and small artefact scatters eroding out of creek banks, the route was moved several hundred metres away to avoid the archaeological material.

After the fieldwork was completed and the alignment and sites were mapped, the location of some sites was much closer to the pipeline than when assessed in the field. Consequently there are currently nine sites located within 100 metres of the centre line of the alignment. The possible impacts upon these sites are listed in Table 7.1:

Table 7-1: Summary of impacts to sites within 100m of alignment

KP	Site No.	Significance	Metres from centre line	Impact
7	20	Moderate	50	Likely to be disturbed
14	21	Low	60	Likely to be disturbed
18	22	Low	80	Likely to be disturbed
26	23	Low to moderate	0	Will be disturbed
257	29	Low	50	None
302	27	Moderate	60	Likely to be disturbed
302	28	Low	20	Likely to be disturbed
321	5	Moderate to high	60	Likely to be disturbed
487	24	Low	60	Likely to be disturbed

As the pipeline cannot avoid crossing Site 23, the remains of the North Australian Railway line, at least 30 metres of the line will be destroyed. As Site 29 is located half way up a very steep hill and the pipeline runs along the base of the hill, this site will not be disturbed.

There are currently five sites located between 100 and 1000 metres from the centre of the pipeline alignment that have a lower risk of being disturbed during the construction activities. These sites are shown in Table 7.1.

Table 7-2: Sites less than 1km away not expected to be impacted by the pipeline alignment

KP	Site No.	Significance	Metres from centre line	Impact
372	25	Moderate to high	260	None
543	6	High	350	None
570	31	Moderate to high	180	None
576	30	Moderate to high	200	None
642	26	Moderate	140	Low risk

Twenty six of the fifty four background scatters identified during the survey are located within 150 metres of the proposed centre line of the alignment and may be either disturbed or destroyed during the construction activities.

There are still two areas in central Arnhem Land along the pipeline route that have not been investigated and where the pipeline route may disturb unidentified sites. The areas consist of approximately thirty kilometres northwest of the Mitchell Ranges and approximately 15 kilometres of the route between Annie Creek and the Goyder River. There is a high potential for the presence of archaeological sites in these both these areas. The first lies in an area where there may be rock outcrops used as a source of raw material for the manufacture of stone artefacts, and between the Goyder and Annie Creek there may be artefact scatters near the several permanent sources of fresh water in the area.

7.1.2. Recommendations

As noted above there are nine sites that may be destroyed during the construction phase if the pipeline alignment is not changed. However as five of these sites, Site 21, 22, 24, 28 and 29 have a low archaeological significance, it would be unwarranted to realign the pipeline to avoid these sites.
Table 7.2 summarises the recommendations for the protection of sites in the design stage.

Table 7-3: Summary of recommendations for site protection

KP	Site No.	Metres from centre line	Significance	Design Stage Recommendations
7	20	50	Moderate	Realign pipeline if possible
14	21	30	Low	Realignment not necessary
18	22	80	Low	Realignment not necessary
26	23	0	Low to moderate	Realignment not necessary
257	29	50	Low	Realignment not necessary
302	27	60	Moderate	Further realignment not necessary
302	28	20	Low	Realignment not necessary
321	5	60	Moderate to high	Further realignment not necessary
487	24	60	Low	Realignment not necessary

The background scatters located in this survey have also been deemed to have low archaeological significance and therefore there is no need to realign the pipeline to avoid these areas.

This leaves two sites, Site 20 and Site 23 with moderate or low to moderate significance located within 50 metres of the centre line of the alignment and two sites, Site 5 and Site 27 with moderate or moderate to high significance located less than 100 metres from the centre line that may be disturbed. Therefore it is recommended that planned measures to protect the sites be implemented, as described below.

7.2. Construction phase

7.2.1. Impacts

As the exact location of the pipeline route will not be identified until the route is surveyed on the ground, there still may be unidentified archaeological sites and objects that will be disturbed by the construction of the pipeline. The amount of impact on the identified archaeological sites also cannot be identified until the exact route has been located.

During the initial clearing of the pipeline alignment and during the construction phase there is a possibility that there may also be disturbances to sub-surface archaeological materials such as human skeletal remains, stone artefacts, shell middens and the remains of hearths.

7.2.2. Recommendations

The specific recommendations for any mitigation actions that may be required at each site cannot be made until the actual location of the sites and the thirty metre wide pipeline alignment is confirmed on the ground. The general recommendations for the protection and mitigation of archaeological sites that will be disturbed or destroyed by the construction of the pipeline will be as follows:

No further action is required at sites and / or objects of low archaeological significance. However as these sites are still protected under the *NT Heritage Act 2011*, consent to disturb the sites must be sought from the Minister for Lands, Planning and the Environment. Consequently there will be five sites, Site 21, 22, 24, 28 and 29 and thirty four background scatters of low archaeological significance that may be either destroyed or damaged.

Sites with moderate to high archaeological significance, Sites 5, 20, 26 and 27, will need various levels of protective actions, including temporary fencing of the site during construction, the necessity to work within a narrowed corridor and or earth moving machinery to operate at a certain distance from the site. If it is not feasible to carry out the protective actions permission to disturb these sites must be obtained from the Minister for Lands, Planning and the Environment under the *NT Heritage Act 2011*. Before construction begins there will be recommendations for salvage procedures and these may include surface collections and / or excavations of archaeological material.

While there is an undertaking by the proponents to have all the pipeline alignment surveyed by an archaeologist when the surveyors are pegging the route, there are several long sections along the route (discussed in Section 6 above) where the potential for locating archaeological material is very low as the terrain consists of featureless plains and very few creek crossings or other landscape features (Table 7.3).

Table 7-4: Sections of the proposed pipeline route with a low potential for the presence of archaeological sites.

Region	KP-KP	Distance KM
A/Land	261-301	40
A/Land	361 - 399	38

Therefore it is suggested a complete survey along the above sections is not necessary at the time the surveyors are pegging the route.

It is possible to make several specific recommendations at this time and they are:

- Before any disturbance occurs to the areas along the pipeline it is recommended that that an archaeologist is present during the surveying and pegging of the pipeline

alignment to verify which sites will be destroyed or disturbed and to record previously unidentified archaeological material. The 2003 and 2004 surveys identified two areas between KP261-301 and 361-399 where there is a very low potential for the presence of archaeological material and where it is recommended that it is not necessary for an archaeologist to be present during the surveying and pegging project.

- Site 23, Northern Australian Railway.
  As the pipeline will cross over the remains of the old railway line processes should be set up to limit the area to be destroyed. It is recommended that the area to be disturbed is minimised and that the boundary of the pipeline alignment is appropriately fenced. The area outside the fence line should be delineated as a "no go" area with no pedestrian or vehicular movement, heavy machinery, drilling or grading occurring outside this fenced area.
- Background Scatters Nos. 11, 12, 15, 16, 18, 38, 39, 40, 41- 43, 45-47, 49, 50, 54, 55, 58, 59, 61-64, 79, 83.
  Twenty two background scatters are located within 100 metres of the centre of the pipeline alignment and may be destroyed or damaged during the construction of the pipeline .As these sites have been deemed to have low archaeological significance it is recommended that no further mitigative action is needed and a permit to disturb these isolated artefacts should be sought by the proponent from the Heritage Branch, Lands, Planning and the Environment, as directed by the *NT Heritage Act, 2011*.
- Subsurface archaeological material
  As it is anticipated that there will be an archaeologist present during most of the pegging of the pipeline route, decisions can be made in the field as to the correct procedures for the protection of sub-surface archaeological material during this period. However during the construction stage it is recommended that a response mechanism is set up to ensure that any archaeological material is not disturbed and is protected. This response should include the cessation of work around the archaeological material, and obtaining advice from the Heritage Branch, Department of Lands, Planning and the Environment, as directed by the *NT Heritage Act, 2011.*

7.3. Operational phase

During this stage the main concern is for the on-going protection of the all sites in the vicinity of the pipeline alignment. The stability of some of the sites would be particularly vulnerable to visitation therefore it is recommended that the location of all archaeological material is not made readily available to employees who will be working in the field.

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APPENDIX 1

Summary of archaeological and historic sites located during the 2003 and 2004 surveys

Site	Region	Lat	Long	Zone	Easting	Northing	Map sheet	Type	Environment	From pipeline (m)	Kilometre point	Landsystem	Year
1	A/Land	-13.9361	134.2698	53	421122	8459215	Marumba	Stone arrangement	Creek	12k	Mainoru by-pass	Emmerugga	2003
2	A/Land	-13.9082	134.4251	53	437891	8462346	Marumba	Stone artefact scatter	Flood plain	22k	Mainoru by-pass	McArthur	2003
3	A/Land	-13.8979	134.4836	53	444203	8463504	Marumba	Stone artefact scatter	Hill	24k	Mainoru by-pass	Siegal	2003
4	A/Land	-13.7543	134.5916	53	455853	8479412	Nymbilli	Stone artefact scatter	Billabong	21k	Mainoru by-pass	Emmerugga	2003
5	A/Land	-13.3345	134.8054	53	478926	8525861	Fleming	Stone artefact scatter	Hill	30	321	Klatt	2003
6	Roper	-14.0629	134.021	53	394300	8445100	Throsby	Skeletal remains	Hill	350	203	Cliffdale	2003
7	Roper	-14.17308	133.8142	53	372033	8432807	Flying Fox	Policeman's Yard	Plain	6000	175	McArthur	2003
20	Tipp	-14.6191	132.3962	53	219497	8382191	Manbulloo	Stone artefact scatter	Creek	50	7	Kimbya	2003
21	Tipp	-14.6231	132.4573	53	226091	8381820	Manbulloo	Stone artefact scatter	Creek	30	14	Wallingin	2003
22	Tipp	-14.6191	132.4923	53	229852	8382305	Manbulloo	Stone artefact scatter	Creek	80	18	Wallingin	2003
23	Tipp	-14.6111	132.5749	53	238760	8383285	Manbulloo	North Australian Railway	Plain	0	26	Blain	2003
24	A/Land	-12.7031	136.0716	53	616351	8595460	Durabudboi	Stone artefact scatter	Creek	60	487	Keating	2003
25	Roper	-14.6048	132.6253	53	244176	8384036	Maranboy	O'land Telegraph Pole	Plain	260	32	Woggoman	2003
26	A/Land	-13.4441	134.6677	53	464023	8513730	Annie Creek	Stone artefact scatter	Creek	140	302	Flatwood	2003
27	A/Land	-14.4459	134.6680	53	464217	8513518	Annie Creek	Stone artefact scatter	Creek	60	302	Flatwood	2003
28	A/Land	-13.4462	134.6671	53	464021	8513490	Annie Creek	Stone artefact scatter	Billabong	20	302	Flatwood	2004
29	A/Land	-13.7124	134.3619	53	431008	8483982	Marumba	Stone artefact scatter	Hill	50	257	Favenc	2004
30	Roper	-13.84025	134.2201	53	415716	8469775	Marumba	Stone arrangement	Outcrop	200	236	Flying Fox	2004
31	Roper	-13.876	134.1794	53	411326	8465836	Marumba	Stone artefact scatter	Creek	180	230	Lindsay / Coolibah	2004
32	Roper	-13.876	134.1657	53	409852	8465830	Marumba	Stone artefact scatter	Creek	1050	230	Lindsay / Coolibah	2004
33	Roper	-14.4363	133.5348	53	342068	8403510	Flying Fox	Marked Tree	Creek	1230	135	McArthur	2004

APPENDIX 2

Details of background scatters

No.	Zone	Easting	Northing	Lat	Long	Map sheet	Vis. %	Transect (m)	Environment	M.s from p/line	Kilometre Point	Region	Land System	Find	Type	Material	Dimensions (mm)
1	53	427868	8460653	-13.9233	134.3323	Marumba 5770	50	1000	rocky rise	15.3km	Mainoru by-pass	A / Land	Wulkulyi	2	flake	quartzite	110 x 90 x 12
															flake	sandstone	21 x 28 x 6
2	53	430239	8460223	-13.9273	134.3542	Marumba 5770	30	800	plain	17.3km	Mainoru by-pass	A / Land	Emmurugga	1	flake	mudstone	35 x 38 x 12
3	53	434572	8461923	-13.9120	134.3944	Marumba 5770	40	1200	hill	19.3km	Mainoru by-pass	A / Land	Favenc	1	flake	chert	36 x 36 x 20
4	53	435344	8461893	-13.9123	134.4015	Marumba 5770	25	600	near flood plain	19.5km	Mainoru by-pass	A / Land	Favenc	1	flake	dolerite	30 x 40 x 15
5	53	450625	8471887	-13.8222	134.5431	Nymbilli 5870	20	600	creek	22.5km	Mainoru by-pass	A / Land	Emmurugga	2	flake	siltstone	95 x 40 x 20
6	53	448656	8471107	-13.8292	134.5249	Nymbilli 5870	95	600	plain	22km	Mainoru by-pass	A / Land	Favenc	1	flake	mudstone	52 x 38 x 24
7	53	455855	8479487	-13.7536	134.5916	Nymbilli 5870	100	800	creek	20km	Mainoru by-pass	A / Land	Emmurugga	1	retouched flake	mudstone	35 x 28 x 8
8	53	457630	8483262	-13.7195	134.6081	Nymbilli 5870	80	600	creek	18.4km	Mainoru by-pass	A / Land	Emmurugga	1	flake	dolerite	45 x 32 x 6
9	53	497437	8559829	-13.0274	134.9764	Annie Creek 5871	95	1000	river	15.3km	Mainoru by-pass	A / Land	Levee	1	flake	chert	29 x 15 x 4
10	53	494635	8549726	-13.1188	134.9505	Annie Creek 5871	25	400	river	9km	Mainoru by-pass	A / Land	Flatwood	3	flake	siltstone	30 x 28 x 2
															flake	chert	25 x 19 x 3
															flake	chert	12 x 22 x 8
11	53	487778	8532618	-13.2735	134.8872	Annie Creek 5871	70	800	hill	30	332	A / Land	Mululu	4	flake	chert	36 x 25 x 3

No.	Zone	Easting	Northing	Lat	Long	Map sheet	Vis. %	Transect (m)	Environment	M.s from p/line	Kilometre Point	Region	Land System	Find	Type	Material	Dimensions (mm)
															flake	silcrete	24 x 30 x 11
															flake	fgs	32 x 23 x 7
															core, broken	chert	22 x 28 x 16
12	53	484260	8529841	-13.2986	134.8547	Annie Creek 5871	45	500	billabong	90	328	A / Land	Mululu	6	flake	silcrete	26 x 20 xx 4
															unifacial point	silcrete	30 x 20 x 4
															grinding stone	sandstone	133 x 110 x 30
															flake with polish	dolerite	25 x 20 x 5
															flake	silcrete	27 x 27 x 5
															flake	silcrete	30 x15 x 4
13	53	376555	8435050	-14.1530	133.8562	Flying Fox 5669	55	200	creek	3.8km	183	Roper River	Strangeways	2	blade flake	siltstone	53 x 32 x 9
															retouched flake	siltstone	93 x 52 x 15
14	53	372829	8433538	-14.1665	133.8216	Flying Fox 5669	80	200	creek	5.5km	180	Roper River	McArthur	1	flake core	sandstone	98 x 69 x 20
15	53	341157	8424254	-14.2488	133.5277	Flying Fox 5669	10	600	creek	18km	148	Roper River		1	flake	quartzite	41 x 41 x 11
16	53	324850	8395750	-14.5054	133.3747	Mataranka 5568	95	400	creek	150	115	Roper River	Weston	3	retouched flake	siltstone	35 x 24 x 17
															flake	chert	42 x 24 x 9
															retouched flake	chert	46 x 20 x 9
17	53	321831	8394607	-14.5156	133.3466	Mataranka 5568	95	1000	hill	150	112	Roper River	Flying Fox	2	retouched flake	fsg	65 x 38 x 15
															flake	fsg	28 x 30 x 9
18	53	314057	8393872	-14.5217	133.2744	Mataranka 5568	50	300	creek	40	104	Roper River	McArthur	1	flake	sandstone	75 x 40 x 15

No.	Zone	Easting	Northing	Lat	Long	Map sheet	Vis. %	Transect (m)	Environment	M.s from p/line	Kilometre Point	Region	Land System	Find	Type	Material	Dimensions (mm)
19	53	287000	8386200	-14.5891	133.0228	Mataranka 5568	95	600	plain	215	75	Roper River	Nutwood	1	flake	sandstone	52 x 62 x 16
20a	53	270488	8385245	-14.5963	132.8695	Maranboy 5468	100	900	plain	245	58	Roper River	Nutwood	2	core	chert	55 x 20 x 28
															flake	chert	65 x 50 x 22
20b	53	270100	8385245	-14.5963	132.8659	Maranboy	50	1200	plain	245	58	Roper	Downs	1	flake	chert	40 x 25 x 11
															flake	chert	
38	53	225043	8381969	-14.6217	132.4476	Manbullo	98	240	creek	40	13	Tipperary	Kimbyan	3	flake	quartz?	19
															flake	chert	60
															flake	chert	14
39	53	225990	8381800	-14.6233	132.4564	Manbullo 5368	90	400	creek	66	14	Tipperary	Woggomon	4	grinding stone	sandstone	60 x 45 x 38
															flake	chert	22
															flake	chert	19
															flaked piece	chert	12
40	53	242296	8383535	-14.6092	132.6078	Maranboy	20	800	river	150	30	Roper	Woggoman	6	flake	chert	32 x 42
															flake	chert	38 x 26
															flake	chert	27 x 40
															flake	silcrete	48 x 32
															flake	chert	38 x 23
															flake	chert	38 x 26
41	53	247405	8383943	-14.6060	132.6553	Maranboy	40	800	creek	30	35	Roper	Yungman	2	core	chert	60 x 65 x 32
															flake	chert	
42	53	584474	8597083	-12.6894	135.7780	Mitchell Ra. 6072	35	640	plain	65	455	A / Land	Queue	1	grinding stone	sandstone	45 x 37 x 36
43	53	589604	8596802	-12.6918	135.8253	Mitchell Ra.	85	800	plain	75	540	A / Land	Queue	1	g. stone	sandstone	25 x 14 x 17
44	53	608194	8596074	-12.6978	135.9965	Mitchell Ra.	90	600	gentle slope	190	480	A / Land	Kay	1	flake	siltstone	22 x 13 x 3
45	53	618540	859548	-12.7028	136.0918	Durabudboi	85	400	plain	60	400	A / Land	Keating	1	bifacial	fgs	16 x 11 x 3
46	53	639370	8600269	-12.6587	136.2834	Durabudboi	5	1100	creek	30	421	A / Land	Keating	1	flake	silcrete	25 x 12 x 2
47	53	688661	8636300	-12.3304	136.7350	Gove 6273	85	880	hill	65	577	A / Land	Giddy	1	flaked	quartz	13 x 14 x 5
48	53	388148	8457396	-13.9515	133.9645	Mainoru 5670	40	400	creek	15km	205	A / Land		2	flake	chert	12 x 7 x 2
															flake	chert	23 x 11 x 5
49	53	464050	8313684	-13.4460	134.6678	Annie Creek	75	900	creek	25	302	A / Land	Flatwood	5	flake	chert	31 x 21 x 6
															flake	chert	37 x 21 x 6
															flake	chert	39 x 21 x 7
															flake	chert	32 x 18 x 5
															core	chert	97 x 82 x 29

No.	Zone	Easting	Northing	Lat	Long	Map sheet	Vis. %	Transect (m)	Environment	M.s from p/line	Kilometre Point	Region	Land System	Find	Type	Material	Dimensions (mm)
50	53	464037	8513678	-13.4398	134.6733	Annie Creek	75	80	creek	95	303	A / Land	Flatwood	1	flake	silcrete	18 x 30 x 4
51	53	433226	8486167	-13.6936	134.3825	Marumba	15	1350	river	170	260	A / Land	McArthur	1	flake	chert	14 x 8 x 4
52	53	422281	8475531	-13.7895	134.2810	Marumba	80	160	creek	450	245	A / Land	Flying Fox	1	flake	chert	24 x 22 x 5
53	53	417764	8471691	-13.8241	134.2391	Marumba	60	400	creek	250	239	Roper	Lindsay/	1	axe	dolerite	96 x 74 x 38
54	53	411088	8465799	-13.8765	134.1768	Marumba	10	340	creek	10	230	Roper	Lindsay/	7	flake	dolerite	30 x 40 x 8
															retouched flake	dolerite	50 x 27 x 8
															flake	dolerite	14 x 10 x 2
															core	dolerite	88 x 66 x 32
															flake	dolerite	55 x 50 x 8
															flake	dolerite	52 x 35 x 8
															flake	dolerite	50 x 32 x 8
55	53	410459	8464898	-13.8853	134.1713	Marumba 5770	5	400	creek	15	229	Roper	Cliffdale	3	retouched flake	chert	80 x 20
															flake	chert	60 x 40
															core	chert	40 x 40
56	53	410763	8464382	-13.8878	134.1678	Marumba	40	800	creek	180	228	Roper	Cliffdale	3	flake	chert	20 x 19 x 4
															flake	chert	30 x 14 c 8
															flake	chert	34 x 18 x 6
57	53	407347	8458467	-13.9425	134.1423	Marumba 5770	90	600	creek	710	222	Roper	Strangeways	5	retouched flake	dolerite	45 x 42 x 8
															flake	siltstone	64 x 32 x 12
															flake	siltstone	41 x 51 x 20
															flake	siltstone	61 x 62 x 32
															retouched flake	dolerite	28 x 38 x 8
58	53	383931	8436828	-14.1376	133.9246	Flying Fox 5669	5	700	creek	85	189	Roper	McArthur	4	bifacial point butt	quartzite	31 x 21 x 8
															flake	chert	24 x 18 x 10
															bifacial point butt	quartzite	22 x 28 x 8
															retouched flake	siltstone	41 x 50 x 10
59	53	383648	8436829	-14.1381	133.9220	Flying Fox 5669	5	800	creek	75	189	Roper	McArthur	1	flaked piece	chert	35 x 20
60	53	383216	8436761	-14.1387	133.9180	Flying Fox 5669	90	500	creek	310	189	Roper	McArthur	2	core	chert	60 x 40

No.	Zone	Easting	Northing	Lat	Long	Map sheet	Vis. %	Transect (m)	Environment	M.s from p/line	Kilometre Point	Region	Land System	Find	Type	Material	Dimensions (mm)
															flake	fgs	70 x 50
61	53	383216	8436761	-14.1841	133.8760	Flying Fox 5669	95	800	hill	90	182	Roper	Bukalar	2	flake	silcrete	32 x 21
															flaked	quartzite	32 x 31
62	53	371046	8424076	-14.2520	133.8048	Flying Fox 5669	70	800	plain	10	171	Roper	Suprise	3	retouched flake	quartzite	68 x 26 x 10
															flake	chert	18 x 12
															flake	chert	40 x 22
63	53	341140	8401323	-14.4558	133.5264	Flying Fox 5669	20	150	hill	20	133	Roper	Emmerugga	1	flake	fgs	48 x 30 x 6
64	53	339362	8400245	-14.4666	133.5096	Flying Fox 5669	50	400	creek	75	131	Roper	Emmerugga	1	flake	quartzite	42 x 48
79	53	667141	8622393	-12.4573	136.5379	Gove 6273	25	600	stoney slope	50	548	A / Land	Gove	1	flake	siltstone	45 x 32 x 4
80	53	574729	8597023	-12.6902	135.6883	Mitchell Ra. 6072	90	200	river	740	445	A / Land	Queue	7	bifacial point butt	quartzite	38 x 28 x 6
															flake	quartzite	29 x 21 x 5
															unifacial point tip	quartzite	28 x 22 x 8
															flaked	quartz	15 x 29 x 3
															flake	chert	34 x 25 x 5
															flake piece	dolerite	22 x 189 x 4
															flake	siltstone	40 x 32 x 2
81	53	571639	8597837	-12.6829	135.6598	Mitchell Ra. 6072	95	500	rocky hill	630	442	A / Land	Queue	1	core	quartz	41 x 44 x 19
82	53	588603	8605133	-12.6173	135.8158	Mitchell Ra. 6072	60	600	creek	8k	459	A / Land	Queue	1	flake	quartz	90 x 70 x 21
83	53	511328	8549178	-13.1234	135.1045	Fleming 5971	30	1200	river	10	361	A / Land	Levee	1	flake	quartzite	92 x 72 x 22

APPENDIX 3

Details of pedestrian transects, 2003 and 2004

Details of pedestrian transects, 2003

Transect	Region	L / System	Zone	Easting	Northing	Lat	Long	Av. Vis. %	Transect Length (m)	Sites	B.S	Terrain
1a	Roper	Favenc	53	399841	8450128	-14.0176	134.0725	95	600			floodplain
2a	Roper	Favenc	53	401428	8454855	-13.9749	134.0874	20	400			hill
2b	Roper	Cliffdale	53	409167	8457032	-13.9555	134.1591	5	400			floodplain
3a	Roper	Rsf	53	416560	8458450	-13.9429	134.2276	60	800			undulating
4a	Roper	Emmerugga	53	417973	8458678	-13.9409	134.2406	30	80			gully
5a	Roper		53	418831	8458840	-13.9395	134.2486	100	800			undulating
5b	Roper		53	419319	8458970	-13.9383	134.2531	10	100			creek
5c	Roper		53	419770	8458953	-13.9385	134.2573	95	550			creek
6a	A / Land	Emmerugga	53	421122	8459215	-13.9361	134.2698	100	1400	1		creek
7a	A / Land	Emmerugga	53	421988	8459444	-13.9341	134.2778	90	800			undulating
7b	A / Land	Emmerugga	53	423505	8459674	-13.9321	134.2919	50	800			creek
8a	A / Land	Emmerugga	53	425734	8460101	-13.9283	134.3125	80	400			creek
9a	A / Land	Emmerugga	53	427868	8460653	-13.9233	134.3323	50	1000		1	low hill
9b	A / Land	Wulkulyi	53	430239	8460223	-13.9273	134.3542	30	800		2	undulating
9c	A / Land	Emmerugga	53	432501	8461401	-13.9167	134.3752	30	400			creek
9d	A / Land	Favenc	53	434572	8461923	-13.9120	134.3944	40	1200		3	hill
10a	A / Land	Favenc	53	434550	8461983	-13.9115	134.3942	40	800			plain
11a	A / Land	Favenc	53	435345	8461886	-13.9124	134.4015	25	600		4	plain
12a	A / Land	Favenc	53	437853	8462317	-13.9085	134.4248	95	800	2		plain
13a	A / Land		53	441665	8462957	-13.9028	134.4600	60	800			ridge
14a	A / Land		53	439533	8462665	-13.9054	134.4403	70	800			creek/hill
14b	A / Land		53	439889	8462742	-13.9047	134.4436	95	800			gully
15a	A / Land		53	444203	8463504	-13.8979	134.4836	60	600	3		hill
16a	A / Land	Emmerugga	53	450625	8471887	-13.8222	134.5431	20	600		5	creek
16b	A / Land		53	449046	8471106	-13.8293	134.5285	92	400			creek

Transect	Region	L / System	Zone	Easting	Northing	Lat	Long	Av. Vis. %	Transect Length (m)	Sites	B.S	Terrain
17a	A / Land		53	448658	8477107	-13.7750	134.5250	95	600		6	undulating
18a	A / Land	Emmerugga	53	455900	8479500	-13.7535	134.5921	100	800	4	7	creek
19a	A / Land	Emmerugga	53	457630	8483262	-13.7195	134.6081	80	600		8	creek
20a	A / Land		53	460344	8488776	-13.6697	134.6333	60	800			slope
20b	A / Land		53	461206	8490140	-13.6573	134.6413	60	800			creek
20c	A / Land		53	461162	8491695	-13.6433	134.6409	60	800			undulating
21a	A / Land		53	462143	8493821	-13.6241	134.6500	60	400			undulating
21b	A / Land	Queue	53	464688	8497606	-13.5899	134.6736	50	600			plain
21c	A / Land	Queue	53	466682	8502421	-13.5464	134.6921	65	400			undulating
21d	A / Land	Queue	53	467594	8504583	-13.5268	134.7005	80	400			creek
21e	A / Land	Queue	53	469323	8508105	-13.4950	134.7165	70	400			creek
21f	A / Land	Levee	53	497466	8559843	-13.0273	134.9766	95	1200		9	river
22a	A / Land	Flatwood	53	494608	8549716	-13.1189	134.9503	25	400		10	creek
22b	A / Land	Flatwood	53	494842	8548771	-13.1274	134.9524	25	400			creek
22c	A / Land	Flatwood	53	496668	8544329	-13.1676	134.9693	20	600			billabong
23a	A / Land	Flatwood	53	497389	8540349	-13.2036	134.9759	20	500			creek
23b	A / Land	Flatwood	53	493790	8537561	-13.2288	134.9427	65	900			plain
23c	A / Land	Mululu	53	490468	8534688	-13.2548	134.9120	5	800			plain
24a	A / Land	Mululu	53	487778	8532618	-13.2735	134.8872	70	800		11	hill
24b	A / Land	Mululu	53	484260	8529864	-13.2984	134.8547	45	500		12	billabong
24c	A / Land	Mululu	53	480717	8527290	-13.3216	134.8219	10	600			creek
24d	A / Land	Mululu	53	479010	8525951	-13.3337	134.8062	80	500	5		hill slope/spring
24e	A / Land	Flatwood	53	476691	8523183	-13.3587	134.7847	10	800			creek
25a	A / Land	Queue	53	475870	8521628	-13.3728	134.7771	10	800			creek
25b	A / Land	Queue	53	475111	8520154	-13.3861	134.7701	10	400			creek
25c	A / Land	Mululu	53	473603	8516359	-13.4204	134.7562	20	400			plain
25d	A / Land	Queue	53	473051	8514343	-13.4386	134.7510	20	400			plain
25e	A / Land	Queue	53	471966	8513530	-13.4460	134.7410	20	400			plain
26a	Roper	Cliffdale	53	394034	8444592	-14.0675	134.0185	5	320	6		hill
26b	Roper	Cliffdale	53	396584	8447602	-14.0403	134.0422	10	160			rocky plain
26c	Roper	McArthur	53	398737	8449161	-14.0263	134.0622	45	600			plain
27a	Roper	Strangeways	53	387763	8440983	-14.0998	133.9603	10	400			plain
27b	Roper	Strangeways	53	381176	8437211	-14.1337	133.8991	15	400			plain
27c	Roper	Strangeways	53	377234	8435312	-14.1507	133.8625	60	800			creek
27d	Roper	Strangeways	53	376555	8435050	-14.1530	133.8562	55	200		13	creek

Transect	Region	L / System	Zone	Easting	Northing	Lat	Long	Av. Vis. %	Transect Length (m)	Sites	B.S	Terrain
27e	Roper	Strangeways	53	374160	8434164	-14.1609	133.8340	80	200			hill
28a	Roper	Emmerugga	53	374136	8434182	-14.1608	133.8337	80	200			hill
28b	Roper	Emmerugga	53	372829	8433538	-14.1665	133.8216	80	200		14	plain
28c	Roper	McArthur	53	372033	8432870	-14.1725	133.8142	100	_	7		undulating
28d	Roper	Emmerugga	53	370927	8434102	-14.1613	133.8040	80	400			creek
28e	Roper	Emmerugga	53	371147	8433608	-14.1658	133.8060	10	400			ridge
29a	Roper	Suprise	53	367356	8427951	-14.2168	133.7706	100	900			b.s. plain
29b	Roper	Suprise	53	366304	8428266	-14.2139	133.7609	15	500			creek
30a	Roper	Suprise	53	368057	8457280	-13.9517	133.7785	5	600			plain
30b	Roper	Suprise	53	365118	8425700	-14.2370	133.7498	95	200			hill
30c	Roper	Bukular	53	364772	8425702	-14.2370	133.7466	75	600			ridge
31a	Roper	Munyi	53	358166	8420638	-14.2824	133.6851	100	600			hill
31b	Roper	Munyi	53	358828	8420968	-14.2795	133.6912	65	600			creek
31c	Roper	Cliffdale	53	353086	8416343	-14.3210	133.6378	35	400			rocky hills
32a	Roper	Patterson	53	349661	8413299	-14.3483	133.6058	65	400			creek
32b	Roper	Patterson	53	349658	8413298	-14.3483	133.6058	100	600			rocky slope
32c	Roper		53	349960	8411467	-14.3649	133.6085	60	800		15	creek
32d	Roper	McArthur	53	341471	8405693	-14.4166	133.5295	50	400			creek
32c	Roper	Emmerugga	53	340090	8405250	-14.4205	133.5166	80	200			creek
33a	Roper	Nutwood	53	339799	8403876	-14.4329	133.5139	95	400			undulating
33b	Roper	Langdon	53	334016	8399852	-14.4689	133.4600	95	600			plain
33c	Roper	Langdon	53	331960	8398900	-14.4774	133.4408	95	400			creek
34a	Roper	Langdon	53	331271	8398118	-14.4845	133.4344	95	900			plain/rise
34b	Roper	Weston	53	324857	8395723	-14.5057	133.3747	95	400		16	creek
34c	Roper	Flying Fox	53	322232	8394645	-14.5153	133.3503	95	1000		17	steep hill
34d	Roper	McArthur	53	314057	8393872	-14.5217	133.2744	55	300		18	river
35a	Roper	Siegal	53	306865	8393614	-14.5235	133.2077	30	600			plain
35b	Roper	Siegal	53	306869	8393550	-14.5241	133.2077	60	800			plain
35c	Roper	Frog	53	296483	8387456	-14.5784	133.1109	50	600			plain
35d	Roper	Frog	53	296117	8387488	-14.5781	133.1075	80	400			river
36a	Roper	Cliffdale	53	291599	8386188	-14.5895	133.0655	90	200			plain
36b	Roper	Nutwood	53	287000	8386200	-14.5891	133.0228	95	600		19	plain
36c	Roper	Ald?	53	284235	8386495	-14.5862	132.9972	90	600			plain
36d	Roper	Ald?	53	278470	8385981	-14.5903	132.9437	95	600			undulating

Transect	Region	L / System	Zone	Easting	Northing	Lat	Long	Av. Vis. %	Transect Length (m)	Sites	B.S	Terrain
36e	Roper	McArthur	53	273687	8385497	-14.5943	132.8992	90	800			billabong
37a	Roper	Downs	53	271358	8385331	-14.5956	132.8776	80	400			stoney plain
37b	Roper	Downs	53	270463	8385243	-14.5963	132.8693	100	900		20a & 20b	stoney plain
37c	Roper	Claravale	53	265674	8384991	-14.5982	132.8248	85	900			plain
37d	Roper	?	53	261342	8384740	-14.6001	132.7846	85	600			plain o'crops
37e	Roper	Claravale	53	261339	8384743	-14.6001	132.7846	5	300			plain
37f	Roper	Claravale	53	252374	8384285	-14.6034	132.7014	80	400			plain
61a	Tipp	Kimbyan	53	215592	8383169	-14.6099	132.3601	5	400			plain
61b	Tipp	Kimbyan	53	219497	8382191	-14.6191	132.3962	75	400	20		creek
62a	Tipp	Kimbyan	53	222338	8382012	-14.6210	132.4225	5	400			undulating
62b	Tipp	Kimbyan	53	225043	8381969	-14.6217	132.4476	98	240		38	creek
62c	Tipp	Kimbyan	53	225990	8381800	-14.6233	132.4564	90	400		39	slope
62d	Tipp	Wallingin	53	226091	8381820	-14.6231	132.4573	95	300	21		creek
62e	Tipp	Wallingin	53	226109	8352079	-14.8918	132.4544	5	260			undulating
62f	Tipp	Wallingin	53	228908	8382297	-14.6191	132.4835	5	100			plain
62g	Tipp	Wallingin	53	229552	8382305	-14.6191	132.4895	90	600	22		creek
63a	Tipp	Blain	53	234189	8382724	-14.6158	132.5325	5	560			plain
63b	Tipp	Blain	53	238145	8383132	-14.6125	132.5693	15	200			plain
63c	Tipp	Blain	53	238760	8383285	-14.6112	132.5750	15	400	23		plain
64a	Roper	Blain	53	239065	8383432	-14.6099	132.5778	50	240			undulating
64b	Roper	Woggoman	53	244177	8383628	-14.6086	132.6253	50	800			creek
65a	Roper	Woggoman	53	244235	8383028	-14.6140	132.6258	20	800		40	creek
65b	Roper	Yungman	53	247332	8383938	-14.6061	132.6546	40	800		41	creek
66a	A / Land	Queue	53	574926	8597331	-12.6874	135.6901	85	800			creek
66b	A / Land	Keating	53	575626	8597569	-12.6853	135.6965	5	400			billabong
66c	A / Land	Queue	53	579386	8597435	-12.6864	135.7311	40	400			undulating
66d	A / Land	Queue	53	584474	8597083	-12.6894	135.7780	35	640		42	undulating
67a	A / Land	Queue	53	589604	8596802	-12.6918	135.8253	85	800		43	creek
67b	A / Land	Keefer Hut	53	593389	8596711	-12.6925	135.8601	90	60			creek

Transect	Region	L / System	Zone	Easting	Northing	Lat	Long	Av. Vis. %	Transect Length (m)	Sites	B.S	Terrain
67c	A / Land	Kay	53	594280	8596715	-12.6925	135.8683	80	800			undulating
67d	A / Land	Effington	53	596626	8596439	-12.6949	135.8899	80	500			plain
67e	A / Land	Kay	53	598821	8596419	-12.6950	135.9102	85	700			plain
67f	A / Land	Kay	53	599617	8596062	-12.6982	135.9175	80	360			plain
67g	A / Land	Kay	53	601161	8596235	-12.6966	135.9317	80	200			plain
67h	A / Land	Kay	53	603400	8596128	-12.6975	135.9523	85	960			undulating
67i	A / Land	Keating	53	603583	8596067	-12.6980	135.9540	90	120			creek
67j	A / Land	Goromuru	53	608333	8596076	-12.6978	135.9978	90	600		44	hill
68a	A / Land	Kay	53	614351	8595629	-12.7016	136.0532	70	1100			undulating
68b	A / Land	Keating	53	616350	8595460	-12.7031	136.0716	90	200	24		creek
68c	A / Land	Keating	53	618540	8595483	-12.7028	136.0918	85	400		45	undulating
68d	A / Land	Keating	53	618880	8595231	-12.7051	136.0949	70	200			creek
68e	A / Land	Goromuru	53	621739	8595204	-12.7052	136.1213	20	470			creek
68f	A / Land	Keating	53	622573	8595260	-12.7046	136.1289	20	800			creek
68g	A / Land	Keating	53	625766	8595020	-12.7067	136.1583	10	220			plain
68h	A / Land	Goromuru	53	626939	8595032	-12.7065	136.1691	40	600			plain
68i	A / Land	Goromuru	53	627785	8594927	-12.7075	136.1769	5	200			billabong
68j	A / Land	Keating	53	628859	8593359	-12.7216	136.1869	5	700			creek
69a	A / Land	Keating	53	628709	8593358	-12.7216	136.1855	5	400			creek
69b	A / Land	Keating	53	629113	8594593	-12.7104	136.1892	15	400			creek
69c	A / Land	Keating	53	631481	8594792	-12.7085	136.2110	30	800			undulating
69d	A / Land	Keating	53	631492	8594919	-12.7074	136.2111	5	400			undul/swampy
69e	A / Land	Kay	53	634885	8597427	-12.6846	136.2422	30	960			creek
69f	A / Land	Efffington	53	639015	8600815	-12.6537	136.2801	5	120			plain
69g	A / Land	Efffington	53	639333	8600166	-12.6596	136.2830	5	1100		46	creek
69h	A / Land	Efffington	53	639386	8601192	-12.6503	136.2835	5	3600			creek
70a	A / Land	Efffington	53	685616	8633141	-12.3591	136.7072	5	360			undulating
70b	A / Land	Klatt	53	687387	8634924	-12.3429	136.7233	30	1000			hill
70c	A / Land	Giddy	53	688667	8636302	-12.3304	136.7350	90	880		47	ridge
70d	A / Land	Giddy	53	699475	8636998	-12.3234	136.8343	90	200			plain

Transect	Region	L / System	Zone	Easting	Northing	Lat	Long	Av. Vis. %	Transect Length (m)	Sites	B.S	Terrain
70e	A / Land	Giddy	53	691645	8639225	-12.3038	136.7622	5	1200			creek
70f	A / Land	Giddy	53	691929	8639539	-12.3009	136.7648	5	800			creek

Details of pedestrian transects 2004

Transect	Region	L / System	Lat	Long	Zone	Easting	Northing	Av. Vis. %	Trans.length (m)	Sites	B.S	Terrain
1	A / Land	Mululu	-13.4361	134.5716	53	453626	8514597	9	800			undulating
2	A / Land	Mululu	-13.4617	134.5849	53	455070	8511768	7	700			undulating
3a	A / Land	Flatwood	-13.4844	134.6093	53	457715	8509262	1	500			undulating
3b	A / Land	Flatwood	-13.4876	134.617	53	458549	8508909	1	400			creek
4a	A / Land	Mululu	-13.4706	134.6387	53	460895	8510793	7	800			plain
4b	A / Land	Mululu	-13.4555	134.6579	53	462971	8512466	7	600			plain
4c	A / Land	Flatwood		134.6678	53	464041	8513518	7	900	26,	4	creek
4d	A / Land	Flatwood	-13.4398	134.6733	53	464635	8514204	7	80		5	plain
4e	A / Land	Mululu	-13.4276	134.6888	53	466312	8515556	4	800			plain
4f	A / Land	Mululu	-13.4192	134.6984	53	467350	8516486	4	900			plain
4g	A / Land	Mululu	-13.4153	134.703	53	467847	8516918	4	300			plain
4h	A / Land	Mululu	-13.4070	134.713	53	468929	8517837	6	660			creek
4i	A / Land	Mululu	-13.3959	134.7261	53	470346	8519066	6	550			plain
4j	A / Land	Mululu	-13.3877	134.7361	53	471427	8519974	1	700			b/s/plain
4k	A / Land	Mululu	-13.4028	134.7165	53	469307	8518302	6	200			plain
5a	A / Land	Queue	-13.4555	134.6799	53	465352	8512469	6	800			plain/ridges
5b	A / Land	Queue	-13.4875	134.6187	53	458733	8508920	5	250			swamp
5c	A / Land	Queue	-13.4862	134.6174	53	458592	8509064	1	200			creek
5d	A / Land	Flatwood	-13.4975	134.6073	53	457501	8507813	8	1060			plain
5e	A / Land	Queue	-13.5242	134.5769	53	454216	8504854	3	1100			billabong
5f	A / Land	Horse Creek	-13.5369	134.562	53	452606	8503447	5	140			creek
5g	A / Land	Emmerugga	-13.5504	134.5462	53	450900	8501951	2	1150			creek
5h	A / Land	Emmerugga	-13.5568	134.5385	53	450068	8501241	2	600			creek

Transect	Region	L / System	Lat	Long	Zone	Easting	Northing	Av. Vis. %	Trans.length (m)	Sites	B.S	Terrain
5i	A / Land	Horse Creek	-13.5742	134.519	53	447962	8499313	3	200			plain
5j	A / Land	Horse Creek	-13.5768	134.5151	53	447540	8499025	7	750			plain/ridges
6a	A / Land	Emmerugga	-13.5937	134.4947	53	445337	8497151	6	900			small hills
6b	A / Land	Emmerugga	-13.5996	134.489	53	444722	8496497	5	350			undulating
6c	A / Land	Emmerugga	-13.6163	134.47	53	442670	8494646	2	450			ridge
6d	A / Land	Emmerugga	-13.6207	134.4644	53	442066	8494158	3	200			hill
7a	A / Land	Emmerugga	-13.6246	134.4608	53	441677	8493726	4	800			undulating
7b	A / Land	Emmerugga	-13.6473	134.4332	53	438698	8491208	4	900			undulating
7c	A / Land	Cliffdale	-13.6538	134.426	53	437921	8490488	5	200			undulating
7d	A / Land	Cliffdale	-13.6602	134.4174	53	436992	8489778	3	80			creek
7e	A / Land	Cliffdale	-13.6657	134.4111	53	436312	8489168	1	80			undulating
7f	A / Land	Cliffdale	-13.6733	134.4034	53	435482	8488325	8	800			creek
7g	A / Land	Favenc	-13.6795	134.3933	53	434391	8487637	5	200			steep hill
7h	A / Land	Favenc	-13.6918	134.3813	53	433097	8486273	1	1100			river
7i	A / Land	McArthur	-13.6936	134.3825	53	433227	8486074	1	1350		5	river
8a	A / Land	Emmerugga	-13.7124	134.3619	53	431005	8483989	10	200	2		river
8b	A / Land	Emmerugga	-13.7209	134.3538	53	430132	8483047	8	900			creek/hill
8c	A / Land	Flying Fox	-13.7419	134.3336	53	427954	8480718	9	900			plains
9a	A / Land	Flying Fox	-13.7556	134.32	53	426488	8479199	5	160			creek
9b	A / Land	Flying Fox	-13.7700	134.3036	53	424719	8477601	4	1000			plain/o'crop
9c	A / Land	Flying Fox	-13.7895	134.28	53	422175	8475437	8	160		5	creek
9d	A / Land	Lindsay/Coolibah	-13.7913	134.2784	53	422002	8475238	5	750			creek
10a	Roper	Lindsay/Coolibah	-13.8190	134.2451	53	418412	8472163	5	800			plains
10b	Roper	Lindsay/Coolibah	-13.8241	134.2391	53	417766	8471597	6	400		5	creek
10c	Roper	Lindsay/Coolibah	-13.8434	134.2242	53	416162	8469457	8	300			plain/o'crop
10d	Roper	Lindsay/Coolibah	-13.8406	134.219	53	415599	8469765	9	350	3		plain/o'crop

Transect	Region	L / System	Lat	Long	Zone	Easting	Northing	Av. Vis. %	Trans.length (m)	Sites	B.S	Terrain
11	Roper	Lindsay/Coolibah	-13.8760	134.1793	53	411322	8465835	5	800	3		creek
11a	Roper	Lindsay/Coolibah	-13.8764	134.1771	53	411084	8465790	1	340		5	creek
11b	Roper	Lindsay/Coolibah	-13.8762	134.418	53	437115	8465889	10	160	3		creek
11c	Roper	Lindsay/Coolibah	-13.8772	134.164	53	409669	8465697	5	160			creek
11d	Roper	Cliffdale	-13.8848	134.1716	53	410493	8464859	5	400		5	plain
11e	Roper	Cliffdale	-13.8878	134.167	53	409997	8464525	4	800		5	creek
12a	Roper	Cliffdale	-13.9030	134.1597	53	409215	8462841	5	300			plain
12b	Roper	Patterson	-13.9130	134.1535	53	408549	8461733	1	110			plain
12c	Roper	Cliffdale	-13.9208	134.1483	53	407990	8460868	5	700			hill
12d	Roper	Strangeways	-13.9424	134.1422	53	407339	8458477	9	600		5	creek
12e	Roper	Cliffdale	-13.9511	134.1403	53	407138	8457514	10	40			creek
12f	Roper	Cliffdale	-13.9563	135.1288	53	513912	8457103	0	350			creek
12g	Roper	Cliffdale	-13.9798	134.1491	53	408100	8454343	5	200			floodplain
13	Roper	Strangeways	-14.1046	133.9476	53	386396	8440451	8	600			ridge/plain
13a	Roper	Strangeways	-14.1067	133.9367	53	385221	8440214	8	600			low ridge
13b	Roper	Strangeways	-14.1140	133.9482	53	386466	8439412	8	700			undulating
14	Roper	McArthur	-14.1227	133.939	53	385477	8438445	5	200			creek
14a	Roper	McArthur	-14.1241	133.9382	53	385391	8438290	0	200			creek
14b	Roper	McArthur	-14.1364	133.9248	53	383951	8436922	5	700		5	slope
14c	Roper	McArthur	-14.1375	133.9225	53	383703	8436800	5	800		5	creek
14d	Roper	McArthur	-14.1388	133.9181	53	383229	8436654	9	500		6	creek
14f	Roper	McArthur	-14.1552	133.906	53	381931	8434834	5	800			undulating
14g	Roper	Cliffdale	-14.1714	133.9004	53	381335	8433039	4	1100			creek
14h	Roper	McArthur	-14.1734	133.8847	53	379642	8432810	5	800			undulating
14i	Roper	Bukalar	-14.1834	133.8758	53	378687	8431699	9	800		6	undulating
14j	Roper	Bukalar	-14.1992	133.8597	53	376958	8429943	9	500			creek

Transect	Region	L / System	Lat	Long	Zone	Easting	Northing	Av. Vis. %	Trans.length (m)	Sites	B.S	Terrain
14k	Roper	Bukalar	-14.1974	133.8546	53	376406	8430139	6	1600			hills
15a	Roper	Munyi	-14.2104	133.8469	53	375583	8428697	9	680			undulating
15b	Roper	Munyi	-14.2100	133.8427	53	375129	8428739	9	300			undulating
15c	Roper	Munyi	-14.2180	133.8381	53	374637	8427852	7	300			creek/slope
15d	Roper	Munyi	-14.2243	133.8321	53	373993	8427151	4	700			plain
15e	Roper	Bukalar	-14.2306	133.8259	53	373328	8426451	4	800			creek/slope
16a	Roper	Bukalar	-14.2412	133.8153	53	372190	8425273	2	200			plain
16b	Roper	Lindsay	-14.2456	133.8096	53	371577	8424783	2	80			plain
16c	Roper	Suprise	-14.2525	133.8038	53	370955	8424016	7	800		6	plain
16d	Roper	Lindsay	-14.2544	133.8011	53	370665	8423805	1	400			creek
16e	Roper	Suprise	-14.2637	133.7939	53	369894	8422772	1	200			creek
18	Roper	Suprise	-14.2849	133.7752	53	367889	8420416	5	700			undulating
18a	Roper	Bukalar	-14.3035	133.7821	53	368644	8418363	5	200			creek
18b	Roper	Siegal	-14.3019	133.7594	53	366194	8418527	9	2200			ridge
19a	Roper	Suprise	-14.2867	133.7733	53	367685	8420216	9	1100			creek
19b	Roper	Siegal	-14.3244	133.7303	53	363069	8416021	5	300			creek
19c	Roper	Siegal	-14.3257	133.7254	53	362541	8415874	5	2600			creek
19d	Roper	McArthur	-14.3387	133.693	53	359054	8414416	5	600			undulating
19e	Roper	McArthur	-14.4329	133.6861	53	358370	8403991	4	750			creek/slope
19f	Roper	McArthur	-14.3492	133.6785	53	357497	8413246	5	700			hill
19g	Roper	McArthur	-14.2867	133.6704	53	356584	8420155	5	80			ridge
19h	Roper	McArthur	-14.3543	133.6691	53	356487	8412676	5	300			creek
19i	Roper	McArthur	-14.3618	133.6598	53	355488	8411841	5	900			creek
19j	Roper	McArthur	-14.3602	133.653	53	354754	8412013	5	400			creek
19k	Roper	McArthur	-14.3579	133.6441	53	353793	8412262	4	600			creek
20	Roper	Nutwood	-14.3849	133.6278	53	352053	8409265	2	700			plain

Transect	Region	L / System	Lat	Long	Zone	Easting	Northing	Av. Vis. %	Trans.length (m)	Sites	B.S	Terrain
20a	Roper	Langdon	-14.3919	133.621	53	351324	8408486	5	200			slope
20b	Roper	Langdon	-14.3953	133.6133	53	350496	8408105	5	800			low hill
20c	Roper	McArthur	-14.4022	133.6063	53	349746	8407337	4	350			creek
20d	Roper	McArthur	-14.4052	133.598	53	348853	8407000	3	200			creek
20e	Roper	Coolibah	-14.4194	133.5785	53	346760	8405416	2	1200			hill
20f	Roper	Suprise	-14.4307	133.5574	53	344493	8404152	5	400			creek
20g	Roper	Emmerugga	-14.4333	133.5568	53	344430	8403864	9	600			floodplain
20h	Roper	Suprise	-14.4399	133.5522	53	343938	8403130	1	200			creek
20i	Roper	Suprise	-14.4466	133.54	53	342628	8402381	0	300			creek
21a	Roper	Emmerugga	-14.4558	133.5264	53	341168	8401354	2	150		6	ridge
21b	Roper	Emmerugga	-14.4637	133.5146	53	339902	8400471	5	400			creek
21c	Roper	Emmerugga	-14.4666	133.5096	53	339365	8400147	5	400		6	creek
21d	Roper	Suprise	-14.4716	133.5054	53	338915	8399591	3	1700			creek/hill
21e	Roper	Suprise	-14.4743	133.4892	53	337171	8399281	5	140			undulating
21f	Roper	Suprise	-14.4751	133.4768	53	335835	8399183	5	200			creek
21g	Roper	Langdon	-14.4747	133.4648	53	334541	8399219	5	700			plain
23a	Tipperary	Blain	-14.6138	132.552	53	236285	8382967	5	**100**			undulating
23b	Tipperary	Blain	-14.6143	132.5506	53	236135	8382910	5	**1000**			undulating
23c	Tipperary	Blain	-14.6099	132.55	53	236065	8383396	5	**1000**			undulating
23d	Tipperary	Blain	-14.6095	132.5544	53	236538	8383445	5	**1000**			undulating
39a	A / Land	Giddy	-12.3639	136.6995	53	684779	8632620	1	500			undulating
39b	A / Land	Giddy	-12.3881	136.6641	53	680912	8629967	3	1000			undulating
39c	A / Land	Giddy	-12.3861	136.6267	53	676847	8630213	8	1200			undulating
39d	A / Land	Giddy	-12.3899	136.6203	53	676148	8629797	8	400			creek
40a	A / Land	Cato	-12.4626	136.5432	53	667718	8621805	3	800			undulating
41a	A / Land	Gove	-12.4676	136.5483	53	668269	8621248	2	600		7	stoney hill

Transect	Region	L / System	Lat	Long	Zone	Easting	Northing	Av. Vis. %	Trans.length (m)	Sites	B.S	Terrain
41b	A / Land	Keefers Hut	-12.4597	136.536	53	666937	8622130	3	450			undulating
41c	A / Land	Keefers Hut	-12.4661	136.5321	53	666509	8621424	7	300			creek
41d	A / Land	Keefers Hut	-12.4814	136.5185	53	665021	8619740	7	200			creek
41e	A / Land	Keefers Hut	-12.4862	136.5135	53	664475	8619213	5	300			creek
41f	A / Land	Keefers Hut	-12.4899	136.511	53	664200	8618805	5	800			swamp dry
41g	A / Land	Keefers Hut	-12.5049	136.4984	53	662822	8617153	5	200			creek
41h	A / Land	Effington	-12.5097	136.4936	53	662297	8616625	5	450			creek
41i	A / Land	Effington	-12.5126	136.4987	53	662849	8616301	7	500			gully
42a	A / Land	Kay	-12.6070	136.4056	53	652675	8605915	7	1200			undulating
42b	A / Land	Kay	-12.6214	136.3843	53	650353	8604335	5	1100			gentle slope
42c	A / Land	Kay	-12.6300	136.3611	53	647828	8603397	4	100			plain
42d	A / Land	Kay	-12.6327	136.3526	53	646903	8603103	5	100			plain
42e	A / Land	Kay	-12.6355	136.3442	53	645989	8602798	5	1600			undulating
42f	A / Land	Kay	-12.6430	136.3236	53	643747	8601980	5	60			floodplain
42g	A / Land	Kay	-12.6457	136.315	53	642811	8601686	5	100			plain
42h	A / Land	Keating	-12.6502	136.3051	53	641734	8601193	4	200			creek
42i	A / Land	Keating	-12.6522	136.6977	53	684378	8600727	8	1300			stony hill
42j	A / Land	Effington	-12.6539	136.292	53	640309	8600791	1	500			creek
42k	A / Land	Effington	-12.6539	136.2922	53	640330	8600791	1	1600			creek
43a	A / Land	Kay	-12.5753	136.4379	53	656204	8609403	3	1400			plain
43b	A / Land	Effington	-12.5648	136.4477	53	657275	8610558	5	1600			billabongs
44a	A / Land	Giddy	-12.2999	136.7659	53	692047	8639653	2	1000			river
44b	A / Land	Giddy	-12.2981	136.7681	53	692288	8639851	5	300			plain
44c	A / Land	Cato	-12.2831	136.7822	53	693832	8641500	3	800			ridge
44d	A / Land	Cato	-12.2800	136.7848	53	694118	8641841	4	1100			ridge
44e	A / Land	Giddy	-12.2755	136.7877	53	694436	8642337	5	450			undulating
44f	A / Land	Giddy	-12.2407	136.7882	53	694516	8646186	6	1200			undulating
44g	A / Land	Giddy	-12.2350	136.7893	53	694640	8646816	5	300			creek

Transect	Region	L / System	Lat	Long	Zone	Easting	Northing	Av. Vis. %	Trans.length (m)	Sites	B.S	Terrain
45a	A / Land	Giddy	-12.3947	136.6144	53	675504	8629270	5	1100			undulating
45b	A / Land	Cato	-12.3981	136.6074	53	674740	8628898	1	400			creek
45c	A / Land	Gove	-12.3993	136.5991	53	673837	8628771	5	1200			undulating
45d	A / Land	Cato	-12.4027	136.572	53	670888	8628412	5	1000			low ridges
45e	A / Land	Cato	-12.4053	136.5658	53	670212	8628129	4	400			ridge
45f	A / Land	Cato	-12.4072	136.5623	53	669830	8627921	4	600			ridge
46a	A / Land	Giddy	-12.2195	136.7882	53	694532	8648532	8	100			undulating
46b	A / Land	Giddy	-12.1946	136.7489	53	690273	8651314	1	100			undulating
46c	A / Land	Giddy	-12.1934	136.7377	53	689055	8651455	5	80			undulating
47a	A / Land	Queue	-12.6896	135.6875	53	574647	8597091	9	200		8	creek
47b	A / Land	Queue	-12.6841	135.6882	53	574724	8597700	5	800			creek
47c	A / Land	Queue	-12.6821	135.6625	53	571934	8597928	9	500		8	hill
47d	A / Land	Mitchell	-12.6907	135.6527	53	570868	8596980	2	1000			slope
47e	A / Land	Durabudboi	-12.7003	135.6429	53	569801	8595920	4	400			slope
47d	A / Land	Mitchell	-12.7141	135.6086	53	566073	8594403	1	1200			undulating
48a	A / Land	Keating	-12.6935	135.7023	53	576252	8596656	2	400			creek
48b	A / Land	Keating	-12.7004	135.7071	53	576772	8595891	5	400			undulating
49	A / Land	Queue	-12.6173	135.8185	53	588896	8605046	6	1200		8	creek
49a	A / Land	Queue	-12.8903	135.3946	53	542810	8574963	8	1500			undulating
49b	A / Land	Queue	-12.9237	135.3632	53	539398	8571274	6	300			undulating
49c	A / Land	Queue	-12.9296	135.3577	53	538801	8570622	4	1200			undulating/hill
49d	A / Land	Queue	-12.9618	135.3481	53	537754	8567063	5	700			creek
50a	A / Land	Queue	-12.9963	135.3225	53	534973	8563251	6	900			undulating
50b	A / Land	Queue	-13.0218	135.2886	53	531294	8560436	8	1360			undulating
50c	A / Land	Queue	-13.0489	135.2522	53	527344	8557443	6	1400			undulating
50d	A / Land	Queue	-13.0825	135.2045	53	522169	8553732	3	1000			plain

Transect	Region	L / System	LAT	LONG	Zone	Easting	Northing	Av. Vis. %	Trans.length (m)	Sites	B.S	Terrain
50e	A / Land	Queue	-13.0895	135.1886	53	520445	8552959	5	1700			lake
50f	A / Land	Queue	-13.0956	135.1814	53	519664	8552285	5	200			undulating
50g	A / Land	Mululu	-13.0999	135.1683	53	518243	8551811	9	40			undulating
50h	A / Land	Mululu	-13.1015	135.1641	53	517788	8551634	8	1400			plain
50i	A / Land	Mululu	-13.1039	135.1597	53	517311	8551369	8	100			plain
50j	A / Land	Mululu	-13.1082	135.1484	53	516086	8550894	5	800			creek
50k	A / Land	Queue	-13.1163	135.1233	53	513365	8550000	6	1400			undulating
50l	A / Land	Levee	-13.1238	135.1045	53	511326	8549171	3	1200		8	river

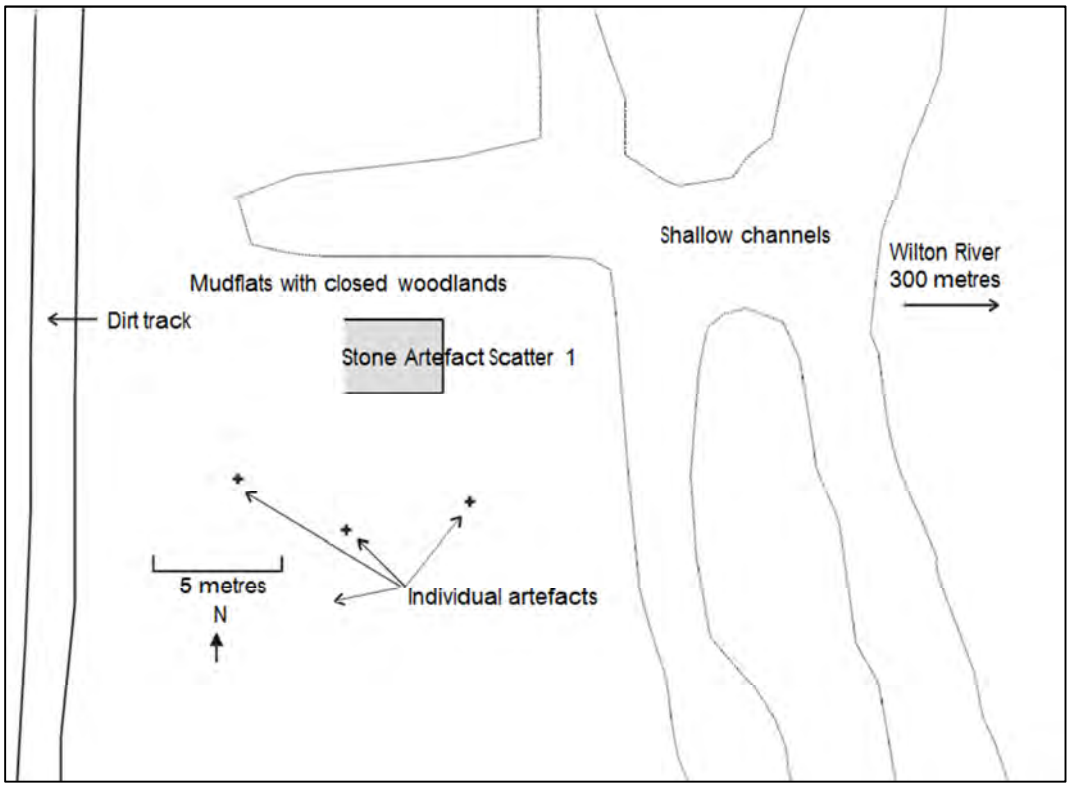
APPENDIX 4

Details of the individual historic and archaeological sites

Site 1
Stone Arrangement 1
Location: 53 421122E 8459215N Marumba 5770 1.100,000 map sheet
-13.9361^{o}S 134.2698^{o}E
Land System: Emmerugga
Geomorphic Context: Stony rise
Method of Discovery: Vehicle transect
Ground surface visibility %: Maximum-100%, Minimum-90%. Average-95%
Site location: The site is located approximately two kilometres east of the border between Arnhem Land and Mainoru Station on a gently stony slope next to an ephemeral creek. The area is covered in open woodland with skeletal soils.
Site description: There are two stone arrangement each consisting of a large narrow sandstone slab resting on small stacks of rocks and termite mounds. The Aboriginal informants said they were 'barbeque plates' and were used by buffalo hunters in the late 1990s. The stone slabs are approximately 1 x 0.8 metres and the two 'plates' are two metres apart.
Relationship to proposed pipeline: Site 1 is 12 kilometres south of the proposed pipeline and will not be disturbed by the development.
Significance: While these stone arrangements may have been recently constructed they represent a novel use of stone and if, as the Traditional owners stated, they were used as cooking plates they represent a way of life, no longer practiced or in danger of being lost. Therefore the site has a historic significance.

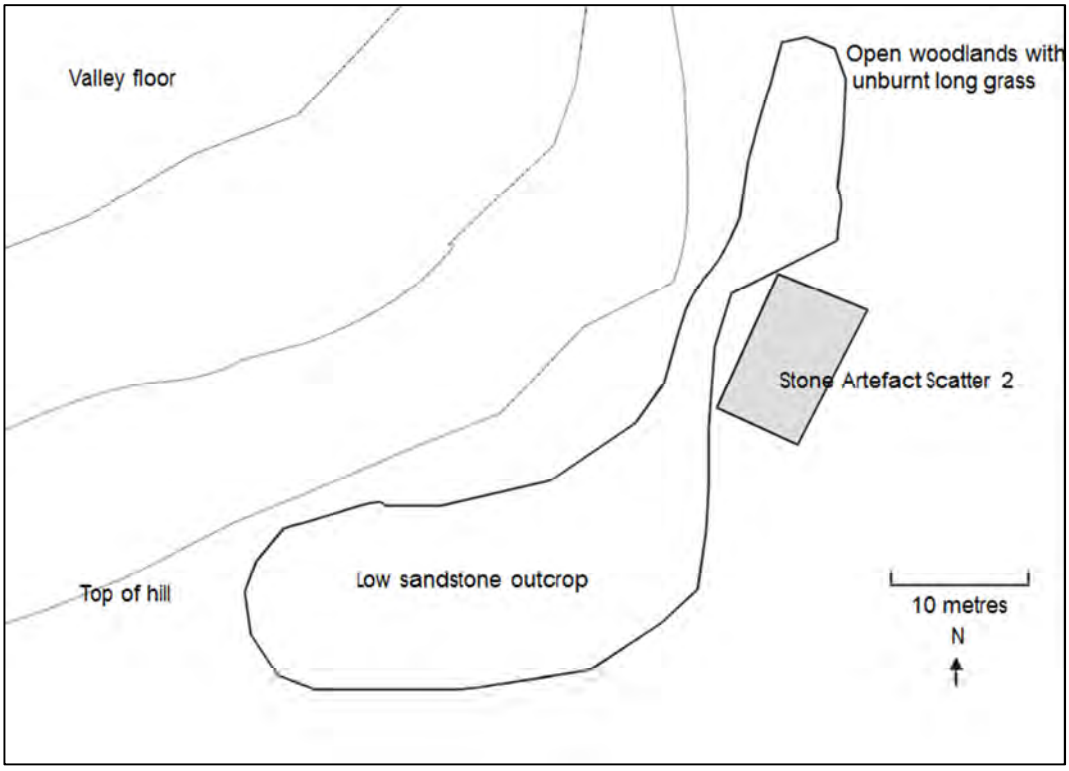
Site 2
Stone Artefact Scatter 1

Location: 52 437891E 8462346N Marumba 5770 1:100,000 map sheet
-13.9082^{o}S 8462346^{o}E
Land System: McArthur
Geomorphic Context: Black soil plain
Method of Discovery: Pedestrian transect
Ground surface visibility %: Maximum-100%, Minimum-90%. Average-95%
Site location: The site is located 300 metres west of the Wilton River in an area of small levee banks and cracking soil flats. It is 10 metres east of a track that runs parallel to the river. The area has been disturbed by cattle and is vegetated by closed low woodland.
Site description: The small stone artefact scatter is located on the side of a low levee bank and consists of unretouched flakes, one core and one flaked piece all made from a pale red brown siltstone, These artefacts are concentrated in one small area. Within 10 metres of the scatter were one core and two flakes made from the same material. The flakes have an average length of 50 mm. It appears that large flakes are being removed from cores, however none of the flakes could be conjoined to the cores.
Site integrity: Unstable floodplain area with several shallow channels in the area.
Site dimensions: 4 x 2 metres
Artefact densities: Maximum: 6/m^2, Average: 0.8/m^2
Relationship to proposed pipeline: Located along the Mainoru by-pass and approximately 22km south of proposed pipeline route revision 7 and will not be disturbed by the development.
Archaeological significance: The site is in a location where the shallow water channels appear to be unstable and the area is regularly disturbed by cattle. The small size of the site and the low number of artefacts in the area result in this site having little potential for further research. The only research potential would be to generate information regarding stone tool technologies of the area. Therefore the site is deemed to have low to moderate archaeological significance.



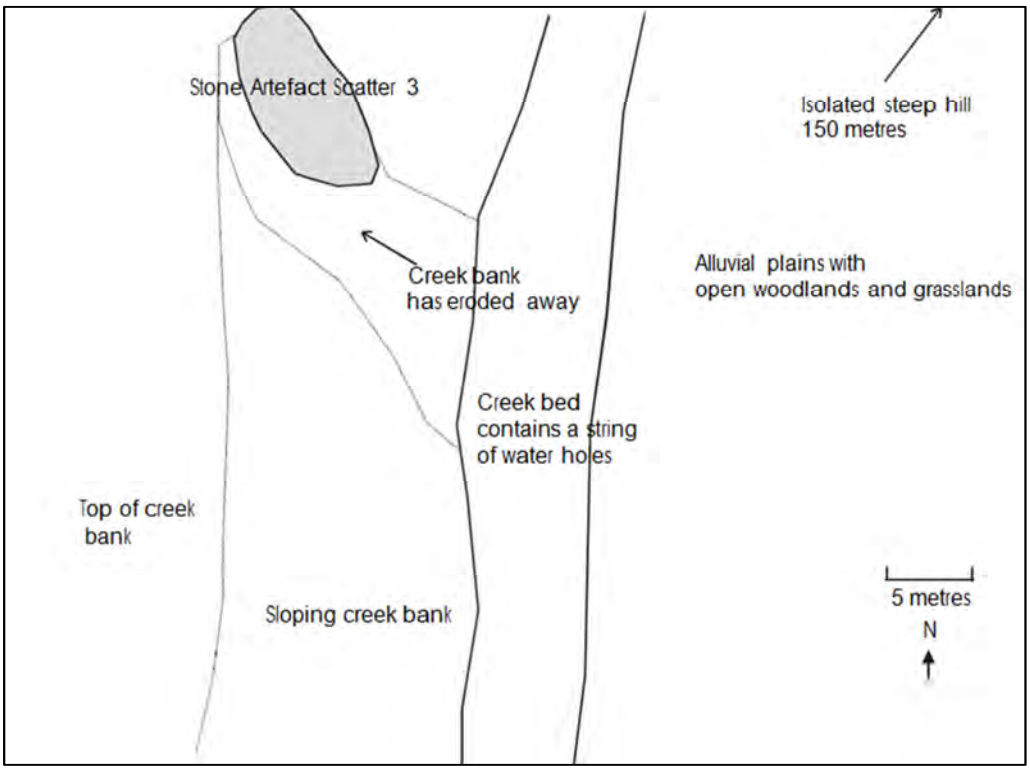
Site 3
Stone Artefact Scatter 2

Location: 53 444203E 8463504N Marumba 5770 1.100,00 map sheet
-13.78979^{o}S 134.4836^{o}E
Land System: McArthur
Geomorphic Context: Stony hill
Method of Discovery: Pedestrian transect
Ground surface visibility %: Maximum-60%, Minimum-5%. Average-50%
Site location: The site is located on a high steep hill overlooking the Wilton River that is located approximately 3 kilometres to the west and Mt Catt can be seen to the north. The area consists of open woodlands with a low sandstone outcrop near the edge of the hill top and skeletal soils covered in long grass and heavy leaf litter.
Site description: The artefact scatter is located 5 metres from the edge of the level hill. Artefacts include three bifacial and one unifacial chert points, two cores and the remainder are unretouched flakes. The unifacial point was considerably longer than the two bifacial points, 51 mm and 3.3 and 3.5mm respectively. All artefacts are highly weathered. The raw material is spotted tuff 10%, chert 80% and 10% grey siltstone. The average length of the stone artefacts was 40 mm. There was no area of the site where there was a greater concentration of artefacts than elsewhere. The site has not been disturbed.
Site dimensions: 11 x 8metres
Artefact densities: Maximum: 3/m^2, Average: 0.2/m^2
Relationship to proposed pipeline: Located along the Mainoru by-pass and south of proposed pipeline route revision 7 and will not be disturbed by the development.
Archaeological significance: Although the site does not have a dense scatter of artefacts there is a relatively wide range of raw material and artefact types. Consequently as the site has the potential to generate information regarding stone tool technologies the site has been assessed as having medium archaeological significance.



Site 4
Stone Artefact Scatter 3

Location: 53 455853E 8479412N Nymbilli 5870 1:100,000 map sheet
-13.7543^{o}S 134.5916^{o}E
Land System: Emmerugga
Geomorphic Context: Creek
Method of Discovery: Pedestrian transect
Ground surface visibility %: Maximum- 100%, Minimum-95%. Average-98%
Site location: The site is located approximately half way between Jasper Creek and Showell Creek and is approximately 8 kilometres northeast of Black Mountain in an area of alluvial plains and open woodlands. It is next to an unnamed creek which has a string of billabongs some of which still contained water. There is a steep stony hill approximately 50 metres to the northeast.
Site description: The stone artefacts are eroding from the top of the western banks of the creek bed and the majority of flakes have fallen down the side of the slope. The area would be flooded during the wet season and disturbed by water gullying. There are approximately 15 unretouched flakes manufactured from a fine grey siltstone, one of silcrete and a unifacial chert point. One large siltstone core had been prepared to remove a series of large flakes. The average length of the flakes was 60mm
Site dimensions: 6 x 15 metres
Artefact densities: Maximum: 3/m^2, Average: 0.06 /m^2
Relationship to proposed pipeline: Located along the Mainoru by-pass and south of proposed pipeline route revision 7 and will not be disturbed by the development.
Archaeological significance: The area around the creek appears to undergo sedimentation process during the wet season and the only artefacts identified along the creek were situated in an area where the bank was being eroded. As the identified artefacts were being displaced down the bank, the site has little stratigraphic integrity in this location. However there is a high potential for the presence of more artefacts under the surface in adjacent areas along the creek banks. Therefore the site has been assessed has having a moderate archaeological significance as there is the potential to contribute to archaeological research for the region.

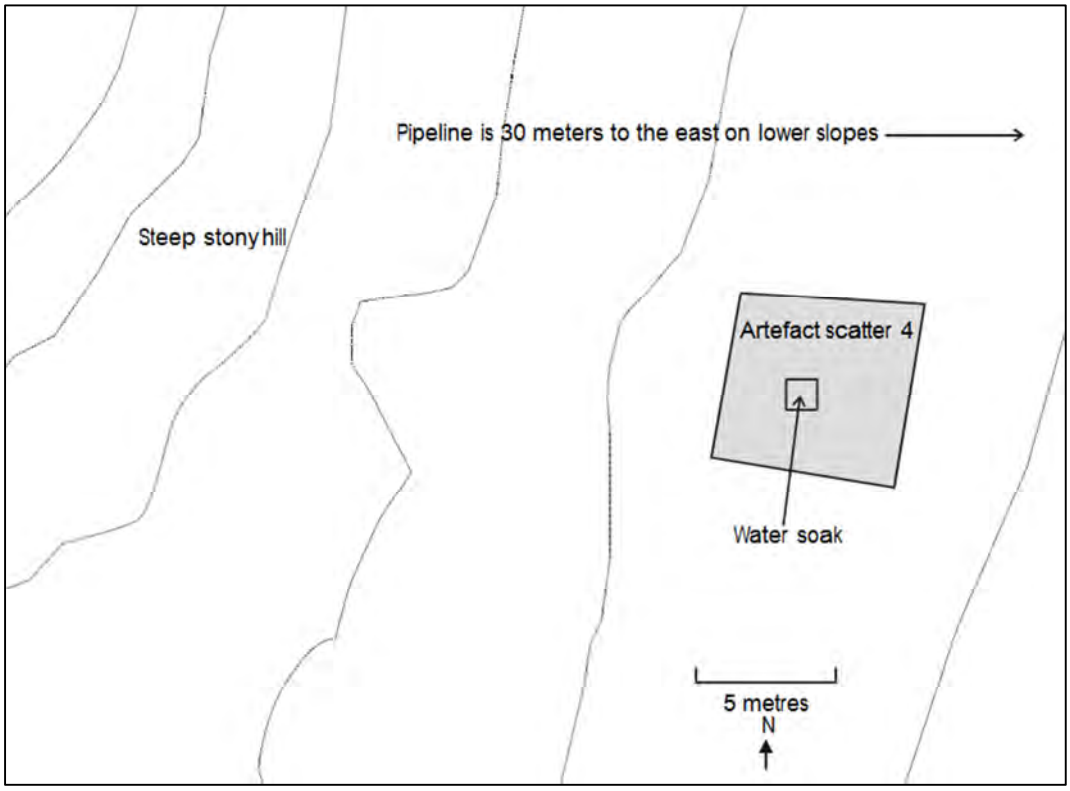


Site 4, facing southeast

Site 5, facing west

Site 5
Stone Artefact Scatter 4

Location: 52 478926E 8525861N Annie Creek 5871 1:100,000 map sheet
-13.3345^{o}S 134.8054^{o}E
Land System: Klatt
Geomorphic Context: Stony rise on lower edges of high ground.
Method of Discovery: Pedestrian transect
Ground surface visibility: 50%
Site location: The site is located on the lower slopes between a lateritic, stony plain and a steep stony hill. The area is covered in open woodland was recently burnt.
Site description: The site consists of a small water soak one metre square located on the side of the rocky slope and is surrounded by a low density of ochre pieces and one fine grained quartzite axe, ground along one side only. One chert unretouched flake was located 50 metres from the soak at the bottom of the hill. The ochre pieces did not appear to be a local stone and none had signs of being altered by flaking or rubbing.
Site dimensions: 5 x 5m
Artefact densities: Average: 2/m^{2}
Relationship to proposed pipeline: Site 5 is 60 metres from the proposed pipeline route revision 7 and may be disturbed by the development.
Archaeological significance: While this site has a low potential for further archaeological research, the site has moderate to high archaeological significance because of the uniqueness of the combination of features present; the ground stone axe, ochre and water soak.



Site 6
Burial 1

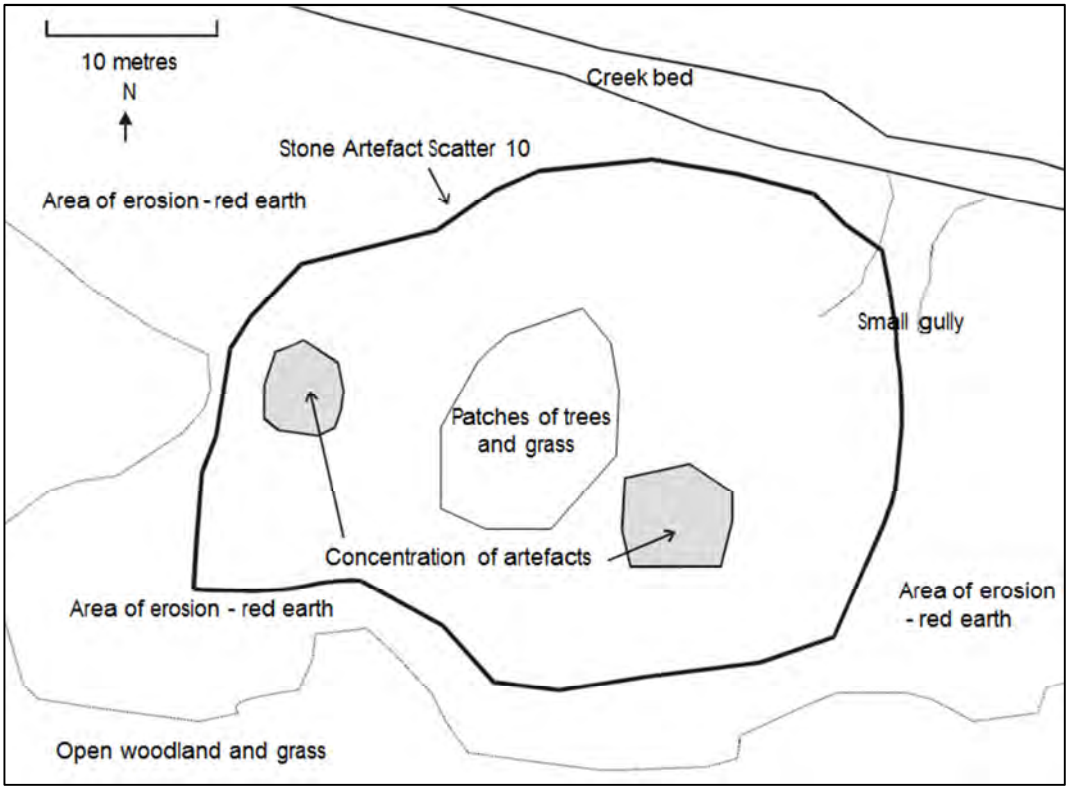
Location: 53 394450E 8445100N Marumba 5770 1:100,000 map sheet
-14.0629^{o}S 134.0210^{o}E
Land System: Cliffdale
Geomorphic Context: Hilltop
Method of Discovery: Verbal information from Traditional Owners
Site location: The site is located on the top of the southern side of the more easterly hill of "The Twins" on Mainoru Station. The location details above are only an approximation, as the site was not visited
Site description: The skeletal remains are those of an Aboriginal Rumbarumpa, speared by another Aboriginal working at Mainoru Station. The owners of the station at the time asked that Rumbarumpa be punished as he was thought to be killing cattle
Relationship to proposed pipeline: Site 5 is approximately 350 metres north of the pipeline and will not be disturbed by the development.
Significance: As Site 4 contains skeletal remains it is deemed to have both high archaeological and historic significance.

Site 7
Policeman's Yard

Location: 53 372033E 8432870N Flying Fox 1:100,00 map sheet
-14.17308^{O}S 133.8142^{O}E
Land System: McArthur
Geomorphic Context: Black soil plains
Method of Discovery: Verbal information from Traditional Owners
Site location: The site is located on alluvial plains and consists of a cattle yard on Mountain Valley Station that appears to still be in use. The yard was not visited as the information was not given until the survey team had passed the area.
Site description: The traditional owners said that a policeman was speared at this location during the 1950s and the cattle yard is named after the event.
Archaeological significance: After researching the possibility of the spearing event and communications with Dr. Bill Wilson from CDU, no evidence was found for a spearing of a policeman at the site. Therefore this site is assessed at this time as having no historic significance.

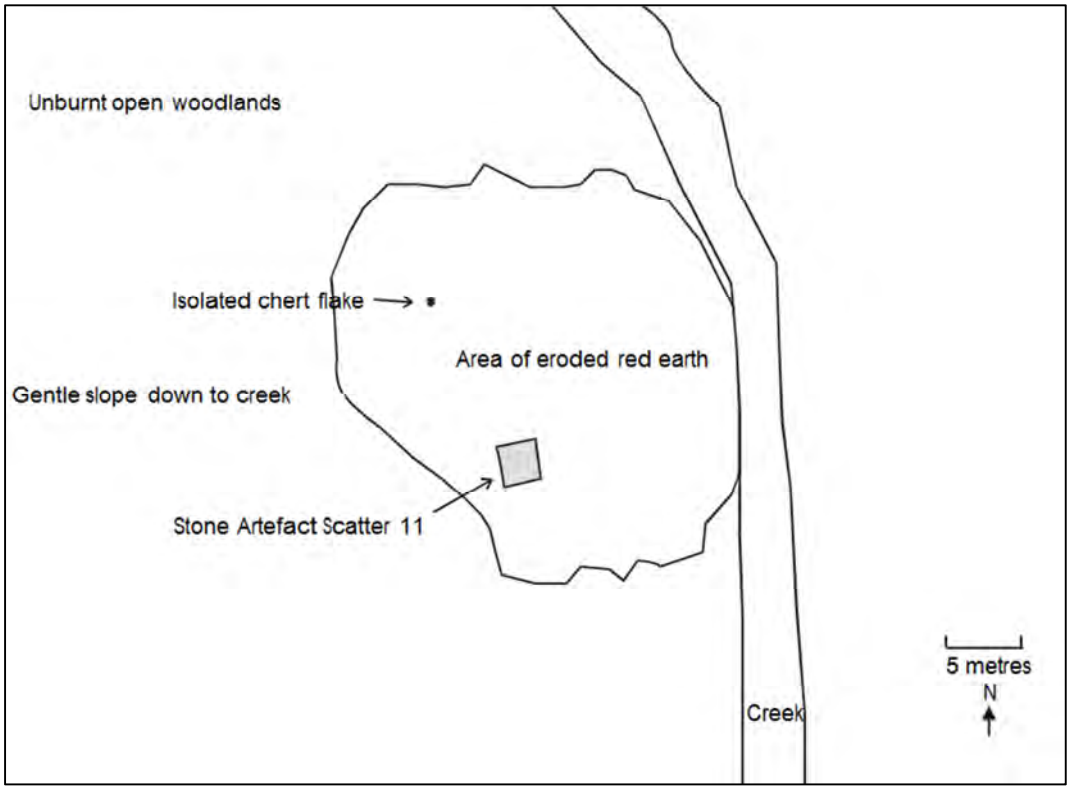
Site 20
Stone Artefact Scatter 10

Location: 53 219497E 8382191N Manbullo 5368 1:100,000 map sheet
-14.6191^{o}S 132.3962^{o}E
Land System Kimbya
Geomorphic Context: The banks of an ephemeral creek
Method of Discovery: Pedestrian transect
Ground surface visibility %: Maximum-95%, Minimum-10%. Average-80%
Site location: The site is located approximately 10 kilometres south of the Tindal RAAF base on a gentle slope covered by unburnt open woodlands and grass. There is a large area of red soil that has been eroded by sheet wash and gullying up to a metre deep adjacent to an ephemeral creek. In the eroded area there were patches of grass and trees.
Site description: The artefacts are scattered over most of the large eroded area and there were two smaller areas, 5 x 5 metres, where the concentration of artefacts was much greater. The artefacts were made from chert, silcrete and a fine grained siliceous material. The majority of artefacts were unretouched chert flakes and there were cores of chert and silcrete. There was one edge ground axe of silicified sandstone and an unusual nearly circular retouched (20 x 17 x 4mm) chert flake.
Site dimensions: 50 x 50 metres
Artefact densities: Maximum: 6/m^2, Average: 0.1/m^2
Relationship to proposed pipeline: Site 20 is 50 metres from the proposed pipeline route revision 7 and may be disturbed by the development.
Archaeological significance: Although the site has lost some of its spatial integrity because of the erosion in the area, the site has been given moderate archaeological significance because there are several stone artefacts types manufactured from different raw materials, indicating that various activities were carried out in this area.



Site 21
Stone Artefact Scatter 11

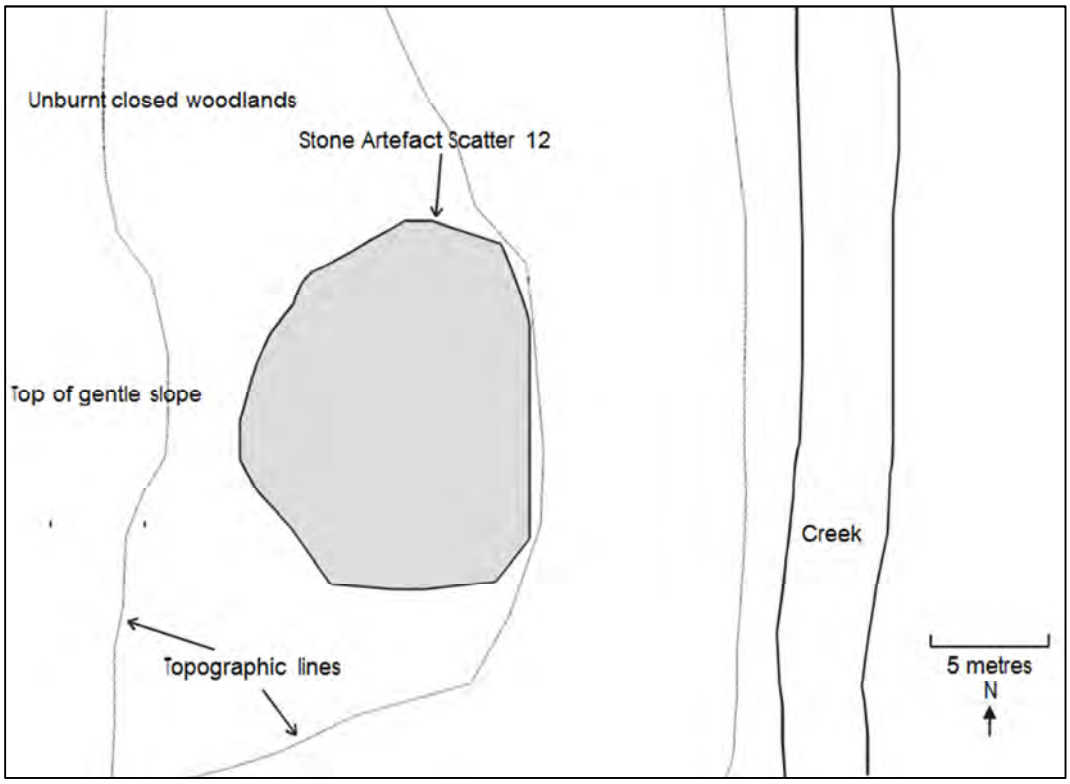
Location: 53 226091E 8381820N Manbulloo 5368 1:100,000 map sheet
-14.6231^{o}S 132.4573^{o}E
Land System: Wallingin
Geomorphic Context: Ephemeral creek
Method of Discovery: Pedestrian transect
Ground surface visibility %: Maximum-100%, Minimum-90%. Average-95%
Site location: The surrounding area consisted of unburnt open woodland and grass understorey on gentle slopes leading down to an ephemeral creek. The eastern side of the creek has several large areas that have been eroded by sheet wash.
Site description: The stone artefact scatter is located approximately 20 metres from the edge of the dry creek in an eroded area of 25 x 25 metres of red soil. All but one of the artefacts were located in the same small area in south western section of the eroded area. Ninety percent of the artefacts were made from chert and the remainder from silcrete. The average length of the flakes was 30mm. Two chert retouched flakes and one chert core were also identified. One chert flake was located 10 metres from the main concentration of artefacts.
Site dimensions: 3 x 3 metre
Artefact densities: Maximum: 4/m^2, Average: 0.07/m^2
Relationship to proposed pipeline: Site 21 is 60 metres from the proposed pipeline route revision 7 and may be disturbed by the development. As there are other similar eroded slopes along the slope there is a high probability for other sites in the area.
Archaeological significance: As this site is small and has a low density and diversity of artefacts it very little potential to contribute further knowledge regarding past Aboriginal activities in the area and is therefore considered to have low archaeological significance.



Site 21, facing east

Site 22
Stone Artefact Scatter 12

Location: 53 229852E 8382305N Manbulloo 5368 1:100,000 map sheet
-14.6191^{o}S 132.4923^{o}E
Land System: Wallingin
Geomorphic Context: Ephemeral creek
Method of Discovery: Pedestrian transect
Ground surface visibility %: Maximum-95%, Minimum-<5%. Average-40%
Site location: The stone artefacts are situated in an area of open woodland plains / gentle slopes and unburnt grasslands. An ephemeral creek is located 10 metres east of the site and the site is located on a level eroded section of a gentle slope surrounded by thick grass.
Site description: The boundaries of the site were difficult to determine away from the eroded patches where the stone artefacts were initially located. The eroded surface consisted of gravely sands. Only one unretouched silcrete flake was identified, the remainder were chert unretouched flakes, average length 20mm.
Site dimensions: 10 x 20m
Artefact densities: Maximum: 8/m^2, Average: 0.3/m^2
Relationship to proposed pipeline: Site 22 is 80 metres from the proposed pipeline route revision 7 and may be disturbed by the development.
Archaeological significance: As the site is located in an area disturbed by erosion and has a low diversity and density of artefacts it has little potential for further research and consequently has low archaeological significance.



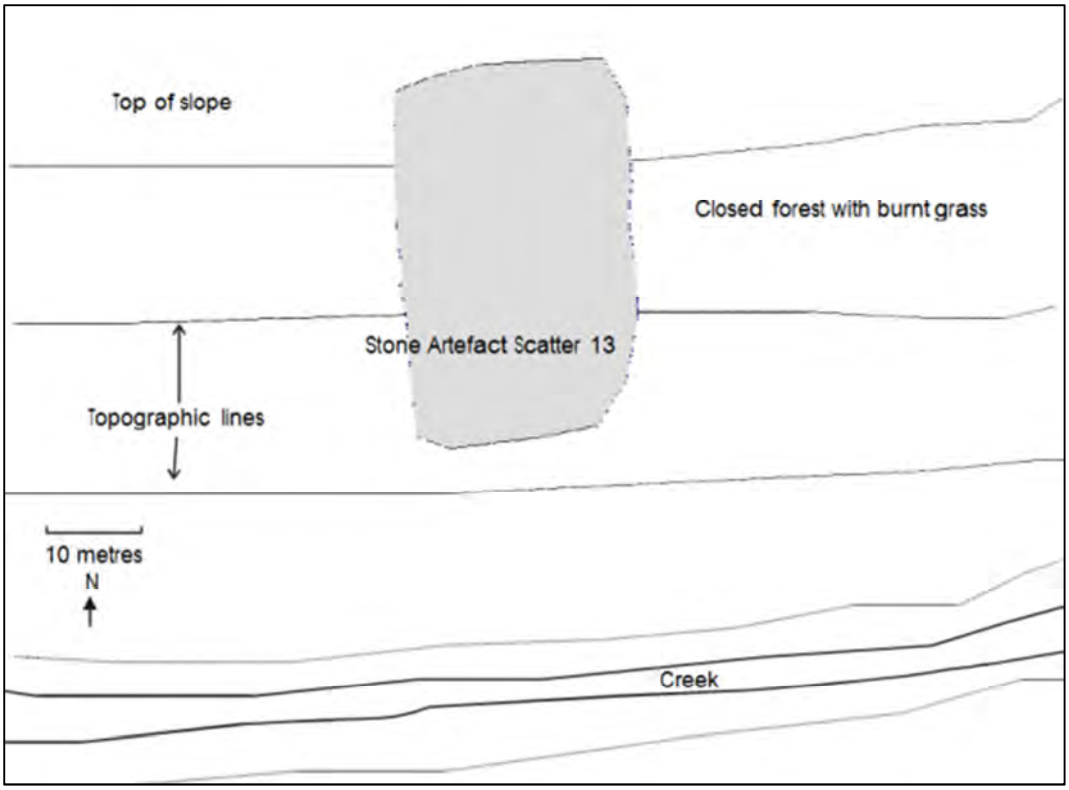
Site 23
North Australian Railway

Location: 53 238760E 8383285N Maranboy 5468 1:100,000 map sheet
-14.6111^{o}S 132.5749^{o}E
Land System: Blain
Geomorphic Context: Plains
Method of Discovery: Vehicle transect
Ground surface visibility %: Average-100%
Site location: The railway line is in open woodland and grassed plain approximately 20 metres west of the Stuart Highway.
Site description: All that remains of the railway line at this location is the 50 cm high gravel bed on which the tracks were placed. Also in the area are broken 1950s ceramic electric insulators and old railway bolts and nuts.
Relationship to proposed pipeline: The pipeline will cross over the old railway line and be destroyed in this area.
Archaeological significance: While the North Australian Railway line was an important feature in the development of the Top End and consequently has a high historic significance, the remains of the railway line where the pipeline crosses consists only of the gravel bed on which the line was placed. Therefore the line in this area has low to moderate historic and archaeological significance.

Site 23, facing north

Site 24
Stone Artefact Scatter 13

Location: 53 616351E 8595460N Durabudboi 6172 1:100,000 map sheet
-12.7031^{o}S 136.0716^{o}E
Land System: Keating
Geomorphic Context: Creek
Method of Discovery: Pedestrian transect
Ground surface visibility %: Maximum-98%, Minimum-80%. Average-90%
Site location: The site is on a lateritic gravel surface that slopes gently down to an ephemeral creek (a tributary of Richard River) in an area of closed forest that had been recently burnt.
Site description: This site is a low density artefact scatter with eleven stone artefacts The artefacts were concentrated on the upper slope of a small rise and 20 metres north of the creek. All the artefacts were very weathered and consisted of 90% unretouched flakes and 10% flaked pieces. All but two of the artefacts were made from a fine grained sedimentary rock that were smaller in size (average length 20mm) than those made of silcrete and siltstone (42mm long).
Site dimensions: 10 x 8 metres
Artefact densities: Maximum: 4/m^2, Average: 0.15/m^2
Relationship to proposed pipeline: Site 24 is 60 metres from the proposed pipeline route revision 7 and may be disturbed by the development**.**
Archaeological significance: As this is a small site with a low density and diversity of stone artefacts the site has a low archaeological significance.



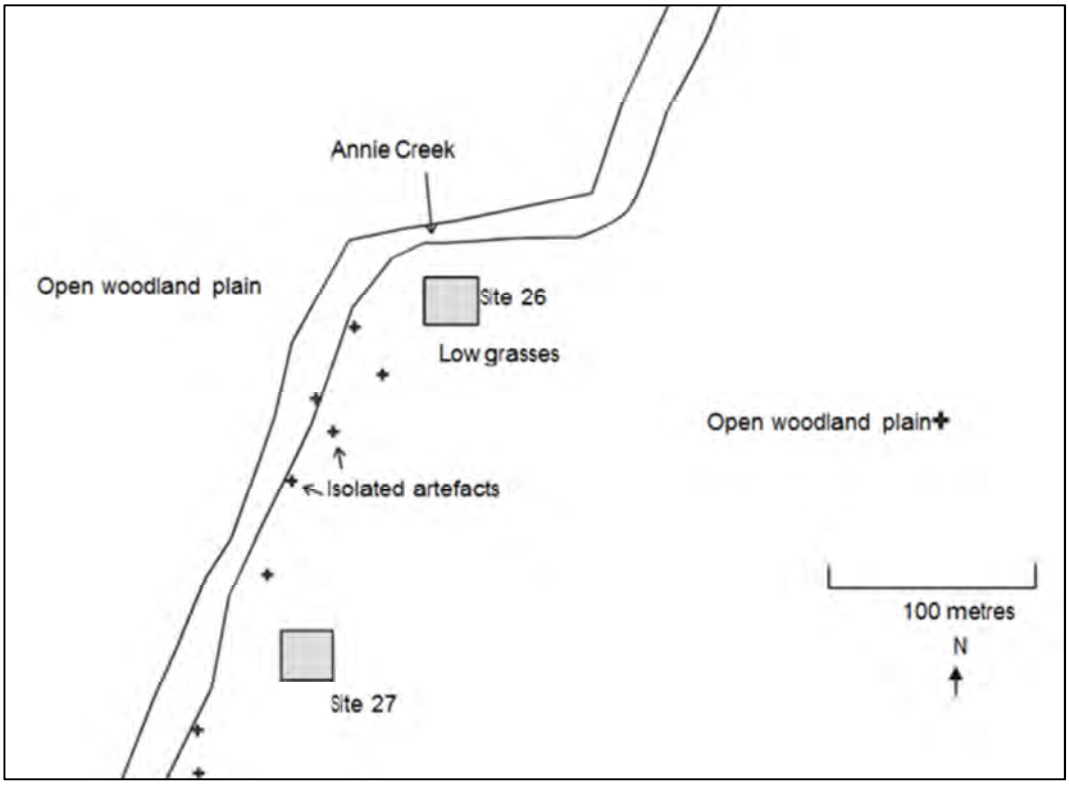
Site 25
Overland Telegraph Pole

Location: 53 244176E 8384036N Maranboy 5468 1:100,000 map sheet
-14.6048^{O}S 132.6253^{O}E
Land System: Woggoman
Geomorphic Context: Plain
Method of Discovery: Vehicle transect
Site location: The Overland Telegraph Pole is located in closed woodlands with an understorey of tall grass and is approximately 300 metres north of the King River Station Road.
Site description: Only one pole made from the Oppenheimer design was located. There were two strands of wire still attached and they appeared to be running in a north south direction.
Relationship to proposed pipeline: Site 25 is 260 metres north of the pipeline of the proposed pipeline route revision 7 and will not be disturbed by the development.
Historic significance: This isolated pole is unusual in that it does not appear to be located along the main route of the Overland Telegraph line. The Oppenheimer pole may not be related to the original line which is thought to have been located west of the North Australian Railway line in the area south of Katherine. The line was perhaps related to a subsidiary line that was constructed between Katherine and Maranboy in 1920s as the wire was facing in a north south direction. If the line was a spur line from the main line it would most likely be in an east west direction. Therefore the pole is deemed to have medium to high historic significance as it is associated with events and developments in human occupation in the Top End.

Site 26
Stone Artefact Scatter 14

Location: 53 464023E 8513730N Annie Creek 1:100,000 map sheet
-13.4441^{0}S 134.6677^{0}E
Land System: Flatwood
Geomorphic Context: Ephemeral creek
Method of Discovery: Pedestrian transect
Ground surface visibility %: Maximum- 70 %, Minimum- 20 %. Average- 60 %
Site location: Ten metres east of a tributary creek of Annie Creek in open woodlands on a grassy sandy plain
Site description: The low density artefact scatter is located next to a bend in the creek. There is also a relatively high density of isolated stone artefacts that were found along the banks of the creek and on the stony creek bed where there was no water. The source of the raw material for the artefacts appeared to be from stones found in the creek bed and eroded areas along the creek bank.
The majority of artefacts identified were unretouched chert flakes with an average length of 60mm.
There were also two silcrete and four mudstones unretouched flakes. The four cores were also manufactured from chert.
Site dimensions: 11m x 10m
Artefact densities: Maximum: 6 /m^2, Average: 0.3 /m^2
Artefact dimensions (length): Maximum: 39mm, Average: 35mm
Relationship to proposed pipeline: This site is 140 metres from the proposed pipeline route revision 7 and is not expected to be impacted by the development.
Archaeological significance: This small low density artefact scatter with a variety of raw material and artefact types is located in an area where the background scatter was high along the creek bank**.** Therefore the site and adjacent areas along the creek has research potential associated with stone tool manufacture and procurement and consequently the site is assessed as having moderate archaeological significance.

Site 26, facing west



Site 27, facing north.

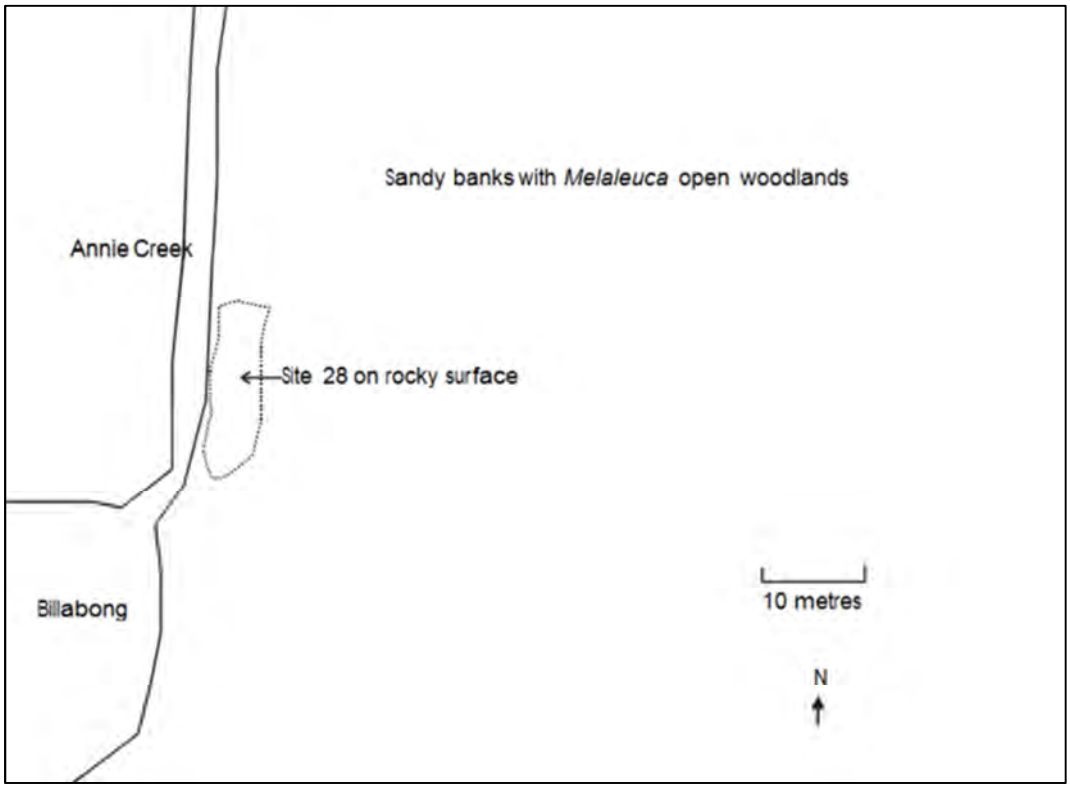
Site 27
Stone Artefact Scatter 15

Location: 53 464217E 8513518N Annie Creek 5871 1:100,000 map sheet
-14.4459 ^{0}S 134.6680 ^{0}E
Land System: Flatwood
Geomorphic Context: Ephemeral creek
Method of Discovery: Pedestrian transect
Ground surface visibility %: Maximum-80%, Minimum-40%. Average-60%
Site location: The artefact scatter is located 100 metres south of Site 26 on the same side of the creek in an area of level sandy grassy plain with open woodlands
Site description: The site is located 20 metres from the creek in an area that was not heavily grassed.
The majority of artefacts were located in an area of 2 x 2metres and were manufactured from chert with one mudstone and one quartz unretouched flake. There was one chert retouched flake and three chert cores.
As mentioned in Site 26 there appears to be a high density of background scatter along the banks of the creek. Four chert flakes and one chert core were located between sites 26 and 27 and another four chert flakes and one retouched chert flake were located within 50 metres south of Site 27.
Site dimensions: 5 x 5m
Artefact densities: Maximum: 12 /m^2, Average: 0.6/m^2
Artefact dimensions (length): Maximum: 90 mm, Average: 35 mm
Relationship to proposed pipeline: This site is 60 metres from the pipeline alignment and may be disturbed during the development.
Archaeological significance: This small low density artefact scatter with a variety of raw material and artefact types is located in an area where the background scatter was high along the creek bank**.** Therefore the site and adjacent areas along the creek has research potential associated with stone tool manufacture and procurement and consequently the site is assessed as having moderate archaeological significance.

For sketch map see Site 26.

Site 28
Stone Artefact Scatter 16

Location: 53 464021E 8513499N Annie Creek 5871 1:100,000 map sheet
-13.4462^{0}S 134.6671^{0}E
Land System: Flatwood
Geomorphic Context: Billabong
Method of Discovery: Vehicular transect
Ground surface visibility %: Maximum-95%, Minimum-50%. Average-70%
Site location: The site is located on the north east side of a billabong and adjacent to the eastern banks of Annie Creek. Open *Melaleuca* woodlands and sandy soils surround the area.
Site description: The site dimensions are defined by an area where sand has been washed away from the gently sloping banks of the creek uncovering an area of rocks along the sides of the creek. There is a high proportion of orange chert cores (50%) and the flakes are all manufactured from the same coloured chert. There was one retouched flake. The distribution of artefacts was evenly
distributed across the site.
Site dimensions: 21m N-S x 6m E-W
Artefact densities: Maximum: 6 /m^2, Average: 0.2 /m^2
Artefact dimensions (length): Maximum: 120 mm, Average: 90mm, Minimum 24mm
Relationship to proposed pipeline: This site is 20 metres from the proposed pipeline route revision 7 and will be disturbed or destroyed during the construction of the pipeline.
Archaeological significance: This site appears to be highly disturbed as the artefacts are all located in an area where the surface would be removed during the flooding of the creek. The sandy banks have been completely removed leaving the stone artefacts visible on the rocky and stony bank and bed of the creek. The high proportion of cores and the size of the large flakes suggest that the raw chert material was located in the vicinity. However the rocks on which the artefacts were found were not the source of the chert raw material. As the artefacts do not appear to be in situ and have been possibly washed down the creek during the wet season the small artefact scatter is considered to have low archaeological significance.



Artefacts from Site 28

Site 29
Stone Artefact Scatter 17

Location: 53 431008E 8483982N Marumba 5770 1:100,000 map sheet
-13.7124^{0}S 134.3619^{0}E

Land System: Favenc

Geomorphic Context: Steep stony hill

Method of Discovery: Vehicle transect

Ground surface visibility %: Maximum- 100%, Minimum-95%. Average-98%

Site location: The stone artefact scatter is located 50 metres south of an ephemeral creek and approximately a quarter of the way up a steep stony sandstone hill on a level area that overlooks the plains and the Wilton River. The hill is covered in open woodlands that had been recently burnt.

Site description: There was a low density artefact scatter on the level area of the hill slope with only one concentration of artefacts 10 metres from the edge of the slope in an area of 2 x 2 metres. The other artefacts were located along the edge of the level ground. The surface of the area was covered in small sandstone rocks.

The artefacts consisted mostly of flakes manufactured from a highly weathered fine grained sedimentary rock, possibly siltstone. There was a unifacial white chert point broken laterally (58 x 28 x 5mm) and one white chert core (20 x 15 x 20mm).

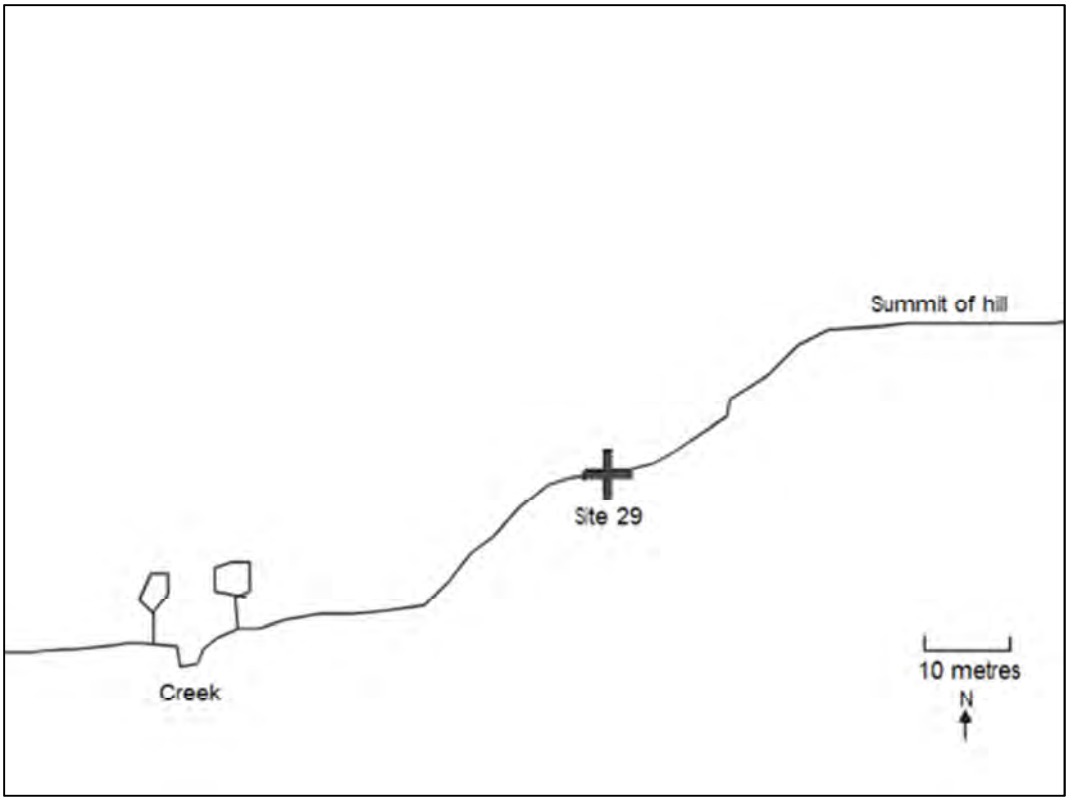
Site dimensions: 10m x 5m

Artefact densities: Maximum: 4/m^2, Average: 0.05/m^2

Artefact dimensions (length): Maximum: 58mm, Average: 30mm

Relationship to proposed pipeline: This site is 50 metres from the proposes pipeline and will not be disturbed as it is located half way up a steep hill and the pipeline is located at the bottom of the slope.

Archaeological significance: As this site has a low diversity and density of artefacts it is considered to have a very low research potential and consequently low archaeological significance.



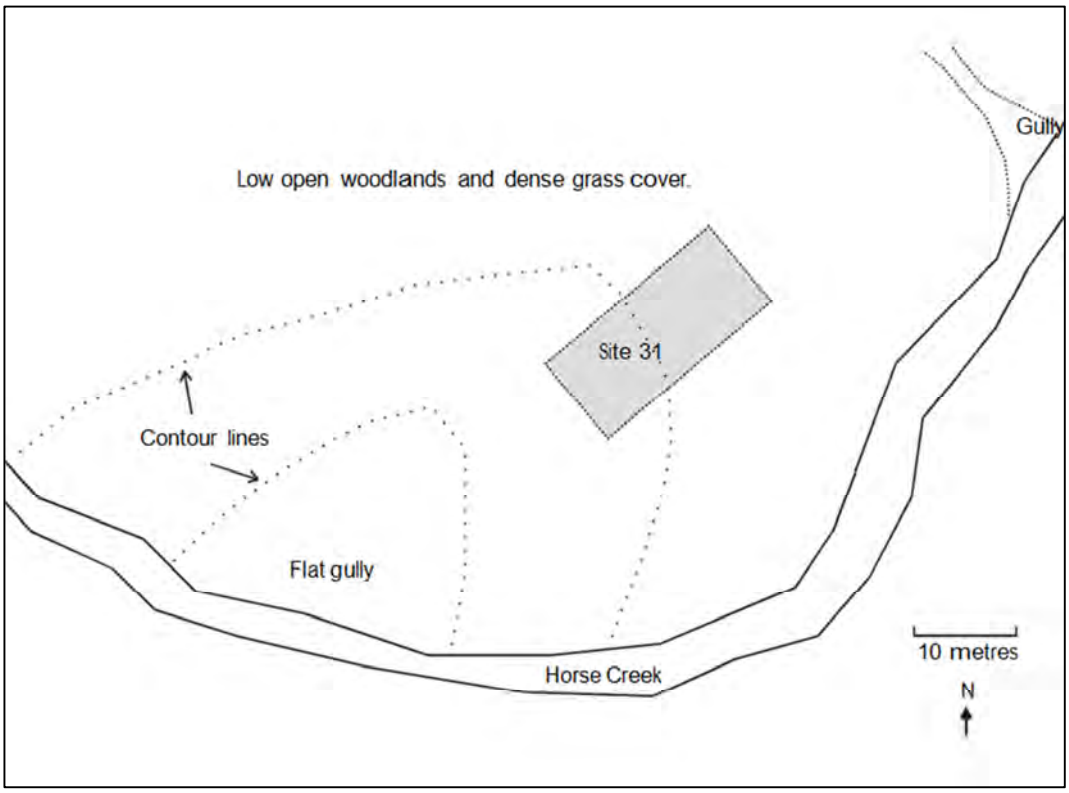
Site 30
Stone Arrangement 2

Location: 53415716E 8469775N Marumba 5770 1:100,000 map sheet
-13.84025^{0}S 134.2201^{0}E
Land System: Flying Fox
Geomorphic Context: Large quartzite outcrop
Method of Discovery: Pedestrian transect
Ground surface visibility %: Maximum-100%, Minimum-95%. Average-95 %
Site location: The site is located on the top of a large quartzite outcrop that is approximately 5 metres high and covers an area of several 100 square metres and surrounded by open woodlands and undulating plains.
Site description: A stone cairn was located on approximately the highest point of the quartzite outcrop on a level and smooth area in the southern most section of the summit of the outcrop. The cairn covered an area of 1 x 1metres and was 0.5m high. The stone appeared to have been gathered from the sides of the outcrop. No stone artefacts were located in the area.
Relationship to proposed pipeline: The pipeline will not disturbed the stone arrangement as it is located on the summit of a quartzite outcrop and the pipeline is located 200 metres away from the proposed pipeline route revision 7on an undulating plain.
Archaeological significance: This site is considered to have moderate to high archaeological significance based on its rarity alone.

Site 30, facing west

Site 31
Stone Artefact Scatter 18

Location: 53 411326E 8465836N Marumba 5770 1:100,000 map sheet
-13.8760 ^{0}S 134.1794^{0}E
Land System: Lindsay / Coolibah
Geomorphic Context: Creek
Method of Discovery: Pedestrian transect
Ground surface visibility %: Maximum-60%, Minimum-5%. Average-30%
Site location: The site is located on northeast bank of Horse Creek near a bend in the creek. The banks are covered in dense grass and isolated trees. The surface consists of black soils with many small sandstone rocks.
Site description: The stone artefacts were located approximately 10-15 metres from the creek on the upper sections of a gentle slope that leads into a small wide gully that runs into the creek. All the artefacts were manufactured from dolerite and there was no concentration of artefacts in the area. Two of the flakes were retouched and there was one core flake (81 x 46 x 26mm). There were also several tips from broken points. Given the low ground visibility possible that the site has a much higher density of artefacts. The site appears to be in a relatively stable area and does appear to have suffered from too much erosion or gullying.
Site dimensions: 15m NS, 20m EW
Artefact densities: Maximum: 4/m^2, Average: 0.2 /m^2
Artefact dimensions (length) Maximum: 81 mm, Average: 45mm
Relationship to proposed pipeline: This site is 180 metres from the proposed pipeline route revision 7 and is not expected to be disturbed by the development.
Archaeological significance: The site appears to be relatively intact and is unusual in that it contains cores, retouched and unretouched flakes made from only one raw material, dolerite. Consequently the site has the potential for researching both the use and the manufacture of the dolerite artefacts. This site also appears to have a good potential for excavation as the artefacts are located on the top and sides the creek banks. Therefore site 31 is considered to have a moderate to high archaeological significance.

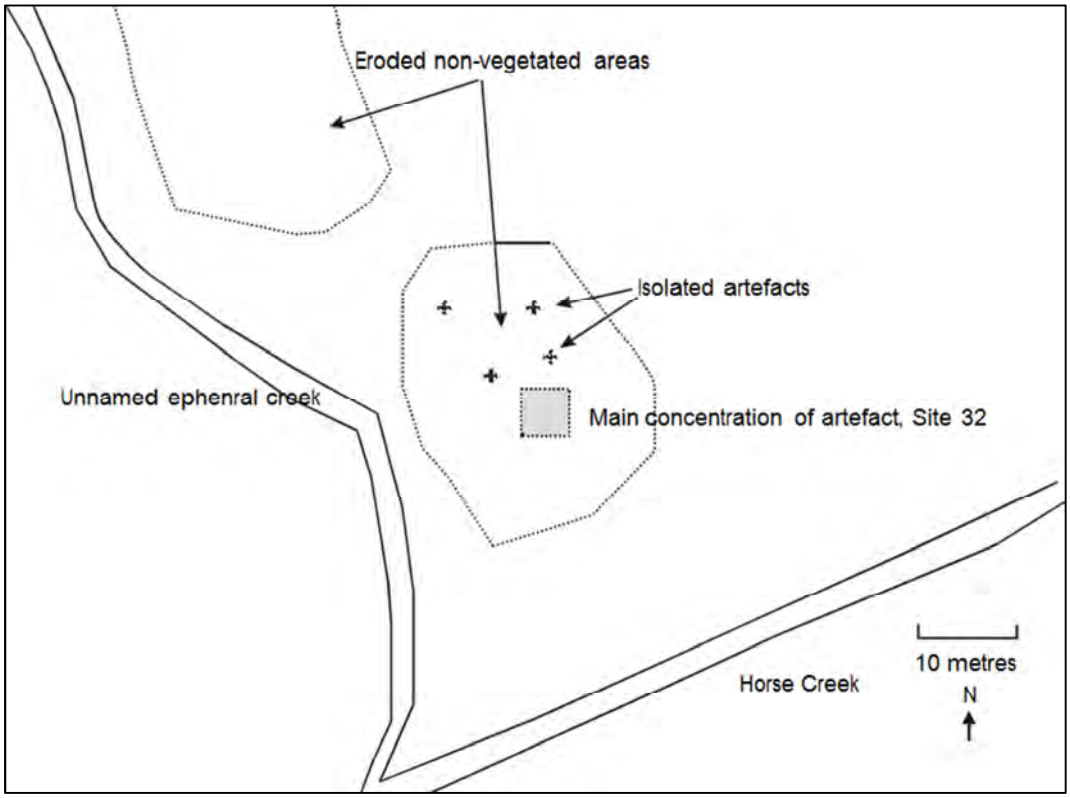


Site 31, facing east

Site 32
Stone Artefact Scatter 19

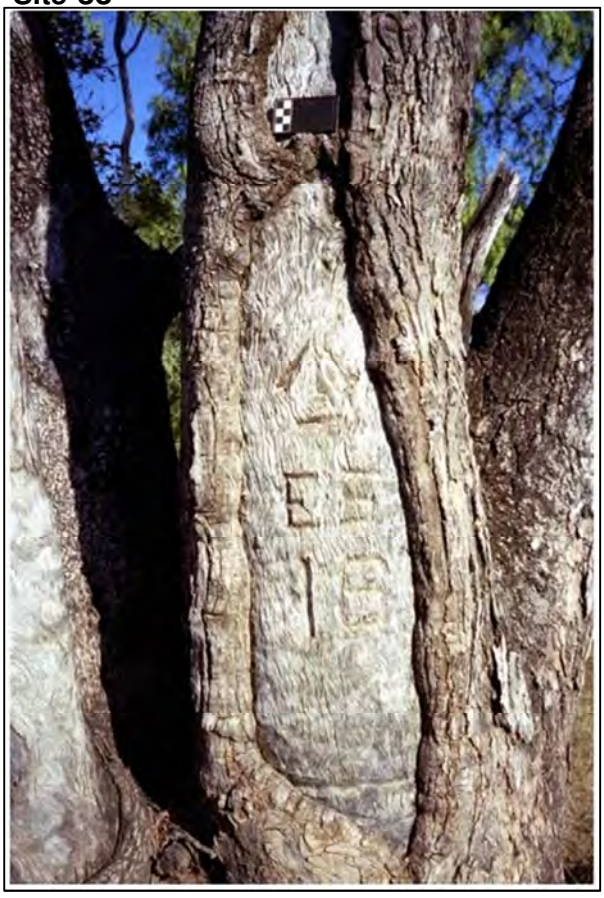
Location: 53 409852E 8465830N Marumba 5770 1:100,00 map sheet
-13.8760 ^{0}S 134.1657 ^{0}E

Land System: Lindsay / Coolibah
Geomorphic Context: Creek
Method of Discovery: Pedestrian transect
Ground surface visibility %: Maximum-100%, Minimum-90%. Average-95 %
Site location: The site is located on the eastern side of Horse Creek in one of several areas along the creek that have been eroded by sheet wash and disturbed by animals
Site description: The artefacts are eroding out of a open sandy sheet 25 metres from Horse Creek and 5 metres from a small ephemeral creek that runs into Horse Creek. Visibility was less than 5% on areas where there was no erosion. The stone artefacts were only located in the one of the eroded areas in a concentration of artefacts 4 x 4 metres. Eighty percent of the artefacts were flakes and twenty percent were cores. The majority were manufactured from dolerite with smaller proportions of chert and siltstone. There were 2 bifacial points made of chert and dolerite.
Site dimensions: 15m NS & 5m EW
Artefact densities: Maximum: 7/m^2, Average: 0.1 /m^2
Relationship to proposed pipeline: This site is one kilometre west of the proposed pipeline route revision 7 and is not expected to be disturbed by the development.
Archaeological significance: As this site has been disturbed by erosion and animal tracks and there is a very low density of artefacts the site has little potential for contributing to archaeological research and consequently is considered to have a low level of archaeological significance.



Site 32, facing north west

Site 33



Site 33
Marked Tree 1

Location: 53 342068E 8403510N Flying Fox 5569 1:100,000 map sheet
-14.4364^{0}S 133.5349^{0}E
Land System: McArthur
Geomorphic Context: Plains, near ephemeral creek
Method of Discovery: Information supplied by Ian Johnstone
Ground surface visibility%: Average: 10%
Site location: The tree is located 30 metres west of Bukalorkmi Creek in open woodlands and dense grass in an area that floods
Site description: On the NNW side of a *Eucalyptus tectifica* is an area where the bark has been removed and marked with an arrow type design on the top, ES in the middle and on the bottom below IB or possibly I8 or I6. The inscription is 14cm wide and 40cm long.
Ian Johnstone who pointed out the site to the survey members had discovered that the tree was marked in the early 1970s by surveyors as a national mapping third order levelling point.
Relationship to proposed pipeline: This site is located 1.2 kilometres north of the proposed pipeline alignment of the proposed pipeline route revision and will not be disturbed by the development.
Archaeological significance: While this site is relatively recent, there is moderate historic significance in that the method of marking trees as a recording point for surveyors has not been used since the more technologically sophisticated ways of marking survey points have become available.