COMMONWEALTH DEPARTMENT OF
TRANSPORT AND REGIONAL
DEVELOPMENT

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Aboriginal Cultural Heritage

Proposal for a Second Sydney Airport
at Badgerys Creek or Holsworthy Military Area

Technical Paper

PPK

Prepared for:

COMMONWEALTH DEPARTMENT OF
TRANSPORT AND REGIONAL DEVELOPMENT

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Proposal for a Second Sydney Airport
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December 1997
Report No: 58H233B PR1112
ISBN No: 064228041X

Explanatory Statement

This technical paper is not part of the Draft Environmental Impact Statement (EIS) referred to in paragraph 6 of the Administrative Procedures made under the Environment Protection (Impact of Proposals) Act 1974.

The Commonwealth Government is proposing to construct and operate a second major airport for Sydney at Badgerys Creek. This technical paper contains information relating to the Badgerys Creek airport options which was used to assist the preparation of the Draft EIS.

The technical paper also assesses the impacts of developing a major airport at the Holsworthy Military Area. On 3 September 1997, the Government eliminated the Holsworthy Military Area as a potential site for Sydney's second major airport. As a consequence, information in this technical paper relating to the Holsworthy Military Area is presented for information purposes only.

Limitations Statement

This technical paper has been prepared in accordance with the scope of work set out in the contract between Rust PPK Pty Ltd and the Commonwealth Department of Transport and Regional Development (DoTRD) and completed by PPK Environment and Infrastructure Pty Ltd (PPK). In preparing this technical paper, PPK has relied upon data, surveys, analyses, designs, plans and other information provided by DoTRD and other individuals and organisations, most of which are referenced in this technical paper. Except as otherwise stated in this technical paper, PPK has not verified the accuracy or completeness of such data, surveys, analyses, designs, plans and other information.

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Acknowledgments

Data used to develop the figures contained in this document have been obtained and reproduced by permission of the Australian Bureau of Statistics, NSW Department of Land and Water Conservation, NSW National Parks and Wildlife Service (issued 14 January 1997), NSW Department of Urban Affairs and Planning and Sydney Water. The document is predominantly based on 1996 and 1997 data.

To ensure clarity on some of the figures, names of some suburbs have been deleted from inner western, eastern, south-eastern and north-eastern areas of Sydney. On other figures, only 'Primary' and 'Secondary' centres identified by the Department of Urban Affairs and Planning's Metropolitan Strategy, in addition to Camden, Fairfield and Sutherland, have been shown.

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CHAPTER 1 OVERVIEW OF THE PROPOSAL

1.1 INTRODUCTION

This technical paper addresses the potential Aboriginal cultural heritage impacts identified as part of the previously proposed development of the Second Sydney Airport at either Badgerys Creek or Holsworthy Military Area. It contains information used to prepare the Draft Environmental Impact Statement (EIS) which addresses the overall environmental impacts of the Badgerys Creek airport options.

1.2 A BRIEF HISTORY

The question of where, when and how a second major airport may be developed for Sydney has been the subject of investigation for more than 50 years. The investigations and the associated decisions are closely related to the history of the development of Sydney's existing major airport, located at Mascot.

The site of Sydney Airport was first used for aviation in 1919. It was acquired by the Commonwealth Government in 1921, and was declared an International Aerodrome in 1935. In 1940 the first terminal building and control tower were opened.

In 1945 the airport had three relatively short runways. A major expansion began in 1947, and by 1954 the current east-west runway was opened. The north-south runway was first opened in 1954 and was extended to its current length in 1972. The present international terminal was opened in 1970.

Planning and investigations for a site for a second Sydney airport first started in 1946. A large number of possible sites both within and outside the Sydney Basin have been investigated.

The *Second Sydney Airport Site Selection Program Draft Environmental Impact Statement* (Kinhill Stearns, 1985) re-examined all possible locations for the second airport and chose 10 for preliminary evaluation. Two sites, Badgerys Creek and Wilton, were examined in detail and an EIS was prepared. In February 1986 the then Commonwealth Government announced that Badgerys Creek had been selected as the site for Sydney's second major airport.

The Badgerys Creek site, which is about 46 kilometres west of Sydney's Central Business District and is 1,700 hectares in area, was acquired by the

Commonwealth between 1986 and 1991. A total of $155 million has been spent on property acquisition and preparatory works.

Since 1986, planning for Sydney's second airport has been closely linked to the development of the third runway at Sydney Airport. In 1989 the Government announced its intention to construct a third runway. An EIS was undertaken and the decision to construct the runway was made in December 1991.

At the same time as investigations were being carried out on the third runway, detailed planning proceeded for the staged development of the second airport at Badgerys Creek. In 1991 it was announced that initial development at Badgerys Creek would be as a general aviation airport with an 1,800 metre runway.

The third runway at Sydney Airport was opened in November 1994. In March 1995, in response to public concern over the high levels of aircraft noise, the Commonwealth Senate established a committee in March 1995 to examine the problems of noise generated by aircraft using Sydney Airport and explore possible solutions. The committee's report, *Falling on Deaf Ears?*, containing several recommendations, was tabled in parliament in November 1995 (Senate Select Committee on Aircraft Noise, 1995).

During 1994 and 1995 the Government announced details of its proposed development of Badgerys Creek, and of funding commitments designed to ensure the new airport would be operational in time for the 2000 Olympics. This development included a 2,900 metre runway for use by major aircraft.

The decision to accelerate the development of the new airport triggered the environmental assessment procedures in the *Environment Protection (Impact of Proposals) Act 1974*. In January 1996 it was announced that an EIS would be prepared for the construction and operation of the new airport.

In May 1996, the present Commonwealth Government decided to broaden the environmental assessment process. It put forward a new proposal involving the consideration of 'the construction and operation of a second major international/domestic airport for Sydney at either Badgerys Creek or Holsworthy on a site large enough for future expansion of the airport if required' (Department of Transport and Regional Development, 1996). A major airport was defined as one 'capable of handling up to about 360,000 aircraft movements and 30 million passengers per year' (Department of Transport and Regional Development, 1996).

The Government also indicated that 'Badgerys Creek at this time remains the preferred site for Sydney's second major airport, subject to the favourable outcome of the EIS, while Holsworthy is an option to be considered as an

alternative' (Minister for Transport and Regional Development, 1996). The two sites considered in this technical paper are shown in *Figure 1.1*.

Following the substantial completion of a Draft EIS on the Badgerys Creek and Holsworthy airport options, the Government eliminated the Holsworthy Military Area as a potential site for Sydney's second major airport. The environmental assessment showed that the Badgerys Creek site was significantly superior to the Holsworthy Military Area. As a result a Draft EIS was prepared which examines only the Badgerys Creek site. While this technical paper examines both the Badgerys Creek and Holsworthy airport options, only the parts of the assessment relating to the Badgerys Creek airport options were used to assist the preparation of the Draft EIS.

1.3 THE PROPOSAL

The Commonwealth Government proposes the development of a second major airport for Sydney capable of handling up to 30 million domestic and international passengers a year. By comparison, Sydney Airport will handle about 20 million passengers in 1997. The *Second Sydney Airport Site Selection Program Draft Environmental Impact Statement* anticipated the airport would accommodate about 13 million passengers each year (Kinhill Stearns, 1985).

A stated objective of the Government is the building of a second major airport in the Sydney region to a full international standard, subject to the results of an EIS. In the Government's view, Sydney needs a second major airport to handle the growing demand for air travel and to control the level of noise experienced by Sydney residents (Coalition of Liberal and National Parties, 1996).

Government policy (Coalition of Liberal and National Parties, 1996) indicates:

- that Sydney's second airport will be more than just an overflow airport and will, in time, play a major role in serving Sydney's air transport needs; and

- a goal of reducing the noise and pollution generated by Sydney Airport as much as possible and that the Government would take steps to ensure that the noise burden around Sydney Airport is shared in a safe and equitable way.

The assumptions made on how the Second Sydney Airport would operate and the master plans which set out the broad framework for future physical development of the airport are based on an operational limit of 30 million passengers a year. The main features include parallel runways, a cross wind

runway and the provision of the majority of facilities between the parallel runways.

Consideration has also been given to how the airport may be expanded in the future and the subsequent environmental implications. Such an expansion could not proceed, however, unless a further detailed environmental assessment and decision making process were undertaken by the Government.

Five airport options are considered, as well as the implications of not proceeding with the proposal. Three of the airport options are located at Badgerys Creek and two are located within the Holsworthy Military Area. Generally, the airport options are:

- Badgerys Creek Option A which has been developed to be generally consistent with the planning for this site undertaken since 1986. The airport would be developed within land presently owned by the Commonwealth with two parallel runways constructed on an approximate north-east to south-west alignment;

- Badgerys Creek Option B would adopt an identical runway alignment to Option A, but provides an expanded land area and also a cross wind runway;

- Badgerys Creek Option C would provide two main parallel runways on an approximate north to south alignment in addition to a cross wind runway. Again the land area required would be significantly expanded from that which is presently owned by the Commonwealth;

- Holsworthy Option A would be located centrally within the Holsworthy Military Area and would have two main parallel runways on an approximate north to south alignment and a cross wind runway; and

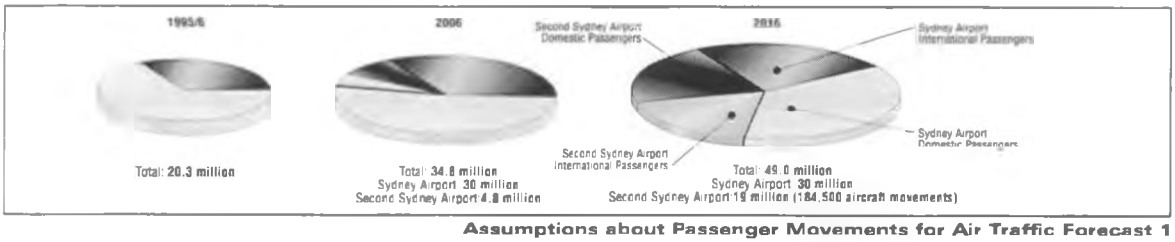
- Holsworthy Option B would be located in the south of the Holsworthy Military Area and would have two main parallel runways on an approximate south-east to north-west alignment and a cross wind runway.

To ensure that the likely range of possible impacts of the airport options are identified a number of different assumptions about how the airport options would be developed and operate have been adopted. These different assumptions relate to the number and types of aircraft that may operate from the airport, the flight paths used and the direction of take offs and landings.

The number of flights into and out of the proposed Second Sydney Airport would depend on a number of factors including the types of aircraft that would use the airport and the associated numbers of passengers in each aircraft. The

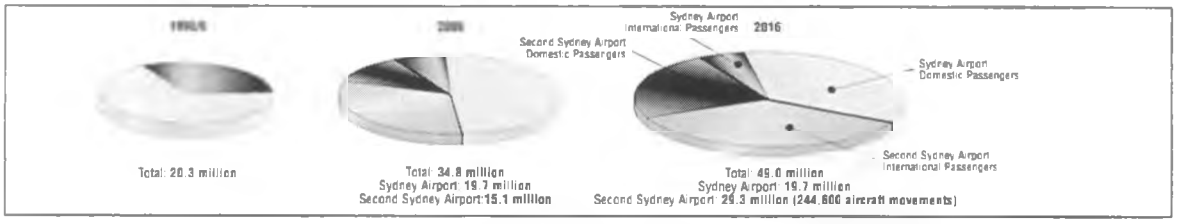
Figure 1.1

Potential Airport Sites Considered in the Draft EIS



Assumptions about Passenger Movements for Air Traffic Forecast 1

Assumptions about Passenger Movements for Air Traffic Forecast 2



Assumptions about Passenger Movements for Air Traffic Forecast 3

Figure 1.2

Summary of Passenger Movement Forecasts Used for Environmental Assessment

proposal put forward by the Government anticipates a major airport handling 30 million passengers and up to 360,000 aircraft movements per year.

Air traffic forecasts have been developed based on an examination of the number and type of aircrafts that would use the airport as it approaches an operating level of 30 million passengers per year. This examination has shown that if the airport accommodated about 245,000 aircraft movements each year, the number of air passengers would approach 30 million. This assumes a relatively high percentage of international flights being directed to the Second Sydney Airport. Therefore it is appropriate for this Draft EIS to assess the airport operating at a level of 245,000 aircraft movements per year, rather than the 360,000 originally anticipated by the Government. It has been assumed that this level of operation could be reached by about 2016.

1.4 AIR TRAFFIC FORECASTS

Cities around the world which have developed second major airports have responded to their particular needs in different ways. For example, the original airport in Dallas, United States, is now used for short range traffic that does not connect with other flights. Second airports in New York and Washington serve as hubs for particular airlines. In Taipei, Taiwan, smaller domestic aircraft use the downtown airport and larger international flights use a newer airport 40 kilometres from the city.

It is clear that each metropolitan area around the world has unique characteristics and the development of multi-airport systems respond to particular local circumstances. The precise role and consequential staging of development of the Second Sydney Airport would be the subject of future Government decisions. To assist in developing a realistic assessment of the potential impacts of the Second Sydney Airport, three sets of air traffic forecasts for the airport were developed. Each forecast assumes a major airport would be developed, however, this may be achieved at different rates of growth.

The three potential air traffic scenarios considered for the Second Sydney Airport are shown in *Figure 1.2*. They are:

- *Air Traffic Forecast 1* where the Second Sydney Airport would provide only for demand which cannot be met by Sydney Airport. This is an overflow forecast, but would nevertheless result in a significant amount of air traffic at the Second Sydney Airport. The proportion of international and domestic air traffic is assumed to be similar at both airports;

- *Air Traffic Forecast 2* where the Second Sydney Airport would be developed to cater for 10 million passengers a year by 2006, with all

further growth after this being directed to the second airport rather than Sydney Airport. The proportion of international and domestic traffic is also assumed to be similar at both airports; and

- *Air Traffic Forecast 3* which is similar to Forecast 2 but with more international flights being directed to the Second Sydney Airport. This would result in the larger and comparatively noisier aircraft being directed to the second airport. It would accommodate about 29.3 million passengers by 2016.

1.5 OPERATION OF THE AIRPORT OPTIONS

At any airport, aircraft operations are allocated to runways (which implies both the physical runway and the direction in which it is used) according to a combination of wind conditions and airport operating policy. The allocation is normally performed by Air Traffic Control personnel.

Standard airport operating procedures indicate that a runway may not be selected for either approach or departure if the wind has a downwind component greater than five knots, or a cross wind component greater than 25 knots. If the runway is wet, it would not normally be selected if there is any downwind component. This applies to all aircraft types, although larger aircraft would be capable of tolerating relatively higher wind speeds. Wind conditions at the airport site therefore limit the times when particular runways may be selected. However, there would be a substantial proportion of the time, under low wind conditions, when the choice of runways would be determined by airport operating policy.

For the environmental assessment, the maximum and minimum likely usage for each runway and runway direction was estimated and the noise impact of each case calculated. The actual impact would then lie between these values and would depend on the operating policy which is applicable at the time.

The three airport operation scenarios were adopted for the environmental assessment, namely:

- *Airport Operation 1* shown in *Figure 1.3*. Aircraft movements would occur on the parallel runways in one specified direction (arbitrarily chosen to be the direction closest to north), unless this is not possible due to meteorological conditions. That is, take offs would occur to the north from the parallel runways and aircraft landing would approach from the south, travelling in a northerly direction. Second priority is given to operations in the other direction on the parallel runways, with operations on the cross wind runway occurring only when required because of meteorological conditions;

- *Airport Operation 2* shown in *Figure 1.4*. As for Operation 1, but with the preferred direction of movements on the parallel runways reversed, that is to the south; and

- *Airport Operation 3*. Deliberate implementation of a *noise sharing* policy under which seven percent of movements are directed to occur on the cross wind runway (equal numbers in each direction) with the remainder distributed equally between the two parallel runway directions.

Since a cross wind runway is not proposed at Badgerys Creek Option A, only Operations 1 and 2 were considered for that option.

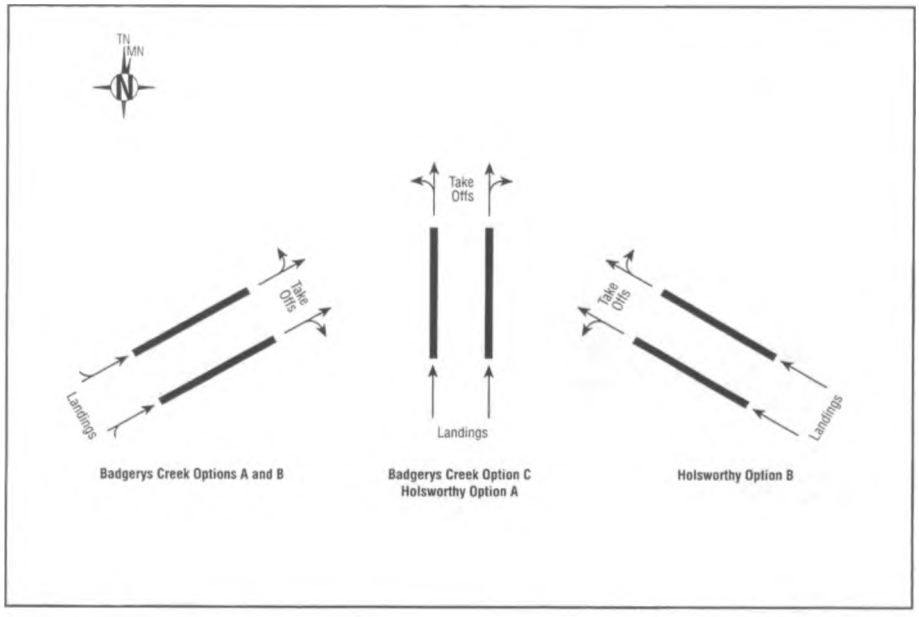


Figure 1.3

Predominant Directions of Movement of Aircraft for Airport Operation 1

Note: Cross wind runway used only when required because of meteorological conditions

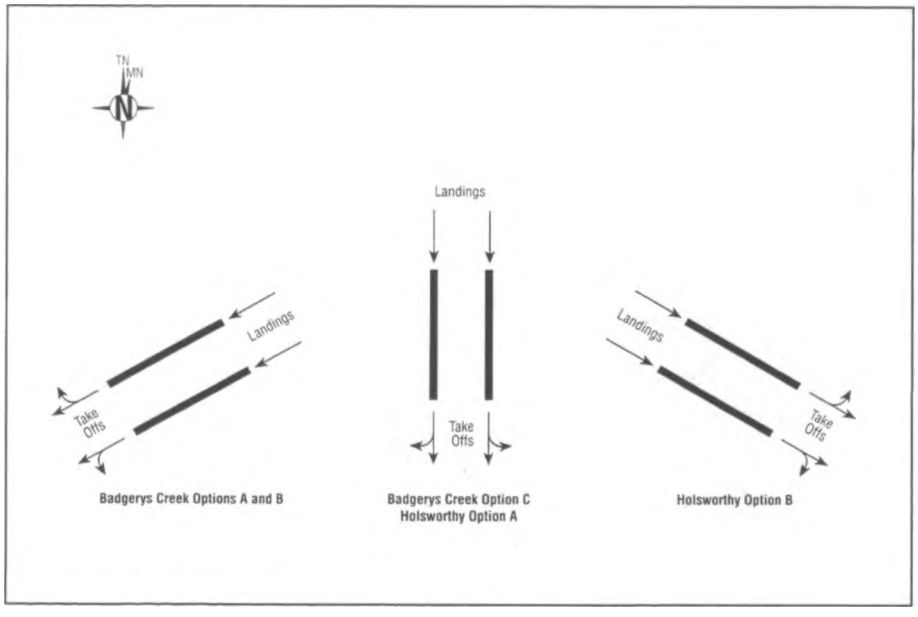


Figure 1.4

Predominant Directions of Movement of Aircraft for Airport Operation 2

Note: Cross wind runway used only when required because of meteorological conditions

CHAPTER 2 CONSULTATION

Preparation of this Draft EIS involved consultation with the community, other stakeholders, Commonwealth, State and local Governments and Government agencies.

2.1 COMMUNITY CONSULTATION

The primary role of the consultation process during the preparation of the Draft EIS was to provide accurate, up to date information on the proposals being considered and the assessment process being undertaken. From October 1996 to May 1997, ten separate information documents were released and over 400,000 copies distributed to the community. Four types of display posters were produced and 700 copies distributed. Over 140 advertisements were placed in metropolitan and local newspapers. Non English language documents were produced in 14 languages and over 20,000 copies distributed. Advertisements in seven languages were placed on ethnic radio.

Opportunities for direct contact and two way exchange of information with the community occurred through meetings, information days, displays at shopping centres, telephone conversations and by responding to written submissions. Through these activities over 20,000 members of the community directly participated in the consultation activities.

Written and telephone submissions received were incorporated into a database which grouped the issues in the same way as the chapters of the Draft EIS. The issues raised were progressively provided to the EIS study team to ensure that community input was an integral part of the assessment process.

Further details of consultation with the community and other stakeholders and its outcomes are contained in *Technical Paper No. 1 Consultation*.

2.2 OTHER CONSULTATION

Various Government departments and agencies were consulted during the preparation of the Draft EIS. These are outlined in *Table 2.1* as follows.

TABLE 2.1 CONSULTATION UNDERTAKEN WITH GOVERNMENT AND OTHER ORGANISATIONS

Organisation	
Commonwealth	
Aboriginal and Torres Strait Islander Commission	Details of legislation
Australian Heritage Commission	Details of legislation and listed sites on Heritage Register
Department of Defence	Aboriginal sites in the Holsworthy Military Area
Metropolitan Local Aboriginal Land Council	Aboriginal concerns and EIS process
National Native Title Tribunal	Native title claims in study areas
State	
National Trust of Australia (NSW)	Items listed on National Trust Register
NSW Aboriginal Land Council	Aboriginal concerns
NSW National Parks and Wildlife Service	Aboriginal sites and legislation
Local	
Campbelltown Aboriginal Advisory Committee (Campbelltown Council)	Aboriginal concerns regarding Holsworthy Military Area
Other Groups	
Australian Museum - Sydney	AXIS/Australian Museum Business Services Report
Darug Custodial Aboriginal Corporation	Aboriginal concerns regarding Badgerys Creek
Darug Tribal Aboriginal Corporation	Aboriginal concerns regarding Badgerys Creek
Daruk Local Aboriginal Land Council	Aboriginal concerns regarding Badgerys Creek
Eora Centre	Aboriginal concerns
Gandangara Local Aboriginal Land Council	Aboriginal concerns regarding Badgerys Creek
Korewal Elouera Jerrungarugh Tribal Elders Corporation	Airport sites, native title and Aboriginal concerns
La Perouse Local Aboriginal Land Council	Aboriginal concerns
Macquarie University, Department of Archaeology	Cumberland Plains Aboriginal sites
National Museum of Australia - Canberra	Aboriginal sites
Sydney University, Department of Archaeology	Rock art sites in the Holsworthy Military Area
Tharawal Local Aboriginal Land Council	Aboriginal concerns regarding the Holsworthy Military Area

As part of the consultation for this study, interviews with local Aborigines and Aboriginal community representatives were undertaken as well as interviews with local land owners and administrators, archaeologists and amateur recorders, and a review of information held by Government authorities including site registers. A full list of people consulted during the study is provided in *Appendix A*. Additional details about consultation with Aboriginal groups and Aborigines is provided in *Section 3.4*.

CHAPTER 3 METHODOLOGY

3.1 AIMS AND SCOPE OF WORK

3.1.1 AIMS

The aims of the Aboriginal cultural heritage study are to:

- identify and describe a representative sample of the Aboriginal archaeological sites within the Badgerys Creek and Holsworthy study areas;
- make predictions about the likely archaeological resource in unsurveyed areas, based on the results of a comprehensive survey of representative sample areas;
- identify traditional and contemporary Aboriginal cultural values associated with the study areas;
- assess the cultural heritage significance of Aboriginal sites and places within the study areas, based on the known and predicted resource;
- assess the likely construction and operational impacts of the Second Sydney Airport proposal on the heritage significance and values of the known and predicted resource;
- identify the main heritage issues relating to the construction and operational impacts of the proposed airport options;
- propose management strategies for the mitigation of potential impacts associated with each of the proposed airport options; and
- incorporate local Aboriginal community involvement as an integral component of the study.

For the purposes of the Aboriginal cultural heritage assessment, the Badgerys Creek and Holsworthy study areas are defined by the following descriptions:

- Badgerys Creek - the area covered by all three of the proposed airport options (as defined by the proposed site boundaries) including areas of clearing for Obstacle Limitation Surface requirements. This is shown in *Figure 3.1*; and

- Holsworthy - the area covered by the Holsworthy Military Area (excluding the extreme northern section) and those areas of anticipated impact from the proposed two airport options where these fall outside of the Military Area. This includes the proposed access corridors, the borrow areas and clearing required for Obstacle Limitation Surface requirements. This is shown on *Figure 3.2*.

3.1.2 SCOPE OF WORK

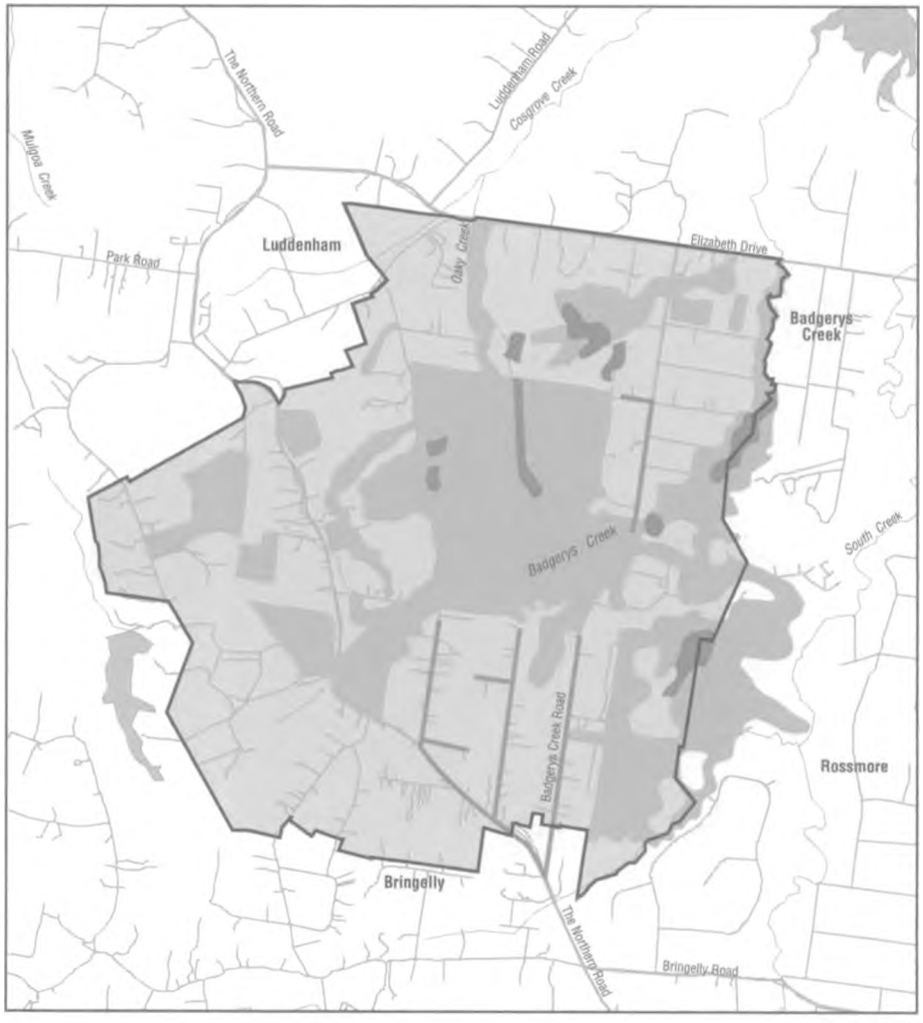
The general scope of work and methodology for the Aboriginal cultural heritage assessment contained the following key components:

- review of previous work;
- program of Aboriginal consultation (continuous throughout the Draft EIS program);
- investigation of contemporary Aboriginal cultural heritage issues and values;
- formulation of a survey and sampling strategy;
- field surveys;
- results analysis;
- significance assessment;
- impact assessment of the proposed airport options; and
- preparation of potential mitigation and site management strategies.

Information Sources

The study and assessment of Aboriginal archaeological sites was based on three sets of information:

- site recordings made prior to this study and produced as a result of selective or non comprehensive surveys;
- site recordings made as a result of comprehensive field survey coverage; and
- a set of predictive statements describing the probable occurrence and nature of Aboriginal archaeological sites in areas not comprehensively surveyed.



Combination of Options A, B and C airport boundaries

Field survey coverage

Previous survey coverage (Kinhill Stearns, 1985)

Road corridors surveyed

Figure 3.1

Badgerys Creek Study Area and Survey Coverage for Aboriginal Cultural Heritage Assessment

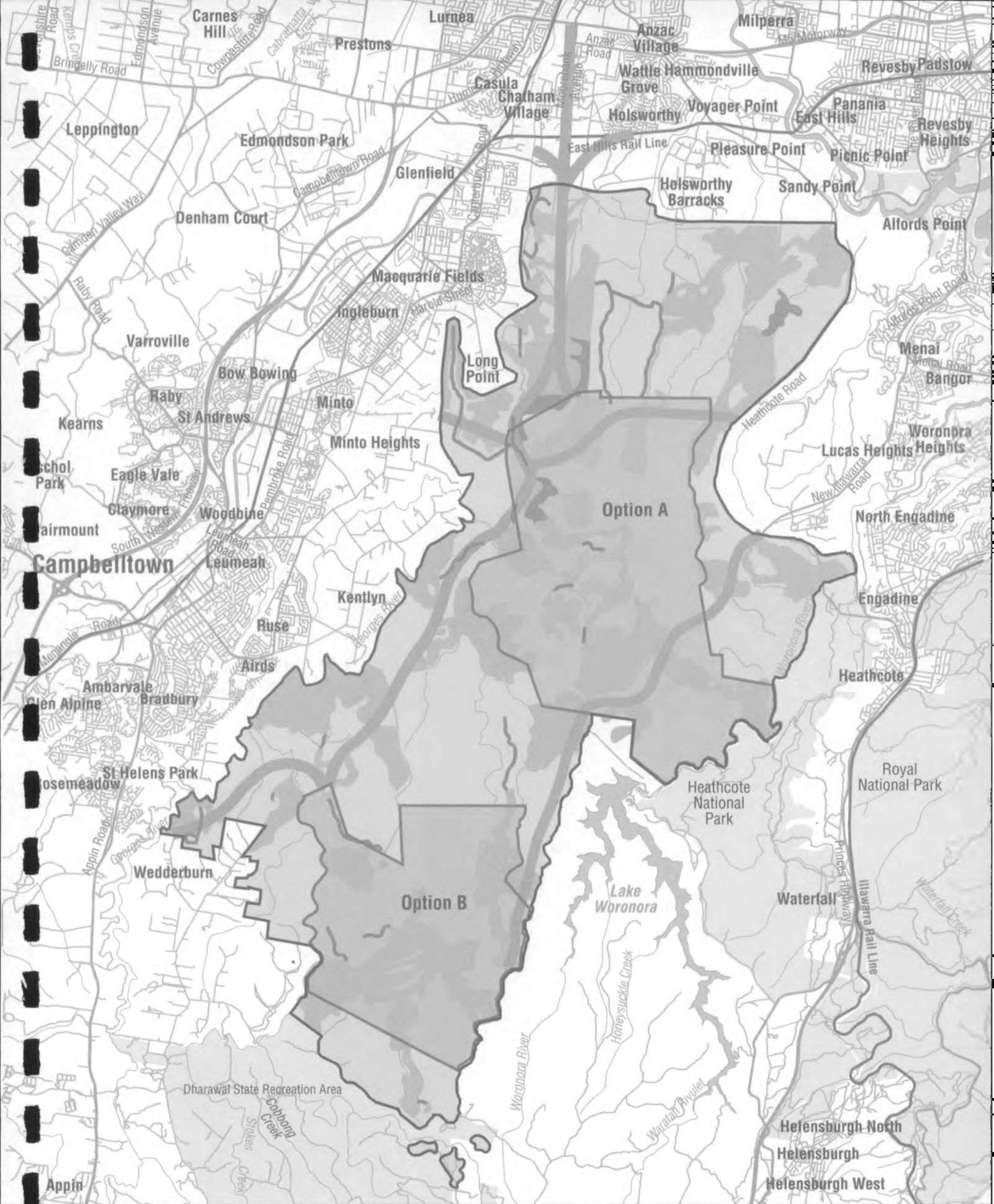


Figure 3.2

Holsworthy Study Area and Survey Coverage for Aboriginal Cultural Heritage Assessment

The assessment of non-archaeological Aboriginal cultural heritage values was based on two sets of information:

- previous reports and historic documentary accounts of local Aboriginal society; and
- oral accounts and memories provided by Aborigines interviewed or approached during the course of these investigations.

Sampling Strategy

The survey for Aboriginal archaeological sites was conducted using a sampling strategy which was required to:

- cover a representative sample of the topographic variation within each of the study areas;
- be flexible so that Military and freehold/leasehold requirements could be accommodated;
- provide an effective sample of the areas likely to be directly impacted by each of the proposed airport options; and
- comply with these requirements and be conducted at the same time as the process of identifying and refining the location and design of each of the proposed airport options.

Aboriginal Consultation

The involvement and participation of local representative Aboriginal organisations was an integral component of the study, the nature of which was defined through initial discussions where roles and protocols were established. Key roles adopted by local representative Aboriginal organisations were:

- the dissemination of information throughout relevant local Aboriginal communities;
- the discussion of survey results, the assessment of heritage values and other issues such as native title, within the local Aboriginal communities; and
- the provision of written reports providing statements of Aboriginal significance about the study areas and identifying the impacts of the proposed airport options, and the organisations views regarding the proposed airport options.

Limitations

The geographical scope of the Aboriginal cultural heritage study was restricted with regard to the following:

- Aboriginal sites of cultural or heritage value which are located within the Holsworthy and Badgerys Creek study areas were the subject of the recording and assessment conducted in this investigation;

- field work was limited to surface surveys and the recording of surface archaeological features. No sub-surface excavation or testing was conducted. The exclusion of subsurface testing was based on the following reasons:

  - the allocated period of time for the study did not allow for the time-consuming methodologies of test excavation, materials analysis and reporting which would be required for an appropriate subsurface testing program;
  - the conduct of a subsurface testing program in the study areas was not warranted given the available data from excavations carried out in adjacent and comparable environments; and
  - a subsurface testing program conducted as part of this study would result in avoidable and irreversible damage (through excavation) to many archaeological sites located outside of the zone of impact which would result if an airport was constructed.

Study Team

The Aboriginal cultural heritage study was primarily conducted by three consultants and a large field team. The personnel involved, their role and qualifications are listed in *Appendix B*.

3.2 INFORMATION SOURCES

A range of information sources were consulted for this study. These included contemporary and historic written reports and documents, interviews with local Aborigines and Aboriginal community representatives, interviews with local land owners and administrators, archaeologists and amateur recorders, and a review of information held by Government authorities including site registers.

Libraries contacted for relevant information included:

- Australian Institute of Aboriginal and Torres Strait Islander Studies Canberra;

- National Library of Australia, Canberra;
- Mitchell Library, Sydney;
- Liverpool Bicentennial Museum; and
- NSW National Parks and Wildlife Service - archaeological reports.

The following is a list of the key sources of previously recorded information and analysis which relates specifically to the two study areas. A full list of references is provided in the reference list of this Technical Paper.

- AXIS Environmental/Australian Museum Business Services Consulting (1995), *Holsworthy Training Area Environmental Audit*, Main Report and Appendix 1. Report for the Department of Defence;
- Kinhill Stearns (1985), *Second Sydney Airport Site Selection Programme. Draft Environmental Impact Statement.* Prepared for the Department of Aviation;
- McDonald, J, (1994), *Dreamtime Superhighway: An Analysis of Sydney Basin Rock Art and Prehistoric Information Exchange*. Unpublished PhD thesis, Department of Prehistory and Anthropology, Australian National University, Canberra;
- NSW National Parks and Wildlife Service Aboriginal Sites Register;
- Officer KLC (1984), *From Tuggerah to Dharawal: Variation and Function Within a Regional Art Style*. Unpublished BA Hons thesis, Department of Prehistory and Anthropology, Australian National University, Canberra; and
- Sydney Prehistory Group (1983), *In Search of Cobrakall: A Survey of Aboriginal Sites in the Campbelltown Area South of Sydney*, Parts 1 and 2, NSW National Parks and Wildlife Service.

3.3 REVIEW OF PREVIOUS WORK

A review of previous archaeological, ethno-historical, and anthropological work was conducted at the commencement of the study. The aims of this review were to:

- identify previously recorded archaeological sites and other places of Aboriginal heritage significance within the study areas;

- provide a regional overview with which to compare the study area results;
- provide a brief historical outline of the Aboriginal groups associated with the study areas following European contact;
- review any previous models of site location and site significance relevant to the study areas;
- identify traditional owners and their descendants; and
- provide baseline information for the development of an effective survey sampling strategy.

The review included:

- searches of the NSW National Parks and Wildlife Service Register of Aboriginal Sites, the Register of the National Estate (Australian Heritage Commission), the Register of the National Trust (NSW), and the Register of Native Title Claims held by the Native Title Tribunal;
- searches of published and unpublished thesis, reports and articles held in the NSW National Parks and Wildlife Service library, relevant university departments, the Australian National Library, Local Aboriginal Land Councils and the library of the Australian Institute of Aboriginal and Torres Strait Islander Studies; and
- a survey of land use history and levels of ground surface disturbance, drawing upon aerial photography and early mapping.

3.4 ABORIGINAL PARTICIPATION, CONSULTATION AND ISSUES

Aboriginal participation and consultation was conducted in four coordinated programs:

- general consultation with representative Aboriginal community groups;
- investigation of contemporary Aboriginal issues conducted by project anthropologist Ilona Horvath;
- participation within the field survey program; and
- assessment of site significance and impacts.

3.4.1 GENERAL ABORIGINAL CONSULTATION

The involvement and participation of local representative Aboriginal organisations was considered to be an integral component of this study. The initial task was to identify key representative organisations and establish mutually acceptable roles and protocols.

Locally based Aboriginal organisations with a primary interest or function in cultural heritage can be broadly grouped into two categories - Local Aboriginal Land Councils established under the Aboriginal Land Rights Act 1983, and other organisations such as Elders or Custodial groups generally incorporated under the Aboriginal Councils and Associations Act 1976.

Land Councils are run by a periodically elected group of Council officers who are nominated from, and elected by, a local community membership. All adult Aborigines resident within a Land Council boundary, or other Aborigines who have an association with that area, and recognised by the Council membership, can become Council members. Other Aboriginal organisations vary considerably in their stated aims, charters and membership criteria. Typically, 'Elders' or other Custodial groups consist of members who have a shared tribal identity and set of custodial interests.

The two study areas fall within the boundaries and stated areas of interest of several locally based Aboriginal organisations. The Holsworthy Military Area is located solely within the boundaries of the Tharawal Local Aboriginal Land Council based at Buxton, NSW. The area also falls within the tribal territory of the Tharawal people as best can be determined from early European records. The Badgerys Creek study area is located solely within the boundaries of the Gandangara Local Aboriginal Land Council based at Liverpool, NSW. This area falls within the recorded 19th century tribal territory of the Daruk people. In addition to the Land Councils, three other organisations have formed to represent the views and interests of Daruk and Tharawal descendants. These are the Darug Tribal Aboriginal Corporation based at Blacktown, the Darug Custodial Aboriginal Corporation based at Kellyville, and the Korewal Elouera Jerrungarugh Tribal Elders Aboriginal Corporation based at Warilla in Wollongong.

Consultation with the Tharawal Local Aboriginal Land Council and the Gandangara Local Aboriginal Land Council commenced as part of initial investigations. The Land Councils were contacted initially by phone and letters were sent to each Council introducing the consultants and briefly explaining the Second Sydney Airport proposal.

Meetings were held at Buxton on 23 October 1996 and Liverpool on 4 November 1996, to discuss the study, ascertain which indigenous groups should be consulted and how Land Councils wished to participate. Both

groups indicated that they saw the Land Councils as the primary representative indigenous group for the respective study areas.

In recognition of the wider Sydney Aboriginal community and the potential for participants to reside outside of the local Land Council boundaries, approaches were made to other Aboriginal groups based within the Sydney metropolitan area. These consultations aimed at ensuring that interested people had access to information about the proposal and the study and an opportunity for discussion with the specialist archaeologists and anthropologist.

The three other Sydney metropolitan Aboriginal Land Councils - Daruk, Metropolitan and La Perouse were contacted by phone and letter. These groups all indicated that they did not have an official role to play in the process as the subject land is not within their Land Council boundaries. They were happy to disseminate information on the investigations to their communities. It was agreed that interested individuals or groups would contact Navin Officer Heritage Consultants or PPK if more information or meetings were required.

Other groups consulted included the Korewal Eloura Jerrungarugh Tribal Elders Aboriginal Corporation, the Darug Tribal Aboriginal Corporation, and the Darug Custodial Aboriginal Corporation. Interviews with various members of these organisations were conducted and the provision of information and its discussion conducted in parallel to the main Land Council programs. No personal contact with the Darug Custodial Aboriginal Corporation was achieved, however information and invitations to discuss the proposal or hold meetings were provided to the organisation's postal address. A meeting with the Campbelltown Aboriginal Advisory Committee at Campbelltown City Council was held in January 1997.

Copies of the Second Sydney Airport information brochure were sent to all of these organisations, together with specific correspondence.

As a result of initial discussions, the Tharawal and Gandangara Local Aboriginal Land Councils adopted roles to:

- disseminate information throughout the local Aboriginal communities;
- discuss survey results and the assess heritage values and other issues such as native title, within the local Aboriginal communities; and
- provide written reports with statements of Aboriginal significance about the study areas, identify the impacts of the proposed airport options, and providing the organisation's views regarding the options proposed.

Both Tharawal and Gandangara Land Council representatives undertook to consult widely within their respective communities to ensure that information about the Second Sydney Airport proposal was available to those that requested it and to ascertain if members wanted to meet with the study team. These representatives also undertook initial approaches to elders within the community to determine if information relevant to the study areas was known within the communities.

The Tharawal Local Aboriginal Land Council approached the proposal as a co-operative joint study with the archaeologists and anthropologist. The aim of the Land Council was to participate as fully as possible in all phases of the study, with the end goal being a report which documented the informed views of the indigenous community. Land Council participation in the investigation, the dissemination of information, and issue discussions were principally conducted with Land Council officers and qualified Sites Officers.

Formal and informal meetings were held with Tharawal Local Aboriginal Land Council representatives on numerous occasions throughout the fieldwork period. Representatives of the Council also attended public information days and meetings.

The Gandangara Local Aboriginal Land Council wished to be involved in all stages of the Badgerys Creek site assessment, and stressed the need for Aboriginal community requirements to be integrated within the process, and clearly defined in the final report. The Council indicated that many of the responsibilities regarding cultural heritage sites could be handled by the members of their heritage sub-committee. Subsequent consultations were directed through members of this sub-committee. This included presentations at a special general meeting of the Land Council and field participation by Land Council representatives.

3.4.2 INVESTIGATION OF CONTEMPORARY ABORIGINAL ISSUES

The objectives of investigating Aboriginal issues were to:

- review the literature for references to the study areas, the sites within them and the history of the Aboriginal people associated with them;
- familiarise the relevant Aboriginal people and representative groups with the current Second Sydney Airport proposal;
- elicit opinion regarding the proposal; and
- locate any areas of Aboriginal significance in the study areas and record this significance.

This investigation was conducted by an anthropologist with:

- a search and review of ethno-historic and anthropological work relevant to the study areas. This consisted of a literature survey including early settlers accounts, early anthropological work, explorers journals, other environmental impact statement and management reports, ethnographic material and local histories;

- a search of Native Title claims;

- an extensive program of consultation. This involved initial discussions with relevant Land Councils and Aboriginal organisation leaders where further contact was suggested. Further discussions and interviews were then conducted with other individuals who were interested in the study areas, the proposed project, or related issues. Consultations included face to face meetings and telephone interviews; and

- documentation of the views and issues identified.

3.4.3 FIELD SURVEY

The participation of Local Aboriginal Land Council representatives in the field survey program was considered by all parties to be an essential component of Aboriginal community access and participation in the Draft EIS process. Provision was made for one representative to participate in the daily survey tasks of each field team. The selection of field representatives by both the Tharawal and Daruk Local Aboriginal Land Councils was based on recognised survey and site recording experience.

The role of the Land Council field representatives were to:

- represent the Land Council in the field surveys;

- be first hand observers of the field program;

- participate as an integral team member in field survey and site discovery activities;

- take part in site recording and site interpretation activities according to their level of previous experience; and

- communicate their experience of the study area and survey methodology to the wider local Aboriginal community.

Tharawal Land Council representatives contributed over 100 person days within the field survey of the Holsworthy study area. Gandangara Land

Council representatives contributed 12 person days within the field survey of the Badgerys Creek study area. In each case, representatives were present on each survey day. A full list of field representatives is provided in *Appendix B*. The Land Councils have each expressed their satisfaction with the conduct and results of each of the field survey programs.

Following the completion of the field survey, summary data sheets and brief plain English reports were provided to the Land Councils for their consideration and discussion. These are provided in *Appendix C*. The plain English reports were also provided to other local Aboriginal organisations with an invitation to comment.

The survey results were presented by the archaeologists and discussed at a special general meeting of the Gandangara Land Council and at a meeting of the Campbelltown Aboriginal Advisory Committee.

3.4.4 ASSESSMENT OF SITE SIGNIFICANCE AND POTENTIAL IMPACTS

Five main categories of assessment were used for determining the cultural heritage significance of Aboriginal sites and places within the study areas. These are based on the definition of cultural significance used in the Burra Charter (Australia ICOMOS, 1987) and can be summarised as:

- significance to Aboriginal people;
- scientific (or archaeological) significance;
- aesthetic value;
- representativeness; and
- value as an educational and/or recreational resource.

These criteria are explained in greater detail in *Chapter 5*.

The assessment of significance to Aboriginal people was determined by the relevant Local Aboriginal Land Councils and presented to the consultants in post-survey discussions, and in written statements of significance prepared as part of the Land Council reports for the Draft EIS. Assessments by the Land Councils included reference to aspects of all the assessment criteria, particularly educational and aesthetic values. These determinations were based on internal processes of consultation and review conducted by Land Council Officers within their respective communities.

Draft assessments of scientific significance, representativeness, and educational value were determined by the archaeologists and subsequently

presented to the Land Councils for discussion and review. Final assessments were developed following this process of review.

3.4.5 INFORMATION ACCESS AND PUBLICATION PROTOCOL

One of the issues discussed with Aboriginal community groups was the protection of culturally sensitive information. Concerns about the protection of site location information to prevent inappropriate site visitation, and to ensure that published cultural information was appropriate for a general audience were raised.

Following discussions about appropriate forms of information presentation for the Draft EIS, a draft list of protocols was agreed to as follows:

- no map co-ordinates for sites will be published in any parts of the Draft EIS or the associated Technical Papers;
- a full list of site locations in the form of map co-ordinates will be included in a restricted appendix to the Draft EIS Technical Paper on Aboriginal Heritage (included as *Appendix M*). This information will be needed in the future by Land Council representatives and archaeologists who wish to refind, monitor, or continue survey work in the Badgerys Creek or Holsworthy areas;
- the restricted appendix will not be made available to the public;
- copies of the site cards will only be provided to the Land Councils and to the NSW National Parks and Wildlife Service;
- the restricted appendix will only be provided to the NSW National Parks and Wildlife Service, Sites Officers nominated by the Land Councils, the DoTRD and any other person or organisation who is consented to by both the relevant Aboriginal Land Council and the NSW National Parks and Wildlife Service;
- only small scale maps showing site locations will be included in the Draft EIS;
- photographs of the sites taken during the field survey may be provided to the NSW National Parks and Wildlife Service for inclusion in their sites register;
- photographs of Aboriginal sites, artefacts and rock art may be included in the Draft EIS after agreement by the relevant Aboriginal Land Council. This is to ensure that rock art motifs or other pictorial information of a sensitive nature is not published;

- a list of the Holsworthy site names, map co-ordinates and brief site descriptions will be provided to the Department of Defence at Holsworthy so that its existing Aboriginal site database can be upgraded with the new site information determined through this study; and

- freehold landowners in the Badgerys Creek study area may also be advised about the location of Aboriginal sites on their land, where normal land use practise could be expected to cause damage beyond existing levels. This will depend on the views of the Gandangara Local Aboriginal Land Council. The statutory responsibility for managing recorded site information rests with the NSW National Parks and Wildlife Service.

3.5 FIELD SURVEY

3.5.1 OVERVIEW

Archaeological survey has previously been conducted in both the Holsworthy and Badgerys Creek study areas. The extent and location of these areas is shown in *Figures 3.1* and *3.2*. However, limitations in methodology and ground coverage achieved resulted in none of the previous work being able to satisfy contemporary EIS and cultural heritage assessment standards without considerable additional work.

The *Holsworthy Training Area Environmental Audit* report (AXIS Environmental/Australian Museum Business Services Consulting, 1995) found that the coverage achieved in previous archaeological surveys was not representative of either the topographic variation or the site types actually present. This study tested the accuracy of previous recordings by conducting comprehensive surveys in sample areas totalling 1.4 square kilometres (around 0.8 percent of the Holsworthy Military Area). The study found that Aboriginal site types such as shelters with occupation deposits, scarred trees and open artefact scatters were under represented. Survey coverage on ridgetops was found to be negligible. The consistency and comprehensiveness of previous site recording was found to be limited, and re-survey and upgrading of recordings was a recommended component of any future survey and analysis.

A comprehensive survey of sample areas in the Badgerys Creek study area was conducted for the *Second Sydney Airport Site Selection Programme Draft Environmental Impact Statement* (Kinhill Stearns, 1985). This involved around 70 hectares and represented four percent of the study area.

A major program of surface survey was required in each study area. The objectives of the survey methodology were to:

- identify all above ground material evidence of Aboriginal occupation within defined sample survey areas, within the limitations imposed by environmental conditions;

- identify all areas of moderate or high archaeological potential (unassociated with surface artefacts) within defined sample survey areas, within the limitations imposed by environmental conditions;

- cover a representative sample of the topographic variation within each study area;

- be flexible and accommodate Military and freehold/leaseholder land use requirements; and

- provide an effective sample of the areas likely to be directly impacted by each of the proposed airport options.

3.5.2 SAMPLING STRATEGY

Sampling is an integral component of any archaeological study. It provides a means of controlling how and what data is collected, relative to environmental constraints and the objectives of the study. There are two main types of sampling present in an archaeological surface survey - environmentally determined degrees of visibility which affect how and what surveyors see; and the pattern and type of survey coverage adopted by the surveyors. The former is the result of environmental constraints which cannot be modified but impose an unintentional filter on the process of detecting surviving sites. The latter is an intentional process which determines how survey results can be applied when predicting sites in unsurveyed areas.

Environmental visibility variables cannot be controlled and their assessed impact on site detection rates is incorporated into the final results. The intentional processes of survey sampling, such as the percentage of the total area covered, the criteria for selecting survey areas, and how those areas are inspected, are the main sampling parameters and are described in the following sections.

Survey Coverage

A 100 percent survey coverage is feasible only in relatively small study areas, (for example, less than 10 square kilometres), and where this degree of ground scrutiny can be justified by high levels of ground surface exposure. For larger study areas, the financial and time commitments of a 100 percent survey cannot be justified when compared to the results achievable from an appropriately designed sample survey.

The Holsworthy study area is approximately 174 square kilometres and Badgerys Creek study area around 34 square kilometres. For both areas a 100 percent survey coverage is not practical or effective.

Most archaeological surveys of large study areas have achieved survey coverages of between five and 20 percent, depending on study objectives, environmental and economic constraints. Examples from the Sydney Basin include: the 19 percent Rouse Hill infrastructure surveys (total area of 40 square kilometres) (McDonald, 1993); the 10 percent Mangrove Creek catchment survey (total area of 101 square kilometres) (Attenbrow, 1981a, 1987); five percent for the proposed Warre Warren Aboriginal Place (85 square kilometres) (McDonald, 1988); and 4.2 percent of the proposed extension to the Warragamba inundation area (113 square kilometres) (Brayshaw, 1989). Elsewhere in NSW, objectives of 20 to 25 percent of a defined study area have been stated as a desirable and statistically viable sample (Attenbrow and Hughes, 1983). Coverage of up to 60 percent (of a total area of 740 kilometres) has been achieved for EIS investigations of linear easements where a survey bandwidth can be tightly defined (Kuskie, Navin and Officer, 1995).

Given the range of small and large scale topographic variability across the Holsworthy study area, it was considered that a 20 to 25 percent survey sample should be a minimum objective. Smaller samples may not have effectively covered large scale variations such as potential differences in upper and lower catchment contexts, or cross catchment trends.

In most of the large scale surveys noted above, the study areas were delineated by the anticipated impact of an already defined development proposal. The study areas for the present study were different in that they delineated a larger area within which a smaller area of proposed direct impact would eventually be defined. A major challenge for the survey methodology was to ensure that an effective level of survey coverage was achieved within the boundaries of the final airport options, without detailed prior knowledge about their location. Therefore, sample areas had to be of a significant size and be spread as evenly as possible throughout the study area.

For these reasons, the survey coverage target was increased to 33 percent for each of the study areas.

Sample Area Selection Criteria

The survey coverage achieved in both study areas consists of a stratified sample in which all major landscape units have been effectively sampled and the proportion of survey conducted in each landscape unit is known relative to that unit's total incidence within the study area.

Ideally a stratified sample requires that sample areas are identified prior to field work. This makes it possible to ensure that the coverage for each landscape unit is proportional to its study area incidence. In addition, a process of random selection of survey areas can be employed in an attempt to remove surveyor bias (Attenbrow, 1981a, 1987; McDonald, 1988). Pre-survey selection of sample areas could not be achieved for the present study because of limited information about surface conditions, and access and hazard constraints which could not be accurately forecast. Such constraints included:

- the location and level of hazard associated with unexploded ordnance throughout the Holsworthy study area;
- access restrictions associated with daily Military exercises and target areas in the Holsworthy study area;
- the level of hazard associated with steep terrain in the southern sections of the Holsworthy study area;
- the quality of ground surface exposures in both study areas; and
- the requirement for gaining the approval of the landowner, leaseholder or occupier prior to field survey at Badgerys Creek.

As a consequence of these constraints, a large degree of flexibility was required on a day-to-day basis in defining the exact location of survey areas. Guidelines used in selecting sample survey areas were:

- the total survey coverage objective was at least 33 percent for each study area;
- where possible, the percentage survey coverage of each landscape unit should approximate the actual proportion of that unit within the total study area;
- sample areas should cover at least 25 hectares;
- where feasible, sample areas of different landscape units should be grouped together to achieve coverage over a continuous landscape;
- sample areas should be spread as evenly as possible across the study areas;
- the boundaries of each sample area should follow natural features such as drainage lines, the break of slope or ridge crests (often approximated by vehicular tracks);

- preference was given to areas with relatively high levels of existing ground surface exposure (such as recently fired areas in the case of Holsworthy, shallow gravel or soil extraction areas, shallow vehicular tracks with minimal foreign gravels and erosion scarps and scalds);

- during the second half of the survey program, some sample areas were biased toward the defined areas of the two Holsworthy airport options;

- small landholdings in the Badgerys Creek area were generally excluded from field surveys due to the difficulties in obtaining access consent and the small area of coverage achieved; and

- areas of relatively high density of unexploded ordnance were avoided. This resulted in large sections of the ridgelines located between Williams and Deadmans Creeks, and Punchbowl Creek and the Old Coach Road not being sampled.

The following landscape variables were identified and used to subdivide each study area into landscape units and potential sample survey areas.

Local Landform

- Plateau surfaces (equivalent to ridge crests)
- Crests
- Steep sided valleys
- Moderate gradient undulating terrain
- Low gradient undulating terrain
- Alluvial flats

Order of Ridgeline

- Major watershed ridgeline complex
- Secondary watershed ridgeline complex
- Minor spur or ridgeline

Order of Stream

- Major fluvial corridor
- Secondary fluvial corridor
- Minor fluvial corridor

In addition to comprehensive survey coverage conducted in sample survey areas, a small number of people days (21) were expended at the end of the survey program revisiting and documenting previously recorded sites. This was done in order to record archaeological characteristics which may not have been encountered in the comprehensive survey coverage, and to generate comparable recordings of potentially important sites within areas of potential direct impact.

3.5.3 SURVEY METHOD

Within each sample area, a survey was conducted to achieve a comprehensive level of inspection of ground surface exposures, old growth trees and sandstone rock exposures. In this context, comprehensive survey is defined

to mean visual scrutiny of all the above features from a distance of between 30 and 100 metres, and close range inspection (from less than 10 metres away), of at least 30 percent of those features, and all rock platforms and overhangs greater than one metre in height and covering at least one square metre of sediment.

To achieve this coverage, survey team personnel were spaced evenly across the survey area, generally between 30 and 100 metres apart, and surveyed concurrently within defined parallel bandwidths along a common alignment or the valley side contours. Each survey team member attempted to stay in oral contact with neighbouring team members and site recording tasks were often shared and discussed between two or more recorders.

A small number of areas where the risk of injury from falling was considered to be too great or areas of multiple escarpment occurred were excluded from the survey. These areas were located on the steep sides of the O'Hares Creek valley and totalled roughly five hectares. Shelters which could not be accessed safely without ropes were not inspected. These shelters accounted for less than one percent of the shelters inspected and, based on comparable shelters, are likely to have contained sloping rock floors and have low archaeological potential.

Survey teams generally consisted of between three and five people, with one member designated as 'team leader' and responsible for team safety, mobile phone communications, survey strategy, site location checking and logging of visibility variables. Where possible, all teams included at least one Local Aboriginal Land Council representative. All team members carried colour 1:25,000 scale maps covering their allocated sample areas and each team leader also held relevant colour aerial photography and maps showing locations of previously recorded sites. In a limited number of sample areas, orthophoto maps were also used with scales of 1:4,000.

From the second week of field work each team carried a hand held Geographic Positioning System unit (Magellan 3000 or Trimble Ensign XL). These units were found to be useful in identifying landscape features or locations where uncertainty was in the order of at least two to 300 metres. However, nearly all site location determinations were made at a finer scale (around plus or minus 100 metres or less), and based on local topographic interpretations and compass bearings using 1:25,000 topographic mapping and aerial photography.

The Holsworthy survey was conducted between 28 October 1996 and 13 December 1996. The Badgerys Creek survey was conducted between 9 and 11 December 1996. A total of 489 people days were spent conducting surveys in Holsworthy and 57 people days in Badgerys Creek. Survey was

conducted in all weather conditions, mostly in five day blocks which excluded weekends.

A list of maps used during the field survey is provided in *Appendix D*.

3.5.4 RECORDING PARAMETERS

The archaeological survey aimed at identifying material evidence of Aboriginal occupation as revealed by surface artefacts and areas of archaeological potential unassociated with surface artefacts. Three types of place were recorded: *isolated finds*, *sites* and *potential archaeological deposits*.

Examples of the site cards used for recording of Aboriginal archaeological sites are presented in *Appendix E*. A general site card was designed for all sites which included surface artefacts or which occurred in rock shelters. Separate cards were designed for potential archaeological deposits and scarred trees. A supplementary card was used for recording rock art.

Isolated Finds

An *isolated find* is a single stone artefact, not located within a rock shelter, and which occurs without any associated evidence of Aboriginal occupation within a radius of 60 metres. Isolated finds may be indicative of:

- random loss or deliberate discard of a single artefact;
- the remnant of a now dispersed and disturbed artefact scatter; and
- an otherwise obscured or sub-surface artefact scatter.

Except in the case of the latter, isolated finds are considered to be constituent components of a *background scatter* present within any particular landform. Archaeologists often make a distinction between an isolated find and a site because an isolated find cannot normally be reliably related to a place or focus of past activity.

Background Scatter

Background scatter is a concept used by archaeologists to refer to artefacts which cannot be usefully related to a place or focus of past activity (except for the net accumulation of single artefact losses). Background scatters are a temporally unrelated accumulation of artefacts across a large area and will vary in density according to the type and frequency of past occupation within that landscape. A background scatter can be defined as artefactual material

where association between artefacts can only be described using large scale and inclusive temporal and spatial categories of past occupation.

Accurate estimates of *background scatter* artefact densities within the study area landforms cannot yet be made. McDonald and Rich (1993) indicate from their Rouse Hill data that subsurface densities of 10 or less artefacts per square surface metre are *'suggestive of background scatter and/or excavation beyond the edges of activity areas'*. However it is difficult to extrapolate this to expected surface artefact densities recorded during surface survey.

The distance used to define an isolated artefact varies according to the survey objectives, the incidence of ground surface exposure, the extent of ground surface disturbance and estimates of background scatter densities.

In the absence of baseline information relating to background scatter densities, the defining distance for an isolated find must be based on methodological and visibility considerations. Given the varied incidence of ground surface exposure across the two study areas, the low ground disturbance in Holsworthy, and the lack of background baseline data, the specification of 60 metres is considered to be an effective parameter. This distance provides a balance between detecting fine scale patterns of Aboriginal occupation and avoiding environmental biases caused by ground disturbance or high ground surface exposure rates. The 60 metre parameter has provided an effective separation of low density artefact occurrences in similar south-east Australian topographies outside of semi-arid landscapes.

Sites

A site is defined as any material evidence of past Aboriginal activity which remains within a context or place which can be reliably related to that activity.

A full range of potential site types within the study areas is described in *Chapter 4*. These include open artefact scatters, rock shelter sites including occupation deposits and/or rock art, grinding groove sites and scarred trees. For the purposes of this chapter, only the methodologies used in the identification of these site types are outlined.

Most Aboriginal sites in the Sydney Basin are identified by the presence of three main categories of artefacts: stone or shell artefacts situated on or in a sedimentary matrix; marks located on or in rock surfaces; and scars on trees. Artefacts situated within or on a sedimentary matrix in an open context are classed as a site when two or more occur no more than 60 metres away from any other constituent artefact. The 60 metre specification relates back to the definition of an isolated find. In a rock shelter, a site is defined as one or more artefacts occurring within or immediately adjacent to the sheltered space. Unlike a single artefact in an open context, a rock shelter provides a probable

occupational focus to the interpretation of a single artefact and can therefore be considered to be indicative of a site. An exception would be a single artefact which may have been deposited in the shelter through natural processes.

Any location containing one or more marks of Aboriginal origin on rock surfaces is classed as a site. Marks typically consist of grinding features such as grinding grooves for hatchet heads, and rock art such as engravings, drawings or paintings. The boundaries of these sites are defined according to the spatial extent of the marks or the extent of the overhang, depending on which is most applicable to the spatial and temporal integrity of the site.

Scarred Trees

Trees with scars of Aboriginal origin form the other major type of artefactual evidence. Each tree is normally considered to be a separate site. The identification of a scar as Aboriginal in origin is dependent on a set of inter-related interpretive criteria. The credibility of alternative causal explanations such as natural traumas and other types of human scarring must be tested for each scar.

A range of diagnostic criteria have been developed to assist in the identification of Aboriginal scarred trees based on archaeological work conducted by Simmons (1977) and Beesley (1989). It should be noted that these criteria have never been quantitatively tested or quantified using non-relative criteria such as absolute dating or an analysis of pre-occluded scar morphologies. This is because radiocarbon dating or dendrochronology is mostly inconclusive, and the removal of regrowth exposes trees to further damage. Diagnostic criteria include:

- the scar does not normally run to ground level (scars resulting from fire, fungal attack or lightning nearly always reach ground level). However, ground termination does not necessarily discount an Aboriginal origin (some ethno-historic examples of canoe scars reach the ground);

- if a scar extends to the ground, the sides of the original scar must be relatively parallel (natural scars tend to be triangular in shape);

- the scar is either approximately parallel sided or concave, and symmetrical (few natural scars are likely to have these properties except fire scars which may be symmetrical but are wider at the base than their apex. Surveyors marks are typically triangular, and often adzed);

- the scar should be reasonably regular in outline and regrowth, scars of natural origin tend to have irregular outlines and may have uneven regrowth;

- the ends of the scar should be 'shaped', either squared off, or pointed (a 'keyhole' profile with a 'tail' is suggestive of branch loss);

- a scar which contains adze or axe marks on the original scar surface is likely to be the result of human scarring. Their morphology and distribution may lend support to an interpretation of an Aboriginal origin (marks produced after the scarring event may need to be discounted);

- the tree must date to the time of Aboriginal bark exploitation within its region (within the Sydney Basin a scar age of at least 90-100 years is a prerequisite); and

- the tree must be endemic to the region (and thus exclude historic plantings).

Field based identification of Aboriginal scars is based on surface evidence only and will not necessarily provide a definitive classification. In many cases the possibility of a natural origin cannot be ruled out, despite the presence of several diagnostic criteria or the balance of interpretation leaning toward an Aboriginal origin. For this reason interpretations of an Aboriginal origin are qualified by the recorder's degree of certainty. Categories used to describe classification are:

- **Definite Aboriginal scar,** which conforms to all of the criteria and/or has in addition a feature or characteristic which provides definitive identification, such as diagnostic axe or adze marks, or an historical identification. All conceivable natural causes of the scar can be reliably discounted;

- **Aboriginal origin** is most likely where the scar conforms to all of the criteria and where a natural origin is considered unlikely and improbable;

- **Probable Aboriginal scar,** where the scar conforms to all of the criteria and where an Aboriginal origin is considered to be the most likely. Despite this, a natural origin cannot be ruled out; and

- **Possible Aboriginal scar,** which conforms to all or most of the criteria and where an Aboriginal origin cannot be reliably considered as more likely than alternative natural causes. The characteristics of this scar will also be consistent with a natural cause.

Potential Archaeological Deposits

A potential archaeological deposit is defined as any location where the potential for subsurface archaeological material is considered to be moderate or high, relative to the surrounding study area landscape. Archaeological potential is assessed using criteria developed from the results of previous surveys and excavations relevant to the region. The boundaries of potential archaeological deposits are generally defined by the extent of particular landforms known to have high correlations with archaeological material. A potential archaeological deposit may or may not be associated with surface artefacts. In the absence of artefacts, a location with potential will be recorded as a potential archaeological deposit. Where one or more surface artefacts occur on a sedimentary deposit, a potential archaeological deposit may also be identified where there is insufficient evidence to assess the nature and content of the underlying deposit. This is mostly due to poor ground surface visibility.

A small number of criteria were used as guidelines in identifying potential archaeological deposits in rock shelters. These were that the:

- shelter should contain a sediment floor at least around one square metre in area;
- deposit must be at least 15 centimetres deep (determined by inserting pegs);
- deposit should be relatively compact and show evidence for a significant period of accumulation (deposit should not be spongy and contain only clean sand derived from recent stone weathering);
- shelter space should be at least one metre high and one metre deep (but exceptions may occur, such as where the deposit is deep); and
- shelter should be relatively dry.

3.5.5 SCOPE AND DETAIL OF RECORDING

All recordings were documented to a level of detail sufficient to fulfil the requirements of the survey objectives. General site attributes were recorded according to standardised categories defined on the site cards. Detailed site mapping and inventory recordings of rock art and surface artefacts were not made. The aims of the recording format were to:

- produce an accurate record of site location;

- produce sketch maps and profiles to aid in re-finding and identifying each site, and record the main spatial arrangement of site features;

- gain a broad overview of each site within the categories of site type, site identification, landscape context, site content, site condition and site potential; and

- generate enough broad scale information to allow an effective assessment of the potential impacts of each of the proposed airport options.

This broad level approach was adopted as:

- detailed artefact recordings are of limited use in addressing EIS requirements for assessing and comparing broad area impacts across a number of proposed options;

- the primary survey objective was the coverage of a 33 percent sample. The creation of detailed artefact recordings would have significantly reduced the coverage achieved and would not have been an effective expenditure of resources; and

- the large number of field assistants required to cover the ground within the allotted time meant that a potentially wide range of recording skills and archaeological interpretations could be expected. In order to maximise compatibility across different recorders, emphasis was placed on broad categories of interpretation.

The recording of all art sites was conducted during daylight hours. Only one engraving site (H64) was inspected at night using oblique artificial torch light. This was undertaken to check the accuracy of previous recordings and the daylight recordings of the Draft EIS investigation. Time constraints did not allow the incorporation of night recording as a systematic survey methodology.

3.5.6 VISIBILITY AND SURVEY COVERAGE VARIABLES

The effectiveness of archaeological field survey is to a large degree related to the obtrusiveness of the sites being looked for and the incidence and quality of ground surface visibility. Visibility variables were estimated for all comprehensive survey areas in the study areas. These estimates provide a measure with which to gauge the number and type of sites which have not been detected by the survey.

Ground surface visibility is a measure of the bare ground visible to the archaeologist during the survey. There are two main variables used to assess ground surface visibility - the frequency of exposure encountered by the

surveyor and the quality of visibility within those exposures. The predominant factors affecting the quality of ground surface visibility within an exposure are the extent of vegetation and ground litter, the depth and origin of exposure, the extent of recent sedimentary deposition, and the level of visual interference from surface gravels. Two variables of ground surface visibility were estimated for daily survey areas or relevant landforms:

- a percentage estimate of the total area of ground inspected which contained useable exposures of bare ground; and

- a percentage estimate of the average levels of ground surface visibility within those exposures. This is a net estimate and accounts for all impacting visual and physical variables including the archaeological potential of the sediment or rock exposed.

The obtrusiveness of different site types is also an important factor in assessing the impact of visibility levels. Sites based on rock exposures, such as rock shelters, open engravings and grinding grooves are more likely to be encountered than sites with no surface relief located on, or within, sedimentary matrices. Rock platform sites are subject to visibility constraints in the form of obscuring ground litter, flood debris and sedimentation, however, rock shelters are less likely to go uninspected. The inspection rate of rock shelters is likely to be very high in a survey, however the extent of leaf litter and recent sediment on a rock shelter floor may be an important factor in a recorder's ability to detect either a site, or simply a potential archaeological deposit.

In another example, artefacts made from locally occurring rock such as quartz may be more difficult to detect under usual field survey conditions than rock types which are foreign to the area. Within the two study areas the detection of surface artefacts was only significantly impacted when moderate to high frequencies of naturally fractured quartz or silcretes were encountered. This was taken into account in the visibility variables estimates outlined above.

The natural incidence of sandstone platforms suitable for grinding grooves or engraving, together with the incidence of old growth trees, are important considerations in identifying both survey effectiveness and site location patterns outside of environmentally determined factors.

Variables relating to site obtrusiveness estimated for daily survey areas or relevant landforms were the:

- incidence of old growth trees;

- incidence and quality of sandstone platforms; and

- incidence and quality of rock shelters.

3.5.7 QUALITY ASSURANCE

A system of quality assurance was undertaken with the field program in order to ensure that a standard of recording and artefact interpretation was maintained. The main elements of this system were:

- the role of team leaders in reviewing and verifying site locations, and checking site recordings;
- the role of team leaders in training and checking recordings made by field assistants and Aboriginal Land Council representatives who may be initially unfamiliar with some of the terms and requirements of the site cards;
- standardised recording using standard site recording forms and associated interpretive sheets;
- individual debriefing sessions after each survey day between the principal field program consultant and each team leader; and
- post fieldwork checking of each site card by the principal field program consultant.

3.6 RESULTS ANALYSIS

All site card data, with the exception of sketch maps and photographs was entered into a specifically designed database program using Microsoft Access. The data set produced from the survey results was then supplemented with the addition of any previous archaeological site recordings in the study area which were the result of comprehensive survey and where the extent of survey coverage was known. These requirements ensured that any supplementary data was compatible for the predictive analysis generated from the database. Sites from the 1985 Badgerys Creek EIS study (Lance, 1984) and the 1995 environmental audit of the Holsworthy Military Area (AXIS Environmental/ Australian Museum Business Services Consulting, 1995), were included in the database. Various topographic and archaeological correlations were then tested for within the broader mapping boundaries of the study area and potential direct and indirect zones of impact of the proposed airport options.

An analytical division of the study areas was provided by the classification and mapping of large scale topographic variables. Based on the strong correlation between landform and the archaeological resource identified in field surveys, the division of the study area according to topographic variables was used as

a framework for characterising the potential nature and distribution of the archaeological resource. Predictive statements could then also be made based on these divisions.

The potential impact of the proposed airport options was assessed in terms of the known resource, and the predicted resource, using landform correlations identified in the database analysis.

Part B

Existing Environment

CHAPTER 4 CULTURAL CONTEXT

4.1 STATUTORY CONTEXT

4.1.1 COMMONWEALTH LEGISLATION

While the primary legislation offering protection to Aboriginal sites is enacted by the individual states, several Acts administered by the Commonwealth are relevant.

Aboriginal and Torres Strait Islander Heritage Protection Act 1984

The Act provides for the protection of areas and objects which are of significance to Aboriginal people in accordance with Aboriginal tradition. The Act allows Aborigines to apply to the Minister to seek protection for significant Aboriginal areas and objects. The Minister has broad powers to make such a declaration should the Minister be satisfied that the area or object is a significant Aboriginal area or object and is under immediate threat of injury or desecration. An 'emergency declaration' can remain in force for up to thirty days. It is an offence under the Act to contravene a provision of a declaration. Provisions are made for penalties of up to $50,000 for a corporation found guilty of contravening the Act and up to $10,000 and imprisonment for a maximum of five years, for a person found guilty of contravening the Act.

Under the Act, *Aboriginal tradition* means:

> 'the body of traditions, observances, customs and beliefs of Aboriginals generally or of a particular community or group of Aboriginals, and includes such traditions, observances, customs or beliefs relating to particular persons, areas, objects or relationships' (Section 3).

A *significant Aboriginal area* refers to:

> 'an area of land or water in Australia being of 'particular significance to Aboriginals in accordance with Aboriginal tradition' (Section 3).

A *significant Aboriginal object* refers to:

> 'an object (including Aboriginal remains) of particular significance to Aboriginals in accordance with Aboriginal tradition' (Section 3).

For the purposes of the Act, an area or object is taken to be injured or desecrated if:

'a) in the case of an area it is used or treated in a manner inconsistent with Aboriginal tradition; the use or significance of the area in accordance with Aboriginal tradition is adversely affected by reason of anything done in or near the area; or passage through or over, or entry upon the area by any person occurs in a manner inconsistent with Aboriginal tradition; and

b) in the case of an object it is used or treated in a manner inconsistent with Aboriginal tradition' (Section 3).

Australian Heritage Commission Act 1975

This Act was established by the Australian Heritage Commission as the Commonwealth Government's adviser on the protection of Australia's National Estate. The National Estate encompasses those places in the natural, historic or Aboriginal and Torres Strait Islander environments which the Commission considers should be conserved because of their *'aesthetic, historic, scientific or social significance or other special value for future generations as well as for the present community'*.

The Australian Heritage Commission maintains a Register of National Estate places and advises the Commonwealth Minister and Government on all matters concerning the National Estate. The Australian Heritage Commission's advisory role is primarily related to the actions of the Commonwealth Government and its departments and authorities. The Act states that such Commonwealth Government bodies should ensure their actions do not adversely affect the national estate values of places in the Register, unless there are no feasible and prudent alternatives, in which case all reasonable measures should be taken to minimise the adverse affect. Hence, the Act does not place legal constraints or controls over the action of State or Local Governments, or private owners.

The Holsworthy Military Area was placed on the Interim List of the Register of the National Estate in July 1997 as the *Cubbitch Barta National Estate Area*. Recognised heritage attributes include Aboriginal cultural values, the archaeological resource, the natural environment, flora and fauna values and European historical significance.

Native Title Act 1993

The main purpose of the Act is to recognise and protect Native Title, which can be defined as the 'rights and interests in land and waters that Aboriginal

and Torres Strait Islander people have under laws and customs and that are recognised by the common law' (Section 223).

The Act contains a process for determining whether native title exists, what rights and interests native title holders have (Sections 13 and 61) and whether people who have title have 'exclusive possession' (Section 225) (ATSIC, 1993).

There are currently two native title claims which have been lodged which variously include the Badgerys Creek and Holsworthy study areas.

Native Title Claim NC96/21 was lodged by Gordon Mitchell Wellington on 11 July 1996 as a member of the 'Gundungarra'. The boundaries of this claim include both the Badgerys Creek and Holsworthy study areas. As at early February 1997 it is still referred to Presidential Member.

Native Title Claim NC97/3 was lodged by Esther Florence Ford, Gwendoline Laura Brown and James Denzil Bell 'on behalf of the Traditional Illawarra Tribal Owners'. This claim covers a portion of the Holsworthy Military Area (approximately 34 square kilometres) to the north and north-east of Giles Junction including the Woronora River catchment and the upper catchments of Williams and Deadmans Creeks. As at early February 1997 this claim had not yet been accepted.

4.1.2 NSW LEGISLATION

National Parks and Wildlife Act 1974 (as amended)

This Act provides the primary basis for the legal protection and management of Aboriginal sites within NSW. The implementation of the Aboriginal heritage provisions of the Act are the responsibility of the NSW National Parks and Wildlife Service.

The rationale behind the Act is the prevention of unnecessary or unwarranted destruction of relics and the active protection and conservation of relics where such action is considered warranted. With the exception of some Aboriginal artefacts in collections, the Act generally defines all relics to be the property of the Crown. The Act then provides various controls for the protection, management or destruction of these relics.

A 'relic' is defined by the Act as:

> 'any deposit, object or material evidence (not being a handicraft made for sale) relating to indigenous and non-European habitation of the area that comprises New South Wales, being habitation both prior to and concurrent with the occupation of that area by persons of European extraction' (Section 5(1)).

In practice, archaeologists tend to subdivide the legal category of 'relic' into different site types which relate to the way artefacts are found within the landscape. The archaeological definition of a site may vary according to survey objectives, however it should be noted that even single and isolated artefacts are protected as relics under the Act.

Generally it is an offence to disturb or to excavate any land for the purpose of discovering, disturbing or moving a relic without the written consent of the Director General of the National Parks and Wildlife Service. Consents regarding the use or destruction of relics are managed through a National Parks and Wildlife Service permit system. The issuing of permits is dependent upon adequate archaeological review and assessment, together with an appropriate level of Aboriginal community liaison and involvement.

The Act, together with the policies of the National Parks and Wildlife Service provides constraints and requirements on land owners and managers including:

- it is an offence to knowingly disturb an Aboriginal artefact or site without an appropriate permit;
- an archaeological survey and assessment is required prior to instigating any action which may conceivably disturb a 'relic'; and
- where the archaeological resource of an area is known or can be reliably predicted, appropriate land use practices should be adopted which will minimise the necessity for the destruction of sites and relics, and prevent destruction to sites and relics which warrant conservation.

One Aboriginal site is listed on the NSW National Parks and Wildlife Service Register of Aboriginal Sites as occurring in the Badgerys Creek study area. Fifty three Aboriginal sites are listed on the NSW National Parks and Wildlife Service Register of Aboriginal Sites as occurring in the Holsworthy study area.

NSW Land Rights Act 1983

The Act recognises that land in NSW was traditionally owned and lived on by the Aborigines and that land is particularly important to Aborigines for spiritual, social, cultural and economic reasons.

The Act was designed to give control over land, where possible, to local Aboriginal communities. Under this Act the Minister is allowed to contribute an area of the State as a Local Aboriginal Land Council area (Section 5(1)), as a Regional Aboriginal Land Council area (Section 14), and sets up the NSW Aboriginal Land Council as a corporate body (Section 22(1)).

The Badgerys Creek study area falls within the Gandangara Local Aboriginal Land Council area. The Holsworthy study area falls within the Tharawal Local Aboriginal Land Council area.

National Trust Act 1990

This Act does not provide any statutory obligations for protection of Aboriginal sites, however, the acknowledgment of a place being listed on the National Trust Register as a significant site endorses its heritage value.

The Trust, over the last few years has been upgrading the information on places listed, with criteria for assessment based on the Australian Heritage Commission Criteria of assessment for entry to the Register of the National Estate.

The Holsworthy Military Training Area is included within a National Trust (NSW) citation for the Holsworthy Landscape Conservation Area.

4.2 ENVIRONMENTAL CONTEXT

Both the Badgerys Creek and Holsworthy study areas are located within the Sydney basin, a large sedimentary basin which dominates the NSW central coast and its fluvial catchments. The Basin consists of various, approximately horizontally bedded sedimentary facies which accumulated during a marine transgression at the end of the Late Palaeozoic glaciation, and subsequently followed by a marine regression during the Late Permian and Triassic.

There are two geological and structural divisions within the basin which are relevant to the present study - the Cumberland Plain and the Woronora Ramp.

The surface of the Cumberland Plain is predominantly shales of the Wianamatta Group which have weathered to form low to moderately graded and predominantly undulating landscapes. Surrounding the plain are extensive exposures of the underlying Hawkesbury sandstone, which is relatively resistant to erosion compared to the overlying shales. The Hawkesbury sandstones support steep slopes, minor overhangs and often extensive vertical or near vertical escarpments. Sandstone topographies dominate where drainage lines have downcut through shales to lower valley levels, or where structural uplift has elevated extensive sandstone plateaus which have subsequently become incised by fluvial erosion. The Holsworthy study area is situated on one such elevated topography known as the Woronora Ramp.

4.2.1 BADGERYS CREEK

Geomorphology

The Badgerys Creek study area is located on the western section of the Cumberland Plain, which is typified by low undulating topography and a medium drainage line density. The underlying geology of the Badgerys Creek study area is dominated by the Triassic Wianamatta Group of sedimentary rocks which consist mostly of shales, laminites and claystones. The Bringelly Shale sub-group outcrops are present throughout the area. The consistent and erodible nature of these sediments have created a predominantly low lying undulating plain with little outstanding relief and low gradient streams. A post-Triassic basaltic dyke outcrops along a north-west south-east alignment in the northwestern section of the study area. The resistant nature of this rock has formed higher slope gradients and a small area of moderately graded undulating terrain. The steeper slopes contain screes of volcanic gravels.

Small areas of naturally occurring surface silcrete gravels also occur in the study area, predominantly on the north facing slopes, north of Badgerys Creek. There is, to date, no known source of silcrete, such as tertiary river gravels, within the Badgerys Creek study area, and the gravels noted may be derived from weathered lag deposits (Tessa Corkill, pers. comm. 1997).

In the study area soils are predominantly clay loams of the Cumberland association, with an area of the Menangle association near the middle of the study area, and an area of Mulgoa association alluvium near the western edge (Kinhill Stearns, 1985).

The Badgerys Creek study area is characterised by upper catchment contexts in which the only perennial streamline is the waters of Badgerys Creek. The majority of the area is situated within the upper catchment of Badgerys Creek which is itself a major tributary of South Creek, one of the main fluvial corridors draining the central Cumberland Plain. The watershed between Badgerys Creek and the Nepean River catchments transects the western third of the study area and is approximated by the existing line of The Northern Road. The watershed is significant in terms of the hydrology of the Plain but provides an unimposing topographic feature as a broad and low gradient ridgeline.

In the south-eastern corner of the study area a small portion of the lower reaches of the Thompson Creek catchment occurs prior to its confluence with South Creek, approximately 500 metres east of the study area boundary. Small sections of the upper catchment of the immediate South Creek catchment also occur along the eastern margin of the study area. Along the northern margin, the upper catchments of Cosgrove, Oaky and an unnamed tributary of Badgerys Creeks occur.

The Badgerys Creek landscape can be subdivided according to a range of basic topographic variables which in combination provide an appropriate categorisation of the large scale landform units. The following landform variables have been identified as the most relevant for testing archaeological site location patterning. They are shown in *Figures 1* to *3* in *Appendix L*.

- crests - defined as the upper surfaces of a ridge or spurline, situated between the break-of-slope on either side of the ridge or spur. Where the break of slope was indistinct, the average crest width values of 300 metres and 100 metres were used, as defined in the ridgeline categories below;

- low gradient undulating terrain - occurs over most of the low gradient slopes, spurlines and upper drainage lines within the Badgerys Creek study area;

- moderate gradient undulating terrain - occurs on some higher gradient slopes either side of the basaltic dyke in the western third of the study area;

- alluvial flats or valley floor - defined as a significant area of alluvial flats forming a relatively flat valley floor. All of the main stream lines within Badgerys Creek are associated with alluvial flats of varying widths. The most extensive occur along Badgerys Creek and Thompson Creek;

- major watershed ridgeline complex - defined as the ridge crests which define major watersheds generally defined to be 300 metres in width where no clearly defined break-of-slope exists;

- secondary watershed ridgeline complex - defined as the crests which define secondary watersheds generally defined to be 300 metres in width where no clearly defined break-of-slope exists;

- minor spurs and ridgelines - defined as the crests which define minor streamline catchments generally defined to be 300 metres in width where no clearly defined break-of-slope exists;

- secondary fluvial corridor - defined as the streamline, valley floor and adjacent basal slopes which adjoin large creeklines inclusive of 100 metres upslope from the edge of the streamline or associated flats; and

- minor fluvial corridor - defined as the streamline, valley floor and adjacent basal slopes which adjoin minor tributaries inclusive of 100 metres upslope from the edge of the streamline or associated flats.

Table 4.1 summarises the proportion of the various landform divisions within the Badgerys Creek study area.

TABLE 4.1 PROPORTION OF VARIOUS LANDFORM DIVISIONS WITHIN THE BADGERYS CREEK STUDY AREA

Landform Category	Area (Square Kilometre)	Percentage of Badgerys Creek Study Area
Crests	8.88	26.3
Low Gradient Undulating Terrain	27.72	82.0
Moderate Gradient Undulating Terrain	3.05	9.0
Alluvial Flats or Valley Floor	3.04	9.0
Major Watershed/Ridgeline Complex	1.51	4.5
Secondary Watershed/Ridgeline Complex	3.69	8.4
Minor Spurs and Ridgelines	7.35	21.7
Secondary Fluvial Corridor	3.69	10.9
Minor Fluvial Corridor	1.95	5.7
Total Study Area	**33.82**	**100**

Vegetation

The original vegetation of most of the Cumberland Plain was an open eucalypt woodland in which the trees were widely spaced and the ground cover dominated by grasses (Perry, 1963). Most of the original native vegetation has been cleared from the study area and vegetation cover over much of the area now comprises predominantly thick pasture grasses with scattered Eucalypts and exotic trees, shrubs and weeds. Few old growth Eucalypts remain in the area.

Land Use

The Badgerys Creek study area has primarily been used for agricultural purposes, including cropping, market gardening and grazing, since the early 1800s. The area is still used for farming, although a number of farms have been abandoned and some buildings demolished since Commonwealth acquisition of land in the 1980s. Subdivision into small rural residential lots has occurred over a significant proportion of the study area. Land use in the area today includes cattle and sheep grazing, chicken farms, horse breeding properties and training tracks, the Royal Australian Air Force Bringelly Remote Receiving Station Brickworks and small allotment rural residential properties and associated infrastructure. All of these activities have the potential to

disturb and/or destroy Aboriginal sites. Land clearance and repeated ploughing and cropping will have destroyed most scarred trees and impacted artefact scatters at least to a depth of the plough zone. Ploughing both mixes the contents of the upper soil profile vertically, and spreads artefactual material horizontally, making artefact scatters more dispersed and larger in area.

4.2.2 HOLSWORTHY

Geomorphology

The Holsworthy Military Area is located on the north-western edge of the deeply incised sandstone plateau referred to as the Woronora Ramp. The ramp dips gradually to the north and west and can be seen as a continuation of the coastal zone with a gradual decline in ridge top elevation from the inland upper valleys to the coastal flats around Port Hacking.

The surface topography of the Holsworthy study area is dominated by Triassic rocks, notably Hawkesbury sandstone and to a lesser extent in the north, the overlying residual Wianamatta shales. Small areas of shale characteristically occur as relict mantles on ridge crests and become less discontinuous toward the north-west, where a continuous area of low gradient undulating topography defines the edge of the Ramp and the beginning of the Cumberland Plain. Small areas of apparently naturally occurring silcrete gravels are sometimes associated with relict areas of shale.

The soils derived from the Hawkesbury Sandstone are sandy and relatively infertile, soils derived from the shales tend to have a high clay and gravel content (Walker, 1960).

The Holsworthy study area includes sections of the region's three major catchment fluvial corridors - the Georges and Woronora Rivers and O'Hares Creek. Based on catchment size and valley entrenchment, O'Hares Creek should be considered as the natural extension of the Georges River, and the remaining portion of Georges River a major tributary. Several major creek catchments are also included in the study area, including the entire catchments of Punchbowl and Gunyah Creeks, and most of the catchments of Harris, Williams and Deadmans Creeks. Within all of these catchments the topography can be effectively categorised into three main landform units - the ridgecrests, the valley slopes and the valley floors.

The ridgecrests are formed by remnant plateau landsurfaces which have not yet been eroded by the steeply incised valleys which characterise Hawkesbury sandstone fluvial corridors. They generally do not have a distinct crest line and do not have higher elevations relative to the order of watershed they define. The elevation of the ridgelines increases gradually from north-west to south-east, from around 20 to 340 metres above sea level (Australian Height

Datum). This is consistent with the origin of the Ramp as a raised and tilted plateau. Most ridge and spurlines combine to form complexes of remnant plateau landsurfaces in which the differentiation of ridges and spurs is of little value until the relevant valley itself is encountered.

Several major watersheds occur within the study area and these provide a means of differentiating ridgetop/plateau complexes. The watershed between the Woronora and the Georges/O'Hares Creek catchments runs along or parallel to the eastern boundary of the Military Area, and is approximated by the Old Illawarra Road (refer *Figure 5* in *Appendix L*). Another major watershed occurs between Williams and Harris Creeks, and Punchbowl Creek and the immediate Georges River. This is approximated by the line of the River Road. The latter watershed meets the former at Giles Junction and forms a major watershed node at this point. The alignment and position of the watersheds are important for the archaeological interpretation of the landscape because their relatively flat topography and continuity would have provided the easiest through access routes for Aborigines.

The valley slopes are characteristically steep with a distinct break-of-slope and nick-point separating the low gradient slopes of the ridge and spurlines plateaux surfaces. Valley relief in the northern half of the study area ranges from around 50 to 80 metres, and 60 to 130 metres in the southern half. Highest slope gradients occur in the O'Hares Creek and Punchbowl Creek valleys, and correspond to the highest plateau elevations.

The valley floors are characterised by two basic forms - narrow corridors with minimal flat ground and sediment accumulation, or a small zone of adjacent alluvial flats, either as a narrow margin parallelling major creeks, or discontinuous areas on the insides of major creek or river meanders. Most upper and middle catchment streamlines within the study area flow over bedrock exposures, however, sandy and silty streambanks occur in the lower reaches of Deadmans, Williams and Harris Creeks. At the north-western end of the study area, the sandstone gorge which dominates the upper catchment corridor of the Georges River is relaced by a substantial margin of alluvial flats and terrace formations. Some terrace deposits also appear to form sections of valley floor further upstream within the Gorge.

Sandstone outcrops in all topographic contexts except the far north-west of the study area, and is predominant on the break-of-slope, the valley slopes and the upper and middle catchment beds of creeks and rivers. Exposures fall into four main archaeologically relevant categories - open platforms on ridge crests and above escarpments; major and minor escarpments which are characterised by roughly vertical and variously continuous rock faces (up to 15 metres high) which often support overhangs due to cavernous weathering at the base; discontinuous rock outcrops (up to three metres in relief); isolated tors which

have become dislodges from escarpments; and the beds of drainage lines. Rock shelters may also occur on ridgetops in low escarpments around knolls.

The Holsworthy landscape can be subdivided according to a range of basic topographic variables which in combination provide an appropriate categorisation of the large scale landform units. The following landform variables have been identified as the most relevant for testing archaeological site location patterning. These are shown in *Figures 4* and *5* in *Appendix L* and described below:

- plateau surface - (used instead of crest, for most of the Holsworthy ridges and spurlines), defined as the upper surfaces of a ridge or spurline, situated between the break-of-slope (often marked by a minor or major escarpment) on either side of the ridge or spur;

- steep valley slopes - (most of the slopes adjacent to the Holsworthy drainage lines except the far north-western corner), defined as the valley side slopes situated between the upper break-of-slope and the lower break-of-slope adjoining a significant area of alluvial flats or valley floor;

- low gradient undulating terrain - occurs in the far north-western end of Holsworthy study area, where the topography is derived from shale bedrock;

- alluvial flats or valley floor - defined as a significant area of alluvial flats forming a relatively flat valley floor or where no significant flats exist, the bottom of a valley (in or immediately adjacent to the drainage line), provided that at least two kilometres of distinct drainage line exists upstream of that point. In most cases, the initial two kilometres of any drainage line occurs within the large scale landforms of plateau surface or steep sided valley slopes. Small fringes of alluvial flats occur along the lower catchment sections of Harris, Williams and Deadmans Creek;

- major watershed ridgeline complex - defined as the plateau surface or crests which define major watersheds;

- secondary watershed ridgeline complex - defined as the plateau surface or crests which define secondary watersheds;

- minor spurs and ridgelines - defined as the plateau surface or crests which define minor streamline catchments;

- major fluvial corridor - defined as the streamline, valley floor and steep valley sides which adjoin a major or minor river;

- secondary fluvial corridor - defined as the streamline, valley floor and steep valley sides which adjoin large creeklines; and

- minor fluvial corridor - defined as the streamline, valley floor and steep valley sides which adjoin minor tributaries.

Table 4.2 summarises the proportion of the various landform divisions within the Holsworthy study area.

TABLE 4.2 PROPORTION OF VARIOUS LANDFORM DIVISIONS WITHIN THE HOLSWORTHY STUDY AREA

Landform Category	Approximate Area (Square Kilometre)	Percentage of Holsworthy Study Area
Plateau Surface/Ridgetop	76.5	43.9
Steep Valley Sides	89.22	51.2
Low Gradient Undulating Terrain	4.2	2.4
Alluvial Flats or Valley Floor	4.2	2.4
Major Watershed/Ridgeline Complex	19.0	10.9
Secondary Watershed/Ridgeline Complex	35.0	20.1
Minor Spurs and Ridgelines	22.5	12.9
Major Fluvial Corridor	22.0	12.6
Secondary Fluvial Corridor	18.8	10.8
Minor Fluvial Corridor	52.6	30.2
Total Study Area	**174.1**	

Vegetation

Mills (1989) in Sefton (1990a) has broadly described the vegetation of Hawkesbury Sandstone of the Woronora Plateau.

Vegetation on the lower valley slopes and valley bottoms is typified by an open forest or woodland community to about 25 metres in height. The forests are usually dominated by *Eucalyptus piperita* with *Angophora costata*, *E. agglomerata*, *Allocasuarina littoralis* and *Ceratopetalum gummiferum*.

On the ridgetops and ridgesides near plateau level vegetation is a complex of heathland, woodland and open woodland. Tree species include *E. gummifera*, *E. sieberi* and *E. haemastoma*. Shrubs and ground covers include *Banksia*, *Acacia*, *Leptospermum*, *Hakea*, *Persoonia* and *Epacris* species.

The Sydney Prehistory Group noted that the vegetation within the Holsworthy area tended to be distinct along each ridgeline and valley (Sydney Prehistory Group, 1983). The group has listed plant species which occur in the Holsworthy area and which may have been utilised by the Aborigines. These are provided in *Appendix F*. They note that their availability would have motivated Aborigines 'to penetrate this difficult country' (Sydney Prehistory Group, 1983).

Land Use

The study area has been used as a military firing and training range since late last century. It was officially gazetted as a military training range in 1913 and is used for this purpose to the present day. The area has been selectively logged and cleared for various agricultural activities including grape growing (vineyards). Some rock shelters are known to have been occupied in historic times (Sydney Prehistory Group, 1983).

Some of the land uses outlined above would have adversely affected Aboriginal sites. Land clearance on ridgelines may have disturbed and destroyed artefact scatters and scarred trees. An increase in the rate of bushfires caused by exploding ordnance may have prejudiced the survival of sites such as carved and scarred trees. In addition, it is likely that the firing rate has increased the amount of superficial surface erosion and downslope movement and deposition of sands. It is possible that this has increased the rate of sedimentation on many rock shelter floors and consequently obscured evidence of Aboriginal occupation. The direct impact of ordnance and the infrastructure required for the training area (for example, roads, fences, firing ranges, bridges, excavated trenches) has impacted a range of site types, including open engraving sites and rock shelters (AXIS Environmental/ Australian Museum Business Services Consulting, 1995). However the restricted access to the site over the past 90 years has also assisted in the preservation of Aboriginal sites by protecting them from visitor damage, including potential impacts from bush camping, vandalism and graffiti.

4.3 HISTORICAL CONTEXT

4.3.1 ETHNO HISTORY

References to the Aborigines of the Sydney region are found in the journals, diaries and general writings of the early colonists, explorers and settlers. Natives were one of the main subjects of interest to those who arrived in the First Fleet and 'all the journals contain frequent references to them' (Fitzhardinge, 1961).

Accounts written by early visitors to Australia document the more obvious details of Aboriginal life include Bradley (1786-92), Collins (1798), Hunter (1968), Phillip (1789), Tench (1961) and White (1790). Although these early commentators were not trained in anthropology or linguistics some useful information is provided by them regarding the Aborigines around the Sydney region.

Tench (1961) describes the equipment of the Aborigines as 'exclusive of their weapons of offence, and a few stone hatchets very rudely fashioned, their ingenuity is confined to manufacturing small nets, ... and to fish-hooks made of bone, neither of which are skilfully executed.' Tench also notes the use of bark canoes for fishing.

Comments were made on the types of Aboriginal shelters observed. These were described as consisting 'only of pieces of bark laid together in the form of an oven, open at one end, and very low, though long enough for a man to lie at full length in.....they depend less on them for shelter, than on the caverns with which the rocks abound' (Tench, 1961). Collins observed that the huts were 'often large enough to hold six to eight people' (Collins, 1798). These shelters were often grouped together.

Within a short period of time after white settlement, the Sydney Aboriginal population was greatly reduced as a result of two epidemics, (most probably) smallpox. The first occurred only a short time after settlement in 1789 and the second from 1829 to 1831 (Butlin, 1983). The first outbreak of the disease is believed to have killed 50 percent of the Aboriginal population (Collins, 1798; Ross, 1988; Tench, 1961; Turbet, 1989). Loss of life on such a scale resulted in a major social reorganisation of Aborigines around the area (Ross, 1988) with 'remnants of bands combining to form new groups' (Kohen, 1986). Therefore the anthropological observations and other observations by chroniclers of the time do not depict the pre-settlement situation accurately.

There are other accounts dating from the early 1800s which provide more detailed references to Aboriginal life in the Sydney region. However the information must be interpreted with caution due to the immense changes that occurred in the Aboriginal population and society during the early years of settlement (McDonald, 1994).

Detailed anthropological work focussing on a systematic documenting of Aboriginal society was not undertaken until the late 19th century, beginning with RH Mathews (Mathews 1898; 1901a; 1901b; 1904; 1908; Mathews and Everitt, 1900). His anthropological work was, however, undertaken with a population of people after more than a hundred years of contact and it does not therefore represent the situation at the time of contact or reflect pre-contact society. He documented some myths and vocabulary of Aboriginal groups around the Sydney region.

4.3.2 TRIBAL AND CULTURAL AFFILIATIONS

There have been numerous attempts at mapping the pre-contact and contact territories of Aboriginal people in the Sydney region (Capell, 1970; Eades, 1976; Kohen, 1986, 1988; Mathews 1901a, 1901b; Ross, 1988; Tindale, 1974). The exact boundaries between Aboriginal people which existed at 1788 are impossible to reconstruct because of the lack of reliable data available from that period of time. The primary data is limited as the early observers (members of the first fleet and settlers) did not document how Aboriginal people perceived their own groups or how they differentiated themselves from one another.

Early anthropological work that was carried out is also not totally reliable. The population of Aboriginal people around Sydney was depleted by disease and aggression by Europeans and many of the survivors would have relocated and/or probably joined other groups.

Before outlining the various attempts that have been made at drawing boundaries, an explanation of traditional Aboriginal social organisation is needed. Aboriginal society is comprised of a hierarchy of groups with fluid boundaries between them, the smallest being the family and the broadest being a culture area (Peterson, 1976). The family is comprised of a man with one or more wives, their children and often a parent of one of the adults. A second level of organisation is the band, which is a group of several nuclear families which in turn is followed by a regional network. Regional networks are groups of several bands.

The next level of social organisation is the tribe. At each successive level from family through to tribe there are less common or shared beliefs amongst the individuals making up that particular group. At the level of a tribe the members share common initiation ceremonies and speak closely related languages (Peterson, 1976). Anthropologists previously used the term tribe to denote concrete political, cultural, economic, geographical and linguistic units, however today they recognise geographic variability in the way that Aboriginal people perceive themselves and their relationship to one another (Peterson, 1976).

The following discussion then gives an overview of boundaries in the Sydney region between different groups of Aboriginal people. These boundaries are variously named tribal and/or linguistic boundaries by different authors. Although Aboriginal people are working within Local Aboriginal Land Council boundaries, some appear to accept Tindale's (1974) map, others are aware of the fact that there are differing versions of tribal boundaries in the literature and yet others accept Eades (1976) drawing of linguistic boundaries. It is likely that in the future the Dharug tribe will accept the boundaries proposed by Kohen (1993) who has written a monograph dealing with this tribe.

As *Figures 6* to *9* in *Appendix L* clearly demonstrate, there are differing views as to where to locate the boundaries between these groups. Tindale (1974) included a tribe called the Eora between Tharawal and Dharug on the coast whereas others do not include them at all. He also added the Wodi Wodi south of Tharawal extending down to Nowra, whereas others make all of this area Tharawal and omit Wodi Wodi altogether. Capell (1970) includes many band names in his territory map and does not draw definite lines as boundaries. The broken line depicting boundaries in Eades (1976) map also denotes the uncertainty of where the exact boundaries lay.

Today, Local Aboriginal Land Council boundaries are situated so that the Badgerys Creek study area is within the jurisdiction of Gandangara Local Aboriginal Land Council and the Holsworthy Military Area is within Tharawal Local Aboriginal Land Council area.

RH Mathews' (1901a) description of boundaries is confusing as he changes the extent of certain boundaries. He places the Dharook (Dharug) north of the Thurrawal (Tharawal) extending along the coast to the Hawkesbury River and inland to Windsor, Penrith and Campbelltown (Mathews, 1901a) whereas earlier in the same paper he documented that 'The Dharook dialect ... was spoken at Campbelltown, Liverpool, Camden, Penrith, and possibly as far east as Sydney' (Mathews, 1901a).

Mathews was also inconsistent with the range of Thurrawal territory as he doubled their range from one article to the next (Eades, 1976). In 1901 he wrote that their territory had '... formerly spread over the south-east coast of New South Wales from Port Hacking to Jervis Bay, and extended inland for a considerable distance' (Mathews, 1901a). In a second article published in the same year he wrote that '.... the Thurrawal language, spoken by a number of aboriginal tribes on the south-east coast of New South Wales between the Hawkesbury River and the Victorian border' (Mathews, 1901b). Eades (1976) interprets this second quote as intending to mean '... the Thurrawal and closely related languages' not simply the Thurrawal.

It is not possible from Mathews' information to clearly ascertain in which tribal area the two study sites were located. It appears that the northern section of the Holsworthy Military Area was probably Dharug and the southern Tharawal, and that Badgerys Creek could have been Dharug or Gandangara.

Tindale's (1974) map of tribal boundaries was constructed in 1940 from fieldwork and existing literature. The boundaries as defined show the Tharawal's northern boundary in Botany Bay extending west to where it adjoins the Gandangara (Gandangara) and south to just east of Picton then east to the coast above Wonoona. Tindale (1974) includes a group named the Eora directly north of the Tharawal whose area extends north to Woy Woy. The Daruk (Dharug) lie mostly to the west of the Eora from Terrigal to Glen Davis

on the northern boundary southwards to Lithgow then southeast. In this schema the Daruk reach the coast between Terrigal and the northern shore of Botany Bay. In Tindale's map of territories the Holsworthy Military Area is within Tharawal tribal area and the Badgerys Creek site is shared between Daruk and Gandangara.

Capell (1970) reorganised the existing data and carried out a very limited period of fieldwork with speakers of Aboriginal languages in the area and drew different conclusions. His schema also makes use of a manuscript by Reverend Threlkeld which was recorded after 1824. In his view the territory of the Dharawal (Tharawal) starts on the southern shore of Botany Bay and extends to Nowra and Jervis Bay. Others refer to the southern shore of Botany Bay as being Gwiyagal but Capell claims this is simply a dialect of Dharawal (Capell, 1970).

In his schema the Dharruk (Dharug) do not reach the coast between Manly and Broken Bay, having no natural eastern boundary. His boundaries run along Lane Cove River north to Wisemans Ferry. The Hawkesbury River was the northern boundary and '... southwards it extended to the Burragorang Valley area ... on the east it met Dharawal along some line yet to be worked out ... north of Hawkesbury River Dharruk would meet Darinyung on the west and a Kuringgai dialect on the east' (Capell, 1970). He also concluded that the Eora or Sydney tribe spoke a Dharruk dialect. He reached this conclusion from a comparison of word lists from early 1790s from Collins and Hunter with information on Dharug languages from Mann (1885) and RH Mathews at the turn of the century. Ross (1988) however, claims that this conclusion does not accord with historical data. In Capell's (1970) outline of boundaries Badgerys Creek is wholly within Dharug boundaries, while the eastern half of the Holsworthy Military Area is Tharawal and the western half is Dharug.

Eades (1976) used existing data including ethnohistorical accounts for her map of linguistic boundaries. Eades claims the Dharawal territory began on the northern shore of Botany Bay at La Perouse and ended in the south at Jervis Bay, whilst the Dharug territory began in the south-east at La Perouse and bordered the Tharawal south-west to Campbelltown and Picton. The eastern boundary then runs across to Boorowa and north to Bathurst. The northern boundary extends from Bathurst in the west to the Hawkesbury River in the east. According to Eades, the Badgerys Creek site falls within Dharug boundaries and most of the Holsworthy site is Tharawal except for the north-west corner which is Dharug.

Kohen has written extensively about the Darug (Dharug). He has also prepared his version of 'linguistic tribal' boundaries which he based on Capell (1970) and an unpublished manuscript by William Dawes (Kohen, 1988). Kohen recognises three tribal groups in the region - the Darug, Kuringgai and the Dharawal (Tharawal). According to Kohen, the Darug are located along

the coast between Port Jackson and Botany Bay and extend inland to some point west of Windsor, Penrith and Mulgoa and south past Camden. The Darug border the Dharawal along the Georges River and Botany Bay (Kohen, 1988). The Dharrawal boundaries lie on the southern bank of Botany Bay inland to the Georges River which it then follows south. According to Kohen, the Badgerys Creek site is wholly within the Dharug area and the Holsworthy site is wholly within the Tharawal boundary.

Ross (1988) disputes Kohen's boundaries and claims that the Dharug did not reach the coast, and thus were exclusively an inland tribe. She bases her map on ethnohistoric evidence and claims that the Dharawal (Tharawal) occupied an area bounded by the sea on the west, the Georges River on the east, Botany Bay in the north, and an indeterminate point in the south. The Dharug were situated west of the Guringai on the Hawkesbury River with the Gandangara (Gandangarra) to their south around the Nepean. The Gandangara in Ross' schema border the Dharawal on the Georges River.

According to Ross the Holsworthy site is wholly within Dharawal boundaries and the Badgerys Creek site is totally within Gandangara boundaries.

In summary, although the boundaries and size of areas attributed to the Dharug, Gandangarra and Tharawal vary between these different interpretations, the Badgerys Creek study area falls within Dharug boundaries (except in Tindale, 1974). The Holsworthy site is more complex. In the majority of cases it lies within Tharawal boundaries but in some interpretations the north-west or the entire western half falls into Dharug or is further divided between Dharug and Gandangara.

4.3.3 OVERVIEW OF LOCAL ABORIGINAL HISTORY

The following overview highlights the major events which affected Aboriginal people living near the two study areas. Local information for the Cumberland Plain is restricted to generalised comments which relate opinions or events where Aborigines were encountered on the Plain. Few historical accounts mention or record details specific to the Aborigines who lived on the land which is now located in the Holsworthy Military Area.

Investigative field expeditions by early settlers to the Cumberland Plains and Cow Pastures/Cowpastures are documented, including meetings with Aborigines in these areas. Typical are the references provided by Captain Tench in 1790 (Collins, 1798) and Governor Macquarie in 1802 and 1815 (Macquarie, 1956), which relate the observation of camp remains and notched trees, and actual encounters with 'natives'.

Aboriginal observations of the initial incursion of European culture is evidenced from the Cowpasture area by three drawings of bulls which

probably represent the original polled cattle which escaped to the area from the first fleet (Lyon and Urry, 1979).

References from the early explorers indicate that there was little contact between coastal and inland tribes. Tench (1793) noted that coastal Aborigines had no knowledge of the region west of what is now known as Parramatta.

Although no reliable appraisal of the number of Aborigines living in the Sydney area was made by early observers, it has been estimated that the population density for the region was between five and 10 individuals per square mile (Maddock, 1972). With European settlement this population was quickly decimated, and in less than a century traditional Aboriginal lifestyle patterns in the Sydney area were virtually destroyed.

The Dharug came into conflict with the Europeans earlier than the Tharawal or the Gandangarra because of early competition for the same resources. The Dharug had been using the fertile banks of the Hawkesbury River to cultivate yams. After harvesting wild yams the Dharug replanted portions ensuring they did not deplete the resource for the following season. The Europeans also discovered this fertile land and began portioning it off for cultivation, coming into direct competition with the Dharug (Goodall, 1996). By 1795 the majority of the yam beds had been replaced by crops (Kohen, 1993). Conflicts over land and resources then occurred throughout the 1790s, resulting in numerous deaths (Keating, 1996).

In 1804 Governor King promised a delegation of Aborigines that there would be no further grants of land on the lower Hawkesbury near Portland Head, thus leaving some of the riverbank for yam production (Wiley, 1979). This promise was however dishonoured after King departed in 1807 (Goodall, 1996).

In January of 1805, George Caley made an expedition to the Georges River region area which he later described as 'a Journey Towards Jugroy ...' (MacLeod Morgan, 1955). The river itself prevented him from crossing, making impossible 'the idea of visiting Jugroy' which apparently lay to the east of the river. Although the meaning of the possibly Aboriginal word 'jugroy' is never revealed, Caley does comment on the apparently extensive occupation of the area: 'By the marks or notches on the trees it is much frequented by natives'. This observation was made in forested land in the vicinity of Long Point in the north-west of the survey region.

The northern section of the Holsworthy Military Area was being portioned off as land grants by Lieutenant Governor Paterson in 1809 for grazing (Liston, 1988; McLoughlin, 1988). The southern section was opened up for settlement in 1884 under the Crown Lands Act (Longhurst et al, 1995).

There was considerable conflict between Aborigines and Europeans in the region. In 1809 Young Bundle with Tedbury (the son of Pemmulwuy the legendary Aboriginal activist) were terrorising and stealing from travellers as well as driving sheep off properties around the Cook and Georges Rivers area (Liston, 1988; Keating, 1996). There were more severe conflicts between 1814 and 1816 when the area was gripped by a severe drought (Perry, 1963). This combined with the fact that Aborigines' staple food gathering and hunting areas were overtaken by European grazing and cultivation, caused Aborigines to raid crops thus angering the farmers who retaliated.

Governor Macquarie advised caution and stated that the loss of part of ones' crop was a small price to pay for peace (Liston, 1988). Tensions however escalated and Aborigines and Europeans were killed in the ensuing struggles.

In 1816 Macquarie ordered the apprehension of Aborigines in the area and if they resisted, their death (Liston, 1988). There were three punitive expeditions, two of which had Aboriginal guides (variously claimed to be Tharawal or Dharug) which were mostly unsuccessful. In 1816 a regiment headed by Wallis perpetrated a massacre of fourteen Aboriginal men, women and children at Appin (Keating, 1996; Liston, 1988).

Aboriginal people lived and sought refuge on some properties in the area of Holsworthy, especially during the 1814 to 1816 conflicts. The literature records that Charles Throsby sheltered wanted Aboriginal men from authorities in 1816 and there are other references to European farmers being accused of interfering with a punitive expedition led by Wallis (Liston, 1988).

Some Dharug clans lived on Charles Marsden's property at South Creek (Keating, 1996). The Macarthur's were known to have Aboriginal people living on their property and Macarthur's daughter is quoted as writing to a friend praising them and begging her friend to accept them (Liston, 1988). In fact, in 1818 land was marked out on the Macarthur estate for Aborigines who wanted to live there under his protection (Liston, 1988). Many Aborigines did choose to live on the estate. A Tharawal informant who had discussions with the anthropologist for this study claims that her ancestors lived on Camden Park (the Macarthur property) from 1820 to 1973, being employed by the Macarthurs in various capacities (Aboriginal informant, pers. comm. 1997). After 1816 the Tharawal stayed in the Cow Pastures. This was an area which was mainly used for grazing, so it was more sparsely populated than some neighbouring areas.

Cunningham (1827) notes at this time that:

> 'toward the Hawkesbury and Cowpasture, the aborigines are not nearly so debased as around Sydney, and most of them will live in huts if they are built for them. Many of these too will work at

> harvest, and attend to other matters about the farm, having been brought up from infancy among the farming whites...'.

An article written by a 'Medical Gentleman of Bunbury Curran', a district just to the west of the Holsworthy study area and published in 1820, describes 'the mortal efficacy of the late influenza that raged throughout the Colony for many weeks with increased violence, and particularly among the scattered tribes of natives'. After describing 'a great mortality' amongst the Aborigines regardless of health or age, during the winter, it notes that 'they had for the most part quitted the thinly wooded and more open tracts of the interior and betaken themselves to the sea coast and bushy and broken country, where were quantities of honey, and where they would undoubtedly remain until they return in the summer' (Sydney Gazette, 1820) .

Etheridge (1889), comments that a site recorded by him on Harris Creek, (and now in the Holsworthy Military Area), was known to the father of his guide, a Mr JD Brown, 'who was acquainted with the figures fifty years ago, say about 1838, when he was in the habit of frequenting the creek in company with the aborigines'. This is the only documentary record to date, which directly refers to 19th century Aboriginal occupation in the study area, as well as co-habitation or use by both Aborigines and Europeans.

The traditional food economy appears to have been predominantly replaced by the 1840s, with most Aborigines being employed by whites on farms or selling their traditional food items for European goods (Hassell, 1902; Jervis, 1935, 1949). In a report to a Select Committee on the Aborigines in 1845, a local Campbelltown JP reported that:

> 'For the last five to ten years they [the Aborigines] have been gradually decreasing, from the number of about fifteen to twenty, until none can be said to belong to this police district, as a tribe. Their death may be attributed to natural causes' (Select Committee on the Aborigines, 1845).

All of the Badgerys Creek area was already under grant by 1835 and most of the study area was granted to John Blaxland (pers. comm, Mark Dunn, 1997). As a consequence traditional hunting and gathering grounds were lost to the local Aborigines.

However, some aspects of traditional life appear to have continued in Sydney despite the enormous changes which had taken place. Macarthur describes a corroboree which took place on his property (Liston, 1988) and Mathews documented ceremonies in the late 1800s. There is another mention of a ceremony taking place at Denbigh near Camden in the 1830s (Kohen, 1985), and a corroboree involving over 400 individuals at the same place in the mid 1820s (Hassell, 1902). Even to the present day Aborigines of the Sydney

region continue some traditional ceremonies in the Bents Basin area (Keating, 1996).

4.3.4 MISSIONS, RESERVES AND OTHER SETTLEMENTS

Aboriginal people were granted small portions of land in some parts of the Sydney Basin, however no references have been found to grants within the study areas (Kohen, 1993). There is however, evidence from various sources suggesting that an Aboriginal settlement was situated on the Georges River to the east of the Holsworthy Military Area and outside the study area.

The National Trust citation for the Holsworthy landscape conservation area states that one of the first reserves set up in Sydney by the Aboriginal Protection Board (which was established in 1883) was on Portion 53 in the Parish of Holsworthy. This is an area of 100 acres at Voyager Point on the eastern side of Williams Creek at its confluence with the Georges River. This portion was first granted to John Thomas Williams in August 1809. An Aboriginal 'reserve' located in the Holsworthy region is also mentioned by Keating (1996) and Kohen (1993). No documentary reference however has been found for a dedicated Aboriginal reserve in the Holsworthy region.

In 1950, portion 53 was transferred to the Commonwealth for a migrant hostel. The Trust citation mentions that the area was still occupied by people of Aboriginal descent at this time. This hostel was mentioned to the anthropologist for this study by a member of the Gandangarra Local Aboriginal Land Council's Culture and Heritage Section when asked about settlements, missions, and camps in the region (pers. comm. Aboriginal informant, 1997). He indicated that there was some sort of settlement at Voyager Point but then said that it was only a migrant hostel.

A member of the Tharawal Local Aboriginal Land Council also had knowledge about this 'reserve' site but placed it at Sandy Point, which they identified on a map as being at the confluence of the Georges River and Deadmans Creek (three kilometres downstream of portion 53). This individual stated that it was a Church of England mission and the first Aboriginal mission to the area. This settlement may be the same referenced for portion 53 and the location has subsequently become confused, or there may have been two settlements or institutions involved. When it was suggested (by the anthropologist) that perhaps the mission was located at Voyager Point the individual indicated that they were sure that the mission was at Sandy Point and added that they visit the area at least once a year. They also described artefacts that are found there. Another member of this Land Council also mentioned the existence of a settlement site in that area but could not locate the site on a map.

Kohen (1993) has conducted extensive research into the Aboriginal history of the Sydney Basin and notes that most of the information about the Holsworthy settlement comes from oral sources (James Kohen, pers. comm. 1997). His understanding is that the settlement was located at Picnic Point (on the north bank of the Georges River, adjacent to Sandy Point) and was an unofficial settlement and never registered or administered as a reserve or mission. The settlement was formed by the last groups of Aborigines removed from the Burragorang Valley in the 1920s and 1930s. Most of the people subsequently moved to La Perouse but Aborigines were still living there in the 1950s (James Kohen, pers. comm. 1997).

An extensive survey of the literature did not provide any evidence of Aboriginal occupation of the Badgerys Creek site other than as labourers or domestics on surrounding properties.

The Holsworthy Military Area was formally proclaimed a military reserve in March 1913 (Sharp, 1994). This effectively closed off the area and access was restricted to military personnel. This meant that Aboriginal people did not have easy access to any sites in this area for over eighty years. They did however, continue to use areas directly adjacent to the area. In 1993 an agreement was made between the military and the Tharawal Local Aboriginal Land Council to allow authorised representatives access to the Holsworthy Range to inspect and maintain heritage sites (correspondence from Australian Army to Tharawal Local Aboriginal Land Council, November 1993).

Thus, although traditional links to land in the two study sites have been disrupted, areas around and in the Holsworthy Military Area are still visited by local Aborigines, a few of whom remember visiting these areas as children.

As the above discussion illustrates the history of Aboriginal people around these two study areas is one of very early disruption and major change. Dharug, Gandangarra and Tharawal descendants are now scattered throughout Sydney, its surrounding areas and the north and south coast of NSW.

4.4 ARCHAEOLOGICAL CONTEXT

4.4.1 REGIONAL CONTEXT

Sydney Basin

The Sydney basin has been the subject of intensive archaeological survey and assessment for many years. This research has resulted in the recording of thousands of Aboriginal sites and a wide range of site types and features. The most prevalent sites or features include isolated finds, open artefact scatters or camp sites, middens, rock shelters containing surface artefacts and/or

occupation deposit and/or rock art, open grinding groove sites and open engraving sites. Rare site types include scarred trees, quarry and procurement sites, burials, stone arrangements, carved trees, and traditional story or other ceremonial places. Another feature recorded by archaeologists is the Potential Archaeological Deposit. This is an area where sub-surface artefacts are considered likely but no surface evidence exists. In an investigation of the Upper Mangrove Creek catchment, Attenbrow (1987) found that almost 90 percent of recorded Potential Archaeological Deposits in rock shelters contained archaeological material. Descriptions of these site types and features are provided in *Appendix G*.

Archaeological studies in the Sydney basin have generated hundreds of reports and monographs and a number of academic theses. Studies generally fall into four categories - those which have been carried out within a research-oriented academic framework; larger scale planning and management studies (for example, regional heritage studies); archaeological surveys carried out by interested amateurs; and impact assessment studies which have been carried out by professionals within a commercial contracting framework. The latter deal with specific localities subject to development proposals and constitute a large proportion of the archaeological research carried out to date. The following review draws upon all of these sources, but places emphasis on recent research and studies located within or close to the study areas.

Aborigines have lived in the Sydney region for at least 20,000 years (Stockton and Holland, 1974). Late Pleistocene occupation sites have been identified around the fringes of the Sydney Basin at Shaws Creek (13,000BP) in the Blue Mountain foothills (Kohen, 1984), at Mangrove Creek (11,000BP) and at Loggers Shelter (Attenbrow, 1981). Nanson et al (1987) have suggested that artefacts found in gravels of the Cranebrook Terrace indicate Aboriginal occupation over 40,000 years ago, however there is some doubt as to the contextual integrity of these artefacts.

The majority of both open and rockshelter sites in the Sydney region date to within the last 3,000 years. A similar trend in occupation age occurs in dated deposits in NSW coastal sites. This has led many researchers to propose that population and occupation intensity increased from this period (Attenbrow, 1987; Kohen, 1986; McDonald and Rich, 1993; McDonald, 1994). The increased use of shelters postdates the time when sea levels stabilised after the last ice age around 5,000 years ago (the Holocene Stillstand). Following the stabilisation of sea levels, the development of coastal estuaries, mangrove flats and sand barriers would have increased the resource diversity, predicability, and the potential productivity of coastal environments for Aborigines. In contrast, occupation during the late Pleistocene (prior to 10,000BP) may have been sporadic and the Aboriginal population relatively small.

The stone technologies used by Aborigines within the Sydney basin have not remained static and a sequence of broad scale changes through time have been consistently identified. This is known as the Eastern Regional Sequence and can be applied with various degrees of success and allowances for regional differences, to sites throughout eastern seaboard of Australia. Within the Sydney Basin the Sequence can be characterised using the following terminology and phases (based on McDonald, 1994):

- The Capertian - artefacts from this period consist mostly of large heavy artefacts including unifacial pebble tools, scrapers, core tools, denticulate saws, and hammerstones. Some bipolar tools and burins also occur. The Capertian is present up to around 5,000 years BP;

- The Early Bondaian - within this phase characteristics of the Capertian continue but tools on smaller blades are introduced and become predominant. Blades which are backed (one edge blunted by fine trimming) and ground edge implements are notable introductions. There is a major shift in the type of rocks used for tool manufacture to fine grained siliceous materials (such as silcrete, chert and tuff/indurated mudstone). The Early Bondaian has been identified in deposits dating between around 5,000 and around 3,000 years BP;

- The Middle Bondaian - in this phase the percentage of Bondi points (a type of backed blade) increases and remains greater than the percentage of bipolar artefacts. Edge ground artefacts are present in higher proportions as are quartz artefacts. This phase dates from around 3,000 to as late as 1,000 years BP; and

- The Late Bondaian - this phase is characterised by quartz either becoming the predominant rock type used or markedly increasing in proportion. Bondi points and most types of backed blades become rare or are no longer found. Eloueras, bipolar artefacts and edge ground hatchets are the predominate tool types. Bone and shell implements including fish hooks appear in this phase, particularly in some coastal sites. This phase dates from around 1600 (Attenbrow, 1987), or 1,000 years BP (McDonald, 1994), to the cessation of stone working following contact with European Society.

McDonald (1994) notes that the introduction of ground implements around 4,000 years BP and shell fishhooks in the last 1,000 years were major technological innovations. The significance and possible reasons for the technological changes in the Eastern Regional Sequence has been the subject of considerable research and debate since their identification. Contemporary theories postulate various changes in social behaviour, group interactions, and population dynamics either as contributing causes or as a consequence of these technology changes (for example, Attenbrow, 1987; Beaton, 1985;

Lourandos, 1985; Walters, 1988; McDonald, 1994). McDonald (1994) for example interprets the introduction of the Bondaian in the Sydney basin as a manifestation of social change brought about by population pressure promoted by sea level rise.

McDonald (1994) has recently conducted a review of the archaeology of the Sydney Basin as part of a research program investigating the rock art in the Basin. Her investigation involved both excavations and statistical analyses of rock art recordings across the Basin. On the basis of this work she has proposed a series of site type characterisations and models relating to change in occupation dynamics and rock art, across time and space. These can be summarised by the following outlines.

From a sample of 717 engraving sites and 546 shelter art sites (39.5 percent and 32.7 percent of the known sites of each type from the Basin), the following trends were identified (McDonald, 1990; 1994):

Engraving Sites

- the average (mean) number of graphics at a site is 10.9 (the largest site contained 174 and 19.1 percent contained only one graphic);
- most sites (83.4 percent) have less than 16 graphics and about two thirds (66.1 percent) have less than eight;
- nearly all (97 percent) of open engraving sites occur on horizontal sandstone platforms, 22 open sites occur on vertical boulders adjacent to waterways (around Broken Bay and its tributaries);
- just over half (55.9 percent) occur on ridgelines, with 41.2 percent occurring on hill side contexts, and only 2.8 percent in valley floors (mostly on vertical boulder surfaces);
- grinding grooves occur in 13.4 percent of engraving sites, and only 3.1 percent also included pecked and abraded water channels (being 23 percent of sites with engraved graphics and grinding grooves);
- the predominant motif type is the human footprint or 'mundoe' (17 percent), followed by unidentifiable motifs (15 percent) and fish (12 percent). Other types with notable frequencies are bird tracks and macropods (each at seven percent), and men (five percent); and
- when motif types are grouped into larger subgroups, the following breakdown was gained:

Motif Type	Percent (Total Number = 7,804)
Tracks	27.1
Marine Animals	17.2
Unidentified	15.2
Terrestrial Animal	11.7
Anthropomorphic	10.2
Material Objects	10.2
Other	5.3
Birds	3.1

Shelter Art Sites

- the average (mean) number of graphics at a site is 26.4 (the largest site contained 857 and 5.7 percent contained only one graphic);
- most sites (87.5 percent) have less than 30 graphics and 52.2 percent have less than 10 (only 5.5 percent have more than 100 graphics);
- a majority of sites (69.6 percent) are located on hill slopes with the remainder fairly evenly divided between ridgetop (13.7 percent) and valley floor (16.7 percent) zones;
- a quarter (25.3 percent) also had recorded surface evidence of occupation deposit and of these 13.7 percent also contained grinding grooves. It is probable however, that recorder bias has extensively under-represented surface occupation evidence in shelter art sites;
- five percent of shelter art sites also contain grinding grooves, with nearly all of these associated with occupation deposit;
- 41 percent of graphics are of unidentifiable motif or stencilled object type;
- the average number of identifiable graphics or stencilled objects per site is 15.4;
- 49 percent of identifiable graphics are stencilled hands, (a potential result of recorder bias because stencilled objects are easier to identify than most motif types);
- of non-stencilled graphics (motifs), macropods are the most dominant (nine percent) followed by anthropomorphs (seven percent) and other land animals (5.5 percent);

- the diversity in motif and object types is considerably more extensive than in engraved motifs;

- when motif and stencilled object types are grouped into larger sub-groups, the following breakdown was gained:

Motif Type	Percent (Total Number = 14,424)
Unidentified	41.0
Tracks	30.3
Terrestrial Animal	10.0
Anthropomorphic	7.1
Other	3.4
Material Objects	3.1
Marine Animals	2.6
Birds	2.4

- about a third of shelter art was stencilled, and engraved motifs are very rare (1.3 percent);

- nearly all (nine percent) non-stencilled and pigmentary graphics are drawn, with painted graphics making up eight percent and one percent using both techniques;

- nearly all (93 percent) non-stencilled pigmentary graphics use one colour only, with only seven percent including two colours and one percent with three or more;

- 46.2 percent of pigmented graphics are black, followed by white (34.6 percent), red (16.6 percent) and yellow (2.8 percent). The proportion of colour usage varies considerably in localised areas;

- stencils are mostly made in either white or red;

- about a third (37.6 percent) of non stencilled graphics consist of an outline and linear infill, 34.1 percent consist of an outline only, and 28.3 percent are solid graphics (a relatively continuous non linear area of pigment); and

- geometric or patterned infills are rare and occurred in only 2.5 percent of cases.

Art Phases

McDonald (1994) has proposed a three phase sequence within the shelter rock art, based on a detailed study of 65 shelter art sites in the Mangrove Creek valley and correlations with stone technologies in excavated deposits. These are:

- Sydney Basin Art Phase 1 - pecked engravings of tracks and circles, created during the Pre- or Early Bondaian, greater than 4,000 years BP;

- Sydney Basin Art Phase 2 - red paintings, red hand stencils, and possibly white hand stencils (red and white hand stencils do not occur together), made in the Early Bondaian from less than 4,000 to around 1,600 years BP; and

- Sydney Basin Art Phase 3 - characterised by a 'proliferation' of techniques and colour usage, possibly starting with drawn black and drawn red graphics and then developing into a range of paints, drawn bichromes, stencils in various colours, polychromes and incised graphics. Outline only graphics end the sequence in many shelters. White stencils and drawn red and white outline and infill forms are also known from the contact period, and hence the end of the sequence. Localised variations in the use and timing of different techniques and motifs occurred. Phase 3 extended from around 1,600 to a time soon after 1788 following European contact.

Older art sites, consistent with Phase 1, are suggested to be 'focussed' on the middle reaches tributaries of the Hawkesbury Nepean River (McDonald, 1994). McDonald (1994) argues that the main period of shelter art production evident at most sites is also contemporaneous with the period of greatest stone tool discard at shelter sites - the Middle Bondaian. She links this production with a model of increasing use of social mechanisms to control social interaction and symbolic behaviour defining local group social affiliation and identity. Within the last 1,000 years, evidence from excavations indicates that the rate of artefact accumulation as well as the rate of occupation in shelters reduces significantly. There is however no corresponding evidence for a fall in population. This suggests that the type of occupation in rock shelters changed and this is reflected by a reduced artefact discard rate. McDonald (1994) suggests that a change in the 'social curtilage' of local Aboriginal groups may explain the changing role of shelter sites and that there may have been a 'shift in focus' to open sites. Larger group sizes may have required a shift away from the spatial constraints of rock shelters. Art production in shelters however, is thought to have continued into the Late Bondaian without appreciable stylistic change and continued into the time of Contact. McDonald (1994) also suggests that a large number of open engraving sites may have been produced in the last phase as a consequence of increasing

social complexity and the need to symbolically demonstrate group cohesion and moderate social interchange.

Site Density

A review of comprehensive survey results from dissected sandstone plateau topographies in the Sydney basin indicates that surface site densities range from 11 to 3.1 sites per square kilometre, with frequencies between four and six representing average rates.

Despite the numerous archaeological surveys conducted on the Cumberland Plain, most have involved small areas and little work has been conducted regarding overall site density determinations. Previous determinations of site densities from comprehensive survey of large area samples are not readily available from the existing literature.

TABLE 4.3 ARCHAEOLOGICAL SURVEYS UNDERTAKEN ON THE CUMBERLAND PLAIN

Location	Number of Sites Per Square Kilometre	Area Surveyed (square kilometres)	Landscape Type	Reference
Maroota (Devils Rock)	11	N/A	ridgeline complex, sandstone plateau	McDonald (1986)
Bardens Creek	6 to 7	1.2	dissected sandstone plateau	Silcox (1980) Attenbrow and Negerevich (1981)
Mangrove Creek Dam Catchment	5.9	101	dissected sandstone plateau	Attenbrow (1981)
Warre Warren	5.4 (8 PADs)	4.25	dissected sandstone plateau	McDonald (1988)
Upper Cattai Creek	4	3.4	dissected sandstone plateau	Koettig (1985)
Brimstone Colliery, Burragorang Plateau	3.1 (4.6 PADs)	14.7	dissected sandstone plateau	Navin (1995)
Eastern Woronora River Catchment	2.7	42	dissected sandstone plateau	Sefton (1990a)
Woronora Plateau	2.1	418	dissected sandstone plateau	Sefton (1988)

Location	Number of Sites Per Square Kilometre	Area Surveyed (square kilometres)	Landscape Type	Reference
Holsworthy	1.7	Approx. 171	dissected sandstone plateau	Various compiled by AXIS Environmental/ Australian Museum Business Services Consulting (1995)
Cordeaux River Catchment	1.2	73	dissected sandstone plateau	Sydney Prehistory Group (1983)

Cumberland Plain

The Badgerys Creek study area is located on the northern Cumberland Plain - defined as that area of the Wianamatta Shale Plain where the creeklines drain north and west to the Hawkesbury River (McDonald, 1993). Hundreds of Aboriginal sites, predominantly open artefact scatters (also referred to as open camp sites), have been recorded within the Plain. The camp sites vary greatly in size from small sparse scatters to large concentrations of artefacts. Other sites types known include scarred trees, raw material extraction/procurement sites, stratified deposits and grinding grooves where there are exposures of Minchinbury sandstone in the Wianamatta shales and clays.

The picture of Aboriginal utilisation and occupation of the Cumberland Plain is constantly being revised and refined as archaeological methods improve and more archaeological data becomes available for the area. Larger scale projects undertaken on the Cumberland Plain include Kohen's 1986 doctoral research on the western Cumberland Plain (Kohen, 1986), Smith's major compilation and analysis of data for the northern Plain (Smith, 1989a) and McDonald and Rich's more recent investigations at Rouse Hill (McDonald and Rich, 1993).

Several predictive models have been formulated to explain Aboriginal site location on the Plain. Haglund (1980) developed a predictive model of site location based on early survey work in the Blacktown area. She predicted that sites would most likely be located near water courses such as creeks and soaks and on high ground near water.

Kohen (1986) postulated that the availability of water was the most important factor influencing the distribution of sites across the landscape. Other criteria which appear to play a role in site location are proximity to a diversity of economic resources such as food and lithic materials and to a lesser extent,

elevation. Smith (1989a) supported the predictions made by Haglund (1980) and Kohen (1986) that sites will most commonly be found near water sources.

Smith (1989a) concluded that sites will occur in all areas of the Cumberland Plain, except where destroyed by European land use, erosion processes and flooding; sites will be located in all topographic units with site densities expected to be 10 percent higher in the northern section of the Plain because of the greater concentrations of stone resources in that area; 50 percent of all sites will be found within 50 metres of a water source with sites tending to be more frequent around permanent water sources (apart from areas overlying the Londonderry Clay or Ricaby Creek Formation and the Werrington Downs area); and that sites will be expected in relatively high frequencies on or near stone resources.

Smith's (1989b) study of the Liverpool release areas tended to confirm this site location model in that almost 75 percent of sites were found in association with a permanent water source and over 60 percent of sites were within 50 metres of water. In this study Smith concluded that sites in the Liverpool area were more likely to occur on creek flats than on any other topographical feature and that the probability of sites occurring on creek flats increased near creek confluences.

McDonald (1992a), however, noted that Smith had focused on surface sites and on creeklines and creekbanks in her predictive model for the Liverpool area, thus introducing a bias into the survey results. Rich and McDonald (1995) have noted that Kohen's (1986) site location model is also based on surface sites only.

Subsequent excavations on the Cumberland Plain have demonstrated that surface sites are generally an inaccurate representation of subsurface deposits (McDonald and Rich, 1993; Rich and McDonald, 1995).

The results of test excavations at Rouse Hill (McDonald and Rich, 1993) have confirmed that sites occur widely across the landscape including areas such as hilltops and slopes and near creeks. Larger sites with higher artefact densities are more likely to be located near permanent water. Excavations of a site at West Hoxton, south-east of Badgerys Creek, provided evidence of artefacts present up to 80 metres from a creekline, extending onto adjacent lower slopes (Rich and McDonald, 1995).

Prior to 1993 relatively few open sites had been excavated on the Cumberland Plain. Excavations at Plumpton Ridge, a major source of silcrete raw material, have provided evidence of extraction activity at this site at least 2,200 years ago (McDonald, 1986). The stratified Power Street Bridge site on Eastern Creek at Doonside yielded a date of 5,957 $\pm$ 74 (NZA-3112) which is the earliest occupation date for the Cumberland Plain (McDonald, 1993). A

deflated Aboriginal hearth site located on a sand dune at Randwick provides the earliest secure date (7820±50 BP Beta 87211) for an open site in the Sydney Basin (Mary Dallas, pers. comm. 1997). The site was located in the course of investigations of the Randwick Destitute Children's Asylum at the Prince of Wales Hospital.

Baker (1995) disputes the veracity of a number of the dates claimed for unstratified open sites on the Cumberland Plain. He argues that as charcoal is a common material in the environment its association with artefacts has a good chance of being 'background environmental material', and as such does not securely date the artefacts with which it is associated.

In the largest test excavation program in metropolitan Sydney to date, nineteen sites and fifteen Potential Archaeological Deposits were systematically investigated in the context of the Rouse Hill Infrastructure Project. These investigations were documented in some 17 reports (see McDonald, 1993). Over 7,000 artefacts were retrieved from these excavations and 87 percent of identified Potential Archaeological Deposits were subsequently designated sites. Many of the sites and small surface scatters proved to be extensive, complex and relatively intact archaeological sites. The two identified Potential Archaeological Deposits which were found not to be sites were located on hillslopes with thin topsoil development (McDonald and Rich, 1993).

McDonald (1993) notes that:

> 'the range, complexity and high degree of intactness of the archaeological record were not expected either from the original surface recordings made nor from previous test excavations on the Cumberland Plain, which (in retrospect) were all of an extremely limited nature'.

Charcoal from two knapping floors located in sites in the Rouse Hill development area have provided Early Bondaian dates of 4,060±90BP (Beta 66450) and 4,690±80BP (Beta 66453) respectively (McDonald and Rich, 1993). These dates are the earliest so far obtained for backed blade reduction sequences at open sites on the Cumberland Plain.

The Rouse Hill Development Area included four major (probably permanent) creek systems - Cattai, Smalls, Caddies and Second Ponds Creeks. A second Smalls Creek located in the area is a tributary to Caddies Creek.

The south-west section of the Rouse Hill study area is on shale geology and includes the upper reaches of Caddies Creek and its tributary, Smalls Creek. This area provides a somewhat comparable topographic context to the Badgerys Creek study area which is also on shale geology and contains the

upper reaches of Badgerys Creek, Thompsons Creek and Oakey Creek. In this part of the Rouse Hill study area sites included three repeated occupation large group sites on hillslopes and three on alluvium, eight repeated occupation small group sites on hillslopes and one on alluvium, one repeated small group occupation site and one single occupation small group site on ridgetops and three sites interpreted as background scatters.

Findings from the Rouse Hill investigations which could be extrapolated from the results of the Rouse Hill studies to similar areas on the Cumberland Plain are:

- most areas which were the subject of subsurface investigations contained sub-surface material;
- site patterning could be related to gross environmental factors, however, the relationship between sites and the environment is complex - sites on permanent water are more complex than sites on ephemeral drainage lines. Major confluences are prime site locations;
- depositional environments for example, alluvial terraces, contain the best potential for intact cultural material, although some hillslope zones may also have good potential;
- intact archaeological material may remain below the plough zone that is, top 25 centimetres of soil;
- minor gullies tend to have low density sites; and
- fewer sites were located on ridgetops possibly due to greater disturbance of these areas.

A number of surveys have been conducted in the suburbs around the Badgerys Creek study area and 25 sites are listed on the NSW National Parks and Wildlife Service Register of Aboriginal Sites as occurring within a 20 square kilometre area around the study area. These comprise 22 artefact scatters, one isolated find, one grinding groove site and a carved tree site. One of the open artefact scatter sites, National Parks and Wildlife Service Site No. 45-4-517, is located within the study area.

Eight carved trees which were located on the Greendale Estate south-west of the study area were presented to the Australian Museum in 1892 by the property owner. It was assumed that the trees were gravemarkers, although no burials were found in association with the trees (National Parks and Wildlife Service Site Card; Etheridge, 1918; Bell, 1982).

North of the Badgerys Creek study area Rhoads (1984; 1985) located two artefact scatters within the Fleurs radio observatory facility (north of Elizabeth Drive). One hundred and fifty artefacts, predominantly silcrete waste flakes, were retrieved from an excavation by Sydney University students of the Fleurs 1 site (National Parks and Wildlife Service Site No. 45-5-96).

Kohen (1991) surveyed a proposed landfill area of approximately 100 hectares, located north of Elizabeth Drive and the present study area, and south of the junction of South and Badgerys Creek. One surface scatter of 22 artefacts was located on a slight rise 30 metres east of Badgerys Creek (Kohen, 1991). It appears that almost exactly the same area was resurveyed in 1989 in relation to proposed extensions to an existing extraction area, with no reference to the earlier Kohen report (Nicholson, 1989).

A preliminary survey of the Luddenham Equestrian Centre at Erskine Park located twelve artefact scatters (Dallas, 1988a). The scatters were all associated with water courses - Cosgrove Creek, South Creek and Badgerys Creek. Further investigations were undertaken at Luddenham including subsurface testing (Dallas, 1988b).

No sites were located by Haglund (1979) in the course of a survey of the Kemps Creek substation site south of Elizabeth Drive and east of the study area. Hanrahan (1981) surveyed an area at Bossley Park, locating two artefact scatters - both of which have subsequently been collected/destroyed.

East of the study area, Dallas and Hankel (1985) carried out a survey along Ropes Creek at Cecil Park and located two sites. Both sites were artefact scatters found along a minor tributary of Ropes Creek. One site contained ten artefacts with raw materials including red and yellow silcrete and cream and yellow indurated mudstone. The second site comprised 36 artefacts, with similar raw materials present.

Navin and Dallas (1991) surveyed an area of approximately 155 hectares at Cecil Park, comprising gently undulating plains and ridgeline spurs and saddles. One low density artefact scatter was located at the confluence of two small streams. The site comprised five artefacts with raw materials including quartzite, silcrete and quartz.

One low density artefact scatter and one isolated find were located in the course of a linear survey for a proposed 33kV transmission line from Bringelly to Rossmore south and west of the study area. The site was located on a spur above South Creek, with most of the artefacts between 80-150 metres from the creek. Artefacts were predominantly indurated mudstone and silcrete (McDonald, 1992b).

A survey for a clay/shale extraction area on Adams road at Luddenham, just west of and adjacent to the Badgerys Creek study area, located one artefact scatter in a disturbed context (Dean Jones, 1991).

Woronora Ramp

Large area archaeological surveys have been conducted on the Woronora Ramp by amateur groups, particularly the Illawarra and the Sydney Prehistory Groups, while smaller scale investigations have generally been undertaken by professional archaeologists.

The survey methods and interests of amateur groups have biased the resulting database toward rock based sites. Both the Sydney and Illawarra Prehistory Groups have tended to focus their activities on obtrusive site types such as shelters with rock art, engravings and grinding grooves on rock platforms. Surveys for these site types is most effective when concentrated on escarpments, large areas of rock platforms, and drainage lines. Consequently, ridgetop and plateau surfaces have been subject to less scrutiny due to their low incidence of rock exposures and overhangs. Scarred trees, artefact scatters, shelters with Potential Archaeological Deposits and open Potential Archaeological Deposits have not been consistently recorded or searched for.

Systematic surveys for rock based sites by members of the Illawarra Prehistory Group, guided by Carol Sefton have located large numbers of sites on the Woronora Ramp. Survey areas include parts of the Avon, Cordeaux and Cataract River Catchments, O'Hares Creek and the Eastern Woronora Catchment in Heathcote National Park (Sefton, 1988; 1989; 1990a; 1992). The latter area is located immediately to the east of the Holsworthy Military Area and O'Hares Creek is located to the south of the area.

Sefton (1988; 1992) has found a 'broad concurrence' in the distribution of relative densities of grinding grooves, charcoal drawings and rock engravings across the whole Woronora Ramp. High densities are noted in the coastal sections of the Georges River catchment and in the Cataract River catchment. Higher numbers of painted and engraved graphics were recorded where the number of occupied shelters was found to be relatively high. In a statistical analysis of 7,641 graphics from the Ramp, Sefton made several conclusions and compilations:

- the most common combination of colour and technique is black drawing (78 percent);
- 64 percent of charcoal graphics were found to be indeterminate due to natural deterioration;
- motif types in charcoal occur throughout the Ramp;

- only 188 red drawn graphics have been recorded from the Ramp. The most common motif types are kangaroos and frontal humans. Eel, echidna, snake, bird, and 'symbols' also occur as minor components. Profile human figures, lizards, bats and gliders have not been recorded. The absence of profile human figures makes the red motif distribution distinct from the black;

- based on a limited number of superimpositions where charcoal drawings are located over red drawings, Sefton concludes that the red drawings are older than some of the black drawings;

- Sefton argues that based on statistical analyses, the red motifs can be considered as an independent group, relative to black motifs;

- profile human figures are only drawn in black (or white clay) and are a late addition to rock art on the Ramp; and

- there is a gradual south-westerly decline in the depiction of kangaroos and fish relative to an increase in frontal human figures and eels.

Technique and Colour Combination	**Percent of Total Graphics (Number = 7,641)**
Charcoal Drawing	78.1
Red Stencil	8.1
Red Drawing	4.0
White Stencil	3.4
White Drawing	2.2
Bichrome Graphics	1.2
Painting	2.9

Charcoal Motif Type	**Percent of Total Graphics (Number = 5,971)**
Indeterminate	64.2
Kangaroo (profile quadrupled land animal)	13.4
Frontal Human	8.6
Profile Human	3.9
Track/Symbol	2.4
Fish	1.8

Charcoal Motif Type (Cont'd)	Percent of Total Graphics (Number = 5,971) (Cont'd)
Bird	1.3
Eel	1.3
Snake	1.2
Echidna (splayed limbs)	0.7
Possum (splayed limbs)	0.5
Lizard	0.3
Bat	0.2
Tortoise	0.2

Eastern Woronora Catchment

Sefton's (1989) survey of the Eastern Woronora catchment (an area of 47 square kilometres) located 62 sites including 20 open sites and 42 shelter sites (Sefton, 1990a). Fifty eight percent contained pigmented rock art, 18 percent contained surface stone artefacts, 29 percent contained grinding grooves, five percent contained engravings and eight percent contained 'engraved groove channels'. The open sites consisted of 17 grinding groove sites, two sites with engravings and grinding grooves and one site with engravings only (Sefton, 1990a). A total of 75 shelter sites, 35 sites containing grinding grooves, seven containing engravings and nine containing 'engraved groove channels' are known from the Eastern Woronora Catchment. This provides a general site density of 2.7 per square kilometre (Sefton, 1990a).

Seventy four percent of grinding groove sites were found to have less than 10 grooves, with a mean of 18 and a mode of 10. A total of 614 grinding grooves were recorded. 'Engraved groove channels' were located in five open sites, four of which contained grinding grooves. A total of nine sites with this form of groove are known from the Eastern Woronora Catchment. Sefton concludes that the grooves were created to control and direct water seepage across rock platforms, apparently with the aim of keeping some areas dry, others wet, and controlling the water level of potholes. One site on Girronba Ridge was found to contain grooves constructed from metal tools and associated with grinding grooves. This led Sefton to conclude that the grooves may indicate Aboriginal occupation during the contact period (Sefton, 1990a).

Sefton (1990a) has identified 68 shelters in the Eastern Woronora Catchment area. A total of 659 graphics were identified with a mean of 9.7 graphics per shelter. The range was between one and 69. Most shelters (43 percent) were located on upper valley slopes, 26 percent on lower valley slopes. Twenty six percent were found in valley bottom contexts and only two percent on ridge tops.

Charcoal drawings were the most common graphic, occurring in 91 percent of shelters. The condition of the charcoal drawings was generally poor with 62 percent classed as indeterminate. The following provides a breakdown of the identifiable drawn black motifs (Sefton, 1990a):

Motif Type	**Percent of Identifiable Graphics**
Kangaroos	38
Frontal Human Figures	16
Fish	16
Profile Human Figures	15
Echidna	3
Eel	2
Birds	2
Snake	2
Tracks	1
Wombat	1
Lizard	Less than 1

Thirty two red drawings were identified in 26 percent of shelters, with a mean of 1.8 drawings per site. Sixty two percent were classed as indeterminate. A total of nine white drawings were found in only four shelters (six percent of shelters).

Red stencils were found to be limited to hands or indeterminate areas of pigment and represented 10 percent of recorded graphics in 18 percent of the shelters. Both adult and children's hands were identified. At least six children's hand prints in red were also identified in one particular site. White stencils (all hands) were rarely recorded, accounting for 0.8 percent of recorded graphics in four percent of shelters. Elsewhere on the Woronora Plateau, white stencils include a wider range of images including material objects and kangaroo and bird feet (such as in the Cordeaux catchment), but red stencils remain restricted mostly to hands, with rare occurrences of axe and human foot images.

Painted motifs (non-stencilled or printed graphics) were found to be a rare graphic with only four motifs identified in three sites, all in red or yellow, including a yellow outline kangaroo, a red kangaroo and a yellow-orange 'oval symbol'. These account for less than one percent of the total graphics. Six bichrome graphics were identified in six shelters, representing 0.9 percent of total graphics in nine percent of sites.

The rock art of the Woronora Ramp has been placed within a broader analytical context by several research projects which investigated stylistic trends across the whole of the Sydney basin. In a pioneering analysis of 285 engraving sites across the Basin, McMah (1965) demonstrated that there was

clinal variation in motif type and distribution along both north-south and east-west planes. She argued that when the influence of differing environmental factors were accounted for, there remained stylistic variation which could be attributed to cultural differences. She identified the sites located south of Botany Bay as a distinct artistic unit, characterised by the presence of unique motifs, particularly 'beaked' anthropo morphs.

The further stylistic differentiation of the rock art south of the Georges River has been argued by McDonald (1990; 1994) from the results of her Basin-wide analysis of both the engraved and pigmented art assemblage.

The following distinctions were noted within the engraved art occurring south of the Georges River (McDonald, 1994):

- no full profile anthropo morphs are known to occur;
- 'beaked' anthropo morphs are only known to occur in this area (this is a motif interpreted to be a representation of a frontal view human with a head shown in profile);
- no 'culture heroes', emus or contact motif types are known to occur;
- there is a high proportion of unidentified motif types;
- the proportions of tracks (particularly 'mundoes' or human foot/track motifs) are appreciably lower;
- the proportion of anthropomorphic, marine and terrestrial (animal) motif types is higher commensurate with the reduced number of motif types and track motifs;
- motifs with profile orientated limbs include pairs of fore and hind limbs, in contrast to the inclusion of only one fore and hind limb in motifs north of the river (two exceptions north of the river were noted);
- whale motifs tend to have less anatomical detail shown and no 'decorative' infill;
- echidna motifs have splayed limbs, (two located on both sides, as in a view from the top or bottom), in contrast to profile orientated limbs north of the river;
- a statistical test known as correspondence analysis indicated that the art from sites located on the Wollongong 1:100,000 topographical map sheet showed a marked increase in heterogeneity in terms of motif

types used and motif combinations when compared to other map sheet samples (McDonald, 1994);

- when the art is grouped according to the Tharawal language precinct (as defined by Capell (1970) to be south of Georges River and east of a line which approximately halves the Holsworthy study area longitudinally (Refer *Figure 6* in *Appendix L*), the following trends were observed (McDonald, 1994):

  - the average number of motifs per site is the smallest in the Basin, (five motifs per site);
  - there is a focus on marine orientated motif types (30.7 percent), which can be explained by the proximity to the coastline;
  - the most commonly depicted individual motif types are men (14.8 percent) and non-gendered anthropomorphs (20.3 percent), with macropods and land animals also having significant percentages;
  - mundoes are the most frequently depicted track motifs are significantly lower proportions of women, snake, shield and axe motifs (McDonald, 1994); and
  - correspondence analysis of this subset also indicates considerably more stylistic heterogeneity and variance when compared with other groupings (McDonald, 1994).

The following distinctions were noted within the shelter art occurring south of the Georges River (McDonald, 1994):

- sites have a lower association with recorded occupation deposit (13.8 percent compared to 31 percent north of the river);

- sites with recorded occupation deposit have a higher incidence of association with grinding grooves (28 percent, rather than 10.6 percent north of the river);

- the proportion of shelter sites which include engraved graphics is 1.1 percent (two out of 181 sites), compared to 15.4 percent (55 out of 365 sites) north of Port Jackson and the Parramatta River;

- motifs with profile orientated limbs include pairs of fore and hind limbs, two legs on birds, in contrast to the inclusion of only one fore and hind limb in motifs north of the river (McDonald, 1994);

- correspondence analysis indicated that the art from sites located on the Wollongong 1:100,000 topographical map sheet showed a considerable diversity in motif preference and techniques employed.

Drawings of (predominantly) land animal motifs in black pigment are most common (McDonald, 1994);

- when the art is grouped according to the Tharawal language precinct the following trends were observed (McDonald, 1994):

  - a high proportion of graphics are unrecognisable;
  - the average number of graphics per site is 24.1;
  - unlike the rest of the Basin, hand stencils are relatively absent and do not dominate recognisable graphic categories;
  - macropod motifs and hand stencils co-dominate the assemblage;
  - macropods dominate the recognisable motif types (25 percent), followed by other land animals (11 percent) anthropo morphs and birds (both 10 percent). This is in contrast to marine motif types dominating the engraved assemblage;
  - profile anthropo morphs account for three percent of motifs (compared to none in the engraved assemblage);
  - women, culture hero, and snake motifs are extremely rare or absent (McDonald, 1994);
  - black is the predominant colour (78 percent), followed by red (14 percent), white (seven percent) and yellow (one percent);
  - drawing dominates the assemblage (around 90 percent), stencils account for around 10 percent, and (non-stencilled) painted motifs, engravings (0.1 percent), and combined painted and drawn graphics (0.2 percent) are rare;
  - there is a combined emphasis on outlined, and outlined and infilled graphic forms. Infill only forms are less common; and
  - correspondence analysis of the art south of the Georges River indicates high levels of heterogeneity in motif type (McDonald, 1994), but homogeneity in techniques used, with a focus on black drawing.

Based on these results, McDonald (1994) views the art assemblage south of the Georges River, and consequently the art within the Holsworthy study area, as being of particular interest in understanding and contrasting the possible social dynamics manifest by rock art in the Sydney basin. She links stylistic homogeneity in 'centre' or 'source' Basin precincts, with a social imperative for symbolic mediation of inter-group cohesion and co-operation. She argues that high levels of heterogeneity and the decline in engraved sites and graphics toward the south is evidence of a peripheral region where the need for broad scale group cohesion was less, or alternative social mechanisms operated. Varying levels of heterogeneity are argued to manifest different types of social information. In this way, high levels of homogeneity between sites in drainage basins on the margins of the basin are thought to indicate the increased importance of the display of social boundaries (McDonald, 1994).

Local Area Surveys

Outside of the larger and regional scope of the above studies, a large number of local area surveys and assessments have been conducted on the Woronora Ramp. These have mostly been conducted by professionals for environmental impact assessment work. Within the lands surrounding the Holsworthy Military Area surveys have been conducted around Lucas Heights, Alfords Point, Illawong, Menai, Wattle Grove, Holsworthy and Wedderburn. Surveys which have principally included ridgetop or plateaux areas have tended to locate fewer sites than those which included incised escarpment country.

No sites were located in a number of surveyed areas along the New Illawarra Road ridgeline located to the east of Heathcote Road and the Military area. These included two concrete batching plants (Attenbrow, 1981b, Brayshaw, 1982a), two small areas on Davids Road (2.2 hectares, 6.2 hectares) and one on Bardens Lane (1.25 hectares) (Byrne 1985a, 1985b and 1985c), a 'flat-lying area of Hawkesbury sandstone' on Allies Road at Lucas Heights (Byrne, 1987) and the Water Board's Lucas Heights Reservoir compound on New Illawarra Road (McDonald, 1995).

A sample survey was carried out by Brayshaw (1982b) of the 1,600 hectare West Menai Urban Release Area. Ten sites (three shelters with art, six shelters with occupation deposit and a grinding groove site) and 13 Potential Archaeological Deposits were recorded during the survey (Brayshaw, 1982b). Part of Brayshaw's West Menai study area was later to be considered for use as the northern portion of the proposed Lucas Heights Waste Disposal Depot. Brayshaw's report was reviewed and updated by McDonald in 1990.

Silcox (1980) surveyed an area of 120 hectares on Bardens Creek, a small tributary of Mill Creek, at Lucas Heights, east of Heathcote Road. This survey was the first of a number of archaeological investigations associated with the Lucas Heights waste disposal facility and Bardens and Mill Creeks. Nine sites comprising five shelters with art, one shelter with art and occupation deposit, one shelter with deposit and two grinding groove sites were located by Silcox (1980). The art comprised figurative motifs and six yellow hand prints. Prior to this survey only three sites were known for the upper Bardens Creek area, comprising two grinding groove sites (National Parks and Wildlife Service Site No. 52-2-856/858) and a rock engraving associated with grinding grooves (National Parks and Wildlife Service, Site No. 52-2-210). Silcox recommended that test excavations be carried out in three of the shelter sites.

Subsequently Attenbrow and Negerevich (1981) recorded all of the Bardens Creek sites in detail and excavated four of the rockshelters. The occupation evidence recovered from the shelters comprised principally lithic artefacts with very small amounts of shell - Sydney Cockle (*Anadara trapezia*), oyster (*Saccostrea commercialis*) and mussel (*Trichomya hirsutus*) (Attenbrow and

Negerevich, 1981). The presence of the shell material was interpreted as possible utilisation of the estuarine reaches of the Georges and/or Woronora Rivers by the inhabitants of the shelters.

Stone materials present at the sites included quartz, chert, silcrete and quartzite. Artefact types had the characteristics of the Late Bondaian and Middle Bondaian phases of the Eastern Regional Sequence that is, the presence of bondi points, the predominance of quartz and the presence of 'reasonable numbers of bipolar pieces' (Attenbrow and Negerevich, 1981).

It was suggested that the lack of levels with silcrete or chert as the predominant stone made it unlikely that initial occupation of the Bardens Creek sites was earlier than 3,000 years BP - 'initial occupation probably occurred between 3,000 and 2,000 years ago' (Attenbrow and Negerevich, 1981). A radiocarbon date of 1630 ± 90 BP (SUA-1746) on charcoal from Bardens Creek Site nine validated the earlier conclusions based on the artefact assemblages in the sites. Site density in this area, which included incised valleys and ridgetops, was six to seven sites per square kilometre, however, no sites were recorded for the ridgetops which comprised some 27 percent of the total study area.

Koettig and McDonald (1984) carried out a survey of an alternative 100 hectare area under consideration for the Lucas Heights Waste Disposal area across the headwaters of Mill Creek. This area is referred to as the 'southern portion of the waste disposal area' (Koettig, 1985). One shelter with art (seven faded white hand stencils) and two shelter Potential Archaeological Deposits (which were later excavated and proved to be sites) were located in the survey (Koettig and McDonald, 1984). The sites were interpreted as possibly representative of the smaller or less frequently occupied shelters of the region. The 'southern portion' was adjacent to part of the West Menai area surveyed by Brayshaw in 1982 which was then under consideration as the 'northern portion' of the proposed disposal area. Further site recording and excavation in the Mill Creek study area was recommended by Koettig and McDonald.

Two shelter sites, M11 and M12, and an open campsite M14, were excavated by Koettig (1985; 1990). Over 14,000 stone artefacts and identifiable bones from wallaby, possum, potoroo, bandicoot, snake and skink were retrieved from the deposit in one shelter M11. Radiocarbon dates indicated that the site was initially occupied over 2,200 years ago (2220 ± 70BP - SUA 2257), with occupation apparently ceasing around 400 to 500 years ago (480 ± 70 BP - SUA 2255) (Koettig, 1985). Koettig noted a change in knapping techniques, primarily on silcrete, at around 1,500BP in this shelter (ibid). In 1992 Clegg reinspected the rock art in site M11 on behalf of the NSW Aboriginal Land Council. Two hundred and thirty four artefacts were recovered from excavations totalling one square metre in a shelter site M12. Raw materials present were quartz, silcrete and fine grained siliceous.

Initial excavations at one open campsite M14, adjacent to Mill Creek, located less than 200 artefacts, however insitu knapping floors were identified at the site (Koettig, 1985). Subsequent excavations by Koettig in 1990 recovered over 7,000 artefacts within a site area approximately 70 by 25 metres which extended from a talus slope near rock shelter site M11, to the creek bank. Koettig notes that Mill Creek 'has no clear bank in this section, the drainage channel being very shallow and consisting of a series of deeper waterholes joined by swampy ground' (Koettig, 1990).

A hearth, associated with the bipolar knapping of quartz was dated to 2160±80BP (Beta-27197). The overall 'impression' of the site gained from the type and distribution of archaeological material was of an open site utilised mainly for the bipolar knapping of quartz (Koettig, 1990).

Koettig has noted an interesting correlation between the marked late decline in artefact discard in shelter site M11 and a corresponding increase in discard on open site M14, located just outside M11, in its later phase. This could indicate a change in living habits or may have been a reaction to the increase in splintered quartz resulting from bipolar knapping. Knapping activities may have moved outside of the shelter as a living space full of shattered quartz would not have made for comfortable living.

The shift from M11 to M14 seems indicative at an individual level, of the Sydney Basin trend for a decline in the rate of artefact discard over the last 1,000 years (Attenbrow, 1981a; McDonald, 1994). It is also consistent with McDonald's model for a shift in occupation focus to open sites in this late period.

A further two shelter sites and an open artefact scatter were located in the course of a survey of an extension to the Waste Disposal depot (Koettig and Oakley, 1991).

In summary, some 17 Aboriginal sites have been recorded in the course of systematic survey of the Mill and Bardens Creek system. Investigations carried out at a number of the sites indicate that initial occupation of this area commenced relatively late in the Holocene period, that is, less than 3,000 years ago and continued until close to the time of European arrival. Cultural material present in excavated deposits reflects a predominantly 'inland' economy with minimal exploitation of estuarine resources.

Other surveys conducted east of the study area include Byrne and Du Cros' survey of 16 housing blocks on Old and New Illawarra Road (two shelters with occupation deposit were located) (Byrne and Du Cros, 1985) and a series of surveys and excavations at Alfords Point (Greer at al, 1983; McIntyre, 1984a, 1984b, 1984c; Rich, 1984; McDonald, 1984). McIntyre's (1984c) test

excavations of two rock shelters with Potential Archaeological Deposits confirmed the presence of occupation deposit in both sites.

Eastern Woronora Catchment

Surveys in the vicinity of Wedderburn have included assessments for proposed subdivisions (Smith and Crew, 1988; 1989; Smith, 1991) and various coal mining activities (Sefton, 1981; 1982; 1986; 1987; 1990b).

A survey of a ridgeline situated between O'Hares Creek and a tributary of Pheasant Creek, approximately one kilometre east of Wedderburn and west of the Holsworthy Military Area, was conducted by Smith and Crew in 1988. The survey of the proposed subdivision, Yeomans Estate, located eight sites and seven Potential Archaeological Deposits in an area of approximately 3.5 square kilometres. The sites comprised five shelters with art, two grinding groove sites and a scarred tree. One of the grinding groove sites and the tree were located on the ridgetop (Smith and Crew, 1988).

Charcoal was the most common material used for drawing motifs in the Wedderburn art sites. Three of the sites contained more than ten motifs, with one site, W5, containing the largest known assemblage with 73 motifs (ibid). The Yeomans Estate area was re-evaluated in 1989 after changes to the original subdivision plans (Smith and Crew, 1989), and four of the shelter art sites were recorded in detail in 1991 (Smith, 1991). One site, W3, was classed as highly significant due to the presence of rare motif types, including snake and profile anthropomorph motifs and the relatively good condition of the art. Another site, W4, was considered to be significant due to its rare ridgetop location and the presence of 'abraded grooves' (Smith, 1991).

Sefton's Wedderburn investigation areas included some areas which had been previously surveyed by the Illawarra Prehistory Group and some areas located immediately adjacent to the study area.

Surveys have also been carried out on the Cumberland Plain and the Plain/ Sandstone plateau interface around Holsworthy. No sites were recorded in the survey of the proposed route of the East Hills-Glenfield Railway (Koettig and Hughes, 1983). Boot (1990; 1992; 1993; 1994a and 1994b) carried out a series of investigations at Wattle Grove north of the study area. Several artefact scatters were located in the surveyed areas, two of which were test excavated in 1995 (Haglund, 1995). A 1985 survey of a pipeline route at St Helens Park located one open scatter of quartz and silcrete artefacts (Du Cros, 1985).

An environmental impact statement was prepared in 1996 for the proposed Holsworthy sewerage scheme transfer, located on the southeastern edge of the Cumberland Plain and north of the Holsworthy Military Area. The Aboriginal

archaeological survey for the pipelines and pump station areas located five isolated finds which were considered to be of low archaeological significance (Mills, 1995).

4.4.2 PREVIOUS INVESTIGATIONS WITHIN THE STUDY AREAS

Badgerys Creek

The Badgerys Creek study area, or parts thereof, have been the subject of three previous archaeological investigations.

In 1978 a preliminary study of possible second Sydney airport locations was carried out (Haglund, 1978). This study is generally referred to as the *Major Airport Needs of Sydney* study and it included an archaeological assessment of several zones, including south-west zones SW1 and 2, and SW3 and 4 (Haglund, 1978).

The present Badgerys Creek study area falls within zones SW3 and 4. There does not appear, however, to be a complete colour copy of the survey report in existence (the National Parks and Wildlife Service does not appear to hold a complete copy; Haglund's copies were partially destroyed in a fire L. Haglund, pers. Comm. 1996). It is not clear where Haglund surveyed as colour coding was used on the maps in the report. No sites were located in the present Badgerys Creek study area. Haglund located three sites (two artefact scatters - National Parks and Wildlife Services Site No. 45-5-213 and 214, and a grinding groove Site No. 45-5-215) north of Elizabeth Drive.

Lance and Hughes (1984) compiled a predictive study and Lance (1984) carried out a sample survey of the Badgerys Creek study area. Lance structured his survey to 'concentrate on areas in which prehistoric archaeological sites were considered most likely to occur'. A comprehensive survey of sample areas in the Badgerys Creek study area was conducted for the 1985 Environmental Impact Statement. This involved around 70 hectares and represented four percent of the 1985 study area.

One artefact scatter was located in the survey - National Parks and Wildlife Service Site No. 45-5-517. The site, comprising five silcrete flakes and flaked pieces, was found in an area of ground surface visibility adjacent to Badgerys Creek.

Lance (1984) argued that the uniformity of landforms within the proposed airport site in 1985 and the low density of sites reported in similar locations suggested that the paucity of sites was a real archaeological pattern rather than a function of poor ground surface visibility in the study area. Lance concluded that the only sites likely to have survived in his study area were stone artefact scatters which would have already been disturbed by the extensive land use

in the area. Consequently such artefact scatters would have little scientific importance. An exception to this may be sites which occurred along the banks of Badgerys Creek and in areas which had incurred only 'minor surface damage and disturbance'.

In 1985, the proposed airport site was assessed as having relatively low archaeological sensitivity and no further archaeological assessment was recommended (Kinhill Stearns, 1985).

Brayshaw (1995) undertook an assessment of a section of Elizabeth Drive from Luddenham Road to Wallgrove Road. A survey including an area extending south of Elizabeth Drive between Badgerys Creek and Badgerys Creek Road located no sites or potential archaeological deposits. This area is located within the present study area. Two artefact scatters and several areas of potential archaeological deposit were, however, located north of Elizabeth Drive and a site comprising eight artefacts was located near a small drainage line south of Elizabeth Drive and east of Mamre Road.

Holsworthy Military Area

The presence of Aboriginal sites in the Holsworthy Military Area has been known to Europeans since before the middle of the last century. Sites, specifically shelters with art, rock engravings and rock holes, were described in journals by Etheridge (1889) and Mathews (1895, 1901c). Etheridge comments that the person who acted as his guide to one of the sites (H166) in 1888/89 stated that his father 'Mr. J.D. Brown, was acquainted with the figures fifty years ago, say 1838, when he was in the habit of frequenting the creek in company with the Aborigines' (Etheridge, 1889). This is to date, the latest documentary reference to Aborigines within the Holsworthy study area.

It is interesting to note that within Holsworthy some sites, particularly those which have been known for a long time (such as site H166), have been recorded on many occasions. This one site has been entered on the National Parks and Wildlife Service Register of Aboriginal Sites four times (as Site Nos. 52-2-86, 52-2-69, 52-2-614 and 45-5-124). Site H204, also described by Etheridge in 1889, has been recorded three times (National Parks and Wildlife Service Site Nos. 52-2-65, 52-2-1310 and 45-5-123).

Investigations and site surveys undertaken within the Military Area, or which analysed data pertinent to the area, include Sim (1962), Sydney Prehistory Group (1983), Officer (1984), Sharp (1994), Sefton (1994), Axis Environmental/Australian Museum Business Services Consulting (1995), Mitchell McCotter (1995) and surveys by Corporal Robert Thompson.

In 1960 Ian Sim recorded the engraving site H136 within in the study area (Sim, 1962). This site has been recorded and registered twice (as National Parks and Wildlife Service Site No. 52-2-269 and 52-2-1872).

The Sydney Prehistory Group formed in the early 1970's with the aims of making 'a fully representative record of sites within a specific area, including every site, no matter how insignificant and every drawing, no matter how incomplete' (Sydney Prehistory Group, 1983). The group, comprising around 20 interested amateurs, recorded 64 sites in the Campbelltown area, including 44 sites in the Holsworthy Military Area and the remainder in sandstone contexts to the west of the Georges River. Their study area included the upper portions of Harris and Williams Creeks, a majority of the Georges River corridor within the Training area, and the terminal portion of Punchbowl creek and the whole of Kalibucca Creek.

The group compiled the results of their work in a two volume publication titled *In Search of the Cobrakall* (Sydney Prehistory Group, 1983). After the group disbanded several members continued to record sites within, and adjacent to the study area. This group has been termed the second Sydney Prehistory Group by subsequent analysts (AXIS Environmental/Australian Museum Business Services Consulting, 1995). An additional 107 sites were recorded in the Holsworthy Military Area by this second grouping.

The Sydney Prehistory Group sub-divided their study area into two zones based on presumed accessibility and access constraints. These were the 'interior' zone (Williams and Punchbowl Creeks) and the 'marginal' zone (Georges River and western tributaries and, Harris Creek). The site density was found to be 0.6 per square kilometre in the marginal zone and 1.5 in the interior. This difference was interpreted as a function of environmental conditions, particularly the greater density of available shelters due to a higher drainage line density and weathering rates in the interior (Sydney Prehistory Group, 1983).

Within the interior, shelters were found to contain fewer drawings and less variety of subject, and very few stencils. In contrast, the marginal zone contained most human and anthropomorphic motifs, the only contact motifs (representations of bulls - outside of the Holsworthy study area), most graphics in red ochre, and the only large concentration of grinding grooves (Sydney Prehistory Group, 1983).

The Sydney Prehistory Group (1983) noted the following site location trends:

- many apparently suitable shelters in more precipitous areas have not been decorated;

- there was an apparent preference for shelters on tributaries in contrast to main streams, possibly because of easier access;
- shelters facing south were generally avoided with highest frequencies recorded for west and north-east facing shelters; and
- therefore shelters were selected primarily for convenience and comfort in camping, and drawings were made on the nearest suitable rock face.

Officer (1984) conducted a stylistic analysis of the rock art data and recordings compiled by the original Sydney Prehistory Group. The aim of Officer's analysis was the exploration and description of formal variability within a local assemblage of rock art at a local and regional scale (Officer, 1984). A total of 626 graphics were identified from 63 sites. Ninety percent of these were found to be classifiable to some level of schema or motif level. This is in contrast to the low percentages of determinate motifs achieved previously and subsequently using conventional motif typologies. Officer's (1984) typology differed from conventional schemes in that graphics which were incomplete or indeterminate (according to the recorder's interpretation), could still be usefully categorised. This was achieved by defining and incorporating into the typology, the hierarchical sub-groupings or 'pedigree' which distinguished a 'specific' motif type. Subgroupings were differentiated by using diagnostic criteria within a hierarchical ordering of formal traits. These criteria included distinctions such as figurative and non-figurative, schematic arrangements such as splayed or profile limbs, overall body shape, and naturalistic interpretations such as toes, tails and head shape. A total of 45 'specific' motif types were identified using 95 'pedigree' derivations.

The advantage of this typology was that a more accurate and inclusive measure of stylistic diversity could be gained because indeterminate or incomplete motifs were not lost or excluded from the system. Similarly, motif categories more accurately reflected the inherent schematic divisions within the art assemblage, in contrast to conventional typologies which largely depend on the recorder's skill at interpreting supposed subject categories.

As a consequence of Officer's (1984) methodology, the findings of his analysis provide an effective counterbalance to the broad scale and conventional categorisations of Sefton (1988, 1989, 1990a) and McDonald's (1990, 1994) work. Officer (1984) identified various levels of stylistic variability within the pigment and engraved art assemblage including highly consistent 'conventional forms' and an extensive spread of highly varied forms, both between and within motif categories. He concluded that the assemblage presents a comparatively non-conventional range of variation and an emphasis on the direct figurative representation of form. By contrast, engravings from the region were comparatively more consistent, schematic and conventional. Officer (1984) argues that this contrast may relate to a functional distinction

and that engravings served a more ritualistic function and pigmented graphics may have operated in a less structured cultural context.

Officer's (1984) research supports many of the trends and conclusions subsequently made by McDonald (1990; 1994). McDonald quantified the relative homogeneity of the engraved assemblage, compared to the heterogeneity of the shelter (and predominantly pigment) assemblage, and suggested that the former related to large scale group cohesion and the latter to localised group identifying behaviour. McDonald's analysis also places the Holsworthy area within the stylistically different assemblage south of Georges River which she characterised by schema differences and greater heterogeneity and diversity relative to the Basin as a whole. Both the work by Officer (1984) and McDonald (1990; 1994) identify the Holsworthy rock art assemblage as belonging to a locally distinct variant of the Sydney Basin. Various stylistic traits and their distributions appear to relate to social dynamics practised within a peripheral or intermediate Basin context.

Distribution and Variability in Graphics and Motif Types

In terms of the general distribution of graphics, the greatest numbers of graphics and greatest motif diversity occurs in the upper middle portion of the Sydney Prehistory Group (1983) study area (equivalent to the northern margin of direct impact associated with the proposed Holsworthy Option A).

The distribution of motif types across the Sydney Prehistory Group study area indicates that certain types were restricted to particular regions or localities, whereas others occur more evenly throughout the art site distribution. Observations are as follows (Officer, 1984):

- greatest numbers of red and white hand stencils occurred in sites to the west of the Georges River;

- fish and eel motifs rarely occur together in the same site, but often occur in the same general vicinity;

- the number of identified motif types and the frequency of their use, indicates that the art assemblage is highly varied with a tendency away from standardisation. Only a small number of categories contain high frequencies with 52 percent of the identified motif categories including one percent or less of the determinate graphics. Only five categories, or 12 percent, include five percent or more;

- greatest variation in the arrangement of formal attributes in motif type groupings occurred in profile animal motifs, followed by splayed animals and non-figuratives;

- only seven motif types occur in over nine sites, 82 percent of motif divisions occur in seven or less sites, with 25 percent occurring in any one site;

- different types of graphic have different types of distributions: hand stencils represent 23 percent of identifiable graphics but occur in only 16 percent of sites, fish account for five percent within five percent of sites, human motifs account for 10 percent within 21 percent of sites, and macropods account for 9 percent but occur in 41 percent of sites;

- a large number of sites have only one motif type recorded, and a small number of sites have large numbers of motif types;

- the site distribution of motif types is not even and location appears to be a significant factor in the type of motifs at any particular shelter; and

- 82 percent of all sites contain between one and five graphics, with only 16 percent containing between 26 and 85 graphics.

Technique and Colour

Observations are as follows (Officer, 1984):

- 98 percent of graphics were pigmented;

- around 60 percent of graphics are black only, 20 percent are red, or white. Red and black are used together in five percent of graphics and black and white were recorded together in only one instance;

- all motif types which occur as engravings, (including eels and macropods) also occur in black and red pigmented form, suggesting that only a small range of motif types were executed across a variety of mediums and colours;

- the number of sites containing red pigment graphics (37 percent) is roughly proportional to the number of red graphics in the assemblage (24 percent);

- the use of white appears to be more selective than red. Categories of graphic which include black or black and red examples, are rarely executed in white. However, 80 percent of graphic categories which are executed in white, are also executed in red (all are stencil categories);

- 90 percent of all graphics containing white pigment also occur in sites with black and/or red graphics;

- no evidence was found for a consistent chronological sequence defined according to colour usage; and

- stencilling presents the clearest evidence for the differentiation and significance of colour. Red stencils occur with white stencils in only two sites, and only in small proportions relative to red stencils.

White stencils occur in 45 percent of sites with stencils, and always in sites with drawn graphics. In contrast, red stencils occur in 72 percent of sites with stencils and occur on their own in three sites. White stencils tend to occur in larger numbers and in fewer sites than red stencils which occur in more sites and in smaller numbers. All stencils superimposed by drawn graphics are, with one exception, all white.

No graphics with solid white infill and black outlines were identified in the Sydney Prehistory Group study area, however three fish and two eels with this form have been recorded by Maynard (1968) at a shelter at Audley in Royal National Park. Similar black outline and white infill motifs have been recorded from the Cordeaux catchment area (McCarthy, 1961; Kinsela, 1953).

Repetitive Compositions

Observations are as follows (Officer, 1984):

- 'repetitive compositions' (defined as an areal sequence of equivalent motif types made up of two or more nearest neighbour graphics) are a significant characteristic of the region's rock art. Thirty six percent of all determinate motifs occurred within repetitive compositions. Motifs in repetitive compositions tend to be the same size; and

- nearly all human motifs lacking an anatomical indication of gender, occur in repetitive compositions, compared with 59 percent of humans with a representation of a penis.

Schema

Observations are as follows (Officer, 1984):

- five percent of all motifs appear to have an 'abbreviated' schema (such as a figure with a head and back but no limbs) which can be related to the full form of a specific motif type or sub group. A high proportion of these occur in repetitive compositions, providing support for the proposition, that these graphics are an intentional form of graphic abbreviation or 'shorthand' rather than unfinished or weathered examples. So called 'abbreviated' forms appear to rely on key

figurative attributes and often leave out limbs and/or digits, or reduce limbs to diminutive short appendages.

The schematic convention, identified by McDonald (1990), for including paired fore and hind limbs in engraved motifs south of the Georges River is less clearly defined in the Sydney Prehistory Group study area which is dominated by pigment shelter art. However, the majority of schemas recorded follow the preference for including paired projections. Of all profile motifs retaining a discernible head (excluding birds), 75 percent had two ears indicated, 13 percent had no ears, and 12 percent had only one. Of all profile motifs with discernible fore and/or hind limbs, 72 percent had only paired limbs, while 28 percent had single limbs.

A wide range of schematic variation is evident in the representation of naturalistic and figurative details such as head profile, ears, limbs feet and tails.

There is extensive variation in the schematic representation of pigmented human motifs, which is one of the more frequent figurative motif types. In contrast, macropod motifs have a more restricted schematic range. Officer (1984) suggests that this is indicative of a difference in the social function of each motif type.

A small number of human motifs seem 'sketchy and amorphous' due to the use of schema outside of the conventions found in most of this motif group. Many of these include simple linear representations of spears and appear to inter-relate with other adjacent figures. Most humans with spears are in repetitive compositions. Seventy seven percent include 'stick figure' limbs. Fifty percent of humans with 'beaked' or asymmetrical head outlines also hold simple representations of spears.

At a broad and generalised level there is a consistent and limited number of stylistic conventions evident in the assemblage. However, at a finer scale, there is an extensive range of formal variation 'consistent only in its lack of standardisation'.

Officer (1984) concluded that there is a significant lack of conventional representation and an overall amorphous character in many of the pigmented graphics and that this was an important regional characteristic. He described this stylistic character in terms of a 'casual' and less conventionally constrained approach to representation. Macintosh (1965) has identified a similar distinction at Mount Manning where he identified both 'accomplished' or conventional figures, and 'inefficient' or amorphous figures.

Form

Observations are as follows (Officer, 1984):

- sixty three percent of motifs contained outlines that enclosed space, five percent did not enclose space and the remainder were inconclusive; and

- motif infills were variable and diverse and not consistent within motif categories. Eighty two percent of motifs with determinate form and an outline had various forms of infill, and eighteen percent had no infill. The two most frequent infill forms were found to be scattered dots and dashes (22 percent), and broken discontinuous lines arranged longitudinally (35 percent).

Comparison of Engraved and Pigmented Graphics

A number of similarities and differences were noted between the engraved and pigmented graphic assemblages from the Sydney Prehistory Group study area and surrounding areas of the Woronora Ramp. Officer (1984) argued that both assemblages reflect the same stylistic tradition but reveal a difference in the way each were used or applied:

- basic schemas such as major motif shapes are frequently the same or clearly related;

- approaches to detail and the delineation of natural attributes such as fins, limbs and heads are often similar or shared;

- 'beaked' human motifs occur in both mediums although pigmented examples are more varied and less consistent in form and schema than engraved examples;

- McMah (1965) identified consistency in the size range of engraved men and kangaroos, particularly in graphics south of Botany Bay. Similar consistent size ranges in pigmented examples were found by Officer (1984);

- sixty percent of engravings south of Botany Bay have paired ears, which is consistent with the 63 percent in pigmented graphics from the Sydney Prehistory Group study area (13 percent have one ear, ten percent have none and 13 percent have indeterminate representations);

- engravings are more strictly bound by formal conventions and present a more homogeneous and uniform style than the pigmented motifs. Drawn graphics have a great variety of conventional and non conventional forms whereas engravings vary within a restricted range;

- pigmented graphics display a greater range of animal motifs, are more diverse, amorphous, naturalistic and possess a less restricted range of

formal representations. Engravings are more restricted in both motifs and schema and vary with an apparently well defined range of forms; and

- some pigmented graphics appear to 'adopt' some of the more standardised stylistic conventions which characterise the engraved motifs, particularly simple outline delineations and standardised representative schemas and limb orientations. Officer suggests that this may indicate a shared semantic complexity and ritualistic function across both the engraved and a small number of pigmented graphics. That this occurred close to the southern extent of figurative engravings in the Sydney Basin was felt to be significant.

From the late 1980s and through the 1990s Corporal Robert Thompson has recorded over 150 Aboriginal sites within the Holsworthy Military Area.

Sharp, in an assessment of Army training areas in Australia concluded that 'the Holsworthy Training Area offers the potential for the existence of many sites of cultural significance' (Sharp, 1994).

Sefton (1994) surveyed the location of two drill holes sites located on ridgelines at plateau level on the upper reaches of Punchbowl Creek in the southern part of the Military Area. The drill holes were required to test the coal quality of the underlying Bulli Seam. No sites were located in the course of the survey.

In 1995 an archaeological survey was carried out on the proposed 165 hectare International Shooting Centre within the north-western section of the Holsworthy Military Area (Mitchell McCotter, 1995). An artefact scatter comprising over 130 artefacts was located during the survey. No other data is readily available about the survey as the report is not held by the National Parks and Wildlife Service.

In 1995 the Department of Defence commissioned an environmental audit of the Holsworthy Military Area, inclusive of an audit of the Aboriginal cultural heritage within the area. The audit attempted to synthesise the known data relating to Aboriginal sites in the area and included a limited program of field survey and site recording (AXIS Environmental/Australian Museum Business Services Consulting, 1995). A notable omission from this synthesis was the work conducted by Officer (1984).

The audit field survey involved a small number of sample areas and reinspection traverses. The survey program aimed at inspecting: sites which may be vulnerable to direct impact from military activities, sites which included large numbers of recorded figures, all the larger engraving sites, and a range of locations from across the whole training area. As a result of this

strategy, 29 sites were inspected or recorded for the area, with the survey sample comprising approximately 0.8 percent of the total Military Area.

The audit concluded that 295 Aboriginal sites had been recorded in the Military Area, including four new sites located during the audit field surveys. The sites comprised 219 shelters with art and/or deposit, 58 grinding grooves, five engravings, 11 grooves and engravings in association, one shelter with deposit and one open site. Artificial water channels associated with engraving/ grinding groove sites were also noted in the audit surveys.

The audit synthesis of the rock art assemblage was limited by the typologies and recordings created by previous recorders. Their analysis was consequently limited to a small number of common or consistent recorded attributes.

The following tabulations and conclusions were made based on the audit data compilation (AXIS Environmental/Australian Museum Business Services Consulting, 1995).

- sites had been previously recorded in all parts of the landscape and in all topographic contexts;

- the distribution of sites revealed the location of archaeological survey rather than patterns of Aboriginal occupation;

- shelters with art were the most commonly occurring site type (74 percent), followed by grinding groove only sites (20 percent) and engraving sites (five percent). Shelters with only archaeological deposit and open sites with artefacts accounted for less than one percent. It was concluded that these percentages reflected recorder bias and were not an accurate sample of the surviving archaeological record;

- 69 percent of engraving sites also included grinding grooves;

- of the 703 recognisable (determinate) graphics, including drawn and painted motifs and stencils, the most common motifs were macropods (23 percent) and anthropomorphs (23 percent) followed by hand stencils (17 percent), fish, unidentified animal and eels;

- recorded shelter art graphics included (in descending frequency) anthropomorphs, macropods, hand stencils, fish, animal, eel, emu, snake/serpent, weapons, bird, echidna, glider/possum, lizard, other stencils, bandicoot, turtle, dog/dingo, design, koala, wombat, bat and 'cow';

- charcoal was the most commonly used pigment (95 percent of graphics), red (three percent) and white was extremely rare (0.8 percent);
- graphics which were scratched as well as drawn were rare (1.2 percent);
- hand stencils were equally produced in red (52 percent) and white (47 percent), with yellow represented by one percent;
- although red pigment occurs in only three percent of graphics, it was recorded at 23 percent of sites;
- most art sites contained 10 graphics or less (89 percent), with only two percent containing more than 30;
- engraving sites were small with no more than six graphics at any one site and at each site the graphics appear to form a composition;
- engraving sites are smaller and fewer than elsewhere in their Sydney Basin distribution and 66 percent of all Basin engraving sites contain less than eight graphics;
- engraved motifs included mundoes, emu tracks, macropods, anthropomorphs, eels, koalas and fish;
- the range of grinding grooves recorded at any one site was from one to 243 grooves, from 65 sites;
- 60 percent of sites with grinding grooves contained between two and 10 recorded grooves, 17 percent between 11 and 30, and 14 percent with over 30 grooves. Only five percent contained one groove;
- within the context of the Woronora Ramp, a comparison of the Holsworthy data with other sample areas by the Illawarra Prehistory Group found a broad consistency in motif type, technique and colour use frequencies. The only clear difference was found to be the use of stencil colour. Within Holsworthy, both red and white pigments are used about equally for hand stencils, while in other samples red predominates; and
- a relatively large number of sites were anticipated to remained unrecorded in the area. Many site types, including scarred trees, open and shelter sites with occupation deposits, and open artefact scatters are grossly under represented in previous work, due to specialist recording and survey objectives.

The study concluded that the known sites in the Holsworthy Military Area represented a 'very rich resource for Aboriginal prehistory' and the art sites represented 'a very informative and visually impressive body of archaeological evidence' (AXIS Environmental/Australian Museum Business Services Consulting, 1995).

4.4.3 PREDICTIVE MODELS AND CONCLUSIONS

Based on the results of the previous work reviewed above, the following predictive statements can be made about the nature of the surviving archaeological resource within each of the study areas.

Badgerys Creek Study Area

Site Types

- the predominant site type recorded during surface survey will be artefact occurrences, ranging from isolated finds to relatively large scatters; and

- other site types and features are likely to include scarred trees, Potential Archaeological Deposits, and stone procurement or quarry sites if exposures of suitable rock occur.

Site Location Criteria and Trends

- sites will occur in all major landform types within the study area, except where destroyed by historic land use, erosion processes or flooding;

- stone artefact material types are likely to be dominated by cherts and fine grained rocks derived from fluvial gravels;

- most sites identified during surface survey will be located in close proximity (within 50 metres) to water sources present prior to agricultural development (sources include minor and major creeklines and soaks);

- most sites, and higher site densities, will occur near permanent water sources and utilised stone exposures;

- major streamline confluences are prime site locations;

- sites located near permanent water sources are more likely to be large (in area and number of artefacts), to have higher artefact densities, and be more complex in terms of spatial arrangement and technology, than sites on ephemeral drainage lines;

- relatively few sites will occur on ridgetops and crests;
- most sites which include stone artefacts will occur in landscape contexts which are well drained, often on a locally elevated landform adjacent to a water source;
- most sites which include stone artefacts will be located on low gradients or mostly level ground, however large sites may extend onto higher gradients towards the edge of the scatter;
- sites identified from surface survey may not accurately reflect the distribution or density of artefacts present below the surface; and
- site location may also be influenced by proximity to resources such as rock exposures suitable for tool manufacture, and areas where a diverse range of foods and materials can be procured such as ecotones (the boundaries of different vegetation and habitat types), and wetlands.

Potential Archaeological Deposits and Sub-Surface Material

- Potential Archaeological Deposits are likely to occur in basal slope and valley floor contexts on well drained and aggrading landforms;
- a high proportion of Potential Archaeological Deposits (around 80 percent or more) are likely to contain sub-surface artefacts;
- depositional and aggrading sedimentary environments contain the best potential for in situ artefactual material, particularly on relatively level landforms although some hill slope context also have potential;
- undisturbed artefactual material may occur below the plough zone which is generally around 25 centimetres in depth;
- the actual spatial extent of an artefact occurrence is unlikely to be accurately reflected by surface survey recordings which are dependent on existing ground exposures. Many sites will be larger, and have higher artefact densities than surface indications suggest; and
- stone artefacts are likely to occur sub-surface throughout the whole study area at varying densities, according to the intensity of Aboriginal occupation and subsequent processes of sedimentation and erosion.

Subsurface densities of up to 10 artefacts per square surface metre may be indicative of a 'background' rate of artefact discard and may occur anywhere outside of specific Aboriginal activity areas (McDonald and Rich, 1993).

Holsworthy Study Area

Site Types

- site types likely to occur are rock shelters with occupation deposit and/or rock art, open and sheltered grinding groove sites, open engraving sites, scarred trees, open artefact scatters, isolated finds and potential archaeological deposits in both shelter and open contexts;

- rock shelter recordings (including sites and Potential Archaeological Deposits) will be the predominant recording generated by surface survey;

- open artefact scatters are likely to be under represented in surface surveys conducted in uncleared land; and

- a high proportion of grinding grooves located in shelters will be associated with occupation deposit.

Site Location Criteria and Trends

- major watershed ridgelines may contain higher site densities and/or greater occupation evidence due to their use as access routes;

- open artefact scatters are unlikely to have survived in areas which have been quarried for gravel or heavily impacted by vehicles;

- open artefact scatters and isolated finds are likely to occur on relatively level, well drained ground on the crests of major ridgelines and spurlines, and in valley floor contexts adjacent to water sources. Water sources such as soaks and minor wetlands may be important in determining site locations on ridgeline crests;

- rock shelter sites with occupation deposit and/or rock art may occur where ever suitable rock outcrops and overhangs occur. These may be weathered areas in major, minor or discontinuous escarpments - especially at the break of slope along a ridge crest, or may occur in isolated stone tors which have moved downslope;

- rock art or other occupation evidence rarely occurs in rock shelters with predominantly rock floors, or sloping floors;

- most grinding groove sites will be located in ridgetop contexts;

- grinding grooves may occur wherever relatively level rock faces of fine-grained homogeneous sandstone occur, and most sites will also be associated with a local water source;

- larger sites are most likely to be associated with permanent water sources;

- Aboriginal scarred trees may occur where ever old growth trees survive; and

- midden deposits are likely to occur only in the north-eastern portion of the study area which is closest to the Georges River estuary.

Potential Archaeological Deposits

- open sites containing artefacts are unlikely to be detected by surface survey due to the lack, or poor quality of, ground exposure, or subsequent burial by later sediments (especially during flooding and after fires);

- open sites with in situ sub-surface artefactual material is most likely to occur in well drained, sedimentary aggrading landforms in valley floor contexts, adjacent to streamlines;

- many of the recorded Potential Archaeological Deposits in rock shelters will contain sub-surface artefactual material below a top layer of recent sand and sandy loam. Between 30 and 72 percent of tested Potential Archaeological Deposits elsewhere in the Sydney Basin have contained occupation deposit (Attenbrow, 1981a; 1987).

Rock Art

- a high proportion of engravings sites will be associated grinding grooves;

- engraving sites are a rare site type, and all have small numbers of graphics;

- engravings will most frequently occur on relatively flat rock faces on open rock platforms in either ridgecrest/plateau contexts or very rarely within rock shelters;

- rock art may occur in any type of rock shelter, in any landscape context, but is unlikely to occur in shelters which do not include a sediment and relatively level floor;

- most graphics will be drawn using black pigment, motifs in red pigment are relatively rare and motifs using white pigment or more than one colour are also rare;
- painted motifs (not including stencils) are a rare graphic;
- pigmented motif types are dominated by anthropomorphs and macropods; and
- graphic form is dominated by outline only and outline and linear infill combinations.

CHAPTER 5 RESULTS OF ABORIGINAL ARCHAEOLOGICAL SURVEY

5.1 BADGERYS CREEK

5.1.1 SYNTHESIS OF SITE RECORDINGS

A total of 110 recordings were made during the Draft EIS field survey program for the Badgerys Creek study area. The location of sites recorded are shown on *Figure 5.1*. One additional recording (Site B2, National Parks and Wildlife Service site number 45-5-517) was added to the study area database from a previous survey conducted by Lance (1984). A previously recorded site, located to the north of Elizabeth Drive (National Parks and Wildlife Service site number 45-5-2309), was originally included in the database (Site B1), but was subsequently removed following the refinement of the study area to south of Elizabeth Drive.

Surveys were conducted in sample areas within all of the proposed airport options, as well as some areas which subsequently fell outside of the final airport option boundaries. Fourteen recordings are located outside of all the Badgerys Creek airport option boundaries.

A total of 58 open artefact scatters, eight scarred trees, 44 isolated finds, and one open potential archaeological deposit were recorded during the field survey. Of these, 48 open artefact scatters, seven scarred trees, 41 isolated finds and one open potential archaeological deposit, fall within the boundaries of at least one of the airport option areas. A summary of the number of recordings within the study area, and each airport option is presented in *Table 5.1*. Photos of representative examples of these site types are included in *Appendix H*.

TABLE 5.1 SURVEY RECORDINGS WITHIN THE BADGERYS CREEK STUDY AREA, ARRANGED ACCORDING TO SITE TYPE AND OPTION AREA

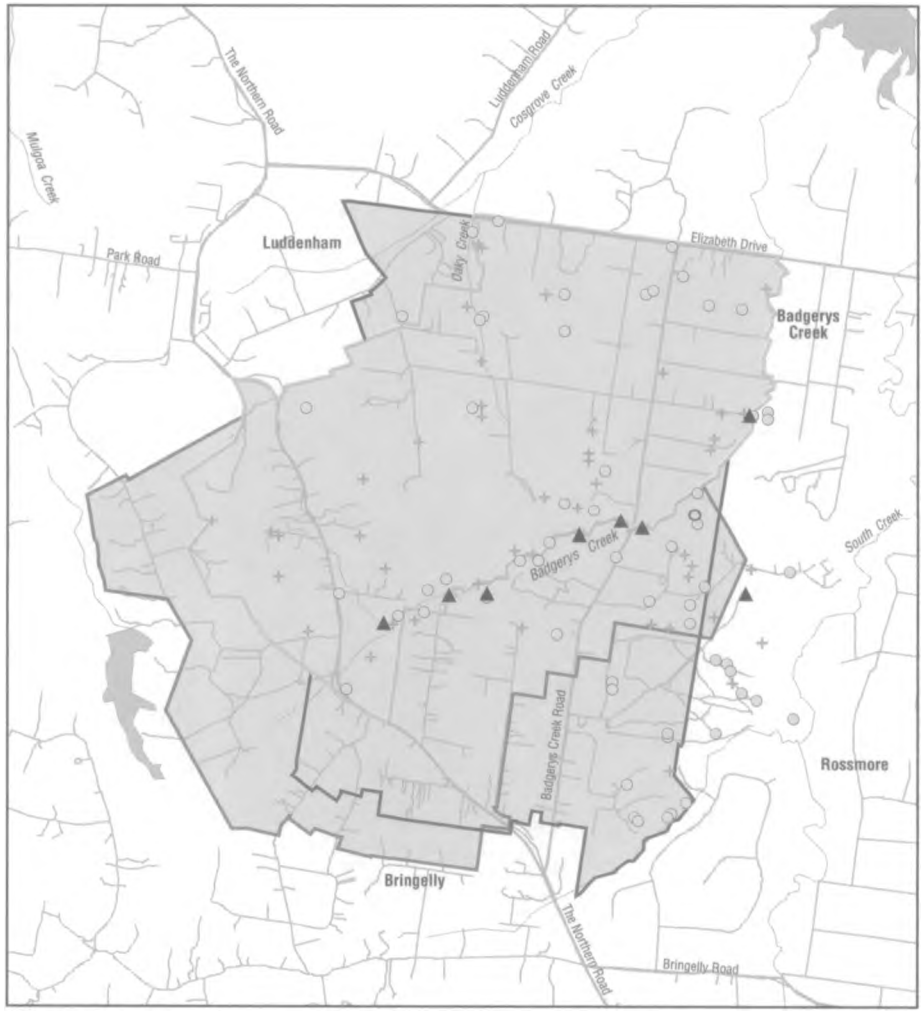
Recording Attribute	Number Recorded	Airport Option A	Airport Option B	Airport Option C	All Airport Options	Outside of Airport Option Boundaries
Total Number of Recordings	111	60	85	95	97	14
Total Number of Sites and Isolated Finds	110	60	84	94	96	14

Recording Attribute	Number Recorded	Airport Option A	Airport Option B	Airport Option C	All Airport Options	Outside of Airport Option Boundaries
Total Number of Sites	66	30	45	54	55	11
Open Artefact Scatters	58	25	37	47	48	10
Scarred Trees	8	5	7	7	7	1
Isolated Finds	44	30	40	40	41	3
Site or Isolated Find Associated with a Potential Archaeological Deposit	9	5	6	6	6	3
Potential Archaeological Deposit Only (Recorded During Field Survey)	1	0	1	1	1	0

Open Artefact Scatters

Open artefact scatters form the principal recording type within the Badgerys Creek study area. The surface characteristics of these sites are dominated by low numbers of artefacts and low artefact densities. The number of recorded artefacts ranges from two to 31, with 46 percent of this site type containing between three and five artefacts and 22 percent containing only two artefacts. Nineteen percent contain between five and 10 artefacts and 10 percent contain between 11 and 20 artefacts. Average surface artefact densities per site are correspondingly low with a maximum value of one artefact per square metre. The majority of sites recorded have less than 0.1 artefacts per square metre (55 percent), and between 0.1 and 0.5 artefacts per square metre (40 percent). Maximum recorded artefact densities per site are also low with a range of between one and six artefacts per square metre. The majority of sites recorded had values of one (50 percent), or two (26 percent) artefacts per square metre.

These predominantly low artefact frequencies, coupled with the relatively high degree of ground surface visibility encountered during the survey, provide a generalised but reliable overall indication of the type and character of open artefact scatters within the Badgerys Creek study area. Most sites of this type are likely to contain small numbers of artefacts at low densities. Sites with larger numbers of surface artefacts and greater densities are consistently



Boundary of airport option A
Boundary of airport option B
Boundary of airport option C
Open site (including artefact scatters and grinding groove sites)
Isolated find
Scarred tree
Potential archaeological deposit (only) in open context

Figure 5.1

Aboriginal Recordings in the Badgerys Creek Study Area

TN
MN

0Km 2.5Km

restricted to valley floor and fluvial corridor contexts. This is consistent with the site patterning identified elsewhere on the Cumberland Plain.

It is important to note that these values are based on surface indications only and ground surface disturbance is likely to have disturbed these sites by the dispersal of artefacts and a consequential reduction in surface density. Subsurface testing programs in comparable Cumberland Plain contexts indicate that artefact densities and the spatial extent of sites may be considerably higher below the surface, particularly within aggrading landscape contexts such as alluvial flats and basal valley slopes. It is therefore likely that subsurface testing of open artefact scatters would identify higher artefact numbers and densities, particularly in contexts subject to consistent sedimentation, such as basal slopes and alluvial flats. Any potential increases in artefact frequency which may be determined through subsequent sub-surface testing are unlikely to identify site sizes and densities outside of the values which have been identified elsewhere for minor or secondary tributary corridors in upper catchment contexts on the Cumberland Plain. Previous work consistently supports a general correlation between site size and the size and dependability of an adjacent freshwater source. The limited nature of the streams within the Badgerys Creek study area are therefore an indicative guide to the nature of the sub-surface archaeological resource.

An assessment of the condition of each site was made during field recording based on the nature and extent of ground disturbance evident to the recorder. Seventy six percent of open artefact scatters were rated to be in poor condition, with 21 percent rated as good, and only one classed as very good. None were considered to be in excellent condition. These ratings are considered to be a reliable indication of the condition of sub-surface artefactual material within the zone of ploughing and clearing disturbance. Where sedimentary facies occur below this zone, mostly within valley floor and some basal slope contexts, the potential remains for artefactual material to remain unaffected by historic land use impacts.

A set of field assessments were also conducted into various aspects of the archaeological potential of an artefact occurrence. These were:

- the potential to be larger than the recorded surface extent;
- the potential to contain more artefacts than those recorded; and
- the potential to contain undisturbed sub-surface (in situ) artefacts.

The results of these assessments are presented in *Table 5.2*. A significant percentage of open artefact scatters were considered to have moderate or high potential to be larger in area and number of artefacts. This relates to the often limited extent of surface exposures in which artefacts were detected and the

likelihood that the exposure boundaries are unrelated to the artefact distribution. In addition, the effects of ploughing and soil mobility are likely to have enlarged the artefact distribution. Just over half of the sites were considered to have a moderate or high potential for in situ artefactual material, and this relates predominantly to sites within fluvial corridor contexts.

TABLE 5.2 ASSESSMENTS OF ARCHAEOLOGICAL POTENTIAL FOR OPEN ARTEFACT SCATTERS - BADGERYS CREEK STUDY AREA

Type of Potential	Low	Moderate	High	Not Recorded
To be larger	31%	41%	26%	2%
To contain more artefacts	29%	43%	26%	2%
To have in situ material	41%	33%	19%	7%

Open artefact scatters in fluvial corridor contexts account for 53 percent of recordings of this type. This is a clear indication of a site location preference, with fluvial corridors accounting for only 17 percent of the study area. Thirty one percent of sites occur on alluvial flats or valley floor contexts within the corridor zone. Crests and ridgeline zones contain proportionately low artefact densities (12 percent), with the highest percentages (seven percent) occurring on minor watersheds which are closest to the fluvial corridor zones.

Silcrete dominated the stone material types recorded at open artefact scatters, being present in 86 percent of sites, and accounting for more than 50 percent of the recorded artefacts in 66 percent of these locations. Other stone types rarely accounted for more than 50 percent of recorded artefacts. Other important stone types are quartz, chert and tuff/mudstone which are present in 41, 36 and 29 percent of sites respectively. Quartzite, other volcanics and rhyolite were recorded in a small number of sites.

Isolated Finds

Isolated finds accounted for 69 percent of all Badgerys Creek recordings. The frequency of stone material types indicates a similar order of preference to open artefact scatters with silcrete dominating (48 percent), followed by chert (27 percent), quartz (14 percent) and tuff/mudstone (seven percent).

The condition of these single artefact occurrences also mirrored the ratings for open artefact scatters with 64 percent assessed as being poor, 25 percent as good, and two percent as very good. Nine percent were unassessed. This concurrence across recording categories is an indication of the homogeneity and widespread nature of the ground surface disturbance within the Badgerys Creek study area.

The assessment of the archaeological potential of isolated find localities is consistently lower than for open artefact scatters. This is shown in *Table 5.3*. The majority of locations have low potentials, with only 11 percent assessed as having high potential for *in situ* artefactual material. These lower values are a reflection of the larger number of isolated finds recorded in shallow soil contexts, such as crests and upper slopes.

TABLE 5.3 ASSESSMENTS OF ARCHAEOLOGICAL POTENTIAL FOR ISOLATED FINDS IN THE BADGERYS CREEK STUDY AREA

Type of Potential	Low	Moderate	High	Indeterminate or Unrecorded
To be larger	52%	27%	16%	2%
To contain more artefacts	50%	29%	16%	2%
To have in situ material	45%	25%	11%	2%

Although higher proportions of isolated finds were recorded from crest and watershed contexts compared to artefact scatters (approximately twice artefact scatter values), the relative sequence in landform occurrence is relatively the same. Highest frequencies occur in secondary and minor fluvial corridors with 74 percent of these recorded on alluvial flats. Seven percent of isolated finds were recorded from major watershed ridgeline contexts (compared to three percent of artefact scatters), suggesting that Aboriginal occupation of this topographic zone was more likely to result in the discard of isolated artefacts than lower and better watered contexts.

Artefact Traits

If all artefact occurrences (isolated finds and open artefact scatters) are considered together, the proportional distribution of various artefact traits can be roughly characterised for the study area as a whole. There are 102 occurrences, with a combined assemblage of 373 artefacts. It should be noted however that such a description is limited by the methodological and environmental constraints of surface recordings, namely bias toward visually obtrusive artefacts, lack of temporal control and the impact of post depositional environmental processes. For this reason, a more detailed analysis is considered to be outside of the representativeness of the database.

Flakes were the most commonly recorded artefact type, and were noted in 73 percent of all artefact occurrences. This is followed by flaked pieces with 57 percent and cores with 17 percent. The high percentage of flaked pieces is likely in part, to be indicative of the high degree of post depositional damage to artefacts from farming and other mechanical land use impacts. Eighteen percent of sites contained artefacts with some form of secondary flaking, and

six percent included artefacts with use wear. Backed blades or microliths were noted in seven percent of occurrences. Bipolar reduction techniques were noted in only two percent of occurrences, and are probably under represented in the sample due to difficulties in distinguishing artefactual quartz in highly disturbed surface contexts. This low frequency may also be a reflection of the predominance of silcrete working compared to quartz. Single platform cores were noted from 10 percent of locations, with multiplatform cores noted from eight percent.

Pebble cortex, mostly indicative of alluvial wear, was noted on artefacts from 25 percent of occurrences, providing a strong indication that pebble and gravel beds were a major source of stone used for flaking. Pebble cortex was noted on both silcrete and quartz primary flakes. Hammerstones were noted from one site only, and manuports from three.

Greater diversity in technological traits is evident from sites in fluvial corridor contexts and particularly adjacent to more permanent streamlines. Taken at face value, this breakdown of the distribution of artefactual traits suggests that the majority of artefact occurrences are indicative of non-intensive lithic working such as could be expected from small and low intensity occupation sites away from major camp sites or base camps. The latter are more likely to be situated adjacent to the larger stream beds and it is in these contexts that indications of more intensive stone use, such as utilised tools and cores are concentrated. Although this is a pattern which is supported by research conducted elsewhere on the Cumberland Plain, further research and sub-surface sampling would be required to substantiate these trends within the Badgerys Creek study area.

Scarred Trees

Eight scarred trees were recorded from the Badgerys Creek study area. Five of these were interpreted as possibly of Aboriginal origin, two as probable, and only one as most likely to be an Aboriginal scar. Seven occurred on rough barked Eucalypt species and one on a smooth barked Eucalypt.

The small number of recordings and the generally low degree of certainty regarding their origin is not unexpected given the low survival rate of old-growth endemic trees within the study area and the high incidence of historic sources of scarring. Possible alternative causes of scarring include bird and domestic animal damage, disease, and impact from farming machinery and fencing. Two recordings were on dead trees, and a further two on trees in poor or very poor condition. Three trees were classed as being in good condition and only one was classed as excellent. The generally poor condition of the recorded trees is indicative of the surviving old growth trees throughout the study area which have been heavily impacted by land clearance, fire and agricultural practices. Most trees were recorded from alluvial flats/valley floor

contexts and fluvial corridor zones. However, this is more likely to reflect the local pattern of European tree clearance than any Aboriginal pattern of bark exploitation.

5.1.2 POTENTIALLY EXPLOITED NATURAL RESOURCES

Apart from the scarred trees, no other forms of site specific natural resource exploitation were noted from Badgerys Creek. A local surface concentration of ochreous sandstone nodules with apparently high concentrations of iron oxide was noted along a section of Oaky Creek in the north-west of the study area. No evidence of Aboriginal quarrying or exploitation of the nodules was identified, however it is conceivable that these nodules may have been used by Aborigines as a source of ochre. This source is not of outstanding quality however, and any exploitation was probably restricted to locally resident groups.

Non-artefactual forms of silcrete in the form of relatively small flaked and rounded surface gravels were noted from many locations within the northern and north-eastern portions of the study area. Typically, silcretes on the Cumberland plain are derived from relict alluvial gravel beds of Tertiary age, however, no such source is currently known from the study area (Tessa Corkill, pers. comm. February 1997). The natural gravels in the study area appear too widespread to be readily explained as the result of historic importation in fill, and may therefore represent a remnant surface scatter from a now eroded source. If this is the case, the dominance of silcrete in the Badgerys Creek artefactual assemblage may be partly indicative of local Aboriginal exploitation of these surface gravels.

5.1.3 SITE DISTRIBUTION

Landform Analysis

The percentage of sites and archaeological types within key landform classifications are provided in *Table 5.4*. Corresponding site and isolated find densities, based on the survey coverage achieved in each topographic zone, are presented in *Table 5.5*. Using these density calculations, the same table also indicates the predicted number of sites and isolated finds, which could be expected to be recorded in a 100 percent survey of each of the proposed airport option areas.

TABLE 5.4 DISTRIBUTION OF VARIOUS SITE AND OTHER ARCHAEOLOGICAL TYPES ACCORDING TO KEY LANDFORMS PRESENT WITHIN THE BADGERYS CREEK STUDY AREA

Landform Type	Percentage of all Field Recordings					
	Open Artefact Scatter	Isolated Find	Scarred Tree	Site with Potential Archaeo-logical Deposit	Potential Archaeo-logical Deposit Only	All Recording Types
Alluvial flats or valley floor	16	13	4	2	0	33
Secondary fluvial corridor	20	13	6	4	1	39
Minor fluvial corridor	8	4	0	2	0	13
Crests	4	6	0	1	0	10
Major watershed ridgeline	2	3	0	0	0	4
Secondary watershed ridgeline	1	4	1	0	0	5
Minor spur or ridgeline	4	4	0	0	0	7
Low gradient undulating terrain	33	25	3	6	1	62
Moderate gradient undulating terrain	2	2	0	0	0	4

The following conclusions can be made from this analysis:

- the average surface site density for the whole study area is 4.1 sites per square kilometre, or 6.9 sites and isolated finds per square kilometre;
- secondary and minor fluvial corridors contain the highest site and isolated find densities with values of 9.5 and 8.2 sites per square kilometre, or 14.0 and 12.7 sites and isolated finds per square kilometre respectively. These zones incorporate the high density topographies of alluvial flat, valley floor and adjacent basal slope topographies. When combined with the associated potential for in situ sub-surface material, and the higher potential for larger sites and more diverse artefact traits, these topographies can be identified as the most archaeologically sensitive within the study area;

TABLE 5.5 SITE DENSITY, SURVEY COVERAGE AND PREDICTED SURFACE SITES IN BADGERYS CREEK OPTION AREAS

Landform Units	Total Area in Study Area	Total Area Surveyed	Total Number Recorded		Site density (per Square Kilometre)		Predicted Number of Surface Archaeological Features: Sites, (Sites and Isolated Finds)			
	km²	km²	Sites	Sites and Isolated Finds	Sites	Sites and Isolated Finds	Option A 16.97 km²	Option B 28.11 km²	Option C 28.95 km²	All Options 33.82 km²
All Landforms (Unstratified)	33.82	14.22	66	(110)	*4.6*	*(7.7)*	78 (131)	129 (216)	133 (223)	155 (260)
All Landforms (Stratified)	33.82	14.22	66	(110)	-	-	72 (119)	118 (196)	126 (205)	140 (235)
Moderately Undulating Terrain	3.05	0.86	2	(4)	*2.3*	*(4.6)*	4 (8)	6 (13)	5 (9)	*7* (14)
Low Undulating Terrain	27.72	10.71	42	70	*3.9*	*(6.5)*	53 (88)	89 (148)	93 (155)	105 (180)
Alluvial Flats/ Valley Floor	3.04	2.64	24	(36)	*9.1*	*(13.6)*	15 (23)	23 (35)	28 (41)	28 (41)
Valley Slopes	21.90	8.78	33	(56)	*3.8*	*(6.4)*	40 (68)	68 (115)	71 (120)	83 (140)
Crests	8.88	2.79	3	(11)	*1.1*	*(3.9)*	5 (18)	8 (29)	8 (28)	10 (35)
Secondary Fluvial Corridor	3.69	3.06	29	(43)	*9.5*	*(14.0)*	22 (32)	32 (46)	35 (52)	35 (52)
Minor Creek Fluvial Corridor	1.95	1.10	9	(14)	*8.2*	*(12.7)*	*7* (10)	12 (18)	16 (25)	16 (25)
Major Watershed Ridgeline	1.51	0.252	2	(5)	*7.9*	*(19.8)*	6 (16)	12 (30)	6 (16)	12 (30)
Secondary Watershed Ridgeline	2.86	1.50	2	(6)	*1.3*	*(4)*	2 (7)	3 (8)	3 (10)	4 (11)
Minor Crests and Spurlines	7.35	2.20	3	(11)	*1.4*	*(5)*	5 (16)	8 (27)	*7* (25)	10 (37)

- the Badgerys and Thompson Creek fluvial corridors are likely to contain more and larger sites than the remaining tributary corridors within the study area;

- in general, crests contain the lowest density of sites and isolated finds with values of 1.1 sites and 3.9 sites and isolated finds per square kilometre. Disturbance levels tend to be high and archaeological potential to be correspondingly low. The overall sensitivity of this landform is low. Relatively high densities have however been defined for the major watershed ridgeline between the Nepean River and South Creek catchments. The relatively small percentage of survey achieved within this landform may have skewed this result and further research would be required to verify this figure;

- the density of isolated finds appears to be greatest on minor spur lines; and

- in comparison to crests and valley floor contexts, valley slopes have middle range densities with values of 3.8 sites and 6.4 sites and isolated finds per square kilometre. The majority of sites are however located on the basal slopes within the overlapping fluvial corridor zone. Middle and upper slopes have low densities and low archaeological potential. This is also reflected in the low densities achieved for moderately graded terrain which incorporates the steepest slopes within the study area.

Area Analysis of Airport Options

Based on the results of the sample survey and a stratified extrapolation of site densities across all landform types, it can be predicted that a 100 percent survey of the Badgerys Creek Airport Option A area would identify around 72 surface sites and 47 isolated finds. Within the airport Option B area a 100 percent survey would identify around 118 surface sites and 78 isolated finds. Within the airport Option C area a 100 percent survey would identify around 126 surface sites and 79 isolated finds.

The main distinction between the various airport options is the extent of secondary and minor fluvial corridor topographies included within each airport option.

5.1.4 POTENTIAL ARCHAEOLOGICAL DEPOSITS

Potential archaeological deposits were not systematically or individually recorded during the field survey program. Following initial survey and reconnaissance inspection it quickly became apparent that the core potential archaeological deposit areas were consistently situated on basal slope, locally

elevated, and level or low gradient areas within, and immediately adjacent to, valley floor topographies and in close association (up to 100 metres) with water sources. Wherever ground surface exposures into pre-historic sediments existed within these contexts, artefacts were consistently recorded. In addition, alluvial and colluvial sedimentation within the fluvial corridor zone provide the only significant areas in which sub-surface artefactual material may remain undisturbed below a plough zone depth of approximately 20 centimetres.

One potential archaeological deposit only is identified within the field survey results (recording number B111), however zones of archaeological potential can be reliably defined throughout the Badgerys Creek study area by the area of the minor and secondary fluvial corridors. This is shown in *Figure 3* in *Appendix L*.

5.1.5 SURVEY COVERAGE AND VISIBILITY VARIABLES

Tables 5.6 to 5.8 summarise the degree to which separate landforms within the study area were examined and also provide estimates of the average ground visibility present in each case.

The objective of a 33 percent survey coverage was exceeded both for the overall study area and each of the individual airport option areas. The actual coverage achieved within the whole study area was 36.8 percent. The areas surveyed are shown on *Figure 3.1* in *Chapter 3*. In the majority of landform categories, coverage close to or exceeding the objective was also achieved. One exception was the major watershed ridgeline landform in which only 16.7 percent was covered. This was due to the withdrawal of property access by freehold landholders during the field survey program.

TABLE 5.6 SURVEY COVERAGE ACHIEVED IN THE BADGERYS CREEK STUDY AREA, ACCORDING TO LANDFORM UNIT

Landform Units	Total Area in Study Area (km^2)	Percent of Study Area	Total Area Surveyed (km^2)	Study Area Surveyed (km^2)	Percent of Landform in Study Area Surveyed	Surveyed Area as Percent of Total Study Area
All Landforms	33.82	100	14.22	12.46	36.8	36.8
Moderately Undulating Terrain	3.05	9.0	0.86	0.86	28.3	2.5
Low Undulating Terrain	27.72	82.0	10.71	9.33	33.6	27.6
Alluvial Flats/ Valley Floor	3.04	9.0	2.64	2.26	74.5	6.7
Valley Slopes	21.9	64.7	8.78	7.72	35.2	22.8
Crests	8.88	26.3	2.79	2.48	7.9	7.3
Secondary Fluvial Corridor	3.69	10.9	3.06	2.46	56.7	7.3
Minor Creek Fluvial Corridor	1.95	5.7	1.10	1.10	56.7	3.3
Major Watershed Ridgeline	1.51	4.5	0.252	0.25	16.7	0.7
Secondary Watershed Ridgeline	3.69	8.4	1.50	1.24	43.7	3.6
Minor Crests and Spurlines	7.35	21.7	2.20	1.94	26.4	5.7

TABLE 5.7 SURVEY COVERAGE ACHIEVED WITHIN EACH OF THE BADGERYS CREEK OPTION AREAS

Badgerys Creek Airport Option	Total Option Area (km^2)	Survey Coverage (km^2)	Survey Coverage (Percent of Option Area)
Option A	16.97	8.5	50.1
Option B	28.11	10.8	34.8
Option C	28.95	12.1	41.8

A total of 36.8 percent of the ground area in the Badgerys Creek study area was inspected during the survey. An estimated nine percent of this area providing useable archaeological exposures. These included animal and

vehicle tracks, animal digging, stream and gully erosion banks, drip zones and root disturbance around trees, salt scalds and sheet erosion scars, ploughed fields and fire breaks, excavated trenches, drains training tracks and agricultural dams, and road side cuttings. Taking into account survey coverage, archaeologically useable exposures, and visibility variables, the effective net survey coverage was around five percent of the total study area.

The average coverage per person survey day was 24.9 hectares.

It is estimated that between 95 and 100 percent of all old growth trees within the sample survey areas were inspected for possible Aboriginal scarring.

TABLE 5.8 VISIBILITY VARIABLES ENCOUNTERED DURING SURVEY WITHIN KEY LANDSCAPE UNITS, AND THE CORRESPONDING EFFECTIVE COVERAGE ACHIEVED

Landform Units	Study Area Surveyed	Estimated Average Incidence of Ground Exposures		Estimated Average Ground Visibility in Exposures	Estimated Net Area of Bare Ground Inspected
	Hectare	Percent	Hectare	Percent	Hectare
Alluvial Flats/ Valley Floor	226	10	22.60	60	13.56
Valley Slopes	772	5	38.60	75	28.95
Crests	248	20	49.60	40	19.84
Totals	**1,246**	**9**	**110.8**	**5**	**62.35**

5.2 HOLSWORTHY

5.2.1 SYNTHESIS OF SITE RECORDINGS

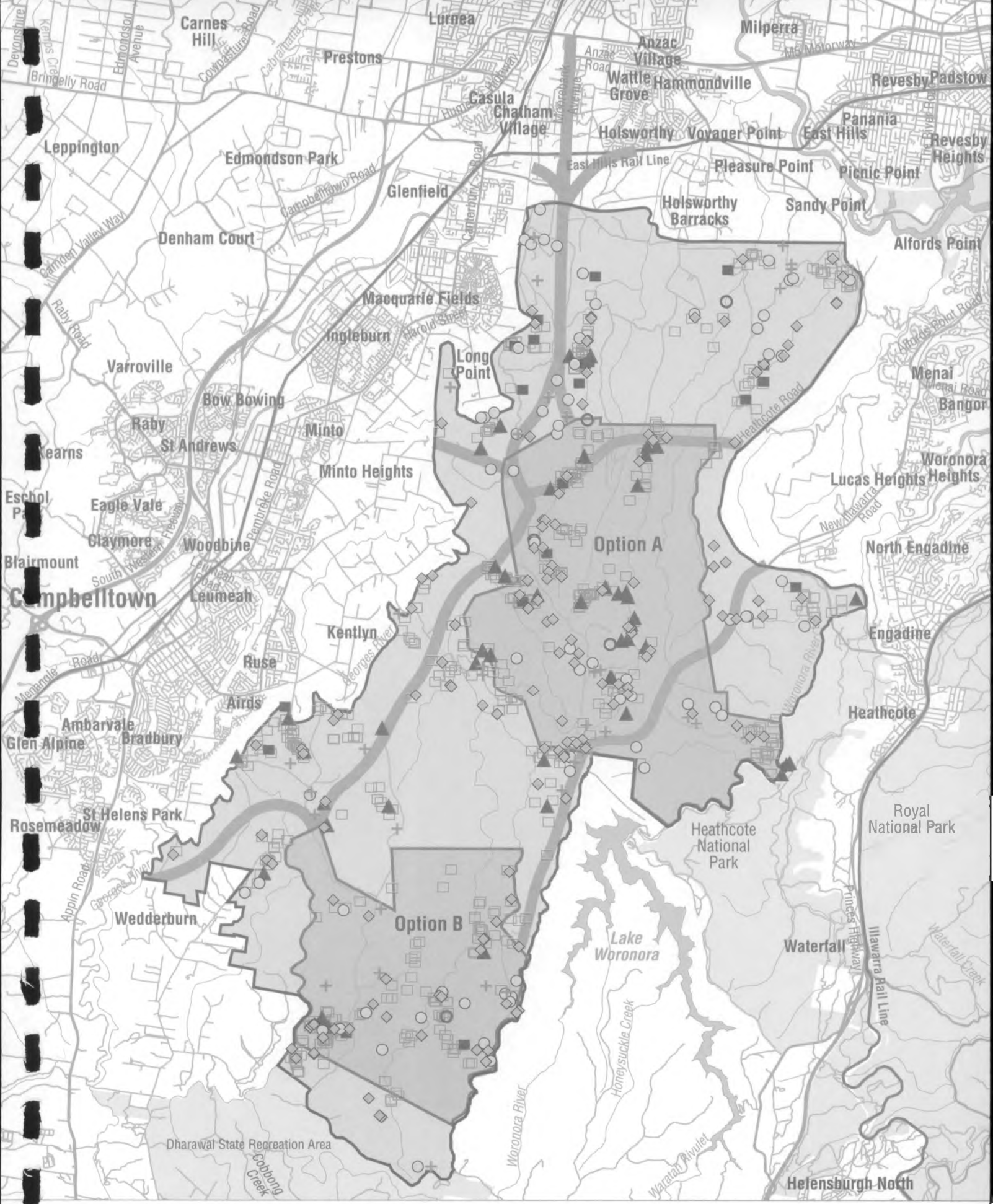
A total of 835 recordings were used for the analysis of Aboriginal archaeological sites within the Holsworthy study area. Eight hundred and twenty one of these were generated during the field survey program. The location of these is shown in *Figure 5.2*. Fourteen additional recordings were added to the database using the results from comprehensive surveys conducted during the *1995 Environmental Audit of the Military Area* (AXIS Environmental/Australian Museum Business Services Consulting, 1995). No other previously made recordings satisfied the requirements for database inclusion. A record's inclusion was dependent on it's production within a comprehensive survey methodology and documented survey coverage data.

The draft EIS survey was conducted in a range of sample areas throughout the Holsworthy Military Area, and included coverage within both airport option areas. Just under half of the database recordings are located outside of the Holsworthy airport option areas.

A summary of the number of recordings generated as a result of comprehensive survey, together with various attribute combinations is provided in *Table 5.9*. The database can be divided according to the following mutually exclusive categories: 19 open artefact scatters, 37 isolated finds in open contexts, 48 scarred trees, 54 open sites with grinding grooves only, 15 open engraving sites (some with grinding grooves), 133 rock shelters with pigment art, 20 shelter sites with no art but surface artefacts and/or archaeological deposit, one shelter with engraved art, 506 shelters with potential archaeological deposit only, and three potential archaeological deposits in open contexts. According to non-exclusive categories, the database includes 289 sites, 583 potential archaeological deposits, 659 shelter recordings, 56 artefact occurrences in open contexts, 67 sites with grinding grooves, 16 engraving sites, and 133 sites with pigment art. Photos of representative examples of some of these site types are included in *Appendix H*.

TABLE 5.9 SUMMARY OF RECORDINGS AND RECORDING ATTRIBUTES AS A RESULT OF COMPREHENSIVE SURVEY WITHIN THE HOLSWORTHY STUDY AREA

Recording Attributes[1]	Number Recorded	Airport Option A	Airport Option B	All Airport Options	Outside of Airport Option Boundaries
Total number of Recordings	835	255	167	422	413
Total number of Sites and Isolated Finds	326	111	59	170	156
Total number of Sites	289	99	52	151	138
Open Artefact Scatters	*19*	*3*	*1*	*4*	*15*
Scarred Trees	*48*	*24*	*4*	*28*	*20*
Isolated Finds	*37*	*12*	*7*	*19*	*18*
Site with Griding Grooves	67	21	18	39	28
Open Grinding Groove Site	64	20	18	38	26
Open Site with Grinding Grooves Only	*54*	*18*	*14*	*32*	*22*
Open Engraving Sites	*15*	*3*	*5*	*8*	*7*
Open Site with Grinding Groove(s) and Engravings	10	2	4	6	4
Shelter Recordings	659	194	136	330	329



Boundary of study area
Boundary of airport option
Alternative road and rail access corridors (not to scale)
Rock shelter with artefacts and/or archaeological deposit and/or grinding grooves
Rock art site (open or shelter context)
Isolated find
Open site (including artefact scatters and grinding groove sites)
Scarred tree
Potential archaeological deposit (only) in open context
Potential archaeological deposit (only) in rock shelter

Figure 5.2
Aboriginal Recordings in the Holsworthy Study Area

Recording Attributes[1]	Number Recorded	Airport Option A	Airport Option B	All Airport Options	Outside of Airport Option Boundaries
Shelter Sites	153	51	28	79	74
Shelter with Pigment Art	133	48	26	74	59
Shelter with Pigment Art Only	25	12	1	13	12
Shelter with Engraved Art	1	0	0	0	1
Shelter with Surface Artefacts and/or Archaeological Deposit	58	14	10	24	34
Shelter with Surface Artefacts and/or Archaeological Deposit and no Other Artefactual Evidence	20	4	2	6	14
Shelter with Grinding Features	3	1	0	1	2
Shelter with Pigment Art and Surface Artefacts and /or Archaeological Deposit	50	13	11	24	26
Shelter with Pigment Art and Surface Artefacts and/ or Archaeological Deposit and Grinding Features	2	1	0	1	1
Potential Archaeological Deposit (not a site recording)	509	144	108	252	257
Open Potential Archaeological Deposit	*3*	*1*	*0*	*1*	*2*
Shelter with Potential Archaeological Deposit Only	*506*	*143*	*108*	*251*	*255*
Shelter Site with Potential Archaeological Deposit	72	25	17	42	30
Open Site with Potential Archaeological Deposit	2	2	0	2	0

Note: 1. Categories in italics are mutually exclusive of each other.

Open Artefact Scatters

Nineteen open artefact scatters were recorded, comprising only seven percent of all site recordings. When combined with isolated finds in open contexts, the resulting open artefact occurrence category still accounts for only 17 percent of all sites and isolated finds. This is in contrast to the dominance of this category in the Badgerys Creek study area.

The surface characteristics of the Holsworthy sites, like those at Badgerys Creek, are dominated by low numbers of artefacts and low artefact densities. The range and spread of artefact incidence is more limited however. The number of recorded artefacts ranges from two to 20, with 43 precent containing between three and five artefacts and 37 percent containing only two artefacts. Ten percent contained between six and 10 artefacts and between 11 and 20 artefacts. Average surface artefact densities per site are correspondingly very low with a maximum value of 0.5 artefacts per square metre and just over half recorded at less than 0.1 artefacts per square metre. Maximum recorded artefact densities per site are also predominantly low, with a range of between one and 25 artefacts per square metre, and a majority of sites recorded with a maximum value of one (70 percent of sites with this variable recorded).

Unlike the Badgerys Creek distribution of this site type, Holsworthy recordings are most common on the elevated relict plateau topographies, specifically secondary watershed and major watershed ridgeline complexes (20 and 30 percent respectively). Major and minor fluvial corridors account for a further 20 and 10 percent. Only five percent were recorded on alluvial flats or valley floor contexts. It is probable that the higher exposure incidence from vehicle tracks, clearing and quarrying, on the Holsworthy ridgelines, relative to the valley floors, has skewed this result away from fluvial corridor contexts. The low recording frequency from minor spurs and ridgelines, despite relatively good exposure rates, does however indicate a ridgetop distribution which is distinctively different from the Badgerys Creek pattern where minor spurs were favoured. The shift away from the terminal spurlines to the major watersheds may be an indication of the preferential occupational focus provided by rock shelters (which are prevalent on the slopes immediately adjacent to the break of slope), and the presumed function of the main ridgelines as through-access routes.

Fifteen percent of open artefact scatters were recorded on the low gradient undulating topography restricted to the north-western portion of Holsworthy. This landform accounted for only one percent of the survey coverage achieved. The relatively small coverage is cause for caution in interpreting the resulting high density for this landform, however the ecotonal importance of this zone between the dissected sandstone valleys and the rolling terrain of the Cumberland Plain may be an effective explanation.

The poor incidence of archaeologically useful ground exposures in valley floor and basal slope contexts, means that the archaeological resource of these zones has not been effectively described by the results of this survey. The low levels of disturbance and high incidence of aggrading landsurfaces within these topographies, provides for considerable potential for sub-surface archaeological deposits.

An assessment of the condition of each site was made during field recording based on the nature and extent of ground disturbance evident to the recorder. Fifty three percent of open artefact scatters were considered to be in a poor condition, 31 percent were rated as good, and 16 percent as very good. This is significantly better than the Badgerys Creek sample, despite the predominantly shallow soils of the ridgetops and disturbed nature of many of the exposure types.

The results of field assessments of archaeological potential are presented in *Table 5.10*. The predominantly shallow contexts of the Holsworthy ridgetop recordings is reflected in over half falling within the low potential category for in situ sub-surface material. The limited number and density of exposed artefacts, in spite of generally lower levels of disturbance compared to Badgerys Creek, has been interpreted as a reliable indicator of the nature of the resource in adjoining vegetated contexts. Consequently, the number of sites with high potential to be larger or to contain more artefacts is low.

TABLE 5.10 ASSESSMENTS OF ARCHAEOLOGICAL POTENTIAL FOR OPEN ARTEFACT SCATTERS - HOLSWORTHY STUDY AREA

Type of Potential	Low	Moderate	High	Not Recorded
To be larger	37%	53%	10%	
To contain more artefacts	37%	47%	10%	6%
To have in situ material	63%	10%	26%	1%

Isolated Finds

Isolated finds accounted for four percent of all Holsworthy recordings. The condition of these single artefact occurrences also mirrored the ratings for open artefact scatters with 51 percent assessed as being poor, 30 percent as good, and thirteen percent as very good. Five percent were unassessed.

Like open artefact scatters, isolated finds were most frequently recorded from the elevated relict plateau topographies which form the Holsworthy ridgeline complexes (76 percent of all isolated finds). At a finer scale, however, isolated finds reverse the open artefact scatter distribution, in being most prevalent on secondary watershed complexes (31 percent) and minor spurlines (26 percent),

with major watershed ridgelines containing the minor proportion (16 percent). These trends are independent of ridgetop survey coverage which account for 16, 10 and 15 percent of total coverage for secondary, minor and major watershed complexes.

The higher density on secondary and minor watershed complexes may relate to the proximity of most shelter occupation sites to these landforms, which may have been preferred locations for activities more likely to produce higher artefact discard rates.

The assessment of the archaeological potential of isolated find localities is consistently lower than for open artefact scatters as shown in *Table 5.11*. The overwhelming majority of locations have low potentials, with only three percent assessed as having high potential for in situ artefactual material. These values are a reflection of predominantly shallow soil contexts and the effective survey coverage provided by frequently multiple and continuous and shallow track exposures encountered on ridge areas.

TABLE 5.11 ASSESSMENTS OF ARCHAEOLOGICAL POTENTIAL FOR ISOLATED FINDS - HOLSWORTHY STUDY AREA

Type of Potential	Low	Moderate	High	Indeterminate or Unrecorded
To be larger	73%	22%	8%	
To contain more artefacts	76%	22%	3%	5%
To have in situ material	81%	3%	3%	11%

Artefact Traits

If all surface artefact occurrences (isolated finds, open artefact scatters and rock shelter sites) are considered together, the proportional distribution of various artefact traits can be roughly characterised for the study area as a whole. There are 114 occurrences with a combined assemblage of 658 artefacts. These recordings consist of 37 isolated finds, 19 open artefact scatters, 58 shelter sites with surface artefacts, and one shelter site where artefact descriptions were not recorded. It should be noted that this description is generalised and limited by the methodological and environmental constraints of surface recordings, namely bias towards visually obtrusive artefacts, lack of temporal control, and the impact of post depositional environmental processes. For this reason, a more detailed analysis is considered to be outside of the representativeness of the database.

Flakes were the most commonly recorded artefact type and were noted in 67 percent of all artefact occurrences. This is followed by flaked pieces with 42 percent, and cores with 30 percent.

The frequency of cores is twice that recorded for the Badgerys Creek study area and probably reflects an emphasis on quartz working and the consequential higher production of bipolar cores. Twenty one percent of occurrences contained bipolar cores, most of which were made from quartz. Multiplatform cores were recorded from eight percent of locations, single platform cores from five percent and hammer stones from four percent.

The proportion of locations with secondary working closely parallel values from Badgerys Creek. Fifteen percent of sites contained artefacts with some form of secondary flaking, and six percent included artefacts with use wear. Backed blades and microliths were noted in six locations (five percent). Whole or fragments of hatchet heads were recorded in five locations (four percent).

Bipolar reduction techniques were noted in only two percent of occurrences and are probably under represented in the sample due to difficulties in distinguishing artefactual quartz in highly disturbed surface contexts. This low frequency may also be a reflection of the predominance of silcrete working compared to quartz. Single platform cores were noted from 10 percent of locations, with multiplatform cores noted from eight percent.

Pebble cortex, mostly indicative of alluvial wear, was noted on artefacts from 18 percent of occurrences, providing some indication that pebbles and gravel beds were a significant source of stone used for flaking. Manuports were noted at four locations.

Quartz was the predominant stone material recorded, being present in 64 percent of sites, and accounting for more than 50 percent of the recorded artefacts in 80 percent of these locations. Silcrete was the only other stone type which accounted for more than 50 percent of a site's recorded artefacts, occurring at this level in 30 percent of locations with silcrete. Other important stone types are chert, quartzite and volcanics which are present in 30, 14 and 12 percent of sites respectively. Silicified wood, tuff/mudstone and rhyolite were recorded in a small number of sites.

The frequency of stone types is most likely to be a reflection of the availability of raw materials. The major sources of silcrete in the Sydney Basin occur in Tertiary gravels on the Cumberland Plain and are a significant distance from the Holsworthy area. In contrast quartz is locally available from local conglomerates and gravels derived from their erosion.

Scarred Trees

Forty eight scarred trees were recorded from the Holsworthy study area. Twenty five of these were interpreted as possibly of Aboriginal origin, sixteen as probable, and seven as most likely to be an Aboriginal scar. Eighty three percent of scarred trees were rough barked Eucalypts, with rough barked Angophora accounting for 12 percent and the remainder recorded on Smooth barked Angophoras. These results provide for an overall density of 0.8 scarred trees per square kilometre which is locally and regionally high, given the rare status of scarred trees elsewhere in the Sydney basin.

Eighty nine percent of trees were recorded in fluvial corridors, with 40 percent in minor fluvial corridors, followed by 29 percent in secondary fluvial corridors and 21 percent from major fluvial corridors. Trees on ridgeline topographies account for only 10 percent, with only one recording from the low gradient undulating terrain and two specifically from alluvial flat and valley floor contexts. Taking survey coverage into account, the density of scarred trees is highest in secondary fluvial corridors at 1.8 sites per square kilometre, followed by 1.3 in major corridors and 0.9 in minor corridors.

The dominance of fluvial corridor categories can be explained by several environmental factors influencing the distribution and survival of suitable trees. The frequency and intensity of wild fire, appears to have been less on the sheltered fluvial corridor valley slopes when compared to the open ridgeline topographies. This is evidenced on the ridgelines by lower canopies, younger growth structures and extensive fire damage on the small number of remaining old growth trees. Higher frequencies of old growth trees were noted on the sheltered slopes, most of which formed part of a high forest canopy, less at risk from ground fires. Considerable evidence for 19th century logging was noted from the more open and accessible valley slopes in the form of remnant old growth tree stumps. However, the high densities in secondary corridors and lower rates in minor corridors appears to contradict the expected impact of logging where the more accessible slopes of the major corridors would have been preferentially harvested. The higher incidence from the secondary fluvial corridors may therefore relate to Aboriginal exploitation patterns, and this is corroborated by higher shelter site densities from these zones.

The condition of the scared trees is relatively evenly divided between the middle categories of good (40 percent) and poor (42 percent) and the extreme categories of excellent (six percent) and very poor (three percent).

The most frequent girth category was between 2.1 and 3.0 metres with 38 percent of recordings, followed by 1.1-2.0 metres (29 percent) and 3.1-4.0 metres (27 percent).

Sites with Grinding Grooves

Sixty four open sites containing grinding grooves were recorded. Ten of these (16 percent) also contained engraved art and 16 percent also contained pecked and or abraded channels. Fifty percent of sites with channels also contained engraved art.

The number of grooves present per open site ranged from one to 243, with most sites (79 percent) containing 15 or less grooves, and half the sites containing between one and five grooves. Seventeen percent contained only one groove. Fourteen percent contained more than 30 grooves. This frequency distribution is indicative of an opportunistic pattern of exploitation whereby many locations are sampled or used at a low level of intensity and only a small number are repeatedly and extensively exploited. In common with all Sydney Basin grinding groove sites, nearly all of the Holsworthy sites are associated with regular or periodic surface water flow, typically from a small tributary or creek, but also from seepage from upper catchment soaks and wet heaths.

Sites with small groove numbers mostly include only one close arrangement of grooves. This suggests that specific and highly localised conditions were favoured or required for the activity which created the grooves, presumably the production of bevelled edges on stone implements. Seventy five percent of sites with one to five grooves consist of only one grouping.

The distribution of open grinding groove sites is concentrated within minor fluvial corridors which account for 73 percent of all recorded sites. This translates into a survey density of 2.3 sites per square kilometre. The next most frequent mutually exclusive landscape category is secondary fluvial corridors, with only eight percent of sites and a survey density of 0.3 sites per square kilometre. This clear distribution trend is directly related to environmental factors regarding the incidence and quality of suitable sandstone platforms. Despite extensive rock platforms and the greater availability of water in the relatively permanent streamlines encountered in secondary and major corridors, the quality of rock surface in these contexts was almost universally noted to be poor. In contrast to the typically smooth and homogenous rock surfaces of the upper tributary valleys and upper valley slopes, lower Holsworthy rock exposures display a dipping and lamellate weathered surface. This condition relates either to an older and unsuitable rock facies or a detrimental weathering process related to higher water flows.

The general condition of grinding groove sites was relatively evenly spread between, good, very good and excellent categories, with 31, 28 and 36 percent of sites respectively. The potential for associated in situ stone artefacts for most sites was considered to be low (86 percent of sites), mostly due to the minimal development of adjacent basal slopes and flats in the upper valley

slopes. Approximately half of the recorded sites were assessed as having moderate or high potential to include further grooves presently obscured by vegetation or sediment.

Sites which also include engraved art, tend also to have relatively large numbers of grooves and to contain channels. Fifty percent of sites with engravings have more than 30 grooves (compared to 14 percent of all groove sites), and also contain channels (compared to 16 percent of all groove sites). These trends are typical of the small number of engraving sites recorded from the Woronora Ramp and suggest a relationship between engravings and rock platforms which were also used for other activities.

Three rock shelter sites also contain grinding grooves or other ground rock surfaces. In each case the shelter contained evidence for high archaeological potential or/and extensive evidence of occupation in the form of pigment art, surface artefacts and archaeological deposit.

Sites with Engraved Art

Fifteen open sites were recorded with engraved art. The location of these is shown on *Figure 10* in *Appendix L*. Sixty seven percent of these also contained grinding grooves. One shelter site with engraved art has been recorded from Holsworthy during comprehensive survey conducted by AXIS Environmental/ Australian Museum Business Services Consulting, (1995) (site H83).

These recordings can be divided into two groups: sites which contain graphics of clear Aboriginal origin and those which only contain engravings which are of indeterminate human origin.

There are four sites in the latter category (H495, H693, H695 and H712), each containing a single pit and ring motif, in isolation, and unassociated with other artefactual evidence. In each of these locations, the engraving is located on a rock platform or boulder in close proximity, or within rough water on a major streamline, (the Punchbowl Creek, Georges River or O'Hares creek). This landscape context is uncharacteristic of all other Holsworthy engraving sites. In at least two cases the engravings appear to have been executed (or re-executed) using a metal tool, and in the remaining cases the tool type was indeterminate. Despite this, in each case, the motif is clearly the result of freehand execution, that is, not the result of a uniform, reflex or automated mechanical action. The ring is irregular in delineation and the enclosed pit irregular in cross-section. The diameter of the ring is relatively consistent ranging between 14.5 and 20 centimetres, and the pit between two and 2.7 centimetres wide.

To date, hypotheses involving a European origin are unconvincing or unsubstantiated. Neither the rings or pits are deep enough to anchor or reliably position any form of beam, stay or rope. The engraving locations do not coincide with cadastral boundaries and their form is not a conventional surveyors motif. The surface form of the engravings appears to rule out direct percussion as a cause, such as from an exploding projectile or a utilised target. Their use as a visual marker for a military trail or other training feature is a conceivable function but is as yet unsubstantiated.

A previously recorded engraving, consistent with this motif type, was recorded by Koettig (AXIS Environmental/Australian Museum Business Services Consulting, 1995; National Parks and Wildlife Service site card 52-2-1855). The motif occurs on a boulder in a rock shelter adjacent to Deadmans Creek and is associated with Aboriginal pigment art (Site H83). Based on the clear evidence for the use of a metal tool, Koettig concluded that it was likely to be European in origin. No other evidence for European occupation of the shelter was noted.

Recordings made by the present study however, provide for an alternative interpretation and suggest an Aboriginal origin for these engravings. At three additional engraving sites (H271, H882 and H1049), similar motifs consisting of pecked rings enclosing either natural or human made pits/depressions occur in association with grinding grooves. One site includes engraved animal track motifs. None of these sites have evidence of metal tool use and occur in upper tributary landscape contexts typical of prehistoric Aboriginal occupation. The dimensions of these Aboriginal motifs are relatively consistent with the disputed examples, with ring diameters of 14 and 18 centimetres, and pits of 3.4 and 4 centimetres (H882 and H1049). Site H271 has five apparent ring and enclosed pit motifs. When Koettig's shelter site is added to this group, half of the sites containing this motif type display clear evidence of Aboriginal occupation.

Given the evidence for similar engraved motifs made from stone tools in undisputed Aboriginal occupation contexts, the use of metal tools and uncharacteristic landscape context of the remaining engraving sites are inadequate arguments for ruling out the possibility of an Aboriginal origin subsequent to European contact. Until a substantiated European origin for these engravings can be documented, these engravings must be considered as possibly Aboriginal in origin. If this interpretation could be confirmed, these motifs would constitute a rare and atypical engraving type, of particular significance to research into Aboriginal art and occupation during the brief 'contact' period when traditional indigenous practise manifested interaction with European materials and culture.

If the ring and pit motifs of undetermined origin are excluded from the database, 11 sites remain with undisputed Aboriginal engraved art motifs (also

referred to as graphics). Most of these sites (81 percent) are located in minor fluvial corridors in valley floor or streamline margins. This distribution mirrors that of grinding grooves and may relate to the same environmental factors which determine suitable rock surfaces for engraving. Only two sites (18 percent) occur on ridgetop plateau topography contexts.

The number of engraved graphics per site is characteristically low, with 45 percent containing only one motif, and 73 percent containing less than five. The average is 4.7 graphics. One site provides an exception with 21 recorded graphics consisting of animal tracks, non-figurative designs and indeterminates (site H271).

Table 5.12 shows the frequency of motif types according to motif numbers and site numbers. The most frequently occurring motif types across sites are animal tracks and non-figuratives (including 'mundoes'), followed by macropods, other profile quadruped animals, birds and indeterminates. Relative to the total graphic assemblage, the most frequent motifs types are tracks and non-figuratives, birds, indeterminates and other profile quadrupeds. These results go against the trends previously identified for the Woronora Ramp which identify track and mundoe motifs to be relatively low, and the most frequent categories to be anthropo morphs and macropod/profile quadruped animals (McDonald, 1994).

A splayed female anthropomorphic motif which includes mid and lower body design traits which could be figuratively interpreted as pregnancy or childbirth, has been previously recorded in the study area (AXIS Environmental/Australian Museum Business Services Consulting, 1995) and was confirmed during the present investigation during daylight inspection and using night time oblique lighting (site H64). This is a rare motif type in the Sydney basin, with at least one and possibly two other examples known which resemble this subject (McCarthy, 1983; pers. comm. Jo McDonald, April 1997). Other uncommon or rare motif types occur in sites H309 and H190. These include large anthropomorphic figures with figurative animal characteristics which are at least partly consistent with a 'culture hero' type, identified by McDonald (1990) as a rarely occurring motif type south of the Georges River. Also included is a probably unique, splayed quadrupled animal motif. These motifs are shown in Figure 18 in Appendix L.

TABLE 5.12 FREQUENCY OF ENGRAVED MOTIF TYPES ACCORDING TO NUMBER OF GRAPHICS AND NUMBER OF SITES

Motif Type	Number of Sites	Percentage of Engraving Sites	Number of Graphics	Percentage of Graphics (T = 52)
Tracks, non-figurative designs, (including 'mundoes'	5	33	23	44
Macropods	3	20	3	6
Other profile quadruped animal	3	20	5	10
Bird	2	13	10	19
Indeterminate motif type	2	13	5	10
Other fish (excluding eel)	1	7	1	2
Anthropomorph	1	7	3	5
Other splayed quadruped	1	7	2	4

Shelter Sites

Rock shelters containing archaeological evidence of Aboriginal occupation are the largest site sub-category within the Holsworthy study area. One hundred and fifty three shelter sites have been recorded in the Holsworthy Military Area as a result of comprehensive survey of 61.6 square kilometres. This provides an overall density of 2.5 shelter sites per square kilometres. Shelter sites account for 53 percent of all site recordings and 18 percent of all recordings. *Table 5.13* provides a breakdown of various shelter site attributes in non-mutually exclusive categories. The largest categories are shelters with pigment art, and a combined category of shelter sites with potential or identified archaeological deposit.

The pigment art component of this category is likely to be artificially high due to the visually obtrusive nature of pigments, compared to shelter floor stone artefacts which were detected in only 38 percent of recordings. It is probable that most occurrences of stone artefacts in shelter sites are obscured either by leaf litter or recent layers of sand which have accumulated following the surface mobilisation of adjacent sediments immediately following fire. If the proportion of shelters with no artefacts but recorded potential archaeological deposit is considered (506 recordings) the actual number of shelter sites with occupation deposit and no art may in fact be the largest, but obscured, site component within the Holsworthy study area.

Two sites were noted to contain evidence of small scale and opportunistic quarrying of quartz pebbles extending from the shelter rock surfaces (H86 and H456).

TABLE 5.13 A NON-MUTUALLY EXCLUSIVE BREAKDOWN OF HOLSWORTHY SHELTER SITE ATTRIBUTES

Shelter Site Attribute	Number of Sites	Percentage of Shelter Sites
With Potential Archaeological Deposit	72	47
With Surface Stone Artefacts	58	38
With Archaeological Deposit	55	36
With Potential Archaeological Deposit or Archaeological Deposit	127	83
With Pigment Art	133	87
With Engraved Art	1	<1
With Grinding Grooves	3	2
With Evidence of Quarrying	2	1

The majority of shelter sites occur within fluvial corridors (93 percent) which is where the overwhelming majority of sandstone escarpments occur within the study area. Highest site densities per surveyed square kilometre occur in secondary fluvial corridors (6.3), followed by minor fluvial corridors (3.8) and major fluvial corridors (two). The remaining sites occur on secondary and minor ridgeline topographies. The clear preference for occupation sites in secondary fluvial valley contexts indicated in these figures is not discounted by an examination of the natural incidence of rock shelters in these topographic zones. One measure of shelter incidence is the density of potential archaeological deposits across the three fluvial categories. Unlike the site densities, shelter potential archaeological deposit densities are relatively consistent ranging from 12.3 to 13.3 recordings per square kilometre. Nor is there significant variation in the proportion of moderate or moderate to high archaeological potential rated recordings, with values ranging from 10 to 15 percent of recorded potential archaeological deposits for each zone.

The overall qualitative character of shelters within each of these categories was observed to differ however. Shelters in major fluvial corridors tend to be located on the upper valley slopes, have high ceilings, and more commonly include sloping rock floors and active rock surface deterioration. Shelters in the minor fluvial corridors tend to be smaller and distributed more evenly

along the upper, middle and lower slopes. A higher incidence of damp and low shelters was apparent.

In comparison to these observations, the shelters in secondary fluvial corridors tend to be in lower gradient contexts, be closer to more permanent streams and occupy more open valley contexts. These are all likely to be positive attributes for occupation sites and are considered here to provide an effective explanation of the Holsworthy shelter site distribution.

No strong trends were apparent in shelter site aspect. Sites were recorded from all of eight 45 degree sections of the magnetic compass, with frequencies ranging from seven to 20 percent of shelter sites. Highest categories were eastern and western aspect with 20 and 18 percent respectively, followed by south facing shelters with 13 percent. The slight emphasis on east and west aspects is likely to be an environmental bias and relate to the dominant north-south alignment of the fluvial corridors within the study area.

The condition rating of shelter sites in Holsworthy is relatively high (excluding pigment art condition), with 67 percent of sites assessed as being in good or very good condition and fifteen percent rated as being excellent. A major component of this appears to be minimal disturbance of deposits from digging animals. Rabbit disturbance appears to be minimal, due presumably to the lack of agricultural development within the region.

Shelter Sites Containing Pigment Art

One hundred and thirty three shelter sites were recorded containing pigment art. The location of these is shown in *Figure 11* in *Appendix L*. Shelters with applied pigment occur throughout the whole distribution of shelter sites. They do not appear have a distinctive distribution pattern with the local scale exception of tending to occur in clusters. Thirty eight percent of shelters containing pigment art also contained surface artefacts and/or archaeological deposit. Sites with large assemblages of graphics will not uncommonly be located in relative proximity to other large assemblage sites and also to smaller sites. This is a characteristic of rock art sites throughout their distribution in the Sydney Basin.

The range in the estimated number of graphics of the database sites is between one and 83. Seventy one percent of sites contain between one and 10 graphics, with 13 percent containing only one, and 57 percent between two and 10. The frequency sharply falls above this category with only six percent of sites containing more than 40 graphics. The average number of estimated graphics per site is 11.25, with the total assemblage consisting of 1,497 estimated graphics.

The internal distribution of the graphics across the available rock surface space provides a different pattern to the exponential pattern of gross graphic numbers. Sites with less than one percent of the available space used are rare with only two percent of occurrences. Between the categories of 1-10 and 51-60 percent of utilised space, the frequency declines relatively evenly from 21 percent to two percent of sites. An anomaly within the minimal numbers of sites with over 60 percent of available space utilised, is the category between 71 and 80 percent which accounts for seven percent of sites. This concentration at the upper scale suggests that sites with little remaining space were of specific cultural importance, promoting repeated visits beyond frequencies which could be expected from a normal frequency distribution.

Despite a high proportion of sites with low usage of available space, around half of the sites included maximum graphic densities of between one and five graphics per square metre. Isolated or sparse graphics occurred in 21 percent of sites and low (1-5 per square metre) and high (greater than 5 per square metre) densities in 16 and 13 percent of sites. This defines a characteristic of the local area rock art for the grouping together of graphics into discrete spatial associations, rather than simply expanding to cover the available space. Close grouping does not translate into a high superimposition rate, with 61 percent of sites containing no evident overlap of graphics, and rare and frequent categories recorded in a moderate number of instances (15 and 17 percent respectively). One site was noted to have very frequent superimpositions.

The distribution of determinate graphics (defined as graphics which retain enough original delineation to allow an interpretation of the original form) is less diagnostic and spread relatively evenly throughout the range given the underlying distribution of total graphic numbers. Twenty nine percent of sites did not contain determinate graphics. The average number of determinate graphics per site is 4.5.

The majority of shelters contained graphics on the back wall (82 percent) with 32 percent containing ceiling graphics. Most graphics occur on vertical (42 percent) and sloping (74 percent) surfaces with a small number in horizontal contexts (13 percent) and other niche contexts (eight percent). In most cases art was located on rock surfaces adjacent to the most spacious and sheltered living areas (87 percent). In two percent of cases art occurred throughout the shelter extent and in seven percent, art was placed away from the largest spaces. One site combined the former and the latter and in three percent this variable was unrecorded.

Drawing is the dominant technique throughout the study area with 97 percent of all sites containing drawings. Seventeen percent of sites contain paintings, all but one of which consist of stencils. One site only contains freehand paintings of motifs (site H253). Drawing and stencilling occur together in 13 percent of sites and five sites contain only stencils.

Black is the dominant colour, occurring in 92 percent of sites and as the only colour present in 87 percent of sites. Red occurs in 29 percent of sites and is the only colour in only four percent of cases. Thirty six percent of sites with red contain only stencils in red, indicating that red freehand motifs are relatively rare. White pigment occurs in only nine percent of sites and is predominantly used for stencilling. One site with only white was recorded and contained only stencils. Eighty three percent of sites with white pigment contain only stencils in white. White freehand motifs are therefore a rare graphic form. One yellow stencil was recorded (H487) and is representative of a rare stencil colour throughout the Sydney basin.

Graphics with more than one colour are also rare with only eight sites containing examples (24 percent). The number of 'bichrome' graphics per site is always small, with normally only one or up to five. All but one contain a black linear outlines and a red (and sometimes also black) multiple line infill. One motif has a rare combination of a solid red head and a solid black body. One site (H824), contains the only recorded examples from the Holsworthy study area and the northern Woronora Plateau, of motifs with black outline and abraded white solid infill. This is apparently a regionally significant and northern 'outlier' of a stylistic trait which is most common to the south of the Woronora Ramp (Officer, 1993; McCarthy, 1961).

The number of sites with stencils is 22, two, with a range of between one and 25 stencils per site. Sixty percent of stencil sites have up to four stencils and sites with larger numbers (more than 12), also contain drawings. The most frequent stencil frequency per site is one, with 27 percent of sites. In a rare variation in non-motif (real-object image) graphics one site (H714) was recorded with four red hand prints, positive images rather than negative outlines. Hand prints are consistently rare throughout most of the Sydney Basin.

Nearly all stencil sites (91 percent) contain images of human hands or portions, thereof. In three sites other recognisable objects are stencilled including boomerangs and hafted hatchets (H160 and H166), and macropod feet (H55 and H166). Stencilling of real objects other than hands is uncommon on the northern Woronora Ramp, with higher densities occurring along its southern portions (Carol Sefton, personal communication, 1993).

The means by which motifs in the study area are delineated (sometimes described as the form of a motif) fall well within the characteristic types already recognised for the Woronora Ramp. Around half of the sites include motifs with linear outline and varied multiple line infills, and linear outlines only. Mostly solid motifs, linear and solid, and line outline and solid infill occur in 12, 10 and six percent of sites. One rare type of delineation, utilising a linear outline and an infill of large round dots was noted in a rare red painted and freehand motif in site H253.

The frequency of motif types also substantiates, and falls within, previously identified trends. *Table 5.14* presents a breakdown broad motif type groupings according to site occurrence. This summary is based on short duration field inspections and is biased toward clear determinate graphics, particularly figurative types. Anthropomorphs and Macropods are the most frequently occurring categories (47 and 41 percent of sites with determinate motifs), followed by other profile quadrupeds, other splayed quadrupeds and fish other than eels.

TABLE 5.14 BROAD MOTIF TYPE GROUPINGS IN SHELTER PIGMENT ART, ACCORDING TO SITE OCCURRENCE

Motif Type	Number Site Present	Percentage of Sites with Determinate Motifs
Macropod	44	47
Anthropomorph	39	41
Other splayed quadruped	21	22
Other profile quadruped	23	24
Other fish	21	22
Bird	15	16
Other long thing	14	15
Other	13	14
Eel	12	13
Snake	11	12
Echidna	6	6
Dog	4	4
Lizard	3	3
Shield	1	1

The condition of the art was mostly assessed to be poor or good (51 and 34 percent respectively), with 11 percent rated as very good and around two percent as excellent. In eighty six percent of sites, the art was described as faded and fragmentary, which is a reflection of actual pigment loss and difficulties in distinguishing superimposed marks, rather than gross rock surface loss which was noted in only 13 percent of sites. The general stability of the shelter rock surfaces was found to be comparatively good, with around half of the sites displaying stable rock surfaces over more than 60 percent of the shelter surfaces.

Natural deterioration factors were the most frequently noted with the linked processes of surface water wash, scalar exfoliation and mineral surface skins noted in between 23 and 35 percent of cases. Dust accumulation and surface micro-organic growth were also noted in between 29 and 20 percent of sites. European graffiti was noted, mostly as a minor element, in 11 percent of sites and ordnance impact in seven percent of sites.

5.2.2 SITE DESCRIPTION

Landform Analysis

The survey coverage, number of recordings and density of recording types for each large scale landform zone within the Holsworthy study area are presented in *Tables 5.15* to *5.18* and shown in *Figure 3.2* in *Chapter 3*. Also presented are a series of predictions of the total archaeological resource which could be expected to be found by surface survey for the whole Holsworthy study area and each of the proposed Holsworthy airport options.

The calculations and totals in *Table 5.15* are based on results from the whole Holsworthy study area, and in effect average out localised variation by combining the whole spectrum of landscape variation. *Table 5.16* provides predicted total for the whole Holsworthy study area based on overall study area densities. *Tables 5.17* and *5.18* are restricted to the database and survey coverage achieved in each of the airport option areas A and B. These tables more accurately reflect the localised characteristics of site distribution for each option.

The following conclusions can be made from this analysis:

- the average site density for the whole Holsworthy study area, based on a stratified sample, is in the order of 4.4 sites per square kilometre, or 5.1 sites and isolated finds per square kilometre. Highest sites densities occur on alluvial flat/valley floor zones and secondary and minor fluvial corridors. Highest isolated find densities occur on minor crests and spurlines however all ridgeline complex landunits contain below average densities. Highest potential archaeological deposit densities occur on the slopes of secondary fluvial corridors;

- a review of these overall density figures however reveals that the predicted estimates are too low. Based on overall densities (*Table 5.15*), a predicted 188 sites would be found in a comprehensive survey of Option A. However the survey of 32 percent of Option A identified 99 sites. A further 93 previous recordings not investigated for this study create a total of 192, already three above the prediction. A similar underestimation is evident for Option B;

- an analysis of the datasets specific to the separate option areas (*Tables 5.18* and *5.19*) reveals that archaeological density levels within large scale landform divisions are not consistent across the study area and site densities are generally higher than average in both airport options;

- within the boundaries of Option A, the overall site density is 6.5 sites per square kilometre, and 17.2 sites, isolated finds and potential archaeological deposits per square kilometre. The location of all recordings within the Option A area are shown on *Figures 12* and *13* in *Appendix L*. The predicted number of sites is 280, including 40 isolated finds and 420 potential archaeological deposits. Highest site densities occur on alluvial flats or valley floor contexts (31.2), secondary fluvial corridors (14.9) and minor creek fluvial corridors (9.0). In keeping with the overall study area trend, ridgeline topographies have the lowest densities with less than two sites per square kilometre. Highest potential archaeological deposit densities occur on major and secondary fluvial corridors (32.0 and 16.7).;

- within the boundaries of Option B, the overall site density is 5.1 sites per square kilometre, and 17.6 sites, isolated finds and potential archaeological deposits per square kilometre. The location of all recordings within the Option B area are shown on *Figures 14* and *15* in *Appendix L*. The predicted number of sites is 164, including 201 isolated finds and 566 potential archaeological deposits. Highest site densities occur on secondary fluvial corridors (16.7), alluvial flats or valley floor contexts (10.0), and minor creek fluvial corridors (8.3). Ridgeline topographies have the lowest densities with less than 2 sites per square kilometre. Highest potential archaeological deposit densities occur on major and secondary fluvial corridors (26.7 and 18.3);

- based simply on the gross numbers of known and predicted archaeological features within each large scale landform, it can be concluded that the most sensitive large scale landforms are the secondary fluvial corridors, alluvial flat/valley floor zones, and minor fluvial corridors. Landforms with lower sensitivity consist of the ridgeline topographies, particularly the major watershed and minor watershed ridgeline complexes. Major fluvial corridors and low gradient undulating terrain are of relative moderate sensitivity, provided small scale sensitive landforms, such as alluvial flats and terraces, and areas of old growth trees are excluded;

- many specific site type distributions mirror these broad density trends: most shelter sites, scarred trees, engravings and grinding groove sites occur within these high density zones; and

- some site types however, such as open engraving sites, do not occur consistently below the ridgeline break-of-slope and a small percentage are likely to occur on rock platforms on the ridgeline topographies.

TABLE 5.15 SITE DENSITY, SURVEY COVERAGE AND PREDICTED SURFACE SITES IN BOTH HOLSWORTHY AIRPORT OPTIONS (BASED ON COMPREHENSIVE SURVEY DATABASE COMPLIED FOR THE WHOLE HOLSWORTHY STUDY AREA)

Landform Units	Total Area in Study Area	Total Area Surveyed	Total Number of Recorded			*Density (per Square Kilometre)*				Predicted Number of Surface Archaeological Features: Sites (Sites and Isolated Finds), [Site, Isolated Finds and PADs]	
	km²	km²	Sites	Site and Isolated Finds	PADs	*Sites*	*(Sites and Isolated Finds)*	*PADs*	*[Sites, Isolated Finds and PADs]*	Option A 42.9km²	Option B 32.1 km²
All Landforms (Unstratified)	174.1	61.6	289	(326)	509	*4.69*	*(5.29)*	*8.26*	*[13.55]*	201 (227) [581]	150 (170) [435]
All Landforms (Stratified)	174.1	61.6	289	(326)	509	-	-	-	-	188 (213) [662]	149 (167) [446]
Low Undulating Terrain	4.2	0.7	3	(4)	0	*4.26*	*(5.71)*	*0*	*[5.71]*	0 (0) [0]	0 (0) [0]
Alluvial Flats/Valley Floor	4.2	1.2	15	(17)	3	*12.50*	*(14.17)*	*2.50*	*[16.67]*	4 (4) [5]	2 (3) [3]
Valley Slopes	89.2	34.8	230	(236)	459	*6.61*	*(6.78)*	*13.19*	*(19.97)*	159 (163) [479]	130 (133) [391]
Crests	76.5	24.9	34	(62)	43	*1.36*	*(2.49)*	*1.73*	*[4.22]*	26 (45) [78]	17 (31) [52]

Landform Units	Total Area in Study Area	Total Area Surveyed	Total Number of Recorded			*Density (per Square Kilometre)*				Predicted Number of Surface Archaeological Features: Sites (Sites and Isolated Finds), [Site, Isolated Finds and PADs]	
	km^2	km^2	Sites	Site and Isolated Finds	PADs	*Sites*	*(Sites and Isolated Finds)*	*PADs*	*[Sites, Isolated Finds and PADs]*	Option A 42.9km^2	Option B 32.1 km^2
Major Fluvial Corridor	22.0	7.8	38	(39)	103	*4.87*	*(5.00)*	*13.20*	*[18.20]*	9 (9) [35]	29 (30) [109]
Secondary Fluvial Corridor	18.8	7.8	68	(68)	104	*8.72*	*(8.72)*	*13.33*	*[22.05]*	45 (45) [115]	5 (5) [13]
Minor Creek Fluvial Corridor	52.6	20.7	147	(153)	255	*7.10*	*(7.39)*	*12.31*	*[19.71]*	121 (126) [337]	94 (97) [260]
Major Watershed Ridgeline	19.0	9.0	10	(16)	6	*1.11*	*(1.65)*	*0.67*	*[2.44]*	8 (12) [18]	2 (3) [4]
Secondary Watershed Ridgeline	35.0	9.7	15	(27)	21	*1.55*	*(2.78)*	*2.16*	*[4.95]*	11 (19) [34]	9 (16) [29]
Minor Crests and Spurlines	22.5	6.2	9	(19)	16	*1.45*	*(3.06)*	*2.58*	*[5.64]*	6 (13) [25]	7 (15) [27]

TABLE 5.16 PREDICTED SURFACE SITES AND OVERALL DENSITY VALUES ACROSS THE WHOLE HOLSWORTHY STUDY AREA (BASED ON THE STRATIFIED LANDFORM ANALYSIS)

Landform Units	Total Area in Holsworthy Study Area	Predicted Number of Surface Archaeological Features			
	km^2	Sites	Isolated Finds	PADs	Sites, Isolated Finds and PADs
All Landforms (*overall density*) based on stratified analysis	174.1	764 (*4.39/km^2*)	114 (*0.65/km^2*)	1,318 (*7.57/km^2*)	2,198 (*12.62/km^2*)
Low Undulating Terrain	4.2	18	6	0	24
Alluvial Flats/ Valley Floor	4.2	52	7	10	70
Valley Slopes	89.2	590	15	1,176	1,781
Crests	76.5	104	86	132	323
Major Fluvial Corridor	22.0	107	3	290	400
Secondary Fluvial Corridor	18.8	164	-	251	414
Minor Creek Fluvial Corridor	52.6	373	15	647	1,037
Major Watershed Ridgeline	19.0	21	13	13	46
Secondary Watershed Ridgeline	35.0	54	43	76	173
Minor Crests and Spurlines	22.5	33	36	58	127

TABLE 5.17 SITE DENSITY, SURVEY COVERAGE AND PREDICTED SURFACE SITES FOR HOLSWORTHY OPTION A (BASED ON THE DATASET SPECIFIC TO THIS AREA)

Landform Units	Total Area in Option A	Total Area Surveyed in Option A	Total Number of Recorded			*Density (per Square Kilometre)*				Predicted Number of: Sites (Sites and Isolated Finds), [Site, Isolated Finds and PADs]
	km^2	km^2	Sites	Sites and Isolated Finds	PADs	*Sites*	*(Sites and Isolated Finds)*	*PADs*	*[Sites, Isolated Finds and PADs]*	Option A 42.9km^2
All Landforms (Unstratified)	42.9	13.6	99	(111)	144	*7.28*	*(8.16)*	*10.58*	*[18.75]*	312 (350) [804]
All Landforms (Stratified)	42.9	13.6	99	(111)	144	-	-	-	-	280 (320) [740]
Alluvial Flats/Valley Floor	0.3	0.16	5	(5)	1	*31.25*	*(31.25)*	*6.25*	*[37.50]*	9 (9) [11]
Valley Slopes	24.0	8.4	90	(95)	127	*10.71*	*(11.31)*	*15.12*	*(26.43)*	257 (271) [634]
Crests	18.6	5.1	4	(11)	15	*0.78*	*(2.16)*	*2.94*	*[5.10]*	14 (40) [95]
Major Fluvial Corridor	1.9	0.5	4	(4)	16	*8.00*	*(8.00)*	*32.00*	*[40.00]*	15 (15) [76]

Landform Units	Total Area in Option A	Total Area Surveyed in Option A	Total Number of Recorded			*Density (per Square Kilometre)*				Predicted Number of: Sites (Sites and Isolated Finds), [Site, Isolated Finds and PADs]
	km²	km²	Sites	Sites and Isolated Finds	PADs	*Sites*	*(Sites and Isolated Finds)*	*PADs*	*[Sites, Isolated Finds and PADs]*	Option A 42.9km²
Secondary Fluvial Corridor	5.2	2.15	32	(32)	36	*14.88*	*(14.88)*	*16.74*	*[31.63]*	77 (77) [164]
Minor Creek Fluvial Corridor	17.1	5.9	53	(58)	75	*8.98*	*(9.83)*	*12.7*	*[22.54]*	154 (168) [385]
Major Watershed Ridgeline	7.3	3.1	2	(4)	4	*0.64*	*(1.29)*	*1.29*	*[2.58]*	5 (9) [19]
Secondary Watershed Ridgeline	6.9	1.1	2	(4)	4	*1.82*	*(3.64)*	*3.64*	*7.27*	13 (25) [50]
Minor Crests and Spurlines	4.4	0.9	0	3	7	*0*	*(3.33)*	*7.78*	*[1.11]*	0 (15) [49]

TABLE 5.18 SITE DENSITY, SURVEY COVERAGE AND PREDICTED SURFACE SITES FOR HOLSWORTHY OPTION B (BASED ON THE DATASET SPECIFIC TO THIS AREA)

Landform Units	Total Area in Option B	Total Area Surveyed in Option B	Total Number of Recorded			*Density (per Square Kilometre)*				Predicted Number of: Sites (Sites and Isolated Finds), [Site, Isolated Finds and PADs]
	km²	km²	Sites	Sites and Isolated Finds	PADs	*Sites*	*(Sites and Isolated Finds)*	*PADs*	*[Sites, Isolated Finds and PADs]*	Option B 32.1 km²
All Landforms (Unstratified)	32.1	9.7	52	(59)	108	*5.36*	*(6.08)*	*11.13*	*[17.22]*	172 (195) [553]
All Landforms (Stratified)	32.9	9.7	289	(326)	509	-	-	-	-	164 (201) [566]
Alluvial Flats/Valley Floor	0.2	0.16	1	(2)	0	*10.00*	*(20)*	*0*	*[20.00]*	2 (4) [4]
Valley Slopes	19.6	5.7	45	(46)	101	*7.89*	*(8.07)*	*17.72*	*(25.79)*	155 (158) [505]
Crests	12.3	4.1	7	(13)	6	*0.57*	*(3.17)*	*1.46*	*[4.63]*	7 (39) [57]
Major Fluvial Corridor	6.0	2.0	11	(11)	29	*5.5*	*(5.5)*	*14.50*	*[20.00]*	33 (33) [120]

Landform Units	Total Area in Option B	Total Area Surveyed in Option B	Total Number of Recorded			*Density (per Square Kilometre)*				Predicted Number of: Sites (Sites and Isolated Finds), [Site, Isolated Finds and PADs]
	km^2	km^2	Sites	Sites and Isolated Finds	PADs	*Sites*	*(Sites and Isolated Finds)*	*PADs*	*[Sites, Isolated Finds and PADs]*	Option B 32.1 km^2
Secondary Fluvial Corridor	0.6	0.3	5	(5)	8	*16.67*	*(16.67)*	*26.67*	*[43.33]*	10 (10) [25]
Minor Creek Fluvial Corridor	13.2	3.5	29	(30)	64	*8.28*	*(8.57)*	*18.28*	*[26.86]*	109 (113) [355]
Major Watershed Ridgeline	1.6	0.3	0	0	0	*0*	*0*	*0*	*0*	0 (0) [0]
Secondary Watershed Ridgeline	5.9	1.7	3	(7)	2	*1.76*	*(4.12)*	*1.18*	*[5.29]*	1 (24) [31]
Minor Crests and Spurlines	4.8	2.1	4	6	4	*1.90*	*(2.86)*	*1.90*	*[4.76]*	9 (14) [23]

Area Analysis of Airport Options

Based on the results of the sample survey, and a stratified extrapolation of site densities across all landform types, it can be predicted that a 100 percent surface survey of the airport Option A area would identify around 280 sites, 40 isolated finds and 420 potential archaeological deposits.

Within airport Option B, a 100 percent surface survey would identify around 164 sites, 37 isolated finds and 365 potential archaeological deposits.

Both Options A and B contain site densities which are higher than the overall values calculated from the whole study area dataset. This could potentially be explained by various survey bias within the sample area selection process, or as an accurate indication of higher than average occupation and exploitation rates within these areas. The higher proportion of secondary fluvial corridor landforms within Option A and the adjacent northern half of the study area may have acted as a focus for Aboriginal occupation, particularly given the access afforded from the Georges River estuary by multiple north-south secondary watershed ridgelines.

The proximal location of major watershed ridgelines to and within both Holsworthy options may also explain the above average densities in these areas. It has long been presumed that ridgelines of this order were used by Aborigines as through routes across otherwise dissected and broken country. Despite the low density of sites on the ridgeline complexes, use of these zones as access routes is suggested by the high sites numbers on immediately adjacent slopes and the characteristically high incidence of isolated finds on these landforms.

5.2.3 POTENTIAL ARCHAEOLOGICAL DEPOSITS

Rock shelters with potential archaeological deposit were systematically recorded throughout the Holsworthy study area. Open potential archaeological deposits were not systematically recorded, principally due to the consistent incidence of potential areas along valley floor and associated small-scale alluvial and colluvial basal slope landforms. These landforms are consequently identified as representing a major and integral potential archaeological resource. Excavations in similar contexts on Mill Creek to the east of the study area has already demonstrated the high local potential of such landforms (Koettig, 1990). Five open potential archaeological deposits were recorded from Holsworthy, compared to 509 shelter recordings.

The rock shelter potential resource constitutes a major representative resource in its own right. Ninety percent occur within fluvial corridor contexts and are therefore spatial related to most of the confirmed archaeological sites. Studies from elsewhere in the Sydney basin have determined high site detection rates

from between 30 and 90 percent of potential archaeological deposits following subsurface testing.

Some 68 percent of shelter potential archaeological deposits were field assessed as having low to moderate archaeological potential, 21 percent as having moderate potential, eight percent with moderate to high and two percent (11 locations) with a high assessment.

Around half of the shelter potential archaeological deposits displayed between 0 and 30 percent ground visibility, with the remaining 28 percent containing 31 to 60 percent surface exposure and 22 percent between 61 and 100 visibility. The relatively high visibility values combined with low artefact detection rates, suggests that high rates of sediment accumulation may have obscured many archaeological sites.

5.2.4 SURVEY COVERAGE AND VISIBILITY VARIABLES

Tables 5.19 and *5.20* summarise the degree to which key landform groupings within the study area were examined and also provide estimates of the average ground visibility present in each case.

The objective of a 33 percent survey coverage was exceeded for the overall Holsworthy study area and nearly achieved within each of the individual airport option areas. The actual coverage achieved within the whole study area was 35.3 percent. Thirty two percent was achieved in Option A and 30 percent in Option B. The proportion of survey coverage within individual landform categories varied between 17 percent for low gradient undulating terrain and 47 percent of major watershed ridgeline topography. In the majority of landform categories, coverage close to or exceeding the objective was achieved.

TABLE 5.19 SURVEY COVERAGE ACHIEVED IN HOLSWORTHY STUDY AREAS AND AIRPORT OPTION AREAS

Location	Area of Option, and Associated Direct Impact (est. km^2)	Survey Coverage (km^2)	Survey Coverage (Percent of Option Area)
Option A	42.9	13.6	31.7
Option B	32.1	9.7	30.0
Whole study area	174.1	61.6	35.3

TABLE 5.20 VISIBILITY VARIABLES ENCOUNTERED DURING SURVEY AND THE EFFECTIVE COVERAGE ACHIEVED

Landform Units	Estimated Average Incidence of Ground Exposures	Estimated Average Ground Visibility in Exposures	Study Area Surveyed	Estimated Net Area of Bare Ground Inspected		Incidence of Old Growth Trees	Incidence of Quality Sandstone Platforms	Incidence of Quality Rock Shelters
	Percent	Percent	Hectares	Hectares	Percent of Survey Area			
Low Undulating Terrain	15	50	70	5.25	0.08	low	low	very low
Alluvial Flats/Valley Floor	5	25	120	1.5	0.02	high	low	very low
Valley Slopes	2	25	3480	17.4	0.28	mod and high	mod and high	mod and high
Ridgeline/ Plateau (Crests)	25	70	2490	435.75	7.07	low and mod	mod and high	low
Totals	11		6160	459.9	7.46			

A total of 35.3 percent of the ground area in the Holsworthy study area was inspected during the survey. An estimated 11 percent of this area providing useable archaeological exposures. These included formed and off-road vehicle tracks, animal digging and burrows, stream and gully erosion banks, drip zones and root disturbance around trees, sheet erosion and surface exposures in rock shelters. Taking into account survey coverage, archaeologically useable exposures, and visibility variables, the effective net survey coverage was around 7.4 percent of the area surveyed and 2.6 percent of the total study area.

The average coverage per person survey day was 12.6 hectares.

It is estimated that around 90 percent of all old growth trees and 95 percent of suitable rock shelters within all sample survey areas were inspected or assessed during survey. An estimated 80 percent of all open context sandstone platforms were also inspected within the survey areas.

Based on these figures it can be concluded that the incidence of rock based recordings (rock shelters and rock platform sites), identified in the survey results are accurate determinations which are at least within five percent of the actual surviving resource. The number of open sites containing artefacts will be considerably under-detected given the low degree of ground surface visibility across most of the landforms, except ridgelines.

5.3 REGIONAL CONTEXT OF SURVEY RESULTS

5.3.1 BADGERYS CREEK

The results of the present study are fully consistent with previous conclusions for the Cumberland Plain. Based on a comparison with the corpus of previous findings, the known and predicted archaeological resource within the Badgerys Creek study area does not stand out as having unique or outstanding features. Nor can the study area be reliably considered to represent a significant potential to include unique or outstanding features to any greater extent than comparable topographies elsewhere within the Cumberland Plain.

The following points summarise the concurrence between the results of the present study and previous conclusions:

- sites and varying artefact densities do occur in all topographic zones;
- sites density is higher in topographies associated with permanent water sources;

- alluvial flats are a high site density zone and appear to have been a focus of Aboriginal occupation;

- basal slopes adjacent to valley floor contexts also have relatively high site densities;

- sites in association with permanent water (secondary or higher order fluvial corridors), tend to be larger and have higher artefact densities and greater complexity than those associated with lesser order drainage lines;

- in line with the results of the recent Rouse Hill investigations, all of the fluvial corridor zones are identified as zones of archaeological potential relative to adjacent topographies (McDonald, 1993; McDonald and Rich, 1993). These zones are likely to contain the larger and more complex sites as well as the least disturbed sub-surface deposits below the plough zone;

- ridgetops in general contain fewer sites; and

- minor gullies (that is, drainage lines outside of fluvial corridors) tend to have low site densities.

The study area does not contain environmental features or characteristics which would indicate a potential for archaeological sites which are atypical, of clear high scientific significance, or inconsistent with the above points. No naturally occurring rocks or minerals within the study area appear to have been a focus for Aboriginal exploitation. It is possible that natural silcrete surface gravels from within the study area were utilised for tool manufacture, however there is no surface evidence for procurement or extraction, and the resource appears to be of a very limited and local nature. Similarly, ochre nodules noted within the study area do not have any associated evidence for Aboriginal use.

The study area consists mostly of an upper portion of the South Creek catchment, but does not include any section of this major Cumberland Plain drainage line or its associated flats and basal slopes. As such the study area is comparable to many other similar upper catchment Cumberland plain topographies. This is further supported by the observation that the extent of previous land surface disturbance, particularly from vegetation clearance, agricultural development, and recent residential developments in no way distinguishes the Badgerys Creek area as a zone of better than average archaeological potential. South Creek is situated within one kilometre of the eastern study area boundary and is likely to contain larger sites, deeper sedimentary contexts and a greater archaeological potential than comparable fluvial corridors within the study area.

5.3.2 HOLSWORTHY

The Holsworthy results characterise the known and predicted archaeological resource of the study area as both consistent with previous findings, and in some cases extending beyond the predictions of previous comparable datasets. These areas of concurrence and departure are effectively summarised by the following outlines:

Site Types and Characteristics

- the Holsworthy study area contains a suite of site types and archaeological features which are characteristic of dissected sandstone plateau topographies throughout the Sydney basin;

- the range and proportion of rock based site types (rock shelters and rock platforms) is broadly characteristic of those recorded previously on the Woronora Ramp. Engraving sites are a rare site type. Grinding groove sites are mostly small;

- the proportion of shelter sites with engravings or grinding grooves is low compared to the adjacent eastern Woronora catchment. This may partly reflect the clinel increase in engravings toward the coast. However, the identification of grinding grooves in occupation shelters as a rare local trait is a confirmation of previous work (McDonald, 1994);

- the proportion of open grinding groove sites associated with abraded channels appears to be les than for the adjacent Eastern Woronora catchment. The correlation between channels and engraved art, another rare rock based site feature, in the Holsworthy study area may be relevant here;

- the Holsworthy study area contains a relatively high percentage of recorded open sites containing artefacts. This has been a poorly detected archaeological component in previous survey work in sandstone topographies in the Sydney basin;

- a large number of the Holsworthy rock shelters contain evidence of historic occupation, such as remnant stone walling and this suggests some potential for discovering 'contact period Aboriginal occupation within the Holsworthy sites and potential archaeological deposits. This potential is supported by the known presence of historic Aboriginal settlements in adjacent areas to the north on the Georges River estuary;

- the frequency of recorded scarred trees within the Holsworthy study area is significantly greater for this rare Sydney basin site type than for other comparable survey areas; and

- the Holsworthy option areas contain site densities which are higher than for comparable survey samples elsewhere on sandstone plateau topographies. The average site density of 4.7 is nearly twice as high as the 2.7 figure recorded for the Eastern Woronora catchment (Sefton, 1990a). If open artefact scatters are removed from the density figure, to make the survey results more comparable, the amended value of 4.3 is still significantly higher.

Potential Archaeological Deposits

- there are 740 predicted potential archaeological deposits in Option A and 566 in Option B; and

- based on investigations on comparable areas, up to 90 percent of the potential archaeological deposit rock shelter recordings will include subsurface archaeological material. This provides a significant local resource base which is applicable to a wide range of scientific fields of research. The potential archaeological deposit resource has the potential to contain evidence which is of regional and possibly national significance. Based on excavations elsewhere in the Sydney Basin, most site occupation is likely to date to within the last 3000 years, however it is also established that some Sydney basin shelters in similar contexts contain evidence of late Pleistocene occupation older than 10,000 years.

Rock Art

- within the bounds of the summary recording notation used in this study, the rock art assemblage contained in the option areas is consistent with previously defined determinations regarding the stylistic heterogeneity and local distinctiveness of many of its traits. Drawn black pigments predominate. Stencils are a small component of the assemblage, in red and white. Drawn red and white pigments are rare, as are graphics in more than one colour. Painted freehand graphics are very rare. Macropods and Anthropomorphs are the dominant motif types. There is a high proportion of indeterminate graphics;

- previously determined schematic characteristics of the Woronora Ramp rock art motifs were confirmed within the Holsworthy study area samples;

- the broadly similar distribution of shelters which contain art and shelters which contain deposit is consistent with the pattern for the whole Woronora Ramp;

- thirty eight percent of shelters containing pigment art also contained surface artefacts and/or archaeological deposit. This is significantly higher than previous reports of around 14 percent (McDonald, 1994);

- most engraving sites occur in creek bed platforms on valley side or valley floor contexts, in contrast to the general Sydney Basin distribution where over half occur on ridgelines and only three percent occur in valley floors;

- the average number of graphics recorded per Holsworthy site (11.2) was found to be slightly higher than comparable Woronora Ramp surveys (for example East Woronora). However the average number of determinate graphics remains consistent at around five per site. This would be likely to rise if comprehensive rock art recording was conducted;

- compared to adjacent regions of the Sydney basin, the Aboriginal rock art of the northern Woronora Ramp contains several distinctive traits and includes a number of uncommon or rare features which may indicate the stylistic transitional nature of the region;

- several sites in each of the Holsworthy option areas include a significant combination of rare rock art traits and archaeological deposit of high potential and consequently have high research potential;

- a distinctive and small group of open engraving sites with ring and pit motifs may conceivably be the result of early historic Aboriginal occupation. Further research is required to clarify this issue. 'Contact' rock art motifs are unknown, and other forms of Aboriginal occupation evidence from the 'contact' period are very rare on the Woronora Ramp. This group of sites may be of high regional significance;

- track motifs appear to account for a higher proportion of total engraved graphics than previously determined for the Woronora ramp (McDonald, 1994); and

- the Holsworthy option areas are likely to contain a substantial and representative proportion of the surviving rock art resource for the whole of the northern Woronora Plateau.

Site Condition and Preservation

The 20th century history of public exclusion, and a restricted range of military uses in the Holsworthy option areas has acted to protect many aspects of the archaeological resource from land use and visitation impacts which now degrade a significant proportion of Sydney Basin sites located elsewhere, and particularly in comparable close proximity to urban areas.

5.4 ABORIGINAL ISSUES AND CONSULTATION

5.4.1 PREVIOUSLY RECORDED ABORIGINAL VIEWS

Badgerys Creek

The *Second Sydney Airport Site Selection Program Draft Environmental Impact Statement* included a section titled 'Concerns of Aboriginal People' (Kinhill Stearns, 1985). The anthropological consultant for this study was referred to Gandangara Local Aboriginal Land Council by the Western Metropolitan Regional Land Council as being the appropriate body to liaise with. She also canvassed other Aboriginal residents from around the area for their views on the project and concluded that:

> 'Generally, there was considerable opposition to the concept of airport development in the area and fears were expressed about the changes to Aboriginal lifestyles which this would cause' (Kinhill Stearns, 1985).

The 'changes to lifestyles' referred to were noise and air pollution, and the loss of the relative peace and quiet of the area. There was also much cynicism expressed regarding employment opportunities for Aboriginal people.

The area was regarded as having characteristics which would have made it of significance in the traditional life of Aboriginal people of the pre-colonial past and, as such it should be retained in as natural state as possible (Kinhill Stearns, 1985).

In response to the Kinhill Stearns (1985) study the members of the Gandangara Local Aboriginal Land Council passed the following motion at a meeting in November, 1984.

> 'That the Gandangara Local Aboriginal Land Council strongly oppose the development of an airport at either Badgerys Creek or Wilton and that land council officers be instructed to lobby to prevent airport development in both these areas' (Kinhill Stearns, 1985).

In addition, a range of actions were recommended by the Land Council in the event that an airport at Badgerys Creek was constructed. These can be summarised by the following points (Kinhill Stearns, 1985):

- contractors to be advised of the protected status of Aboriginal sites and all site discoveries be reported to the National Parks and Wildlife Service;
- all site mitigation work to be checked by the National Parks and Wildlife Service and the Land Council prior to commencement, and that this review process be acknowledged in construction contracts;
- if the Land Council is dissatisfied with actions which damage sites, the Land Council may invoke the Commonwealth *Aboriginal and Torres Strait (Interim) Heritage Protection Act 1984*;
- appropriately trained Aboriginal Sites Officers to be employed in monitoring construction works;
- the Gandangara and Tharawal Local Aboriginal Land Councils to select an appropriate Dharawal language name for the airport;
- an appropriate commemorative tribute to the Aboriginal people of the area to be included in the airport design; and
- an Aboriginal curator of any display items associated with this tribute to be appointed.

Holsworthy

Aboriginal views have not been previously canvassed regarding an airport being constructed at Holsworthy. However, many previous references and acknowledgments of the Aboriginal cultural values of the Holsworthy area exist, particularly in response to the use of the area as a military training area and the growing knowledge about archaeological sites within the area.

The Sydney Prehistory Group (1983) made various references to the high archaeological value of the rock art in the Holsworthy Military Area and recommended that several sites be specifically protected from potential impacts as a result of military activities.

Many recent actions by both the Australian Army and the Tharawal Local Aboriginal Land Council both acknowledge and recognise the high Aboriginal cultural heritage significance of the Holsworthy Military Area. In 1993 the Australian Army was reportedly directing fire away from known areas of Aboriginal sites, in recognition of their heritage values and obligations to

protect such sites (The Sun Herald, July 11, 1993). Close to this time, representatives of the Tharawal Local Aboriginal Land Council were inspecting sites within the Military Area with a view to assessing the 'possibility of Sacred Mens' Sites being present' and how the Land Council should be represented at the Holsworthy Range in the future (Tharawal Local Aboriginal Land Council, internal memo 29 June, 1993). Subsequently in November of that year an agreement was drafted between the Land Council and the Australian Army which allowed for two authorised Land Council members to access the Military Area, subject to conditions, and 'inspect and maintain heritage sites' (Army correspondence 25 November, 1993, ref: 521-1-17). In 1994 the Army engaged an Environmental Manager in recognition of its obligations to appropriately manage the environmental and heritage values of the Military Area. Archaeological sites of known high Aboriginal significance are now excluded from areas subject to potentially damaging training activities (Marina Peterson, pers. comm. 1996).

In 1995 an environmental audit for the Department of Defence found that Aboriginal sites in the Holsworthy Military Area were a 'very rich resource for Aboriginal prehistory' and that the art sites represented 'a very informative and visually impressive body of archaeological evidence' (Axis Environmental/ Australian Museum of Business Services Consulting, 1995). When compared to the destruction and extensive impact which has occurred to Aboriginal sites elsewhere in the Sydney Basin, the Holsworthy area was found to contain 'a body of sites which has considerable integrity and their protection should be a high priority' (Axis Environmental/Australian Museum of Business Services Consulting, 1995).

5.4.2 ABOUT THE BADGERYS CREEK STUDY AREA

Gandangara Local Aboriginal Land Council

Early in the consultation process for this study enquires were made of the Land Council by the project anthropologist and archaeologists as to who were the appropriate people to consult in relation to this Draft EIS. The Land Council indicated that they assumed responsibility for these matters within their Land Council boundaries and could not suggest anyone else whom they felt should be consulted. The views documented below have been expressed by various Gandangara informants in the course of preparing this study.

Some Land Council members perceive the proposed Second Sydney Airport as a stepping stone for further development in the area which would result in a further loss of cultural and environmental heritage. Concerns were also expressed regarding noise pollution. Members of the Land Council's Culture and Heritage Section believed that any airport development in the south-west of Sydney would be the 'thin edge of the wedge' of development in the region and they argued against the proposal.

It was commented upon that Pemmulwuy, a legendary Aboriginal activist of last century, probably visited the area in question (Badgerys Creek) in a recruitment drive and that his 'presence' can certainly be felt there.

At a meeting with the Land Council on January 29 1997, members were informed (by the archaeologists and anthropologist) of the results of the heritage studies in both airport study areas. Members were very interested in the findings and generally expressed their opposition to, and concerns about, the siting of a Second Sydney Airport in either Badgerys Creek or Holsworthy. One member however, did say that a new airport in the area would be 'good for the economy', meaning both the Sydney economy in general and the local economy.

Native Title issues were also discussed and the Land Council expressed some concerns about conflicts of interest between certain Aboriginal groups regarding Native Claims over both Holsworthy and Badgerys Creek.

Consideration was also given to a comparison of both Badgerys Creek and Holsworthy airport sites on Aboriginal cultural heritage grounds. The community expressed a strong opinion against the development of an airport at Holsworthy. When asked why, they replied that there was 'too much out there' and that the area was 'too rich' by which they meant rich both in cultural artefacts and sites and from an environmental perspective. It was noted by some members that although many sites would be destroyed at Badgerys Creek the types of sites in that area were not as varied or unique (for example, there are no Aboriginal art sites at Badgerys Creek) as those at Holsworthy.

The impression gained from this meeting was that the majority of Gandangara Local Aboriginal Land Council members are opposed to developing an airport at Badgerys Creek and that they were eager to add their opinion to the Draft EIS.

The Land Council has indicated that they wish to be involved in all further consultation relating to Aboriginal issues associated with the proposed Second Sydney Airport. Should an airport be built at Badgerys Creek then Land Council representatives wish to be involved in all archaeological salvage works and to monitor construction works. Consideration should also be given to employment opportunities for local kooris.

Some informants have indicated that consideration should be given to using an Aboriginal name (from the local language group) for the proposed airport. Mention was made about Aboriginal themes and cultural tourism opportunities such as handicraft shops within the airport.

Two motions were passed at the Gandangara Local Aboriginal Land Council meeting on 29 January 1997 regarding the proposal:

- when the report comes in from the Archaeologist that a Special General Meeting be held to discuss this issue; and
- that for the purposes of continuity that Navin and Officer (sic) be employed throughout the process.

The following draft recommendations have been presented by the Gandangara Local Aboriginal Land Council in a draft report regarding the Badgerys Creek study area survey:

- the Land Council to undertake further investigation into the location, integrity, ambience and complexity of sites and artefacts located in the study area;
- the Land Council to analyse Aboriginal local and regional significance of sites in the study area;
- further research in the form of appropriate test excavation to be undertaken by qualified archaeologists and Land Council representatives;
- in the event of the Second Sydney Airport being approved at Badgerys Creek, Aboriginal monitors from the Land Council are to be employed at the proponent's expense to monitor for Aboriginal artefacts, relics or skeletal remains being unearthed during development procedures;
- monitors are to be engaged prior to construction commencing;
- if the proposal details change then a further archaeological and Aboriginal survey is to be undertaken; and
- any artefacts found during survey or construction are to be held in the custody of the Land Council.

These recommendations are based on the direct field experience of the members who participated in the survey, and on summary survey results presented to the Land Council in February 1997 (Refer *Appendix C*). A copy of the Land Council report is provided in *Appendix J*.

Darug Tribal Aboriginal Corporation

The Darug Tribal Aboriginal Corporation (a Koori group based at Blacktown and whose area of interest includes Badgerys Creek) responded to consultation

by indicating that they would like to visit the Badgerys Creek site with the archaeologists some time in the future. They indicated that some of their members live in the general Badgerys Creek region, but saw no need to talk with the anthropologist because they have 'lost all traditional knowledge'. Several family groups were noted as having a residential association with the general region, including Narellan, Hoxton Park and Liverpool, and being descendants of original Darug ancestors including Merri Merri.

Korewal Elouera Jerrungarugh Tribal Elders Aboriginal Corporation

Members of this organisation have submitted a large Native Title claim over a large portion of the southern Sydney Basin which includes all Crown lands or lands held by the Crown within the Badgerys Creek study area. The claim is on behalf of the 'Gundu-Ngura' people (NC96/21).

This submission states that the 'Gundu-nguru people have always occupied this land' and that it contains 'much rock and cave art and Lore, and sacred sites and places...' (NC96/21). Proposed and existing developments, such as the proposed airport, are referred to as 'inappropriate activities' (NC97/3). A legally defined right of access and control of site management is requested.

In discussions held with relevant members of the Elders Corporation, the basis for the submission of the Native Title claim by an organisation member was described in terms of descent from ancestors of known local tribal affiliation. Further information regarding traditional lore or other cultural values relevant to the Badgerys Creek study area was not provided.

Campbelltown City Council Aboriginal Advisory Committee

The following points were made at a meeting of the Campbelltown City Council Aboriginal Advisory Committee held on December 10, 1997. This committee includes representatives of both the Gandangara and Tharawal Local Aboriginal Land Councils:

- continuous consultation with the key representative Aboriginal organisations throughout the impact assessment, planning and development process is essential;

- recommendations made by Aboriginal organisations must be taken seriously and not ignored as has been the case for many recent local development projects;

- information about sites, and access to this information must be carefully controlled and any restrictions must take into account Aboriginal requirements and concerns for the protection and conservation of sites;

- impact assessment must address both indirect and direct impacts;
- development impacts associated with the airport proposals but outside of the EIS study areas is a concern; and
- a group of Gandangara Local Aboriginal Land Council members would like to inspect the Badgerys Creek study area and a selection of sites in a field trip with the archaeologists.

5.4.3 ABOUT THE HOLSWORTHY STUDY AREA

Tharawal Local Aboriginal Land Council

It is recognised by the local community that there is little traditional knowledge remaining about sites or areas of particular Aboriginal significance in the Holsworthy study area. This has been related to a loss of knowledge through exclusion from the area over a long period of time. The Holsworthy Military Area has been virtually inaccessible to local kooris for over eighty years. Despite this, there has been a long held belief, based on some limited local knowledge that the Holsworthy study area is of major Aboriginal cultural importance because of its Aboriginal history, significant sites and places, and geographic and historical context within the Sydney basin. Locations in the surrounding region are known to have historical significance such as the 1816 massacre site at a gorge near Appin, and an Aboriginal settlement on the Georges River north of the Holsworthy study area. In adjacent areas where access has been less restricted, such as the Woronora catchment area and the upper O'Hares Creek catchment, many significant Aboriginal sites are known. Knowledge about Aboriginal archaeological sites in the Military Area has more recently been available from the results of surveys both by Army and civilian groups and Aboriginal army employees.

With regard to the study area, many community members referred to the large number of archaeological sites which were already known prior to the Draft EIS investigations. Several informants have mentioned a women's 'birthing site' - a tradition apparently based on the interpretation of an engraved motif at a site in the southern portion of the study area. The existence of ceremonial places have also been alluded to by various community members. An individual who assisted with the field survey mentioned becoming very ill as they approached a particular area and suggested that it be investigated further if the proposal to build the airport in Holsworthy is approved.

Aboriginal representatives participated in the site survey of Holsworthy and are now quite familiar with the heritage resource of the Military Area. Based on this knowledge the Tharawal Land Council have expressed grave concerns over the construction of an airport in the Military Area.

It was noted that as the area has been inaccessible for over eighty years the sites have been kept relatively pristine and as such are culturally very important for the Aboriginal people of the region. One comment indicated that the Aboriginal people of the Sydney region have little of their material culture or sites of significance left to them and the sites in the Holsworthy study area are therefore highly valued. The potential destruction of the physical environment was also lamented. Concerns were consistently expressed about the potential loss of landscape, natural habitats, and plants and animals. Serious concern was expressed at the potential for sites to remain undetected or unrecorded in impact areas. The large number of sites and often poor visibility in Holsworthy may mean that sites are destroyed without recordings being made.

There is a general consensus that all available measures would be taken by the Tharawal (and by other koori groups in Sydney and on the south coast) to ensure that their heritage is protected and that an airport is not built at Holsworthy.

Korewal Elouera Jerrungarugh Tribal Elders Aboriginal Corporation

Members of this organisation have submitted several Native Title claims over all or part of the Holsworthy study area on behalf of 'the Traditional Illawarra Tribal Owners' (NC97/3), and the 'Gundu-Ngura' (NC96/21).

These submissions state that known Koori and tribal ancestors occupied these lands and that they contain 'thousands of sacred sites known to National Parks and Wildlife Service (and others too that they don't know of), places of spiritual and cultural significance...' (NC97/3), and that 'There is much rock and cave art and Lore, and scared sites and places...' (NC96/21). Proposed and existing developments, such as the proposed Second Sydney Airport are referred to as 'inappropriate activities' (NC97/3). A legally defined right of access and control of site management is variously requested in both submissions.

In discussions held with relevant members of the Elders Corporation, the basis for the submission of the Native Title claims by various individual members was described in terms of descent from ancestors of known local tribal affiliation. Further information regarding traditional lore or other cultural values relevant to the Holsworthy study area was not provided except in references to the large number of archaeological sites known in the area.

The Korewal Elouera Jerrungarugh Tribal Elders Aboriginal Corporation strongly oppose the proposal for an airport in the Holsworthy Military Area.

Campbelltown City Council Aboriginal Advisory Committee

The following points were made at a meeting of the Campbelltown City Council Aboriginal Advisory Committee held on 10 February 1997. This committee includes representatives of both the Gandangara and Tharawal Local Aboriginal Land Councils:

- continuous consultation with the key representative Aboriginal organisations throughout the impact assessment, planning and development process is essential;
- recommendations made by Aboriginal organisations must be taken seriously and not ignored as has been the case for many recent local development projects;
- information about sites, and access to this information must be carefully controlled and any restrictions must take into account Aboriginal requirements and concerns for the protection and conservation of sites;
- impact assessment must address both indirect and direct impacts;
- development impacts associated with the airport proposal but outside of the EIS study areas is a concern; and
- the reported Holsworthy Aboriginal site with an art motif of a four masted sailing ship (variously reported in the press since 1993, and recently by the National Trust), is actually thought to be situated outside of, and to the south of the study area.

Conclusions

There is general opposition by both the Gandangara and Tharawal Aboriginal communities to a Second Sydney Airport being sited in south-western Sydney. Other groups and individuals consulted have also expressed a similar opinion.

The Gandangara also recognise the relative importance of the Aboriginal heritage resource at Holsworthy (when compared to Badgerys Creek) and have indicated their total opposition to the Holsworthy airport options.

The Tharawal community are totally opposed to the construction of an airport within the Holsworthy Military Area, an area which is seen as being extremely culturally important. The community feel they have a crucial role as custodians of their heritage for future koori generations. Opposition to the Holsworthy airport options from koori groups can be expected to be vocal and relentless.

Aboriginal Land Council reports which include statements of significance for each of the study areas are included in *Appendix J*. At the time of publication of the Draft EIS a statement of significance has been provided by the Tharawal Local Aboriginal Land Council, however its full report remained in preparation.

5.5 ASSESSMENT OF SIGNIFICANCE

5.5.1 ASSESSMENT CRITERIA

The Burra Charter of Australia defines cultural significance as 'aesthetic, historic, scientific or social value for past, present and future generations' (Australian ICOMOS, 1988). The assessment of the cultural significance of a place is based on this definition but often varies in the precise criteria used according to the analytical discipline and the nature of the site, object or place.

In general, Aboriginal archaeological sites are assessed using five potential categories of significance:

- significance to contemporary Aboriginal people;
- scientific or archaeological significance;
- aesthetic value;
- representativeness; and
- value as an educational and/or recreational resource.

Many sites will be significant according to several categories and the exact criteria used will vary according to the nature and purpose of the evaluation. Cultural significance is a relative value based on variable references within social and scientific practice. The cultural significance of a place is therefore not a fixed assessment and may vary with changes in knowledge and social perceptions.

Aboriginal significance can be defined as the cultural, social and historical values of a place held by and manifest within the local and wider contemporary Aboriginal community. Places of significance may be landscape features as well as archaeologically definable traces of past human activity. The significance of a place can be the result of several factors including: continuity of tradition, occupation or action; historical association; custodianship or concern for the protection and maintenance of places; and the value of sites as tangible and meaningful links with the lifestyle and values

of community ancestors. Aboriginal cultural significance may or may not parallel the archaeological significance of a site.

Scientific significance can be defined as the present and future research potential of the artefactual material occurring within a place or site. This is also known as archaeological significance.

There are two major criteria used in assessing scientific significance:

- the potential of a place to provide information which is of value in scientific analysis and the resolution of potential research questions. Sites may fall into this category because they: contain undisturbed artefactual material, occur within a context which enables the testing of certain propositions, are very old or contain significant time depth, contain large artefactual assemblages or material diversity, have unusual characteristics, are of good preservation, or are a constituent of a larger significant structure such as a site complex; and

- the representativeness of a place. Representativeness is a measure of the degree to which a place is characteristic of other places of its type, content, context or location. Under this criteria a place may be significant because it is very rare or because it provides a characteristic example or reference.

The value of an Aboriginal place as an educational resource is dependent on the potential for interpretation to a general visitor audience; compatible Aboriginal values; a resistant site fabric; and feasible site access and management resources.

The principal aim of cultural resource management is the conservation and management of a representative sample of site types and artefactual variation from differing environmental and behavioural contexts. Sites with inherently unique features or which are poorly represented elsewhere in similar environment types, are considered to have relatively high cultural significance.

In addition to assessments of individual and place-specific archaeological materials, a dependent sphere of significance can also be defined, which recognises complimentary and contextual associations across and between individual place boundaries. Such a network is often described in terms of a site complex and may be defined in terms of shared attributes such as a particular landscape, a theme in occupation or exploitation, or relevance to common research questions. This concept is particularly relevant to the proposed airport option areas which will obliterate a large and locally resident assemblage with little or no opportunity for the reservation of representative samples. The representativeness of the airport option areas as a whole, and the significance derived from potential interrelations across surviving sites must

also be considered. These aspects are considered for each study area under the sub-heading *Collective Values* in *Section 5.5*.

The cultural heritage significance of a place can be usefully classified according to a comparative scale which combines a relative value with a geographic context and area of reference. For this investigation, a 3 by 3 matrix was adopted which provides for a site or feature to be of low, moderate or high significance within a local, regional or national context. This system provides a hierarchy in which a small scale of referral, such as a local rating, defines a sphere of relevance and significant context, which is more limited than a larger scale, such as a regional or national rating. This should not be taken to imply that places of local significance necessarily warrant less conservation than regionally rated places. A place of high local significance may have a comparable level of value within its local context, to a place of high regional or national significance. Similarly it can be stated that the conservation of regionally rated places is of little value if appropriate locally rated places are not also conserved.

For the purposes of this study, the local context is defined as the Cumberland Plain for the Badgerys Creek study area and the Woronora Ramp for the Holsworthy study area. The regional area for both study areas is defined as the Sydney - Bowen sedimentary Basin. This includes all of the topography formed on the approximately horizontally bedded sedimentary facies and dissected plateau lands of the central NSW coast, and extends inland to the Great Divide and the start of the Western Slopes.

All sites and isolated finds located within Badgerys Creek Airport Options A, B and C and Holsworthy Airport Options A and B have been assessed using the criteria outlined above. The following is a brief outline of the characteristics associated with the summary ratings used in formulating significance assessments for individual sites or places. A basic three or four tiered classification is used in order to be consistent with the broad scale character of the surface survey data.

Research Potential (Descriptive traits are not necessarily exclusive to each category)

0 negligible research potential (poor condition, single artefact, no potential to be larger or to contain in situ material);

1 minimal research potential (poor condition, few artefacts, limited potential to be larger or to contain in situ archaeological deposit, indeterminate or poorly preserved graphics);

2 good research potential (generally fair condition plus any of the following: moderate artefact assemblage, uncommon artefact types, good potential for in situ archaeological deposit, graphics with moderate research potential, potentially including moderate densities, stylistic diversity and pigment preservation); and

3 excellent research potential (generally good condition plus any of the following: large artefact assemblages, rare artefact types, high potential for in situ archaeological deposit, unusual context, a large graphic assemblage and/or rare stylistic traits, a relatively high degree of graphic preservation, moderate to high graphic density and superimpositions).

Representativeness

1 a common site or feature type;

2 less common; and

3 uncommon features and/or a well preserved and representative example.

Educational/Recreational Values

0 poor (the site or feature may be in poor condition, be difficult to detect, interpret or access);

1 fair (may have limited potential to demonstrate important aspects of Aboriginal culture or the study and appreciation of Aboriginal culture);

2 good (moderate educational potential, with the potential for relatively good conditions for public access and visitor control); and

3 excellent (moderate to high educational potential and actual or potential means for public access and visitor control).

Aesthetic Values

0 poor (the site may be difficult to detect, be in poor condition, of limited appeal, or contain features which are visually inaccessible or difficult for a visitor to adequately experience);

1 fair (may have more than limited appeal or visual accessibility);

2 good (moderate or better visual accessibility with a notable subject, range and/or diversity of perceptual experiences); and

3 excellent (excellent visual accessibility with some outstanding components in subject, range and/or diversity of perceptual experiences).

The assessment of research potential included consideration of the following identified research themes:

Badgerys Creek

- the age of Aboriginal occupation and change in exploitation and occupation patterns over time. In particular, research into Pleistocene occupation patterns, population dynamics and social group differentiation, and change in the use and occupation of open sites (compared to shelter sites);

- the exploitation of natural resources and its role in the patterns of occupation across the cultural landscape;

- the types of behaviours and occupation patterns which are indicated or can be inferred by open artefact scatters and their artefactual content;

- how background levels of artefacts can be effectively defined and what they represent;

- patterns in the distribution and exploitation of lithic and other materials across the Sydney basin, such as silcretes, tuffs and pigments, which may be indicative of exchange networks and social boundaries;

- the development and sequence of technological change over time and space. Are there localised variations to regional and national trends and how can they be interpreted?; and

- the interpretation and verification of Aboriginal scarred trees, including the improvement of existing interpretive criteria.

Holsworthy Military Area

In addition to the themes identified as relevant to Badgerys Creek:

- the identification and effective description of the stylistic variability of the rock art assemblage, and relating these to the behaviours, cultural and social dynamics of the art makers and users;

- the interpretation and analysis of the rock art of the Holsworthy and Woronora Plateau areas, as a distinct, but also consistent component of the rock art of the Sydney basin;

- the development and application of techniques for the conservation and management of rock art on sandstone surfaces;

- the development and application of absolute dating techniques of rock art on sandstone surfaces;

- how, if at all, are the art assemblages from pigment sites and engraved sites related in function or origin, and how can the similarities and contrasts between these two assemblages be interpreted in terms of past human behaviours and social dynamics;

- intra site patterns of rock shelter occupation, including the use of space, functional differentiation and specialisation, and change through time;

- intra and inter site variation across grinding groove sites and how these can be interpreted in terms of past behaviours and exploitation patterns across space and through time; and

- the archaeological record of the 'contact' period, when both European and Aboriginal people occupied the land and inter-related. Does an archaeological record of this period exist and how can it add to this poorly documented period in history?

5.5.2 SCOPE OF ASSESSMENT

The scope of the assessment of significance values conducted for this study was bounded by the following factors:

- all of the recordings within the study areas are based on surface based survey and inspections;

- no archaeological excavations have been conducted within either the Badgerys Creek or Holsworthy study areas;

- all assessments of sub-surface archaeological deposits are predictive;

- rock art recordings are summary in nature, are based on a brief visual inspection, and do not quantify many forms of stylistic variation; and

- the local and regional comparative database is limited in the scope of previous survey coverage, and the categories of information collected.

There are, as a consequence, two main areas in which the assessments generated by this study represent conservative determinations. These are the assessment of sub-surface deposits and the assessment of rock art. Most factors which determine the scientific value of a deposit, such as the age, duration and

intensity of occupation, the extent of deposit disturbance, and the type and distribution of surviving material cannot be anticipated from surface evidence. Surface based assessments can evaluate the potential for deposit depth, ground disturbance, and surface artefactual associations, and these can be placed within a relative comparison with the potential archaeological resource of surrounding areas. However, this effectively restricts determinations to a local scale of assessment. Factors which designate regional or national significance, such as ancient or distinctive evidence of Aboriginal occupation, can only be identified from excavation. The proportion of archaeological deposits which are above a local scale of significance is therefore likely to be under-represented in this investigation, particularly for the Holsworthy airport options. The impact of agricultural disturbance and the upper catchment context of the Badgerys Creek options present more reliable interpretive constraints on archaeological potential and significance.

The rock art of the Woronora Plateau is typically in poor condition and consists of narrow drawn lines which are frequently superimposed. This represents a considerable recording constraint because the creation of a comprehensive recording may require extensive onsite scrutiny and a significant investment in time. The option of creating comprehensive art recordings was not available to the present study and the summary recordings produced must be interpreted appropriately. Graphics which require detailed inspection to interpret their original form are likely to be recorded as indeterminate and the number of graphics is likely to be under-estimated.

The assessment of the significance of rock art within the Sydney basin can, as yet, only be conducted according to a small number of the total defining variables which could potentially describe the stylistic variation of this region. This is due partly to the limited nature of comparative regional analyses, as well as the largely undeveloped state of scientific methodologies for the classification of fine scale stylistic variation in rock art. The conventional typologies often provide a poor measure of the actual stylistic variation present in an art assemblage. Quantification of a these can provide a misleading and over simplified characterisation.

With these limitations in mind, the assessment of rock art for this study was broadly based on two datasets: key quantified variables derived from the summary data compiled during the field survey; and local and regionally scaled evaluations researched in more depth in previous studies. The key variables used from the summary data were:

- the number of graphics and determinate graphics at a site - sites with large assemblages and determinate graphics, are likely to have greater research potential;

- the density of graphics and incidence of superimpositions - higher values will tend to indicate greater research potential and possibly a longer period of occupation;

- stylistic diversity, such as the range of motif types, colours, techniques, form, and schemas present - greater diversity will tend to indicate greater research potential;

- condition, clarity and aesthetic value of the art - graphics which are clear, well preserved or visually accessible will tend to have greater scientific and educational value; and

- rarity relative to landscape context, the location of art within the site, or other combination of stylistic variables.

The thesis by Officer (1984), and the Sydney basin rock art studies by McDonald (1990, 1994) provide both local and regionally scaled analyses relevant to the assessment objectives of the present investigation. Officer (1984) provides a fine scale characterisation of a sample of the Holsworthy rock art based on detailed recordings made by the Sydney Prehistory Group. The findings of this study were drawn upon in assessing significance ratings under research and representative criteria. The larger scaled analyses of McDonald (1990, 1994) place Holsworthy within the context of the wider Sydney basin and were similarly utilised in this assessment. Both of these studies were relied upon in the identification of rare or potentially significant stylistic traits.

5.5.3 BADGERYS CREEK

Site Specific Values

Table I1 in *Appendix I* provides a summary of significance assessments for the known recordings in Badgerys Creek according to all criteria except for Aboriginal contemporary values. These are dealt with separately in the Land Council reports as provided in *Appendix J*. All assessments are based on known surface traits, together with estimates of subsurface potential based on the surface recordings and the results of comparable sub-surface investigations elsewhere on the Cumberland Plain.

Ninety seven sites or isolated finds and one potential archaeological deposit are assessed. All recorded sites and features are considered to fall within a local context of significance only. Sixty eight percent are assessed as having low significance (67 locations), 30 percent as having moderate significance (29 locations), and two percent as having high significance.

The zones of archaeological potential identified within the minor and secondary fluvial corridors are considered to have mostly local significance. Those with moderate or high archaeological potential are shown on *Figure 5.3*. This is based on the absence of any broad environmental or archaeological characteristics which clearly differentiate the study area as applicable to research themes which could not equally addressed elsewhere within the local region. It must however be acknowledged that it is impossible to be certain of assessments based, in this way, on surface and contextual evidence. Below the plough zone and within the deeper sedimentary deposits of the lower Badgerys Creek fluvial corridor, the potential for significant archaeological deposits within a regional context cannot be wholly discounted.

Collective Values

The collective values of the known and predicted archaeological resource within any of the proposed airport options in the Badgerys Creek study area are limited by the following points:

Factors which promote collective values are:

- the existence of archaeological potential below the plough zone in aggrading landscape contexts within fluvial corridors is the main promoting factor within the Badgerys Creek study area; and

- the developed nature of the airport option areas facilitates access for sub-surface excavation research.

Factors which limit collective values are:

- the extent of previous landsurface disturbance within the study area means that only below plough zone contexts are likely to contain undisturbed artefactual material. This effectively negates the collective values of the majority of the surviving resource within the study area which is mostly located in the plough effected soil zones;

- the existence of intensive and focused forms of disturbance within particular landform zones, such as road construction and verge development on crests, small block subdivisions across much of the eastern, southern and south-western sections, and changes to the stream channel morphology as a result of vegetation clearance, agricultural development and changed sediment regimes. These impacts severely reduce the representativeness of the study area as a topographically defined site complex;

- the suite of landform types and their interrelation within the study area can be found in many other sections of the Cumberland Plain. A possible exception is the basaltic dyke in the western section of the study area, however an extensive search failed to detect any Aboriginal exploitation of this rock type, or site traits specific to this terrain sub-type;

- the complexity, discontinuity and diversity of existing land tenure within the study area would make the integrated management and conservation of the surviving archaeological resource an expensive exercise which would be difficult to justify given the nature and condition of the resource; and

- the study area lacks a representative portion of the main South Creek fluvial corridor which would form an integral component of any reserve of an upper catchment Cumberland Plain archaeological landscape.

In summary, the surviving archaeological resource within the Badgerys Creek airport options have negligible collective values as a scientifically significant suite or complex of Aboriginal sites.

The Gandangara Aboriginal Land Council have identified that the Badgerys Creek study area is valued by the local Aboriginal community both for the Aboriginal sites which survive there, and its remaining natural environment. It is stated that 'although somewhat disturbed by European occupation, [the environment] still has an affiliation with the Aboriginal people as it contains significant tangible (visible) and intangible (invisible) cultural significance that is a part of Australia's true history.' The natural environment of Badgerys Creek is 'important to the Aboriginal community because Aboriginal people see themselves as part of nature and nature as part of themselves.' (Refer Land Council report contained in Appendix J).

5.5.4 HOLSWORTHY

Tables I2 and *I4* in *Appendix I*, provide a summary listing of significance assessments for all comprehensive survey recordings within Holsworthy Options A and B, based on all criteria excepting Aboriginal contemporary values.

Tables I3 and *I5* in *Appendix I*, provide a summary listing of previously recorded sites within Holsworthy Options A and B which were not inspected during the study or generated from previous comprehensive surveys. These ratings are based on information sources which vary in quality, comprehensiveness and consistency and are provisional only. They are included primarily to ensure that sites of known archaeological significance

Boundary of airport option A
Boundary of airport option B
Boundary of airport option C
Areas of moderate or high archaeological sensitivity
Isolated find
Open site (including artefact scatters and grinding groove sites)

Figure 5.3

Zones and Sites of Moderate or High Archaeological Potential in the Badgerys Creek Study Area

are taken into account in the assessment of the potential impacts for each option.

Site Specific Values - Airport Option A

One hundred and ninety two known sites and 12 isolated finds occur within Option A. This total combines sites and isolated finds made during the present study, and all other previously recorded sites. Two hundred and one of these recordings have been assessed.

Of the 111 site and isolated find recordings analysed for this study, 91 percent fall within a local significance scale and nine percent within a regional scale. *Table 5.21* provides a breakdown of the assessment categories. The largest category is low local with 40 percent of the recordings, followed by moderate local (28 percent) and low local (24 percent). This is shown on *Figure 16* in *Appendix L*. No more than four sites occur in each of the regional categories, with three sites assessed as having high regional significance. These sites are H160, H253 and H309, and include significant rock art assemblages, rare site and graphic traits, and high potential archaeological deposits. If the significance of the predicted archaeological resource within Option A followed the same pattern, then approximately 77 recordings would be of high local significance, 29 would have regional significance with 10 in the high regional category.

TABLE 5.21 FREQUENCY OF SIGNIFICANCE CATEGORIES FOR COMPREHENSIVE SURVEY RECORDINGS OF SITES AND ISOLATED FINDS, AND PREDICTED SITES WITHIN HOLSWORTHY OPTION A

Significance Assessment	Number of Recordings from Sample Survey Areas	Percentage of Assessed Recordings	Number of Predicted Recordings for Whole Option Area (Approximately)
Low Local	44	40	128
Moderate Local	31	28	90
High Local	27	24	77
Low Regional	4	4	13
Moderate Regional	2	2	6
High Regional	3	3	10

There are 93 previously recorded sites within Option A which were not used within the Draft EIS analysis. In a similar distribution to the systematic recording data, 96 percent of the provisional assessments of these recordings

fall within the local category, and four percent within the regional. *Table 5.22* provides a breakdown of the assessment categories.

With the addition of the provisionally assessed sites, the Option A 'low local' significance category increases but all other categories decrease slightly. This is likely to be a product of the conservative site assessments provided for these sites. In most cases, limitations in the available data prevent an effective assessment or characterisation of the art assemblages or any potentially occurring archaeological deposits.

TABLE 5.22 FREQUENCY OF PROVISIONAL SIGNIFICANCE CATEGORIES FOR PREVIOUSLY RECORDED SITES WITHIN HOLSWORTHY OPTION A (NOT INCLUDED IN THE ANALYSIS)

Significance Assessment	Number of Recordings	Percentage of Assessed Recordings
Low Local	56	62
Moderate Local	21	23
High Local	9	10
Low Regional	3	3
Moderate Regional	1	1
High Regional	0	0
Unassessed	3	-

There are 144 recordings of potential archaeological deposits within Option A. One of these is an open location and the remainder are rock shelters. The assessment of the archaeological potential of these locations provide the only effective means for assessment in the absence of any evidence of Aboriginal occupation. Nearly three quarters of these recordings are assessed as having low to moderate potential only, with 28 percent having from moderate to high potential.

All locally elevated and well drained sedimentary contexts in valley floor alluvial flats are considered to have archaeological potential within Option A. This zone is conservatively estimated to include at least 300 hectares.

Site Specific Values - Airport Option B

Ninety two known sites and seven isolated finds are located within Option B. This total combines sites and isolated finds made during the present study and all other previously recorded sites. Ninety two of these have been assessed.

Of the 59 site and isolated find recordings analysed for the study, 90 percent fall within a local significance scale and 10 percent within a regional scale. This division is the same as for Option A. *Table 5.23* provides a breakdown of the relative assessment categories, which also closely resemble the Option A frequencies. The largest category is low local with 42 percent of the recordings, followed by high local (29 percent) and moderate local (19 percent). This is shown on *Figure 17* in *Appendix L*. No more than three sites occur in each of the regional categories, with three sites assessed as having high regional significance. These sites are H64, H802, and H824, and include significant rock art assemblages, rare site and graphic traits, well preserved and visually impressive art, and high potential archaeological deposits. If the significance of the predicted archaeological resource within Option B followed the same pattern, then approximately 58 recordings would be of high local significance, 20 would have regional significance with 10 in the high regional category.

TABLE 5.23 FREQUENCY OF SIGNIFICANCE CATEGORIES FOR COMPREHENSIVE SURVEY RECORDINGS OF SITES AND ISOLATED FINDS AND PREDICTED SITES WITHIN HOLSWORTHY OPTION B

Significance Assessment	Number of Recordings from Sample Survey Areas	Percentage of Assessed Recordings	Number of Predicted Recordings for Whole Option Area (Approximately)
Low Local	25	42	84
Moderate Local	11	19	38
High Local	17	29	58
Low Regional	3	5	10
Moderate Regional	0	0	0
High Regional	3	5	10

There are 40 previously recorded sites within Option B which were not used within the analysis. In a similar distribution to the systematic recording data, 94 percent of the provisional assessments of these recordings fall within the local category and six percent within the regional. *Table 5.24* provides a breakdown of the assessment categories.

Similarly to Option A, when the provisional assessments are added to the total, the percentage of 'low local' sites rises and most other categories drop.

TABLE 5.24 FREQUENCY OF PROVISIONAL SIGNIFICANCE CATEGORIES FOR PREVIOUSLY RECORDED SITES WITHIN HOLSWORTHY OPTION B (NOT INCLUDED IN THE ANALYSIS)

Significance Assessment	Number of Recordings	Percentage of Assessed Recordings
Low Local	19	57
Moderate Local	9	27
High Local	3	9
Low Regional	2	6
Moderate Regional	0	0
High Regional	0	0
Unassessed	7	-

There are 108 recordings of potential archaeological deposits within Option B. All recordings are shelter locations. The assessment of the archaeological potential of these locations provide the only effective means for assessment in the absence of any evidence of Aboriginal occupation. In a similar pattern to Option A, nearly three quarters of these recordings are assessed as having low to moderate potential only, with 20 percent having from moderate to high potential (eight are unassessed).

All locally elevated and well drained sedimentary contexts in valley floor alluvial flats are considered to have archaeological potential within Option B. This zone is conservatively estimated to include at least 200 hectares.

Collective Values - Airport Options A and B

The collective values of the known and predicted archaeological resource within both of the Holsworthy airport options can be summarised by the following points and is shown in *Figure 5.4*:

Factors which promote collective values are:

- the acknowledged Aboriginal cultural values of the Holsworthy Aboriginal sites are best interpreted and conserved within a collective and inclusive landscape based approach;
- archaeological sites and deposits are likely to be well preserved due to minimal landsurface disturbance from human land use over a large proportion of each option area;
- destruction of archaeological sites through gross landsurface disturbance is highly restricted in area and distribution to small portions

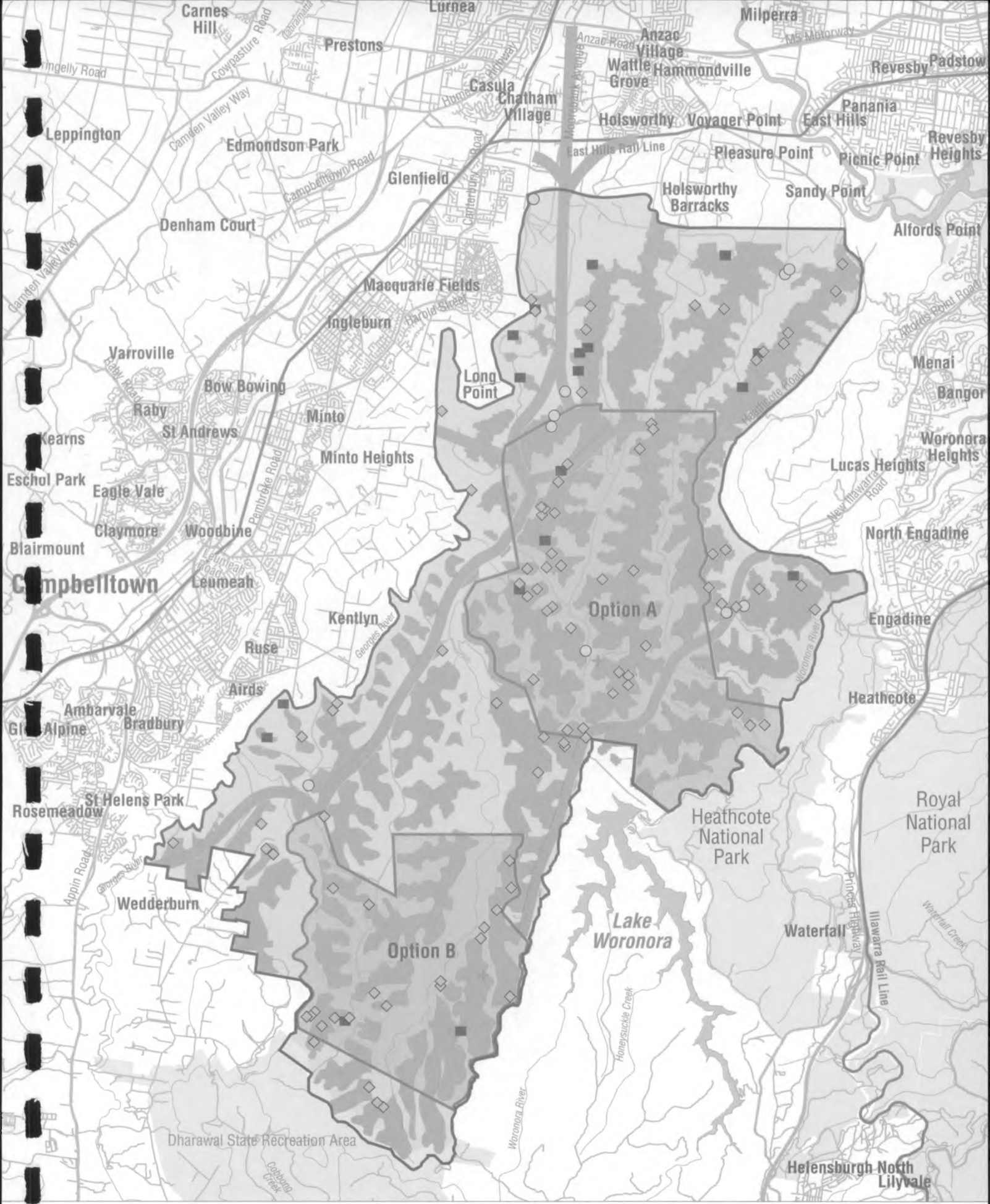


Figure 5.4

Zones and Sites of Moderate or High Archaeological Potential in the Holsworthy Study Area

of ridge crest topography, and to target areas subject to a high density of explosive impacts;

- the Holsworthy landscapes contain a high density of sites (relative to both local and regional scales), and a diversity of site types and artefactual material;

- the Holsworthy landscapes contain a representative range of Aboriginal sites, within a relatively undisturbed natural setting;

- many regionally rare, and some unique artefactual traits, occur within each of the Holsworthy airport options;

- the majority of art sites with large numbers of graphics and motif types in the Holsworthy study area (Officer 1984), occur within Holsworthy Option A;

- the high density of sites and often close or grouped spatial associations between the Holsworthy sites provides for high scientific and educational values when sites and potential deposits are considered or assessed collectively;

- a significant proportion of Aboriginal scarred trees appear to have survived within the Holsworthy landscapes. This incidence of survival is unlikely to be found elsewhere in the Sydney Basin due to the historically unique restrictions on logging created by military use from the turn of the century;

- the incidence of graffiti in the Holsworthy rock shelter sites, and notably in rock art sites, is dramatically less within the Holsworthy options, and negligible when compared to sites in adjacent areas in close proximity to Campbelltown residential development. The conservation of rock art in these areas tends to be focussed on large or highly significant sites. Smaller sites consequently deteriorate. The Holsworthy sites therefore represent a valuable conservation opportunity where a representative range of small and large sites remain with minimal or no impact from visitors;

- both Holsworthy airport options contain a large proportion of the known and predicted archaeological resource of the northern Woronora Ramp; and

- the rock art of the northern Woronora Ramp is known to include a wide range of fine scale stylistic variation (Officer, 1984), and a distinctive set of broad scale traits which distinguish it from the rest of the Sydney Basin (McDonald 1990, 1994). Consequently, a collective and

landscape based approach is the most appropriate means of identifying and maintaining a representative sample.

Factors which limit collective values are:

- the presence of unexploded ordnance at various densities throughout each of the option areas is a significant constraint to access, future research, and public interpretation values;

- previous military use of the Holsworthy landscapes has variously impacted archaeological sites, particularly through projectile impact and off-road vehicle disturbance. A significant proportion of ridgeline plateau topography has been modified through these processes; and

- continued military training activities within Holsworthy have the potential to reduce collective values if they are not appropriately managed and areas of archaeological sensitivity are avoided.

In summary, the surviving archaeological resource within both of the Holsworthy airport options have high collective values. The Aboriginal, educational, scientific and aesthetic values of individual sites are increased and augmented if they are considered as a collective whole. This evaluation recognises the Holsworthy airport options as Aboriginal cultural landscapes where a suite of differing and well preserved archaeological traits are conserved, in situ, within their original determinate landscape contexts.

Within the local context of the Woronora Ramp, the Holsworthy study area and the Holsworthy airport options in particular, represent cultural landscapes which are not replicated elsewhere on the plateau. The high site density and distinctive rock art assemblage of these areas differentiate them from other similarly remote areas of the plateau. The exclusion of major development, logging and mining works also provides a clear distinction. The creation of Sydney water supply impoundments has removed most of the valley floor environments from the major fluvial corridors on the Plateau. The presence of underground coal mining over much of the plateau may also have indirectly impacted the surviving archaeological resource through land surface subsidence and surface infrastructure. The exclusion of commercial logging from the Holsworthy Military Area since its establishment appears to be a major factor in the high incidence of surviving scarred trees. It is unlikely that similar restrictions occurred elsewhere on the plateau until much later.

Within the regional context of the Sydney Basin, the Holsworthy study area and airport option areas represent a high value sample of a distinctive southern variant of the archaeologically manifest cultural dynamics of pre-European Aboriginal culture. Areas of comparable site density and rock art diversity are known to occur elsewhere within the Sydney Basin (such as the Warre Warren

Aboriginal Place), but differ in their local characteristics and are often in a poorer state of preservation, particularly in high sensitivity landforms.

A relative evaluation of the Holsworthy collective cultural heritage values within a national context cannot be fully determined without further research. The area's extensive potential and predicted archaeological resource holds considerable potential for containing cultural material of importance to national themes of Aboriginal significance and research. Certainly the present state of knowledge indicates that as a collective assemblage, the area's rock art has high Aboriginal and scientific significance, and is a significant sample within the national spectrum of surviving Aboriginal rock art.

Aboriginal Cultural Values

Following the initial drafting of this Technical Paper, two statements of significance relating to the Aboriginal cultural values of the Holsworthy study area have been produced. These are a brief statement provided by the Tharawal Local Aboriginal Land Council (Refer Appendix J) and a statement supporting the Interim Listing of the Holsworthy Military Area of *Cubbitch Barta* on the Register of the National Estate (Refer Appendix N). The nomination of *Cubbitch Barta* was at the instigation of the Tharawal Local Aboriginal Land Council.

In summary, these documents state that the Holsworthy Military Area is of outstanding heritage value and is highly valued by the local Aboriginal community for the Aboriginal places, traditional and historic associations and cultural landscape values if incorporates. The area provides symbolic, cultural, educational and social associations which both demonstrate past Aboriginal lifestyles and enable the maintenance of contemporary custodial associations and responsibilities. The archaeological and research values of the area (defined in the previous section), are recognised as an integral component of the Aboriginal cultural values, particularly in the potential to gain further knowledge about past Aboriginal society.

Part C

Assessment of Impacts

CHAPTER 6 IMPACT CATEGORIES

The impact to cultural heritage places and values which may potentially result from the construction and operation of the Second Sydney Airport can be effectively assessed under the categories of direct and indirect impacts, and construction and operational impacts.

With regard to archaeological and scientific values, impact can be effectively defined as deterioration in the physical content and environmental context of a place or feature.

Impact to cultural and social values includes both the physical environment and the culturally defined perceptions of that landscape. A site which remains physically intact, can still be subject to impact if its heritage values relate to non physical attributes such as function or context. Developments will often change the context of surrounding places or impose limitations on their future function. The assessment of impacts to heritage values which are resident within the perceptions of contemporary culture must therefore involve evaluations derived from the community who hold those perceptions. Impacts to Aboriginal values, as opposed to scientific or archaeological values, can therefore only be adequately assessed by appropriate custodial Aboriginal Communities, through appropriate processes of representative consultation.

6.1 DIRECT IMPACTS

Direct impacts are defined as all those changes which result from the actual physical transformations of the *intended* structures and actions which constitute the Second Sydney Airport proposal. All direct impacts to cultural heritage places and values would most probably occur during the construction of the proposal.

In the following chapters the assessment of the zone of direct impact is limited to within each of the study areas, and taken to be the combined areas of the following:

- the boundary of the proposed airport site;
- the area of any required cut and fill, including borrow areas, Obstacle Limitation Surface cut areas and fill batters;
- the area of any required tree felling; and
- the alternative alignments of the proposed access (infrastructure) corridors.

In terms of the archaeological resource, the direct impact resulting from the construction of the Second Sydney Airport would be effective destruction. Destruction would result either from physical obliteration, or through loss of any feasible access such as from the burial of deposits with landfill. Due to the large scale and limited flexibility of the major elements of an airport's design, the potential to mitigate impacts by avoiding physical impact is minimal. The zone of direct impact would include the entire land platform of the airport site (including passenger terminals, runways and aprons, freight, maintenance, fuel and commercial facilities, air traffic control, meteorology and fire safety facilities), associated earthworks and construction facilities, and service or infrastructure facilities such as roads, railways, pipelines and transmission lines.

In terms of Aboriginal cultural values, impact may vary between concepts of total destruction to continuity of meaning despite, or via, physical transformation. An example of the latter could conceivably be the burial of a place of significance under fill, where the values of that place may endure despite permanent physical inaccessibility. Alternatively a place could conceivably be transformed but not destroyed within the contemporary context of an airport.

6.2 INDIRECT IMPACTS

Indirect impacts are defined as all consequential changes derived from a development which are not the result of the actual physical transformations which constitute the development's intended structures and actions.

The indirect physical impacts of the Second Sydney Airport would variously occur within a range of distances from the airport site and/or its infrastructure and service corridors. The areal extent and severity of indirect impact would vary according to the nature of the processes involved. Impacts may also result from changes in the human environment, such as land use, perceptions of value and management practices.

The construction of access and service corridors may also have indirect contextual impacts such as subdividing or truncating site complexes, degrading visual quality or diminishing the landscape integrity of a site.

In terms of the archaeological resource, detrimental indirect impact to the known or potential resource may include:

- increased human visitation;
- changed sedimentation regimes;

- changed micro-climate and protective vegetation;
- changed air quality and airborne pollution;
- increased dust and accumulation rates;
- fire impact due to changed fire management strategies;
- changed water table conditions and subterranean flow patterns;
- physical proximity to facilities;
- reduction of interpretive and contextual landscape qualities; and
- subdivision of site complexes.

The potential impacts of airport derived airborne pollution on sandstone based Aboriginal sites (such as pigment art sites, and open engravings or grinding groove sites), are impossible to predict or reliably define. Little work has been conducted on the potential impact of airport pollution on Aboriginal sites and no comparative data is available. This field of impact assessment is further obscured by the fact that physical and chemical surficial processes relevant to the stability of rock art are still largely unknown and unresearched. In addition the impacts of other environmental contaminants or natural processes of deterioration would need to be identifiable and distinguished from potential airport impacts. Due to both a lack of data or a body of supporting research, it is not possible to effectively address this issue at the Draft EIS stage of assessment.

Indirect impacts to Aboriginal cultural values may be measured in both terms of physical deterioration (as outlined above) and the impact to associative and contextual values. The presence and proximity of a major airport may or may not be considered to impact upon adjacent places or broad scale landscape values. A structure may, for example, be considered to be incompatible with a landscape's cultural values due to its size, form or the technologies implemented. The definition of impact is dependent upon contemporary Aboriginal perceptions of meaning and the functional contexts of belief and practice. These interpretive contexts do not remain static and it can be expected that 19th century or 'traditional' approaches will have been transformed and adapted in line with contemporary changes in Aboriginal societies.

6.3 CONSTRUCTION IMPACTS

Construction impacts are defined as all direct and indirect impacts which result from activities conducted during construction of the Second Sydney Airport and its associated infrastructure.

6.4 OPERATIONAL IMPACTS

Operational impacts are defined as all direct and indirect impacts which result from activities conducted during the operation of the Second Sydney Airport.

CHAPTER 7 IMPACTS OF BADGERYS CREEK OPTIONS

The impacts of the Badgerys Creek options on Aboriginal archaeology have been assessed assuming that no mitigative measures are in place. Some of these impacts (mostly the indirect impacts) could be reduced or ameliorated by implementing the management measures proposed in this Chapter and Chapter 9.

7.1 AIRPORT OPTION A

7.1.1 DIRECT IMPACTS

A total of 60 known sites or isolated finds are located within the area of Badgerys Creek Option A. These comprise 25 open artefact scatters, five scarred trees and 30 isolated finds. Five of these recordings are associated with recorded potential archaeological deposit.

The predicted archaeological resource for the Option A area is in the order of 119 surface sites and isolated finds with potential areas of in situ subsurface archaeological material occurring mostly within minor and secondary fluvial corridors. There is approximately 3.1 square kilometres of fluvial corridor within Option A, including the western flats and basal slopes of Badgerys Creek and a substantial portion of Oaky Creek.

All but a small minority of the archaeological resource in Option A is likely to be impacted upon (destroyed) by construction of the Second Sydney Airport. Both permanent and temporary construction impacts are likely to extend across the majority of the Option A landscape including cut and fill areas, construction camps, trackways, and stockpile areas. All of the minor drainage lines and fluvial corridor zones would be substantially altered through the creation of retention basins and channel modifications.

Areas of surviving resource may survive within the narrow margin of land between the boundary road on the outside of the proposed south-eastern perimeter fence and the bank of Badgerys Creek. This margin is likely to be no more than 100 to 150 metres in width and would be discontinuous according to the extent of landscaping and channel modification required along Badgerys Creek. Small areas of sub-surface archaeological material may also survive in retained pockets of existing tree cover within the airport grounds, however the size and quality of this resource would not justify the management strategies required to conserve them. The potentially surviving resource adjacent to Badgerys Creek is likely to contain deep sedimentary

contexts and may justify management strategies to actively conserve them. A recorded scarred tree occurs within this zone.

7.1.2 INDIRECT IMPACTS

Given the type and already disturbed nature of the adjacent surviving archaeological resource in the Badgerys Creek region, there are only a limited number of construction and operational indirect impacts which could pose a significant threat. Most of the surviving resource occurs on or below the ground surface and would therefore be protected from dust, noise or atmospheric pollution. The existing landscape context of sites in the Badgerys Creek region retains little original or Aboriginal character, and the presence of an airport would not significantly impact these already diminished contextual and interpretive values. An exception to this may be the interpretive contexts of more distant Aboriginal places of significance, such as Bents Basin on the Nepean River. This location could be subject to greater visual and noise intrusion from aircraft.

The main potential indirect impacts are anticipated to be:

- the erosion or siltation of sites in downstream contexts as a result of changed sediment and flow regimes both during construction and airport operation. The surviving downstream or adjacent sections of Oaky, Cosgroves and Badgerys Creek are the most likely zones to be subject to this form of deterioration;

- operational impact to adjacent living scarred trees as a result of changes to air quality and increased insect attack due to a smaller resident or visiting bird population;

- increased visual and noise intrusion to the contextual landscape of Bents Basin; and

- impact to sites as a result of potentially increased commercial and industrial development of the privately owned lands adjacent to the airport.

7.1.3 MITIGATION OF ADVERSE IMPACTS

Direct Impacts

The mitigation of direct impacts resulting from Option A would need to focus on a prioritised program of salvage due to the highly limited scope for conserving significant sites in situ. The presence of a narrow margin of minimal construction impact along sections of Badgerys Creek would necessitate a management program to ensure the conservation of sites or

potential archaeological deposits within both construction and operational contexts. In the case of both the salvage and *in situ* conservation programs, salvage and on-ground conservation strategies would need to be informed by initial stages of resource identification and evaluation. This would aim to identify effective levels of sampling and accurately identify the potential archaeological resource.

The elements of these two programs would comprise:

- surface survey of remaining portions of the study area to effectively identify all significant surface site locations;

- subsurface testing of a representative sample of surface sites and potential archaeological deposits in order to accurately identify the nature of the sub-surface archaeological resource;

- a prioritised salvage program including:

  - collection of field data;
  - excavation of various site types and contexts as guided by the results of the above components; and
  - salvage of tree scars where considered appropriate.

- identifying any significant sites or potential deposits which can be conserved undisturbed in the context of the proposal and formulate strategies for their retention and management; and

- monitoring all construction disturbance in land zones with potential for *in situ* material in order to:

  - facilitate salvage procedures in the event that significant archaeological material is exposed which is outside of the expected or predicted resource for that area (such as burials); and
  - fulfil cultural or custodial requirements specified by the local Aboriginal community.

Indirect Impacts

It would be expected that the majority of these types of potential indirect impacts would be mitigated by implementing measures proposed below and in Chapter 9.

The following strategies and programs could be instigated to mitigate potential indirect impacts:

- a program of archaeological survey in land zones which may be subject to the indirect impacts from siltation, stream bank erosion, or reduced tree health, with the aim of identifying sites potentially at risk;

- review and if necessary upgrade environmental protection measures designed to control water flow velocities and sediment loads into relevant drainage lines;

- where necessary, stabilise or reinforce the physical environment of sites if impacts are likely to be significant either during or after construction;

- establish a program of environmental and Aboriginal site monitoring during construction, and where necessary as part of normal airport operation, in order to identify the exact nature of any adverse impacts and modify management strategies accordingly;

- instigate a monitoring program and conservation study of airborne pollutants and their possible role in rock surface instability in a sample of shelter pigment sites and open grinding groove and engraving sites. The study would aim to identify what impacts, if any, can be attributable to airport derived pollutants, and to recommend mitigation strategies where appropriate; and

- ensure that planning and development approval procedures in local government require that archaeological survey and assessment is conducted prior to any approval for the redevelopment of lands adjoining the proposed airport site. These procedures would ensure that existing State Government legislation protecting Aboriginal sites is effectively applied.

7.2 AIRPORT OPTION B

7.2.1 DIRECT IMPACTS

A total of 85 known sites or isolated finds are located within the area of Badgerys Creek Option B. These comprise 37 open artefact scatters, seven scarred trees, and 40 isolated finds. Six of these recordings are associated with recorded potential archaeological deposit.

The predicted archaeological resource for the Option B area is in the order of 196 surface sites and isolated finds with potential areas of *in situ* sub-surface archaeological material occurring mostly within minor and secondary fluvial

corridors. There is approximately 4.8 square kilometres of fluvial corridor within Option B, including most of the upper sections of Badgerys Creek and a substantial portion of Oaky Creek.

Most of the significant archaeological resource in Option B would be impacted upon (destroyed) by the construction of the Second Sydney Airport. Both permanent and temporary construction impacts are likely to extend across the majority of the Option B landscape including cut and fill areas, construction camps, trackways, and stockpile areas. Most of the minor drainage lines and nearly all of the Badgerys Creek fluvial corridor zones would be substantially altered through the creation of runway and building platforms, retention basins and channel modifications.

Areas of surviving resource would be restricted to peripheral areas not subject to vegetation clearing or other construction disturbance. These potential areas appear to be limited areas of relative low archaeological sensitivity, such as upper slope and ridgeline contexts adjacent to minor drainage lines and are unlikely to constitute useful conservation zones protecting significant archaeological deposits.

7.2.2 INDIRECT IMPACTS

The type and range of indirect impacts associated with Option B is the same as those identified for Option A.

Given the type and already disturbed nature of the adjacent surviving archaeological resource in the Badgerys Creek region, there are only a limited number of construction and operational indirect impacts which could pose a significant threat. Most of the surviving resource occurs on or below the ground surface and would therefore be protected from dust, noise or atmospheric pollution. The existing landscape context of sites in the Badgerys Creek region retains little original or Aboriginal character, and the presence of an airport would not significantly impact these already diminished contextual and interpretive values. An exception to this may be the interpretive contexts of more distant Aboriginal places of significance, such as Bents Basin on the Nepean River. This location could be subject to greater visual and noise intrusion from aircraft.

The main potential indirect impacts are anticipated to be:

- the erosion or siltation of sites in downstream contexts as a result of changed sediment and flow regimes both during construction and airport operation. The surviving downstream sections of Cosgroves, Oaky and Badgerys Creek are the most likely zones to be subject to this form of deterioration;

- operational impact to adjacent living scarred trees as a result of changes in air quality and increased insect attack due to a smaller resident or visiting bird population;

- increased visual and noise intrusion to the contextual landscape of Bents Basin; and

- impact to sites as a result of potentially increased commercial and industrial development of the privately owned lands adjacent to the airport.

7.2.3 MITIGATION OF ADVERSE IMPACTS

Direct Impacts

The mitigation of direct impacts resulting from Option B would need to focus on a prioritised program of salvage due to the highly limited scope for conserving significant sites in situ. It is unlikely that a management program for the *in situ* conservation of sites or potential archaeological deposits would be required unless scarred trees were identified in peripheral vegetation which did not require clearing. All areas of relative sub-surface potential would be grossly impacted by the proposal. In the case of the salvage and any potential *in situ* conservation programs, excavation and proposed conservation strategies would need to be informed by initial stages of resource identification and evaluation. This would aim to identify effective levels of sampling and accurately identify the potential archaeological resource.

The elements of these two programs would comprise:

- surface survey of remaining portions of the study area to effectively identify all significant surface site locations;

- subsurface testing of a representative sample of surface sites and potential archaeological deposits in order to accurately identify the nature of the sub-surface archaeological resource;

- a prioritised salvage program including:

  - collection of field data;
  - excavation of various site types and contexts as guided by the results of the above components; and
  - salvage of tree scars where considered appropriate.

- identifying any significant sites or potential deposits which can be conserved undisturbed in the context of the proposal and formulate strategies for their retention and management; and

- monitoring all construction disturbance in land zones with potential for *in situ* material in order to:

  - facilitate salvage procedures in the event that significant archaeological material is exposed which is outside of the expected or predicted resource for that area (such as burials); and
  - fulfil cultural or custodial requirements specified by the local Aboriginal community.

Indirect Impacts

It would be expected that the majority of these types of potential indirect impacts would be mitigated by implementing measures proposed below and in Chapter 9.

The following strategies and programs could be instigated to mitigate potential indirect impacts:

- a program of archaeological survey in land zones which may be subject to the indirect impacts of siltation, stream bank erosion, or reduced tree health, with the aim of identifying sites potentially at risk;

- review and if necessary upgrade environmental protection measures designed to control water flow velocities and sediment loads into relevant drainage lines;

- where necessary, stabilise or reinforce the physical environment of sites if impacts are likely to be significant either during or after construction;

- establish a program of environmental and Aboriginal site monitoring during construction, and where necessary as part of normal airport operation, in order to identify the exact nature of any adverse impacts and modify management strategies accordingly;

- instigate a monitoring program and conservation study of airborne pollutants and their possible role in rock surface instability in a sample of shelter pigment sites and open grinding groove and engraving sites. The study would aim to identify what impacts, if any, can be attributable to airport derived pollutants, and to recommend mitigation strategies where appropriate; and

- ensure that planning and development approval procedures in local government require that archaeological survey and assessment is conducted prior to any approval for the redevelopment of lands adjoining the proposed airport site. These procedures would ensure

that existing State government legislation protecting Aboriginal sites is effectively applied.

7.2.4 OPTION B CONCEPTUAL PLAN

The additional areas of landsurface disturbance identified in the Option B conceptual plan occupy approximately 4.6 square kilometres outside of the master plan site boundaries. These areas are predominantly located on the ridgelines and upper catchment slopes of Cosgroves Creek in the north-west and Thompsons Creek in the south-east. Neither of these areas represent archaeologically sensitive or high density landforms and contain little potential for significant *in situ* sub-surface archaeological material.

7.3 AIRPORT OPTION C

7.3.1 DIRECT IMPACTS

A total of 94 known sites or isolated finds are located within the area of Badgerys Creek Option C. These comprise 47 open artefact scatters, seven scarred trees and 40 isolated finds. Six of these recordings are associated with recorded potential archaeological deposit.

The predicted archaeological resource for the Option C area is in the order of 205 surface sites and isolated finds with potential areas of in situ sub-surface archaeological material occurring mostly within minor and secondary fluvial corridors. There is approximately 5.6 square kilometres of fluvial corridor within Option C, including most of the upper sections of Oaky and Badgerys Creeks and a 1.5 kilometre section of the western bank and flats of Thompsons Creek.

Most of the significant archaeological resource in Option C would be impacted upon (destroyed) by airport construction. Both permanent and temporary construction impacts are likely to extend across the majority of the Option C landscape including cut and fill areas, construction camps, trackways, and stockpile areas. Most of the minor drainage lines and nearly all of the Badgerys Creek fluvial corridor zones would be substantially altered through the creation of runway and building platforms, retention basins and channel modifications.

Areas of surviving resource would be restricted to peripheral areas not subject to vegetation clearing or other construction disturbance. A significant proportion of the 1.5 kilometre section of the Thompsons Creek fluvial corridor may not be subject to major landsurface disturbance and consequently represents an opportunity to conserve *in situ* significant archaeological deposits. A small section of Cosgroves Creek in the north-west

may remain relatively intact, as may a narrow margin of land between the boundary road on the outside of the proposed eastern perimeter fence and the bank of Badgerys Creek. Elsewhere, potential areas of remnant surviving landsurface are limited to areas of relative low archaeological sensitivity, such as upper slope and ridgeline contexts and are unlikely to constitute useful conservation zones.

7.3.2 INDIRECT IMPACTS

The type and range of indirect impacts associated with Option C is the same as those identified for Options A and B.

Given the type and already disturbed nature of the adjacent surviving archaeological resource in the Badgerys Creek region, there are only a limited number of construction and operational indirect impacts which could pose a significant threat. Most of the surviving resource occurs on or below the ground surface and would therefore be protected from dust, noise or atmospheric pollution. The existing landscape context of sites in the Badgerys Creek region retains little original or Aboriginal character, and the presence of an airport would not significantly impact these already diminished contextual and interpretive values. An exception to this may be the interpretive contexts of more distant Aboriginal places of significance, such as Bents Basin on the Nepean River. This location could be subject to greater visual and noise intrusion from aircraft.

The main potential indirect impacts are anticipated to be:

- the erosion or siltation of sites in downstream contexts as a result of changed sediment and flow regimes both during construction and airport operation. The surviving downstream sections of Cosgroves, Oaky, Badgerys and Thompsons Creek are the most likely zones to be subject to this form of deterioration;

- operational impact to adjacent living scarred trees as a result of changes in air quality and increased insect attack due to a smaller resident or visiting bird population;

- increased visual and noise intrusion to the contextual landscape of Bents Basin; and

- impact to sites as a result of potentially increased commercial and industrial development of the privately owned lands adjacent to the airport.

7.3.3 MITIGATION OF ADVERSE IMPACTS

Direct Impacts

The mitigation of direct impacts resulting from Option C would need to focus on a prioritised program of salvage due to the highly limited scope for conserving significant sites in situ. The presence of several limited sections of minor or secondary fluvial corridor would necessitate a management program to ensure the conservation of sites or potential archaeological deposits within both construction and operational contexts. In the case of both the salvage and *in situ* conservation programs, salvage and on-ground conservation strategies would need to be informed by initial stages of resource identification and evaluation. This would aim to identify effective levels of sampling and accurately identify the potential archaeological resource.

The elements of these two programs would comprise:

- surface survey of remaining portions of the study area to effectively identify all significant surface site locations;
- subsurface testing of a representative sample of surface sites and potential archaeological deposits in order to accurately identify the nature of the sub-surface archaeological resource;
- a prioritised salvage program including:
  - collection of field data;
  - excavation of various site types and contexts as guided by the results of the above components; and
  - salvage of tree scars where considered appropriate.
- identifying any significant sites or potential deposits which can be conserved undisturbed in the context of the development and formulate strategies for their retention and management; and
- monitoring all construction disturbance in land zones with potential for *in situ* material in order to:
  - facilitate salvage procedures in the event that significant archaeological material is exposed which is outside of the expected or predicted resource for that area (such as burials); and
  - fulfil cultural or custodial requirements specified by the local Aboriginal community.

Indirect Impacts

It would be expected that the majority of these types of potential indirect impacts would be mitigated by implementing measures proposed below and in Chapter 9.

The following strategies and programs could be instigated to mitigate potential indirect impacts:

- a program of archaeological survey in land zones which may be subject to the indirect impacts of siltation, stream bank erosion, or reduced tree health, with the aim of identifying sites potentially at risk;

- review and if necessary upgrade environmental protection measures designed to control water flow velocities and sediment loads into relevant drainage lines;

- where necessary, stabilise or reinforce the physical environment of sites if impacts are likely to be significant either during or after construction;

- establish a program of environmental and Aboriginal site monitoring during construction, and where necessary as part of normal airport operation, in order to identify the exact nature of any adverse impacts and modify management strategies accordingly;

- instigate a monitoring program and conservation study of airborne pollutants and their possible role in rock surface instability in a sample of shelter pigment sites and open grinding groove and engraving sites. The study would aim to identify what impacts, if any, can be attributable to airport derived pollutants, and to recommend mitigation strategies where appropriate; and

- ensure that planning and development approval procedures in local government require that archaeological survey and assessment is conducted prior to any approval for the redevelopment of lands adjoining the airport site. These procedures would ensure that existing State government legislation protecting Aboriginal sites is effectively applied.

7.3.4 OPTION C CONCEPTUAL PLAN

The additional areas of landsurface disturbance identified in the Option C conceptual plan occupy approximately 3.3 square kilometres outside of the master plan site boundaries. These areas include sections of the upper catchment of Cosgroves Creek minor fluvial corridor and the remaining sections of the relatively original Badgerys Creek secondary fluvial corridor

north of Elizabeth Drive. These areas represent archaeologically sensitive landforms and are likely to contain significant sub-surface *in situ* archaeological deposits. Expansion of the proposed Second Sydney Airport into these areas would therefore significantly increase the total direct impact of this Option. Little of the Badgerys Creek corridor would subsequently remain in a relatively natural condition of retain a representative sample of sub-surface archaeological material.

CHAPTER 8 IMPACTS OF HOLSWORTHY OPTIONS

The impacts of the Holsworthy options on Aboriginal archaeology have been assessed assuming that no mitigative measures are in place. Some of these impacts (mostly the indirect impacts) could be reduced or ameliorated by implementing the management measures proposed in this Chapter and *Chapter 9*.

8.1 AIRPORT OPTION A

8.1.1 DIRECT IMPACTS

A total of 204 known sites and isolated finds (comprising 192 sites and 12 isolated finds) are located within the site boundaries of Holsworthy Option A. These include 111 recordings made during the survey and 93 previously recorded sites.

The known sites and isolated finds comprise three open artefact scatters, 24 scarred trees, 12 isolated finds, eight open engraving sites, 36 open grinding groove sites, 118 shelter sites (shelters with art, deposit, engravings, grinding grooves or grinding surfaces) and three sites of unknown type (no detailed data available). Two open sites and 72 shelter sites were recorded as having potential archaeological deposit. One additional open context recording and 143 shelter contexts contained potential archaeological deposit but no surface archaeological material.

The predicted archaeological resource for the Option A area is in the order of 320 surface sites and isolated finds and around 740 potential archaeological deposits. Potential areas of in situ sub-surface archaeological material occur throughout the natural distribution of rock shelters and in open context valley floor alluvial and colluvial deposits. Areas of greatest known and predicted site density occur on valley floors and within secondary and minor fluvial corridors, which constitute 53 percent of the Option A area.

Practically all of the archaeological resource in the Option A site would be impacted upon (destroyed) by construction of the Second Sydney Airport. Both permanent and temporary construction impacts are likely to extend across the majority of the Option A landscape including firing and landsurface impact from unexploded ordnance clearance, vegetation clearing, cut and fill areas, construction camps, trackways, stockpiles, and water detention ponds. The required land platforms for the placement of the runways, roads, and associated terminal and commercial infrastructure would destroy a majority of the original landforms within the proposed airport site. The construction of

permanent stormwater detention basins would transform most of the remaining larger fluvial corridor areas adjacent to the land platform batters.

Possible areas of surviving original landform may include the north-western slopes of the Woronora River corridor (south of the east-west runway), and some of the western slopes of the Deadmans Creek fluvial corridor. Within these peripheral areas (approximately eight percent of the total area), there may be some scope for conserving sites *in situ*, provided that the positioning of proposed works is flexible and the sites have survived the results of unexploded ordnance clearance.

These areas of potentially minimal disturbance are likely to contain significant sites, at relatively high or moderate densities, but could not be considered to provide a representative sample for effective conservation.

The areas of the alternative infrastructure corridors for road, rail, and other service easements are incorporated into the direct impact area used for the above breakdown. Three recordings are known from these corridor areas, one previously recorded, and two recorded by this study.

The northern alignment for the road/rail access extends along the major watershed ridgeline from the north-western corner of the proposed airport site. This alignment is approximately 5.7 kilometres long and consists mostly of ridgetop topography (53 percent) and low gradient undulating terrain at the northern end of the study area (31 percent). In keeping with the relatively low site densities for these landforms, the number of potential sites and isolated finds would be relatively low, in the order of six, with around four potential archaeological deposits. Five recordings are presently known from this area, mostly isolated finds and open artefact scatters.

8.1.2 INDIRECT IMPACTS

There are a large number of potential indirect impacts associated with the construction and operation of the proposed Second Sydney Airport at the Option A site and its infrastructure corridors. This is due both to the diversity of the remaining archaeological resource, and the good condition and integrity of the landscape context. The nature of these potential impacts and their possible area of extent (where feasible) are outlined below.

Construction Impacts

- the erosion or siltation of sites in downstream contexts as a result of changed sediment and flow regimes. Sub-surface sites in sedimentary contexts are the most likely sites to be impacted in this way although a small number of grinding groove sites may also occur. The surviving downstream sections of Deadmans, Williams and Harris Creek are the

most likely to be affected. Lesser impacts, such as from siltation, may also occur on the Woronora River (although grinding groove sites are rare in this river bed) and Punchbowl Creek. The distance over which significant impact may occur is not known, but could be in the order of one kilometre for bank erosion and five kilometres for siltation (depending on turbidity);

- deterioration of shelter rock surfaces containing pigment art as a result of vibration effects transmitted through bedrock from blasting. Damage may range from the loss of small areas of surface exfoliation, to major changes in the distribution of surface water flow across the art panels, to total overhang collapse. Potential impacts of this nature may conceivably occur within a one kilometre radius around any blasting, depending on the condition of the site and the blasting techniques adopted;

- changes in shelter specific ground water hydrology, such as the frequency and volume of surface water seepage and the type of solids transported by sub-surface water, can have a direct impact on the stability and visual clarity of surface pigments. Changes of this sort may be caused by construction works which affect the quality and level of ground water, such as large scale excavation and filling. It is probable that these potential impacts would occur in relative proximity to construction works and may only impact a small number of surviving sites in the direct impact zones;

- deposition of airborne dust onto shelter rock art surfaces. This could conceivably occur over large distances, depending on wind direction and velocities, and affect sites located in adjacent lands;

- increased visitation to sites by construction workers and site visitors. Unless adequately advised or supervised, visitors may inadvertently damage sites by camping, touching the art panels or making graffiti; and

- the impacts associated with clearing unexploded ordnance including fire and ground disturbance from detonations. Both of these processes can seriously impact sites, particularly sub-surface deposits and rock art surfaces. Detonations are likely to be limited mostly to the proposed airport site and access corridors, however exceptions to this may be required.

These potential indirect impacts are unlikely to occur if controlled by the mitigative measures specified in *Section 23.7.*

Operational Impacts

- the erosion or siltation of sites in downstream contexts as a result of changed sediment and flow regimes. Increased volumes and peak flow frequencies are likely to pose a greater risk than siltation in the operational phase. Sub-surface sites in sedimentary contexts are the most likely sites to be impacted in this way. The surviving downstream sections of Deadmans, Williams, Harris and Punchbowl Creeks are the most likely to be affected. The distance over which significant impact may occur is not known, but may involve the whole remaining drainage line, depending on the mitigative measures employed;

- potential impact to pigment rock art from airborne pollutants. These include dust accumulation, and changes in surface chemistry, salt accumulation, leaching rates, natural silica deposition, and micro-organic growth conditions. Comparative data does not exist to enable a reliable assessment of these potential impacts;

- loss of contextual landscape values in the form of increased visual and noise intrusion, for Aboriginal sites located in adjacent Crown lands and public reserves such as the remainder of the Military Area, Dharawal State Recreation Area, the Woronora catchment area, Heathcote and Royal National Parks;

- higher rates of deterioration in scarred trees through increased control burn frequencies;

- deterioration in shelter sites as a result of visitor pressure and inappropriate site use (such as graffiti, souveniring of artefacts or art panels, digging in the deposit, camping and lighting fires). Despite the presence of surviving unexploded ordnance in areas adjacent to the proposed airport site, the high public usage of the airport, and presence of public roadways would inevitably increase unauthorised use and visitation of the surrounding bushland. This provides a long term process of deterioration which is often very difficult to prevent or effectively manage, given the number of sites involved and the degree of visual clarity of some of the art; and

- loss of associative and collective heritage significance values. The construction of the Second Sydney Airport and its associated infrastructure corridors would impose a modern industrial landscape into a predominantly bushland and pre-industrial human landscape. This juxtaposition would remove the pre-industrial interpretive character of the surrounding landforms and the sites they contain. Similarly, the proposal may subdivide or isolate culturally related places and site complexes.

8.1.3 MITIGATION OF ADVERSE IMPACTS

Direct Impacts

The mitigation of direct impacts resulting from Option A would need to focus on a prioritised program of salvage due to the minimal scope for conserving significant sites *in situ*. The presence of several peripheral areas, where impact to sites may be minimal, would necessitate a management program to ensure the conservation of sites or potential archaeological deposits within both construction and operational contexts. In the case of both the salvage and *in situ* conservation programs, salvage and on-ground conservation strategies would need to be informed by initial stages of resource identification and evaluation. This would aim to identify effective levels of sampling and comprehensively identify the potential archaeological resource.

The elements of these two programs would comprise:

- surface survey of remaining portions of the Option A area prior to the start of construction, in order to effectively identify all significant surface site locations;

- ensure that Aboriginal site management objectives and the unexploded ordnance clearing program are coordinated so that potential damage to sites from detonation can be avoided or minimised;

- subsurface testing of a representative sample of known sites and potential archaeological deposits in order to effectively identify the nature of the sub-surface archaeological resource;

- a prioritised salvage program including:

  - comprehensive recording of all rock art to archival standard and a level appropriate to the site's significance;
  - a comprehensive program of representative surface artefact collection and analysis, including sampling and dating of art pigments/surfaces;
  - appropriate levels of field recording of other site types;
  - full scale excavation of various site types and contexts as guided by the results of the preliminary testing program and a comprehensive research program;
  - physical removal of rock art panels and/or entire rock shelters or platforms, where and if considered appropriate by Aboriginal custodians, and where technically feasible; and
  - salvage and analysis of tree scars where considered appropriate.

- identify any significant sites or potential deposits which could be conserved in the context of the proposal with minimal disturbance and formulate strategies for their retention and management. This may include the redesign of facilities and access corridors to avoid sites; and

- monitor all construction disturbance in land zones with potential for *in situ* material in order to:

  - facilitate salvage procedures in the event that significant archaeological material is exposed which is outside of the expected or predicted resource for that site (such as burials or rare forms of occupation deposit); and
  - fulfil cultural or custodial requirements specified by the local Aboriginal community.

Indirect Impacts

It would be expected that the majority of these types of potential indirect impacts would be mitigated by implementing measures proposed below and in Chapter 9.

The following strategies and programs could be instigated to mitigate potential indirect impacts:

- a program of archaeological survey in land zones which may be subject to the indirect impacts of stream bank erosion, siltation, vibration, changed groundwater hydrology, and reduced tree health, with the aim of identifying sites potentially at risk;

- review and if necessary upgrade environmental protection measures designed to control water flow velocities and sediment loads into relevant drainage lines;

- adopt blasting techniques which would minimise vibration levels in areas adjacent to identified vulnerable sites;

- a program of environmental and Aboriginal site monitoring prior to and during construction with the aims of identifying any adverse impacts, providing baseline comparative data, and assessing the effectiveness of management strategies;

- a long term program of environmental and Aboriginal site monitoring during the airport's operation with the aims of identifying any continuing adverse impacts, collecting comparative data regarding the impact of airborne pollutants, and assessing the effectiveness of management strategies;

- a sub-program should involve a conservation study of airborne pollutants and their possible role in rock surface instability in a sample of variably distant shelter pigment sites and open grinding groove and engraving sites. The study should aim to identify what impacts, if any, can be attributable to airport derived pollutants, and to recommend long term mitigation strategies where appropriate;

- where necessary, stabilise or reinforce the physical environment of sites if impacts are likely to be significant either during or after construction. This could involve hardening of stream banks, restoration of fragile art surfaces and the use of scaffolding in unstable overhangs;

- adopt strict measures to minimise the generation of airborne dust;

- include information to construction workers as part of induction programs about the need to conserve Aboriginal sites in areas adjacent to construction zones, and what to do if a site is found;

- ensure that surface archaeological survey has been conducted in all areas of proposed unexploded ordnance clearance, prior to the instigation of these activities, and provided that the risk of injury to surveyors is deemed acceptable. Clearance activities should attempt to minimise impact to identified archaeological sites, where and if this is considered appropriate; and

- develop and instigate a conservation management plan for the Aboriginal sites which are likely to be indirectly impacted by the operation of the airport. The plan should address issues such as increased visitation levels, and the effects of pollution.

8.1.4 OPTION A CONCEPTUAL PLAN

The additional areas of landsurface disturbance identified in the Option A conceptual plan occupy approximately 2.4 square kilometres outside of the master plan site boundaries. These areas consist mostly of high site density fluvial corridors - the secondary fluvial corridor of upper Deadmans Creek and some upper catchment minor fluvial corridors draining to the Woronora and Georges Rivers.

These areas represent archaeologically sensitive landforms and are likely to contain significant sites including rock art and sub-surface *in situ* archaeological deposits. Expansion of the Second Sydney Airport into these areas would therefore significantly increase the total direct impact of Option A.

8.2 AIRPORT OPTION B

8.2.1 DIRECT IMPACTS

A total of 99 known sites and isolated finds (comprising 92 sites and seven isolated finds) are located within the boundaries of Holsworthy Option B. These include 59 recordings made during the EIS surveys and 40 previously recorded sites.

The known sites and isolated finds comprise one open artefact scatter, four scarred trees, seven isolated finds, six open engraving sites, 22 open grinding groove sites, 52 shelter sites (shelters with art, deposit, engravings, grinding grooves or grinding surfaces) and seven sites of unknown type (no detailed data available). Seventeen shelter sites were recorded as having potential archaeological deposit. One hundred and eight shelter contexts contained potential archaeological deposit but no surface archaeological material.

The predicted archaeological resource for the Option B area is in the order of 201 surface sites and isolated finds and around 566 potential archaeological deposits. Potential areas of in situ sub-surface archaeological material occur throughout the natural distribution of rock shelters and in open context valley floor alluvial and colluvial deposits. Areas of greatest known and predicted site density occur on valley floors, and within secondary and minor fluvial corridors, which constitute 44 percent of the Option area.

Practically all of the archaeological resource in the airport Option B site would be impacted upon (destroyed) by construction of the Second Sydney Airport. Both permanent and temporary construction impacts are likely to extend across the majority of the Option B landscape including firing and landsurface impact from unexploded ordnance clearance, vegetation clearing, cut and fill areas, construction camps, trackways, stockpiles, and water detention ponds. The required land platforms for the placement of the runways, roads, and associated terminal and commercial infrastructure would obliterate a majority of the original landforms within the proposed airport site. The construction of permanent stormwater detention basins would transform most of the remaining larger fluvial corridor areas adjacent to the land platform batters.

Possible areas of surviving original landform may include sections of the eastern slopes of the O'Hares Creek corridor (adjacent to the western boundary of the site), and some small minor fluvial corridors in peripheral site boundary areas in the north-east. These areas constitute about 10 percent of the total proposed airport area and are dominated by the low site density and very steep terrain of the O'Hares Creek corridor. There may exist some scope for conserving sites *in situ* within these peripheral areas if the positioning of the proposed works is flexible. The density of unexploded ordnance within the O'Hares Creek corridor is very low and disturbance from clearance detonation

is most likely in the northern peripheral areas. These areas could not be considered to provide a representative sample for effective conservation.

The area of the alternative infrastructure corridor for road, rail, and other service easements is incorporated into the direct impact area used for the above breakdown. This alignment is approximately six kilometres long. Five recordings are known from these corridor areas, two previously recorded, and three recorded by this study.

There are two basic north-aligned alternatives, 5 and 7, with a further three alternative branches after the mid point of alternative 5: a branch to the west, alternative 4; a branch continuing north, alternatives 1 and 2; and a branch to the east, alternative 3. Alternatives 5 and 1 allow for an alternative rail link.

Alternative 7 extends for approximately 11.5 kilometres and includes mostly major ridgeline topography (83 percent) and the upper slopes of minor fluvial catchments. Based on relevant site density data, the expected surface resource of this area would by six sites and isolated finds and ten potential archaeological deposits. Two recordings are presently known, including a rare ridgetop context open engraving site.

Alternative 5 extends for approximately 16.8 kilometres when combined with alternative 1 (the northern branch), 14.8 kilometres combined with alternative 3 (the eastern branch), and 12.1 kilometres with the western branch (alternative 4). The northern branch combination is dominated by major and secondary watershed ridgetop topographies (67 percent) and consequently has a low predicted resource of 14 sites and isolated finds and 14 potential archaeological deposits, relative to its length. Eighteen recordings are so far known from this proposed corridor. The eastern branch combination has a greater spread of landform types with 69 percent on ridgelines. The predicted resource is 20 sites and isolated finds and 24 potential archaeological deposits. Twenty four recordings have been recorded to date. The western branch combination impacts less fluvial corridors and the predicted resource of eight sites and isolated finds and fifteen potential archaeological deposits is correspondingly lower. Seventeen recordings are presently known.

The main determining factors of the impact of the infrastructure corridors is the area of minor and secondary fluvial corridors and to a lesser degree, the total distance. Alternatives which minimise both factors represent the least impact.

8.2.2 INDIRECT IMPACTS

In common with Option A, there are a large number of potential indirect impacts associated with the construction and operation of the Option B airport site and its infrastructure corridors. This is similarly due both to the diversity of the remaining archaeological resource, and the good condition and integrity

of the landscape context. The nature of these impacts and their possible area of extent (where feasible) are outlined below. The character of the Option B landscape is deeper with higher gradients, however the basic sandstone parameters of the landscape are identical and most of the impacts and mitigative strategies listed below are the same as for Option A.

Construction Impacts

- the erosion or siltation of sites in downstream contexts as a result of changed sediment and flow regimes. Sub-surface sites in sedimentary contexts are the most likely sites to be impacted in this way although a small number of grinding groove sites may also occur. The surviving downstream sections of Punchbowl and Gunyah Creeks are the most likely to be affected. Lesser impacts, such as from siltation, may also occur on O'Hares Creek (although grinding groove sites are rare in this major stream bed). Increased suspended solids may also potentially occur in the upper Woronora River catchment, depending on the effectiveness of the sediment traps employed. The distance over which significant impact may occur is not known, but could be in the order of one kilometre for bank erosion and five kilometres for siltation (depending on turbidity);

- deterioration of shelter rock surfaces containing pigment art as a result of vibration effects transmitted through bedrock from blasting. Damage may range from the loss of small areas of surface exfoliation, to major changes in the distribution of surface water flow across the art panels, to total overhang collapse. Potential impacts of this nature may conceivably occur within a one kilometre radius around any blasting, depending on the condition of the site and the blasting techniques adopted;

- changes in shelter specific ground water hydrology, such as the frequency and volume of surface water seepage,. and the type of solids transported by sub-surface water, can have a direct impact on the stability and visual clarity of surface pigments. Changes of this sort may be caused by construction works which affect the quality and level of ground water, such as large scale excavation and filling. It is probable that these potential impacts would occur in relative proximity to construction works and may only impact a small number of surviving sites in the direct impact zones;

- deposition of airborne dust onto shelter rock art surfaces. This could conceivably occur over large distances, depending on wind direction and velocities, and effect sites in adjacent lands;

- increased visitation to sites by construction workers and site visitors. Unless adequately advised or supervised, visitors may inadvertently damage sites by camping, touching the art panels or making graffiti; and

- the impacts associated with clearing unexploded ordnance including fire and ground disturbance from detonations. Both of these processes can seriously impact sites, particularly sub-surface deposits and rock art surfaces. Detonations are likely to be limited mostly to the proposed airport site and access corridors, however exceptions to this may be required.

These potential indirect impacts are unlikely to occur if controlled by the mitigative measures specified in *Section 23.7.*

Operational Impacts

- the erosion or siltation of sites in downstream contexts as a result of changed sediment and flow regimes. Increased volumes and peak flow frequencies are likely to pose a greater risk than siltation in the operational phase. Sub-surface sites in sedimentary contexts are the most likely sites to be impacted in this way. The surviving downstream sections of Punchbowl and Gunyah Creeks are the most likely to be affected, although the natural flow regime of the former is likely to include high and periodic peak flows. The distance over which significant impact may occur is not known, but may involve the whole remaining drainage line, depending on the mitigative measures employed;

- potential impact to pigment rock art from airborne pollutants. These include dust accumulation, and changes in surface chemistry, salt accumulation, leaching rates, natural silica deposition, and micro-organic growth conditions. Comparative data does not exist to enable a reliable assessment of this potential impact;

- loss of contextual landscape values in the form of increased visual and noise intrusion, for Aboriginal sites located in adjacent Crown lands and public reserves such as the remainder of the Military Area, Heathcote and Royal National Parks, and particularly the Dharawal State Recreation Area and the Woronora catchment area;

- higher rates of deterioration in scarred trees through increased control burn frequencies;

- deterioration in shelter sites as a result of visitor pressure and inappropriate site use (such as graffiti, souveniring of artefacts or art panels, digging in the deposit, camping and lighting fires). Despite the

presence of surviving unexploded ordnance in areas adjacent to the proposed airport site, the high public usage of the airport, and presence of public roadways would inevitably increase unauthorised use and visitation of the surrounding bushland. This is particularly relevant to the south-western corner of the present Military Area where the preferred access route would be located. The incidence of surface ordnance is very low in this area and would not act a deterrent to unauthorised exploration of the area. Unmanaged visitation provides a long term process of deterioration which is often very difficult to prevent or effectively manage, given the number of sites involved and the degree of visual clarity of some of the art; and

- loss of associative and collective heritage significance values. The construction of the Second Sydney Airport and its associated infrastructure corridors would impose a modern industrial landscape into a predominantly bushland and pre-industrial human landscape. This juxtaposition would remove the pre-industrial interpretive character of the surrounding landforms and the sites they contain. Similarly, the proposal may subdivide or isolate culturally related places and site complexes.

8.2.3 MITIGATION OF ADVERSE IMPACTS

Direct Impacts

The mitigation of direct impacts resulting from Option B would need to focus on a prioritised program of salvage due to the minimal scope for conserving significant sites *in situ*. The presence of several peripheral areas, where impact to sites may be minimal, would necessitate a management program to ensure the conservation of sites or potential archaeological deposits within both construction and operational contexts. In the case of both the salvage and *in situ* conservation programs, salvage and on-ground conservation strategies would need to be informed by initial stages of resource identification and evaluation. This would aim to identify effective levels of sampling and comprehensively identify the potential archaeological resource.

The elements of these two programs would comprise:

- surface survey of remaining portions of the Option B area prior to the start of construction, in order to effectively identify all significant surface site locations;

- ensure that Aboriginal site management objectives and the unexploded ordnance clearing program are coordinated so that potential damage to sites from detonation can be avoided or minimised;

- subsurface testing of a representative sample of known sites and potential archaeological deposits in order to effectively identify the nature of the sub-surface archaeological resource;

- a prioritised salvage program including:

  - comprehensive recording of all rock art to archival standard and a level appropriate to the site's significance;
  - a comprehensive program of representative surface artefact collection and analysis, including sampling and dating of art pigments/surfaces;
  - appropriate levels of field recording of other site types;
  - full scale excavation of various site types and contexts as guided by the results of the preliminary testing program and a comprehensive research program;
  - physical removal of rock art panels and/or entire rock shelters or platforms, where and if considered appropriate by Aboriginal custodians, and where technically feasible; and
  - salvage and analysis of tree scars where considered appropriate.

- identify any significant sites or potential deposits which could be conserved in the context of the proposal with minimal disturbance and formulate strategies for their retention and management. This may include the redesign of facilities and access corridors to avoid sites; and

- monitor all construction disturbance in land zones with potential for *in situ* material in order to:

  - facilitate salvage procedures in the event that significant archaeological material is exposed which is outside of the expected or predicted resource for that site (such as burials or rare forms of occupation deposit); and
  - fulfil cultural or custodial requirements specified by the local Aboriginal community.

Indirect Impacts

It would be expected that the majority of these types of potential indirect impacts would be mitigated by implementing measures proposed below and in *Chapter 9*.

The following strategies and programs could be instigated to mitigate potential indirect impacts:

- a program of archaeological survey in land zones which may be subject to the indirect impacts of stream bank erosion, siltation, vibration,

changed groundwater hydrology, and reduced tree health, with the aim of identifying sites potentially at risk;

- review and if necessary upgrade environmental protection measures designed to control water flow velocities and sediment loads into relevant drainage lines;

- adopt blasting techniques which would minimise vibration levels in areas adjacent to identified vulnerable sites;

- a program of environmental and Aboriginal site monitoring prior to and during construction with the aims of identifying any adverse impacts, providing baseline comparative data, and assessing the effectiveness of management strategies;

- a long term program of environmental and Aboriginal site monitoring during the airport's operation with the aims of identifying any continuing adverse impacts, collecting comparative data regarding the impact of airborne pollutants, and assessing the effectiveness of management strategies;

- a sub-program should involve a conservation study of airborne pollutants and their possible role in rock surface instability in a sample of variably distant shelter pigment sites and open grinding groove and engraving sites. The study should aim to identify what impacts, if any, can be attributable to airport derived pollutants, and to recommend long term mitigation strategies where appropriate;

- where necessary, stabilise or reinforce the physical environment of sites if impacts are likely to be significant either during or after construction. This could involve hardening of stream banks, restoration of fragile art surfaces and the use of scaffolding in unstable overhangs;

- adopt strict measures to minimise the generation of airborne dust;

- include information to construction workers as part of induction programs about the need to conserve Aboriginal sites in areas adjacent to construction zones, and what to do if a site is found;

- ensure that surface archaeological survey has been conducted in all areas of proposed unexploded ordnance clearance, prior to the instigation of these activities, and provided that the risk of injury to surveyors is deemed acceptable. Clearance activities should attempt to minimise impact to identified archaeological sites, where and if this is considered appropriate; and

- develop and instigate a conservation management plan for the Aboriginal sites which are likely to be indirectly impacted by the operation of the airport. The plan should address issues such as increased visitation levels, and the effects of pollution.

8.2.4 OPTION B CONCEPTUAL PLAN

The additional areas of landsurface disturbance identified in the Option B conceptual plan occupy approximately 3.1 square kilometres outside of the master plan site boundaries. These areas consist mostly of high site density fluvial corridors - the minor fluvial corridors of the upper Punchbowl Creek catchment. An area of potentially minimal construction impact within the airport site boundary and south-east of the proposed borrow area, would be impacted by the expansion of the airport into these areas.

These areas represent archaeologically sensitive landforms and are likely to contain significant sites including rock art and sub-surface *in situ* archaeological deposits. Expansion into these areas would therefore significantly increase the total direct impact of Option B.

Part D

Environmental Management

CHAPTER 9 ENVIRONMENTAL MANAGEMENT

9.1 SCOPE OF IMPACT MITIGATION

The management measures for the mitigation of the potential impacts of constructing and operating the Second Sydney Airport at both the Badgerys Creek and the Holsworthy sites on Aboriginal cultural heritage are limited because of the difficulty in permanently reserving a representative sample of the significant archaeological resource.

The best strategy available for impact mitigation is the selective salvage of physical materials and information prior to construction. Salvage is an inferior alternative to in situ conservation of representative samples. The former is a controlled form of destruction, incorporating the archaeological techniques of excavation, collection and data recording. Conservation, in contrast, maintains the full amenity of the resource to future research techniques and programs of inquiry.

Regardless of the scope of salvage recovery or the scale of recording, salvage should be understood as a form of destruction. The end result is a net loss of a non renewable resource - the evidence and manifestation of past Aboriginal societies. In terms of Aboriginal cultural values, salvage is also normally a net loss. This typically involves the removal of artefacts from the integrity of their original landscape position, and the transformation of a physically evocative place and/or artefacts into printed information interpreted within a scientific analysis.

In the case of the physical salvage of large features, such as a scarred tree, an engraved or grooved rock platform, or conceivably also a shelter site containing pigment art, the act of salvage is less one of maintaining heritage values, and more that of fundamental transformation. Once removed from its original context and modified by considerable technological endeavour, any salvaged material is also a significant modern artefact. Without in situ conservation, the contextual and landscape dependent values of a place cannot be effectively conserved.

The scale and extent of the potentially impacted archaeological resource is also a significant limiting factor. Holsworthy presents a diverse range of site and artefact traits, and a very large and locally untested sub-surface archaeological assemblage. Any program of salvage is likely to be required to operate within a limited chronology and would have to be prioritised according to research aims and practical sampling considerations. The final reality is that despite the implementation of focused and representative sampling, only a small proportion of the resource would actually be tested or

recovered. The diversity and scope of the Badgerys Creek resource is much less relative to Holsworthy, but the constraints which impose small salvage samples still apply.

Salvage is also fundamentally limited by the state of knowledge at the time of the investigation. The primary aim of salvage is the recovery and/or conservation of significant information or physical remains. However, significance can only be measured by the criteria and paradigms of contemporary culture. The type and scale of data recovery is limited by contemporary technologies and research questions. Inevitably then, today's salvage program would be found to be inadequate in answering the research questions of tomorrow.

9.2 BADGERYS CREEK OPTIONS - MANAGEMENT STRATEGIES

9.2.1 PRE AND DURING CONSTRUCTION

If the Second Sydney Airport was to be constructed within one of the proposed options in the Badgerys Creek study area, the following management strategies would be required:

Surface Survey

Surface survey of the remaining unsurveyed areas of the proposed direct impact areas would be a preliminary requirement with the aim of ensuring that all sites and areas of significant archaeological potential were identified. The target levels of survey coverage across the range of landforms would be dependent on seasonally variable visibility variables and the maximisation of coverage in high potential aggrading landforms and areas of potential scarred tree occurrence.

Surface survey would be a pre-construction activity, conducted prior to any clearing or land surface disturbance which may adversely affect sites or potential archaeological deposits. The survey would aim to provide an accurate, high coverage, and stratified inventory of surface manifestations of Aboriginal sites within the proposed construction area. This would facilitate the development of appropriate research designs for subsurface testing programs.

Based on construction plans, sites or potential archaeological deposits which may be able to be conserved *in situ* within the airport site would be identified.

Survey of areas which may be subject to indirect impacts such as siltation, creek bank erosion and reduced tree health, would also be conducted with the aim of identifying sites potentially at risk.

Statutory Consents under the National Parks and Wildlife Act 1974

Prior to any construction works, and at various stages in the archaeological investigation, applications must be made to the Director-General of the NSW National Parks and Wildlife Service for various consents and permits regarding the excavation, disturbance or destruction of Aboriginal relics.

All archaeological investigation which involves excavation of artefacts, salvage, or the recording of rock art can only be conducted following the provision of a permit. Similarly no relics can be destroyed without a consent authority.

All incidences of artefacts or other relics which would be destroyed or impacted by the proposal would require a Consent to Destroy before any disturbance can occur.

Subsurface Testing

A program of subsurface testing in both sites and areas of defined archaeological potential would be required to accurately identify the nature and distribution of the sub-surface archaeological resource.

Testing would be carried out using both hand and mechanical digging and include sampling methods such as multiple shallow spade excavations, back hoe trenches, and grader scrape transects.

The aim of this program would be to identify the best areas in which to conduct full scale salvage excavations.

Sub-Surface Salvage

Salvage excavations would be conducted in a range of locations, according to the priorities and criteria identified in the preceding testing program. It is anticipated that the greatest focus would be on the fluvial corridors and sedimentary contexts below the plough zone. Priority would be given to recovering artefact assemblages from relatively undisturbed contexts, from early stratigraphic contexts, and where discrete behavioural activity areas can be identified.

Emphasis should be placed on large and open area excavation if sites with low levels of disturbance can be identified which would warrant this approach. Deep trenches with minimal aerial extent may also be required to test and characterise older sedimentary facies.

Major programs of processing, analysis, dating, and curation of excavated material may be required depending on the size and quality of the recovered assemblage.

Tree Scar Salvage

Where considered appropriate by Aboriginal custodians, the scarred sections of Aboriginal scarred trees would be salvaged after appropriate field recording. Selected examples would be the subject of a program of research with the aims of further identifying the origin and age of the scarring.

Monitoring Indirect Impacts

A program of regular monitoring of indirect impacts on sites would be instigated with the aim of developing and assessing the effectiveness of mitigation strategies.

Develop and Implement Strategies to Minimise Indirect Impacts

Based on the results of the above monitoring program, environmental protection measures would be reviewed and if necessary redesigned to mitigate indirect impacts, such as for the control of water flow velocities and sediment loads into relevant drainage lines.

Where necessary, sites would be fenced, or the physical environment of sites stabilised and reinforced if impacts are likely to be significant either during or after construction.

Develop and Implement Strategies for the Emergency Salvage of Significant Sites

In consultation with Aboriginal representatives and construction managers, a set of strategies would need to be adopted which define the actions required in the event that a significant site (such as a burial) is uncovered during construction works. This would normally include the following actions:

- cease impactive works;
- notify any required statutory authorities (the NSW National Parks and Wildlife Service, and in the case of a burial, also the Police);
- identification and assessment of the site by an archaeologist and suitably qualified Aboriginal representative; and
- determine and carry out an appropriate management strategy.

Conservation and Management Plans for In Situ Site Conservation

If sites have been identified which can be effectively conserved in situ and are of a significance which warrants conservation, then management plans would be formulated and instigated for each site.

In situ site maintenance involves the long-term conservation of a site or artefact in its original context and configuration within the landscape. This may involve active intervention to protect a site (by exclusion of defined impacts or activities) or restoration and stabilisation of a site such as a dead standing scarred tree.

Sites located adjacent to the airport site and which may be impacted by indirect impacts would also be the subject of management plans.

Subsequent Curation and Care of Salvaged Materials

The provision of permanent and appropriate places for the storage of salvaged materials is an integral component of any salvage program and is an important funding consideration. Care and control of collections will often be vested in local Aboriginal communities.

Monitoring of Ground Surface Disturbance

Monitoring involves the observation of construction activities by qualified archaeologists and/or members of representative Aboriginal groups. Monitoring is generally carried out in order to salvage artefactual material, prevent inappropriate damage to Aboriginal burials, record relevant data, ensure that permit and consent conditions are met and to provide Aboriginal groups with a means of verifying that conservation or other cultural requirements are being adequately addressed.

Monitoring in an archaeological context has limited application. With the possible exception of burials, artefactual material is rarely salvaged as a result of simple visual monitoring. Any salvaged material is of limited archaeological value as it no longer has any contextual integrity, and may also have been damaged as result of impactive activities. Based on the assumption that an appropriate program of survey, subsurface testing and site salvage has been carried out at Badgerys Creek, the purpose of archaeological monitoring would be limited to ensuring appropriate strategies are followed if burials or atypical artefactual material is uncovered. This form of monitoring would probably only be required in aggrading sedimentary contexts.

The Gandangara Local Aboriginal Land Council has expressed its desire for an appropriate Aboriginal monitoring program to be implemented at Badgerys Creek for the duration of any activities which result in landsurface disturbance.

9.2.2 DURING OPERATION

If the airport is constructed at one of the Badgerys Creek airport options following the commencement of airport operations the following management strategies would be required:

Monitoring of Local Area Indirect Impacts

The monitoring and strategy review process established during the construction phase for creek bank erosion, siltation risk and scarred tree health would continue into the operational phase. This program would need to collect baseline data prior to construction activities.

Monitoring of the Potential Impact of Airborne Pollutants

A monitoring program would be required to test and assess the potential effects of airborne pollutants and their possible role in rock surface instability in a regional sample of shelter pigment sites and open grinding groove and engraving sites. The study would aim to identify what impacts, if any, can be attributable to airport derived pollutants, and to recommend mitigation strategies where appropriate. Sites for study would include occurrences on the nearby Burragorang Plateau.

Monitoring would need to include the collection of baseline data prior to the commencement of airport operation.

Assessment of Aboriginal Sites in Areas Adjacent to Airport Site

In order to provide assurance that Aboriginal sites are being effectively detected and assessed prior to the potential development of freehold land adjacent to the airport site, local government organisations would be encouraged to ensure that development approvals are conditional on conducting adequate levels of archaeological survey assessment, and where necessary, mitigation. These procedures would ensure that existing State government legislation protecting Aboriginal sites is effectively applied.

9.2.3 ABORIGINAL PARTICIPATION

Representatives of key local Aboriginal community organisations would be involved in both the design and implementation of all of the management strategies conducted.

The inclusion of Aboriginal community representatives in relevant decision making and steering committees could be an appropriate means of ensuring local Aboriginal involvement.

9.2.4 ABORIGINAL SIGNIFICANCE

Strategies relevant to the mitigation of possible Aboriginal cultural values are included in the Gandangara Local Aboriginal Land Council report provided in *Appendix J*. The Land Council propose the following strategies and actions:

- further investigations and analysis of the study area including test excavation and significance assessment;
- Aboriginal personnel monitoring of development procedures;
- Land Council care and control of recovered cultural materials; and
- compensation for the loss of sites, cultural material, and the natural and cultural values of the areas impacted.

9.3 HOLSWORTHY OPTIONS - MANAGEMENT STRATEGIES

9.3.1 PRE AND DURING CONSTRUCTION

If the Second Sydney Airport was to be constructed within one of the proposed options in the Holsworthy Military Area, the following management strategies would be required:

Surface Survey

Surface survey of the remaining unsurveyed areas of the proposed direct impact areas would be a preliminary requirement with the aim of ensuring that all sites and areas of significant archaeological potential were identified. One hundred percent coverage of high site density landforms, such as secondary and minor fluvial corridors would be required, with lesser coverage being acceptable in some other ridgetop topographies provided that all high sensitivity small scale landforms were covered, such as large open rock platforms and escarpments. Survey following the completion of firing for the unexploded ordnance clearance program may be an advantage.

Surface survey would be a pre-construction activity, and ideally would also be conducted prior to the detonation of unexploded ordnance. However, in areas of unacceptable risk, survey may have to be conducted after clearance of unexploded ordnance.

The survey would aim to effectively identify all significant surface site locations and provide an accurate, high coverage, and stratified inventory of surface manifestations of Aboriginal sites within the construction area. This

would facilitate the development of appropriate research designs for subsurface testing and salvage programs.

Based on construction plans, sites or potential archaeological deposits which may be able to be conserved *in situ* within the airport site would be identified.

Survey of areas which may be subject to indirect impacts such as siltation and creek bank erosion, would also be conducted with the aim of identifying sites potentially at risk.

Statutory Consents Under the National Parks and Wildlife Act 1974

Prior to any construction works and at various stages in the archaeological investigation, applications must be made to the Director-General of the NSW National Parks and Wildlife Service for various consents and permits regarding the excavation, disturbance or destruction of Aboriginal relics.

All archaeological investigation which involves excavation of artefacts, salvage, or the recording of rock art can only be conducted following the provision of a permit. Similarly no relics can be destroyed without a consent authority.

All incidences of artefacts or other relics which would be destroyed or impacted by the proposal would require a Consent to Destroy before any disturbance can occur.

Coordination of Unexploded Ordnance Clearance Program and Aboriginal Site Management

The management priorities of the Aboriginal site management program would be communicated to the unexploded ordnance clearing program and the priorities of the two programs coordinated so that potential damage to sites from detonation can be avoided or minimised.

Surface archaeological survey would be conducted in all areas of proposed unexploded ordnance clearance, prior to the instigation of these activities, and provided that the risk of injury to surveyors is deemed acceptable. Clearance activities would attempt to minimise impact to identified archaeological sites, where and if this is considered appropriate.

Subsurface Testing

A program of subsurface testing in both shelter and open sites and areas of defined archaeological potential would be required to accurately identify the nature and distribution of the sub-surface archaeological resource.

Testing would be carried out using both hand and mechanical digging and include sampling methods such as hand dug test pits in shelters, multiple shallow spade excavations in open contexts, back hoe trenches, and grader scrape transects.

The aim of this program would be to identify the best areas in which to conduct full scale salvage excavations.

Sub-Surface Salvage

Salvage excavations would be conducted in a range of locations, according to the priorities and criteria identified in the preceding testing program. Although a representative sample of deposits would require excavation, it is anticipated that emphasis would be placed on valley floor alluvial and colluvial deposits, high potential rock shelter deposits and shelters with art.

Emphasis should be placed on large area excavation in both open and shelter sites where low levels of disturbance can be identified. Deep trenches with minimal aerial extent may also be required to test and characterise older sedimentary facies.

Major programs of processing, analysis, dating, and curation of excavated material would be required.

Comprehensive Recording of Rock Art

Comprehensive graphic recording of all rock art to an archival standard and to a level concomitant with the site's significance would be carried out for all sites directly impacted by construction. Recording techniques would include direct tracing using clear film, standard photography and photogrammetry.

Sampling and analysis of pigment and mineral accretions would also be conducted, including chemical analysis of pigment types, engraving surfaces, and a program of accelerator mass spectrometry C^{14} dating of charcoal pigments.

Physical Salvage of Rock Based Sites

Where and if considered appropriate by Aboriginal custodians, a program of physical salvage of selected rock based sites would be attempted, including open rock platforms with engravings and grinding grooves and rock shelters containing pigment art.

The program could only be conceived and developed with the integral involvement and consent of the local Aboriginal community. The maintenance, where possible, of appropriate cultural practise could be an important consideration.

Possible strategies for salvage could range from the removal of specific panels of art or grinding grooves, to the attempted removal of whole rock platforms or shelters.

Large scale physical salvage of Aboriginal rock based sites has rarely been conducted in the Sydney Basin. Elsewhere in Australia salvage has focused on discrete boulders or tors. The removal of massive bedrock exposures such as escarpment shelters may not yet have been attempted and the feasibility of such an exercise remains to be verified. Most removal techniques would be experimental in their application, and considerable resources would be required to develop a successful set of practices.

Of equal importance to a salvage program is the provision of a culturally appropriate area for the permanent storage and/or display of the salvaged material. This would be a significant and challenging issue requiring resolution as part of the salvage program.

Tree Scar Salvage

Where considered appropriate by Aboriginal custodians, the scarred sections of Aboriginal scarred trees would be salvaged after appropriate field recording. Selected examples would be the subject of a program of research with the aims of further identifying the origin and age of the scarring.

Monitoring of Indirect Impacts

A program of regular monitoring of indirect impacts on sites would be instigated with the aim of developing and assessing the effectiveness of mitigation strategies. This program would need to collect baseline data prior to construction activities.

Develop and Implement Strategies to Minimise Indirect Impacts

Based on the results of the above monitoring program, environmental protection measures would be reviewed and if necessary redesigned to mitigate indirect impacts, such as for the control of water flow velocities and sediment loads into relevant drainage lines.

Where necessary, sites would be fenced, or the physical environment of sites stabilised and reinforced if impacts are likely to be significant either during or after construction.

Develop and Implement Strategies for the Emergency Salvage of Significant Sites

In consultation with Aboriginal representatives and construction managers, a set of strategies would need to be adopted which define the actions required in the event that a significant site (such as a burial) is uncovered during construction works. This would normally include the following actions:

- cease impactive works;
- notify any required statutory authorities (the NSW National Parks and Wildlife Service, and in the case of a burial, also the Police);
- identification and assessment of the site by an archaeologist and suitably qualified Aboriginal representative; and
- determine and carry out an appropriate management strategy.

Conservation and Management Plans for In Situ Site Conservation

If sites have been identified which can be effectively conserved in situ and are of a significance which warrants conservation, then management plans would be formulated and instigated for each site.

In situ site maintenance involves the long-term conservation of a site or artefact in its original context and configuration within the landscape. This may involve active intervention to protect a site (by exclusion of defined impacts or activities) or restoration and stabilisation of a site such as a dead standing scarred tree or a fragile rock surface.

Sites located adjacent to the airport site and which may be impacted by indirect impacts would also be the subject of management plans.

Minimise Vibration Levels from Blasting

In areas adjacent to sites potentially sensitive to ground vibration, blasting techniques would be adopted which minimise ground vibration.

Control of Dust Generation

Measures to control dust generation would be employed to minimise potential impact to regional rock art sites.

Subsequent Curation and Care of Salvaged Materials

The provision of permanent and appropriate places for the storage of salvaged materials is an integral component of any salvage program and is an important funding consideration. Care and control of collections will often be vested in local Aboriginal communities.

Monitoring of Ground Surface Disturbance

Monitoring involves the observation of construction activities by qualified archaeologists and/or members of representative Aboriginal groups. Monitoring is generally carried out in order to salvage artefactual material, prevent inappropriate damage to Aboriginal burials, record relevant data, ensure that permit and consent conditions are met and to provide Aboriginal groups with a means of verifying that conservation or other cultural requirements are being adequately addressed.

Monitoring in an archaeological context has limited application. With the possible exception of burials, artefactual material is rarely salvaged as a result of simple visual monitoring. Any salvaged material is of limited archaeological value as it no longer has any contextual integrity, and may also have been damaged as result of impactive activities. Based on the assumption that an appropriate program of survey, subsurface testing and site salvage has been carried out at Holsworthy, the purpose of archaeological monitoring would be limited to ensuring appropriate strategies are followed if burials or atypical artefactual material is uncovered. This form of monitoring would probably only be required in aggrading sedimentary contexts or rock shelter contexts.

Construction Worker Education

Information regarding the need to conserve Aboriginal sites in areas adjacent to construction zones, could be included in induction programs. Information could also be provided about appropriate behaviour in fragile sites such as rock shelters.

9.3.2 DURING OPERATION

If the airport is constructed at one of the Holsworthy options, following the commencement of airport operations, the following management strategies would be required:

Management Plans for Surviving Sites

Conservation management plans would be developed and instigated for Aboriginal sites which are likely to be indirectly impacted by the operation of

the airport. The plans would address issues such as increased visitation levels, and the effects of pollution.

Monitoring of Local Area Indirect Impacts

The monitoring and strategy review process established during the construction phase for creek bank erosion, siltation risk scarred tree health and rock art impacts would continue into the operational phase.

Monitoring of the Potential Impact of Airborne Pollutants

A monitoring program would be required to test and assess the potential effects of airborne pollutants and their possible role in rock surface instability in a sample of variably distant shelter pigment sites and open grinding groove and engraving sites. The study would aim to identify what impacts, if any, can be attributable to airport derived pollutants, and to recommend long term mitigation strategies where appropriate.

Monitoring would need to include the collection of baseline data prior to the commencement of airport operation.

Stabilisation of Site Environments

In the case of fragile or potentially unstable sites, various methods of stabilisation or reinforcement would be employed if it was anticipated that construction or operational impacts may significantly degrade a site. This could involve hardening of stream banks, restoration of fragile art surfaces and the use of scaffolding in unstable overhangs.

9.3.3 ABORIGINAL PARTICIPATION

Representatives of key local Aboriginal community organisations would be involved in both the design and implementation of all of the management strategies conducted.

The inclusion of Aboriginal community representatives in relevant decision making and steering committees could be an appropriate means of ensuring local Aboriginal involvement.

9.3.4 ABORIGINAL SIGNIFICANCE

Strategies relevant to the mitigation of possible Aboriginal cultural values have not yet been received from the Tharawal Local Aboriginal Land Council.

Part E

Summary of Aboriginal Cultural Heritage Impacts

CHAPTER 10 COMPARISON OF AIRPORT OPTIONS

10.1 AREAS OF DIRECT IMPACT

The area of direct impact for each airport option approximates the combined areas of the proposed airport sites and any additional clearing and landfill batters. Little opportunity exists for the retention of significant sites *in situ* within the airport site boundaries.

10.2 KNOWN AND PREDICTED NUMBER OF SITES

The number of known and predicted sites provides a similar relative ordering of the options to the area of direct impact. The density of sites in the Holsworthy options is disproportionately higher due to the occurrence of high sensitivity landforms. Holsworthy Option A includes the highest proportion of high site density landforms and contains the largest archaeological resource in terms of site numbers and aerial distribution.

Badgerys Creek Option A contains 60 known sites or isolated finds, and a predicted resource of around 119 surface sites and isolated finds. Potential areas of *in situ* sub-surface archaeological material occur mostly within 3.1 square kilometres of minor and secondary fluvial corridors (18 percent of the option area).

Badgerys Creek Option B contains 85 known sites or isolated finds, and a predicted resource of around 196 surface sites and isolated finds. Potential areas of *in situ* sub-surface archaeological material occur mostly within 4.8 square kilometres of minor and secondary fluvial corridors (17 percent of the option area).

Badgerys Creek Option C contains 94 known sites or isolated finds, and a predicted resource of around 205 surface sites and isolated finds. Potential areas of *in situ* sub-surface archaeological material occur mostly within 5.6 square kilometres of minor and secondary fluvial corridors (19 percent of the option area).

Holsworthy Option A contains 204 known sites or isolated finds, and a predicted resource of around 320 surface sites and isolated finds. Highest known and predicted site density occurs on valley floors, and within secondary and minor fluvial corridors, which constitute 53 percent of the option area.

One hundred and forty three potential archaeological deposits have been recorded from Option A. Potential areas of *in situ* sub-surface archaeological material occur throughout the natural distribution of rock shelters and in open valley floor contexts. The latter is conservatively estimated to include at least 300 hectares. The predicted number of potential archaeological deposits is around 740.

Holsworthy Option B contains 99 known sites or isolated finds, and a predicted resource of around 201 surface sites and isolated finds. Highest known and predicted site density occurs on valley floors, and within secondary and minor fluvial corridors, which constitute 44 percent of the option area.

One hundred and eight potential archaeological deposits have been recorded from Option A. Potential areas of *in situ* sub-surface archaeological material occur throughout the natural distribution of rock shelters and in open valley floor contexts. The predicted number of potential archaeological deposits is around 566.

10.3 DIVERSITY OF THE ARCHAEOLOGICAL RECORD

All of the Badgerys Creek airport options contain a similar and limited range of surface archaeological indications with open artefact scatters predominating. Greatest diversity in terms of intra site artefact morphology and material types occurs within the fluvial corridors. Based on research elsewhere on the Cumberland Plain, this zone also contains the greatest potential for other sub-surface features such as hearths and in situ discrete activity areas. The proportion of fluvial corridor landform within each option increases in direct relation to the option size.

The known sites in Badgerys Creek Option A comprise 25 open artefact scatters, five scarred trees, and 30 isolated finds. In Badgerys Creek Option B known sites comprise 37 open artefact scatters, seven scarred trees, and 40 isolated finds. Known sites in Option C comprise 47 open artefact scatters, seven scarred trees, and 40 isolated finds.

The Holsworthy options are comparable in the known and potential diversity they present. Differences in the relative frequency of various site attributes occur, such as in scarred trees, grinding grooves and the total number of graphics and this is probably, in part, a reflection of the differing topographic character of each option. Holsworthy Option B contains steeper grades and deeper fluvial corridors, and unlike Option A is not dominated by a major watershed ridgeline.

The attributes of the known Holsworthy Option A archaeological resource includes three open artefact scatters, 24 scarred trees, 12 isolated finds, eight open engraving sites, 36 open grinding groove sites, and 118 shelter sites (shelters with art, deposit, engravings, grinding grooves or grinding surfaces).

In Holsworthy Option B, the known archaeological resource includes one open artefact scatter, four scarred trees, seven isolated finds, six open engraving sites, 22 open grinding groove sites and 52 shelter sites.

10.4 SITE SIGNIFICANCE RATINGS

All of the recorded sites and features within the Badgerys Creek study area are considered to fall within a local context of significance. Sixty eight percent are assessed as having low significance, 30 percent as having moderate significance, and two percent as having high significance. The zones of archaeological potential identified within the minor and secondary fluvial corridors are also considered to have mostly local significance. The main determinant of this assessment is the upper catchment context and the widespread nature of these landforms on the Cumberland Plain.

In contrast, the Holsworthy options contain a greater spread of sites across the moderate and high categories and include consistent proportions of sites with local and regional scaled assessments. The frequency of sites with regional significance is relatively high. It should also be noted that the majority of the archaeological resource, the sub-surface material, remains largely unassessed except for its local relative potential.

Within Holsworthy Option A, 111 sites and isolated find were assessed based on Draft EIS survey recordings. Ninety one percent fell within a local significance scale and nine percent within a regional scale The largest category was low local with 40 percent of the recordings, followed by moderate local (28 percent) and high local (24 percent). No more than four sites occur in each of the regional categories, with three sites assessed as having high regional significance. If the significance of the Option A predicted archaeological resource followed the same pattern, then approximately 77 recordings would be of high local significance, and 29 would have regional significance with 10 in the high regional category.

Within Holsworthy Option B, 59 site and isolated finds were assessed based on EIS recordings. Ninety percent fall within a local significance scale and 10 percent within a regional scale. The largest category is low local with 42 percent of the recordings, followed by high local (29 percent) and moderate local (19 percent). No more than three sites occur in each of the regional categories, with three sites assessed as having high regional significance. If the significance of the predicted archaeological resource within Option B

followed the same pattern, then approximately 58 recordings would be of high local significance, and 20 would have regional significance with 10 in the high regional category.

10.5 SCIENTIFIC VALUES

The scientific value of archaeological sites can be summarised as the known or potential value of a site to be applied within a program of research and the creation of knowledge.

Most of the surface sites identified in the Badgerys Creek study area have low scientific value due to extensive levels of disturbance and low artefact densities. Subsurface investigation of comparable landforms on the Cumberland Plain however indicate that surface indications can be deceptive and the value of archaeological material below the plough zone may be considerable. For this reason, most of the scientific value of the Badgerys Creek options is vested in the sedimentary facies of the fluvial corridors.

Within both of the Holsworthy options, scientific values are generally moderate or high, based mostly on the low levels of disturbance, indications of moderate or high inter- and intra- site diversity, the locally distinctive rock art assemblage and significant number of known and potential deposits with high potential. The high density and diverse range of sites within an original landscape context provides for high research potential. The potential sub-surface archaeological resource holds considerable potential for the survival of occupation evidence of regional and national significance.

The local rock art assemblage is a locally distinct variant within the Sydney basin and includes a degree of heterogeneity which is likely to be of great value to future scientific research. In each case the Holsworthy option areas would destroy a large and significant proportion of the known rock art sites on the Woronora Ramp. Option A in particular includes most of the large graphic assemblages on the northern section of the Ramp. Both options contain rare or unique graphics.

10.6 ABORIGINAL CULTURAL VALUES

The Statements of Significance from the Tharawal and Gandangara Local Aboriginal Land Councils are provided in *Appendix J*.

10.7 COLLECTIVE VALUES

The surviving archaeological resource within the Badgerys Creek options has low to minimal collective values as a scientifically significant suite or complex of Aboriginal sites. The collective values are limited by the extent of land disturbance, degraded nature of the landscape relative to its original 'Aboriginal' context, and multiple pattern of land ownership and exploitation.

The surviving archaeological resource within both of the Holsworthy option areas have high collective values. The Holsworthy options preserve Aboriginal cultural landscapes where a suite of differing and well preserved archaeological traits are conserved, *in situ*, within their original determinate landscape contexts. These collective and landscape values are significant within a local and regional context and include known and potential aspects of national significance, namely the rock art assemblage and sub-surface archaeological resource.

10.8 IMPACT MITIGATION AND SCOPE

The extent to which adverse impacts to cultural heritage values can be successfully mitigated is low across all of the five airport options. This is due both to the large area of the proposal and the minimal opportunity for conserving representative examples *in situ*. Salvage, either by archaeological excavation, field recording, or physical removal are all strategies which are highly selective in the traits they conserve. They all radically transform the character, context and integrity of the subject of salvage.

The degree to which mitigation strategies can effectively salvage heritage values varies significantly between the Badgerys Creek and Holsworthy options. The archaeologically significant Badgerys Creek resource is mostly situated sub-surface (with the exception of some scarred trees) and within contexts which are already under threat from residential and commercial developments. At one level, and in the long term, archaeological salvage may be a positive component by recovering information which may otherwise be lost or never sought. The topographic spread of the potential resource is limited and it would be possible to develop a sampling strategy which at least fulfils contemporary research requirements.

In contrast, the Holsworthy resource is diverse, multivarient, relatively dense, spread over a large area, and is present in a range of forms and contextual constraints. It is arguable whether a sampling strategy could be effectively conducted across the full spectrum of the resource, and comply at least with contemporary research requirements. In many research areas, the present state of archaeological knowledge, methodology or physical analyses remains at a

broad level of inquiry, or is only experimental. Examples are the investigation of rock art, scarred trees and large area excavation. Bounded by these contemporary limitations, salvage of the Holsworthy resource would be unlikely to realise even a small proportion of its considerable potential.

With regard to Aboriginal cultural values, the physical salvage of archaeological features is ineffective in the maintenance of the importance of place and cultural affiliations with tribal lands.

The scope of required works for the mitigation of adverse impacts clearly differentiates the five airport options in terms of the resources required for mitigation. Both the Badgerys Creek and Holsworthy options will require a similar structure and core components, namely: further survey and recording, pre-construction monitoring, subsurface testing, large scale salvage, development of management plans, and subsequent monitoring of construction and operational phases. The Badgerys Creek resource however presents few challenges in the scope and application of strategies.

Holsworthy, by contrast, presents numerous challenges in the variety of archaeological forms it must address and the undeveloped nature of some of the research required. The large size of the known and predicted resource is in itself a primary challenge in logistics and management.

10.9 INDIRECT AND OPERATIONAL IMPACTS

The Badgerys Creek airport options would all involve a limited range of potential indirect and operational impacts. The magnitude of potential impact on the archaeological resource is bounded by the already degraded nature of much of the surrounding Cumberland Plain. Some areas of potential concern, such the effect of airborne pollutants over varying distances, cannot be adequately addressed due to lack of comparative of baseline data.

The Holsworthy options include a wider range of potential indirect impacts, due to the diversity, density and better condition of the surviving resource. Above ground sites tend also to be more vulnerable to indirect impacts such as increased visitation, dust and vibration. Similar to the Badgerys Creek context, some of the areas of concern cannot be adequately assessed due to a lack of data.

In both study areas, there would be significant visual and noise intrusion which may degrade the contextual and educational values of adjacent places of significance such as Bents Basin, and numerous Aboriginal sites in the adjacent publicly accessible Crown land to the south and east of the Holsworthy Military Area.

CHAPTER 11 SUMMARY OF ABORIGINAL CULTURAL HERITAGE IMPACTS

Table 11.1 presents a qualitative numerical summary of the main areas of impact and heritage assessment for each of the proposed airport options. For each category a possible scale of between one and 10 was used. The option with the greatest value was provided with a value of 10, and each subsequent option was graded relative to the first. In this way, the highest numerical value indicates greatest cultural heritage value, and largest potential impact and required mitigation program. The lowest value equates with the least rating option on this relative scale.

There is a clear distinction to be made between the Badgerys Creek and Holsworthy option areas. The Holsworthy options rate at least twice as highly than those at Badgerys Creek. Badgerys Creek Option A is the least impacted, followed relatively closely by Badgerys Creek Options B and C with little effective difference between them. Holsworthy Option A has a maximum value, with ratings assessed at the maximum in every category. Holsworthy Option B has a rating close to Option A, being marginally lower in overall size and significance.

In conclusion, the potential development of the Second Sydney Airport at any of the Badgerys Creek options can be placed within a relative contextual scale which equates the level of impact at a local scale. Similar areal scales of development in upper catchment Cumberland Plain contexts have occurred previously in the recent past, and are continuing as part of the urbanisation of western Sydney. The Holsworthy options can be placed within a regional, and national scale. The degree of loss in terms of cultural heritage significance would not normally be contemplated except where no viable alternatives exist.

TABLE 11:1 COMPARATIVE SUMMARY OF ABORIGINAL CULTURAL HERITAGE IMPACTS FOR THE PROPOSED SECOND SYDNEY AIRPORT OPTIONS

Impact or value category	Badgerys Creek Option A	Badgerys Creek Option B	Badgerys Creek Option C	Holsworthy Option A	Holsworthy Option B
Area of Direct Impact	4	7	7	10	8
Known and Predicted Resource	3	5	6	10	8
Quality and Diversity of Archaeological Resource	2	3	4	10	10
Site Significance	2	3	3	10	9
Aboriginal Cultural Values					
Collective Values	1	2	2	10	10
Scope of Impact Mitigation	3	4	4	10	9
Indirect and Operational Impacts	4	4	4	10	10
Total (Percent)	**19 (27)**	**28 (40)**	**30 (43)**	**70 (100)**	**64 (91)**

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Appendices

Appendix A

Consultation

Appendix A
Consultations

Statutory and Government Authorities

- Keiran Hotchin, Aboriginal and Torres Straight Islander Commission;
- Russell Couch, Manager, Sydney Zone, NSW National Parks and Wildlife Service;
- Margaret Koettig, Archaeologist, Sydney Zone, NSW National Parks and Wildlife Service;
- Katherine Sale, Archaeologist, Sydney Zone, NSW National Parks and Wildlife Service;
- Norm Stephenson, Australian Heritage Commission;
- Ian Coates, Australian Heritage Commission; and
- Rita Morrison, National Native Title Tribunal.

Museums

- Dr Bill Jonas, National Museum of Australia, Canberra; and
- Tim Nelson, Australian Museum, Sydney.

Local Aboriginal Land Councils and Aboriginal Organisations

- Tharawal Local Aboriginal Land Council, Kevin Williams, chairperson;
- La Perouse Local Aboriginal Land Council, David Ingrey, sites officer;
- Metropolitan Local Aboriginal Land Council, Jeff Bradford;
- Daruk Local Aboriginal Land Council, Kevin Cavanagh, treasurer;
- Gandangara Local Aboriginal Land Council, Frederick Malone, chairperson;
- Campbelltown Aboriginal Advisory Committee;
- Darug Tribal Aboriginal Corporation, Colin Gale, chairperson;
- Darug Custodial Aboriginal Corporation, (information provided to postal address but no personal or phone contact achieved);

- Korewal Elouera Jerrungarugh, Reuben Brown, chairperson; and
- Elders Aboriginal Corporation.

Individuals

- Reuben Brown, Korewal Elouera Jerrungarugh Tribal Elders Corporation, chairperson;
- Gwen Brown, Korewal Elouera Jerrungarugh Tribal Elders Corporation member;
- Burnum Burnum, Gandangara Local Aboriginal Land Council member;
- Glenda Chalker, Tharawal Local Aboriginal Land Council member;
- John Clegg, Gandangara Local Aboriginal Land Council member;
- John Clegg, lecturer (archaeology) Sydney University;
- Tessa Corkill, consultant archaeologist;
- Mary Dallas, consultant archaeologist;
- Ernie Duren, Korewal Elouera Jerrungarugh Tribal Elders Corporation member;
- Cliff Foley, Tharawal Local Aboriginal Land Council secretary;
- Verlie Fowler, Campbelltown City Councillor;
- Esther Ford, Korewal Elouera Jerrungarugh Tribal Elders Corporation member;
- Colin Gale, Darug Tribal Aboriginal Corporation member;
- John Griffiths, Gandangara Local Aboriginal Land Council member;
- Barry Gunther, Gandangara Local Aboriginal Land Council member;
- Dr Laila Haglund, consultant archaeologist;
- Christopher Keating, local historian;
- Bruce Kendall, Assistant Director Aboriginal Studies, Eora Centre
- Dr Jim Kohen, academic and historian, Macquarie University;
- Mrs M. Latham, long term local koori resident, Tharawal Local Aboriginal Land Council member;

- Allison Lynch, Tharawal Local Aboriginal Land Council member;
- Dr Jo McDonald, consultant archaeologist;
- C. Mumbler, Tharawal Local Aboriginal Land Council member;
- Charlie Mundine, Tharawal Local Aboriginal Land Council member, and employee and contractor to Holsworthy Military Firing Range;
- Roy Mundine, koori informant;
- Carol Sefton, consultant archaeologist;
- Patricia Siderenko, Tharawal Local Aboriginal Land Council member;
- Lyn Syme, koori informant;
- Judy Tempest, Tharawal Local Aboriginal Land Council member;
- Jamie Thomas, Gandangara Local Aboriginal Land Council Sites Officer;
- Gordon Wellington (snr), Korewal Elouera Jerrungarugh Tribal Elders Corporation;
- Kevin Williams, Tharawal Local Aboriginal Land Council chairperson; and
- Robyn Williams, Tharawal Local Aboriginal Land Council member.

Department of Defence

- Marina Peterson, Environmental Officer for Holsworthy Military Training Area;
- WO1 Richard Chaney, Range Control Officer;
- WO2 Allan Crump, A. Range Control Officer;
- Brigadier Peter Dunn, Ex Area Commander; and
- Corpl Robert Thompson, Site recorder and compiler of Army register of Aboriginal sites on the Range.

Other Organisations

- Graham Quint, The National Trust of Australia (NSW) Senior Conservation Officer.

Appendix B

Study Team

Appendix B
Study Team

Aboriginal Cultural Heritage

The Aboriginal cultural heritage study was conducted by three main consultants and a large field team. Details of individual personnel are provided below.

Main Consultants

Kerry Navin	Archaeologist, BA(Hons) MAACAI with primary roles in project management and coordination, literature review, Aboriginal consultation, results analysis and report writing.
Kelvin Officer	Archaeologist, PhD, BA(Hons) with primary roles in project coordination, the field survey program, data processing, results analysis and report writing.
Ilona Horvath	Anthropologist, BA(Hons), MA (in prep.) with primary roles in Aboriginal consultation and anthropological investigation and reporting.

A male anthropologist was available if gender specific issues were identified requiring a male recorder:

Rod Hagen	Anthropologist, BA(Hons), Grad. Dip. Environmental Science

Field Survey Team

Michael Clarke	Archaeological Assistant, A (U.Syd)
Matthew Campbell	Archaeologist, MA (U. Otago), Ph.D candidate, (U. Syd)
Marie Colvill	Archaeologist, BA(Hons) (ANU), B.Sc (U.Adel)
Charlie Dearling	Archaeologist, BA(Hons) (ANU)
Benjamin Evans	Archaeologist, BA(Hons) (ANU), PhD candidate, (ANU)
Stan Florek	Archaeologist, MA(Hons), Ph.D (U.Syd)
Louise Gay	Archaeological Assistant, BA (U.Syd)
Paul Griffiths	Archaeological Assistant, B. App Sc.Cultural Heritage Management (U.Can)
Ken Heffernan	Archaeologist, BA(Hons), LLB, Ph.D (ANU)
Alexandra Kelly	Archaeologist, BA(Hons) (U.Syd)
Tom Knight	Archaeologist, BA, M.Litt. (ANU), MA candidate
Bobbie Oakley	Archaeologist, BA (U.Syd)
Matt Salmon	Archaeologist, BA(Hons) (J.Cook U.)
Patricia Saunders	Archaeologist, BA (UNE), B.Litt (ANU), Dip Ed (UNE)
Corp. Robert Thompson	Amateur recorder and compiler of Army site register
Doug Williams	Archaeologist, BA(Hons) (ANU), Grad.Dip. candidate

Aboriginal Members of Field Survey Team

Ted Budd	Aboriginal consultant, Tharawal Local Aboriginal Land Council
Glenda Chalker	Aboriginal consultant, Tharawal Local Aboriginal Land Council
Rebecca Chalker	Aboriginal consultant, Tharawal Local Aboriginal Land Council
John Clegg	Aboriginal consultant, Gandangara Local Aboriginal Land Council
Cliff Foley	Aboriginal consultant, Tharawal Local Aboriginal Land Council
John Griffiths	Aboriginal consultant, Gandangara Local Aboriginal Land Council
Barry Gunther	Aboriginal consultant, Gandangara Local Aboriginal Land Council
Allison Lynch	Aboriginal consultant, Tharawal Local Aboriginal Land Council
Charlie Mundine	Aboriginal consultant, Tharawal Local Aboriginal Land Council
Lance Syme	Aboriginal consultant, Tharawal Local Aboriginal Land Council
Patricia Siderenk	Aboriginal consultant, Tharawal Local Aboriginal Land Council
Judy Tempest	Aboriginal consultant, Tharawal Local Aboriginal Land Council
Jamie Thomas	Aboriginal consultant, Gandangara Local Aboriginal Land Council
Robyn Williams	Aboriginal consultant, Tharawal Local Aboriginal Land Council

Research Assistants

Jan Klaver	Archaeologist, BA(Hons) (ANU), Ph.D (ANU)
Marc Verey	Archaeologist, BA(Hons) (U.Syd)

Appendix C

Summary Information Sheets Provided for Aboriginal Community Discussion

Proposed Badgerys Creek Second Sydney Airport Site
Archaeological Survey Results
Information sheet

What is this information sheet for?

This information sheet has been prepared by Navin Officer Heritage Consultants for members of the Local Aboriginal Community to help in consultation and discussion about possible impacts to Aboriginal sites from airport development. With the participation of local Aboriginal community members, Navin Officer are producing the Aboriginal cultural heritage assessment of the airport proposal for the Environmental Impact Statement (EIS).

The EIS will be a public report which describes the likely impacts of the new airport and will be used by the government in deciding where to build the airport.
There are three consultants who will be writing the Aboriginal Cultural Heritage report: two archaeologists, Kerry Navin and Kelvin Officer, and one anthropologist, Ilona Horvath.

What is the proposed development?

The Commonwealth government is investigating two possible site options for a second Airport. These sites are Badgerys Creek, east of Luddenham, and the Holsworthy Military Training Area, east of Campbelltown. There are three possible runway arrangements for Badgerys Creek and two site options for Holsworthy. For more information about the proposal see the colour pamphlets provided to the Gandangara, Daruk or Tharawal Land Councils, or phone the toll free Information line on 1800 818 017.

The Badgerys Creek site (a total area of approximately 50 square kilometres) is located mostly within the boundaries of the area administered by the Gandangara Land Council.

How would an airport impact Aboriginal sites?

Construction of an airport includes major earthworks and landscape changes and there is little scope for saving or avoiding sites in the development area. Most, if not all sites, are likely to be destroyed by the construction of the airport.

What fieldwork has been done?

Field survey for Aboriginal sites has been carried out over 45% of the Badgerys Creek area. The survey included all types of landscape as well as all major creek lines. This amount of survey provides a good sample of the total area and allows accurate predictions about the sites which may occur in unsurveyed areas.

Local Aboriginal community members and Land Council representatives took part in all the field survey and will have an important part to play in assessing the significance of the sites recorded.

What sites were found at Badgerys Creek?

112 recordings have been made in the Badgerys Creek survey area.

These are:
- 46 isolated finds (single artefacts)
- 57 artefact scatters or 'camp sites' (2 or more artefacts)
- 8 scarred trees,
- and 1 potential archaeological deposit (a place where there may be a camp site but grass or soil prevents us from seeing the ground surface). In fact, most of the major creeklines are in zones of archaeological potential.

Based on the survey results, there are, on average, about 5 Aboriginal sites per square kilometre in the Badgerys Creek area.

Most of these sites are artefact scatters or single artefacts (isolated finds). Most of the artefact scatters have small numbers of surface artefacts and have been disturbed by farming and past landuse. Just over half of the artefact scatters have between 2 and 5 artefacts. About a third have between 5 and 15 artefacts. And around 15% have larger numbers of artefacts. The larger sites are located next to the main creeks.

No below-ground testing has been conducted, and in some sites, there is potential for artefacts to survive under the ground. In some locations by the creeks, large numbers of artefacts may have survived in undisturbed soil underneath the damage caused by ploughs and tree clearance.

Three of the eight scarred trees are most likely to be Aboriginal. The other 5 may be Aboriginal or natural scars.

Similar archaeological sites are known to occur elsewhere in the surrounding region, outside of the proposed airport site.

How can you have your say?

Navin Officer Heritage Consultants want to include in their report Aboriginal community's views about the proposed airport and the impact it may have on Aboriginal places and cultural values. If you wish to comment, contact your Local Land Council and include your opinions in that organisation's report to Navin Officer. You can also talk to the consultants directly by ringing 06 282 9415 or faxing us on 06 282 9416.

Proposed Holsworthy MTA Second Sydney Airport Site Archaeological Survey Results Information sheet

What is this information sheet for?

This information sheet has been prepared by Navin Officer Heritage Consultants for members of the Local Aboriginal Community to help in consultation and discussion about possible impacts to Aboriginal sites from airport development. With the participation of local Aboriginal community members, Navin Officer are producing the Aboriginal cultural heritage assessment of the airport proposal for the Environmental Impact Statement (EIS).

The EIS will be a public report which describes the likely impacts of the new airport and will be used by the government in deciding where to build the airport.

There are three consultants who will be writing the Aboriginal Cultural Heritage report: two archaeologists, Kerry Navin and Kelvin Officer, and one anthropologist, Ilona Horvath.

What is the proposed development?

The Commonwealth government is investigating two possible sites for a second Airport. These are Badgerys Creek, east of Luddenham, and the Holsworthy Military Training Area, east of Campbelltown. There are three possible runway options for Badgerys Creek and two options for Holsworthy. For more information see the colour pamphlets provided to the Gandangara, Daruk or Tharawal Land Councils, or phone the toll free Information line on 1800 818 017. Holsworthy Option A is located in the middle of the Military Training Area and covers an area of approximately 31 square kilometres. Option B is at the southern end and covers an approximate area of 28 square kilometres. These estimates do not include the necessary road and other service corridors. Both options are located within the boundaries of the area administered by the Tharawal Local Aboriginal Land Council.

How would an airport impact Aboriginal sites?

Construction of an airport includes major earthworks and landscape changes and there is little scope for saving or avoiding sites. Most, if not all sites in the development area are likely to be destroyed by the construction of the airport.

What fieldwork has been done?

Field survey for Aboriginal sites has been carried out over approximately 30% of the entire Holsworthy Military Training Area (MTA), which is about 190 square kilometres in area. Survey areas were selected to include all types of landscape in the MTA and covered about 38 percent of Option A, and 28 percent of Option B. Survey extended across the whole MTA so that the impact of new road and other service corridors could be accurately predicted.

The large survey coverage provides a good sample of both the options and whole MTA, and makes is possible to predict sites occurring in unsurveyed areas.

Local Aboriginal community members and Land Council representatives took part in all the field survey and will have an important part to play in assessing the significance of the sites recorded.

What sites were found at Holsworthy

310 sites were already recorded prior to this survey - mostly rock art and grinding groove sites. Nearly all were found using selective survey methods.

The EIS survey used a comprehensive method and has produced 804 recordings, including 749 recordings of previously unrecorded locations. These include:

37	Isolated finds (single artefacts not in rock shelters)
18	Open artefact scatters or 'camp sites' (2 or more artefacts not in rock shelters)
47	Scarred trees,
128	Rock shelters with drawn or painted rock art
16	Sites with engraved art (all but one are open sites, 4 may be European)
509	Potential archaeological deposits (a place where there may be artefacts but grass or soil prevents us from seeing the ground surface)
64	Sites with grinding grooves (61 are open sites, 10 have Aboriginal engravings)

Based on the survey results, there would be, on average, about 5 Aboriginal sites, 9 potential archaeological deposits, and 5 isolated finds for every square kilometre of the Holsworthy MTA. Using these average figures, it can be estimated that in Option A there are 172 sites and isolated finds, and 282 potential archaeological deposits. In Option B there may be 153 sites and isolated finds, and 251 potential archaeological deposits.

Around 70% of the recordings include potential archaeological deposit, and around 10% have identified archaeological deposit. No archaeological excavations have been conducted within the Holsworthy MTA, and the knowledge which could be gained from these sites remains untested and unknown. However, it is possible to assume that the scientific value of these sites is considerable based on archaeological work conducted elsewhere in the Sydney Basin. Rock shelters close to the MTA have been dated from 2200 to 500 years ago (Mill Creek), and from 1000 years ago (Bull Shelter). Aboriginal occupation in the Sydney Basin can be firmly dated to 13,000 years ago (Shaws Creek, Blue Mountains), and probably at least as far back as 20,000 years. It is also probable that the majority of the Holsworthy rock art, in common with the art in the rest of the Sydney Basin, was made over the last 3000 years.

Most of the Holsworthy sites have no or little damage from visitors because there has been no farming or public access since the 1900's. Most have also escaped significant damage from military land uses because they are located away from target areas.

The rock art in Holsworthy appears to contain some stylistic traits which are unique to the general area. These traits are only beginning to be recognised by archaeologists as valuable scientific indicators of past social patterns in Aboriginal history.

How can you have your say?

Navin Officer Heritage Consultants want to include in their report Aboriginal community's views about the proposed airport and the impact it may have on Aboriginal places and cultural values. If you wish to comment, contact your Local Land Council and include your opinions in that organisation's report to Navin Officer. You can also talk to the consultants directly by ringing 06 282 9415 or faxing us on 06 282 9416.

Appendix D

List of Maps and Aerial
Photographs Used in Field Survey

Appendix D
List of Maps Used During Field Survey

Holsworthy Range Special (Restricted)	1:50,000	Topographic AUSPEC0018 Edition 1 - AAS 1993 Royal Australian Survey Corps
Ingleburn Special (Restricted)	1:25,000	Topographic AUSPEC0055 Edition 1 - AAS 1994 Royal Australian Survey Corps
Appin 9029-I-S	1:25,000	Topographic Second Edition 1986 Central Mapping Authority
Campbelltown 9029-I-N	1:25,000	Topographic Second Edition 1983 Central Mapping Authority
Liverpool 9030-II-S	1:25,000	Topographic Second Edition 1983 Central Mapping Authority
Penrith 9030-3-N	1:25,000	Topographic Second Edition 1986 Central Mapping Authority
Prospect 9030-II-N	1:25,000	Topographic Second Edition 1983 Central Mapping Authority
Warragamba 9030-3-S	1:25,000	Topographic Second Edition 1987 Central Mapping Authority
Badgerys Creek U7345	1:10,000	Orthophotomap Second Edition 1982 Central Mapping Authority
Campbelltown U8222	1:10,000	Orthophotomap Second Edition 1982 Central Mapping Authority
Harris Forest U9130	1:10,000	Orthophotomap Second Edition 1981 Central Mapping Authority
East Hills U9137	1:10,000	Orthophotomap Second Edition 1981 Central Mapping Authority
Helensburgh U9115	1:10,000	Orthophotomap Second ISG Series 1978 Central Mapping Authority
Minto U8230	1:10,000	Orthophotomap Second Edition 1981 Central Mapping Authority

Badgerys Creek U7345-1	1:4,000	Orthophotomap Second Edition 1984 Central Mapping Authority
Badgerys Creek U7345-2	1:4,000	Orthophotomap Second Edition 1984 Central Mapping Authority
Badgerys Creek U7345-4	1:4,000	Orthophotomap Second Edition 1984 Central Mapping Authority
Badgerys Creek U7345-5	1:4,000	Orthophotomap Second Edition 1984 Central Mapping Authority
Badgerys Creek U7345-7	1:4,000	Orthophotomap Second Edition 1984 Central Mapping Authority
Badgerys Creek U7345-8	1:4,000	Orthophotomap Second Edition 1984 Central Mapping Authority
Campbelltown U8222-3	1:4,000	Orthophotomap Second Edition 1983 Central Mapping Authority
Campbelltown U8222-4	1:4,000	Orthophotomap Second Edition 1983 Central Mapping Authority
Campbelltown U8222-5	1:4,000	Orthophotomap Second Edition 1983 Central Mapping Authority
Campbelltown U8222-7	1:4,000	Orthophotomap Second Edition 1983 Central Mapping Authority
East Hills U9137-7	1:4,000	Orthophotomap Second Edition 1984 Central Mapping Authority
East Hills U9137-8	1:4,000	Orthophotomap Second Edition 1984 Central Mapping Authority
East Hills U9137-9	1:4,000	Orthophotomap Second Edition 1984 Central Mapping Authority
Harris Forest U9130-1	1:4,000	Orthophotomap Second Edition 1984 Central Mapping Authority
Harris Forest U9130-2	1:4,000	Orthophotomap Second Edition 1984 Central Mapping Authority

Harris Forest U9130-3	1:4,000	Orthophotomap Second Edition 1984 Central Mapping Authority
Harris Forest U9130-4	1:4,000	Orthophotomap Second Edition 1984 Central Mapping Authority
Harris Forest U9130-5	1:4,000	Orthophotomap Second Edition 1984 Central Mapping Authority
Harris Forest U9130-6	1:4,000	Orthophotomap Second Edition 1984 Central Mapping Authority
Harris Forest U9130-7	1:4,000	Orthophotomap Second Edition 1984 Central Mapping Authority
Harris Forest U9130-8	1:4,000	Orthophotomap Second Edition 1984 Central Mapping Authority
Harris Forest U9130-9	1:4,000	Orthophotomap Second Edition 1984 Central Mapping Authority
Minto U8230-3	1:4,000	Orthophotomap Second Edition 1984 Central Mapping Authority
Minto U8230-6	1:4,000	Orthophotomap Second Edition 1984 Central Mapping Authority
Minto U8230-9	1:4,000	Orthophotomap Second Edition 1984 Central Mapping Authority
Woronora U9122-6	1:4,000	Orthophotomap Second Edition 1981 Central Mapping Authority

Aerial Photographs used During Field Survey

Penrith Run 10	1:25,000	NSW 4244 colour 178-1994-10-94 Department of Land and Water Conservation, Land Information Centre
Penrith Run 11	1:25,000	NSW 4244 colour 131-152 4-10-94 Department of Land and Water Conservation, Land Information Centre
Penrith Run 13	1:25,000	NSW 4244 colour 62-82 4-10-94 Department of Land and Water Conservation, Land Information Centre

Penrith Run 13 1:25,000	NSW 4244 colour 83-94 4-10-94 Department of Land and Water Conservation, Land Information Centre
Port Hacking Run 2 1:25,000	NSW 4178 colour 38-46 4-01-94 Department of Land and Water Conservation, Land Information Centre
Wollongong Run 1 1:25,000	NSW 4178 colour 01-22 4-01-94 Department of Land and Water Conservation, Land Information Centre
Wollongong Run 2 1:25,000	NSW 4178 colour 47-684-01-94 Department of Land and Water Conservation, Land Information Centre
Wollongong Run 3 1:25,000	NSW 4178 colour 69-90 4-01-94 Department of Land and Water Conservation, Land Information Centre
Wollongong Run 4 1:25,000	NSW 4178 colour 108-129 4-01-94 Department of Land and Water Conservation, Land Information Centre
Wollongong Run 5 1:25,000	NSW 4178 colour 130-152 4-01-94 Department of Land and Water Conservation, Land Information Centre

Appendix E

Site Recording Forms Used in Field Survey

ABORIGINAL SITE FIELD DATA RECORDING FORM 2ND SYD AIRPT

Site Name/code.....
Recorder.....
Date.....
Photos .....

☐ map grid
☐ GPS
☐ mark map & plot later

Site Type
☐ open artefact scatter ☐ rockshelter *with:*
☐ isolated find ☐ *surface artefacts*
☐ open midden ☐ *arch'l deposit*
☐ open grinding grooves ☐ *midden deposit*
☐ open engravings ☐ *pigment art*
☐ quarry ☐ *engraved art*
☐ procurement site ☐ *grinding grooves*
☐ burial ☐ *rock surface pitting*

Large scale landform
☐ crest ☐ valley side/slopes ☐ flats ☐ plains

Small scale landform
☐ major ridge ☐ break-of-slope ☐ major escarpment
☐ spurline ☐ uppr slopes ☐ minor escarpment
☐ knoll ☐ mid slopes ☐ discontinuous outcrop
☐ shoulder ☐ basal slopes ☐ isolated tor/outcrop
☐ saddle ☐ rock platform
☐ valley floor ☐ colluvial fan
☐ terrace ☐ river bed/margin
Bedrock ☐ dune ☐ creek bed/margin
☐ sandstone ☐ sand sheet ☐ wetland margin
☐ shales ☐ lake margin

Site measurements
length:..... width/depth: ..... height: .....
Gradient: ☐ gen.flat ☐ low ☐ mod. ☐ high
Aspect: ☐N ☐NE ☐E ☐SE ☐S ☐SW ☐W ☐NW

Vegetation
☐ forest *Canopy:* *Height:*
☐ woodland ☐ closed ☐ >30m
☐ shrubland ☐ open ☐ 10-30m ☐ 4-2m
☐ grassland ☐ sparse ☐ 10-4m ☐ <2m
main species.....

Visibility & Exposure
exposure. type: .....
soil/matrix type:.....
ground visibility in exposure .....
exposure dimensions X X
visibility away from exposure.....

SITE CONTENTS

Artefact numbers
actual no:.....
Estimate:
☐ 1-5 ☐ 16-50 ☐ 101-500
☐ 6-15 ☐ 50-100 ☐ >500

Artefact density
average (a/m^2).....
max. (a/m^2).....

Other features
☐ shell: ☐ *isolated/sparse*
☐ *low density*
☐ *mod density*
☐ *high density*
☐ bone
☐ charcoal ☐ hearth
☐ evidence of Ab'l quarrying
other:.....
.....

Artefact material types

	✓	no.	%
quartz	☐	.....	.....
quartzite	☐	.....	.....
silcrete	☐	.....	.....
chert	☐	.....	.....
rhyolite	☐	.....	.....
volcanic	☐	.....	.....
pet'd wood	☐	.....	.....
tuff	☐	.....	.....

other:.....

Artefact descriptions

	✓	no.	percentage
flakes	☐	.....	.....
flaked pieces	☐	.....	.....
cores	☐	.....	.....
hatchet head/frag't	☐	.....	.....
secondary flaking	☐	.....	.....
use wear	☐	.....	.....
pebble cortex	☐	.....	.....
microliths	☐	.....	.....
backed blades	☐	.....	.....
geometric microliths	☐	.....	.....
microblade cores	☐	.....	.....
bipolar cores	☐	.....	.....
single platform cores	☐	.....	.....
multiplatform cores	☐	.....	.....
hammerstones	☐	.....	.....
anvil stones	☐	.....	.....
grinding stones	☐	.....	.....
hearth stones	☐	.....	.....
manuports	☐	.....	.....

Archaeological Potential to:
be larger than record'd area: ☐ low ☐ mod. ☐ high ☐ can't tell
contain (more) artefacts: ☐ low ☐ mod. ☐ high ☐ can't tell
have *in situ* subsurface mat'l ☐ low ☐ mod. ☐ high ☐ can't tell

Site Condition/impacts
General rating ☐ poor ☐ good. ☐ v.good ☐ excel. ☐ can't tell
visitor/landuse impacts: ☐ low ☐ mod. ☐ high ☐ can't tell
natural impacts: ☐ low ☐ mod. ☐ high ☐ can't tell
☐ graffiti ☐ rubbish ☐ camp'g ☐ vehicles ☐ fill ☐ animal digg'g
☐ veg.clear'g ☐ plough'g ☐ erosion ☐ quarry'g ☐ ordnance
Other:.....
.....

Abraded/Pecked features
☐ grinding grooves: no. of grooves .....
no. of groups.....
groove length: max: ..... min:.....
groove width: max:..... max:.....
☐ channels: no. .....
☐ other:.....

(over for site sketch & individual artefact descriptions; art description on separate form)

Individual artefact descriptions *(up to 10)* **/notes:**

SITE SKETCHES

Include:
north arrow;
rough scale or measurements;
plan & profile for rock shelters;
for shelters include overhang extent, dripline (if different), major rocks, extent of back wall & edge of deposit;
location of art panels;
plan for open sites;

ROCK ART SUPPLEMENTARY RECORD SHEET

2ND SYD AIRPT

Site Name/code.....
Recorder.....
Date.....
Photos .....

Nature of Site

☐ shelter made by cavernous weather'g
☐ shelter made by tipped/angled rock surfaces
☐ open rock platform ☐ cliff (no overhang)

Condition of art/impacts

mostly: ☐ poor ☐ good ☐ v. good ☐ excel.

☐ faded ☐ fragmentry ☐ surface water wash
☐ large area exfoliation ☐ scalar exfoliation ☐ dust
☐ insect deposits ☐ mineralisation ☐ lichen/organics
☐ animal rubbing ☐ graffiti ☐ ordnance ☐ vehicle
☐ fire blackening Other:.....
.....

Distribution/density

Density: ☐ isolated/sparse ☐ low (1 graphic per 1-2m^2)
☐ mod (1-5 graphics per 1m^2)
☐ high (>5 graphics per 1m^2)
☐ indeterminate
Superimpositions: ☐ none seen ☐ rare ☐ frequent
☐ very frequent
Location: ☐ art mostly near largest sheltered space
☐ art all over shelter surfaces
☐ art mostly on out-of -the-way surfaces

notes/sketches: (if necessary use space on other side)

The Art Support

area (m^2) with art: ..... ☐ back wall ☐ floor
area suitable for art: ..... ☐ ceiling ☐ other overh'g
% stable surface ..... ☐ horiz'l ☐ slop'g ☐ vert'l
% unstable .....
☐ sandstone ☐ conglom. Other:.....
☐ honeycomb weather'g ☐ exfoliation ☐ granular decay
☐ structural crack'g ☐ mineral skins ☐ active water pores

The art assemblage *(summary recording)*

estimate of total no. of graphics.....
estimate of no. of identifiable graphics .....
estimate of no. of indeterminate graphics.....

		✓	*no.*	*percentage*
technique:	drawn (pigmented)	☐	.....	.....
	painted (pigmented)	☐	.....	.....
	'engraved'	☐	.....	.....
	pigment and 'engraved'	☐	.....	.....
	stencilled	☐	.....	.....
	'freehand'	☐	.....	.....
colour:	black	☐	.....	.....
	red	☐	.....	.....
	white	☐	.....	.....
	yellow	☐	.....	.....
	more than 1 colour	☐	.....	.....
motif types:	bird	☐	.....	.....
	anthropomorph/human	☐	.....	.....
	lizard	☐	.....	.....
	other splayed quadruped	☐	.....	.....
	macropod	☐	.....	.....
	dog	☐	.....	.....
	echidna	☐	.....	.....
	other profile quadruped	☐	.....	.....
	eel	☐	.....	.....
	other fish	☐	.....	.....
	snake	☐	.....	.....
	other long thing (no limbs/fins)	☐	.....	.....
	shield	☐	.....	.....
	boomerang	☐	.....	.....
	other	☐	.....	.....
	indeterminate	☐	.....	.....
form:	mostly outline only	☐	.....	.....
	outline and linear type infill	☐	.....	.....
	mostly solid	☐	.....	.....
	linear and solid	☐	.....	.....
	linear outline and solid infill	☐	.....	.....
stencilled things:	red	☐	.....	.....
	white	☐	.....	.....
	yellow	☐	.....	.....
	black	☐	.....	.....
	hands/fingers	☐	.....	.....
	feet	☐	.....	.....
	material culture	☐	.....	.....
	animal	☐	.....	.....
	other	☐	.....	.....

.....

POTENTIAL ARCHAEOLOGICAL DEPOSIT RECORD SHEET 2ND SYD AIRPT

Site Name/code.....
Recorder.....
Date.....

Photos .....

☐ map grid
☐ GPS
☐ mark map & plot later

Site measurements
length:..... width/depth: ..... height: .....

Gradient: ☐ gen.flat ☐ low ☐ mod. ☐ high

Aspect: ☐N ☐NE ☐E ☐SE ☐S ☐SW ☐W ☐NW

Site description
☐ shelter made by cavernous weather'g
☐ shelter made by tipped/angled rock surfaces
☐ open deposit
Describe soil/deposit:.....
.....
Ground surface visibility:.....
Arch'l potent'l: ☐ low-mod. ☐ mod. ☐ mod-high ☐ high

Large scale landform
☐ crest ☐ valley side/slopes ☐ flats ☐ plains

Small scale landform

☐ major ridge	☐ break-of-slope	☐ major escarpment
☐ spurline	☐ uppr slopes	☐ minor escarpment
☐ knoll	☐ mid slopes	☐ discontinuous outcrop
☐ shoulder	☐ basal slopes	☐ isolated tor/outcrop
☐ saddle		☐ rock platform
☐ valley floor	☐ colluvial fan	
	☐ terrace	☐ river bed/margin
Bedrock	☐ dune	☐ creek bed/margin
☐ sandstone	☐ sand sheet	☐ wetland margin
☐ shales		☐ lake margin

Include sketch plan and profile: (include any features which will help in refinding site)

ABORIGINAL SCARRED TREE FIELD DATA RECORDING FORM 2ND SYD AIRPT

Site Name/code.....
Recorder.....
Date.....
Photos .....

The Tree

species .....
est. height.....
girth (c1.2m above ground) .....

Condition/health:
☐ excel. ☐ good ☐ poor ☐ v.poor ☐ dead

☐ missing crown ☐ major crown limbs missing
☐ stock damage ☐ die back ☐ insect attack
☐ natural scars ☐ hollow ☐ unstable

.....
.....
.....

Tne Scar

aspect.....
length (excl. regrowth).....
length (incl. regrowth).....
width (excl. regrowth).....
width (include. regrowth).....
regrowth (max. width).....
regrowth (max. depth).....
height above ground:
base of inside scar .....
base of regrowth .....

Features:
☐ axe/hatchet marks ☐ termite activity
☐ scar surface burnt ☐ core wood missing
☐ orig'l scar surface whole/partly missing
☐ large/small borer holes/tracks

dition:
☐ excel. ☐ good ☐ poor ☐ v.poor

Archaeological interpretation

Checklist:
☐ tree is endemic to area
☐ tree is at least 100 ys old
☐ regrowth is old enough
☐ scar does not extend to ground
☐ scar sides are parallel if extends to ground
☐ scar edges are even and regular
☐ scar outline is uniform & roughly symmetrical

Conclusion about Aboriginal scar origin:
☐ possible ☐ probable ☐ most likely
☐ definite proof

Alternative natural interpretation:
.....
.....
.....
.....

☐ map grid
☐ GPS
☐ mark map & plot later

Large scale landform
☐ crest ☐ valley side/slopes ☐ flats ☐ plains

Small scale landform

☐ major ridge	☐ break-of-slope	☐ major escarpment
☐ spurline	☐ uppr slopes	☐ minor escarpment
☐ knoll	☐ mid slopes	☐ discontinuous outcrop
☐ shoulder	☐ basal slopes	☐ isolated tor/outcrop
☐ saddle		☐ rock platform
☐ valley floor	☐ colluvial fan	
	☐ terrace	☐ river bed/margin
Bedrock	☐ dune	☐ creek bed/margin
☐ sandstone	☐ sand sheet	☐ wetland margin
☐ shales		☐ lake margin

Vegetation

	Canopy:	*Height:*	
☐ forest			
☐ woodland	☐ closed	☐ >30m	
☐ shrubland	☐ open	☐ 10-30m	☐ 4-2m
☐ grassland	☐ sparse	☐ 10-4m	☐ <2m

main species .....

Sketch of scar and tree:

Appendix F

Plants Used by Aborigines -
(Sydney Prehistory Group)

Appendix F
Plants Used by Aborigines

The Sydney Prehistory Group, in their surveys of the Holsworthy Military Area and nearby areas, recorded the occurrence of plants which were known or believed to have been used by Aborigines (Sydney Prehistory Group, 1983: Appendix 7). The following plant species were indicated:

Acacia falcata	bark contains tannin and was used to stupefy fish and make embrocations for cure of cutaneous diseases
Acacia longifolia	edible seeds
Adiantum aethiopicum	slightly astringent and emetic
Astroloma humifusum *Astroloma pinifolium*	berry eaten
Banksia spp.	flowers sucked for sweet liquid
Billardiera scandens	fruit was eaten raw when ripe and roasted when green
Caladenia spp.	edible tubers
Cyathea australis	pith eaten raw or roasted
Cymbidium spp.	edible stems
Dendrobium speciosum	pseudo-bulbs were eaten but contain little nutritive matter
Doryanthes excelsa	root was eaten after preparation. The flower stalk was soaked in water, then roasted
Eucalypt spp.	febrifugal properties. Kino obtained
Exocarpus spp.	edible fruit
Ferns	roots, possibly *Pteridium esculentum* or *Blechnum* spp. were chewed when eating fish and spat out. Eaten when food was scarce. Pounded to a paste and mixed with crushed ants
Ficus spp.	edible fruit pounded into cake
Trachymene incisa	edible tubers

Goodenia spp.	supposed to be used for making children sleep on long journeys but it is not clear which one or how administered
Lambertia formosa	flower contains sweet liquid. Too much produces nausea and headache
Leptomeria acida	berries edible and thirst quenching
Leucopogon lanceolatus	edible berries
Lissanthe strigosa	edible fruit
Macrozamia spp.	nut was pounded, soaked for 7-8 days and then roasted. Caused illness when eaten unprepared
Persoonia spp.	edible fruit
Pittosporum spp.	infusion of fruit and seeds used medicinally
Smilax glycyphylla	recommended as alterative, tonic and anti-scorbutic
Telopea speciosissima	flowers sucked for sweet honey liquid
Thysanotus tuberosus	edible tuber
Typha spp.	young shoots edible. Root edible and somewhat astringent and diuretic
Xanthorrhoea	base of inner leaves edible

Appendix G

Description of Site Types

Appendix G
Description of Site Types

Bora grounds or earth circles functioned as a prepared stage for initiation and other ceremonial activities which held a key role in the teaching and maintenance of the complex religious and social framework within Aboriginal society. Bora grounds consist mostly of one or more circular rings defined by mounded earth, sand and/or rocks. There may also be an associated depression within the ring. A pathway generally connected two rings and was often many hundreds of metres long. Typically one ring was associated with more public ceremonies and the second with restricted and sacred information. Bora grounds are most often located on river flats and low ridges.

Burials are generally found in soft sediments such as aeolian sand or alluvial silts, but may also occur in middens, mound sites, rockshelters and hollow trees. In valley floor contexts, burials often occur in locally elevated topographies rather than poorly drained sedimentary basins. Burials are also known to have occurred on rocky hilltops in some limited areas. Burials are generally only visible where there has been some disturbance of sub-surface sediments or where some erosional process has exposed them.

Carved trees, a much rarer site type, are sometimes found in association with ceremonial or burial grounds and characteristically include carved figurative and non-figurative motifs on the exposed wood created within a scar produced by bark removal.

'Contact' sites relate to sites which contain evidence of Aboriginal occupation during the period of early European occupation in a local area. The term 'contact' is a general description which refers to the generally poorly defined or documented time period when traditional Aboriginal society made initial contact with Europeans and subsequently changed their social, economic and occupational patterns in response to European incursion. Evidence of this period of 'contact' could potentially by Aboriginal flaked glass, art motifs depicting European people or objects, burials with historic grave goods or markers, and debris from 'fringe camps' where Aborigines who were employed by, or who traded with, the White community may have lived or camped. The most likely location for such contact period Aboriginal occupation sites would be camp sites adjacent to permanent water, and located away from the focus of European town occupation or land use.

Grinding grooves are the by-product of the manufacture of ground edge tools. These were generally made of stone, however bone and shell were also ground to fine points. The location of sites with grinding grooves is dependent on the presence of a suitable rock type, usually fine-grained homogeneous sandstone, and an accessible, but not necessarily permanent, water source.

Isolated finds are artefacts which occur without any associated evidence for prehistoric activity or occupation. They are generally defined as single artefacts located more than a certain distance from any other artefact. Frequently used distances are 30, 60 or 100 m. The distance

used depends on variables such as, 'background' artefact densities, land use disturbance, geomorphic processes and research design objectives. Isolated finds can occur anywhere in the landscape and may represent the random loss or deliberate discard of artefacts, or the remains of dispersed artefact scatters.

Middens are defined as a concentration of artefactual debris that includes a significant percentage of marine or freshwater shell. They are usually the result of interim or base camp activity and are normally located close to the aquatic environment.

Mythological sites/story places are frequently natural features, such as mountains and waterholes, which may not exhibit any material evidence that could indicate their importance to an uninformed person. Identification of this site type is dependent on information being available from informed Aboriginal people.

Open artefact scatters may occur almost anywhere that Aborigines have travelled and may be associated with hunting and gathering activities, domestic camps, or the manufacture and maintenance of stone tools. The density of artefacts represented in these scatters can vary considerably between and across individual sites. These sites are classed as 'open', that is, occurring on the land surface unprotected by rock overhangs, and are sometimes referred to as 'open camp sites'. Artefact scatters commonly occur on level or low gradient contexts, along the crests of ridgelines and spurs, and elevated areas fringing watercourses or wetlands.

Potential Archaeological Deposit (PAD) PAD's are deposits, usually associated with rock shelters or actively aggrading landform features. They exhibit no identifiable archaeological material on the surface but may contain sub-surface material. Potential deposits are usually identified by their context within, or associated with, a landscape feature that was likely to have been exploited in prehistory.

Quarry sites are typically exposures of a geological raw material where evidence for human extraction and/or preliminary processing has survived. Typically these involve the extraction of siliceous rock types for the manufacture of artefacts or the removal of ochre. The presence of quarry/extraction sites is dependent on the availability of suitable rock formations and ochre sources.

Rock engravings consist of any Aboriginal mark produced in rock using an extractive technique which is not the result of a domestic process. Rock engravings commonly occur on flat rock faces in either exposed locations or less commonly, within rock shelters. Other evidence of occupation such as artefact scatters, midden debris, stone arrangements or scarred trees is often associated with engravings. Domestic processes which create marks that could be confused with engravings include tool sharpening or shaping and food grinding or preparation. `Engraving' in this terminology is used in a general sense and can refer to direct and indirect percussion, and varying types of abrasion. The location and preservation of engraving sites is dependent on local rock types and their weathering characteristics.

Rock shelter sites with occupation deposit and/or Aboriginal rock art may occur where suitable rock outcrops occur. These may be weathered areas in vertical rock exposures in

sandstone, granite and conglomerate areas or may occur in isolated blocks of material which have moved from their original source.

Scarred trees result when bark has been removed from a tree for a particular purpose such as shield, canoe or coolamon manufacture. Scars may also be the result of making footholds in a tree to collect foodstuffs or to facilitate the removal of bark. These sites may occur almost anywhere, and identification of scars as Aboriginal in origin can often remain problematical. Many remaining scarred trees date to the historic period when bark was removed by Aboriginals for both their own purposes and for roofing on early European houses Consequently the distinction between European and Aboriginal scarred trees is often blurred.

A **Site complex** is usually a geographically discrete group of sites which can be shown to be inter-related according to their locational determinants. Site complexes are commonly identified in association with valuable sources of raw materials, food, and/or places of ceremonial significance.

Stone arrangements are defined as any arrangement of placed rocks that can be reasonably assigned to Aboriginal activity. Typically these include rock cairns and alignments of single or grouped stones. This site type is often located on high ridges and spurs but are difficult to predict and often limited in distribution.

Appendix H

Plates

Plate 1: An isolated stone artefact (B64), exposed in a creek bank in the Badgerys Creek study area. The exposed soil profile displays a typical duplex soil with a distinct clay 'B' sub-horizon. Subsurface artefacts tend to concentrate at the base of the upper 'A' horizon. [Badgerys Creek Options B & C]

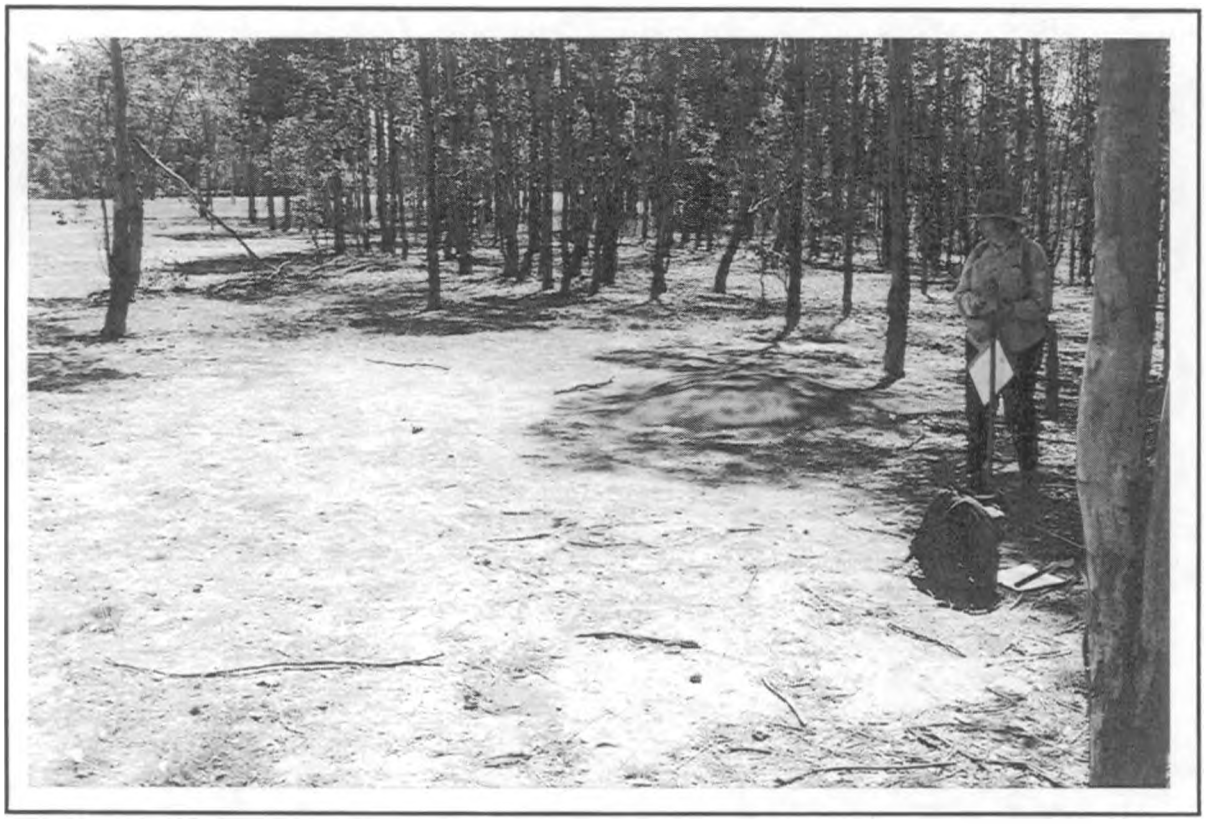


Plate 2: A typical ground surface exposure revealing a characteristic small surface scatter of artefacts (B47). This site is on valley floor alluvial flats in the Badgerys Creek study area. [Badgerys Creek Options B & C]

Plate 3: A relatively large site in the Badgerys Creek study area with an estimated 50 surface artefacts exposed in a grader scrape adjacent to a small drainage line (B102). Photo faces south. [Badgerys Creek Options A, B & C]

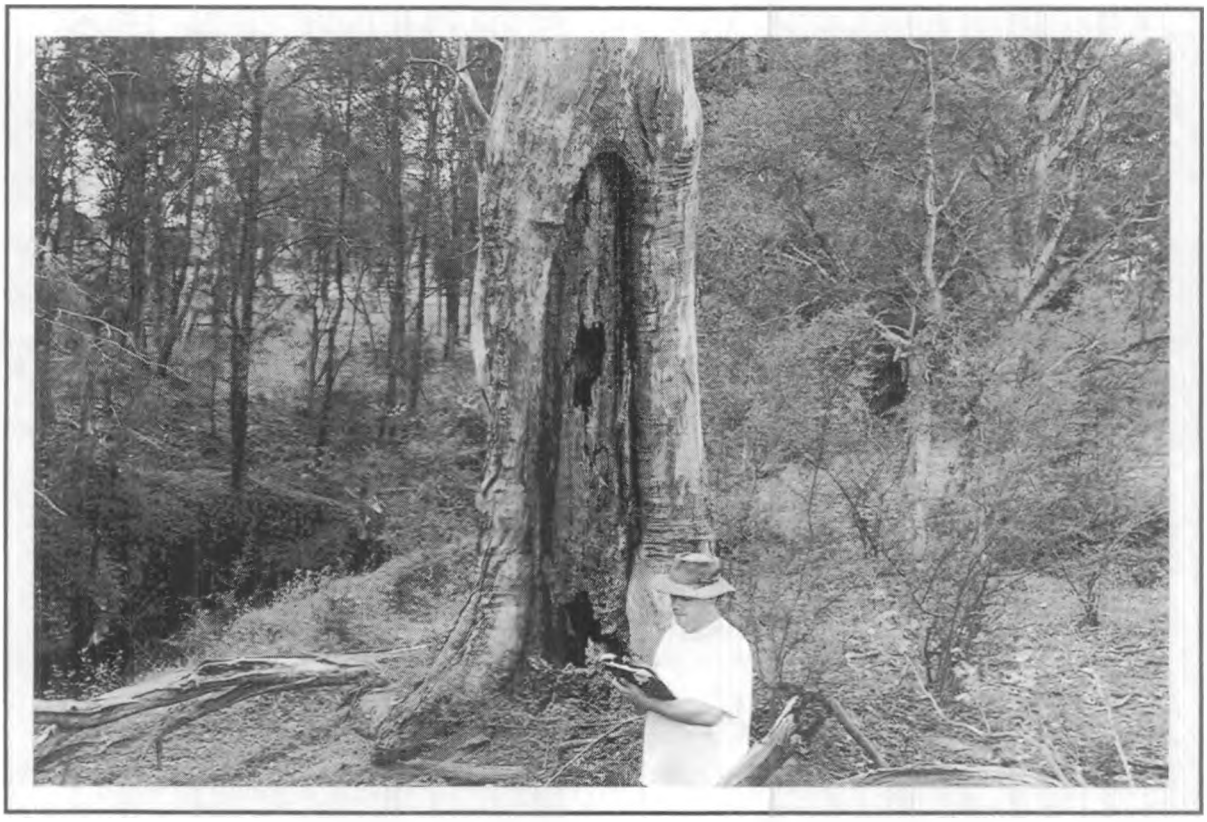


Plate 4: A possible Aboriginal scarred tree adjacent to Badgerys Creek (B40). An alternative explanation for this scar would be from fire damage. [Badgerys Creek Options A, B & C]

Plate 5: An exposure of 11 artefacts (B80), adjacent to a minor fluvial corridor drainage line in the Badgerys Creek study area. [Badgerys Creek Options A, B & C]

Plate 6: A typical vehicle track ground surface exposure on a Holsworthy ridgecrest context. Low density open artefacts scatters and isolated finds are typically found in this context. This site consists of an isolated find (H637).

Plate 7: A large exposure on a river terrace adjacent to the Georges River, created by top soil stripping. A relatively large scatter of fourteen artefacts was revealed in this location (H581).

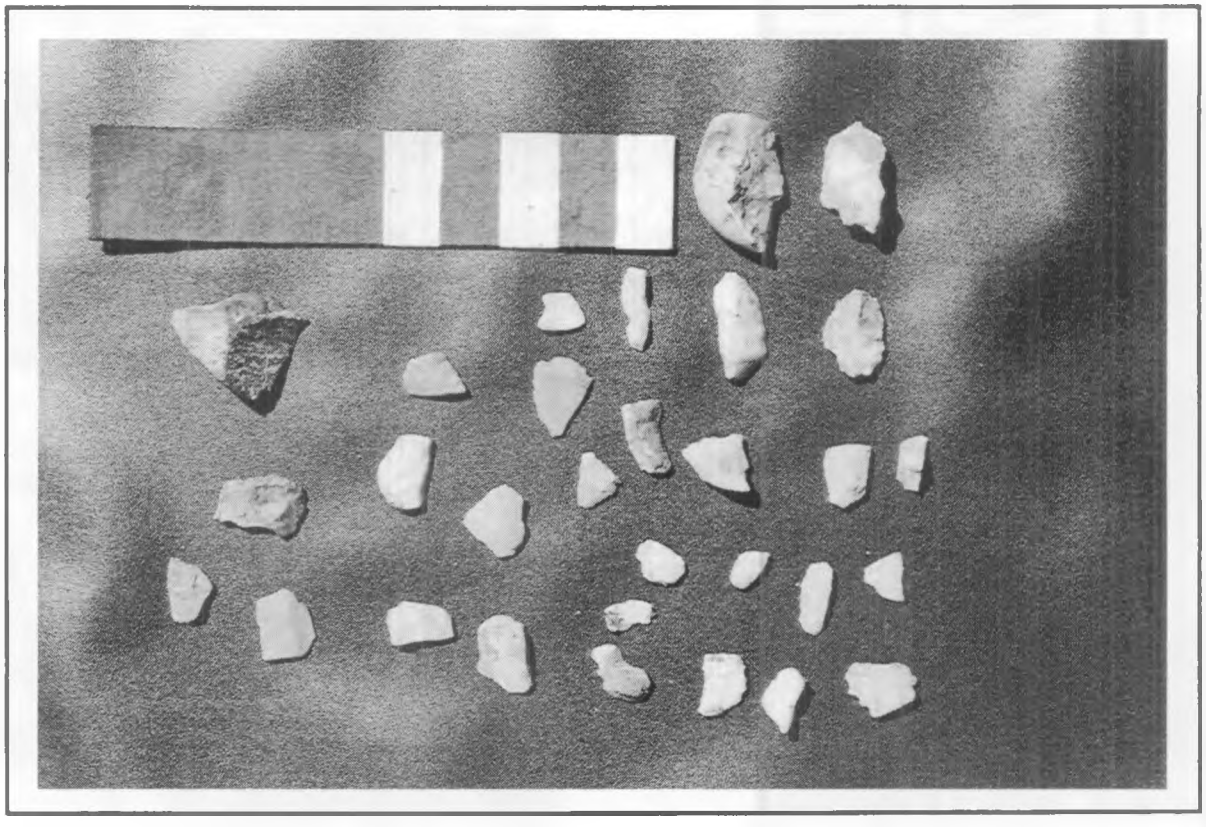


Plate 8: A selection of mainly quartz and silcrete artefacts from a Holsworthy shelter site with a large number of surface artefacts (H1002). [Holsworthy Option A]

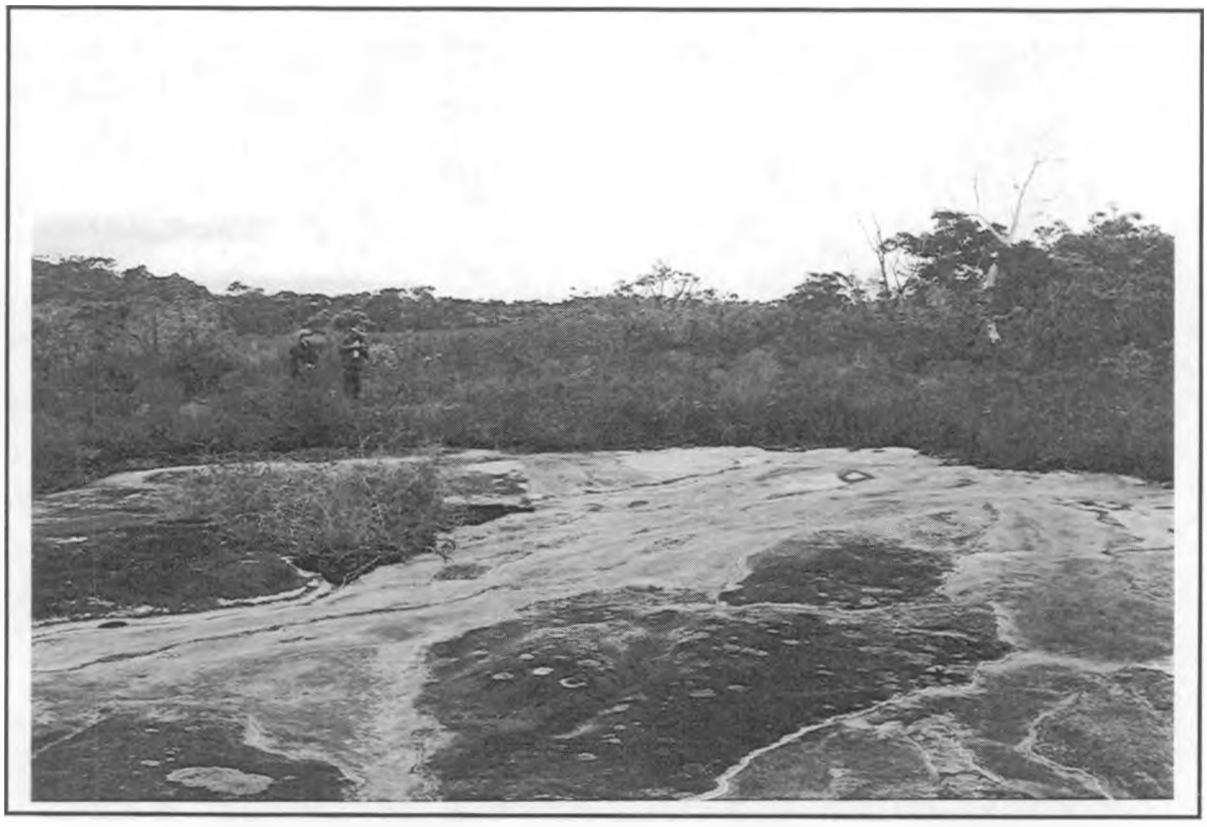


Plate 9: A typical open grinding groove site located on upper slope rock platforms in an area of water seepage adjacent to wet heath. This site has 9 grooves in 5 groups (H461). [Holsworthy Option B]

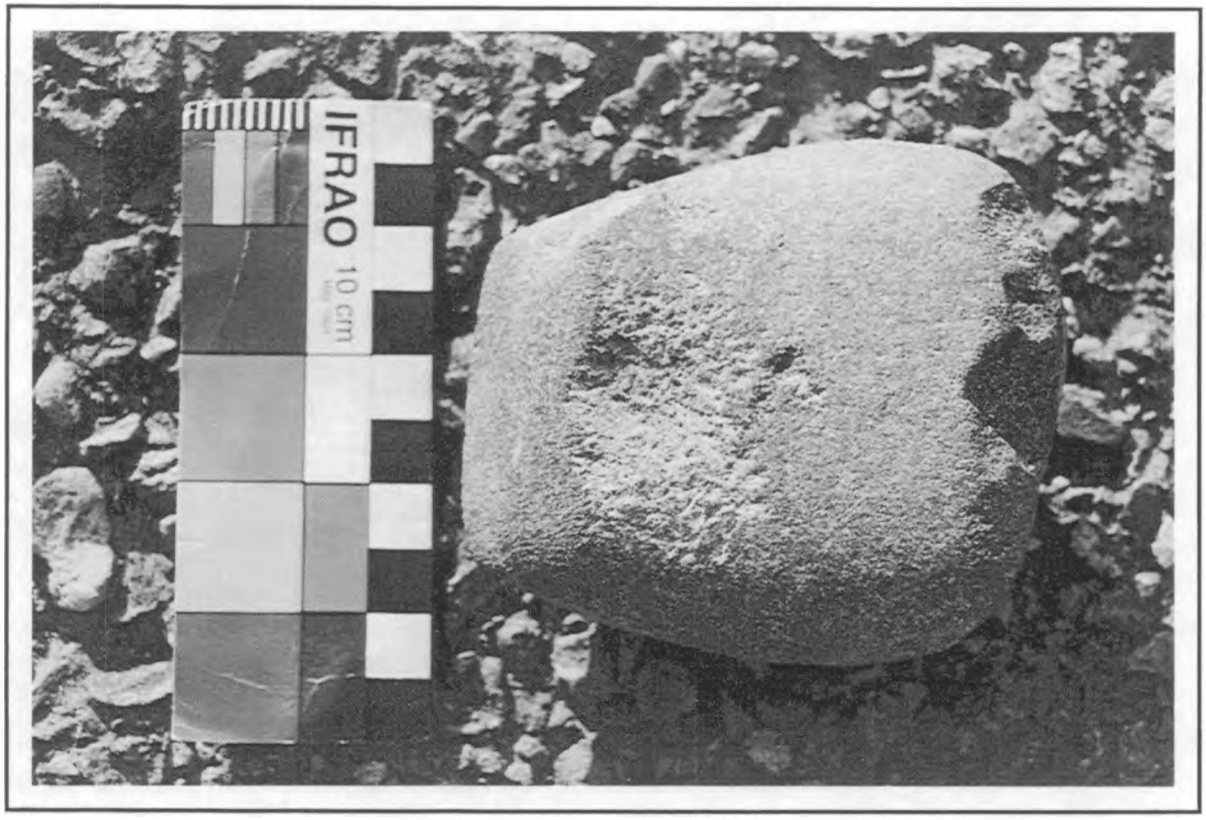


Plate 10: A ground edged stone hatchet, typical of those located in the Holsworthy study area. This example was made from an alluvial pebble and found on valley floor creek flats. It has also been used as an anvil and hammer stone (H1039). Grinding grooves would have been produced during the formation and maintenance of it bevelled edge. [Holsworthy Option B]

Plate 11: A large open grinding groove site (H53), with 101 grooves arranged in 10 groups along the upper reaches of a minor drainage line.

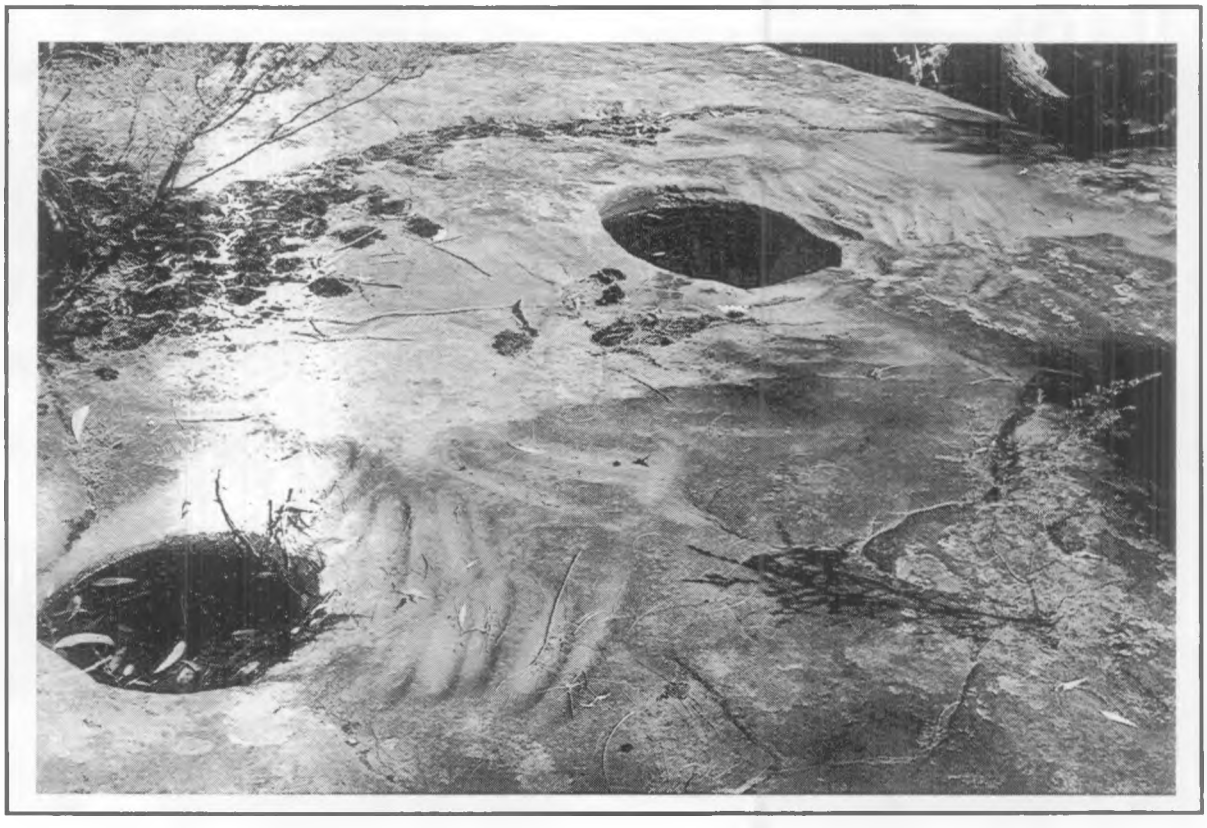


Plate 12: Two grinding groove groups arranged around natural water holes. This site (H168) is the largest recorded grinding groove site in Holsworthy with at least 243 grooves and an associated potential archaeological deposit. [Holsworthy Option A]

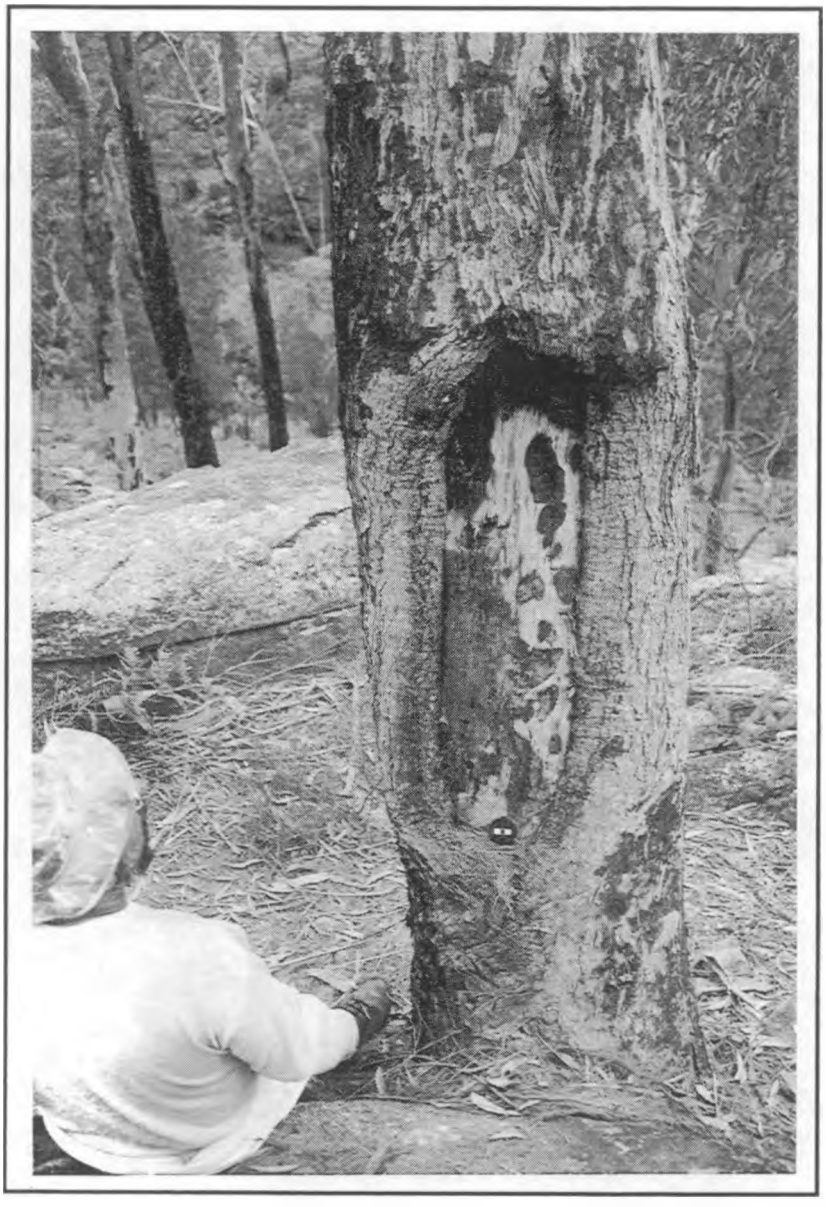


Plate 13: A scarred tree which is most likely to be Aboriginal in origin (H521). The scar has square shaped ends and parallel sides. [Holsworthy Option A]

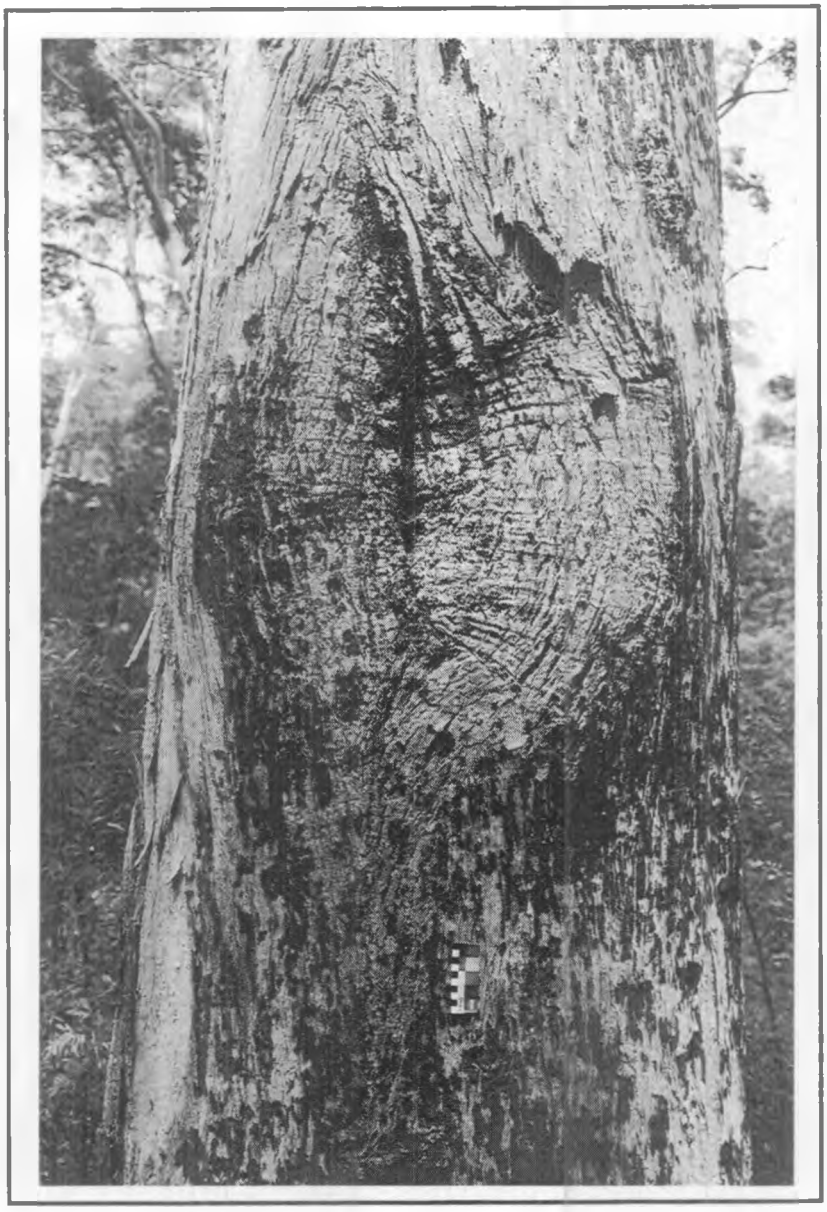


Plate 14: A probable Aboriginal scarred tree (H741) in which the original scar surface has almost been completed occluded by regrowth. This is an indication of considerable age.
[Holsworthy Option A]

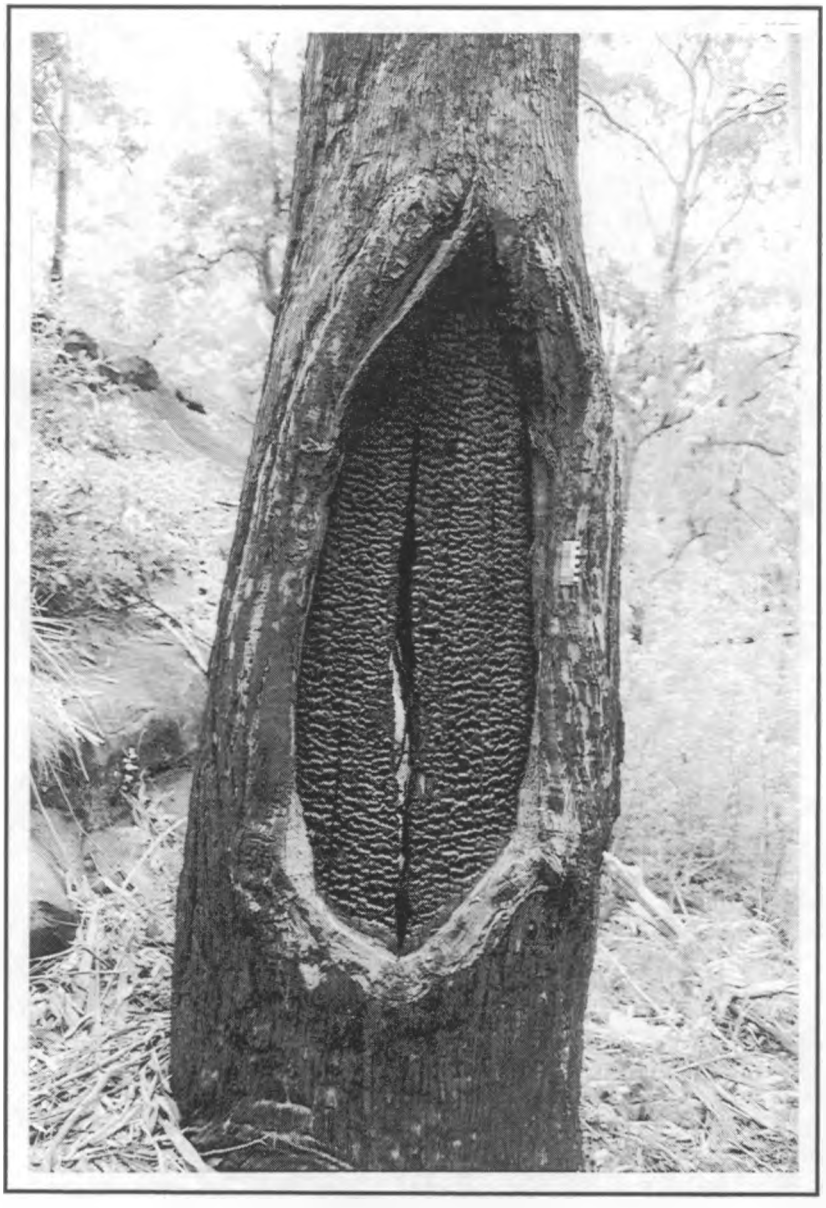


Plate 15: A probable Aboriginal scarred tree (H867) in which the original scar surface has been extensively burnt subsequent to bark removal. Most of the core wood has also been burnt, leaving the tree vulnerable to collapse..

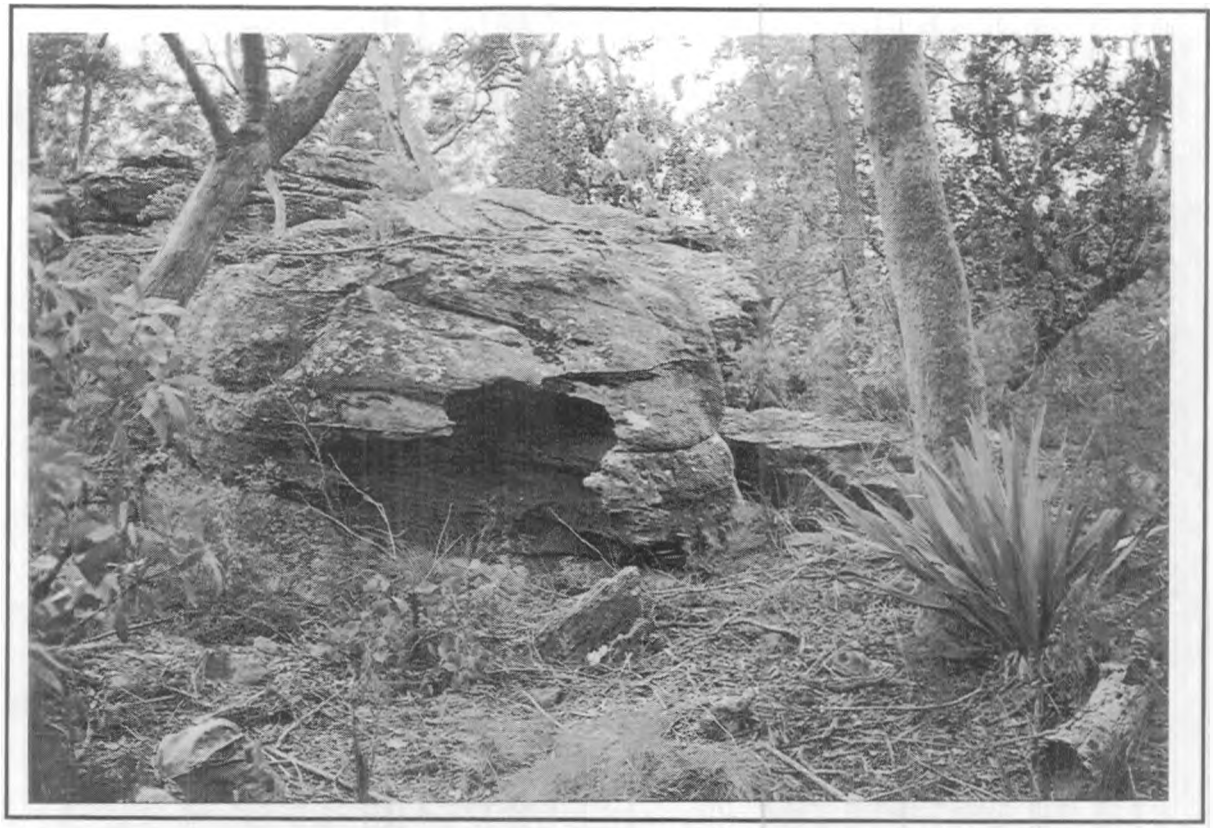


Plate 16: A typical small rock shelter containing a potential archaeological deposit (H634).

Plate 17: A natural accumulation of iron oxide rich sediments within a low rock shelter. Deposits of this type occur relatively frequently throughout Holsworthy and would have been a potential source of ochre to local Aborigines. The oxides are concentrated by water seepage from wall and ceiling fissures.

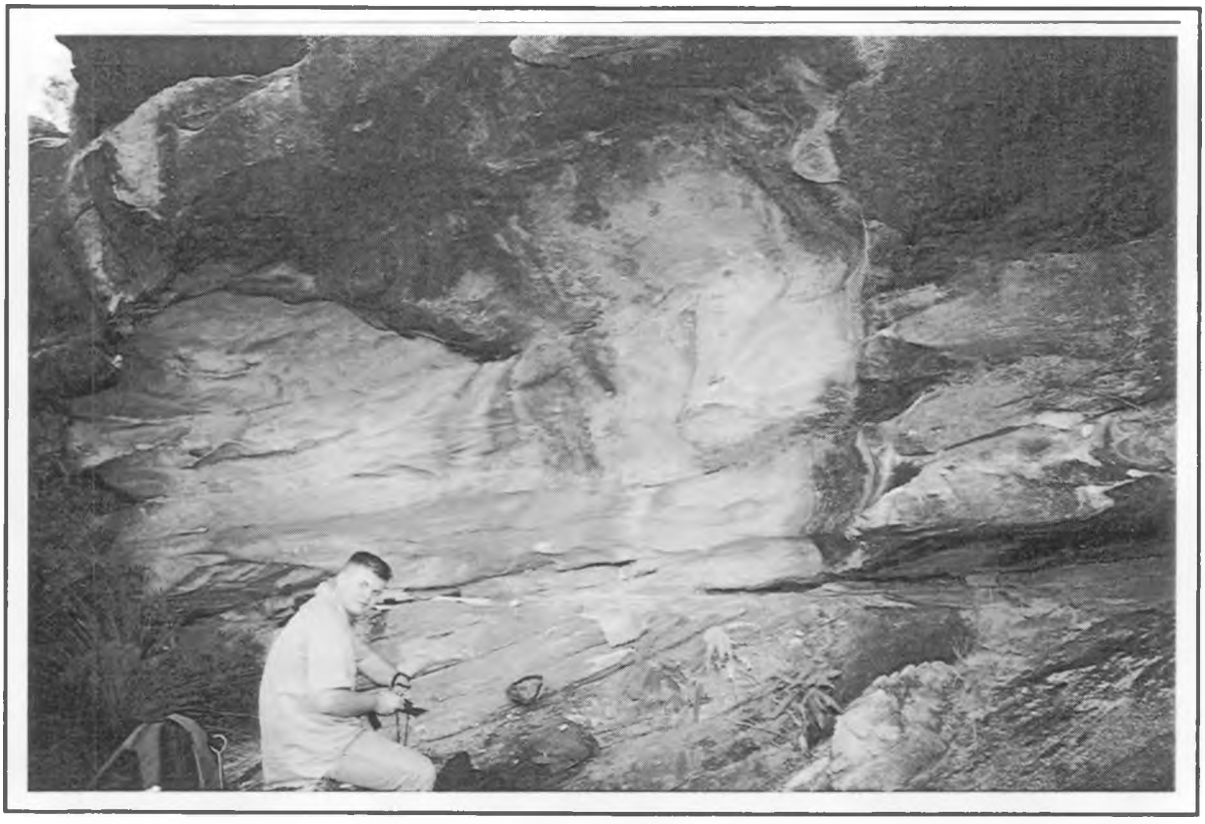


Plate 18: An atypical rock shelter with a rock floor, no significant deposit and pigment art (H39). Most shelters with art contain a sediment floor. (Refer also Plate 27). [Holsworthy Option A]

Plate 19: The interior view of a large rock shelter containing pigment rock art, surface artefacts and archaeological deposit (H905). This shelter is characteristic of large sites located in minor fluvial corridors. (Refer also Plate 30).

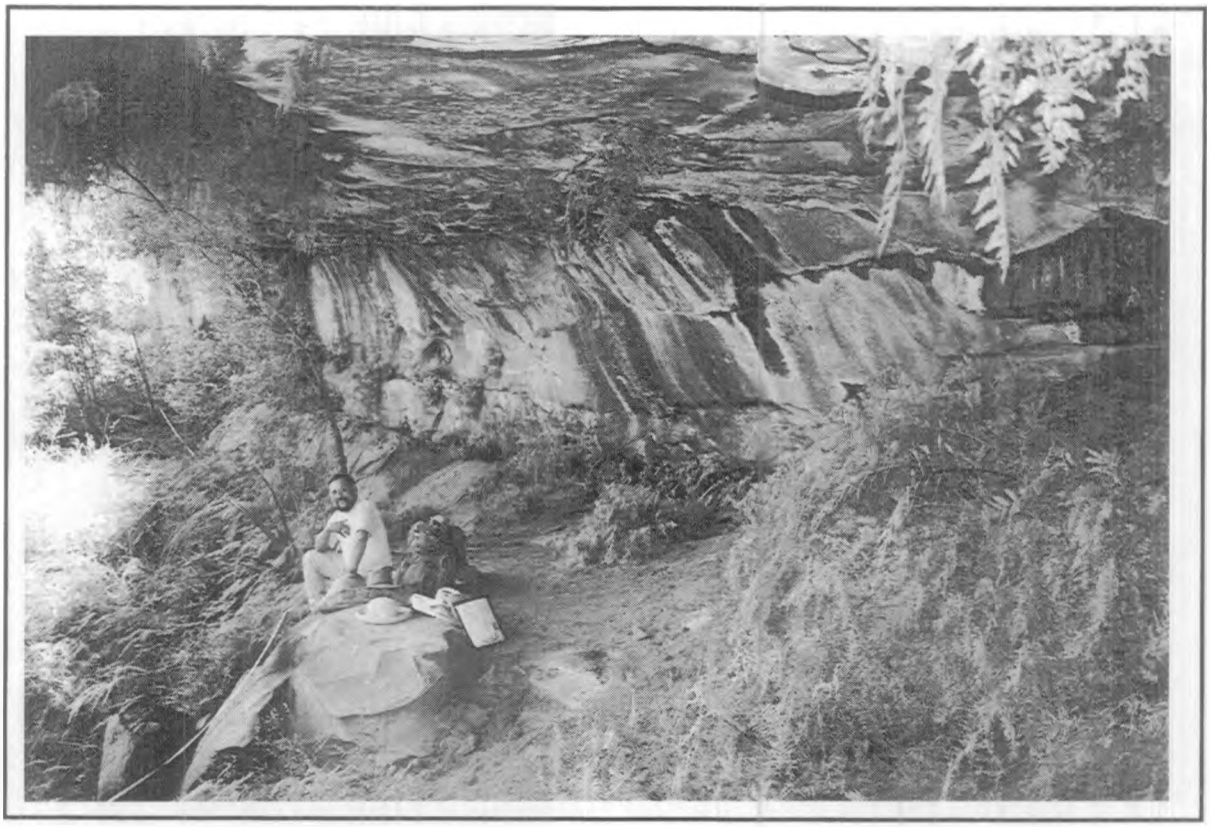


Plate 20: An example of a large rock shelter containing a large assemblage of pigment rock art, together with surface artefacts, archaeological deposit and sandstone grinding surfaces (H253). The rare rock art traits at this site supports a high-regional significance assessment. (Refer also Plates 26 & 36). [Holsworthy Option A]

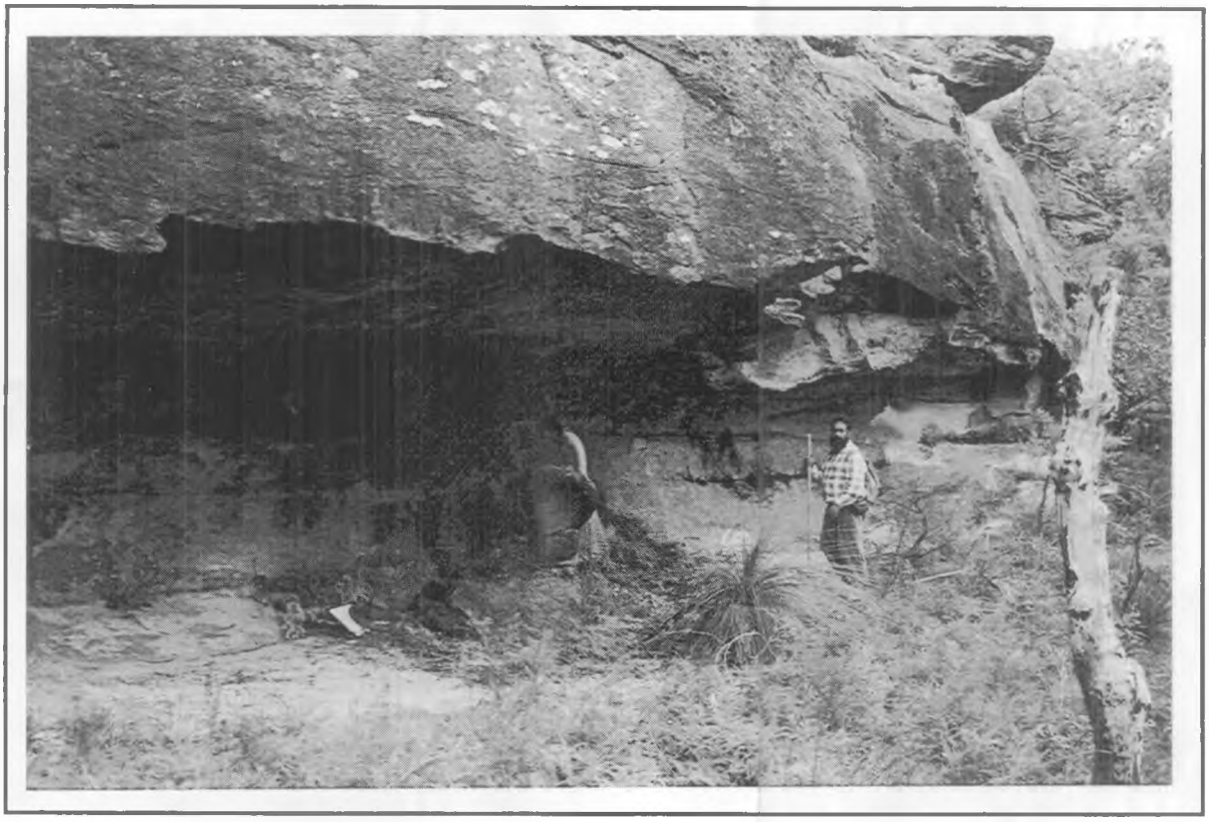


Plate 21: A relatively large rock shelter with surface artefacts and archaeological deposit but no rock art (H795). This site is located on a minor ridgeline complex. [Holsworthy Option B]

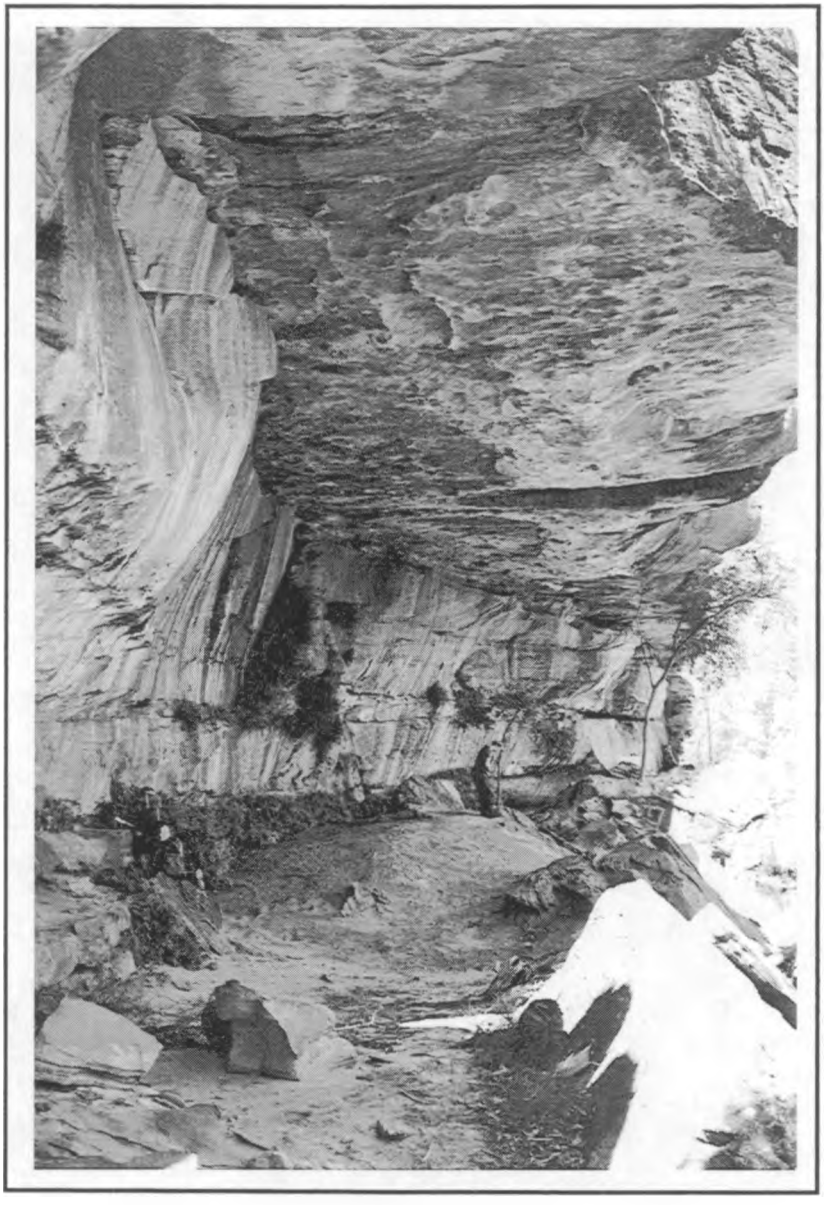


Plate 22: A very large rock shelter containing surface artefacts, archaeological deposit, and only a small area of rock art (H954). This site is characteristic of large shelters occurring on the upper slopes of major fluvial corridors. [Holsworthy Option B]

Plate 23: A large bird motif from site H202. This motif demonstrates the rare combination of a black outline and red linear infill. Note also the rare inclusion of eyes, and also apparent spears.

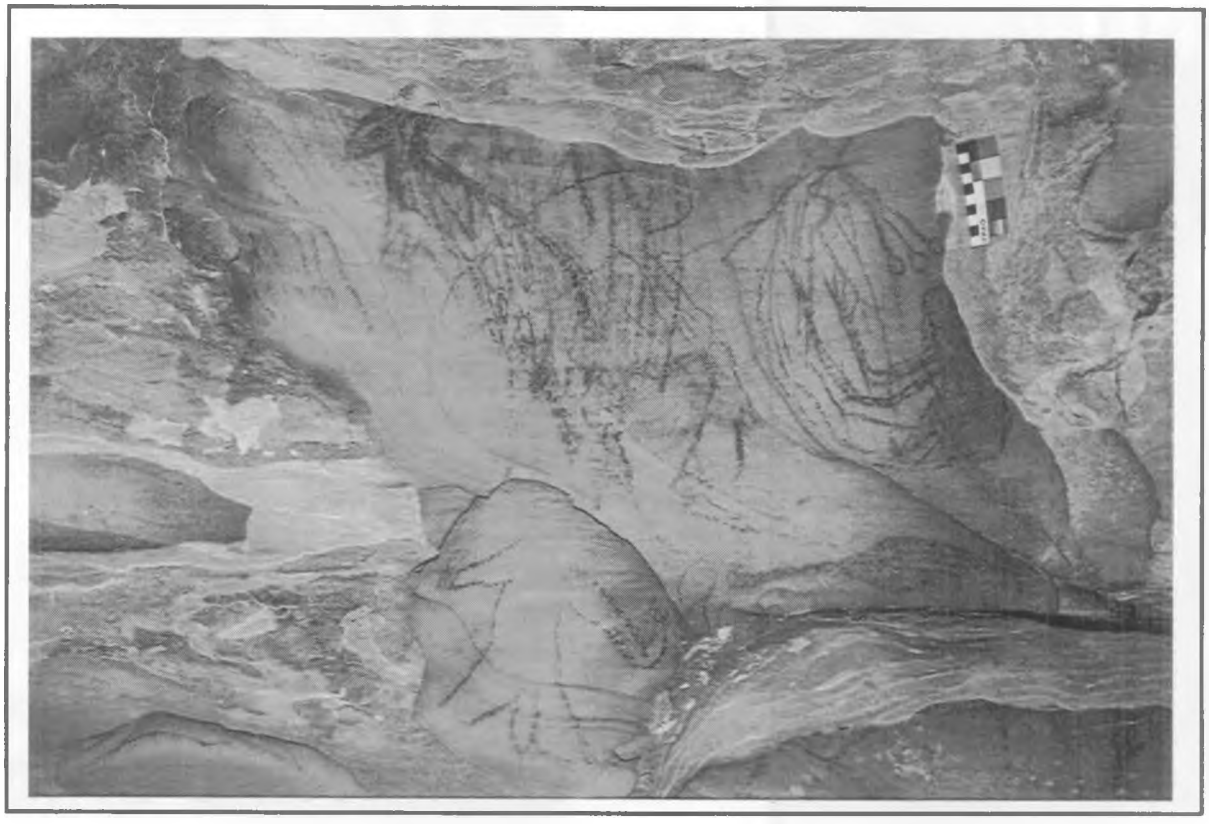


Plate 24: A rock art panel with a high density of graphics including a macropod, a profile quadruped with extended forearms, and anthropomorphs (H824). A male anthropomorph, located bottom middle, and has been executed with a rare combination of a black outline and an abraded white solid infill. [Holsworthy Option B]

Plate 25: A composition of profile quadrupeds with head rays and apparent spears (H824). The delineation of profile animals with all four limbs is a characteristic of the Woronora Ramp rock art. [Holsworthy Option B]

Plate 26: A complex art panel from site H253, which includes rare examples of red painted, outline only, profile quadrupeds. Note also extensive heavy surface mineralisation and small areas of (white) scalar exfoliation. [Holsworthy Option A]

Plate 27: A composition of red hand stencils, other stencilled forms in red are very rare (H39). [Holsworthy Option A]

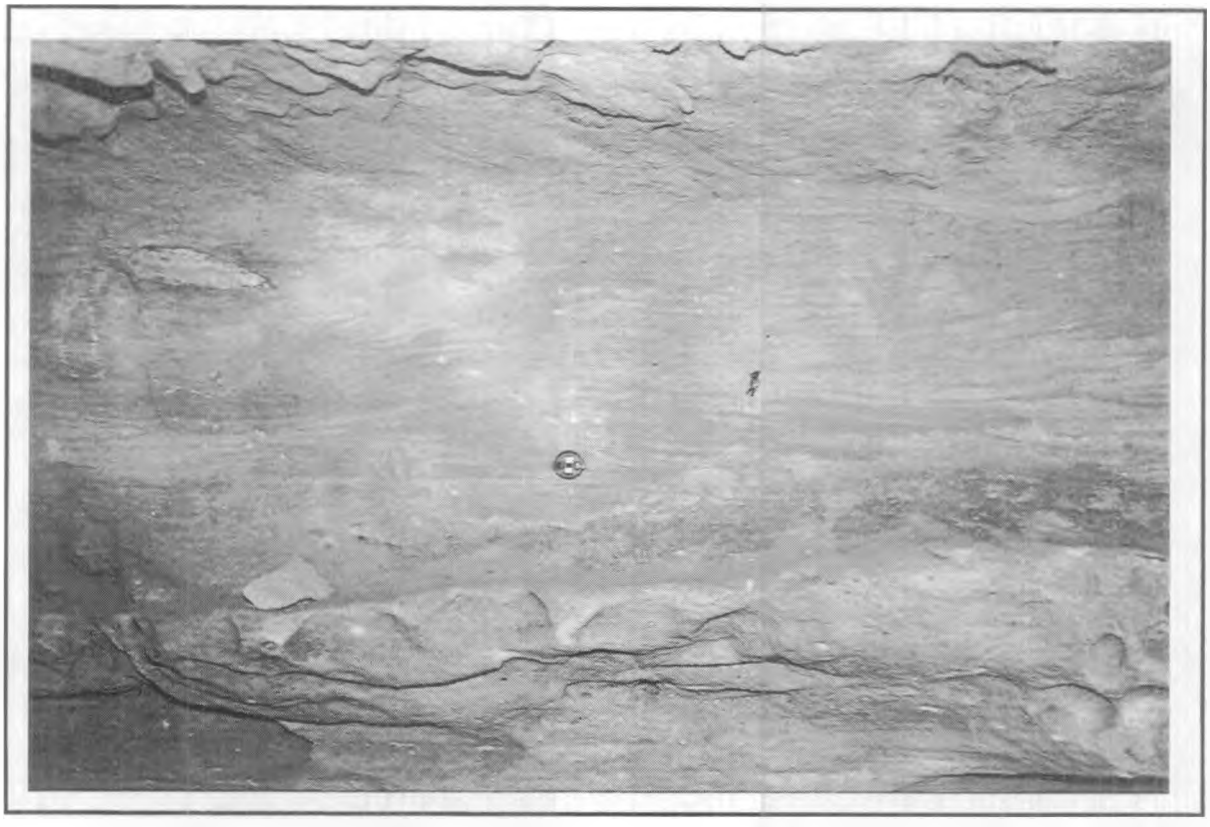


Plate 28: A composition of white stencils including a rare example of stencilled macropod feet (upper left) (H55). Stencils of objects other than hands are more common in white pigment.

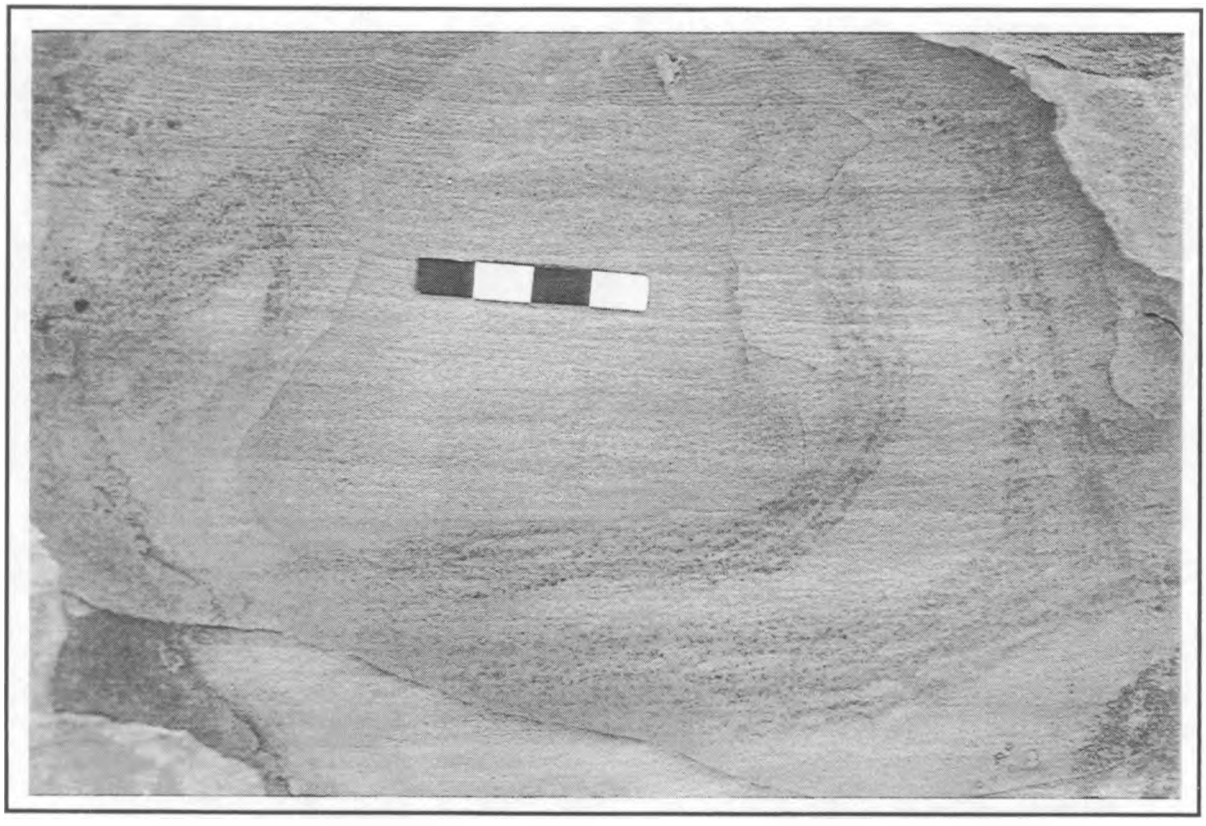


Plate 29: One or two curvilinear drawn red motifs with high density linear infill (H29). Red drawn motifs are a rare component of the pigment art of the study area.

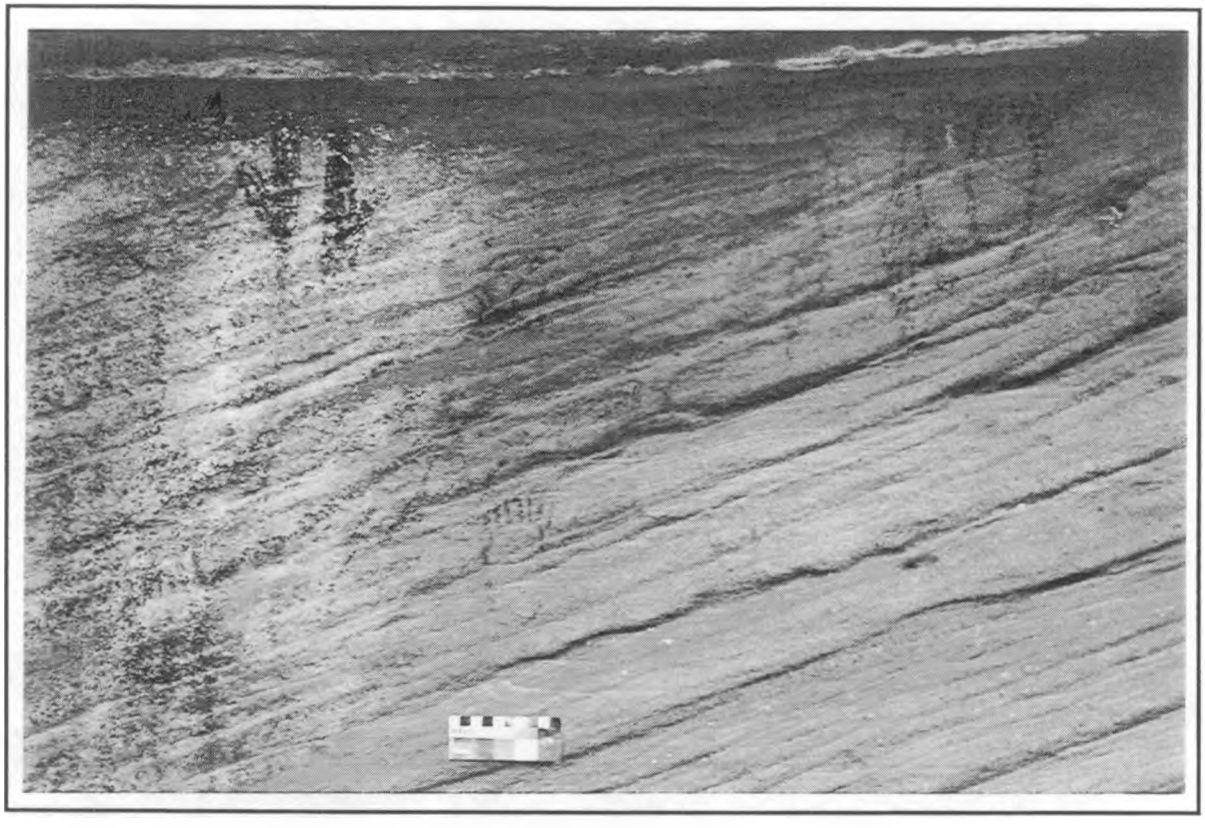


Plate 30: A panel of black drawn pigment motifs including a pair of solid black macropod tracks (top left) and outline only human foot tracks (above scale) (H905).

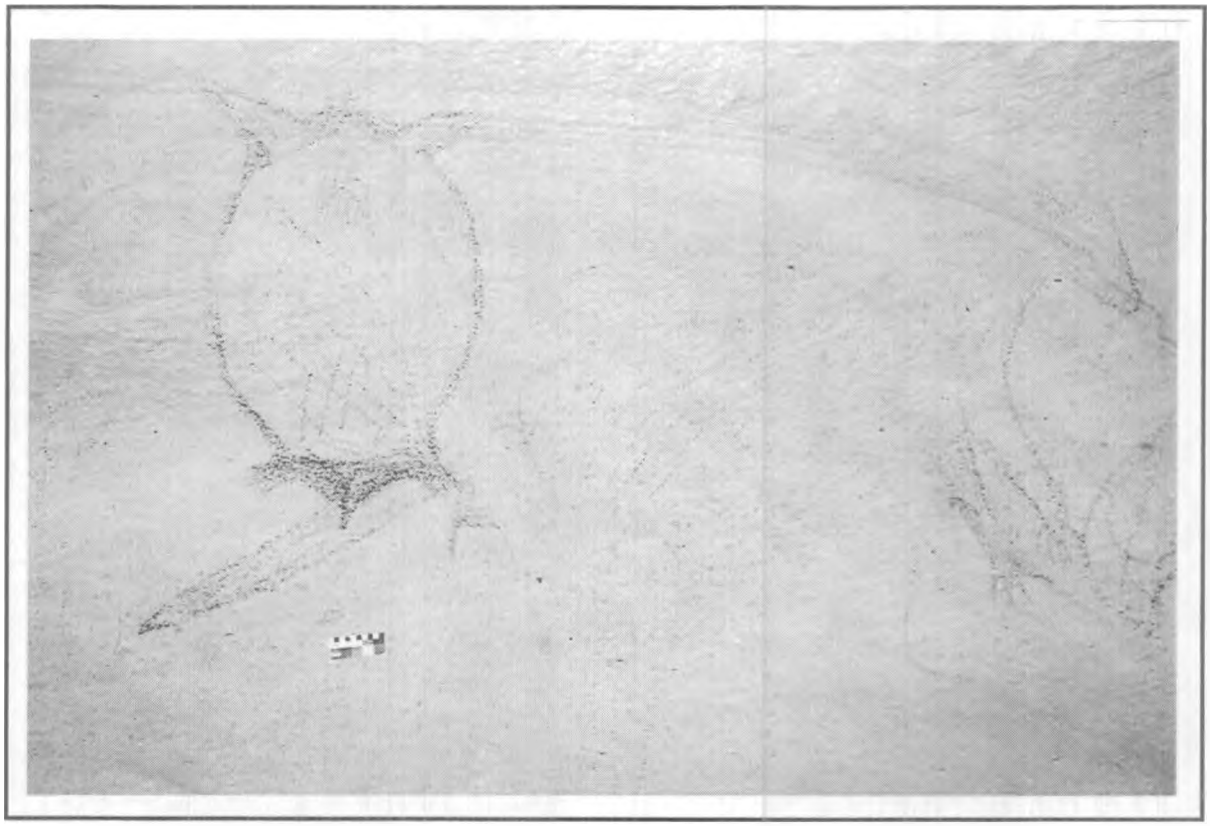
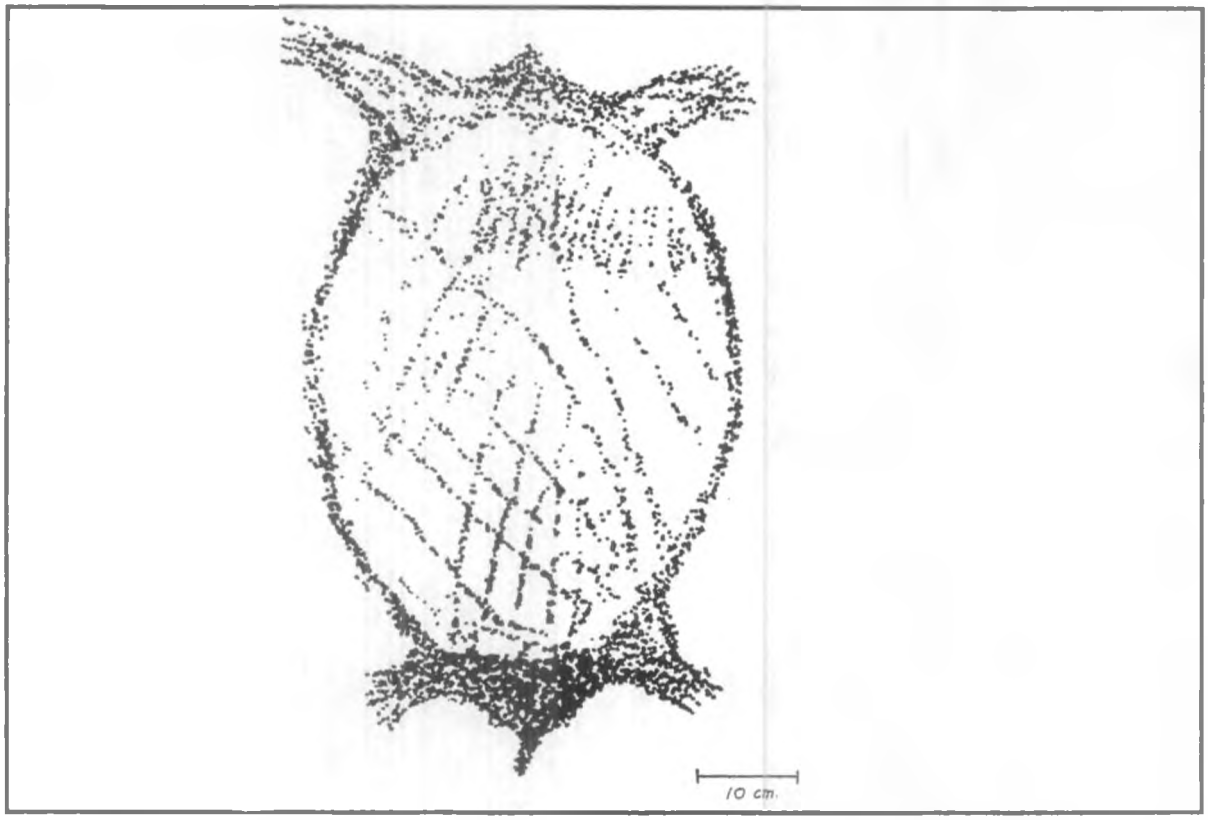


Plate 31: A black outline and solid and cross hatched infill echidna motif (left) which superimposes a large faded black outline and infill macropod (H802). [Holsworthy Option B]



A photographic tracing of the echidna motif. The splayed schema in echidna motifs (limbs to either side) is a characteristic of the rock art south of the Georges River. The inclusion of naturalistic detail such as the echidna's snout, and claws is typical of a proportion of Sydney Basin rock art motifs.

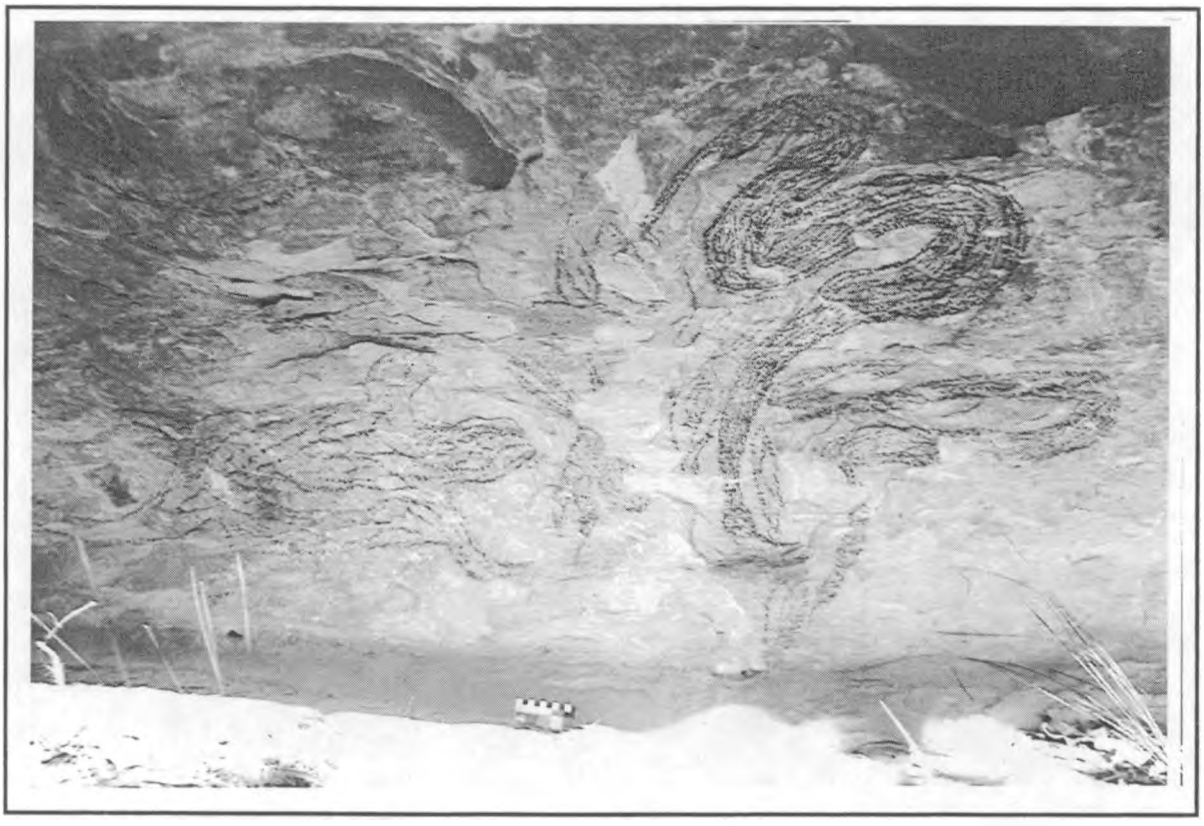


Plate 32: A well preserved art panel including two curvilinear snake motifs and a splayed quadruped motif with a long tail, all in black outline and varying densities of linear black infill (H1054). [Holsworthy Option B]

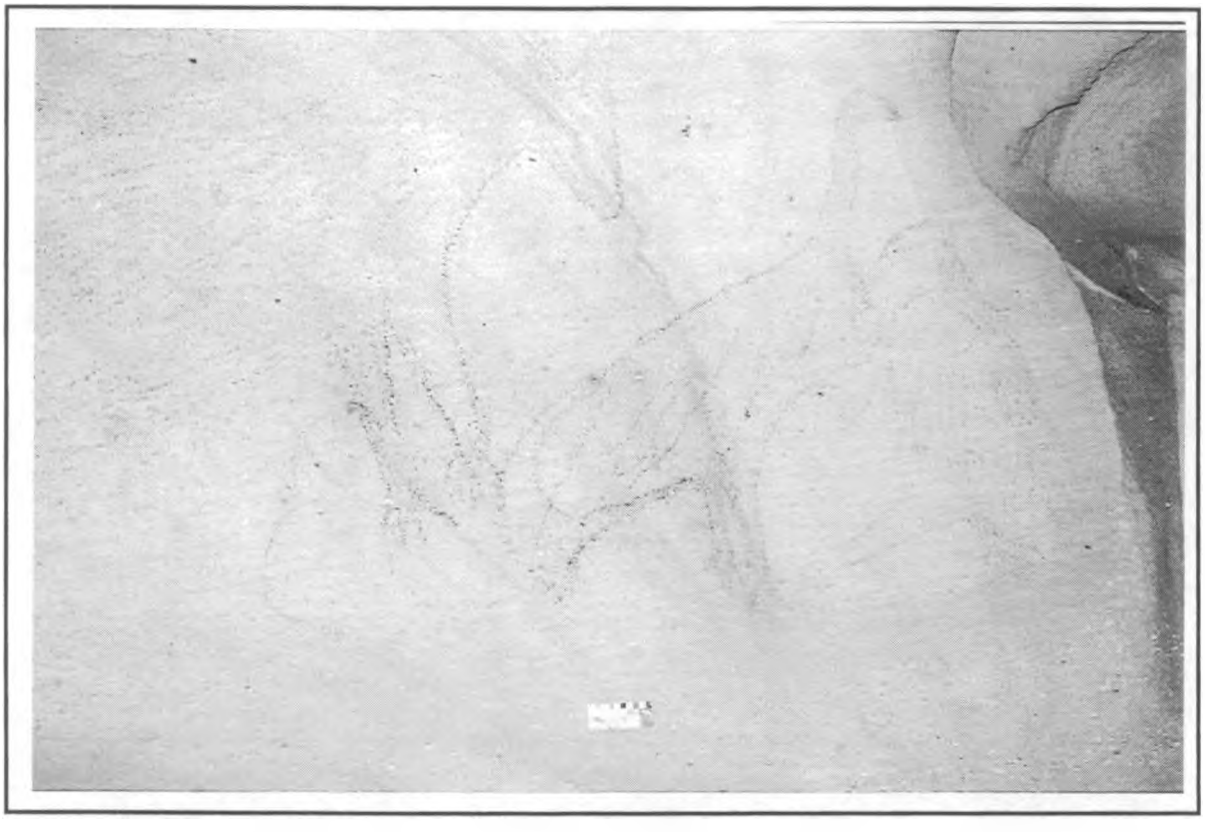


Plate 33: Two black outline and linear infill bird motifs (right) and part of a similarly executed large macropod motif (H802). Although faded, most of the graphics in this shelter display exceptional clarity. [Holsworthy Option B]

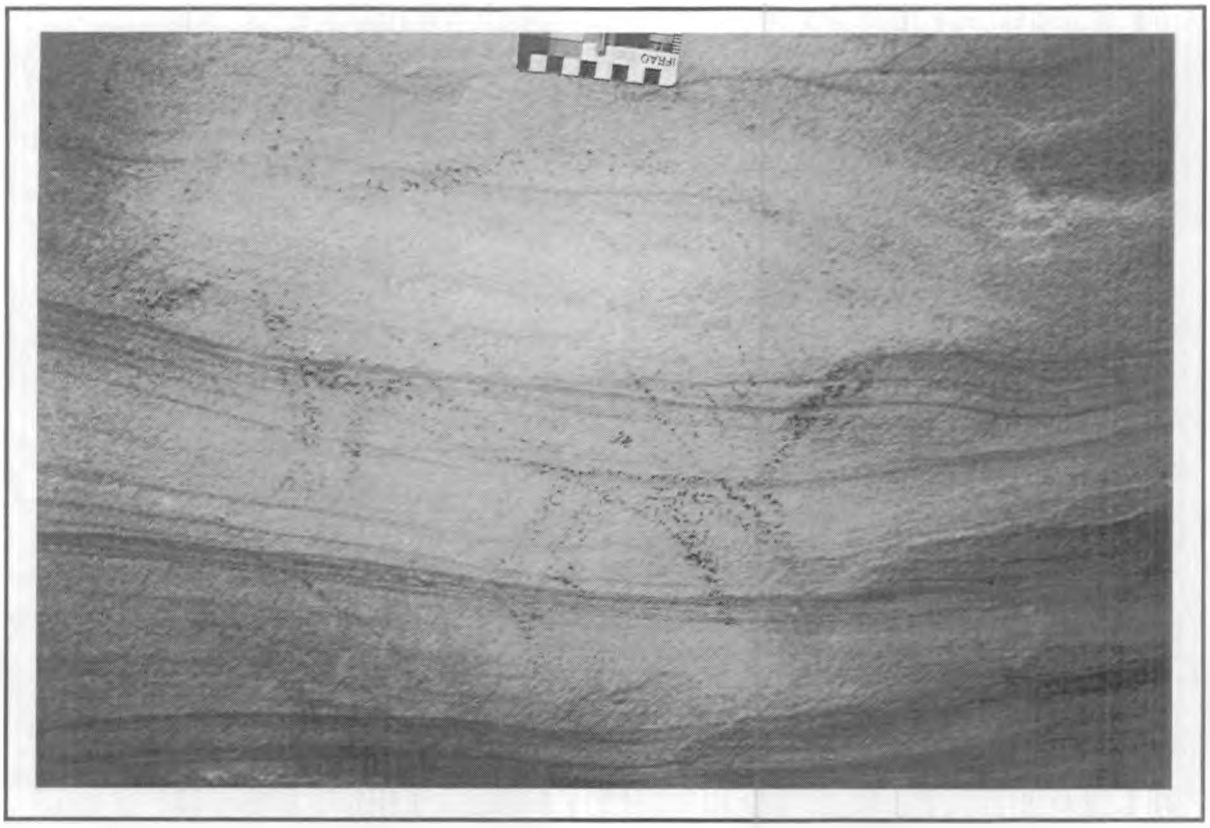
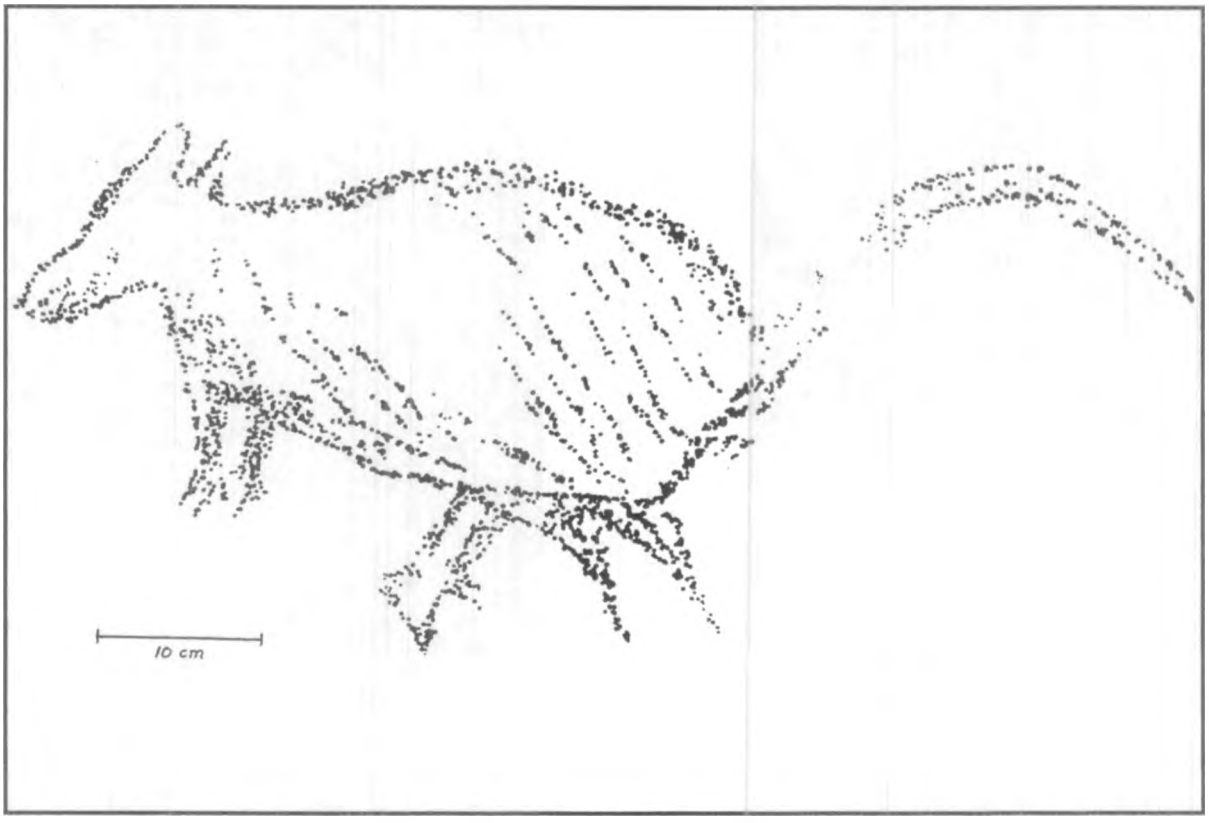


Plate 34: A black outline and linear infilled profile and tailed quadruped with a joey (H527). The small back legs and curved tail suggests the representation of one of the small macropods or quolls. [Holsworthy Option A]



A photographic tracing of the above motif.

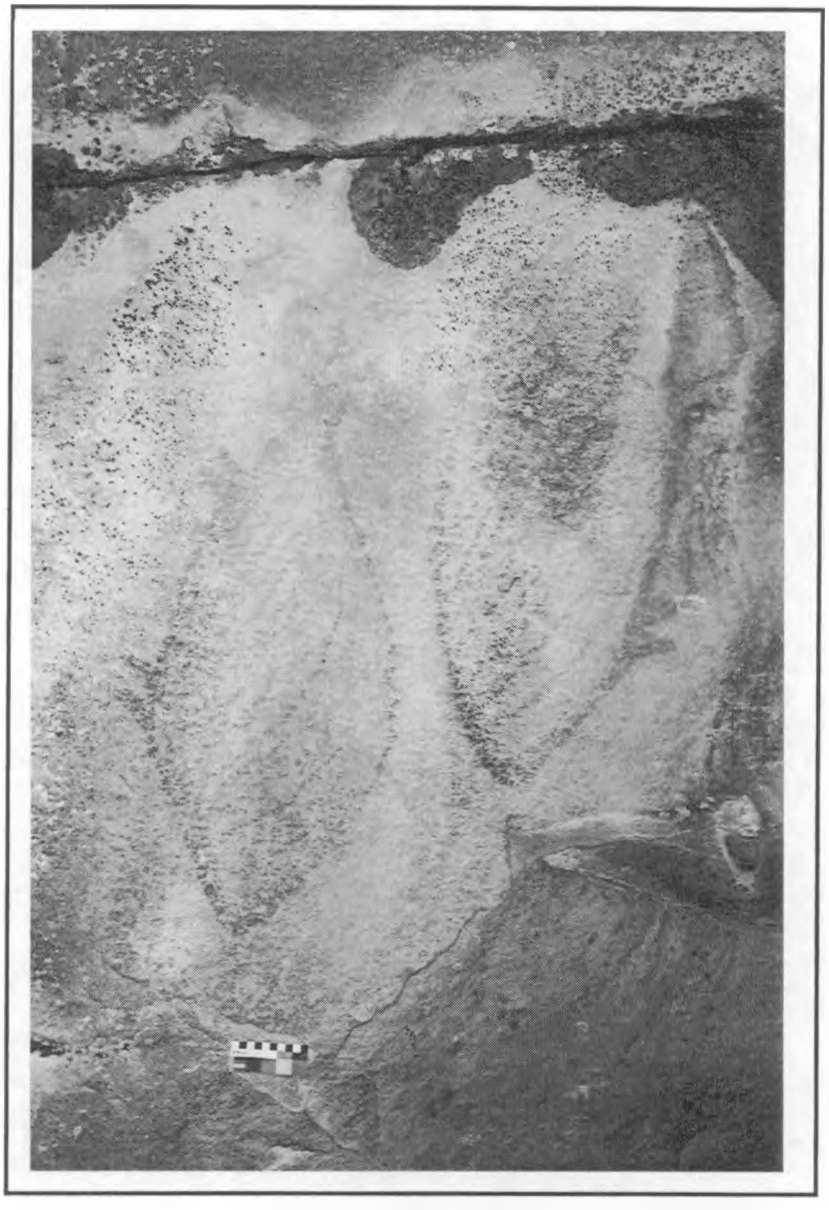


Plate 35: A pair of large fish motifs in black outline and predominantly diagonal linear infill (H253)
Note extensive surface mineralisation. [Holsworthy Option A]

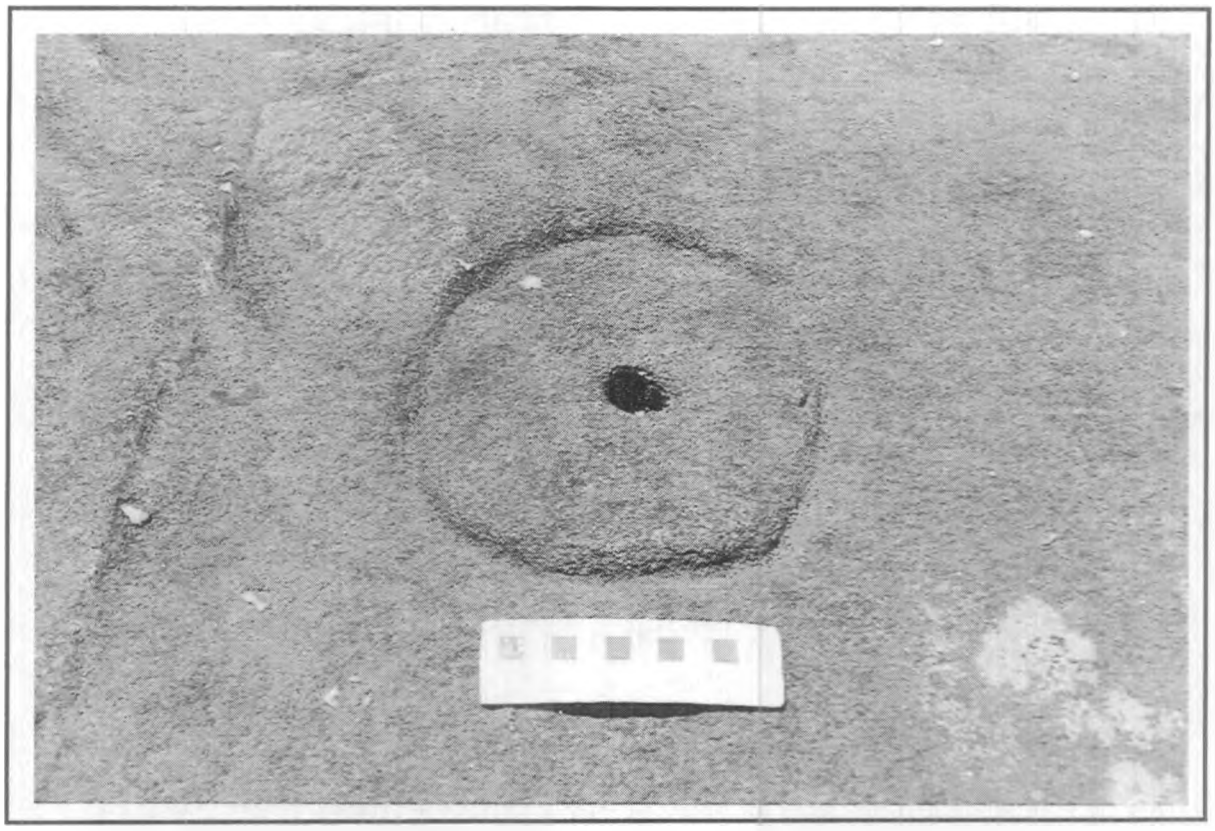


Plate 36: A typical example of a ring and pit engraving, one of several sites which occur on rock platforms adjacent to major drainage lines in the Holsworthy study area (H695). These motifs may be historic Aboriginal art, however further research is required to determine their origin.

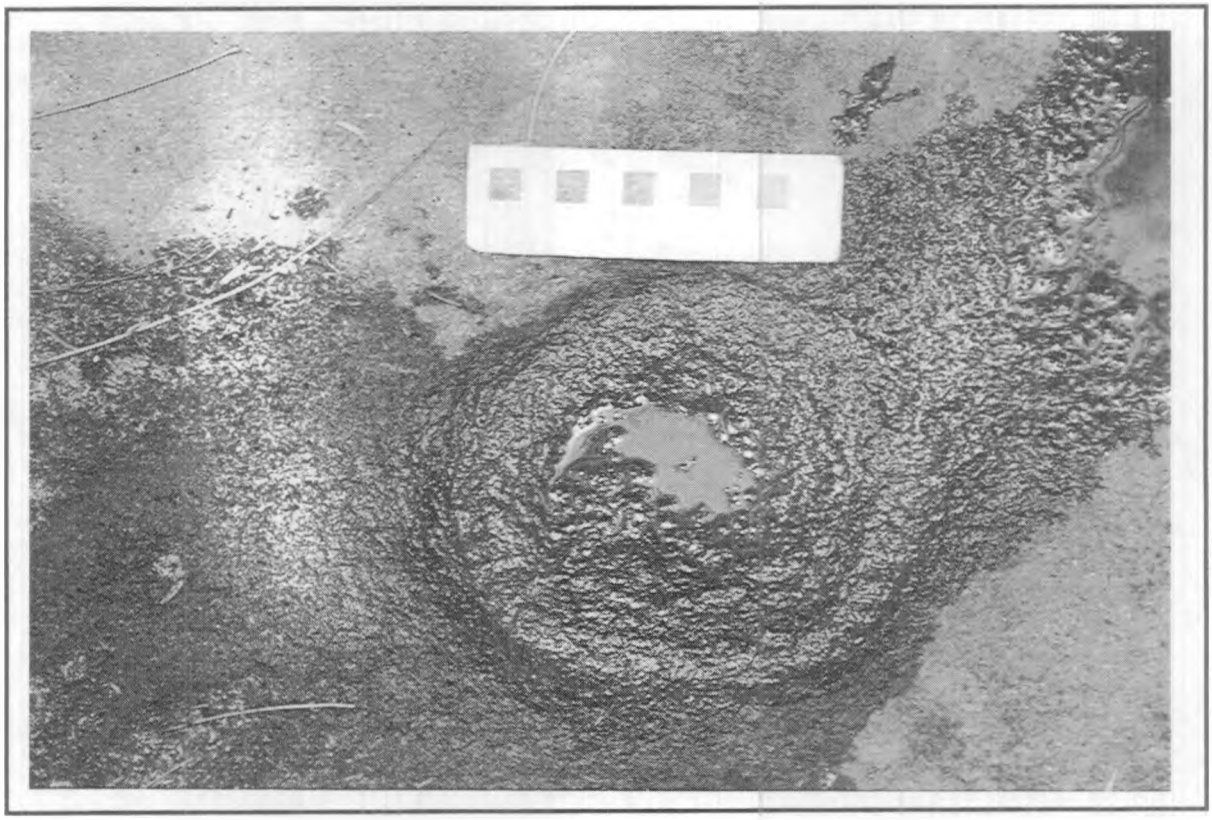


Plate 37: An engraved ring motif located around a central pit, in association with grinding grooves (H882) is of definite Aboriginal origin and similar to the engravings of indeterminate human origin illustrated above. The similarity suggests a shared cultural origin. [Holsworthy Option A]

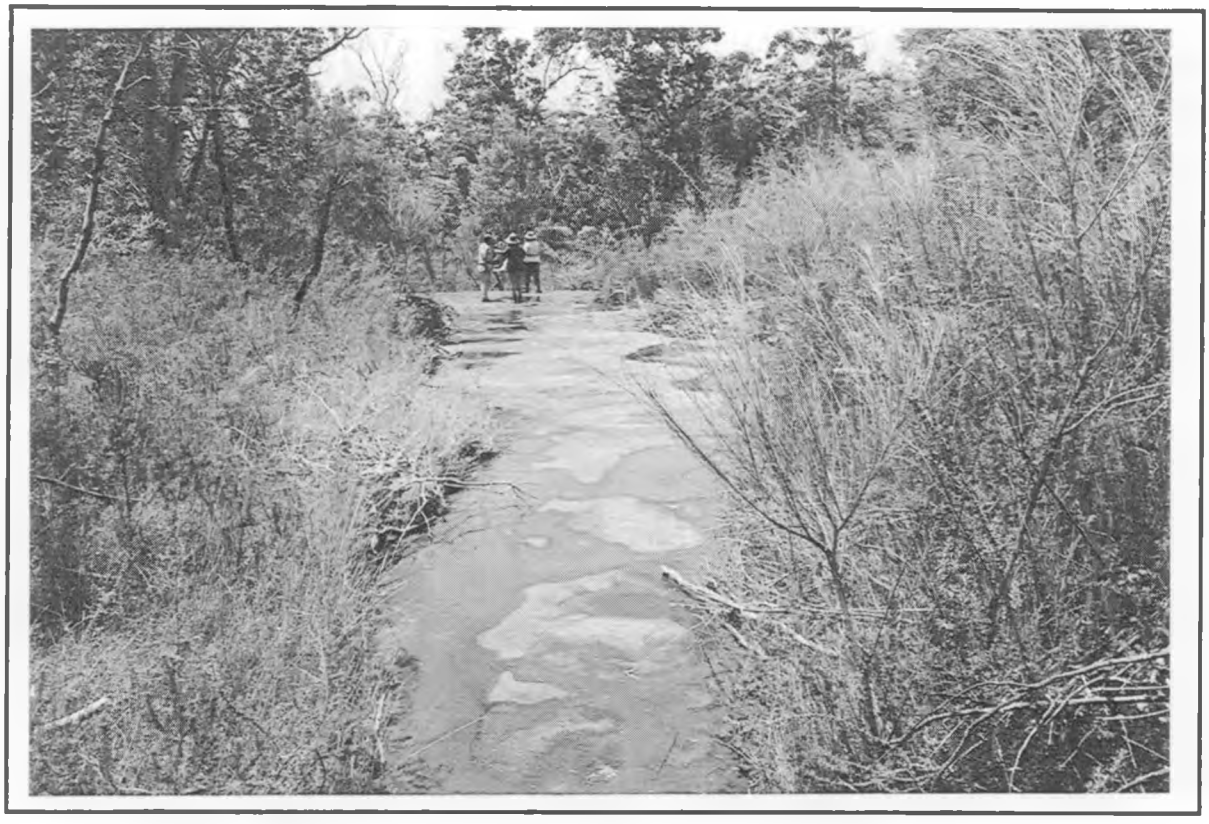


Plate 38: A typical open engraving site, located on a creek bed rock platform in an upper catchment context (H309). [Holsworthy Option A]

Plate 39: A large engraved profile quadruped motif at the above location (H309). The combination of animal and anthropomorphic features in this motif places it within the conventional category of 'mythological' or 'culture hero' figure. [Holsworthy Option A]

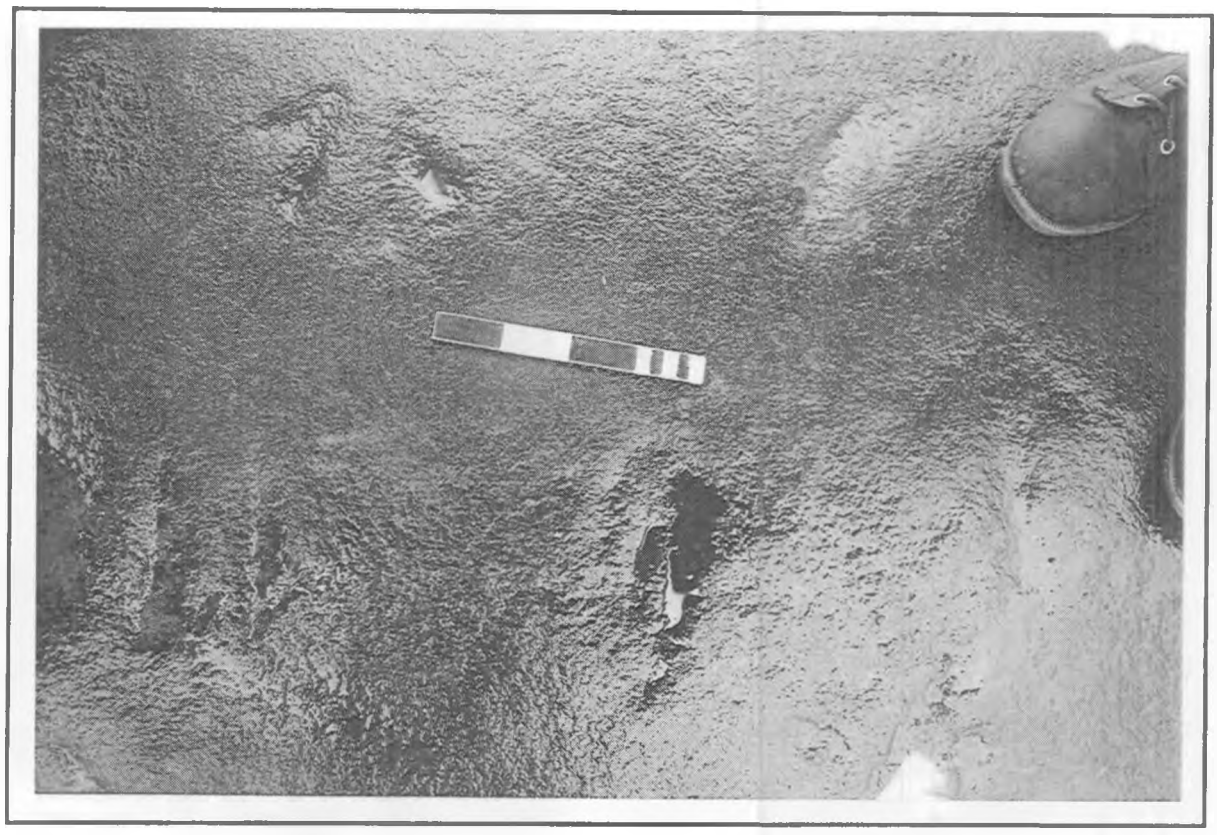


Plate 40: Engraved macropod and emu track motifs, located in association with grinding grooves (H271). The frequency of engraved track motifs appears to be higher than previously recorded for the Holsworthy study area.

Plate 41: An engraved macropod motif with a joey (H136) (compare with similar schema in pigment motif in Plate 34). This engraving site is located on a ridgetop context.

Plate 42: The creek bed valley floor context of an engraving and grinding groove site which contains a unique female motif variant (H64). [Holsworthy Option B]

Plate 43: An engraved male anthropomorphic figure at the above site (H64). This graphic is 1.9 metres long. [Holsworthy Option B]

Appendix I

Site Inventory

Appendix I
Site Significance

Overall Assessment

The cultural heritage significance of a place can be usefully classified according to a comparative scale which combines a relative value with a geographic context and area of reference. For this investigation, a 3 by 3 matrix was adopted which provides for a site or feature to be of low, moderate or high significance within a local, regional or national context. This system provides a hierarchy in which a small scale of referral, such as a local rating, defines a sphere of relevance and significant context, which is more limited than a larger scale, such as a regional or national rating. This should not be taken to imply that places of local significance necessarily warrant less conservation than regionally rated places. A place of high local significance may have a comparable level of value within its local context, to a place of high regional or national significance. Similarly it can be stated that the conservation of regionally rated places is of little value if appropriate locally rated places are not also conserved.

For the purposes of this study, the local context is defined as the Cumberland Plain for the Badgerys Creek study area and the Woronora Ramp for the Holsworthy study area. The regional area for both study areas is defined as the Sydney - Bowen sedimentary Basin. This includes all of the topography formed on the approximately horizontally bedded sedimentary facies and dissected plateau lands of the central NSW coast, and extends inland to the Great Divide and the start of the Western Slopes.

Rating Classifications

The following is a brief outline of the characteristics associated with the summary ratings used in formulating significance assessments for individual sites or places. A basic three or four tiered classification is used in order to be consistent with the broad scale character of the surface survey data.

Research Potential (the categories are not mutually exclusive)

0 negligible research potential (poor condition, single artefact, no potential to be larger or to contain in situ material)

1 minimal research potential (poor condition, few artefacts, limited potential to be larger or to contain in situ archaeological deposit, indeterminate or poorly preserved graphics)

2 good research potential (generally fair condition plus any of the following: moderate artefact assemblage, uncommon artefact types, good potential for in situ archaeological deposit, graphics with moderate research potential, potentially including moderate densities, stylistic diversity and pigment preservation)

3 excellent research potential (generally good condition plus any of the following: large artefact assemblages, rare artefact types, high potential for in situ archaeological deposit,

unusual context, a large graphic assemblage and/or rare stylistic traits, a relatively high degree of graphic preservation, moderate to high graphic density and superimpositions).

Representativeness:

1 a common site or feature type
2 less common
3 uncommon features and/or a well preserved and representative example

Educational/Recreational Values

0 poor (the site or feature may be in poor condition, be difficult to detect, interpret or access)
1 fair (may have limited potential to demonstrate important aspects of Aboriginal culture or the study and appreciation of Aboriginal culture)
2 good (moderate educational potential, with the potential for relatively good conditions for public access and visitor control)
3 excellent (moderate to high educational potential and actual or potential means for public access and visitor control)

Aesthetic Values

0 poor (the site may be difficult to detect, be in poor condition, of limited appeal, or contain features which are visually inaccessible or difficult for a visitor to adequately experience)
1 fair (may have more than limited appeal or visual accessibility)
2 good (moderate or better visual accessibility with a notable subject, range and/or diversity of perceptual experiences)
3 excellent (excellent visual accessibility with some outstanding components in subject, range and/or diversity of perceptual experiences)

Site Descriptions

The following lists present selected key variables and condition assessments for site type categories subdivided according to study area. Map references have been excluded in order to protect these locations from inappropriate or unauthorised visitation. A full listing of site variables has been provided as a restricted compendium to appropriate Aboriginal community groups and statutory authorities.

Contents:

- Holsworthy - Isolated Finds
- Holsworthy - Open artefact scatters
- Holsworthy - Scarred trees
- Holsworthy - Open sites containing grinding grooves
- Holsworthy - Open sites containing engravings
- Holsworthy - Shelter sites containing surface stone artefacts and/or archaeological deposit
- Holsworthy - Shelter sites containing pigment art
- Holsworthy - Shelters with potential archaeological deposit

Site Inventory

TABLE I1 SIGNIFICANCE ASSESSMENTS (EXCLUDING CONTEMPORARY ABORIGINAL VALUES) FOR ALL KNOWN SITES AND FEATURES WITHIN THE BADGERYS CREEK STUDY AREA

Site Name	Airport Option (A, B, C)	Condition Rating from Field Survey[1]	Research Potential[2]	Represent-ativeness[3]	Aesthetic Value[2]	Educational/ Recreational Value[2]	Overall Assessment[4]
B2	BC	poor	2	2	0	0	mod. local
B3	ABC	poor	0	1	0	0	low local
B4	ABC	poor	0	1	0	0	low local
B5	ABC	poor	0	1	0	0	low local
B6	ABC	poor	0	1	0	0	low local
B7	ABC	poor	1	1	0	0	low local
B8	ABC	good	1	3	1	1	mod local
B9	ABC	good	2	1	0	0	mod local
B10	BC	good	3	3	0	0	high local
B11	BC	poor	0	1	0	0	low local
B12	ABC	poor	0	1	0	0	low local
B13	BC	poor	0	1	0	0	low local
B15	ABC	good	0	1	0	0	low local
B17	C	poor	1	2	0	0	mod local
B18	C	poor	1	1	0	0	low local
B19	C	poor	2	1	0	0	mod local
B20	C	poor	2	2	0	0	mod local
B21	C	poor	2	2	0	0	mod local
B22	C	poor	0	1	0	0	low local
B23	C	poor	0	1	0	0	low local
B24	ABC	poor	0	1	0	0	low local
B25	ABC	poor	0	1	0	0	low local
B31	ABC	good	0	1	0	0	low local
B32	ABC	good	0	1	0	0	low local
B33	C	poor	1	2	0	0	low local
B35	C	poor	0	1	0	0	low local
B37	C	poor	0	1	0	0	low local
B38	BC	poor	0	1	0	0	low local
B39	BC	poor	0	1	0	0	low local
B40	ABC	poor	0	3	0	0	mod local
B41	ABC	good	1	2	0	0	low local

Site Name	Airport Option (A, B, C)	Condition Rating from Field Survey[1]	Research Potential[2]	Represent-ativeness[3]	Aesthetic Value[2]	Educational/ Recreational Value[2]	Overall Assessment[4]
B42	ABC	poor	0	1	0	0	low local
B43	ABC	v.good	2	2	0	0	mod local
B44	ABC	poor	1	1	0	0	low local
B45	ABC	poor	2	2	0	0	mod local
B46	ABC	good	2	2	0	0	mod local
B47	BC	good	1	1	0	0	low local
B48	ABC	good	0	2	0	0	mod local
B49	BC	good	0	2	0	0	mod local
B50	BC	poor	1	1	0	0	low local
B51	BC	poor	0	3	0	0	high local
B52	ABC	v.poor	0	3	0	0	mod local
B54	ABC	poor	0	1	0	0	low local
B55	ABC	good	0	1	0	0	low local
B56	BC	good	0	1	0	0	low local
B57	BC	good	1	2	0	0	mod local
B58	BC	good	1	2	0	0	mod local
B59	ABC	poor	0	1	0	0	low local
B60	BC	poor	0	1	0	0	low local
B61	BC	poor	0	1	0	0	low local
B63	BC	poor	1	1	0	0	low local
B64	BC	good	1	1	0	0	low local
B65	BC	good	1	1	0	0	low local
B66	ABC	good	1	1	0	0	low local
B67	ABC	good	1	1	0	0	low local
B68	ABC	good	1	1	0	0	low local
B69	ABC	poor	0	1	0	0	low local
B70	ABC	good	2	1	0	0	mod local
B71	ABC	poor	1	1	0	0	low local
B72	ABC	excel	0	3	0	0	mod local
B73	BC	poor	2	1	0	0	mod local
B74	ABC	poor	1	1	0	0	low local
B75	ABC	poor	1	1	0	0	low local
B76	ABC	poor	0	1	0	0	low local
B77	ABC	poor	2	1	0	0	mod local
B78	ABC	poor	2	1	0	0	mod local
B79	ABC	poor	0	1	0	0	low local
B80	ABC	poor	2	1	0	0	mod local
B81	ABC	poor	2	1	0	0	mod local

Site Name	Airport Option (A, B, C)	Condition Rating from Field Survey[1]	Research Potential[2]	Represent-ativeness[3]	Aesthetic Value[2]	Educational/ Recreational Value[2]	Overall Assessment[4]
B82	ABC	poor	0	1	0	0	low local
B83	AB	good	1	1	0	0	low local
B84	ABC	poor	1	1	0	0	low local
B85	ABC	poor	0	1	0	0	low local
B86	ABC	poor	0	1	0	0	low local
B87	ABC	poor	2	1	0	0	mod local
B88	ABC	poor	0	1	0	0	low local
B89	C	poor	0	1	0	0	low local
B90	ABC	poor	1	1	0	0	low local
B91	ABC	poor	0	1	0	0	low local
B92	ABC	poor	2	1	0	0	mod local
B93	ABC	poor	0	1	0	0	low local
B94	ABC	v good	2	1	0	0	mod local
B95	ABC	good	2	1	0	0	mod local
B96	BC	poor	1	1	0	0	low local
B97	BC	poor	2	1	0	0	low local
B100	BC	poor	0	1	0	0	low local
B101	ABC	poor	0	1	0	0	low local
B102	ABC	poor	2	1	0	0	mod local
B103	ABC	poor	0	1	0	0	low local
B104	ABC	poor	0	1	0	0	low local
B105	BC	poor	0	1	0	0	low local
B105	BC	poor	0	1	0	0	low local
B106	BC	poor	0	1	0	0	low local
B107	B	poor	0	1	0	0	low local
B109	BC	poor	1	1	0	0	low local
B110	BC	poor	0	1	0	0	low local
B111	BC		3	3	0	0	mod local
B112	C	poor	1	1	0	0	low local

Note: 1. Four possible categories: poor, good, very good, excellent
2. Four possible categories: 0, 1, 2, 3
3. Three possible categories: 1, 2, 3
4. Nine possible categories: low, moderate or high combined with local, regional or national

TABLE I2 SIGNIFICANCE ASSESSMENTS (EXCLUDING CONTEMPORARY ABORIGINAL VALUES) FOR ALL SITES AND FEATURES RECORDED AS A RESULT OF COMPREHENSIVE SURVEY WITHIN THE HOLSWORTHY OPTION A AREA AND ASSOCIATED IMPACT ZONE

Site Name	Condition Rating[1]	Research Potential[2]	Represen-tatives[3]	Aesthetic Value[2]	Education and Recreational Value[2]	Rock Art Condition Rating[1]	Overall Assessment[4]
H1	good	1	1	1	1		low local
H2	excellent	2	3	1	1	excellent	high local
H39	v.good	2	2	2	2	excellent	high local
H131	v.good	0	1	1	1		low local
H132	v.good	2	3	2	2		low regional
H139	v.good	3	2	1	1	poor	high local
H142		2	2	1	1	poor	mod local
H147	v.good	3	2	1	1	v.good	high local
H149	good	1	2	2	2	excellent	high local
H159	v.good	3	3	2	2	poor	low regional
H160	v.good	3	3	3	2	good	high regional
H161	v.good	3	2	2	2	v.good	low regional
H168	v.good	3	3	2	2	excellent	mod regional
H171	good	2	2	1	1	poor	high local
H172	v.good	1	1	1	1		low local
H173	good	1	2	1	1	good	low local
H174	poor	1	1	1	1	poor	low local
H175	excellent	1	1	1	1		low local
H177	good	2	2	1	1	good	mod local
H181	good	2	2	1	1	good	mod local
H194	good	2	2	2	1	good	mod local
H195	poor	2	2	2	1	good	mod local
H198	v.good	3	2	3	2	v.good	mod regional
H213	good	2	2	2	1	poor	mod local
H222	good	3	2	1	1	good	high local
H225	good	3	2	1	1	good	high local
H242	v.good	3	2	1	1	poor	high local
H244	excellent	3	2	1	1	poor	high local
H247	v.good	2	2	2	2		high local
H250	v.good	2	2	1	1	good	mod local
H253	v.good	3	3	3	2	good	high regional
H282	poor	1	2	1	1	poor	low local
H294		1	1	1	1		low local

Site Name	Condition Rating[1]	Research Potential[2]	Represen-tatives[3]	Aesthetic Value[2]	Education and Recreational Value[2]	Rock Art Condition Rating[1]	Overall Assessment[4]
H302	poor	1	2	2	1	poor	mod local
H307	v.good	3	3	0	0		high local
H309	v.good	3	3	3	3	v.good	high regional
H389	good	1	2	1	1		low local
H405	good	1	2	1	1		low local
H409	poor	2	2	1	1	poor	mod local
H428	poor	1	3	0	0		low local
H466	excellent	2	3	1	1		high local
H475	good	1	1	1	1		low local
H486	v.good	1	2	0	0		low local
H487	good	2	3	0	2	good	high local
H496	v.good	1	1	1	1		low local
H497	good	2	2	1	1	poor	mod local
H510	good	3	2	1	1	poor	high local
H519	good	2	2	1	1		mod local
H521	good	2	2	2	1		high local
H522	excellent	2	2	1	1		mod local
H526	good	2	2	1	1		mod local
H527	good	2	3	2	1	poor	low regional
H573	poor	1	1	1	1		low local
H588	good	2	3	0	0		mod local
H590	v.poor	1	1	0	0		low local
H591	good	1	2	1	0	good	low local
H606	v.good	2	2	1	1	good	mod local
H607	good	1	2	2	1		mod local
H608	v.poor	1	2	0	0		low local
H609	poor	2	2	1	1		mod local
H613	excellent	1	2	1	1		low local
H628	poor	1	2	1	1		mod local
H629	good	1	2	0	0		low local
H630	good	1	2	2	2		mod local
H641	good	0	2	0	0		low local
H642	v.good	0	2	0	0		low local
H644	excellent	1	1	1	1		low local
H653	good	1	2	0	0		low local
H696	good	1	2	2	2		high local
H698	good	1	2	1	1		mod local
H699	v.good	3	2	1	1	v.good	high local

Site Name	Condition Rating[1]	Research Potential[2]	Represen-tatives[3]	Aesthetic Value[2]	Education and Recreational Value[2]	Rock Art Condition Rating[1]	Overall Assessment[4]
H701	excellent	2	2	2	2		high local
H702	v.good	1	1	1	1		low local
H703	poor	1	2	1	1	poor	low local
H715	good	2	2	1	1	good	mod local
H716	good	0	2	0	0		low local
H719	good	0	2	0	0		low local
H720	good	0	2	0	0		low local
H721	excellent	1	2	1	2		mod local
H722	excellent	1	2	1	2		mod local
H723	good	1	2	0	0		low local
H724	poor	1	2	0	0	poor	low local
H725	good	1	2	0	0	good	low local
H735	excellent	1	2	0	0		low local
H736	excellent	1	2	0	0		low local
H738	poor	0	2	0	0		low local
H741	excellent	1	2	1	1		low local
H742	excellent	2	2	0	1		mod local
H743	excellent	1	2	0	0		low local
H778	good	0	2	0	0		low local
H779	poor	0	2	0	0		low local
H780	good	0	2	0	0		low local
H786	good	1	2	0	0		low local
H787	excellent	1	2	0	0		mod local
H789	v.good	2	2	0	0	poor	mod local
H837	excellent	3	2	1	1	poor	high local
H839	excellent	3	2	0	0		high local
H841	good	1	2	0	0		mod local
H847	good	0	2	0	0		low local
H848	excellent	3	2	0	0	poor	high local
H849	v.good	3	2	0	0	good	high local
H882	v.good	2	3	1	1	good	high local
H912	good	0	2	0	0		low local
H922	good	1	2	0	0		mod local
H925	good	2	2	0	0	poor	high local
H977	v.good	3	2	0	0		high local
H980	good	1	2	0	0	v.good	low local
H981	v.good	2	2	0	0	poor	mod local
H1002	excellent	3	2	1	1	good	high local

Site Name	Condition Rating[1]	Research Potential[2]	Represen-tatives[3]	Aesthetic Value[2]	Education and Recreational Value[2]	Rock Art Condition Rating[1]	Overall Assessment[4]
H1033	good	1	2	1	1		mod local
H1026	v.good	2	2	0	0	poor	mod local

Note: 1. Four possible categories: poor, good, very good, excellent
2. Four possible categories: 0, 1, 2, 3
3. Three possible categories: 1, 2, 3
4. Nine possible categories: low, moderate or high combined with local, regional or national

TABLE I3 RECORDED SITES WITHIN THE HOLSWORTHY OPTION A AREA AND ASSOCIATED IMPACT ZONE, WHICH WERE NOT INSPECTED DURING THE EIS INVESTIGATION (PROVISIONAL RATINGS ONLY)

Site Name	Condition Rating[1]	Research Potential[2]	Represen-tatives[3]	Aesthetic Value[2]	Education and Recreational Value[2]	Rock Art Condition Rating[1]	Overall Assessment[4]
52-2-71		1	2	1	1		low local
52-2-70							not assessed
H124		2	2	2	2		high local
H125			2	1	1		low local
H127		1	1	0	0		low local
H133			2	1	1		low local
H135		2	2	2	1		high local
H137		2	2	1	1	poor	mod local
H140			2				low local
H141		2	2	1	0		mod local
H143		1	2	1	1		low local
H145		1	2	1	1		low local
H148		1	1	1	1		low local
H150		1	2	1	1		low local
H152		2	2	1	1		mod local
H153		1	2	1	0		low local
H155		3	3	1	1		mod regional
H164		1	2	1	0		low local
H165		1	2	1	0		low local
H178		1	2	1	0		low local
H179		1	2	0	0		low local
H18		1	2	0	0		low local
H184		1	2	1	0		mod local
H186		1	2	2	0		mod local
H187		1	2	2	1		mod local
H188		1	2	0	0		low local
H189		1	2	2	1		mod local
H190		2	3	2	2		low regional
H191		2	3	3	2		low regional
H192		2	2	2	2		high local
H193		1	2	0	0		low local
H196		1	3	2	0		high local

Site Name	Condition Rating[1]	Research Potential[2]	Represen-tatives[3]	Aesthetic Value[2]	Education and Recreational Value[2]	Rock Art Condition Rating[1]	Overall Assessment[4]
H197		2	3	2	2		low regional
H20		1	2	0	0		low local
H200		1	1	0	0		low local
H201		1	2	1	0		low local
H203		1	2	1	0		low local
H205		1	2	1	0		low local
H207		1	2	2	0		mod local
H208		1	2	0	0		low local
H209		1	2	0	0		low local
H210		2	3	2	2		high local
H211		1	2	0	0		low local
H212		1	2	0	0		low local
H214			no data available				not assessed
H217		1	1	0	0		low local
H218		1	2	2	2		mod local
H219		1	3	2	2		high local
H220		1	2	2	2		mod local
H221		1	2	2	1		mod local
H226		1	1	0	0		low local
H227		1	1	0	0		low local
H229		2	3	2	1		high local
H230		1	2	1	0		mod local
H231		1	2	0	0		low local
H233		1	2	0	0		low local
H234		1	2	1	0		low local
H235		1	1	0	0		low local
H236		1	2	1	0		low local
H238		1	2	1	0		low local
H239		1	1	0	0		low local
H240		1	1	0	0		low local
H243		1	1	0	0		low local
H245		1	2	1	1		low local
H246		1	2	0	0		low local
H248		1	1	0	0		low local
H249		1	2	1	1		low local
H252		1	2	1	1		low local
H260		2	2	2	1		mod local
H280		1	2	0	0		low local

Site Name	Condition Rating[1]	Research Potential[2]	Represen-tatives[3]	Aesthetic Value[2]	Education and Recreational Value[2]	Rock Art Condition Rating[1]	Overall Assessment[4]
H297		1	1	0	0		low local
H298		1	2	0	0		low local
H300		1	2	1	0		low local
H303		1	2	1	0		low local
H305		1	3	1	1		high local
H306		2	2	2	1		mod local
H308		1	2	2	1		mod local
H34		1	2	1	1		mod local
H37		2	2	2	1		mod local
H38		1	2	0	0		low local
H4		1	2	1	1		low local
H40		1	1	0	0		low local
H49		1	2	2	1		mod local
H50		1	2	1	0		low local
H6		1	1	0	0		low local
H7		1	1	0	0		low local
H76		1	1	0	0		low local
H8		1	1	0	0		low local
H85		1	1	0	0		low local
H89			no data available				not assessed
H90		1	2	2	1		mod local
H91		1	2	2	1		mod local
H97		1	2	2	1		mod local

Note: 1. Four possible categories: poor, good, very good, excellent
2. Four possible categories: 0, 1, 2, 3
3. Three possible categories: 1, 2, 3
4. Nine possible categories: low, moderate or high combined with local, regional or national

TABLE I4 SIGNIFICANCE ASSESSMENTS (EXCLUDING CONTEMPORARY ABORIGINAL VALUES) FOR ALL SITES AND FEATURES RECORDED AS A RESULT OF COMPREHENSIVE SURVEY WITHIN THE HOLSWORTHY OPTION B AREA AND ASSOCIATED IMPACT ZONE

Site Name	Condition Rating[1]	Research Potential[2]	Represen-tatives[3]	Aesthetic Value[2]	Education and Recreational Value[2]	Rock Art Condition Rating[1]	Overall Assessment[4]
H9	good	2	3	1	2		high local
H63	v.good	2	3	2	2		low regional
H64	excellent	2	3	3	3		high regional
H66	poor	2	2	2	2	poor	high local
H96	v.good	3	3	2	2	good	low regional
H98	good	1	1	1	1		low local
H108	good	2	2	2	2	v.good	high local
H264	good	3	2	1	1	poor	high local
H313	good	3	2	1	1	poor	high local
H353	v.good	1	1	1	1		low local
H356	good	2	2	1	2		mod local
H392	poor	2	2	1	1		mod local
H394	poor	2	2	2	2	poor	high local
H396	good	1	2	1	1		low local
H455	poor	0	2	0	0		low local
H456	v.good	3	3	1	1	good	high local
H461	good	1	1	1	1		low local
H462	good	1	2	1	0	poor	low local
H491	good	0	2	0	0		low local
H493	good	3	2	0	0	good	mod local
H494	good	1	2	1	1		low local
H514	good	2	2	1	1	poor	mod local
H515	good	2	2	0	0	poor	mod local
H580	v.good	1	3	0	0		low local
H583	excellent	3	2	0	0	poor	mod local
H631	good	1	1	0	0		low local
H657	excellent	1	1	0	0		low local
H658	poor	1	2	0	0		low local
H666		3	2	1	1	poor	high local
H706	good	1	1	0	0		low local
H712	v.good	3	2	0	0	good	high local
H714	good	2	3	2	2	v.good	low regional
H739	poor	0	2	0	0	poor	low local
H795	excellent	3	2	0	0		high local

Site Name	Condition Rating[1]	Research Potential[2]	Represen-tatives[3]	Aesthetic Value[2]	Education and Recreational Value[2]	Rock Art Condition Rating[1]	Overall Assessment[4]
H801	good	0	1	0	0		low local
H802	v.good	3	3	3	3	v.good	high regional
H811	excellent	1	1	1	1		low local
H813	v.good	2	2	0	0	poor	mod local
H815	poor	0	2	0	0		low local
H817	good	1	2	0	0		low local
H818	v.good	3	2	0	0	good	high local
H820	excellent	1	1	1	1		low local
H824	excellent	3	3	3	2	v.good	high regional
H827	good	3	2	0	0	poor	high local
H876	good	2	2	0	0	poor	mod local
H885	excellent	2	3	0	0	v.good	high local
H931	excellent	1	1	1	1	excellent	low local
H935	excellent	1	1	1	1	excellent	low local
H937	good	2	2	1	1	poor	mod local
H951	good	2	2	0	0		mod local
H953	poor	1	2	0	0	poor	low local
H954	good	3	2	1	1	poor	high local
H1001	good	0	2	0	0		low local
H1021	poor	0	2	0	0		low local
H1024	poor	1	2	0	0		low local
H1039		3	2	0	0		mod local
H1049	v.good	2	3	1	1	v.good	high local
H1051	good	2	2	3	1	good	high local
H1054	v.good	2	2	2	2	v.good	high local

Note: 1. Four possible categories: poor, good, very good, excellent
2. Four possible categories: 0, 1, 2, 3
3. Three possible categories: 1, 2, 3
4. Nine possible categories: low, moderate or high combined with local, regional or national

TABLE I5 PROVISIONAL SIGNIFICANCE ASSESSMENTS (EXCLUDING CONTEMPORARY ABORIGINAL VALUES) FOR ALL PREVIOUSLY RECORDED SITES WITHIN HOLSWORTHY OPTION B AREA AND ASSOCIATED IMPACT ZONE, WHICH WERE NOTE INSPECTED DURING THE EIS INVESTIGATION (PROVISIONAL RATINGS ONLY)

Site Name	Condition Rating[1]	Research Potential[2]	Represen-tatives[3]	Aesthetic Value[2]	Education and Recreational Value[2]	Rock Art Condition Rating[1]	Overall Assessment[4]
H116		1	2	0	0		low local
H117		1	1	1	1		low local
H134		1	2	2	1		mod local
H24		1	2	2	1		mod local
H241			no data available				not assessed
H25		1	2	0	0		low local
H263		1	2	1	1		mod local
H285		2	2	1	1		mod local
H286		1	1	0	0		low local
H288		1	2	0	0		low local
H289		1	2	0	0		low local
H290		1	3	1	1		high local
H291		1	2	1	1		mod local
H292		1	2	0	0		low local
H293		1	2	0	0		low local
H296		1	2	0	0		low local
H30		1	2	0	0		low local
H31		1	1	0	0		low local
H35		1	2	1	0		low local
H36		1	2	2	2		mod local
H48		1	2	0	0		low local
H51		2	3	2	2		high local
H52		2	3	2	2		low regional
H61		1	2	1	1		low local
H5		1	2	1	1		low local
H99		1	2	1	1		low local
52-2-1389	good	1	2	2	1		mod local
52-2-1332	good	2	3	2	2		low regional
52-2-1330		1	3	1	1		high local
52-2-802							not assessed

Site Name	Condition Rating[1]	Research Potential[2]	Represen-tatives[3]	Aesthetic Value[2]	Education and Recreational Value[2]	Rock Art Condition Rating[1]	Overall Assessment[4]
52-2-801							not assessed
52-2-800							not assessed
52-2-793							not assessed
52-2-782		1	2	1	0		low local
52-2-597	poor	2	2	1	1		mod local
52-2-524							not assessed
52-2-350							
52-2-349		1	2	1	0		low local
52-2-348		1	2	1	0		low local
52-2-301		1	2	2	1		mod local

Note: 1. Four possible categories: poor, good, very good, excellent
2. Four possible categories: 0, 1, 2, 3
3. Three possible categories: 1, 2, 3
4. Nine possible categories: low, moderate or high combined with local, regional or national

Badgerys Creek - Isolated Finds

Key:

0	specified category or value does not apply to recording
-1	specified category or value applies to recording
CMALow	Low potential to contain more artefacts
CMAMod	Moderate potential to contain more artefacts
CMAHigh	High potential to contain more artefacts
GRPoor	Poor general condition rating
GRGood	Good general condition rating
GRVGood	Very good general condition rating
GRVExcel	Excellent general condition rating

ArchBase

23-Apr-97

Site Name	CMALow	CMAMod	CMAHigh	GRPoor	GRGood	GRVGood	GRExcel
B3	0	-1	0	-1	0	0	0
B4	-1	0	0	-1	0	0	0
B5	-1	0	0	-1	0	0	0
B7	0	-1	0	-1	0	0	0
B9	0	-1	0	0	-1	0	0
B11	-1	0	0	-1	0	0	0
B15	-1	0	0	0	-1	0	0
B18	0	-1	0	0	0	0	0
B24	-1	0	0	-1	0	0	0
B25	-1	0	0	-1	0	0	0
B31	-1	0	0	0	-1	0	0
B32	-1	0	0	0	-1	0	0
B34	0	-1	0	-1	0	0	0
B39	-1	0	0	-1	0	0	0
B41	0	-1	0	0	-1	0	0
B42	-1	0	0	-1	0	0	0
B50	0	-1	0	-1	0	0	0
B56	-1	0	0	0	0	0	0
B59	-1	0	0	-1	0	0	0
B60	0	-1	0	-1	0	0	0
B61	0	-1	0	0	-1	0	0
B62	0	0	-1	0	-1	0	0
B64	0	0	-1	0	-1	0	0
B65	0	0	-1	0	-1	0	0
B67	0	0	0	0	-1	0	0
B68	0	-1	0	0	-1	0	0
B69	-1	0	0	-1	0	0	0
B71	0	-1	0	0	0	0	0
B74	0	-1	0	-1	0	0	0
B75	-1	0	0	-1	0	0	0

Site Name	CMALow	CMAMod	CMAHigh	GRPo	GRGood	GRVGood	GRExcel
B76	-1	0	0	-1	0	0	0
B78	0	0	-1	-1	0	0	0
B79	-1	0	0	-1	0	0	0
B81	0	0	-1	-1	0	0	0
B82	-1	0	0	-1	0	0	0
B93	-1	0	0	-1	0	0	0
B94	0	0	-1	0	0	-1	0
B99	0	0	0	0	0	0	0
B101	-1	0	0	-1	0	0	0
B103	-1	0	0	-1	0	0	0
B104	-1	0	0	-1	0	0	0
B106	-1	0	0	-1	0	0	0
B107	0	-1	0	-1	0	0	0
B110	0	0	-1	-1	0	0	0

Badgerys Creek - Open Artefact Scatters

Key:

0	specified category or value does not apply to recording
-1	specified category or value applies to recording
ActualNumber	Actual number of artefacts recorded in detail
Average	Average artefact density on surface (artefacts per square metre)
GRPoor	Poor general condition rating
GRGood	Good general condition rating
GRVGood	Very good general condition rating
GRVExcel	Excellent general condition rating
Length	maximum distance dimension between artefacts
WidthDepth	maximum distance dimension between artefacts taken roughly perpendicular to length measurement

ArchBase

23-Apr-97

Site Name	ActualNumber	Average	GRPoor	GRGood	GRVGood	GRExcel	Length	WidthDepth
B2	4	0.1	0	0	0	0	10	3
B6	3	0.1	-1	0	0	0	100	1
B10	31	0.03	0	-1	0	0	175	100
B12	3	0 03	-1	0	0	0	14	6
B13	9	0.1	-1	0	0	0	0	0
B14	4	0 09	-1	0	0	0	0	0
B16	4	0.005	-1	0	0	0	50	15
B17	4	0.005	-1	0	0	0	50	15
B19	6	0.01	-1	0	0	0	50	15
B20	7	0.01	-1	0	0	0	50	15
B21	11	0.003	-1	0	0	0	250	15
B22	3		-1	0	0	0	0	0
B23	4	0.133	-1	0	0	0		
B26	11	0 11	-1	0	0	0	10	10
B27	3	0.5	0	-1	0	0	10	10
B28	3	0.03	-1	0	0	0	10	10
B29	8	0.08	0	-1	0	0	10	10
B30	4	0.4	0	-1	0	0	10	10
B33	3	0.01	-1	0	0	0	25	10
B35	4	0.022	-1	0	0	0	3	60
B36	3	0.08	-1	0	0	0	5	5
B37	2	0.2	-1	0	0	0	10	1
B38	6	0.1	-1	0	0	0	20	3
B43	5	0.01	0	-1	0	0	30	30
B44	3	0.01	-1	0	0	0	150	25
B45	12	0.01	-1	0	0	0	120	30
B46	13	0 016	0	-1	0	0	60	30
B47	4	0.01	0	-1	0	0	6	1
B53	4	0 01	-1	0	0	0	60	30
B54	2	0 18	1	0	0	0	11	1

Site Name	ActualNumber	Average	GRPoor	GRGood	GRVGood	GRExcel	Length	WidthDepth
B55	2	0.1667	0	-1	0	0	23	2
B57	4	0.01	0	-1	0	0	104	10
B58	2	0.25	0	-1	0	0	1	1
B63	3	0.19	-1	0	0	0	4	4
B66	16	0.3	0	-1	0	0	12	4
B70	5	0.23	0	-1	0	0	3	0
B73	3	0.1	-1	0	0	0	100	20
B77	9	0.45	-1	0	0	0	10	2
B80	11	0.01	-1	0	0	0	100	30
B83	2	0.1	0	-1	0	0	2	10
B84	7	0.27	-1	0	0	0	17	1.5
B85	2	0.01	-1	0	0	0	50	5
B86	5	0.01	-1	0	0	0	30	20
B87	5	0.06	-1	0	0	0	20	4
B88	2	0.02	-1	0	0	0	20	5
B89	7	0.005	-1	0	0	0	50	15
B90	2	0.4	-1	0	0	0	10	0.5
B91	2	0.33	-1	0	0	0	6	1
B92	4	0.053	-1	0	0	0	25	3
B95	8	0.01	-1	0	0	0	100	7
B96	2	0.2	-1	0	0	0	10	1
B97	2	0.3	-1	0	0	0	10	10
B100	2	0.66	-1	0	0	0	6	0.5
B102	19	0.42	-1	0	0	0	13.5	3.5
B105	5	0.42	-1	0	0	0	4	3
B108	10	0.01	-1	0	0	0	200	10
B109	2	0.03	-1	0	0	0	10	3
B112	3	0.17	-1	0	0	0	20	1

Badgerys Creek - Scarred trees

Key:

0	specified category or value does not apply to recording
-1	specified category or value applies to recording
LengthIncRegr	Estimated length of scar, including regrowth
WidthIncRegr	Estimated width of scar, including regrowth
Excel	Scar is in excellent condition
Good	Scar is in good condition
Poor	Scar is in poor condition
Vpoor	Scar is in very poor condition
Possible	Scar is of possible Aboriginal origin
Probable	Scar is of probable Aboriginal origin
MostLikely	Scar is most likely to be Aboriginal in origin

ArchBase

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Site Name	LengthInclRegr	WidthInclRegr	Excel	Good	Poor	VPoor	Possible	Probable	MostLikely
B8	1100	680	0	-1	0	0	-1	0	0
B40	3300	800	0	0	0	-1	-1	0	0
B48	1160	530	0	-1	0	0	-1	0	0
B49	2500	730	0	-1	0	0	-1	0	0
B51	2100	1280	0	0	-1	0	0	0	-1
B52	2000	760	0	0	0	-1	0	-1	0
B72			-1	0	0	0	0	-1	0
B98	820	330	0	0	0	-1	-1	0	0

Badgerys Creek - Potential Archaeological Deposits

Key:

0	specified category or value does not apply to recording
-1	specified category or value applies to recording
LowMod	Low to moderate archaeological potential
Moderate	Moderate archaeological potential
ModHigh	Moderate to high archaeological potential
High	High archaeological potential
Excel	Scar is in excellent condition
Good	Scar is in good condition
Poor	Scar is in poor condition
Vpoor	Scar is in very poor condition
Possible	Scar is of possible Aboriginal origin
Probable	Scar is of probable Aboriginal origin
MostLikely	Scar is most likely to be Aboriginal in origin
Length	maximum distance dimension of area of potential
WidthDepth	maximum distance dimension of area of potential, taken roughly perpendicular to length measurement

ArchBase

23-Apr-97

Site Name	LowMod	Mod	ModHigh	High	Length	WidthDepth
B111	0	0	-1	0	100	50

Holsworthy - Isolated Finds

Key:

0	specified category or value does not apply to recording
-1	specified category or value applies to recording
CMALow	Low potential to contain more artefacts
CMAMod	Moderate potential to contain more artefacts
CMAHigh	High potential to contain more artefacts
GRPoor	Poor general condition rating
GRGood	Good general condition rating
GRVGood	Very good general condition rating
GRVExcel	Excellent general condition rating

ArchBase

23-Apr-97

Site Name	CMALow	CMAMod	CMAHigh	GRPoor	GRGood	GRVGood	GRExcel
H329	-1	0	0	-1	0	0	0
H335	-1	0	0	-1	0	0	0
H336	-1	0	0	-1	0	0	0
H363	-1	0	0	-1	0	0	0
H411	-1	0	0	-1	0	0	0
H412	-1	0	0	-1	0	0	0
H455	-1	0	0	-1	0	0	0
H483	0	-1	0	0	-1	0	0
H486	-1	0	0	0	0	-1	0
H491	-1	0	0	0	-1	0	0
H575	-1	0	0	-1	0	0	0
H576	-1	0	0	-1	0	0	0
H585	0	-1	0	0	0	-1	0
H596	-1	0	0	0	0	0	0
H609	0	-1	0	-1	0	0	0
H624	-1	0	0	0	0	-1	0
H637	0	0	0	0	-1	0	0
H641	-1	0	0	0	-1	0	0
H642	-1	0	0	0	0	-1	0
H658	0	0	0	-1	0	0	0
H663	-1	0	0	-1	0	0	0
H664	-1	0	0	-1	0	0	0
H716	0	-1	0	0	0	0	0
H719	0	-1	0	0	-1	0	0
H720	0	-1	0	0	-1	0	0
H738	-1	0	0	-1	0	0	0
H739	-1	0	0	-1	0	0	0
H760	-1	-1	0	0	-1	0	0
H778	-1	0	0	0	-1	0	0
H779	-1	0	0	-1	0	0	0

Site Name	CMALow	CMAMod	CMAHigh	GRPoor	GRGood	GRVGood	GRExcel
H780	-1	0	0	-1	-1	0	0
H912	-1	-1	0	0	-1	0	0
H970	-1	0	0	-1	0	0	0
H1001	-1	0	0	0	-1	0	0
H1008	-1	0	0	0	0	-1	0
H1021	-1	0	0	-1	0	0	0
H1039	0	0	-1	0	0	0	0

Holsworthy - Open Artefact Scatters

Key:

0	specified category or value does not apply to recording
-1	specified category or value applies to recording
ActualNumber	Actual number of artefacts recorded in detail
Average	Average artefact density on surface (artefacts per square metre)
GRPoor	Poor general condition rating
GRGood	Good general condition rating
GRVGood	Very good general condition rating
GRVExcel	Excellent general condition rating
Length	maximum distance dimension between artefacts
WidthDepth	maximum distance dimension between artefacts taken roughly perpendicular to length measurement

ArchBase

23-Apr-97

Site Name	ActualNumber	Average	GRPoor	GRGood	GRVGood	GRExcel	Length	WidthDepth
H307	2	0.01	0	0	-1	0	100	200
H362	20	0.1	-1	0	0	0	35	28
H414	2	0.143	-1	0	0	0	1.3	0.4
H428	9	0.006	-1	0	0	0	30	30
H439	3	0.5	-1	0	0	0	6	1
H501	3	0.187	0	-1	0	0	4	4
H580	3	0.01	0	0	-1	0	30	30
H581	14	0.003	0	-1	0	0	150	30
H588	2	0.4	0	-1	0	0	1	0
H595	3	0.05	-1	0	0	0	13	5
H667	5	0.26	-1	0	0	0	2	1
H668	2	0.3	0	0	-1	0	4	1.5
H731	3	0.07	0	-1	0	0	20	2
H732	2	0.133	-1	0	0	0	0	0
H899	4	0.042	-1	0	0	0	3	3.15
H1009	3	0.075	0	-1	0	0	0	0
H1013	2	0.166	-1	0	0	0	7	0.5
H1020	6	0.005	0	-1	0	0	50	25
H1025	2	0.055	-1	0	0	0	9	4

Holsworthy - Scarred trees

Key:

0	specified category or value does not apply to recording
-1	specified category or value applies to recording
LengthIncRegr	Estimated length of scar, including regrowth
WidthIncRegr	Estimated width of scar, including regrowth
Excel	Scar is in excellent condition
Good	Scar is in good condition
Poor	Scar is in poor condition
Vpoor	Scar is in very poor condition
Possible	Scar is of possible Aboriginal origin
Probable	Scar is of probable Aboriginal origin
MostLikely	Scar is most likely to be Aboriginal in origin

ArchBase

23-Apr-97

Site Name	LengthInclRegr	WidthInclRegr	Excel	Good	Poor	VPoor	Possible	Probable	MostLikely
H389	1230	710	0	-1	0	0	-1	0	0
H396	1300	4500	-1	0	0	0	-1	0	0
H405	940	410	0	-1	0	0	-1	0	0
H406	1000	460	0	-1	0	0	-1	0	0
H440	1100	1300	-1	0	0	0	0	-1	-1
H449	470	500	-1	0	0	0	-1	0	0
H466	580	300	-1	0	0	0	0	0	-1
H470	1300	400	-1	0	0	0	-1	0	0
H519	1400	400	0	-1	0	0	0	0	-1
H521	1400	780	0	-1	0	0	0	0	-1
H522	1000	850	-1	0	0	0	0	0	-1
H524	1900	1700	0	0	-1	0	-1	0	0
H590		1280	0	0	0	-1	-1	0	0
H607	800	600	0	0	-1	0	0	-1	0
H608	2200	1100	0	0	0	-1	0	-1	0
H613	1600	1500	0	0	-1	0	-1	0	0
H614	1000	60	0	-1	0	0	0	-1	0
H625	1600	800	0	0	-1	0	-1	0	0
H628	1900	600	0	0	-1	0	0	-1	0
H629	850	780	0	0	-1	0	-1	0	0
H630	2600	1000	0	-1	0	0	0	-1	0
H653	940	700	0	0	-1	0	-1	0	0
H696	1.36	21	0	-1	0	0	0	0	-1
H698			0	-1	0	0	0	0	-1
H741	1250	1200	-1	-1	0	0	0	-1	0
H743		880	0	-1	-1	0	-1	0	0
H766	3000	700	0	0	-1	0	0	-1	0
H771	2000	850	0	0	-1	0	-1	0	0
H775	1800	850	0	0	-1	0	-1	0	0
H786	830	660	0	0	-1	0	-1	0	0

Site Name	LengthInclRegr	WidthInclRegr	Excel	Good	Poor	VPoor	Possible	Probable	MostLikely
H787	1350	850	0	-1	0	0	0	-1	0
H815	2700	1280	0	0	-1	0	-1	0	0
H817	2700	800	0	-1	0	0	0	-1	0
H841	2500	700	0	-1	0	0	-1	-1	0
H845	3000	1000	-1	-1	0	0	0	-1	0
H847	1000	600	0	-1	0	0	-1	0	0
H855	2500	700	0	-1	0	0	-1	0	0
H867	2.09	1.1	0	-1	-1	0	-1	-1	0
H922	800	380	0	-1	0	0	0	-1	0
H923	1600	450	0	-1	0	0	-1	0	0
H928	2.44	88	-1	-1	0	0	-1	0	0
H966	1300	650	0	0	-1	0	0	-1	0
H985	90	20	0	0	-1	0	-1	0	0
H987	1.41	20	0	0	-1	0	0	-1	0
H1022	2100	490	0	0	0	-1	-1	0	0
H1024	2000	550	0	0	-1	0	-1	0	0
H1033	630	160	0	-1	-1	0	-1	-1	0
H1037	900	590	0	0	-1	0	-1	0	0

Holsworthy - Open Sites Containing grinding grooves

Key:

0	specified category or value does not apply to recording
-1	specified category or value applies to recording
BLTRALow	Low potential to be larger than recorded area
BLTRAMod	Moderate potential to be larger than recorded area
BLTRAHigh	High potential to be larger than recorded area
GRPoor	Poor general condition rating
GRGood	Good general condition rating
GRVGood	Very good general condition rating
GRVExcel	Excellent general condition rating
Length	maximum distance site dimension
WidthDepth	maximum distance site dimension taken roughly perpendicular to length measurement

ArchBase

23-Apr-97

Site Name	BLTRALow	BLTRAMod	BLTRAHigh	GRPoor	GRGood	GRVGood	GRExcel	Length	WidthDepth
H1	0	0	0	0	-1	0	0	50	28
H9	0	0	0	0	-1	0	0	0	0
H44	0	-1	0	0	0	-1	0	7.3	5.7
H45	0	-1	0	0	0	-1	0	6	6
H53	0	0	-1	0	0	0	-1	12	3
H63	0	0	-1	0	0	-1	0	23.7	4.6
H64	0	0	0	0	0	0	-1	18.5	10
H79	0	0	0	0	0	-1	0	1.5	1
H98	-1	0	0	0	-1	0	0	1.3	1
H131	0	0	-1	0	0	-1	0	3	1.6
H132	0	-1	0	0	0	-1	0	25.8	11.5
H136	0	0	-1	0	-1	0	0	4	3.5
H144	-1	-1	0	0	0	0	-1	24	28
H168	0	0	-1	0	0	-1	-1	14	5.5
H172	0	-1	0	0	0	-1	0	17	8
H175	0	0	0	0	0	0	-1	3	3
H232	0	-1	0	0	0	-1	0	3	0
H247	0	-1	0	0	0	-1	0	23	10
H271	-1	0	0	0	0	0	-1	10	10
H309	0	-1	0	0	0	-1	0	0	0
H310	0	0	0	0	0	0	0	0.3	0.4
H353	-1	0	0	0	0	-1	0	82	82
H356	0	0	0	0	-1	0	0	8	6
H413	-1	0	0	0	-1	0	0	0.26	0.04
H437	0	0	-1	0	0	-1	0	5	4.5
H450	-1	0	0	0	0	0	-1	10.8	6
H461	-1	0	0	0	-1	0	0	30	10
H475	-1	0	0	0	-1	0	0	8	6
H494	0	0	0	0	0	0	0	7	2
H496	-1	0	0	0	0	-1	0	4	10

Site Name	BLTRALow	BLTRAMod	BLTRAHigh	GRPoor	GRGood	GRVGood	GRExcel	Length	WidthDepth
H573	0	0	0	-1	0	0	0	38	16
H586	0	-1	0	0	-1	0	0	40	30
H587	0	-1	0	0	0	-1	0	15	3
H615	-1	0	0	0	0	-1	0	1	1
H622	-1	0	0	0	0	-1	0	0.6	0.6
H631	0	0	0	0	-1	0	0	10	3
H644	-1	0	0	0	0	0	-1	5	2
H657	-1	0	0	0	0	0	-1	10	5
H676	-1	0	0	0	-1	0	0	0	0
H677	-1	0	0	0	-1	0	0	0	0
H678	0	-1	0	0	-1	0	0	3	1
H687	-1	0	0	0	-1	0	0	1	1
H701	-1	0	0	0	0	0	-1	6.8	1.5
H702	0	-1	0	0	0	-1	0	3	2
H706	0	-1	0	0	-1	0	0	0.3	0.6
H721	0	0	0	0	0	0	-1	10	5
H722	0	0	0	0	0	0	-1	2	3
H723	0	0	0	0	-1	0	0	0.3	0.08
H735	0	0	-1	0	0	0	-1	4	3
H736	0	0	-1	0	0	0	-1	3	11
H749	0	0	0	0	0	0	-1	6.5	4.8
H755	-1	0	0	0	0	0	-1	8	4
H801	-1	0	0	0	-1	0	0	15	6
H811	0	-1	0	0	0	0	-1	2.5	0.5
H820	-1	0	0	0	0	0	-1	0.45	0.18
H851	-1	-1	0	0	-1	0	0	0.36	0.49
H853	-1	0	0	0	-1	0	0	1.05	0.4
H882	-1	0	0	0	0	-1	0	25	15
H885	0	0	0	0	0	0	-1	25.3	7
H931	-1	0	0	0	0	0	-1	3	15
H935	-1	-1	0	0	0	0	-1	1	1
H986	0	0	0	0	0	0	-1	0.9	0.6
H1029	0	0	-1	0	0	0	-1	10	5
H1049	0	-1	0	0	-1	0	0	7.1	3.85

Holsworthy - Open Sites containing Engravings

Key:

0	specified category or value does not apply to recording
-1	specified category or value applies to recording

ContPoor	Engravings in poor condition
ContGood	Engravings in good condition
CondVGood	Engravings in very good condition
CondExcel	Engravings in excellent condition

TotalNumberOf	Total number of recorded graphics
NumberOfIdent	Number of determinate graphics
NumberOfIndet	Number of indeterminate graphics

ArchBase

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Site Name	ContPoor	ContGood	CondVGood	CondExcel
H2	0	0	0	-1
H44	-1	0	0	0
H45	0	0	-1	0
H63	0	-1	0	0
H64	0	-1	0	0
H136	0	-1	0	0
H271	0	-1	0	0
H309	0	0	-1	0
H495	0	-1	-1	-1
H693	0	0	-1	0
H695	0	0	-1	0
H712	0	-1	0	0
H882	0	-1	0	0
H885	0	0	-1	0
H1049	0	0	-1	0

TotalNumberOf	NumberOfIdent	NumberOfIndet
1	1	0
4	0	4
1	1	0
9	9	0
6	5	1
3	3	0
21	21	0
4	4	0
1	1	0
1	1	0
1	1	0
1	1	0
1	1	0
1	1	0
1	1	0

Holsworthy - Shelter sites containing surface stone artefacts and/or archaeological deposit

Key:

0	specified category or value does not apply to recording
-1	specified category or value applies to recording
SurfaceArtefact	Stone artefacts present on surface
ArchlDeposit	Site includes archaeological deposit
PigmentArt	Site includes pigment art
GrindingGroov	Site includes grinding grooves
ActualNumber	Actual number of surface stone artefacts recorded in detail
GRPoor	Poor general condition rating
GRGood	Good general condition rating
GRVGood	Very good general condition rating
GRVExcel	Excellent general condition rating

ArchBase

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Site Name	SurfaceArtefact	ArchlDeposit	PigmentArt	GrindingGroov	ActualNumber	GRPoor	GRGood	GRVGood	GRExcel
H19	-1	-1	-1	0	5	0	-1	0	0
H54	-1	-1	-1	0	16	0	0	-1	0
H55	-1	-1	-1	0	21	0	-1	0	0
H57	-1	-1	-1	0	5	-1	0	0	0
H59	-1	-1	-1	0	20	0	-1	0	0
H60	-1	-1	-1	0	5	0	0	0	-1
H82	-1	-1	-1	0	1	0	-1	0	0
H96	-1	-1	-1	0	2	0	0	-1	0
H108	-1	-1	-1	0	2	0	-1	0	0
H147	-1	-1	0	0	2	0	0	-1	0
H160	-1	-1	-1	0	10	0	0	-1	0
H166	-1	-1	-1	0	170	0	0	0	0
H173	-1	0	-1	0	1	0	-1	0	0
H198	-1	-1	-1	0	19	0	0	-1	0
H204	-1	-1	-1	0	62	0	-1	0	0
H225	-1	-1	-1	0	8	0	-1	0	0
H253	-1	-1	-1	-1	4	0	-1	0	0
H264	-1	-1	-1	0	3	0	-1	0	0
H277	-1	-1	-1	0	1	-1	0	0	0
H279	-1	-1	-1	0	2	0	-1	0	0
H304	-1	-1	-1	0	12	0	-1	0	0
H308	-1	-1	0	0	0	0	0	-1	0
H313	-1	-1	-1	0	10	0	-1	0	0
H321	-1	-1	0	0	4	0	0	-1	0
H364	-1	-1	0	0	1	0	-1	0	0
H456	-1	-1	-1	0	12	0	-1	0	0
H497	-1	-1	-1	0	16	0	-1	0	0
H515	-1	-1	-1	0	1	0	-1	0	0
H666	-1	-1	-1	0	7	0	-1	0	0
H686	-1	-1	1	0	5	0	0	0	-1

Site Name	SurfaceArtefact	ArchlDeposit	PigmentArt	GrindingGroov	ActualNumber	GRPoor	GRGood	GRVGood	GRExcel
H688	-1	-1	-1	0	4	0	0	0	-1
H718	-1	-1	-1	0	1	0	0	-1	0
H733	-1	-1	0	0	11	0	0	0	-1
H742	-1	-1	0	0	2	0	0	0	-1
H745	-1	0	0	0	2	0	0	0	-1
H748	-1	-1	0	0	3	0	-1	0	0
H759	-1	-1	-1	0	9	0	0	0	-1
H763	-1	-1	0	0	5	0	-1	-1	0
H772	-1	-1	0	0	1	0	-1	0	0
H795	-1	-1	0	0	1	-1	0	0	-1
H800	-1	-1	0	0	2	0	-1	-1	0
H839	-1	-1	0	0	3	0	0	0	-1
H848	-1	-1	-1	0	2	0	0	0	-1
H849	-1	-1	-1	0	1	0	0	-1	0
H863	-1	-1	0	0	6	0	0	0	-1
H864	-1	-1	0	0	3	0	0	0	-1
H871	-1	-1	-1	-1	2	0	0	0	-1
H905	-1	-1	-1	0	1	0	0	-1	0
H951	-1	-1	0	0	5	0	-1	0	0
H954	-1	-1	-1	0	3	0	-1	0	0
H955	-1	-1	-1	0	9	-1	0	0	0
H977	-1	-1	-1	0	2	0	0	-1	0
H1002	-1	-1	-1	0	33	0	0	0	-1
H1005	-1	-1	0	0	5	0	-1	0	0
H1006	-1	-1	0	0	1	0	-1	0	0
H1007	-1	0	0	0	15	0	-1	0	0
H1026	-1	-1	-1	0	4	0	0	-1	0
H1046	-1	-1	-1	0	5	0	0	0	-1

Holsworthy - Shelter sites containing Pigment Art

Key:

0	specified category or value does not apply to recording
-1	specified category or value applies to recording

SurfaceArtefact	Stone artefacts present on surface
ArchlDeposit	Site includes archaeological deposit

ContPoor	Engravings in poor condition
ContGood	Engravings in good condition
CondVGood	Engravings in very good condition
CondExcel	Engravings in excellent condition

TotalNumberOf	Total number of recorded graphics
NumberOfIdent	Number of determinate graphics
NumberOfIndet	Number of indeterminate graphics

ArchBase

23-Apr-97

Site Name	SurfaceArtefact	ArchlDeposit	ContPoor	ContGood	CondVGood	CondExcel	TotalNumberOf	NumberOfIdent	NumberOfIndet
H14	0	0	-1	0	0	0	9	1	8
H19	-1	-1	-1	0	0	0	2	1	1
H26	0	0	-1	0	0	0	6	0	6
H29	0	0	0	-1	0	0	2	2	0
H39	0	0	0	0	0	-1	10	10	0
H54	-1	-1	0	-1	0	0	12	12	0
H55	-1	-1	0	-1	0	0	24	9	15
H57	-1	-1	0	-1	0	0	1	1	0
H59	-1	-1	0	0	-1	0	11	1	10
H60	-1	-1	0	0	-1	-1	25	10	15
H66	0	0	-1	0	0	0	17	10	7
H81	0	0	-1	0	0	0	6	2	4
H82	-1	-1	-1	0	0	0	16	5	11
H83	0	0	-1	0	0	0	4	1	0
H86	0	0	0	-1	0	0	14	3	11
H96	-1	-1	0	-1	0	0	12	8	4
H104	0	0	-1	0	0	0	1	1	0
H108	-1	-1	0	0	-1	0	39	6	33
H126	0	0	0	0	-1	0	35	14	21
H139	0	0	-1	0	0	0	10	2	8
H142	0	0	-1	-1	0	0	9	3	0
H149	0	0	-1	0	0	0	13	5	9
H157	0	0	-1	0	0	0	19	10	9
H159	0	0	-1	0	0	0	49	25	24
H160	-1	-1	-1	-1	0	0	83	25	58
H161	0	0	0	-1	-1	0	23	11	12
H166	-1	-1	0	0	0	0	72	46	26
H167	0	0	0	-1	0	0	26	14	12
H171	0	0	0	0	0	0	5	0	5
H173	-1	0	0	-1	0	0	2	2	0

Site Name	SurfaceArtefact	ArchlDeposit	ContPoor	ContGood	CondVGood	CondExcel	TotalNumberOf	NumberOfIdent	NumberOfIndet
H174	0	0	-1	0	0	0	3	2	1
H177	0	0	0	-1	0	0	4	3	1
H181	0	0	0	-1	0	0	5	3	2
H185	0	0	0	0	0	0	6	2	4
H194	0	0	0	-1	0	0	9	8	1
H195	0	0	0	-1	0	0	9	5	4
H198	-1	-1	0	0	-1	0	40	10	30
H199	0	0	0	-1	0	0	22	4	18
H202	0	0	0	-1	0	0	45	28	17
H204	-1	-1	0	-1	0	0	9	8	1
H213	0	0	-1	0	0	0	6	0	6
H222	0	0	0	-1	0	0	10	2	8
H225	-1	-1	0	-1	0	0	9	3	6
H242	0	0	-1	0	0	0	5	3	3
H244	0	0	-1	0	0	0	5	1	4
H250	0	0	-1	-1	0	0	4	2	2
H253	-1	-1	-1	-1	0	0	82	22	60
H264	-1	-1	-1	0	0	0	6	0	6
H273	0	0	0	-1	0	0	2	1	1
H275	0	0	0	-1	0	0	5	4	1
H277	-1	-1	0	0	0	0	5	0	5
H279	-1	-1	-1	0	0	0	8	1	7
H282	0	0	-1	0	0	0	3	0	3
H284	0	0	0	-1	0	0	5	0	5
H294	0	0	0	0	0	0	3	2	1
H299	0	0	-1	-1	0	0	3	2	1
H302	0	0	-1	0	0	0	8	4	4
H304	-1	-1	-1	0	0	0	1	0	1
H313	-1	-1	-1	0	0	0	2	0	2
H342	0	0	-1	0	0	0	1	0	1
H360	0	0	-1	-1	0	0	4	1	3
H371	0	0	-1	0	0	0	29	10	19
H392	0	0	-1	0	0	0	2	0	2
H394	0	0	-1	0	0	0	15	15	0

Site Name	SurfaceArtefact	ArchlDeposit	ContPoor	ContGood
H409	0	0	-1	0
H410	0	0	-1	0
H442	0	0	-1	0
H443	0	0	-1	0
H447	0	0	-1	0
H456	-1	-1	0	-1
H462	0	0	-1	0
H487	0	0	0	-1
H493	0	0	0	-1
H497	-1	-1	-1	0
H498	0	0	0	-1
H510	0	0	-1	0
H514	0	0	-1	0
H515	-1	-1	-1	0
H526	0	0	-1	-1
H527	0	0	-1	0
H583	0	0	-1	0
H591	0	0	0	-1
H606	0	0	0	-1
H619	0	0	0	0
H666	-1	-1	-1	0
H679	0	0	0	-1
H681	0	0	0	0
H686	-1	-1	-1	0
H688	-1	-1	0	-1
H699	0	0	0	0
H703	0	0	-1	0
H714	0	0	0	0
H715	0	0	0	-1
H717	0	0	0	-1
H718	-1	-1	-1	0
H724	0	0	-1	0
H725	0	0	0	-1
H753	0	0	-1	0

CondVGood	CondExcel	TotalNumberOf	NumberOfIdent	NumberOfIndet
0	0	7	0	7
0	0	1	0	1
0	0	10	6	4
0	0	2	0	2
0	0	12	9	3
0	0	24	6	18
0	0	4	0	4
0	0	4	3	1
0	0	4	0	4
0	0	1	0	1
0	0	6	4	2
0	0	3	0	3
0	0	14	3	11
0	0	2	1	1
0	0	12	3	9
0	0	14	4	10
0	0	2	0	2
0	0	2	1	1
0	0	7	2	5
-1	0	9	8	1
0	0	18	3	15
0	0	1	0	1
-1	0	6	0	6
0	0	2	0	2
0	0	3	1	2
-1	0	4	3	1
0	0	8	0	8
-1	0	4	4	0
0	0	2	0	2
0	0	1	1	0
0	0	5	0	5
0	0	2	0	2
0	0	1	0	1
0	0	3	1	2

Site Name	SurfaceArtefact	ArchlDeposit	ContPoor	ContGood	CondVGood	CondExcel	TotalNumberOf	NumberOfIdent	NumberOfIndet
H759	-1	-1	-1	-1	0	0	9	1	8
H789	0	0	-1	0	0	0	2	0	2
H802	0	0	0	0	-1	0	28	12	16
H813	0	0	-1	0	0	0	4	0	4
H818	0	0	-1	-1	0	0	4	2	2
H824	0	0	0	-1	-1	0	42	17	25
H827	0	0	-1	0	0	0	1	0	1
H837	0	0	-1	0	0	0	6	1	3
H848	-1	-1	-1	0	0	0	1	0	1
H849	-1	-1	-1	-1	0	0	3	2	1
H856	0	0	-1	0	0	0	16	2	14
H860	0	0	-1	0	0	0	6	0	6
H870	0	0	-1	0	0	0	3	1	2
H871	-1	-1	-1	0	0	0	1	0	1
H876	0	0	-1	0	0	0	5	0	5
H894	0	0	-1	0	0	0	7	5	2
H905	-1	-1	-1	-1	0	0	45	21	24
H908	0	0	-1	0	0	0	33	19	14
H910	0	0	0	0	-1	0	28	20	8
H925	0	0	-1	0	0	0	22	1	21
H937	0	0	-1	0	0	0	12	6	6
H953	0	0	-1	0	0	0	3	0	3
H954	-1	-1	-1	0	0	0	7	7	0
H955	-1	-1	0	-1	0	0	2	1	1
H969	0	0	-1	0	0	0	2	1	1
H977	-1	-1	0	-1	0	0	1	0	1
H980	0	0	0	0	-1	0	1	0	1
H981	0	0	-1	0	0	0	1	0	1
H1002	-1	-1	0	-1	0	0	10	3	7
H1023	0	0	0	0	-1	0	1	1	0
H1026	-1	-1	-1	0	0	0	1	0	1
H1046	-1	-1	-1	0	0	0	2	1	1
H1051	0	0	0	-1	0	0	6	6	0
H1054	0	0	0	0	-1	0	15	8	7

Site Name	SurfaceArtefact	ArchlDeposit	ContPoor	ContGood	CondVGood	CondExcel	TotalNumberOf	NumberOfIdent	NumberOfIndet
H1061	0	0	-1	0	0	0	35	8	27

Holsworthy - Potential Archaeological Deposits

Key:

0	specified category or value does not apply to recording
-1	specified category or value applies to recording
CavernousWeat	Recording consists of a rock shelter created through cavernous weathering
TippedAngledR	Recording consists of a rock shelter created by tipped or angled rock surfaces on one or more rock tors
OpenDeposit	Recording is an open location
LowMod	Low to moderate archaeological potential
Moderate	Moderate archaeological potential
ModHigh	Moderate to high archaeological potential
High	High archaeological potential
Length	Length of shelter overhang (or maximum distance dimension of area of potential)
WidthDepth	Width of shelter overhang (or maximum distance dimension of area of potential taken roughly perpendicular to length measurement)

ArchBase

23-Apr-97

Site Name	CavernousWeat	TippedAngledR	OpenDeposit	LowMod	Mod	ModHigh	High	Length	WidthDepth
H10	-1	0	0	-1	0	0	0	7	4
H314	-1	0	0	-1	0	0	0	6.8	1.9
H315	-1	0	0	-1	0	0	0	4.2	0.8
H316	-1	0	0	-1	0	0	0	5.8	2
H317	-1	0	0	-1	0	0	0	13.3	2.4
H318	-1	0	0	-1	0	0	0	9.2	1.5
H319	-1	0	0	-1	0	0	0	6.6	1.9
H320	-1	0	0	-1	0	0	0	16	2.3
H322	-1	0	0	-1	0	0	0	14.5	2.5
H323	-1	0	0	-1	0	0	0	4.9	2.3
H324	-1	0	0	-1	0	0	0	4.9	2.6
H325	-1	0	0	-1	0	0	0	6	4
H326	-1	0	0	-1	0	0	0	5.2	1.7
H327	-1	0	0	-1	0	0	0	4.6	3.2
H328	-1	0	0	-1	0	0	0	4.5	2.1
H330	-1	0	0	-1	0	0	0	6	3
H331	-1	0	0	-1	0	0	0	10	3
H332	-1	0	0	-1	0	0	0	10	2
H333	-1	0	0	0	-1	0	0	8	3
H334	-1	0	0	-1	0	0	0	5	2
H337	-1	0	0	0	-1	0	0	3.5	1.5
H338	-1	0	0	0	-1	0	0	3	7
H339	-1	0	0	-1	0	0	0	5	4
H340	-1	0	0	0	-1	0	0	12	25
H341	0	0	0	0	0	0	0	9	3
H343	-1	0	0	0	-1	0	0	10	3
H344	-1	0	0	0	-1	0	0	7	3
H345	-1	0	0	-1	0	0	0	5	2
H346	-1	0	0	-1	0	0	0	5	2.5
H347	-1	0	0	0	-1	0	0	7	4

Site Name	CavernousWeat	TippedAngledR	OpenDeposit	LowMod	Mod	ModHigh	High	Length	WidthDepth
H348	-1	0	0	-1	0	0	0	6	3
H349	-1	0	0	0	-1	0	0	11	3
H350	-1	0	0	0	0	0	0	9	4
H351	-1	0	0	0	0	0	0	7	4
H352	-1	0	0	0	-1	0	0	3	1.5
H354	-1	0	0	-1	0	0	0	10	2
H355	-1	0	0	0	-1	0	0	10	1.5
H357	-1	-1	0	-1	0	0	0	20	4
H358	-1	0	0	-1	0	0	0	14	2
H359	-1	-1	0	-1	0	0	0	14	2.5
H361	-1	0	0	0	-1	0	0	7	1.5
H365	-1	0	0	-1	0	0	0	35	5
H366	0	-1	0	0	-1	-1	0	430	220
H367	-1	0	0	-1	0	0	0	3	4
H368	-1	0	0	-1	0	0	0	5	4
H369	-1	0	0	-1	-1	0	0	4	2.4
H370	-1	0	0	0	-1	-1	0	2	1.5
H372	-1	0	0	-1	0	0	0	7.4	2.3
H373	0	-1	0	-1	0	0	0	6.8	4
H374	-1	0	0	-1	0	0	0	20	15
H375	-1	0	0	-1	0	0	0	4	4
H376	-1	0	0	0	-1	0	0	3	2
H377	-1	-1	0	-1	0	0	0	3.5	2.8
H378	-1	0	0	-1	0	0	0	4.3	1.45
H379	0	-1	0	-1	0	0	0	3	2.8
H380	-1	0	0	-1	0	0	0	30	3.6
H381	-1	0	0	-1	0	0	0	35	2.5
H382	0	-1	0	-1	0	0	0	2.7	1.1
H383	-1	0	0	-1	-1	0	0	3.9	1.8
H384	-1	0	0	-1	0	0	0	2.3	2.1
H385	-1	0	0	-1	0	0	0	1.4	3.08
H386	-1	0	0	-1	0	0	0	2.3	2.4
H387	-1	0	0	-1	0	0	0	5	2
H388	-1	0	0	-1	0	0	0	6.7	1.8

Site Name	CavernousWeat	TippedAngledR	OpenDeposit	LowMod	Mod	ModHigh	High	Length	WidthDepth
H390	-1	0	0	-1	0	0	0	4.7	1.35
H391	-1	0	0	-1	-1	0	0	3.4	4.06
H393	-1	0	0	-1	0	0	0	3.5	1
H395	-1	0	0	0	-1	0	0	6.3	3.38
H397	-1	0	0	-1	0	0	0	9.3	3.9
H398	0	-1	0	-1	0	0	0	4.3	4.1
H399	-1	0	0	-1	0	0	0	2.8	1.6
H400	-1	0	0	-1	0	0	0	2.4	1.1
H401	-1	0	0	-1	0	0	0	3.9	1.4
H402	-1	0	0	-1	0	0	0	3	1
H403	-1	0	0	-1	0	0	0	2.3	2.6
H404	-1	0	0	-1	0	0	0	4.6	2.2
H407	-1	0	0	0	0	-1	0	9.8	4.3
H408	0	-1	0	0	-1	0	0	8	6
H415	-1	0	0	-1	0	0	0	13	1.5
H416	-1	0	0	0	0	0	0	6.5	4
H417	-1	0	0	-1	0	0	0	16	2.5
H418	-1	0	0	-1	0	0	0	8	2
H419	-1	0	0	0	-1	0	0	18	4
H420	-1	0	0	-1	0	0	0	1.8	1 8
H421	-1	0	0	-1	0	0	0	4	3
H422	-1	0	0	0	0	-1	0	3.2	3
H423	-1	0	0	-1	0	0	0	4	2
H424	-1	0	0	0	0	-1	0	14	3
H425	-1	0	0	-1	0	0	0	50	5
H426	-1	0	0	-1	0	0	0	9	5
H427	-1	0	0	0	-1	0	0	3.5	4
H429	-1	0	0	-1	0	0	0	8	2
H430	-1	0	0	-1	0	0	0	9	2
H431	-1	0	0	-1	0	0	0	4	1.5
H432	-1	0	0	0	-1	0	0	25	3.7
H433	-1	0	0	0	-1	0	0	7	3.8
H434	-1	0	0	-1	0	0	0	2.5	2
H435	-1	0	0	-1	0	0	0	4	1.3

Site Name	CavernousWeat	TippedAngledR	OpenDeposit	LowMod	Mod	ModHigh	High	Length	WidthDepth
H436	-1	0	0	-1	0	0	0	3.2	2
H438	-1	0	0	-1	0	0	0	10	2
H441	-1	0	0	-1	0	0	0	6	2.8
H444	-1	0	0	-1	0	0	0	7	3
H445	-1	0	0	-1	0	0	0	8	2.5
H446	-1	0	0	-1	0	0	0	2.5	1
H448	-1	0	0	-1	0	0	0	10	1.5
H451	-1	0	0	-1	0	0	0	2.5	2
H452	-1	0	0	0	-1	0	0	6	4
H453	-1	0	0	-1	0	0	0	5	2
H454	-1	-1	0	-1	0	0	0	8	1.5
H457	-1	0	0	-1	0	0	0	6	2
H458	-1	0	0	-1	0	0	0	6	3
H459	0	-1	0	-1	0	0	0	6	1.57
H460	-1	0	0	0	0	0	0	8	3
H463	-1	0	0	0	-1	0	0	8	2
H464	-1	0	0	-1	0	0	0	4	2
H465	-1	0	0	-1	0	0	0	4	1.5
H467	-1	0	0	-1	0	0	0	4	1
H468	-1	0	0	-1	0	0	0	5	2
H469	-1	0	0	-1	0	0	0	5	1
H471	-1	0	0	-1	0	0	0	4	1
H472	-1	0	0	-1	0	0	0	15	3
H473	-1	0	0	0	-1	0	0	5	2.5
H474	-1	0	0	-1	0	0	0	10	6
H476	-1	0	0	-1	0	0	0	8	4
H477	-1	0	0	-1	0	0	0	5	2
H478	-1	0	0	-1	0	0	0	4	1.5
H479	-1	0	0	-1	0	0	0	6	4
H480	0	0	0	-1	0	0	0	5	8
H481	-1	0	0	0	-1	0	0	6.1	4.7
H482	-1	0	0	-1	-1	0	0	5	2
H484	-1	0	0	-1	0	0	0	0	3
H485	-1	0	0	0	-1	-1	0	5	4.5

Site Name	CavernousWeat	TippedAngledR	OpenDeposit	LowMod	Mod	ModHigh	High	Length	WidthDepth
H488	-1	0	0	-1	0	0	0	4	1 5
H489	-1	0	0	0	-1	0	0	4.5	2
H490	-1	0	0	-1	0	0	0	4	1.8
H492	-1	0	0	0	-1	0	0	7	4
H499	-1	0	0	-1	0	0	0	8	2.5
H500	-1	0	0	-1	0	0	0	12	6.2
H502	-1	0	0	-1	0	0	0	10	3
H503	-1	0	0	-1	0	0	0	5.5	2
H504	-1	0	0	-1	0	0	0	4	2.5
H505	-1	0	0	-1	0	0	0	4	1.5
H506	-1	0	0	-1	0	0	0	4	3
H507	-1	0	0	-1	0	0	0	5	1.8
H508	-1	0	0	-1	0	0	0	4	2
H509	-1	0	0	0	-1	0	0	6	2.5
H511	-1	0	0	-1	0	0	0	10	4.5
H512	-1	0	0	-1	0	0	0	8	2
H513	-1	0	0	-1	0	0	0	7	1.5
H516	-1	0	0	-1	0	0	0	12	3.5
H517	-1	0	0	-1	0	0	0	5	2
H518	-1	0	0	0	-1	0	0	6.5	1.9
H520	-1	0	0	-1	0	0	0	3	1.7
H523	-1	0	0	0	-1	0	0	10	5
H525	-1	0	0	-1	0	0	0	5	1
H528	-1	0	0	-1	0	0	0	15	5
H529	-1	0	0	-1	0	0	0	5	2
H530	-1	0	0	-1	0	0	0	9	3
H531	-1	0	0	-1	0	0	0	3	2
H532	-1	0	0	-1	0	0	0	9	1
H533	-1	0	0	-1	0	0	0	17	3
H534	0	-1	0	-1	0	0	0	5	1
H535	-1	0	0	-1	0	0	0	12	2
H536	-1	0	0	-1	0	0	0	7	1
H537	-1	0	0	-1	0	0	0	7	1.5
H538	-1	0	0	-1	0	0	0	5	3

Site Name	CavernousWeat	TippedAngledR	OpenDeposit	LowMod	Mod	ModHi	High	Length	WidthDepth
H539	-1	0	0	-1	0	0	0	8	2
H540	0	-1	0	0	0	0	0	5	1.5
H541	-1	0	0	0	-1	0	0	9	3
H542	-1	0	0	-1	0	0	0	4.5	2
H543	-1	0	0	-1	0	0	0	23	2
H544	-1	0	0	-1	0	0	0	7	1.5
H545	-1	0	0	-1	0	0	0	55	4
H546	-1	0	0	0	-1	0	0	9	2
H547	-1	0	0	-1	0	0	0	18	3.2
H548	-1	0	0	-1	0	0	0	10	1.75
H549	-1	0	0	-1	0	0	0	8	1.2
H550	-1	0	0	-1	0	0	0	5	1
H551	-1	-1	0	-1	0	0	0	4.5	2
H552	0	-1	0	-1	0	0	0	4.6	0.75
H553	-1	0	0	-1	0	0	0	5	1
H554	-1	0	0	0	-1	0	0	7	2.5
H555	-1	0	0	0	-1	0	0	4.5	4
H556	-1	0	0	-1	0	0	0	11	2.2
H557	-1	0	0	-1	0	0	0	5	1.5
H558	-1	0	0	-1	0	0	0	3.5	1
H559	-1	0	0	-1	0	0	0	1 5	3
H560	-1	0	0	-1	0	0	0	3	2
H561	-1	0	0	0	-1	0	0	3.5	1.5
H562	-1	-1	0	0	-1	0	0	10	4
H563	-1	0	0	-1	0	0	0	6.5	1.75
H564	-1	0	0	-1	0	0	0	6	1
H565	0	-1	0	-1	0	0	0	3	1.5
H566	0	-1	0	0	-1	0	0	3	6
H567	-1	0	0	-1	0	0	0	2.5	1
H568	-1	0	0	-1	0	0	0	5	1
H569	-1	0	0	-1	0	0	0	3.5	1
H570	0	-1	0	-1	0	0	0	5.5	1.5
H571	-1	0	0	-1	0	0	0	4	1.2
H572	-1	0	0	-1	0	0	0	2	1

Site Name	CavernousWeat	TippedAngledR	OpenDeposit	LowMod	Mod	ModHigh	High	Length	WidthDepth
H574	-1	0	0	0	-1	0	0	3	3
H577	-1	0	0	0	0	-1	0	4	2.9
H578	-1	0	0	0	0	-1	0	4.4	2.2
H579	-1	0	0	0	-1	0	0	6	4.5
H582	-1	0	0	-1	0	0	0	8	3
H584	-1	0	0	0	0	-1	0	10	3.9
H589	-1	0	-1	0	0	-1	0	6	3
H592	-1	-1	0	0	-1	0	0	2.5	1.9
H593	-1	-1	0	-1	0	0	0	5.2	3.2
H594	-1	0	0	-1	0	0	0	5	3.4
H597	0	-1	0	-1	0	0	0	6.5	2.1
H598	-1	0	0	-1	0	0	0	4	1
H599	-1	0	0	-1	0	0	0	2.4	1.4
H600	-1	0	0	0	-1	0	0	10	3.5
H601	0	-1	0	-1	0	0	0	5	1.4
H602	0	-1	0	-1	0	0	0	5	1.5
H603	-1	0	0	-1	0	0	0	4.5	1.3
H604	0	-1	0	-1	0	0	0	3	3.3
H605	-1	-1	0	-1	0	0	0	8	2.1
H610	-1	-1	0	-1	0	0	0	9	2.5
H611	-1	-1	0	-1	0	0	0	5	3
H612	-1	-1	0	-1	0	0	0	4.5	1.9
H616	-1	0	0	0	-1	0	0	10	3.5
H617	0	-1	0	-1	0	0	0	5	3
H618	0	-1	0	-1	0	0	0	4	1.5
H620	-1	0	0	-1	0	0	0	6	2.5
H621	-1	0	0	-1	0	0	0	4	2
H623	-1	0	0	-1	0	0	0	5	2
H626	-1	-1	0	0	0	0	0	4	1.4
H627	0	-1	0	-1	0	0	0	10	2
H632	-1	0	0	0	0	-1	0	46	6
H633	-1	0	0	-1	0	0	0	8	3
H634	-1	0	0	-1	0	0	0	3	1.3
H635	-1	0	0	-1	0	0	0	3 8	2

Site Name	CavernousWeat	FippedAngledR	OpenDeposit	LowMod	Mod	ModHigh	High	Length	WidthDepth
H636	-1	0	0	0	0	0	0	2.5	2.4
H638	-1	0	0	-1	0	0	0	4	2.1
H639	-1	0	0	0	-1	0	0	16	5
H640	-1	0	0	-1	0	0	0	7	2.9
H643	-1	0	0	-1	0	0	0	2	1.3
H645	-1	0	0	-1	0	0	0	2.5	1.5
H646	-1	0	0	-1	0	0	0	5.5	2.5
H647	-1	0	0	-1	0	0	0	3	1.9
H648	-1	0	0	-1	0	0	0	3	2
H649	-1	0	0	-1	0	0	0	4	1.5
H650	-1	0	0	-1	0	0	0	4	2.1
H651	-1	0	0	-1	0	0	0	5.5	2.1
H652	-1	0	0	-1	0	0	0	9	2.4
H654	-1	0	0	-1	0	0	0	5	2.6
H655	-1	0	0	-1	0	0	0	2.5	1
H656	-1	0	0	-1	0	0	0	5	4
H659	-1	0	0	-1	0	0	0	2.5	1.5
H660	0	-1	0	-1	0	0	0	7	2.5
H661	-1	0	0	0	-1	0	0	20	4
H662	-1	0	0	-1	0	0	0	8	4
H665	-1	0	0	-1	0	0	0	3.7	1.4
H669	-1	0	0	-1	0	0	0	9	2.5
H670	-1	0	0	-1	0	0	0	4	1.8
H671	-1	0	0	-1	0	0	0	10	3
H672	0	-1	0	0	-1	0	0	6.6	1
H673	-1	0	0	0	-1	0	0	6.6	2.7
H674	-1	0	0	0	0	-1	0	7.5	4.7
H675	-1	0	0	-1	0	0	0	5.8	2.5
H680	-1	0	0	0	0	-1	0	3.7	7.5
H682	-1	0	0	0	-1	0	0	7.4	1.7
H684	0	0	-1	0	-1	0	0	20	0
H685	-1	0	0	0	0	-1	0	4.2	2.9
H689	-1	0	0	0	-1	0	0	9.1	1.1
H690	-1	0	0	0	-1	0	0	6.8	1.15

Site Name	CavernousWeat	TippedAngledR	OpenDeposit	LowMod	Mod	ModHigh	High	Length	WidthDepth
H691	-1	0	0	0	-1	0	0	9	2
H692	-1	0	0	0	0	-1	0	17	6
H694	-1	0	0	0	0	-1	0	4.5	4.7
H697	-1	0	0	0	-1	0	0	1.5	2.8
H700	-1	0	0	0	-1	0	0	4.7	2
H704	-1	0	0	-1	0	0	0	4	2.1
H705	-1	0	0	0	0	0	-1	80	3.5
H707	-1	0	0	0	-1	0	0	4.1	2
H708	-1	0	0	0	0	0	-1	9.7	5
H709	-1	0	0	0	0	-1	0	5	2.3
H710	-1	0	0	0	0	-1	0	15.2	4.2
H711	-1	0	0	0	0	0	-1	42.1	13.1
H713	-1	0	0	0	0	-1	0	8.3	3.9
H726	-1	0	0	0	-1	0	0	3.9	2
H727	-1	0	0	0	0	0	-1	6.3	2.5
H728	-1	0	0	-1	0	0	0	13.1	3.4
H729	-1	0	0	0	0	0	-1	18.8	2.2
H730	-1	0	0	0	0	0	-1	12.3	2
H734	-1	0	0	0	0	0	-1	18.1	5
H737	-1	0	0	0	-1	0	0	2.5	1.6
H740	-1	0	0	0	-1	0	0	48	9
H744	0	0	-1	0	0	-1	0	10	7
H746	-1	0	0	-1	0	0	0	8	4
H747	-1	0	0	0	-1	0	0	5	3
H750	-1	0	0	0	-1	0	0	3.5	1.8
H751	-1	0	0	-1	0	0	0	3	2
H752	-1	0	0	0	-1	0	0	5	3
H754	-1	0	0	0	-1	0	0	4	1.5
H756	-1	0	0	-1	0	0	0	5	2.5
H757	-1	0	0	-1	0	0	0	8	1.6
H758	-1	0	0	-1	0	0	0	3.5	2
H761	-1	0	0	-1	0	0	0	12	5
H762	-1	0	0	0	-1	0	0	15	3
H764	-1	0	0	0	0	-1	0	8	30

Site Name	CavernousWeat	TippedAngledR	OpenDeposit	LowMod	Mod	ModHigh	High	Length	WidthDepth
H765	-1	0	0	-1	0	0	0	3	2
H767	-1	0	0	0	0	-1	0	13	5
H768	-1	0	0	-1	0	0	0	10	4
H769	-1	0	0	0	-1	0	0	11	5
H770	-1	0	0	-1	0	0	0	7	4
H773	-1	0	0	-1	0	0	0	10	5
H774	-1	0	0	0	0	-1	0	6	4.5
H776	-1	0	0	0	-1	0	0	9	4.5
H777	-1	0	0	-1	0	0	0	14	4.5
H781	-1	0	0	0	-1	0	0	4	1.5
H782	-1	0	0	-1	-1	0	0	6	3.5
H783	0	-1	0	-1	0	0	0	4	7
H784	-1	0	0	0	-1	0	0	5	2
H785	-1	0	0	0	0	-1	0	7	7
H788	-1	0	0	-1	0	0	0	4	3
H790	-1	0	0	0	-1	0	0	8	3
H791	-1	0	0	0	-1	0	0	8	5
H792	-1	0	0	-1	0	0	0	8	2.5
H793	-1	0	0	-1	0	0	0	5	2
H794	-1	0	0	0	-1	0	0	7	2
H796	-1	0	0	-1	0	0	0	6	2.5
H797	-1	0	0	-1	0	0	0	5	1.5
H798	-1	0	0	0	-1	0	0	5	4.5
H799	-1	0	0	-1	0	0	0	8	3
H803	-1	0	0	0	0	0	-1	9	4.5
H804	-1	0	0	-1	0	0	0	6	3
H805	-1	0	0	-1	0	0	0	7	2
H806	-1	0	0	0	0	-1	0	19	4.3
H807	-1	0	0	-1	0	0	0	21	3.5
H808	-1	0	0	0	-1	0	0	7.5	2.2
H809	-1	0	0	-1	0	0	0	12	4
H810	-1	0	0	-1	0	0	0	3	1.5
H812	-1	0	0	-1	0	0	0	8	2
H814	-1	0	0	-1	0	0	0	6	2.5

Site Name	CavernousWeat	TippedAngledR	OpenDeposit	LowMod	Mod	ModHigh	High	Length	WidthDepth
H816	-1	0	0	0	-1	0	0	8	2
H819	-1	0	0	0	0	0	0	13	2.5
H821	-1	0	0	-1	0	0	0	3	1.5
H822	-1	0	0	-1	0	0	0	6	2
H823	-1	0	0	0	0	-1	0	15	4
H825	-1	0	0	0	0	-1	0	12	5
H826	-1	0	0	0	0	0	-1	65	8
H828	-1	0	0	-1	0	0	0	21	4.5
H829	-1	0	0	-1	0	0	0	15	2.5
H830	-1	0	0	-1	0	0	0	3	1.4
H831	-1	0	0	-1	0	0	0	12	3
H832	-1	0	0	0	-1	0	0	7	2.7
H833	-1	0	0	0	-1	0	0	11	5.5
H834	-1	0	0	0	-1	0	0		
H835	-1	0	0	0	-1	0	0	12	3.5
H836	-1	0	0	0	-1	0	0	9	4
H838	-1	0	0	-1	-1	0	0	4	2
H840	-1	0	0	-1	0	0	0	3.5	1.5
H842	-1	0	0	0	-1	0	0	6	2
H843	-1	0	0	-1	0	0	0	4.5	3
H844	-1	0	0	-1	0	0	0	4.5	5
H846	-1	0	0	-1	0	0	0	5	2
H850	-1	0	0	0	0	-1	0	7	3
H852	-1	0	0	0	0	-1	0	10	3
H854	-1	0	0	0	-1	0	0	19	5
H857	-1	0	0	-1	0	0	0	13	3
H858	-1	0	0	-1	0	0	0	7	2.5
H859	-1	0	0	-1	0	0	0	90	1.5
H861	-1	0	0	-1	0	0	0	3.5	2
H862	-1	0	0	-1	0	0	0	3	3.5
H865	-1	0	0	-1	0	0	0	6	4
H866	-1	0	0	-1	0	0	0	2.5	1.2
H868	-1	-1	0	-1	0	0	0	2	2.5
H869	-1	0	0	-1	-1	0	0	9	4

Site Name	CavernousWeat	TippedAngledR	OpenDeposit	LowMod	Mod	ModHigh	High	Length	WidthDepth
H872	-1	0	0	-1	0	0	0	4	2
H873	-1	0	0	-1	0	0	0	7	2.5
H874	-1	0	0	-1	0	0	0	5	3
H875	-1	0	0	-1	0	0	0	6	2
H877	-1	0	0	-1	0	0	0	4	2
H878	-1	0	0	0	0	-1	0	14	4
H879	-1	0	0	0	-1	0	0	7.6	3
H880	-1	0	0	0	0	-1	0	14	5
H881	-1	0	0	0	-1	0	0	7	3
H883	-1	0	0	0	-1	0	0	11	22
H884	-1	0	0	0	-1	0	0	8	1.5
H886	-1	0	0	-1	0	0	0	1.3	1.3
H887	-1	0	0	0	0	-1	0	29	5.5
H888	-1	0	0	0	0	-1	0	4.5	4.5
H889	-1	0	0	-1	0	0	0	3	2
H890	-1	0	0	0	0	-1	0	5	4
H891	-1	0	0	0	0	0	-1	50	5
H892	-1	0	0	-1	0	0	0	4	4.5
H893	-1	0	0	-1	0	0	0	7	2
H895	-1	0	0	-1	0	0	0	3	2.5
H896	-1	0	0	-1	0	0	0	5	2
H897	-1	0	0	-1	0	0	0	10	1.25
H898	-1	0	0	-1	0	0	0	2.5	1
H900	-1	0	0	-1	0	0	0	0	0
H901	0	-1	0	-1	0	0	0	2.2	1.5
H902	-1	0	0	0	0	0	0	7	3
H903	-1	0	0	-1	0	0	0	13	3.4
H904	-1	0	0	-1	0	0	0	7	2.25
H906	-1	0	0	0	-1	0	0	35	5
H907	-1	0	0	0	-1	0	0	4	2
H909	-1	0	0	-1	0	0	0	11	2
H911	0	-1	0	-1	0	0	0	3	1
H913	-1	0	0	-1	-1	0	0	3.5	1.8
H914	-1	0	0	-1	0	0	0	8	3

Site Name	CavernousWeat	TippedAngledR	OpenDeposit	LowMod	Mod	ModHigh	High	Length	WidthDepth
H915	-1	0	0	-1	0	0	0	7	1.5
H916	-1	0	0	0	-1	0	0	4	3
H917	-1	0	0	-1	0	0	0	1	2
H918	0	0	0	0	-1	0	0	3	1.5
H919	-1	0	0	-1	0	0	0	0	0
H920	-1	0	0	-1	0	0	0	6	2
H921	-1	0	0	-1	0	0	0	3	1.2
H924	-1	0	0	-1	0	0	0	3.75	2.5
H926	-1	0	0	-1	0	0	0	6	4
H927	-1	0	0	-1	0	0	0	28	1.5
H929	-1	0	0	-1	0	0	0	7	3.5
H930	0	-1	0	-1	0	0	0	10	2
H932	-1	0	0	0	0	-1	0	4	4
H933	-1	0	0	0	-1	0	0	7	3
H934	0	-1	-1	-1	0	0	0	3	1
H936	-1	0	0	-1	0	0	0	7	1.7
H938	-1	-1	0	-1	0	0	0	8	1.5
H939	-1	0	0	-1	0	0	0	8	5
H940	0	-1	0	-1	0	0	0	4	1.2
H941	0	-1	0	-1	0	0	0	7	8
H942	0	-1	0	-1	0	0	0	13	2
H943	0	-1	0	-1	0	0	0	10	1
H944	0	-1	0	0	-1	0	0	10	4.5
H945	0	-1	0	-1	0	0	0	4.5	2.5
H946	-1	0	0	-1	0	0	0	7	1.5
H947	-1	0	0	-1	0	0	0	5	1.35
H948	0	-1	0	-1	0	0	0	3	1
H949	-1	0	0	-1	0	0	0	1.5	2
H950	-1	0	0	-1	0	0	0	11	2
H952	-1	0	0	-1	0	0	0	33	11
H956	-1	0	0	-1	0	0	0	6	5
H957	-1	0	0	-1	0	0	0	10	6
H958	0	-1	0	-1	0	0	0	3	3
H959	-1	0	0	-1	0	0	0	19	9

Site Name	CavernousWeat	TippedAngledR	OpenDeposit	LowMod	Mod	ModHigh	High	Length	WidthDepth
H1960	-1	0	0	-1	0	0	0	5.5	2
H1961	-1	0	0	-1	0	0	0	3	4
H1962	0	0	0	-1	0	0	0	5	3
H1963	-1	0	0	-1	0	0	0	4.5	2.5
H1964	-1	0	0	-1	0	0	0	4.5	2
H1965	-1	0	0	-1	0	0	0	13	5
H1967	0	-1	0	-1	0	0	0	6	2
H1968	-1	0	0	-1	0	0	0	5	2
H1971	-1	0	0	-1	0	0	0	7	2.5
H1972	-1	0	0	0	0	-1	0	5	4
H1973	0	-1	0	-1	0	0	0	17	5
H1974	0	-1	0	-1	0	0	0	16	4
H1975	-1	-1	0	-1	0	0	0	13	6
H1976	-1	0	0	-1	0	0	0	27	7.5
H1978	-1	0	0	-1	0	0	0	6	2
H1979	-1	0	0	-1	0	0	0	4	2.25
H1982	-1	0	0	-1	0	0	0	11	2
H1983	-1	0	0	0	-1	0	0	1.8	1.7
H1984	-1	0	0	-1	0	0	0	14	3.4
H1988	-1	0	0	-1	0	0	0	25	3
H1989	-1	0	0	-1	0	0	0	5	2.5
H1990	-1	0	0	-1	0	0	0	2.5	2
H1991	-1	0	0	-1	0	0	0	10	2.5
H1992	-1	0	0	-1	0	0	0	2.2	1.1
H1993	-1	0	0	-1	0	0	0	2.5	2.4
H1994	-1	0	0	-1	0	0	0	20	1.5
H1995	-1	0	0	-1	0	0	0	6.3	3.5
H1996	-1	0	0	-1	0	0	0	5.3	2.2
H1997	-1	0	0	-1	0	0	0	8.9	2.3
H1998	-1	0	0	-1	0	0	0	8.5	1.5
H1999	-1	0	0	-1	0	0	0	12.2	3.3
H11000	-1	0	0	-1	0	0	0	10.2	4 4
H11003	-1	0	0	-1	0	0	0	6	2
H11004	-1	0	0	-1	0	0	0	6	1.5

Site Name	CavernousWeat	TippedAngledR	OpenDeposit	LowMod	Mod	ModHigh	High	Length	WidthDepth
H1010	-1	0	0	-1	0	0	0	9.8	2.1
H1011	-1	0	0	-1	0	0	0	3.3	2.9
H1012	0	-1	0	0	0	-1	0	3.9	1.75
H1014	-1	0	0	-1	0	0	0	6	1.7
H1015	0	-1	0	0	-1	0	0	6	2.1
H1016	-1	0	0	-1	0	0	0	15	1.5
H1017	-1	0	0	-1	0	0	0	4.5	2
H1018	-1	0	0	0	-1	0	0	14	3
H1019	-1	0	0	-1	0	0	0	2.2	1.5
H1027	-1	-1	0	-1	0	0	0	4.1	1.8
H1028	-1	0	0	-1	0	0	0	4	3
H1030	-1	0	0	-1	0	0	0	5	1.5
H1031	0	-1	0	-1	0	0	0	3.18	1.03
H1032	-1	0	0	-1	0	0	0	3.57	2.46
H1034	-1	0	0	-1	0	0	0	15	4
H1035	-1	0	0	-1	0	0	0	2.5	2
H1036	-1	0	0	-1	0	0	0	4.4	2
H1038	-1	0	0	-1	0	0	0	6	4.5
H1040	-1	0	0	0	0	0	-1	4	3
H1041	-1	0	0	-1	0	0	0	7	4
H1042	-1	0	0	0	-1	0	0	4.5	1.5
H1043	-1	0	0	-1	0	0	0	2.5	1
H1044	-1	0	0	0	-1	0	0	7.5	2
H1045	0	-1	0	-1	0	0	0	2.5	1.2
H1047	-1	0	0	-1	0	0	0	1.5	0.9
H1048	-1	0	0	0	0	0	0	3.5	1.5
H1050	-1	0	0	0	-1	0	0	13.4	2.8
H1052	-1	0	0	-1	0	0	0	4	2.5
H1053	-1	0	0	-1	0	0	0	8	2.5
H1055	0	-1	0	-1	0	0	0	3	1
H1056	-1	0	0	-1	0	0	0	2.8	3.8
H1057	-1	-1	0	0	-1	0	0	7.7	1.9
H1058	-1	0	0	-1	0	0	0	6.4	3
H1059	-1	0	0	-1	0	0	0	9.4	2.5

Site Name	CavernousWeat	TippedAngledR	OpenDeposit	LowMod	Mod	ModHigh	High	Length	WidthDepth
H1060	-1	0	0	0	0	-1	0	36	8 8
H1062	0	0	-1	0	0	-1	0	150	70
H1063	-1	0	0	0	0	0	0	40	2

Appendix I

Reports from Local Aboriginal Organisations and Land Councils

DARUG TRIBAL ABORIGINAL CORPORATION

(incorporating Darug Link Association Incorporated)

PO Box 441
BLACKTOWN
NSW 2148

TO: KERRY NAVIN
NAVIN OFFICER

17--2--1997
COLIN GALE

DEAR KERRY

In response to the survey on HOLSWORTHY / BADGERRY'S CREEK airport proposal,I submit the following imformation . My personal association with both area's extends back to the late 1940' through my interest in ornithology and hunting rabbits .

Holsworthy , as you know has been off limits for quite a long time, however I have known the area around Deadmans Creek and Heathcote bush.

The Badgerry's Creek area is much better known , from LEPPINGTON to MULGOA and back to ST. MARY'S. At Leppington there is a carved tree near the school , and at Mulgoa there were several scarr trees . Until recently , I worked as a forklift mechanic and as such , worked on Ingham's poultry farms , which covered much of the area .

Some of the families connected with the area, include the BOTTS from Mulgoa , descended from MERRI MERRI , known as Mary Mary , and their relations , who still live around the district , down to Narrelan. Castles also live at Hoxton Park and around the Liverpool area.

We shot and ferreted rabbits in the area up to the 1960's , until it became too built up or fenced off.

Please find enclosed , a map of the tribal boundaries of the DARUG . and note that there are four LOCAL ABORIGINAL LAND COUNCILS , wholly or partly on DARUG land.

We can provide clan area's etc. if you wish, so do hesitate to contact us if you need further imformation

Yours Faithfully
COLIN GALE
CHAIRMAN

WHAT IS THE DARUG LINK ?

The Darug Link was first formed in 1988 by Aboriginal people descended from the Darug tribe, the traditional owners of the Sydney area:

THE DARUG LINK HAS SEVERAL AIMS :

** to trace the family history of Darug people:
** to collect information and objects relating to Darug culture:
** to inform the wider community about the Darug and their history:
** to work in conjunction with other Aboriginal organisations:
** to hold an annual reunion for all Darug descendants, their family and friends:

In order to increase public awareness and to show how the Darug have contributed to the history of Western Sydney before European settlement to the present, The Darug Link coordinates displays of photographs, genealogical trees, and cultural traditions:

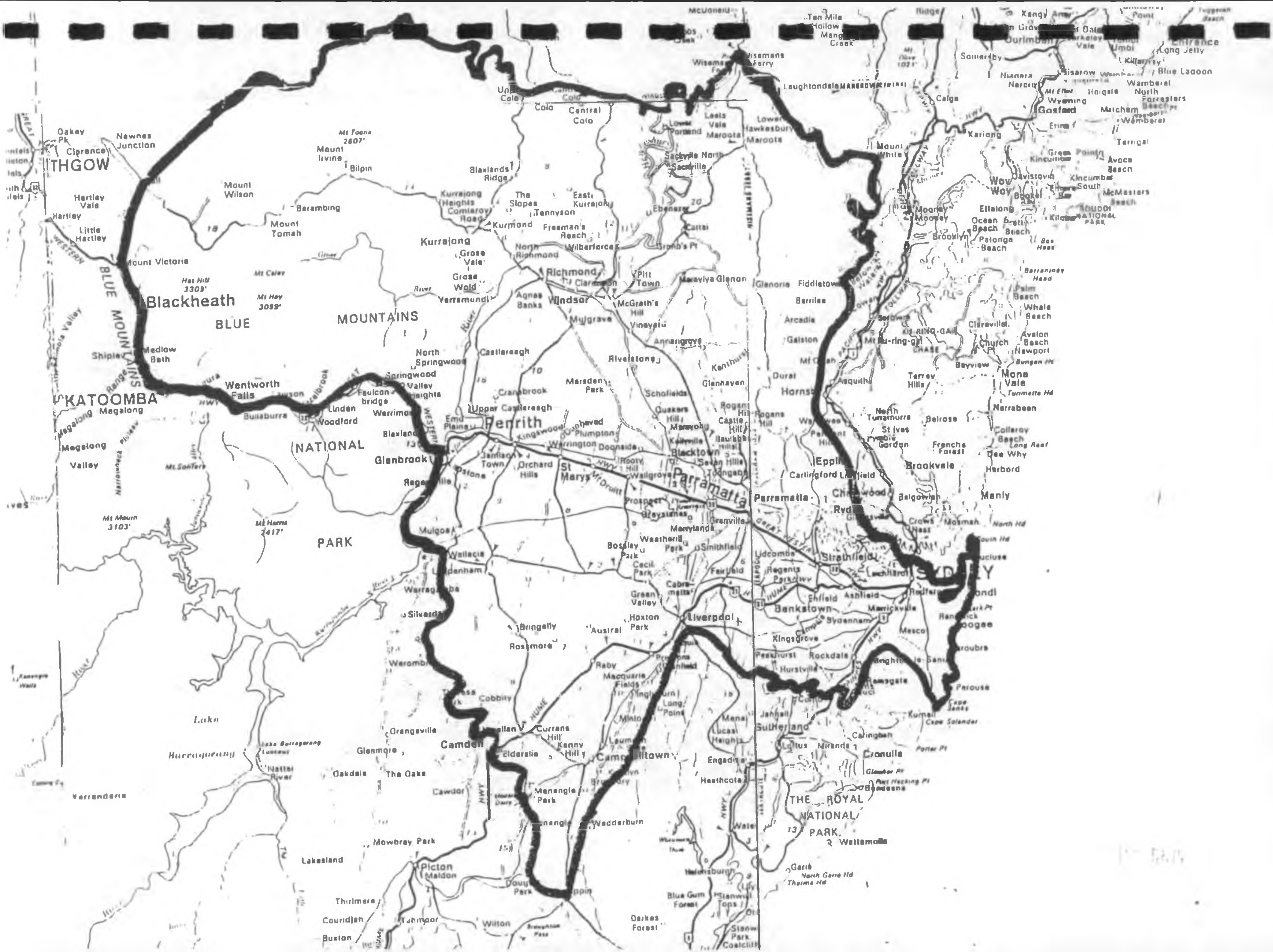
Most Darug Link members can trace their ancestry back to Yarramundi a tribal Elder from the Boorooberongal clan at Richmond.
His descendants lived, and still live, in the area now known as Plumpton, and which was the site of the Native institution, the original Black Town.

FOR FURTHER INFORMATION, CONTACT :

[redacted]

THE DARUG LINK ASSOCIATION :
P.O. BOX 441
BLACKTOWN 2148

CHAIRPERSON : COLIN CALE
671 3991



LITHGOW
Oakey Pk
Clarence
Newnes Junction
Hartley Vale
Hartley
Little Hartley
Mount Wilson
Mount Irvine
Bilpin
Berambing
Mount Tomah
Mount Victoria
Blackheath
BLUE MOUNTAINS
BLUE
MOUNTAINS
Medlow Bath
Shipley
KATOOMBA
Wentworth Falls
Megalong
Megalong Valley
Bullaburra
Linden
Woodford
Faulconbridge
Springwood
Valley Heights
Warrimoo
Blaxland
Glenbrook
NATIONAL
PARK
Mt Hay 3099'
Hat Hill 3309'
Mt Tootie 2607'
Mt Moon 3103'
Mt Harris 2417'
Kurrajong
Kurrajong Heights
Blaxlands Ridge
The Slopes
Tennyson
East Kurrajong
Kurmond
Freeman's Reach
Wilberforce
North Richmond
Richmond
Grose Vale
Grose Wold
Yarramundi
Agnes Banks
Windsor
Clarendon
McGrath's Hill
Pitt Town
Vineyard
Mulgrave
Castlereagh
North Springwood
Cranebrook
Upper Castlereagh
Emu Plains
Penrith
Kingswood
Werrington
St Marys
Mt Druitt
Orchard Hills
Marsden Park
Riverstone
Schofields
Quakers Hill
Blacktown
Seven Hills
Toongabbie
Parramatta
Prospect
Greystanes
Merrylands
Granville
Wetherill Park
Smithfield
Bossley Park
Cecil Park
Fairfield
Cabramatta
Green Valley
Hoxton Park
Austral
Liverpool
Bringelly
Rossmore
Mulgoa
Wallacia
Luddenham
Warragamba
Silverdale
Werombi
Cobbitty
Camden
Narellan
Currans Hill
Kenny Hill
Elderslie
Campbelltown
Menangle Park
Menangle
Wedderburn
Douglas Park
Appin
Picton
Maldon
Thirlmere
Couridjah
Buxton
Tahmoor
Wilton
Glenmore
Oakdale
The Oaks
Cawdor
Orangeville
Mowbray Park
Lakesland
Lake Burragorang
Nattai River
Yerranderie
Raby
Macquarie Fields
Ingleburn
Minto
Long Point
Lucas Heights
Engadine
Heathcote
Helensburgh
Blue Gum Forest
Darkes Forest
Stanwell Tops
Stanwell Park
Coalcliff
Waterfall
THE ROYAL NATIONAL PARK
Wattamolla
Garie
Sutherland
Loftus
Miranda
Caringbah
Cronulla
Kurnell
Cape Solander
Jannali
Como
Hurstville
Peakhurst
Rockdale
Kingsgrove
Brighton-le-Sands
Ramsgate
La Perouse
Maroubra
Randwick
Coogee
Bondi
Mascot
Sydenham
Marrickville
Bankstown
Enfield
Ashfield
Regents Park
Lidcombe
Strathfield
Leichhardt
Redfern
SYDNEY
Rydalmere
Ryde
Carlingford
Epping
Chatswood
Crows Nest
Mosman
Manly
North Hd
South Hd
Brookvale
Harbord
Dee Why
Long Reef
Collaroy Beach
Frenchs Forest
Belrose
Narrabeen
Gordon
St Ives
Turramurra
Pymble
Terrey Hills
Mona Vale
Bayview
Church Pt
Newport
Avalon Beach
Clareville
Whale Beach
Palm Beach
Barrenjoey Head
Mt Ku-ring-gai
KU-RING-GAI CHASE
Asquith
Hornsby
Dural
Glenhaven
Kenthurst
Castle Hill
Baulkham Hills
Rogans Hill
Galston
Arcadia
Berrilee
Fiddletown
Glenorie
Maraylya
Annangrove
Oakville
Cattai
Ebenezer
Sackville North
Lower Portland
Leets Vale
Maroota
Lower Hawkesbury
Wisemans Ferry
Laughtondale
Central Colo
Colo
Upper Colo
Mangrove Creek
Ten Mile Hollow
Mount White
Brooklyn
Mooney Mooney
Patonga Beach
Ocean Beach
Ettalong
Woy Woy
Davistown
Kincumber
Kincumber South
Green Point
Avoca Beach
Terrigal
McMasters Beach
Bouddi NATIONAL PARK
Kariong
Gosford
Wyoming
Narara
Niagara
Somersby
Calga
Holgate
Matcham
Wamberal
North Forresters Beach
Erina
Kangy Angy
Ourimbah
Blue Lagoon
Long Jetty
Entrance

1997

Gandangara Local Aboriginal Land Council

ABORIGINAL SITE SURVEY

FOR

THE

PROPOSED

SECOND SYDNEY AIRPORT

AT

BADGERYS CREEK

NSW

Report compiled by Barry Gunther and Jamie Thomas.

TABLE OF CONTENTS

1:0 INTRODUCTION :

Aboriginal participation in surveys involving development proposals are paramount in the identification, preservation and management of Aboriginal Heritage, Australian history and the environment.

The Badgery's Creek Airport Site falls within the N.S.W. Aboriginal Land Rights Legislative boundary of the Gandangara Local Aboriginal Land Council area

This Aboriginal Site Survey was instigated due to the proposed 2nd Airport development at Badgery's Creek N.S.W.. The G.L.A.L.C. was informed by Archaeologist Kerry Navin from Navin Officer Heritage Consultants that Aboriginal input was required in the survey.

Aboriginal representation comprised of G.L.A.L.C. representatives Mr Jamie Thomas, Mr John Griffiths, Mr Barry Gunther and Mr John Clegg.

The survey was conducted on over a 3 day period (8,9,10th December,1996).

1:1 G.L.A.L.C.'s Aims :

The aims of this inspection were as follows;

- Identify any visible Aboriginal artefacts which may be present in the proposed development area.

- Ascertain the significance of the Aboriginal infrastructure in the environment and the significance of any sites, artefacts located during the survey.

- Protect and / or preserve any Aboriginal artefacts or cultural areas comprising of mythological and aesthetic values.

- Highlight environmental concerns in relation to study area.

- If necessary Gandangara L.A.L.C. to commence negotiation between developers and National Parks and Wildlife Services to determine future fate of sites and to make sure recommendations meet with the Aboriginal Community's agreement

2:0 THE STUDY AREA :

2:1 LOCATION :

Due to the little or no Aboriginal perspective being requested of previous developments in the study area, knowledge of existing past Aboriginal sites is limited.

The study area (Appendix 1 map) known as Badgery's Creek is located approximately 50 kms west of Sydney and east of Luddenham.

Land tenure indicates previous rural activities have altered the environmental content with the probability of Aboriginal Scarred Trees, Carved Trees and other valuable Australian Aboriginal Heritage being destroyed.

2:2 ABORIGINAL CONTENT :

During the survey 112 recordings of Aboriginal Heritage were located and documented in total by the study team.

These included - 57 Camp Sites
46 Isolated Artefact
8 Scarred Trees

It must be noted that **not all visible** artefacts could be located during the survey. These sites and the location of these sites are important to the Aboriginal people and their culture.

Construction of an airport in the study area will result in most if not all Aboriginal sites including the natural environment being destroyed.

3:0 SURVEY METHODOLOGY & STRATEGIES :

The survey was designed to cover all areas affected by the proposed development however only approximately 45% of the study area was surveyed. All areas where possible were surveyed on foot.

The study team was divided into four (4) groups each comprising of an Aboriginal representative. The four groups were allotted individual areas to survey over the three day period.

The Aboriginal representatives where possible due to heavy vegetation or excessive ground cover focused on locating all types of Aboriginal cultural material that may be visible in the study area.

4:0 THE NATURAL ENVIRONMENT :

The natural environment of the study area is important to the Aboriginal community because Aboriginal people see themselves as part of nature and nature as part of themselves.

The natural environment of the study although somewhat disturbed by European occupation, still has an affiliation with the Aboriginal people as it contains significant tangible (visible) and intangible (invisible) cultural significance that is a part of Australia's true history.

South Creek, Badgery's Creek and Thompsons Creek are a major part of the Aboriginal infrastructure which provided resources such as food and recreation for Aboriginal people whom occupied the area over thousands of years.

Today these water ways are a dumping ground for car parts, industrial and household rubbish, in some areas the water is oily black.

Natural plant species such as Tea Tree, Paperbark Trees, Geebung, Wattles and Ferns, of which are known to provide dietary resources for Aboriginal people have been identified within the study area.

5:0 RECOMMENDATIONS :

5:1 CULTURAL RECOMMENDATIONS :

As per NPWS Act (*1974*) ammended :

It is an offence to knowingly destroy, damage ,remove, disturb any Aboriginal artefact or relic unless first obtaining the written consent of the Director of the N.P.W.S.

The G.L.A.L.C. makes the following draft recommendations based on the development being approved and information currently held by the G.L.A.L.C.

- GLALC to undertake further investigation into the location, integrity, ambience and complexity of sites and artefacts located in the study area.

- GLALC to analyse Aboriginal Local and Regional significance of sites in the study area

- Further research in the form of Test excavation to be undertaken by qualified Archaeologists and GLALC representatives.

- Aboriginal monitors from the GLALC are to be employed at the Developers expense to monitor for Aboriginal artefacts, relics or ancestral remains being unearthed during development procedures.

- Monitors are to be engaged prior to the development commencing.

- In the event of the proposed development is to proceed then the GLALC may wish to take care and control of any or all of the Cultural material in the proposed development area.

- If the Development plan changes then further Aboriginal and Archaeological survey is to be undertaken.

5:2 ENVIRONMENTAL RECOMMENDATIONS :

The proposed development of the second airport at Badgery's Creek will have a detrimental impact on the integrity of the natural environment and would cause substantial damage and destruction to flora and fauna species within and around the proposed development area for many years to come with the potential loss of landscapes and natural habitats.

Watercourses in and around the proposed development area will be impacted upon by development procedures.

The shape of these tributaries and the aquatic plant life act as a natural filtration system.

5:3 SPECIFIC RECOMMENDATIONS :

In the event of the development proposal being approved, the G.L.A.L.C. is to be compensated for the loss and destruction of ;

all Aboriginal Sites and Cultural material.

the cultural ambience and mythological integrity of the area.

the natural environment of the area.

Aboriginal and Australian History of the area.

Due to the size and complexity of the development and the devastating impact on the cultural and natural environs of the Badgery's Creek and Holsworthy areas the G.L.A.L.C. is opposed to the development of the Second Sydney Airport within the Sydney Basin.

At a meeting at the G.L.A.L.C. on the 16\7\97 it was resolved (Motion No:4);

"That the G.L.A.L.C. strongly oppose the development of the 2nd Sydney Airport within the Sydney Basin including the Badgerys Creek and Holsworthy proposed sites areas".

Moved- G. Hockings

Seconded- T. Ellis

Motion carried

Holdsworthy Army Base by *Tharawal Local Aboriginal Land Council.*

Statement of Significance

Aboriginal people maintain a traditional and custodial link through their association with Land, the environment and its natural resources.

There is evidence throughout the area of the Holsworthy Army Base of that relationship between Aboriginal People and their Land.

This evidence is laid bare on the creek beds that contain hundreds of axe grinding grooves; and across the rock platforms with engraved motifs, animals, figurines and their tracks.

There are sites where Aboriginal people made tools at open campsites, in rock shelters, down low in the gullies and up high on the ridge tops. These sites expose an indigenous industry of artefacts from the coast and up to the mountains.

Images of stencilled hands, feet, fish, animals, birds, and boomerangs festoon rock shelters and large rock galleries.

The Artists walk with you. And expose their works at their contentment; and conceal them in their fright.

The land is pristine. A time capsule of the Sydney basin - protected by unexploded ordinance.

Cliff Foley
Secretary
Tharawal Local Aboriginal Land Council

Appendix K

Glossary of Terms

Appendix K
Glossary of Terms

Aborigine (noun) a person who is a member of the Aboriginal race and sees themselves as an Aboriginal and is accepted by the rest of the Aboriginal community as an Aboriginal (Aboriginal Land Rights Act 1983, section 4)

Aboriginal significance/values
the cultural value and/or significance of a place as identified by the Aboriginal custodial community

alluvium sediments deposited by the action of water, especially gravels, sands, silts and clays in valley floor contexts

anthropomorph refers to any ***motif*** which ***figurative***ly resembles the shape of a human body

anvil any object on which blows are struck such as during tool manufacture or food production

archaeological significance/values
the significance or value of a place measured according to its known or potential contribution to archaeological research, educational value and/or representativeness

artefact any object or feature which has resulted from a defined period, or type, of human action (in this case, Aboriginal occupation up to and including the period of ***contact***)

assemblage any specified grouping of artefacts, normally from a particular area and/or type of artefact, such as stone artefacts or rock art

backed blades thin blades or flakes, usually triangular in cross-section, mostly 1-5 cm long, characterised by abrupt or blunting retouch on part or all of the thickest margin. See microlith

background scatter
a concept used by archaeologists to refer to artefacts which cannot be usefully related to a place or focus of past activity (except for the net accumulation of single artefact losses). Background scatters are a temporally unrelated accumulation of artefacts across a large area and will vary in density according to the type and frequency of past occupation within that landscape.

backwall that part of the interior rock surface of a rock shelter bounded between the edge of the ***deposit*** (or the break of slope at the back of the floor), and the break of slope at the back of the ceiling. In some cases there is no identifiable boundary between the backwall and the ceiling.

bipolar core a core from which flakes have been struck by placing the base of the core on an anvil and striking from the top

blade core a core from which blade flakes have been struck

bondi point an asymmetric pointed backed blade (microlith) which as a class includes a wide variety of size, cross section and extent of blunting retouch.

BP' Before Present', an abbreviation used when referring to the age of archaeological sites and by convention, understood to mean before 1950

contact The term 'contact' is a general description which refers to the generally poorly defined or documented time period when traditional Aboriginal society made initial contact with Europeans and subsequently changed their social, economic and occupational patterns in response to European incursion

colluvium poorly sorted and frequently angular sediments transported as a result of gravity, and typically forming basal slope deposits

core (nucleus) a piece of rock with one or more negative flake scars but no positive flake scars

deposit refers to the accumulation of sediment and debris located on the horizontal surfaces within a rock shelter, usually the floor, and frequently extending outside of the ***overhang***

determinate refers to a graphic where the original extent of the graphic form or delineation is considered to be identifiable by the recorder

disturbed a deposit is considered to be disturbed when sub-surface material (such as artefacts) has been extensively moved from its original depositional position by activities which have occurred after burial of the material (such as animal burrowing, human digging, water erosion and surface treadage).

drawing a technique involving the application of pigment which has not been combined with a liquid

dripline used in a general sense to indicate the limit of the dry shelter provided from rain and surface runoff by the shelter overhang, or more specifically to the line of erosion on a shelter deposit created by the impact of water drips originating from the extent of the overhang. In some cases there is only a zone of drip impact rather than a 'line'

dry used to describe a drawing ***technique***, that is,. where a ***pigment*** has been applied or generated at the surface without the addition of a fluid.

engraving a generalised term used in Australia to refer to any graphic created in rock using a technique of reduction (subtraction), such as pounding, pecking and abrading

figurative An interpretive term used to describe any graphic which, based on the experience of the viewer, can be named according to a resemblance to a known thing or object. Imaginary creatures are still considered to be figurative if the mark refers to parts and details found in actual animals.

flake any stone material detached from a core. It exhibits a set of characteristics which indicate that it has been struck.

form form consists of all those graphic elements which constitute the shape, arrangement and configuration of a graphic. Form does not include variables such as technique, medium or colour/surface.

graffiti All ***marks*** or ***graphics*** considered to be undesirable according to some culturally defined criteria. In this report, graffiti is used to refer to all deliberate and apparently figurative marks which are interpreted by the recorder to have been executed by a person whose mark making culture is unrelated to the prehistoric Aboriginal tradition.

graphic (n) Any physical mark which the recorder considers to have been made as, or was perceived as art (that is, something which conveyed a culturally mediated meaning to the viewer) (Officer 1993). Previous archaeologists have variously use terms such as 'figure' or 'motif' for this category.

ground surface visibility
a measure of the bare ground visible to the archaeologist during a field survey. The predominant factor affecting surface visibility is the degree of vegetation and ground litter. However, secondary deposition of eroded material can also impact visibility.

hatchet head commonly made from waterworn pebbles which have been ground bifacially on one edge, sometimes over a flaked or pecked surface. Hatchet heads were either hafted or used in the hand. They often have anvil pits and exhibit percussive use on the butt and lateral margins resulting from use as a hammerstone and/or anvil.

impact refers to any adverse change or deterioration to a site or artefact

indeterminate any graphic where the original form cannot be confidently identified by the classifier.

infill refers to any graphic form within a motif outline or delineation.

in situ used to describe any material or object which remains in an ***undisturbed*** sedimentary context, such as artefacts in an archaeological ***deposit***, or ***pigment*** on a rock surface.

interpretation in the context of visitor or public interpretation refers to: the provision (usually as a sign in a site) of explanatory information designed for a general audience which interprets and identifies various archaeological features in a site.

isolated find single artefacts which occur without any associated evidence for prehistoric activity or occupation

living space refers to the ground area within a shelter, between the ***dripline*** and the ***backwall*** and which is unobstructed for a vertical distance of 1 m or more.

matrix the mineral composition and structure of the rock behind a rock surface; or the main sedimentary constituents of a deposit

microblade core a core from which microblade flakes have been struck

microflake small flake measuring less than 1 cm along its longest dimension.

microflora	refers to all forms of primarily microscopic organic plant growth such as algae and lichen.
microlith	small, delicate stone implements that come in various shapes, such as segment, crescentic, triangular and asymmetrical (bondi point). They have a delicately retouched back and a single cutting edge along one margin; the longest is about 5 cm. These implements date to within the last four thousand years and have a distribution throughout the southern half of Australia.
motif	A graphic in which the delineation of form was mediated through culture (after Forge 1991). Put simplistically, this means a graphic made using a freehand technique rather than a mechanical duplication of a real object such as a stencil or print of a hand.
motif type	a combination of design elements which can be categorised by a single name or label based on a figurative resemblance or descriptive criteria, such as 'macropod', or 'long thing'
non-figurative	an interpretive term used to describe any graphic which does not fall into a figurative category
open	when used to describe a site, this refers to a site which does not occur within a rock shelter context.
outline	refers to a linear boundary or delineation of a ***motif***
overhang	refers to the overhanging rock which creates a rock shelter
painting	a technique involving the application of pigment which has been combined with a liquid
panel	refers to the rock surface and adjacent area (usually defined and bounded by natural features) where ***art*** has been executed
pecking	a technique in which a surface is reduced by indirect percussion (after Maynard 1977). This technique is mostly identified by the relative depth of the impactive mark and the supposed spatial control in positioning that mark.
pigment	any material which has been applied to a surface in order to create ***art***.
pigment art	all rock ***art*** which has been executed solely or partly with ***pigment***s.
pleistocene	the geological epoch which includes the glacial and interglacial intervals of the Quaternary, and extending from approximately three million years ago to the start of the Holocene epoch around 10,000 years ago.
print	a technique involving a mechanically produced record of the surface of a real object by impressing the object onto a surface.
profile	when describing a motif, this refers to the predominant arrangement of limbs and/or other appendages to one side only of the motif's longitudinal axis.

quaternary the most recent geological period cnosisting of the last three million years and the Pleistocene and Holocene epochs.

relative sequence refers to a temporal sequence from older to younger where the period of time elapsed is not known, and can only be estimated based on the difference in weathering

rock fall all rock located or exposed on the floor of a rock shelter which is presumed to have become detached from either the ceiling or the ***backwall***.

scarp a relatively small, near vertical rock face

schema the formal arrangement or pattern of delineation within a motif. The way in which formal and schematic elements are combined and arranged within space to constitute a motif. (Officer 1993).

scraper a general group of stone artefacts, usually flakes but also cores, that one or more retouched edges are thought to have been used to cut wood and other materials.

shelter width or depth
in the context of a shelter's interior dimensions, depth or width refers to the maximum distance between the extent of the overhang and the farthest point along the back wall (or ceiling)

site a site is defined as any material evidence of past Aboriginal activity which remains within a context or place which can be reliably related to that activity

splayed a motif in which limbs and/or other appendages are arranged to either side of the motif's longitudinal axis.

solid in the context of describing a ***motif***, solid refers to a completely ***infill***ed ***motif***, that is, all of the enclosed space delineated by a ***motif*** is ***infill***ed

stencil this refers to a graphic which has been produced by creating an outline of a real object. Commonly this is done by spraying a wet pigment around the edge of an object, but s drawn or painted line may also be used.

stone artefact any portable stone object which is the result of Aboriginal occupation up to and including the period of ***contact***

style a way of doing things. Archaeologists, when dealing with rock art, conventionally define style as the sum total of its material traits, such as ***technique***, ***form***, ***motif type***, size and ***schema***. In this way, the term style is used to refer to a combination or range of ***graphic traits*** which can be used to characterise an ***assemblage***. This conventional approach is adopted for this report (after Maynard 1976).

subject in the context of rock art analysis, the subject is the meaning(s) of a motif as interpreted by a specified individual (such as the artist, a member of a cultural group, or an outside viewer).

superimposition refers to the placement of ***graphics*** over previously existing graphics. A superimposed ***motif*** is indicative of a relative sequence and may be virtually contemporary or significantly older than the overlying ***graphic***.

surface water wash
refers to the existence of water (usually either rain water run-off or ground water seepage) flowing across a rock surface due to gravity. The water frequently erodes ***pigment***s applied to the surface and/or can deposit ***sediment*** and dissolved minerals.

technique refers to the method used to create a ***graphic***. A technique either removes material (engraving) or applies it (***pigment***). ***Pigment*** is usually applied either using a ***wet*** or ***dry*** technique.

trait any variable which contributes to the ***style*** of a ***graphic***, such as its colour, ***technique***, ***schema, form***, or any constituent part of the ***graphic*** such as 'toes' or 'head'

use wear Surface wear on a stone tool that results from tool use activity. Wear can take the form of edge rounding, surface smoothing or polishing, areas of abrasion, scratching, and small breakage scars on edges.

utilised flake or blade
an artefact that shows evidence of prehistoric use in the form of use-wear or residues from worked materials.

water wash see ***surface water wash***

wet used to describe a painting ***technique***, that is,. where a ***pigment*** has been mixed with or applied with a liquid medium before or during its application to a surface.

Appendix L

Figures

Figure 1
Badgerys Creek Landform Divisions (Terrain)

alluvial flats/valley floor

moderate gradient undulating terrain

low gradient undulating terrain

scale 1:48262

Figure 2
Badgerys Creek Landform Divisions
(Watershed Ridgelines)

major watershed ridgeline zone

secondary watershed ridgeline zor

minor spurs and ridgelines

scale 1:48262

Figure 3
Badgerys Creek Landform Divisions
(Fluvial Corridors)

secondary fluvial corridor

minor fluvial corridor

scale 1:48262

Figure 4
Holsworthy Landform Divisions (Terrain and Watershed Ridgelines)

Figure 5
Holsworthy Landform Divisions (Fluvial Corridors)

major fluvial corridor

secondary fluvial corridor

minor fluvial corridor

scale 1:100,000

Figure 6 Linguistic Boundaries According to Ca

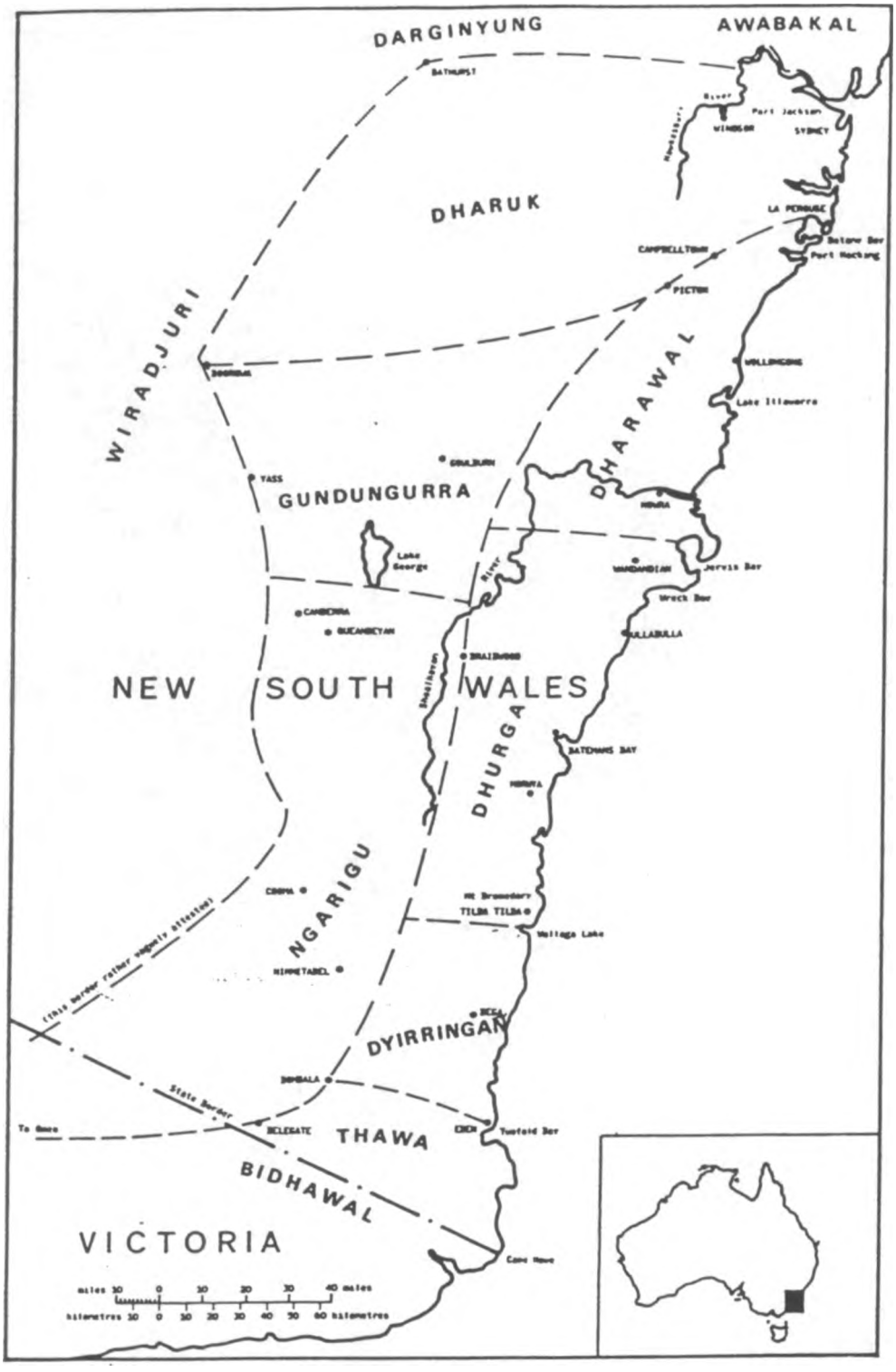


Figure 7 Linguistic Boundaries According to Eades (1976)

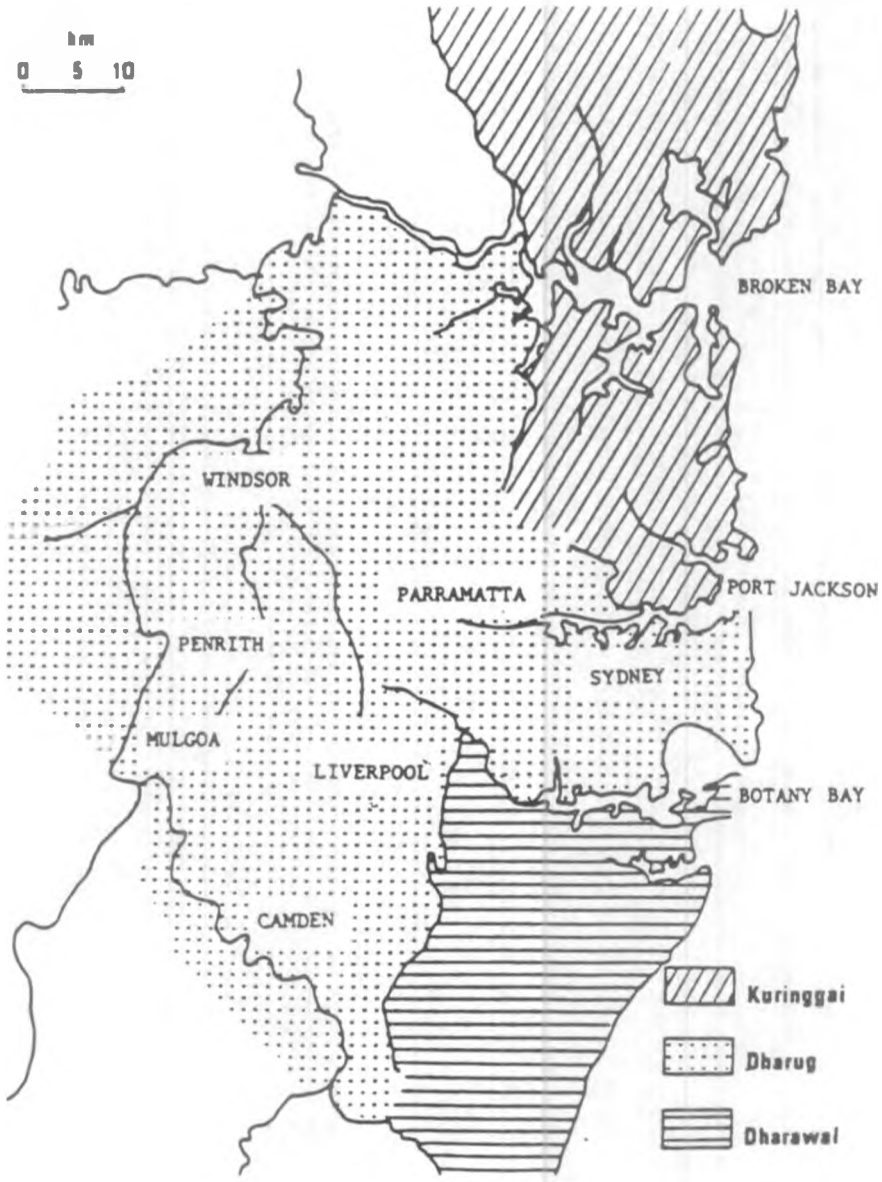


Figure 8 Linguistic Tribal Boundaries According to Kohen (1988)

Figure 9 Tribal Boundaries According to Ross (1988)

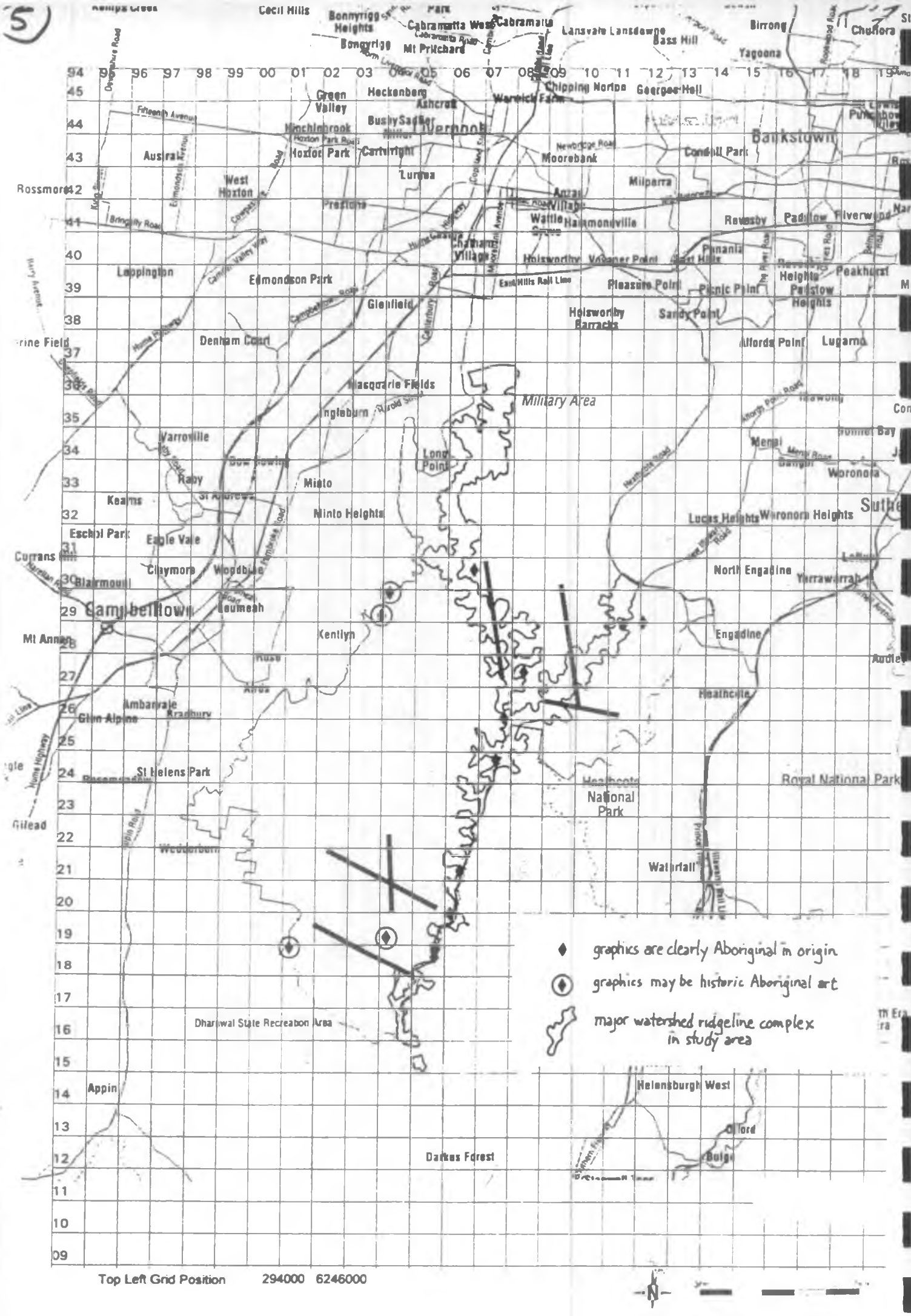


Figure 10 Holsworthy: Location of Engraving Sites

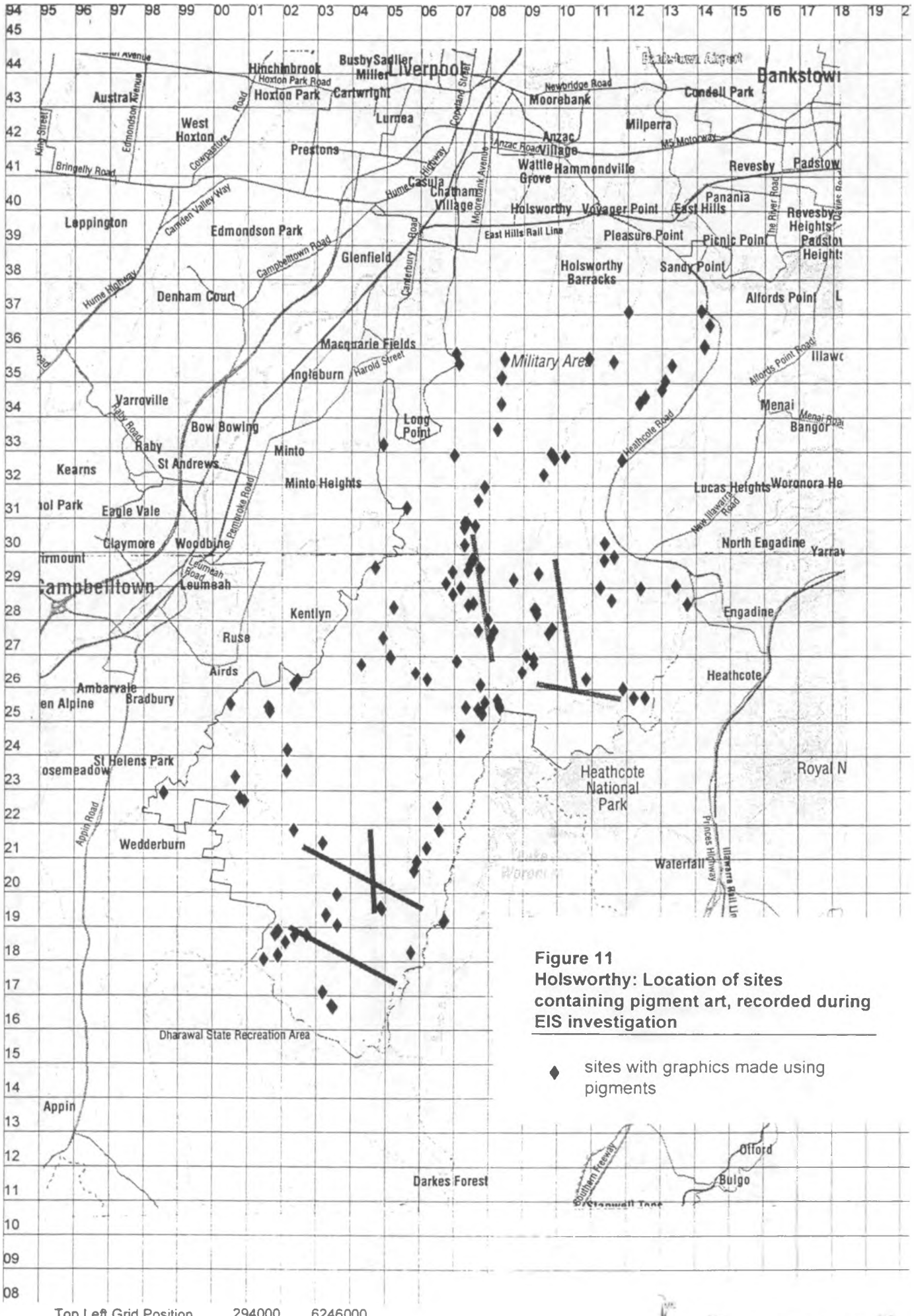


Figure 11
Holsworthy: Location of sites containing pigment art, recorded during EIS investigation

♦ sites with graphics made using pigments

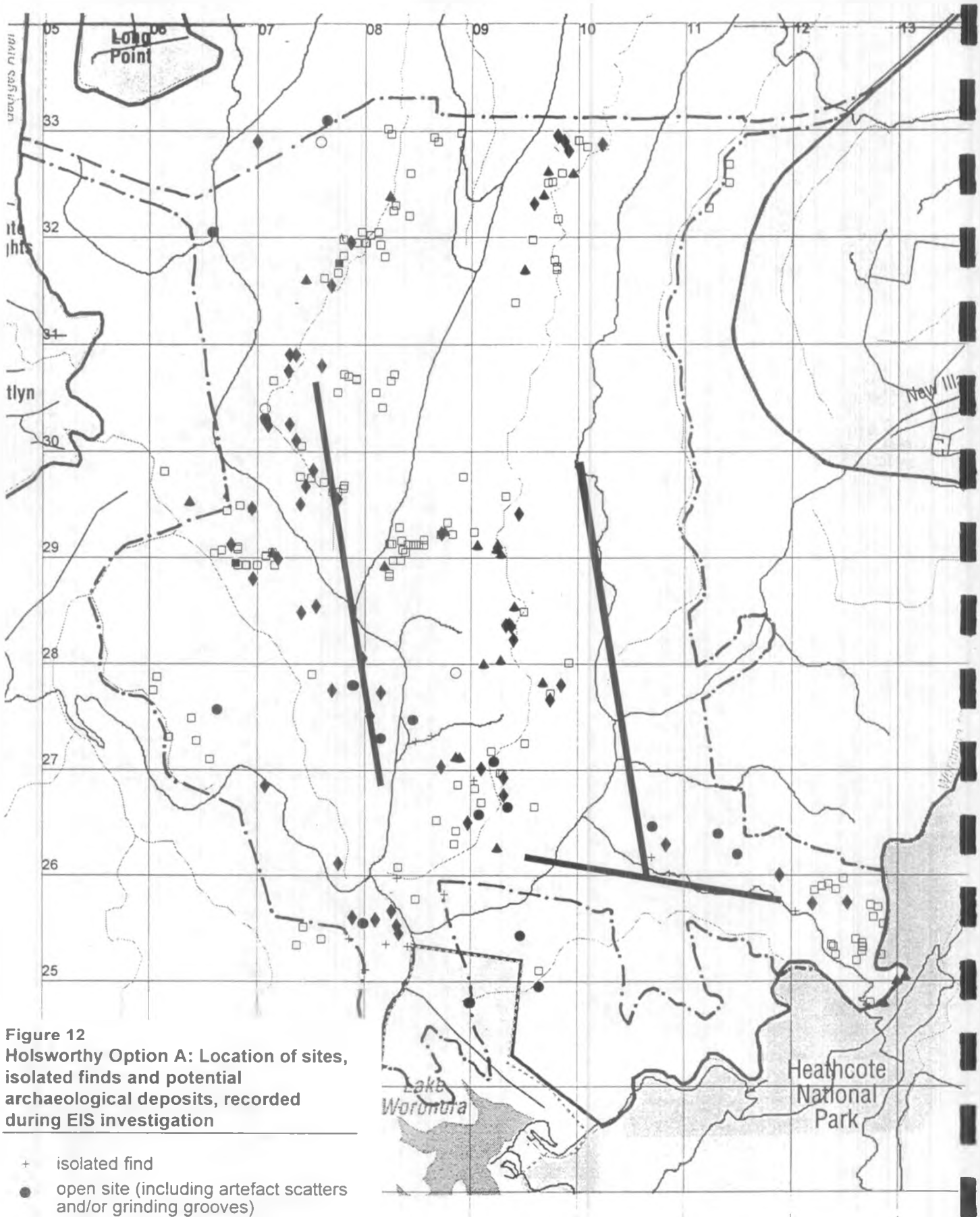


Figure 12
Holsworthy Option A: Location of sites, isolated finds and potential archaeological deposits, recorded during EIS investigation

- + isolated find
- ● open site (including artefact scatters and/or grinding grooves)
- ○ open potential archaeological deposit (only)
- ▲ scarred tree
- ■ rock shelter with artefacts and/or archaeological deposit and/or grinding grooves
- □ potential archaeological deposit (only) in rock shelter
- ♦ rock art site (open or shelter context)
- area of direct impact of airport proposal

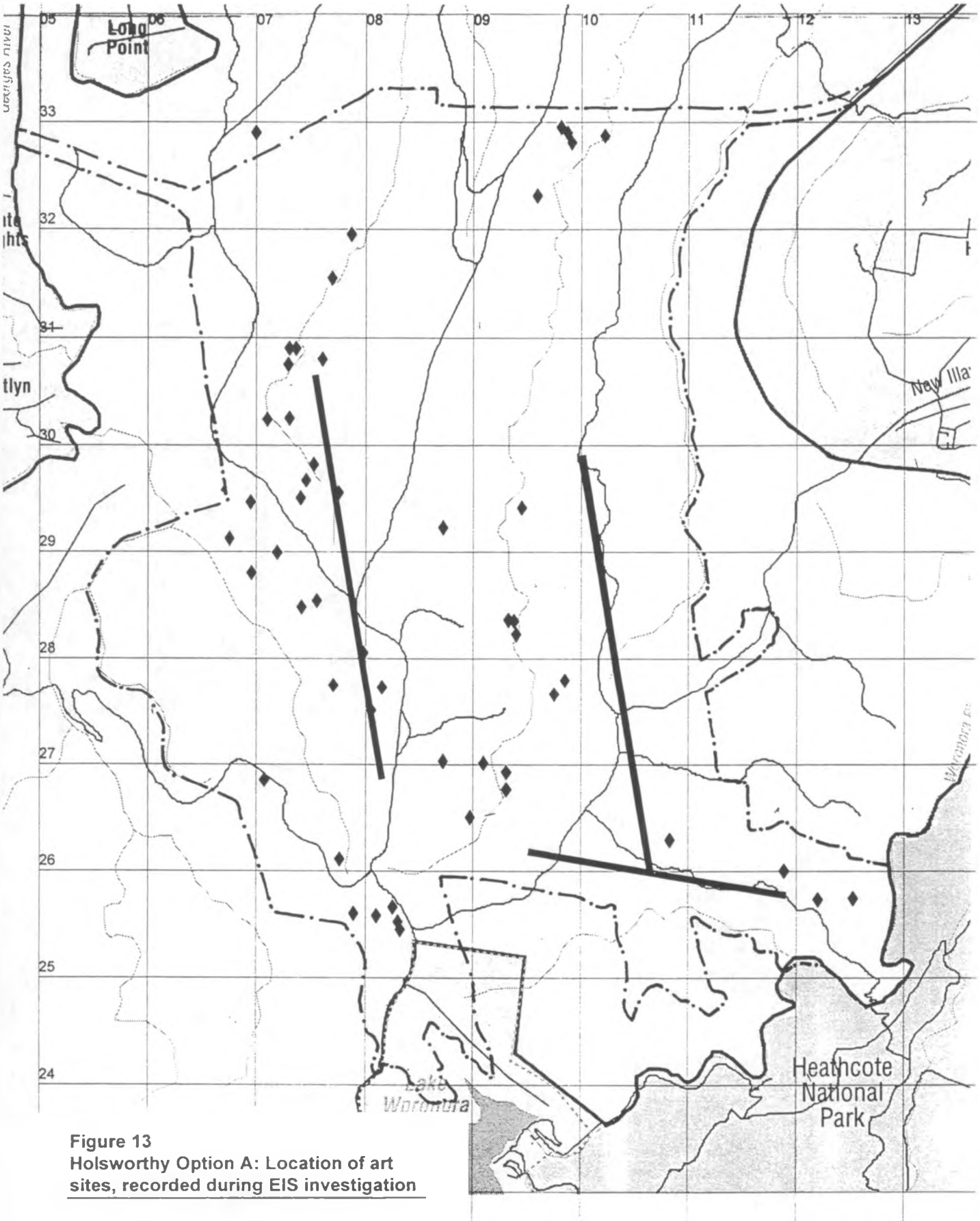


Figure 13
Holsworthy Option A: Location of art sites, recorded during EIS investigation

- ♦ rock art site (open or shelter context)
- area of direct impact of airport proposal

Top Left Grid Position 305000 6234000

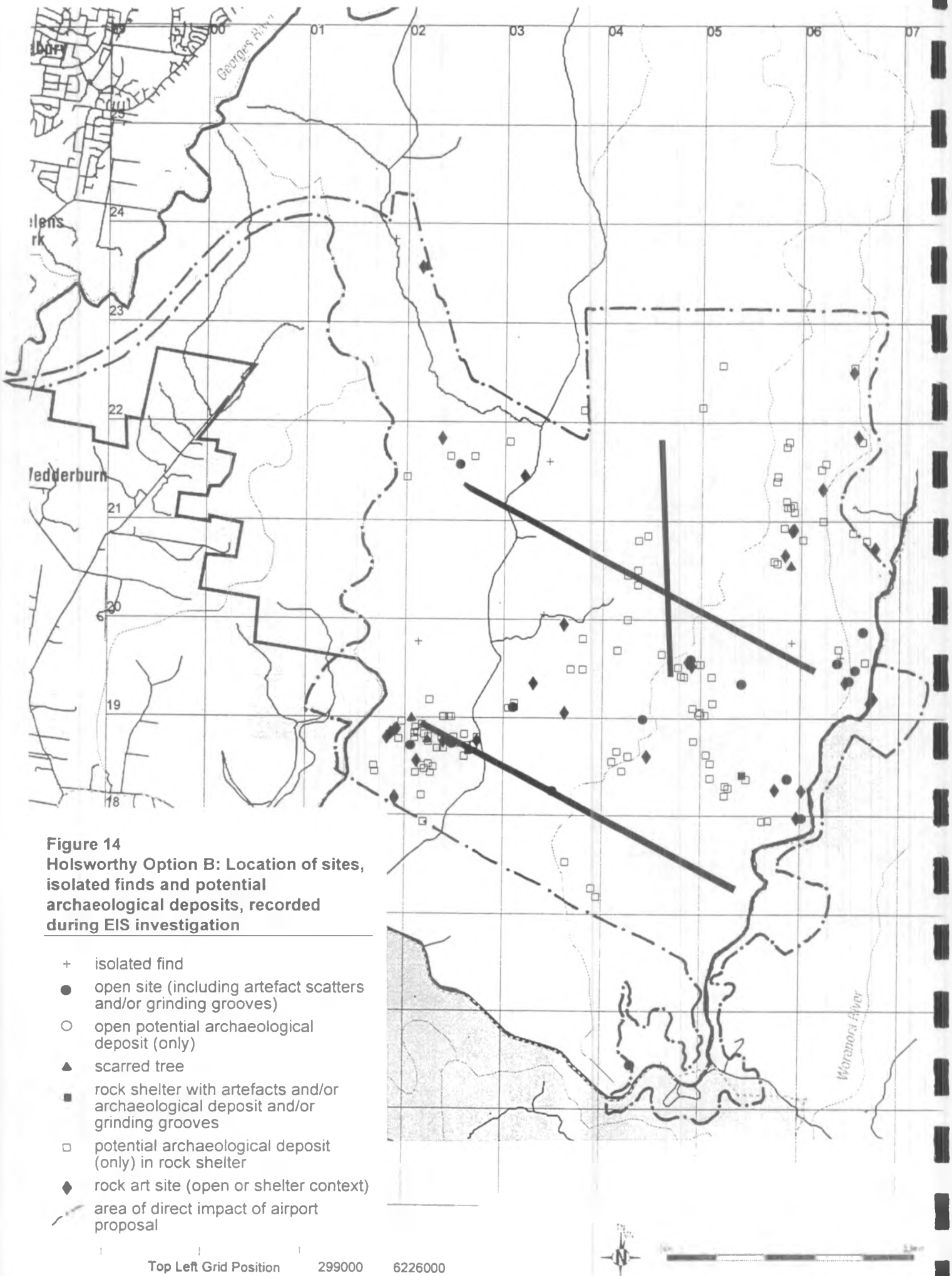


Figure 14
Holsworthy Option B: Location of sites, isolated finds and potential archaeological deposits, recorded during EIS investigation

- \+ isolated find
- ● open site (including artefact scatters and/or grinding grooves)
- ○ open potential archaeological deposit (only)
- ▲ scarred tree
- ■ rock shelter with artefacts and/or archaeological deposit and/or grinding grooves
- □ potential archaeological deposit (only) in rock shelter
- ◆ rock art site (open or shelter context)
- area of direct impact of airport proposal

Top Left Grid Position 299000 6226000

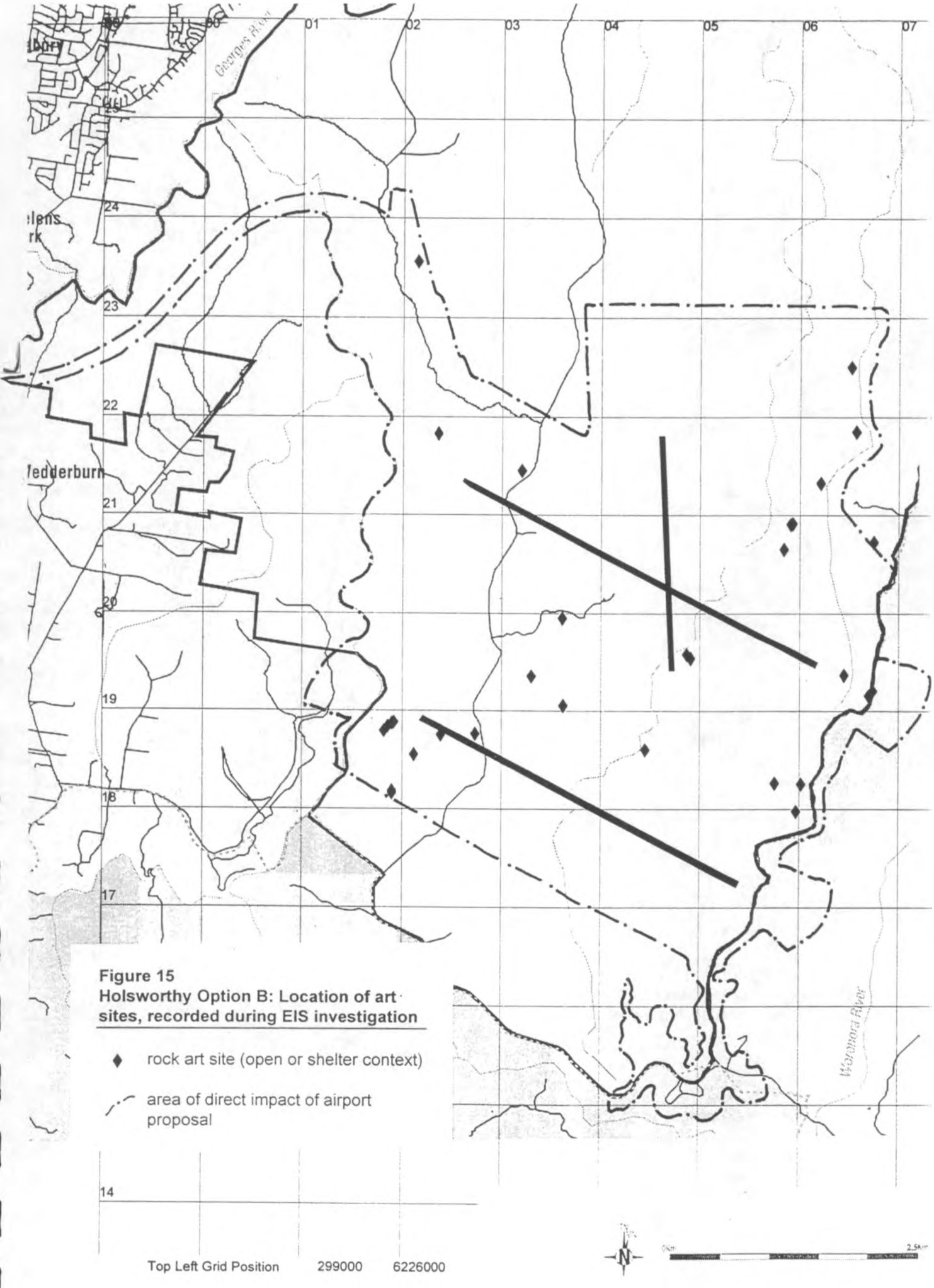


Figure 15
Holsworthy Option B: Location of art sites, recorded during EIS investigation

♦ rock art site (open or shelter context)

area of direct impact of airport proposal

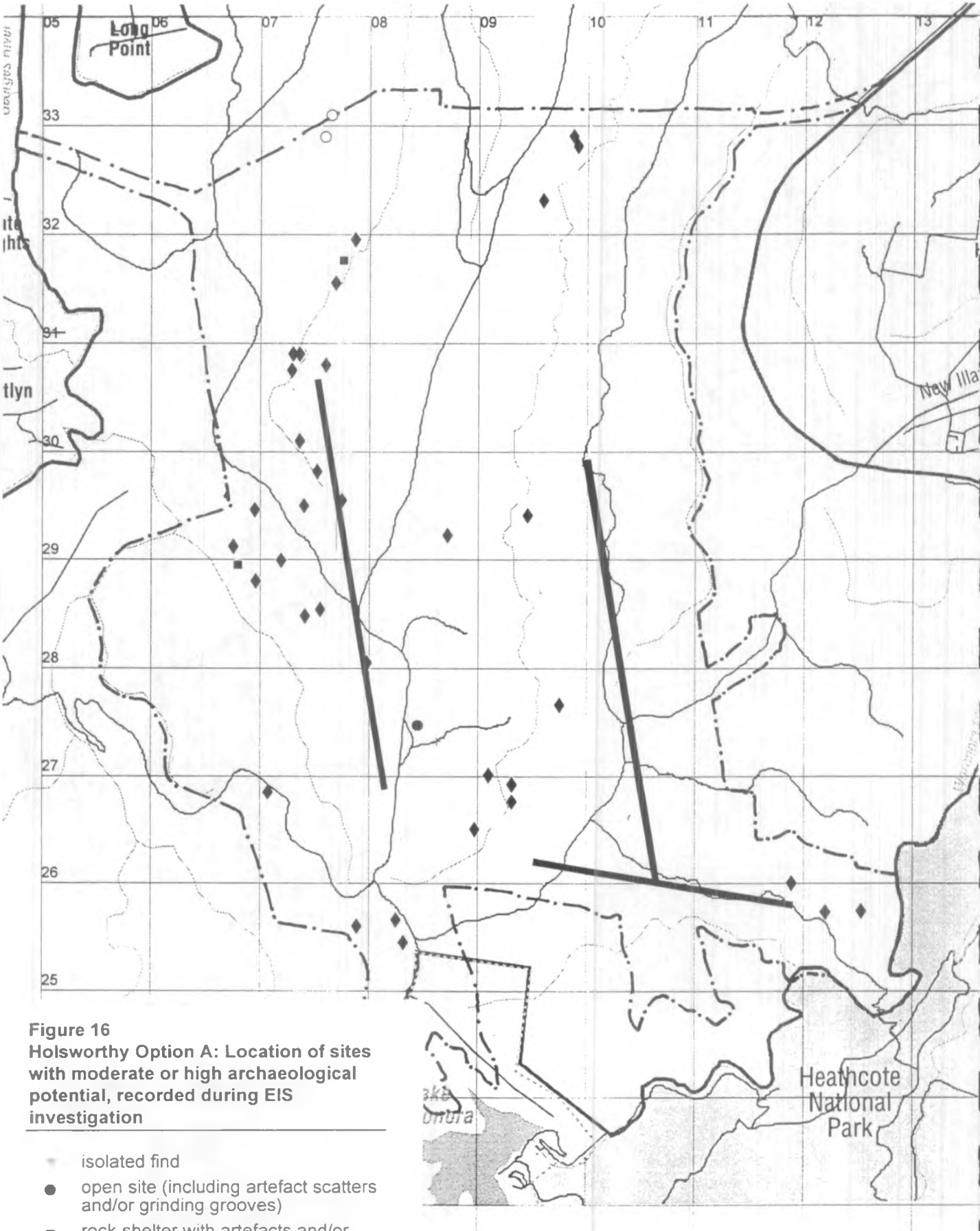


Figure 16
Holsworthy Option A: Location of sites with moderate or high archaeological potential, recorded during EIS investigation

- isolated find
- open site (including artefact scatters and/or grinding grooves)
- rock shelter with artefacts and/or archaeological deposit and/or grinding grooves
- rock art site (open or shelter context)
- area of direct impact of airport proposal

Top Left Grid Position 305000 6234000

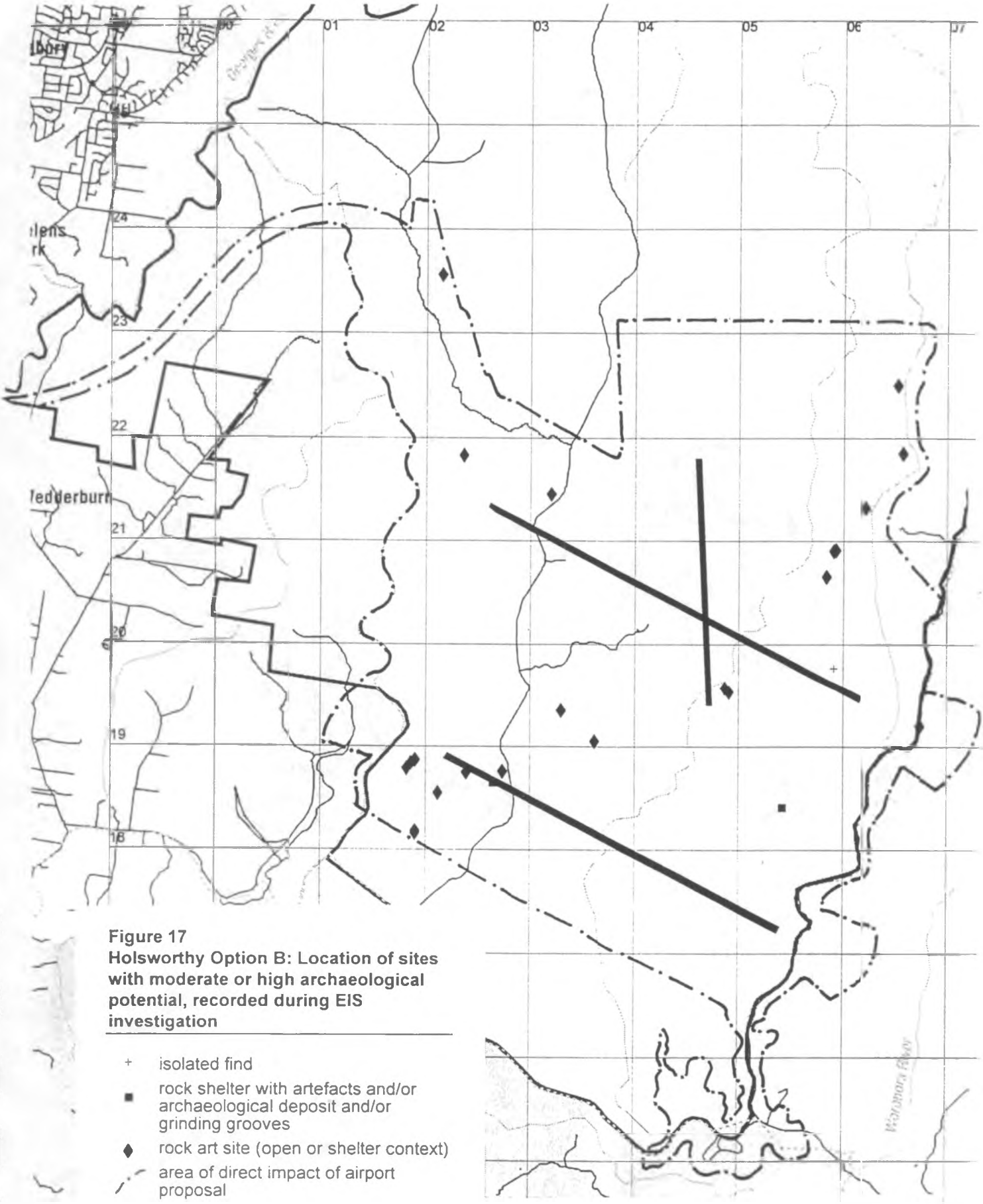


Figure 17
Holsworthy Option B: Location of sites with moderate or high archaeological potential, recorded during EIS investigation

- + isolated find
- ■ rock shelter with artefacts and/or archaeological deposit and/or grinding grooves
- ♦ rock art site (open or shelter context)
- area of direct impact of airport proposal

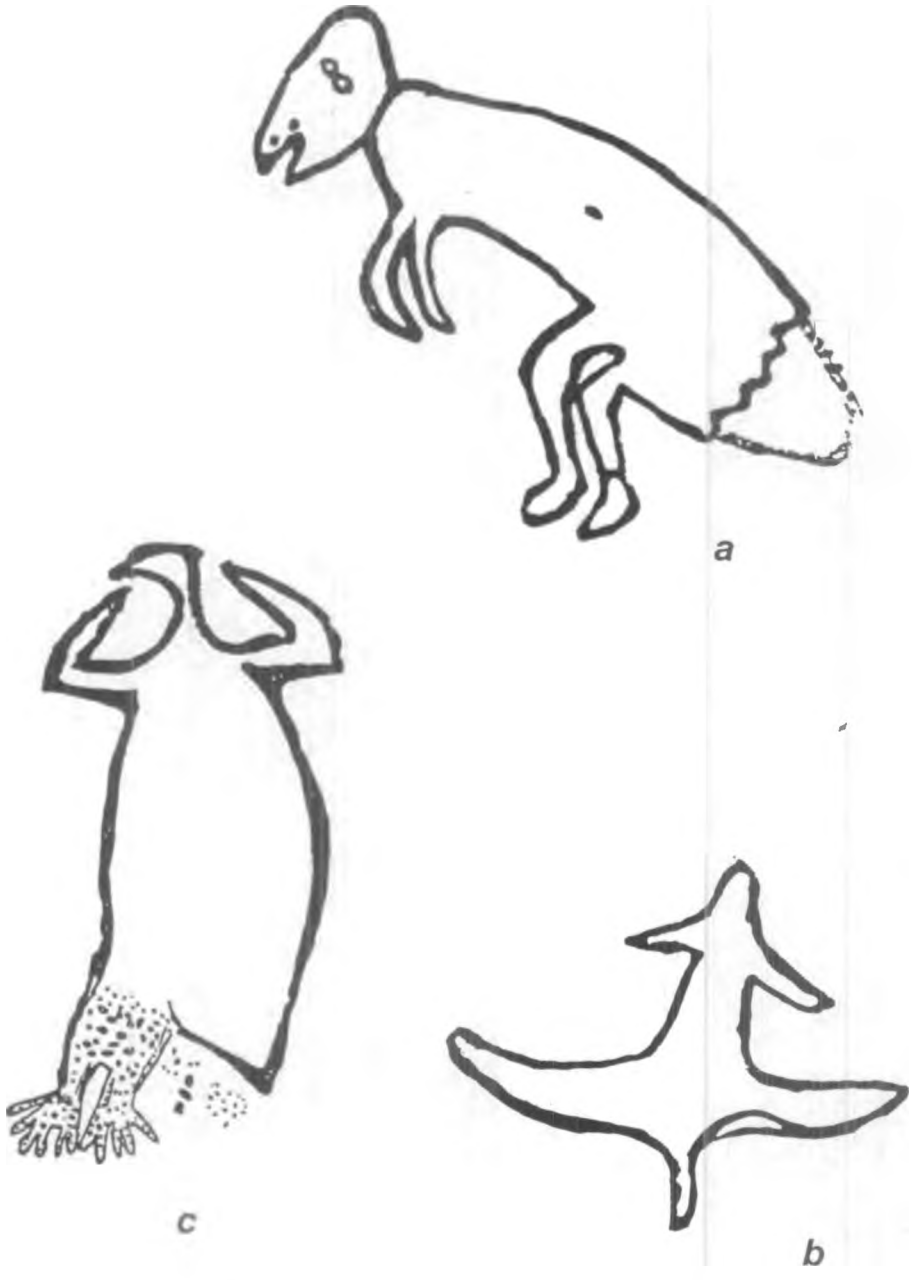


Figure 18
Rare or unique engraved motifs from open sites located in Holsworthy Option A area.
Motifs a & b are from Site H309, and c from site H109.
(after Sydney Prehistory Group recordings 1983).

Appendix M

Site Gazetteer

(Access Restricted)

Appendix N

Statement of Significance for the
Cubbitch Barta National Estate Area
(Access Restricted)

AUSTRALIAN HERITAGE COMMISSION

Cubbitch Barta National Estate Area

Statement of Significance

Cubbitch Barta National Estate Area is a large area with outstanding cultural and natural values. It is very significant as a cultural and natural landscape which demonstrates relationships between the environment and human occupation through time. Its significance is emphasised by its proximity to Sydney, the nation's largest metropolitan centre.

Cubbitch Barta National Estate Area is an integral component of the Woronora Ramp area, stretching south-west from Sydney, together with Royal National Park, Heathcote National Park, the Woronora catchment and O'Hares Creek Catchment. Major parts of the Woronora Ramp region are included in the Register of the National Estate. This region, together with the other tracts of undeveloped areas to the west and north of the metropolitan area, are essential in defining the character of the broader Sydney region.

In the network of gullies which criss-cross the area, many of the natural values remain undisturbed, and the indigenous heritage is impressively retained. Over 500 Aboriginal sites provide a glimpse of the relationship between people and the land prior to 1788. The sites, and the area's long-term and more recent connections with Aboriginal people, combine to form a landscape of great significance for its indigenous heritage. The landscape also provides important illustrations of European settlement, agriculture and Australia's military history.

It is unusual to find landscapes in this region so intact. This provides a rare opportunity to understand both the natural and cultural history of the region. It is remarkable that this landscape has survived on the margins of the nation's earliest and largest urban centre.

INDIGENOUS VALUES

The Cubbitch Barta National Estate Area is highly valued by members of the Tharawal Local Aboriginal Land Council and the Dharawal people for its symbolic, cultural, educational and social associations. (Criterion G.1) The Aboriginal cultural landscape of the area reflects the past lifestyle of Aboriginal people in this region, and its preservation enables Aboriginal people to maintain cultural links to the area. These connections with the past are particularly important, because Aboriginal people in this part of Australia were among the earliest impacted by European settlement of this continent, and their culture has since been disrupted by war, disease and urban development. Throughout the environments of the area, the Dharawal see evidence of the relationship between their people and the land. The Tharawal Local Aboriginal Land Council is also concerned about maintaining the area's natural environment.

The area contains a large and diverse collection of Aboriginal sites, which represent a complex Aboriginal cultural landscape. (Criterion A.3) Over 530 sites are known from the area, and a further 509 potential archaeological sites have been documented. It is highly likely that the area contains many hundreds more sites. Sites include rock

paintings and drawings, engravings, open scatters of artefacts, grinding grooves and scarred trees. The survival of a significant number of scarred trees within the area is important as this is a rare type of site within the Sydney Basin. (Criterion B.2) While rock art sites are well-represented in the Sydney Basin, other types of sites are less so. The preservation within the area of scarred trees, open artefact scatters and archaeological sites in particular, offer considerable potential for further developing a picture of day-to-day activities of Aboriginal people in the Sydney Basin prior to 1788. (Criterion C.2)

This large number of sites, and the stories they may tell, form a landscape in which Aboriginal life prior to 1788 is recorded without the large-scale impact of European settlement. There is also a high density of sites in the area. This is particularly important because sites are found in groups or clusters with their relationship to one another largely intact. By examining where they are located in the landscape and their relationship to other types of sites, a more complete picture of the lifestyle of Aboriginal people could be established. (Criterion C.2)

The Georges River, which bounds the national estate area on the west, and is close to the north, has been identified as an important north-south Aboriginal cultural boundary within the Sydney Basin. The cultural landscape of the national estate area is representative of the southern social unit of the Sydney Basin. (Criterion D.2) This unit has been characterised by the presence of a number of distinctive traits within the art and by complex analyses which show that the art sites of this region are significantly different from those north of the Georges River. The large number of sites, the relatively high site density, the condition of sites and the preservation of the landscape as a whole makes the area important in terms of the further definition of this southern unit.

The area also offers considerable research potential in terms of the analysis and interpretation of small-scale groups. (Criterion C.2) There is evidence to suggest that this area formed the cultural landscape of a single residence group whose territory extended over the Georges River and Williams/Mill Creek drainage basins. In this region, it is uncommon to have such a landscape preserved in this way, and particularly important, as knowledge of local groups from enthnohistory is often incomplete and problematic.

The rich collection of more than 300 rock art sites within the area is regionally significant as a group in the Sydney Basin and representative of rock art south of the Georges River. (Criterion D.2) The rock art sites are diverse in terms of technique (paintings, drawings and engravings) and motifs depicted. (Criterion A.3) The art in the area contains a number of motifs which are rare within the Sydney region, such as the engraving of a pregnant woman. The site where this occurs is considered important, as female motifs and gender-specific evidence of this kind are relatively rare. (Criterion B.2) The long history of recording the rock art sites by voluntary groups and individuals indicates that they are aesthetically important to groups within the broader community. (Criteria E.1) The aesthetic value of these sites is enhanced by their excellent condition and lack of graffiti.

The Cubbitch Barta National Estate Area is important as an illustration of a landscape in which changes in the relationship between Aboriginal people and early settlers took place (Criterion A.4). This is a phase in the cultural history of Australia for which traditional documentation is often poor. The area is associated with Governor Macquarie's war against the Aboriginal people of the Liverpool, Campbelltown and Appin areas from April to November 1816. Despite efforts to move indigenous people away from this country, documentation indicates Aboriginal people were still visiting sites within the area in the 1830s. Within the area, it is the evidence of the strong

Aboriginal presence combined with the nineteenth century history and landuse without much twentieth century development, which makes this area unusual for the way it can illustrate this period of history. Potential exists for further research to shed light on this era through research relating to exploration, settlements within the area and information about the adjacent Aboriginal reserve. (Criterion C.2)

NATURAL VALUES

This area contains a diversity of natural landscapes and vegetation types in a relatively unmodified condition, in an area otherwise greatly altered by urban development. Vegetation communities include plateau forest (covering forest and woodland on both tertiary alluvium soils and on shale), gully forest, woodland/heath complex, riparian forest, sedgeland, heath/swamp complex and melaleuca thickets. The laterite ridgetops are almost entirely intact and are significant reference sites which demonstrate the formation of laterite caps and the occupying vegetation communities. (Criterion A.2)

Diversity of plant species is high, with more than 400 species recorded in the area. At least seven different plant communities have been distinguished in the area, indicating high community diversity. (Criterion A.3)

At least eight plant species considered rare nationally occur here: DARWINIA DIMINUTA, D. GRANDIFLORA, EUCALYPTUS LUEHMANNIANA, GREVILLEA LONGIFOLIA, HIBBERTIA NITIDA, LOMANDRA FLUVIATILIS, MELALEUCA DEANEI and TETRATHECA NEGLECTA. A rare and undescribed species of greenhood orchid PTEROSTYLIS sp. E has also been recorded here. The area contains a substantial remnant of Cumberland Plain woodlands, a vegetation type growing mainly on Wianamatta shale. Only 6% of the original area of Cumberland Plain woodlands remains. This community has been listed as an endangered ecological community under the NSW Threatened Species Conservation Act 1995. LEUCOPOGON EXOLASIUS, found here, is listed as vulnerable under the Commonwealth Endangered Species Protection Act 1992. Regionally significant plants include E. SQUAMOSA, GREVILLEA DIFFUSA and ZORNIA DYCTIOCARPA. (Criterion B.1)

The broad-headed snake HOPLOCEPHALUS BUNGAROIDES, found in this area, is listed under the Commonwealth Endangered Species Protection Act 1992. The koala PHASCOLARCTOS CINEREUS population found locally is considered one of the few remaining viable populations in southern NSW. The area also contains a significant population of the spotted-tailed quoll DASYURUS MACULATUS. Both the koala and quoll are listed as vulnerable under the NSW Threatened Species Conservation Act, together with the giant burrowing frog HELEIOPORUS AUSTRALIACUS, red-crowned toadlet PSEUDOPHRYNE AUSTRALIS, powerful owl NINOX STRENUA, and greater broad-nosed bat SCOTEANAX RUEPPELLII, all of which are recorded in the area. The New Holland mouse PSEUDOMYS NOVAEHOLLANDIAE, considered to be regionally rare, is also found here together with a number of other fauna species of regional or state conservation significance. (Criterion B.1)

The area has areas of significant aesthetic values, particularly the forested creek gorges. (Criterion E.1)

HISTORIC VALUES

The settlement sites and transport routes in the area are associated with the history of nineteenth century European settlement and the development of agriculture in the Liverpool region, including the wine industry and subsistence farming in a bushland

setting. The Grodno settlement site is associated with the activities of migrants in the Liverpool region. The Cubbitch Barta National Estate Area also provides evidence of transport routes for settlers in the Liverpool, Holsworthy and Campbelltown areas. These demonstrate the transport linkages that connected the nineteenth century settlements, industry and farms to more established regions of Sydney. Holsworthy is also significant for its military associations. It was a training site for Australian troops and horses engaged in World War I battles, including Gallipoli. The Holsworthy Military Training Area is also significant for the training activities of the Australian Army after the Second World War. (Criterion A.4)

The Old Army Internment Camp Group was used to inter Germans and other Europeans, from 1914 to 1919. The internment of migrants in Australia followed Britain's foreign nationals policy during World War I and this site reflects Australia's strong defence links with Britain. It also demonstrates Australia's fear of European immigrants during World War I, and reflects concerns that Australia's war effort and national security were threatened by spies and invasion. The Old Army Internment Camp Group also indicates the impact of World War I on Australia's home front when men were interned and their families left to fend for themselves. (Criterion A.4)

The Old Army Internment Camp Group is associated with the history of Federation. The acquisition of its remaining buildings in 1913 was part of the Commonwealth Government's major program of defence construction for Australia. (Criterion A.4)

The Old Army Internment Camp Group survives as evidence of the largest internment camp in Australia during World War I. The guard buildings and structures are rare in demonstrating the guards' section of a World War I internment camp in Australia, and are also significant because they were constructed by German and other European internees. (Criterion B.2.)

This Group has important associations for those who trained there during World War II and who more recently undertook National Service Training or Permanent Army service there during its use as a military camp. It has similar associations for members of the World War I Light Horse Regiments and their families and descendants. It has strong associations for former internees. It also has important associations for Australians as a reminder of a period of conflict and troubled national identity, involving a deep suspicion of non-British immigrants at that time. (Criterion G.1)