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Abbreviations

AHMS = Archaeological and Heritage Management Solutions
JPG = Johnson Property Group
DLALC = Deerubbin Local Aboriginal Land Council
DTAC = Darug Tribal Aboriginal Corporation
DCAC – Darug Custodian Aboriginal Corporation
HO = Heritage Office (New South Wales)
DEC = Department of Environment and Conservation (New South Wales)
AHIA = Aboriginal Heritage Impact Assessment
AHIMS = Aboriginal Heritage Information System (DEC)

EXECUTIVE SUMMARY

Archaeological and Heritage Management Solutions (AHMS) Pty Ltd was engaged by Johnson Property Group to conduct Aboriginal archaeological test excavation and surface collection on rural land situated at Hall Street, Pitt Town, NSW. The investigation was recommended by AHMS in an Aboriginal Heritage Impact Assessment (AHIA) of the site prepared in March 2005. The following report presents the results of the investigation in accordance with Department of Environment and Conservation (DEC) Preliminary Research Permit #2208 (PRP).

The study area comprised eight rural allotments (Lots 11 – 18 DP1021340) covering 61.4 hectares of land bounded by Punt Road to the west, the Hawkesbury River to the north and Hall Street to the south and east. Pitt Town is situated approximately 8km northeast of Windsor and 60km northwest of Sydney CBD. Although development of the site is only at the concept stage, JPG propose to re-zone land above the 1:100 year flood level from rural to residential and subdivide it into large residential allotments and develop land below the flood level for public recreational purposes.

The primary aim of the investigation was to sample landforms present within the study area to determine whether Aboriginal sites and/or objects were likely to be present in subsurface deposits and gain an understanding of their nature, integrity and potential significance. We also aimed to determine the effects of ploughing on archaeological deposits above the 1:100 year flood level. Using the results of testing the archaeological (scientific), public and Aboriginal significance of the Aboriginal sites and deposits were assessed and recommendations for future management of Aboriginal heritage at the site were made.

The investigation was carried out over a 10 day period (11 July to 22 July 2005). Site work was conducted by a team of three archaeologists, in partnership with representatives from Deerubbin LALC (DLALC), Darug Custodian Aboriginal Corporation (DCAC) and Darug Tribal Aboriginal Corporation (DTAC). Transects were placed across various landforms, sampling the river bank, terrace slopes, floodplain, flood channel, the alluvial terrace capped with a sand levee and high ground on the northern edge of Lot 18. Twelve (12) 2 x 2 metre test trenches, situated at 60m intervals along transects, were excavated by a 7 tonne excavator equipped with a 1.2m wide batter bucket. Soil was removed in 10cm spits and dry-sieved though a large 5mm screen to recover archaeological materials. A sample was also sieved through a 3mm screen. The total depth of excavation varied from 40cm to 160cm below the surface, depending on the depth of culturally-sterile deposits. In compliance with Occupational Health and Safety (O, H & S) requirements, trenches excavated below 1m were stepped to ensure deposit stability and crew safety.

Surface collection was limited to Site PT3 (within Lot 12 DP1021340), situated on recently developed land likely to be disturbed during future landscaping. Historical archaeological test excavation in Lot 14 was also monitored by representatives of DLALC, DTAC and DCAC to recover any Aboriginal objects exposed during disturbance of the plough-zone.

Soil profiles and sand deposits recovered during the investigation were analysed by Dr. Peter Mitchell of Groundtruth Consulting. Emeritus Professor Richard Wright conducted a descriptive and functional recording of recovered Aboriginal artefacts

The results of the investigation indicate that: (1) soil disturbance from agricultural land use practices was generally restricted to the upper levels of the soil profile; (ie. the top 20 to 30cm) (2) bioturbation varies in soils across the study area; (3) artefact density varies across landforms; (4) the elevated alluvial terrace and terrace slopes contain a deep, stratified stone assemblage with signs of spatial patterning and; (5) alluvial, rather than aeolian processes, were responsible for site formation and preservation on the sand terrace. Flooding of the Hawkesbury River was found to have had opposing effects on the archaeological deposits at Hall Street, depending on their distance from the river and elevation.

Aboriginal sites and deposits identified at Hall Street, Pitt are highly significant to the Aboriginal community for their cultural heritage values. Consultation with DLALC, DTAC and DCAC indicated that conservation at the site is a priority. Aboriginal archaeological deposits identified at the site also hold considerable public and scientific significance for their integrity, rarity and representative value. Intact portions of the alluvial terrace are of regional significance for their horizontal and vertical integrity, potential antiquity and potential to inform research questions about pre-Bondaian occupation in the greater Sydney region.

The following management strategies were therefore recommended: (1) consultation with DLALC, DTAC and DCAC continue throughout the re-zoning and development application process; (2) a significant portion of the alluvial terrace in Lots 11 and 12 be excluded from the development and included within a Conservation Area; (3) the Conservation Area be the subject of a Voluntary Conservation Agreement (VCA) between the current and/or the future land owners, DLALC, DTAC, DCAC and the National Parks and Wildlife Service (NPWS); (4) the Conservation Area be nominated for listing on the NSW State Heritage Register for its Aboriginal, historical, archaeological and heritage landscape values; (5) a Conservation Management Strategy (CMS) be prepared justifying conservation of the area and outlined future conservation policies regarding management and ownership and be endorsed by DLALC, DTAC and DCAC; (6) Johnson Property Group apply for a Section 90 Heritage Impact Permit to develop land outside the Conservation Area. The permit should include detailed, open-site excavation of a significant sample of the alluvial terrace, surface collection and further consultation and possible savage around the newly constructed house within Lot 12; and (7) a Public Interpretation Plan should be prepared for the site to communicate its heritage significance.

1.0 INTRODUCTION

1.1 PREAMBLE

Johnson Property Group Pty Ltd (JPG) engaged *Archaeological and Heritage Management Solutions Pty Ltd* (AHMS) in April 2005 to conduct Aboriginal archaeological test excavation and surface collection at Lots 11 – 18 DP1021340 Hall Street, Pitt Town (hereafter referred to as 'the study area'). The archaeological investigation was recommended by AHMS in an Aboriginal Heritage Impact Assessment (AHIA) prepared for JPG in March 2005[1].

This report presents the results of archaeological investigations undertaken in July 2005 in accordance with Department of Environment and Conservation (DEC) Preliminary Research Permit #2208 (PRP). The investigations included test excavation of potential archaeological deposits, collection of surface artefact scatters and monitoring of historical archaeological testing in September 2005 under a variation to the PRP. It includes an assessment of the Aboriginal heritage significance of the study area and recommends conservation and mitigation measures to appropriately manage Aboriginal heritage during future planning and development. The report also documents consultation and partnership with the local Aboriginal community during all stages of the investigation.

1.2 RATIONALE

The preceding AHIA included an archaeological survey of the study area, background research, predictive modelling, an assessment of Aboriginal heritage significance and an assessment of the impact of proposed development on Aboriginal heritage. During the field component of the AHIA, eleven open artefact scatter sites and seven isolated artefacts were identified within the study area. The area's disturbance history was mapped using historic aerial photographs and field observations. In general terms, because of the study area's elevation and proximity to the Hawkesbury River and the distribution of known Aboriginal sites in the region, soil deposits not disturbed by historic farming activity were predictive to have moderate to high archaeological potential to contain Aboriginal sites and/or isolated artefacts. It was predicted that ploughing and cultivation activities had disturbed deposits in the upper portion of the soil profile across most of the study area.

Given the assessed potential for intact archaeological deposits below the plough-zone, it was deemed necessary to test various landforms to provide accurate advice about the nature of the local archaeological resource during early planning stages. This information is critical in developing appropriate procedures for management of Aboriginal heritage during development and will be required by DEC when considering an application for Section 90 Consent prior to commencement of site development works. It was also recommended that artefacts at Site PT3 be collected. The artefacts were found on recently developed land likely to be further disturbed by landscaping. Both recommendations were drafted in accordance with DEC guidelines and the legislative requirements of *Section 87* and *Section 90* of the *National Parks and Wildlife Act 1974*.

[1] Leslie & Douglas, 2005

An application for a Section 87 Preliminary Research Permit (PRP) was then submitted to the DEC. Following discussions with Ms. Margrit Koettig (DEC Archaeologist) the Archaeological Research Design for testing was amended. The *Deerubbin Local Aboriginal Land Council* (DLALC), the *Darug Tribal Aboriginal Corporation* (DTAC) and the *Darug Custodian Aboriginal Corporation* (DCAC) provided letters of support. DEC approved the permit on 27 June 200 (Permit # 2208).

Test excavation indicated that Aboriginal objects were present across all landforms above the 100 year flood level and that historical archaeological testing proposed in Lot 14 would potentially disturb such objects. An amendment to the existing S.87 PRP permit was requested by email on 8 September 2005. DEC granted a 2 month extension to the original permit timeframe and permission to recover Aboriginal objects at Historical Area 3 within Lot 14 on 13 September 2005. This work was undertaken by representatives of DLALC, DTAC and DCAC with AHMS historical archaeologists on 20 September 2005 under S.140 Permit No. 2005/140/040 issued by the NSW Heritage Office.

1.3 SITE LOCATION

The study area comprises eight rural allotments (Lots 11 – 18 DP1021340) in Pitt Town, NSW. These allotments cover 61.4 hectares of land bounded by Punt Road to the west, the Hawkesbury River to the north and Hall Street to the south and east. Pitt Town is situated approximately 8km northeast of Windsor and 60km northwest of Sydney CBD. The general location of the study area is shown in Figure 1.1.

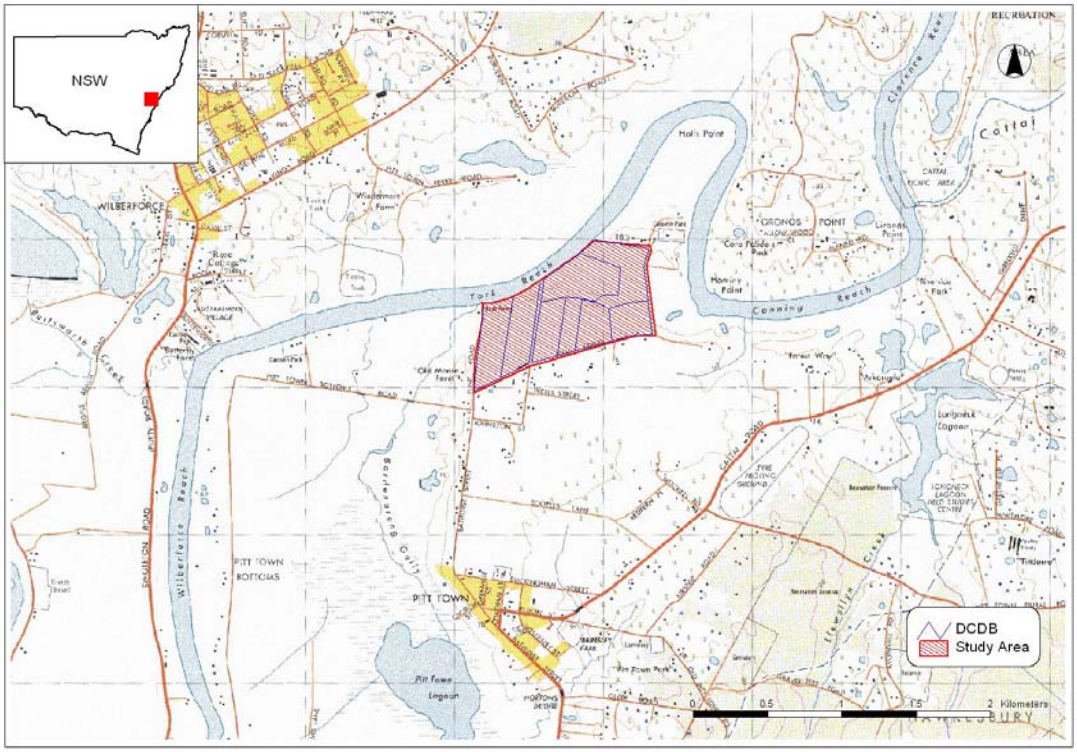

Figure 1.1: Location Plan

During test excavation and surface collection the majority of the subject land consisted of abandoned cultivated fields and grazing paddocks. Some original trees were present bordering Hawkesbury River. An older house is present on Lot 17 fronting Hall Street. A large house has also been recently built on elevated land overlooking the River within Lot 12. Large farm sheds are present on the corner of Hall and Hawkesbury Roads.

1.4 PROPOSED DEVELOPMENT

The form of development across the study area has not been defined beyond a concept plan. However, in general terms, JPG propose to:

1. re-zone land above the 1:100 year flood level from rural to residential and subdivide it into large residential allotments; and

2. develop land below the 1:100 year flood level for public recreational purposes. This development is likely to include landscaping and construction for playing fields, walking trails and a boat launching facility.

Subdivision and future development of allotments above the 1:100 year flood level may involve: clearing of selected vegetation; possible removal of topsoil to obtain required levels; establishment of building footings; installation of services below ground; and possible re-introduction of fill to raise ground levels. Results of archaeological testing during this early stage will inform heritage conservation and impact mitigation required during later planning stages and guide future planning decisions before and after subdivision and finalisation of urban design plans. It is envisaged that a development application (DA) will be lodged following the identification of such constraints.

1.5 SCOPE AND OBJECTIVES

Essentially, the investigation was designed to test potential archaeological deposits (PAD) across landforms within the study area and collect Aboriginal objects currently threatened by damage from vehicles and construction activity within Lot 12. An addition to the original scope was to salvage Aboriginal objects disturbed by historical archaeological testing of Area 3 within Lot 14.

The testing program did not attempt to define the spatial extent of concentrations of Aboriginal objects and/or buried sites within subsoils across the study area. Large-scale open area excavation would be required to effectively achieve this objective and was not considered appropriate at this early planning stage, given that development impact has not been defined.

The principal objectives of the investigation were to:

- Sample landforms within the study area to determine whether Aboriginal sites and/or objects were likely to be present in subsurface deposits and gain an understanding of their nature, integrity and potential significance;

- Determine the effects of ploughing on archaeological deposits above the 1:100 year flood level and the effects of flooding on deposits below the 1:100 year flood level;

- Using the results of testing, assess the archaeological (scientific), public and Aboriginal significance of the Aboriginal sites and deposits containing Aboriginal objects; and

- Determine appropriate recommendations for future management of the study area's Aboriginal heritage values in consultation with the local Aboriginal community. Such recommendations would ensure that future development complies with State and Federal legislative requirements.

1.6 STATUTORY CONTROLS

Future management of the study area's Aboriginal heritage values is determined by a number of legal requirements. These are summarised below.

1.6.1 Statutory Protection

The *National Parks & Wildlife Act (1974)* and the *Environmental Planning and Assessment Act (1979)* provide the statutory tools for Aboriginal cultural heritage management in New South Wales. The *Aboriginal and Torres Strait Islander Heritage Protection Act (1984)* also provides protection for Aboriginal heritage at a federal level.

The implications of these statutes for development at Hall Street, Pitt Town are outlined below.

1.6.2 National Parks & Wildlife Act 1974 (Amended 2001)

The provisions of the *NP & W Act 1974* provide blanket protection for Aboriginal objects (material evidence of indigenous occupation) and Aboriginal places (areas of cultural significance to the Aboriginal community). The following sections are particularly pertinent:

- Section 84 makes provision for protection of 'Aboriginal Places' or locations of special significance to Aboriginal culture.

- Section 86 and 87 state that it is an offence to collect or disturb objects or excavate, or in any way disturb land for the purpose of discovering objects without a permit authorised by the Director-General DEC

- Section 90 states that it is an offence to destroy, deface, damage or desecrate, or cause or permit the destruction, defacement, damage or desecration of, an Aboriginal object or Aboriginal place.

- Section 91 states that anyone who discovers an Aboriginal object is obliged to report the discovery to the DEC.

In accordance with *Section 90* of the *NPW Act 1974*, all Aboriginal objects are protected and cannot be destroyed or disturbed without a *Section 90 Heritage Impact Permit* from DEC. Protection is provided irrespective of both the level of significance of the objects and issues of land tenure. If areas of sub-surface archaeological potential are identified, such as those found during the AHIA, DEC generally require archaeological test excavation prior to development to determine whether sub-surface objects are present, and the nature, extent and significance of such objects. The results of archaeological testing are used to determine appropriate management strategies, which should be developed by consultation between Aboriginal community representatives, the consultant archaeologist, client and DEC.

In December 2004 DEC released new *Interim Community Consultation Requirements for Applicants* under Part 6 of the *National Parks and Wildlife Act 1974.* The guidelines were developed to clarify consultation between proponents and members and representatives of the Aboriginal community during the Development Application (DA) process. The document outlines community consultation requirements as part of the preparation of an application for a consent or permit under Part 6 of the Act (ie. S.87 and S.90 permits). Because the AHIMS for Pitt Town was finalised in September 2004, prior to the release of the requirements, the S.87 PRP Application was not required to comply with the new guidelines.

1.6.3 Environmental Planning & Assessment Act 1979

The *EP & A Act 1979* requires that environmental and heritage impacts are considered by consent authorities prior to granting development approvals. Under *Part IV* of the Act, specific approval from state agencies may be required in certain circumstances. This mechanism is known as an 'integrated development application' or IDA.

The DEC is an approval body in the IDA process when a development will impact on an Aboriginal object or place, and thereby require a *S.90 Heritage Impact Permit* from DEC to allow the destruction or disturbance of a registered site. In this situation, consent must be granted by DEC prior to development.

In accordance with the process described above, Aboriginal sites identified in the study area will require approval of a Section 90 Permit before development at the site can legally commence. Accordingly, the proposed subdivision will be an Integrated Development Application and require approval from DEC. This report recommends an application to DEC for a Section 90 permit.

1.6.4 Aboriginal and Torres Strait Islander Heritage Protection Act 1984

The *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* was enacted at a Federal level to preserve and protect areas (particularly sacred sites) and objects of particular significance to Aboriginal Australians from damage or desecration. Steps necessary for the protection of a threatened place are outlined in a gazetted *Ministerial Declaration (Sections 9 and 10).* This can include the prevention of development.

As well as providing protection to areas, it can also protect objects by *Declaration*, in particular Aboriginal skeletal remains (Section 12). Although this is a Federal Act, it can be invoked on a State level if the State is unwilling or unable to provide protection for such sites or objects. Proposed development at Pitt Town is not currently the subject of a *Ministerial Declaration* under the Act.

1.7 REPORT OUTLINE

The balance of the report is set out as follows:

Section 2: Background to the archaeological investigations including a summary of the environmental context, site formation processes and archaeological background;

Section 3; Excavation and Collection Methods, including a discussion of research aims;

Section 4: Excavation and Collection Results;

Section 5: Discussion of Results;

Section 6: Results of Aboriginal community consultation and partnership;

Section 7: An assessment of Aboriginal heritage significance, including a review of processes used to evaluate Aboriginal, archaeological and public significance;

Section 8: Assessment of the impact of proposed development on Aboriginal sites, objects and heritage values; and

Section 9: Recommendations

Appendices to the report include:

Appendix 1 – Photographs
Appendix 2 – Trench Descriptions
Appendix 3 - Site Plans & Section Drawings
Appendix 4 – Stone Artefacts Report by Emeritus Professor Richard Wright
Appendix 5 – Geomorphology Report by Dr. Peter Mitchell
Appendix 6 – Aboriginal Community Correspondence

1.8 AUTHORSHIP

Fiona Leslie (Archaeologist, AHMS Pty Ltd) prepared this report, directed the archaeological excavation and collection and is the permit holder for the S.87 Preliminary Research Permit. The draft report was reviewed by AHMS Archaeologist Jim Wheeler and AHMS Director Peter Douglas. The report also includes contributions from the following professionals:

- Prof. Richard Wright – Stone Artefact Analysis
- Dr. Peter Mitchell – Geomorphology Analysis
- Dan Tuck – Plans, Photographs and Section Drawings

1.9 ACKNOWLEDGMENTS

The author acknowledges the valuable assistance provided by:

- Keith Johnson, Paul Hedge and Kate Morgan of *Johnson Property Group Pty Ltd*,
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- Kevin Cavanagh, Phil Khan, John Murphy, Lee West, Kerry Marlowe of the *Deerubbin Local Aboriginal Land Council*,
- Leanne Wright, Justine Coplin, Rhiannon Wright and Alyce Mervin of the *Darug Custodian Aboriginal Corporation*,
- Gordon Morton, Celestine Everingham, Jamie Eastwood and Matthew Morton of the *Darug Tribal Aboriginal Corporation*,
- Margrit Koettig of *DEC*,
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- Don Lucci, *Brown Consulting Pty Ltd*
- Tony Davis & Andrew Paterson, *Rick Davis Contracting Pty Ltd*
- Dr. Peter Mitchell, *Groundtruth Consulting Pty Ltd*
- Archaeologists: Emeritus Professor Richard Wright, Dan Tuck, Adam Paterson, Dr. Emma Thompson, Jim Wheeler, Graham Wilson & Peter Douglas; and
- Staff at the *Windsor Terrace Motel*

2.0 BACKGROUND TO INVESTIGATION

This section provides background information relevant for understanding the Aboriginal heritage and archaeology at Hall Street, Pitt Town. The following sections present a summary of the environmental context, archaeological context and past use and occupation of the study area.

2.1 ENVIRONMENT

2.1.1 Background

Archaeological reports include information about the environmental context of study areas because environmental factors play an important role in influencing the types of archaeological sites in any given area. Physical environments influenced both the type and availability of natural resources and the types of cultural activities that were carried out in the past. As a result, this also influenced the types of archaeological sites that may be found.

Accurate determination of the study area's former environmental context is essential to develop accurate models of cultural activity, site distribution patterns and the archaeological potential of any given area. Pitt Town's environmental setting is discussed below.

2.1.2 Landscape

The study area is bounded by Hall Street and Punt Road in Pitt Town, NSW and is situated on the southern bank of the Hawkesbury River, adjacent to a section of the River known as York Reach. Pitt Town is located 4km northeast of Windsor.

Geographically, the study area is located on the north eastern edge of the Cumberland Lowlands[2] - an extensive low lying plain characterised by gently undulating ridges and low hills on Wianamatta Group shales and Hawkesbury sandstone parent rock. The Cumberland Lowlands encompass most of Sydney's western suburbs, extending from the base of the Blue Mountains in the west, the Hornsby Plateau and Macdonald Ranges in the north-east and the Woronora Plateau in the south-east. The plain is dissected by a dense drainage system flowing northward[3].

The topography of the study area is variable. In the west it is dominated by an elevated alluvial terrace and associated plateau (or levee) that descends steeply north and west to the relatively flat fluvial corridor of the Hawkesbury River. Further east the elevated terrace merges into a gentler undulating rise descending towards the southeast and north. A former low lying back swamp appears to have been situated in the north east portion of the study area draining east-west into the Hawkesbury River. Surface water is likely to have flowed into this basin from more elevated areas to the north and south.

The one in 100 year flood level in the Pitt Town area is 17.3m above AHD. Importantly, a large proportion of land in the northern and central portions of the study area sits below this level and

[2] Bannerman and Hazelton 1990: p2
[3] ibid

is likely to have been affected by previous flooding events. During such an event the elevated southern terrace would have formed a large temporary island surrounded by water across the floodplain. The highest elevation on the southern terrace is along its northern edge. Here it rises over 20m above the adjacent floodplain descending slightly to the southeast towards a generally flat topography.

Drainage lines are difficult to define in the study area. This is most likely a result of the predominantly sand composition of the deposit. Deep sand deposits commonly store water, releasing precipitation slowly in the form of subterranean water flows[4]. The former back swamp in the north east is likely to have been fed from surrounding elevated area by this form of drainage.

2.1.3 Geology and Soils

Bannerman and Hazelton's soil landscape map for the Penrith 1:100 000 map sheet indicates that the study area extends across two separate soil landscapes: Agnes Banks and Freeman's Reach[5] (See Figure 2.1).

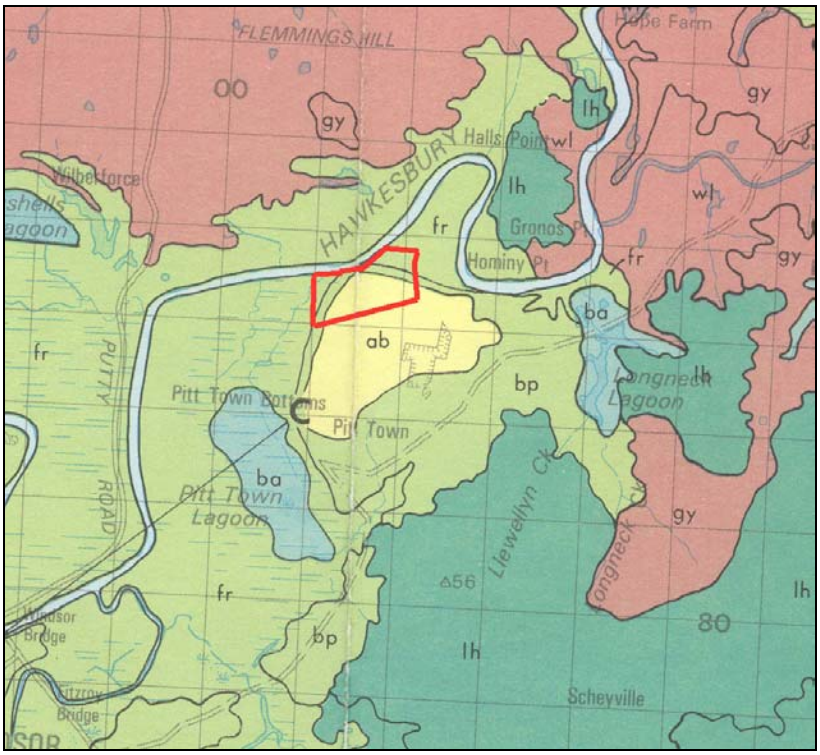


Figure 2.1: Extract from the 1:100 000 Penrith Soil Landscape Map and a rough estimate of the location of the study area. Note: extension of the study area across the Agnes Banks and Freeman's Reach soil landscapes.

[4] Comber, 2004: 64
[5] Bannerman and Hazelton, 1990.

As defined by Bannerman and Hazelton, the elevated alluvial terraces, undulating rises and associated plateaus in the southern portion of the study area are contained within the Agnes Banks alluvial soil landscape. This landscape typically consists of low parallel dunes deposited on flat Tertiary and Pleistocene terraces with an average slope of less than 5% and local relieve of 7m. It occurs in two discrete patches adjacent to the Hawkesbury River, one east of Richmond and the other just north of Pitt Town. The underlying geology of this landscape is coarse to medium grain quartz sands derived from Upper Hawkesbury and Nepean catchment sandstones. Soils are typically deep acidic and sandy overlying yellow sandy clays containing iron rich nodules (coffee rock).

It is worth noting that many authors, including Mitchell[6] and Gobert[7], distinguish between the two sand bodies at Richmond and Pitt Town, separating the *Pitt Town Sands* from the *Agnes Banks Sands*. After analysing the stratigraphy of alluvial sequence in the Hawkesbury Valley, Gobert argues soil development was less pronounced at Pitt Town. She interpreted the sediments as being of Pliocene or Pliocene / Pleistocene age deposited as a levee on an incised floodplain. Drilling by Baker[8] found that the maximum thickness of the sand body was 9m with an average depth of 4m and that the sand overlays clay, although the boundary between the two units was uneven. Whilst argument over the nomenclature of this soil landscape continues, it is generally accepted that both sand bodies are fluvial deposits overlying older clays of the Londonderry Formation, are partially redistributed by westerly winds and are early Pleistocene in age (c1.8 million years BP).

Remaining low-lying areas of land in the northern portion of the study area, including the former back-swamp area and adjacent northern hill-slope, are contained within the Freeman's Reach soil landscape[9]. Bannerman and Hazelton describe this landscape as being discontinuous, extending along the banks of the Hawkesbury / Nepean River north of Victoria Bridge[10]. It is essentially an active floodplain consisting of alluvium derived from Narrabeen Group, Hawkesbury Sandstone and Wianamatta Group soil materials. Soils are typically deep friable brown sands and loams subject to erosion and frequent flooding. The landscape is typically level with some minor relief (less than 10m) extending to scrolls, levees and back swamps. Isolated deposits of ancient river gravels are commonly found along the Hawkesbury / Nepean fluvial corridor.

Three main landforms were identified by Mitchell during his geomorphic analysis of the study area. Each landform contained a different range of soil materials that could be linked with relative age and topographic position. The landforms were.

1. The river-bank, flood channel and flood plain

2. A terrace and terrace slope capped by a low sandy rise of a levee or aeolian sand sheet at 24m elevation

3. An intermediate area of high ground from 12-16m elevation with a different soil profile on the northern edge of Lot 18.

Detailed soil descriptions are presented in Mitchell's report, which is included as Appendix 5.

[6] Mitchell in Comber, 2004: p67
[7] 1978, as referred to in Comber, 2004.
[8] 1977, as referred to in Comber, 2004.
[9] Bannerman & Hazelton, 1990: p72
[10] ibid

2.1.4 Vegetation

Prior to land clearance the Hawkesbury floodplain in the Windsor area was characterised by high alluvial levee banks that separate depressions known as 'back swamps' from freshwater riparian wetlands. Vegetation on these elevated levees consisted of Tall Open forest dominated by Forest red gum (*Eucalyptus tereticornis*) with trees typically over 30 metres in height. Understorey species would have included grasses, such as spear grass (*Stipa verticillata*) and *Microlaena*, shrub species such as Blackthorn (*Bursaria spinosa*) and *Hymenanthera dentata*, ferns including Bracken (*Pteridium esculentum*) and vines such as Sarsparilla (*Smilex spp*). Floodplains typically consisted of dense stands of Swamp Oak (*Casuarina glauca*).

During an exploration along the Hawkesbury - Nepean River in 1791 Captain-Lieutenant Watkin Tench made the following comment on soils, vegetation and fauna bordering the Hawkesbury River[11]. Based on the map of the route followed it is highly likely that this description refers directly to the section of river bordering the study area.

> *The whole of the country we passed was poor, and the soil within a mile of the river changed to a coarse deep sand, which I have invariable found to compose its banks, in every part, without exception, that I ever saw. The stream at this place is about three hundred and fifty feet wide; the water pure and excellent to the taste; the banks are about twenty feet high, and covered with trees, many of which had been evidently bent by the force of the current, in the direction which it runs, and some of them contained rubbish and drift wood in their branches, at least forty-five feet above the level of the stream. We saw many ducks.*

Evidently, the river and surrounding land within the study area had undergone at least one considerable flooding event during this period, given the amount of debris present along the creek.

Almost all of the original vegetation within the study area has been removed, with the exception of a few remnant Eucalyptus and Melaleuca trees near the river bank. A small citrus orchard is present in Lot 12. Remaining areas are either disused / abandoned crop fields or cleared grazing paddocks.

2.2 ARCHAEOLOGY

2.2.1 Regional Context

In terms of its regional archaeological setting, the study area falls within the Northern Cumberland Plain. Aboriginal occupation in this region dates back well into the Pleistocene period (ie. more than 10,000 years ago). This evidence comes from C14 dates retrieved from excavated sites such as Cranebrook Terrace (41,700 years before present) and Shaw's Creek K2 (14,700 years before present). Both of these sites are located in close proximity of the Hawkesbury / Nepean River near Penrith in western Sydney. The dating of Cranebrook Terrace is currently under review, so at this time Shaw's Creek is considered as the oldest reliable date of Aboriginal occupation in the Sydney region[12].

[11] Tench in Fitzhardinge, 1979: p226
[12] Attenbrow 2002: 20-21

The vast majority of dated sites in the Sydney region are, however, less than 5,000 years old (35 out of a total of 48 dated sites). It has been argued that this is a result of increased populations and 'intensification', during this period. The prevalence of sites dating to the last 5000 years may also be a result of the last significant rise in sea level, approximately 6000 years ago. The sea level rise would have potentially submerged many of the older sites along the coastal fringe.

Over the past 20 years the archaeology of the Cumberland Plain has been well documented through a large number of academic, amateur and impact assessment investigations prepared by consultant archaeologists.

In 1984 Dr Jim Kohen conducted intensive PhD research in the surrounding region, comparing sites along the Nepean / Hawkesbury system (including Emu Plains) with those to the east across the Cumberland Plain. In contrast to the small low-density open sites commonly found in the neighbouring Blue Mountains, a very large and significant open site was located on the Nepean River terrace beside Jamison's Creek. A surface collection at the site recovered almost 10,000 stone artefacts that were distributed over an area of 775 square metres. Examples of all major categories of stone tool types were found including stone axe heads, uniface pebble tools, elouera adze flakes, bondi points, geometric microliths, thumbnail discoid scrapers, bipolar cores, single and multiplatform cores and blade cores. Raw material types used to make the artefacts found at the site included chert, basalt, quartz from the Nepean gravels, quartzite, silcrete and siliceous wood. In addition to stone artefacts associated with occupation before c1788, post-contact artefacts were also found. These included clay pipe bowl fragments and ceramics, indicating that the site had been continuously used until at least the 1830s. Excavations at the site revealed a 1.5 metre thick cultural deposit that produced radiocarbon dates ranging from 7,000 to 1,500 years BP. The site is located 25 kilometres southwest of the current study area and is considered one of the most significant open sites in the Sydney region. The site was largely destroyed in 1984 during the development of a sporting complex.

Analysis of 666 sites recorded on the Cumberland Plain (ie. on the DEC Site Register) by McDonald[13] found that open sites (89%) were the most common site type, followed by scarred trees (2.1%). Shelters and axe grinding grooves accounted for 3.6% of recorded sites, and these were concentrated along the periphery of the Plain, at the junction of shale and sandstone geology. The study highlighted difficulties associated with archaeological visibility on the Plain by assessing the potential for areas with no surface evidence to contain buried sub-surface deposits. The study found that:

- 17 out of 61 excavated sites had no surface artefacts prior to excavation;
- the ratio of recorded surface to excavated material was 1:25; and
- none of the excavated sites could be properly characterised on the basis of surface evidence. In short, surface evidence (or the absence of surface evidence) did not necessarily indicate the potential, nature or density of sub-surface material.

The results of McDonald's study clearly highlight the limitations of surface survey in identifying archaeological deposits. The study also shows the importance of test excavation in establishing the nature and density of archaeological material on the Cumberland Plain.

[13]McDonald 1997

More recent archaeological work on the Cumberland Plain has been conducted at Rouse Hill and the ADI Site at St Marys[14]. Although undertaken more than 5 years ago, the test excavation program at Rouse Hill is still the most extensive subsurface investigation conducted on the Plain. Results of the investigation demonstrated that existing predictive models were inaccurate because their conclusions were based on an analysis of surface sites. An analysis of sub-surface deposits provided important insights into the distribution of sites, dominant site types and their preservation. These were as follows:

- Almost all areas contained subsurface archaeological deposits, even areas that showed no evidence of archaeological material on the ground surface;
- Open sites in aggrading and stable landscapes had the potential to contain intact deposits and sites with structural integrity. Deposits in alluvium have potential to contain stratified remains;
- Ploughing only affected deposits to a depth of 30cm, and knapping floors were still identifiable in plough zones;
- Some deposits contained very high densities of artefacts and a variety of artefacts that reflected changes in activity and site use;
- The archaeological record is more complex than was previously assumed. Extensive archaeological testing found intact knapping floors, backed blade manufacturing sites, heat treatment locations and areas designated for the manufacture of specialised tool types;
- A new context of 5,000 – 3,000 BP was identified for the manufacture of backed blades on the Plain; and
- Sites on permanent water sources were found to be more complex than sites on ephemeral / temporary drainage lines.

Aboriginal stone artefacts are an important source of archaeological information because stone is preserved for long periods of time whereas organic materials such as bone, shell, wood and plant fibres decay. Stone artefacts provide valuable information about technology, economy, cultural change through time and settlement patterning. Stone has also been used for 'relative' dating of sites where direct methods such as Carbon dating cannot be applied. A regional technological sequence for stone artefacts was first described in the late 1940s by Fred McCarthy and has since been refined over time. Known as the 'Eastern Regional Sequence' it was based on direct dating of excavated sequences. Some debate about the precise nature and significance of the technological changes described still continues[15], therefore the ERS should be regarded only as a general guide to technological change. The ERS phases, from most recent to oldest, are as follows:

- Late Bondaian – Characterised by bipolar technology, elouras, ground-edged artefacts, bone and shell artefacts. Bondi points are virtually absent and artefacts are predominantly made from Quartz. Generally dated from the Contact period to 1,600 years Before Present (BP).

[14] ibid
[15] Hiscock & Attenbrow 2002; Hiscock & Attenbrow 1988

- Middle Bondaian – Characterised by backed artefacts, particularly Bondi Points and ground-edged artefacts. Artefacts made from silicious materials, however quartz becomes more frequent. Generally dated from 1,600 to 2,800 years BP.

- Early Bondaian – Aspects of the Capertian assemblage continue, but backed artefacts and ground-edged artefacts increase. Artefacts during this period were predominantly made from fine-grained silicious stone such as silcrete and tuff. Generally dated from 2,800 BP to 5,000 years BP.

- Capertian – Distinguished by large uniface pebble tools, core tools, horsehoof cores, scrapers and hammerstones. Backed artefacts occasionally present. Generally dates to greater than 5,000 years before present (BP).

Aboriginal art sites in the form of rock engravings, paintings, drawings and stencils on sandstone are found throughout the Sydney basin, particularly within Hawkesbury sandstone areas. The Aboriginal Sites Register demonstrates that images have been recorded on approximately 840 open rock platforms and 875 shelters in the Sydney region[16]. On rock platforms, only engraved images are found. Within shelter sites, dry pigment drawings, paintings and engravings have been found. Pigment images were made with black charcoal, white pipeclay, red ochre or yellow ochre. Pigments were mixed with combinations of fat, ashes and blood to create a durable medium[17]. Engraved and pigment images in the Sydney region are predominantly from the 'Simple Figurative' style, which are typically outlined or infilled naturalistic depictions of animals, people, weapons, equipment and mythical figures[18]. Although the Aboriginal artwork has not been directly dated, recent comparative studies suggest that the 'Simple Figurative' style probably dates to the last 5,000 years[19].

2.2.2 Local Context

A search of the DEC Aboriginal Heritage Information Management System (AHIMS) for a five kilometre area surrounding the study area indicates that a moderate density of sites have been identified and recorded in its vicinity. A total of 57 sites have been recorded within the search area, including a variety of site types. Site types and frequency are as follows;

Table 2.1: DEC AHIMS Search Results

Site Type	Number	*Frequency (%)*
Open Camp Site (Artefact Scatter)	37	*65*
Axe Grinding Groove	7	*12*
Potential Archaeological Deposit (PAD)	5	*9*
Shelter with Deposit	3	*5*
Axe Grinding Groove + Rock Engraving	2	*3.5*
Rock Engraving	2	*3.5*
Shelter with Art & Deposit	1	*2*
Total	**57**	***100***

[16]Attenbrow 2002: 146
[17]Campbell in Attenbrow 2002: 147
[18]Attenbrow 2002: 147
[19]Stanbury & Clegg 1990

The AHIMS search results show a predominance of open campsites (65%), followed by axe grinding grooves (12%) potential archaeological deposits (9%) and shelters with deposit (5%). It is worth noting the predominance of open camp sites and potential archaeological deposits (PAD) at Pitt Town and axe grinding grooves and shelters near Cattai Creek to the northeast of the study area. This reflects the variation in site types accompanying changes in geology.

The most relevant archaeological work undertaken in Pitt Town to date is a survey and archaeological test excavation conducted by consultant archaeologists at two rural properties known as 'Bona Vista' and 'Fernadell'. A brief summary of both investigations is provided below.

Archaeological Survey of Bona Vista and Fernadell, Pitt Town, NSW.

In December 1998 Jo McDonald CHM conducted an archaeological survey for Aboriginal sites at Bona Vista and Fernadell in Pitt Town, NSW[20]. This area is situated roughly 200m south of the current study area and is bounded by Bathurst Street and Johnston Streets. At the time of the study most of the subject land was under citrus and stone fruit cultivation with some areas recently cleared. Approximately 25% of the area was surveyed on foot with ground surface visibility generally good to excellent, depending on whether the area had been recently ploughed. Conversely, the integrity of the ground was very low with most of the study area significantly disturbed by cultivation activities. Effective ground coverage ranged from 1 to 20%.

Two open artefact scatters, one scarred tree and two isolated artefacts were recorded within the study area. Based on the results of the survey and the assessed degree of disturbance at the site zones of high, moderate and low archaeological potential were identified. Areas assessed as having high archaeological potential were the least disturbed (ie. partially cleared and / or grazed land) and required further archaeological investigation, in the form of sub-surface testing, prior to development. Areas of moderate archaeological potential included cultivated land that had been disturbed by machinery. Area's of low archaeological potential included land that had been extremely disturbed by some form of excavation work. No further archaeological testing work was considered warranted in the moderate and low archaeological potential zones. It was recommended that the scarred tree be protected due to its significance. Isolated artefacts, in contrast, were of low significance and it was recommended that the client apply for a Section 90 Consent-to-Destroy Permit (now referred to as a *Heritage Impact Permit*) if they were to be disturbed.

Archaeological Excavation of Two areas at Pitt Town: Fernadell and land surrounding Bona Vista

Following on from McDonald's survey, archaeologist Jillian Comber was commissioned to conduct Aboriginal archaeological test excavations and an historical archaeological survey at Fernadell and land surrounding Bona Vista in February 2004[21]. The aim of the testing program was to determine the nature, extent and integrity of Aboriginal objects on the two rural properties as part of preparations for future residential development at Pitt Town. Because of its proximity to the study area (ie. less than 200m south of the Hall Street), similarities in underlying geology and topography and distance to the Hawkesbury River the results of Comber's study are directly relevant to the study area.

[20] McDonald, 1998b
[21] Comber, 2004

Following the issue of a DEC S.87 Permit, seventeen test pits were excavated by backhoe using a straight-edged 700 mm bucket. Seven pits were excavated along Bathurst Street and south east of Johnson Street. Thirteen of the seventeen test pits contained a total of 234 stone pieces, of which 96 were identified as artefacts. Remaining stone pieces were nondescript lithic pieces thought to be the product of heat fracture. Occasional glass and porcelain pieces were also found in the assemblage. The ancient levee deposit running parallel to Bathurst Street was found to contain the highest density of artefacts (between 24 and 148 per square metre). Test pits to the south east of Johnson Street, in contrast, contained 0-13 artefacts per metre square. The predominant stone material used was rhyolitic tuff, followed by silcrete, quartz, quartzite, unclassified chalcedony and other volcanic stone types. Artefact size was generally small, consisting of mostly flake debitage and heat fractured pieces of stone. Diagnostic elements included microliths and a possible thumbnail scraper suggesting an age of less than 4,500 years BP.

Based on the results of the testing, the levee was interpreted as a camping and tool manufacturing site, although the density and variety of artefacts suggested short-term use rather than long-term or repetitive encampment. The scientific significance of the archaeological deposit, however, was assessed as being low. The deposit had undergone a substantial degree of vertical disturbance from European farming practices, including land clearance and repetitive ploughing, and bioturbation to a depth of 80 cm below the ground surface. This resulted in the vertical movement of stone artefacts through the soil profile forming a layer above more compact soil (ie. at the base of the ploughing zone. The soil and associated assemblage therefore lacked chronological stratigraphy. Unsurprisingly, temporal differentiation in the artefact assemblage could not be discerned during excavation and analysis, and no cultural features, such as hearths, pits, lenses, shell or other organic material, were identified during excavation. Additionally, no datable material was recovered during the testing program.

Despite the site's limited scientific significance it was assessed by Comber as having some representative value, being the only sub-surface assemblage to be recovered from the Pitt Town Sands soil landscape. It was argued that the assemblage would be of value to future local and regional comparative studies. It was also noted by Comber that the archaeological material was likely to have some cultural value to local Aboriginal groups who participated in the fieldwork.

The following recommendations were made regarding future development at the site:

- Application should be made for a DEC S.90 Heritage Impact Permit to disturb additional Aboriginal objects likely to be present in subsurface deposits. It was recommended that this permit be granted under the condition that a salvage archaeological excavation be conducted prior to development. The aim of the salvage would be to recover a statistically significant sample of the sub-surface assemblage for analysis;

- That native vegetation in the south-east portion of the area be retained and managed under a Management Plan; and

- Ground-excavation work in the Pitt Town levee area be monitored by an archaeologist and representatives from the relevant Aboriginal groups to ensure that any skeletal remains be identified and managed appropriately.

2.3 SITE SPECIFIC HISTORY

The following section provides a brief overview of historical use and occupation of the study area as a means of determining the nature and scale of site disturbance (an Aboriginal ethno-history is included in the preceding AHIA report). This has implications for archaeological site formation processes and the integrity of archaeological deposits across the site.

The general locality has been a farming settlement since c1794, and has close historical associations with Governor's Phillip, Bligh and Macquarie. In 1807, Bligh, who has the most prominent historical associations with the area, established a "Model Farm" on an Estate that incorporated all of the study area. It was named 'Blighton' and was an extensive farmstead, consisting of at least nine major buildings plus ancillary structures, yards, fenced paddocks, gardens and plantings. The farm was a diverse and integrated endeavour that had its origins within the Model Farm system that developed in Britain during the Eighteenth Century. As such, it combined animal husbandry with broad acre horticulture. Cattle and sheep were grazed, but the farm also had a strong focus upon both dairying and pig breeding.

'Blighton' was farmed under Bligh's direction for only twelve months (in 1807) and land that once formed the Estate has been subdivided many times since then. The study area incorporates most of the northern half of the former Blighton estate[22].

The property has operated as a more or less viable agricultural concern since the early Nineteenth Century, with cyclic development and replacement of the field systems and farm buildings being part of that history. During the late Nineteenth Century the structures associated with Blighton were allowed to decay, as pastoral activity became the focus of land use in the area. During the Twentieth Century, removal of old, redundant features and buildings accelerated with the introduction of orcharding and the subsequent removal of these orchards in the 1980s and 1990s.

Occupation in the locality incorporating the study area therefore has a lengthy history that comprises many discrete phases, each linked by subtle and often unseen associations. Aboriginal people lived there for thousands of years before the British arrived in Australia. The locality was the site of early historic contact between Europeans and Aboriginal people. The lowland was developed in the mid-1790s as the principal food for the colony at Port Jackson. Bligh's Model Farm sought to improve and extend the rudimentary and inefficient farming practices that characterised agricultural activity to that date. Subsequent political events saw the farm pass through the hands of a number of tenant farmers and eventually into the orbit of the Hall family who worked the land for three generations (1814 - 1882). Thereafter the property continued to operate as a pastoral enterprise until the introduction of orcharding in the late-1930s by the Cleary family.

2.4 RECENT LAND USE EFFECTS

As described above, the study area has been subject to a number of previous land uses that have modified its ground surfaces and subsurface soil profile. The most significant of these is an intensive period of citrus cultivation during the period after c1940. Such activities are likely to have resulted in the damage and possible destruction of surface Aboriginal sites, and subsurface archaeological deposits.

[22] AHMS, June 2005

To interpret the impact of more recent land uses, particularly orcharding and intensive cultivation, the following sources were analysed:

- 1947 aerial photograph (Land photo NSW 61-146, Windsor Run 46. Jan. 1947);
- 1955 aerial photograph (Land photo NSW 226/5090, Windsor Run 5. Aug. 1944); and
- 1982 aerial photograph (Land Information Centre, NSW, 3253-331, Sydney Run 9. 20th Aug. 1982).

The following definitions were used to distinguish between different degrees of disturbance[23]:

Extremely disturbed: Cutting for tracks, drains and other forms of deep excavation including services and building footings. Note: this does not include buildings constructed on concrete platforms. The depth of disturbance is these areas may vary from widespread disturbance of 500mm to localised disturbance of 2m.

Moderately disturbed: Land clearance, the footprint of buildings constructed on concrete platforms, cultivation, extensive soil disturbance caused by use of farm machinery, extended periods of trampling and excavation to establish subsurface irrigation lines in cultivated areas. The depth of disturbance is these areas may be in the range of 200 -300mm, with localised disturbance of 500mm.

Least disturbed: Partially cleared with some possible grazing, recently disturbed by unformed vehicle tracks but no evidence of cultivation. The depth of disturbance is these areas may be generally less than 200mm.

Disturbance in the study area was systematically mapped using each of the above-cited aerial photographs as a base plan. Excavated and other cultural features were traced and areas displaying various degrees of disturbance (described above) were shaded.

The results of this work are shown in Figures 2.2, 2.3 and 2.4.

[23] Definitions based on McDonald, 1998b: p7

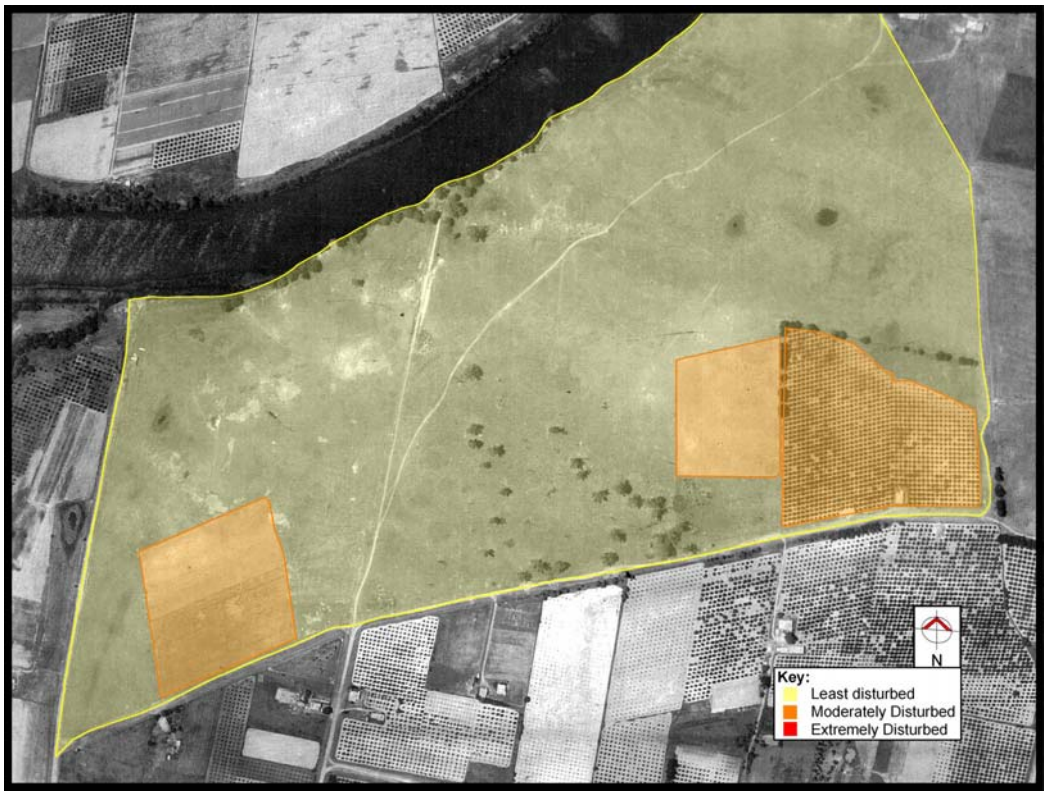


Figure 2.2: Relative site disturbance in 1947. (Base map: 1947 Aerial Photograph)

Figure 2.3: Relative site disturbance in 1955. (Base map: 1955 Aerial Photograph)

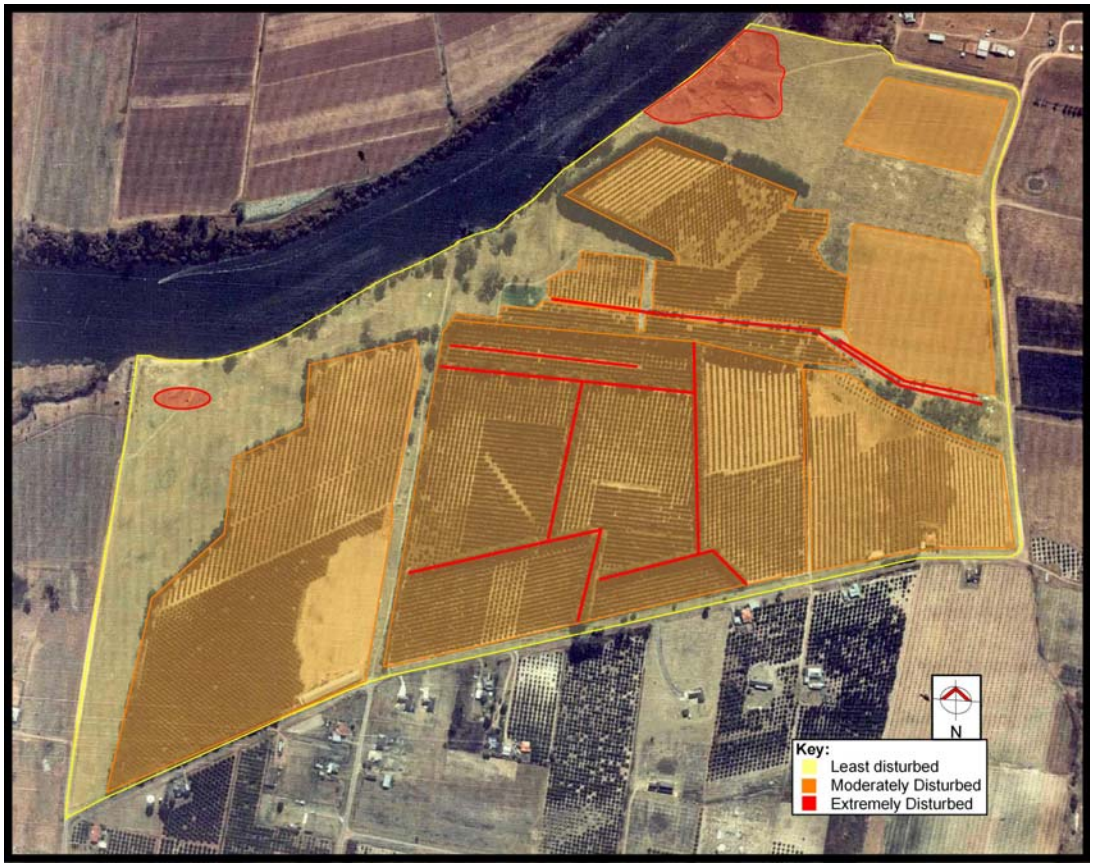


Figure 2.4: Relative site disturbance in 1982. (Base map: 1982 Aerial Photograph)

Figure 2.5 combines the results of mapping with observations made during the survey, on current land use practices and their effects upon soil profiles within the study area.

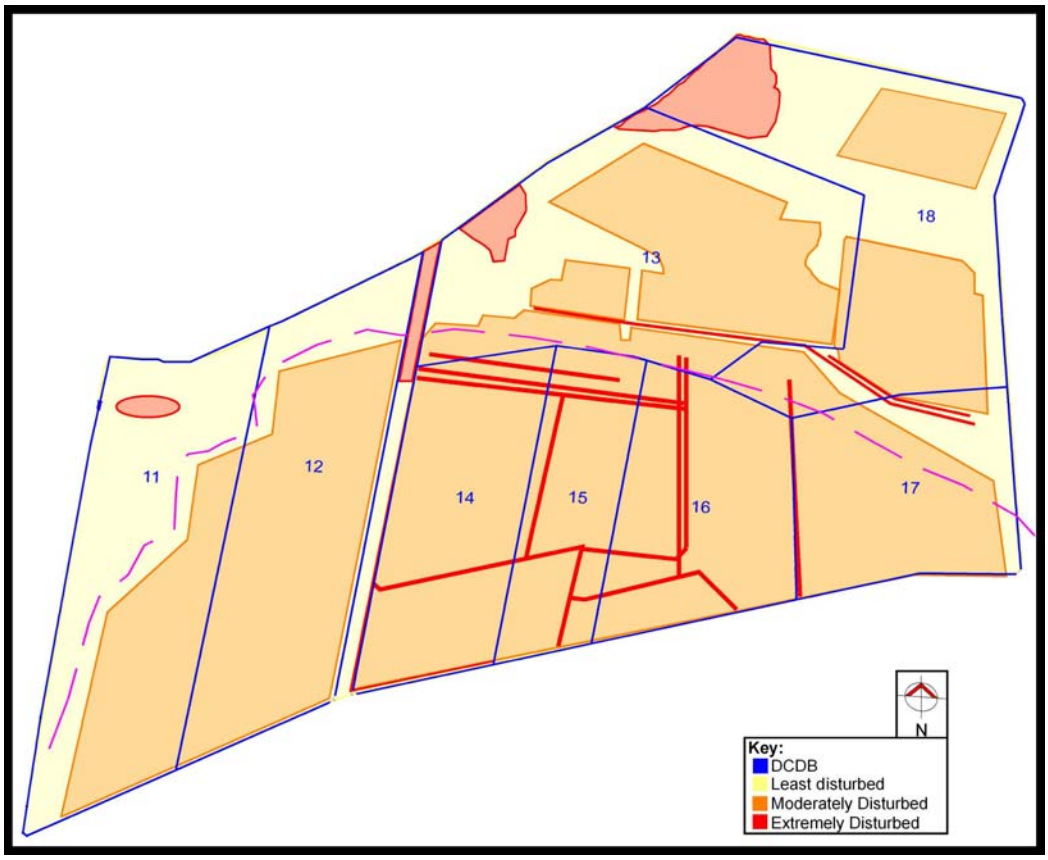


Figure 2.5: Relative site disturbance from 1947 to 2004 (based on evidence from the 1947, 1955, 1982 aerial photographs and observations on the current site configuration made during the 2004 field survey)

3.0 METHODS

3.1 RESEARCH QUESTIONS

The following questions were proposed in the Archaeological Research Design to structure excavation methods, post excavation analysis and reporting. The questions are based on relevant research issues relating to the archaeology of the Hawkesbury – Nepean floodplain and North Cumberland Plain, with particular reference to previous excavations at two neighbouring properties: Fernadell and Bona Vista[24].

What impact has ploughing had on the integrity of the archaeological deposit?

During excavations at the ADI Site at St Mary's Jo McDonald found ploughing only affected deposits to a depth of 30cm below the surface, and knapping floors were still identifiable in plough zones. At Fernadell and Bona Vista Comber found that although there was limited horizontal disturbance from ploughing, considerable vertical mixing had occurred within the Pitt Town Sands, no features were identifiable and there was no temporal differentiation in the soil profile. Test excavations within the study area above the 1:100 year flood level will further test the effect of ploughing on archaeological deposits and features within sand deposit and better define the implications of this on the analysis of recovered stone artefact assemblages.

What impact has flooding of the Hawkesbury-Nepean had on archaeological deposits? Are buried land surfaces present and, if so, how intact are they and what information can be recovered through archaeological excavation?

It has been predicted by Smith that sites along major water sources on the Northern Cumberland Plain will be more complex than sites found further away from water. Buried high-density archaeological deposits were observed and analysed by Kohen along Hawkesbury - Nepean River terraces at Penrith. Test excavation below the 1:100 year flood level within the study area will provide an opportunity to explore the impact of flood events on archaeological deposits and test the hypothesis that flood deposits can potentially seal and preserve archaeological deposits in-situ.

How long did Aboriginal people use the area?

Identification of technologies and formal types (such as backed artefacts) will provide an indication of how long Aboriginal people used the site. Recovery of shell and/or charcoal samples, particularly from hearths, could be used for C14 dating. No hearths or identifiable features were identified by Comber at Fernadell and Bona Vista. The presence of diagnostic elements of a 'microblade' technology indicated an age of less than 4,500 years BP.

What stone materials were used and where did they come from?

Post excavation analysis will identify stone raw material types, such as silcrete, quartz, indurated mudstone or tuff, and their relative proportions. A review of previous studies in the Pitt Town area, previously identified Aboriginal stone sources, and geological mapping may provide an indication about where raw materials were gathered for making stone tools. Nearby excavations

[24] Comber, 2004

have shown a predominance of rhyolitic tuff, followed by silcrete, quartz, quartzite, unclassified chalcedony and other volcanic stone types.

Post-excavation analysis will also examine the percentage of cortex and the relative proportions of different stages of the reduction sequence represented in the assemblage. This may assist in determining more specifically where the stone used for making artefacts was sourced from, in particular, whether the stone came from river gravels or from outcrops.

What types of artefacts were produced and what were they used for?

The stone artefact analysis methodology will aim to determine what artefact types were produced and/or discarded on site and how the raw materials were reduced to make the artefacts. Excavation of stratified deposits may show changes in artefact manufacture over time. The functional analysis will aim to detect use-wear evidence on a sample of stone artefacts recovered from the site. If use wear evidence is found, it may provide an indication of what different artefacts were used for. Artefact size in the Bona Vista and Fernadell assemblage was generally small, consisting of mostly flake debitage and heat fractured pieces of stone. Diagnostic elements included 'microliths' and a possible 'thumbnail scraper' suggesting an age of less than 4,500 years BP.

3.2 SCOPE OF WORK

The scope of work for archaeological test excavation and surface collection in the study area was set out in the *Archaeological Research Design* and is presented below.

3.2.1 Landform Testing

To understand the nature and distribution of archaeological evidence across a landscape best practice excavation procedure is to sample the range of landforms within an area using transects placed across topo-sequences (ie. the range of topography across a landscape). This approach detects variation in density and type of archaeological deposits across various landforms and recognises that Aboriginal people occupied and used different parts of the landscape for different activities.

During the AHIA five landform units were identified:

River Bank: the southern bank of the Hawkesbury River running along the northern boundary of the study area.

Lowland: low-lying land interpreted as a former 'back-swamp' in the northern portion of the study area.

Hill Slope: below the elevated terrace and to the north and south of the former 'back-swamp'.

Terrace: an elevated levee and undulating rises and associated plateaus in the southern portion of the study area.

The River Bank, Lowland and Hill Slope units lie below the 1:100 year flood level.

All landforms were assessed as having potential to contain buried and or obscured surface and subsurface archaeological deposits, given their proximity to the Hawkesbury-Nepean River and the presence of numerous exposed scatters across the study area.

The landform classification was further revised by Mitchell during his geomorphic analysis of the study area (Appendix 5). He identified three main landforms containing a different range of soil materials that could be linked with relative age and topographic position. These were as follows.

1. The river-bank, flood channel and flood plain
2. A terrace and terrace slope capped by a low sandy rise of a levee or aeolian sand sheet at 24m elevation
3. An intermediate area of high ground from 12-16m elevation with a different soil profile on the northern edge of Lot 18.

To assist with the analysis of cultural material recovered during the testing program Mitchell's classification is used in the following *Results* Section.

To adequately sample each landform, two transects were placed across the study area.

Transect 1 ran perpendicular to the River; traversing the river bank, terrace slope and terrace capped with the sand levee.

Transect 2 extended across the eastern portion of the study area, sampling the terrace, terrace slopes, floodplain and flood channel and the high ground on the northern edge of Lot 18 that displayed the different soil profile.

Both transects were deliberately positioned to intersect with two surface scatters: PT3 and PT8. This was necessary to explore the relationship between surface and subsurface deposits. Extremely disturbed areas and areas where historical relics were predicted were avoided.

Along each transect, five 2 x 2 metre test trenches were laid out accurately by a land surveyor under the supervision of Fiona Leslie (excavation director, AHMS Pty Ltd). The distance between test trenches was approximately 60m. Some variation was necessary to avoid irrigation lines and areas of localised disturbance (up to 10 metres).

The location of trenches along Transect 1 and Transect 2 and landform boundaries are shown in Figure 3.1.

The investigation was carried out over a 10 day period, beginning on Monday 11 July and concluding on Friday 22 July 2005. Excavation was directed by Fiona Leslie of AHMS Pty Ltd. The site work was undertaken by a team of three archaeologists, in partnership with representatives from the Deerubbin LALC (DLALC), Darug Custodian Aboriginal Corporation (DCAC) and Darug Tribal Aboriginal Corporation (DTAC). The investigation was undertaken in accordance with the methodology set out in our application to DEC dated 10 May 2005. Dr. Peter Mitchell was present on site on the 19 July 2005 to observe the excavation and record soil profiles. During excavation soil samples were taken from each spit for microscopic analysis by Dr. Mitchell. Results of his analysis are presented in Appendix 3.

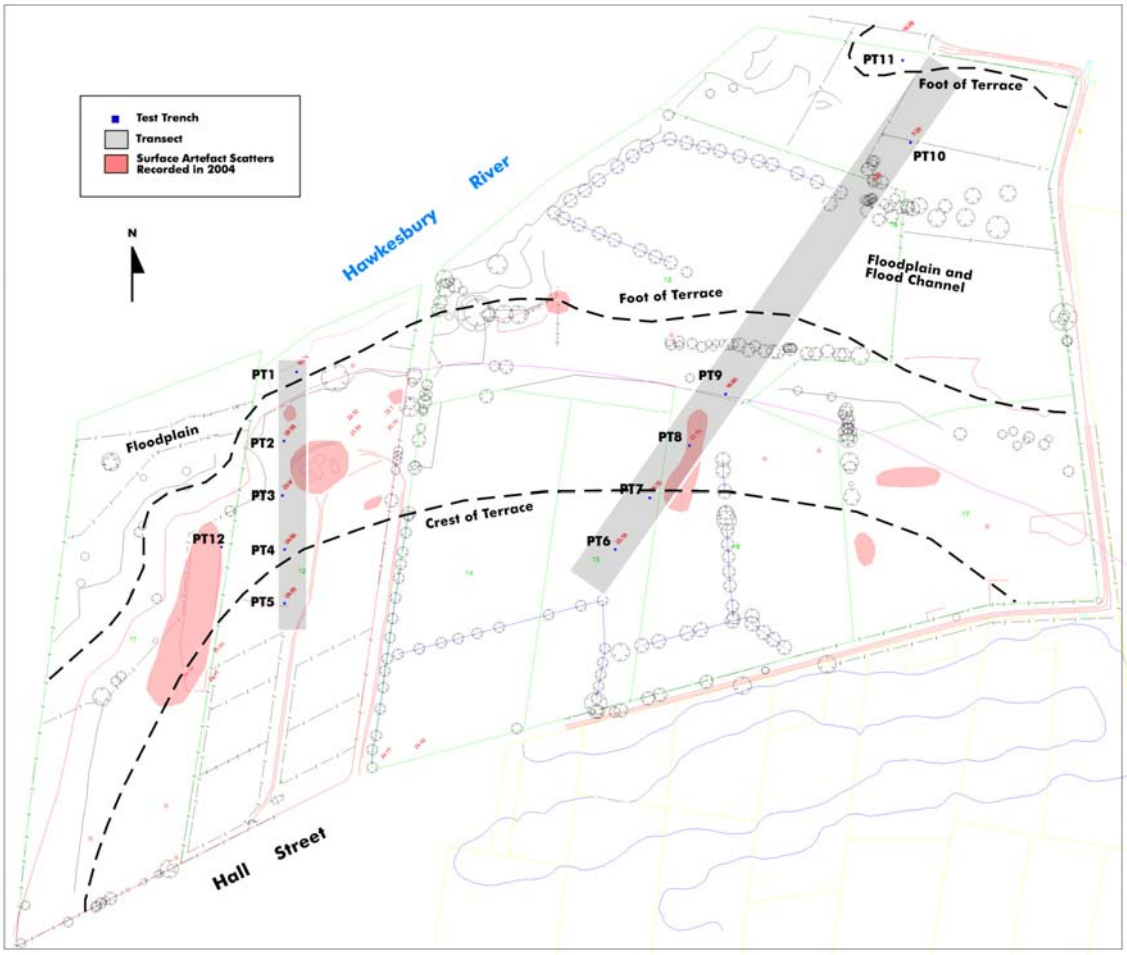


Figure 3.1: The location of 2 x 2m Test Trenches excavated along Transect 1 and Transect 2 and landform boundaries at Hall Street, Pitt Town, NSW.

Excavation of each trench was undertaken by a 7 tonne excavator equipped with a 1.2 metre wide batter bucket. Soil was removed in 10cm spits. The total depth of excavation varied between 40cm and 160cm below the surface, depending on the depth of culturally-sterile deposits. The maximum depth of excavation was 1.6m. Excavated sand was dry-sieved through a large 5mm screen to recover archaeological material. Sand containing a high density of artefacts was sample sieved through a 3mm screen to retrieve small flake debitage.

In compliance with Occupational Health and Safety (O, H & S) requirements, trenches excavated below 1m were stepped to ensure deposit stability and crew safety. Typically, the first step was established at 70cm below the ground surface and the second at 1.3m. Sand above the 1:100 year flood level was more compact than initially expected. Shoring using plywood planks and metal pickets to stabilise the deposit was not required. Completed trenches were backfilled at the end of each days work.

On completion of the 10 planned trenches, two additional 2 x 2m trenches were excavated to extend the sample. This was required by DEC, as a condition of the S.87 permit. The first trench was added to the north end of Transect 2, to sample duplex soil along the northern boundary of the study area. On inspection it was evident that this soil was significantly different to that of adjacent low-lying flood deposits. The second was added 60m perpendicular to Transect 1 to further sample the deepest sand deposit above the 1:100 year flood level. During excavation of Trenches 3 & 4, a significant density of Aboriginal stone artefacts was recovered to a depth of 1.2m below the ground surface. Given the potential significance of this deposit and possible impact from development it was deemed necessary to extend the sample to determine whether artefacts extended to a similar depth within allotment 11 – the adjacent allotment. Extending the sample further south towards Hall Street was considered less important, as excavation of Trench 5 had clearly demonstrated a dramatic decline in artefact density and the depth of artefact bearing deposits.

3.2.2 Surface Collection

Site PT3 (within Lot 12 DP1021340) was situated on recently developed land likely to be further disturbed by landscaping around a newly constructed house (see Figure 3.2 for extent of the site). Following identification of the site the landowner was informed of the location of the material and advised of its legal status and the requirement for a S.90 permit if additional excavation works were planned. Because of its threatened status, surface material was collected during the testing program and analysed as part of the recovered assemblage. The landowner agreed to postpone landscaping works until the surface collection had been completed.

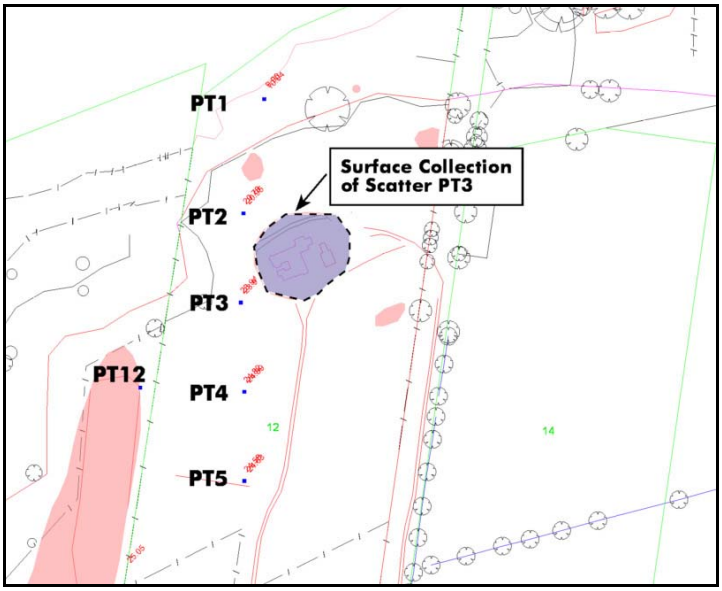


Figure 3.2: Site PT3, Hall Street, Pitt Town, where Aboriginal artefacts on the ground surface were collected to prevent further impact from construction and landscaping.

3.2.3 Monitoring of Historical Archaeology Testing

The results of test excavation indicated that Aboriginal objects were present across all landforms above the 100 year flood level within the study area and that historical archaeological testing proposed in Lot 14 would potentially disturb such objects. Amendment to the existing S.87 PRP permit was requested by email on 8 September 2005. DEC granted a 2 month extension to the original permit timeframe and permission to recover Aboriginal objects at Historical Area 3 within Lot 14 on 13 September 2005. This area is shown in Figure 3.3.

The work was undertaken by AHMS historical archaeologists with representatives of DLALC, DTAC and DCAC on 20 September 2005 under S.140 Permit No. 2005/140/040 approved by the NSW Heritage Office. An initial 60m trench was excavated by backhoe using a 1.6m wide bucket in a roughly east-west direction across the testing area. A second 6m long trench was then excavated in a northward direction perpendicular to the first trench.

The S.140 permit did not allow for excavation or removal of intact historical archaeological deposits. The excavation was limited to the plough zone and designed to reveal any historical archaeological features that may have been present at the base of the plough zone. As had been demonstrated during previous landform testing, this consisted of 200-300mm of sandy loam that had been under constant, localised redistribution since the 1950s. Following recording and photography, the trenches were backfilled.

Aboriginal objects identified during the investigation were collected and analysed as part of the total stone assemblage. Given the disturbed nature of the plough-zone it was considered unlikely that other archaeological features associated with Aboriginal occupation, such as hearths, would have survived. However, if any such features were noted at the base of the plough-zone they were recorded, photographed and planned by an AHMS archaeologist prior to backfill.

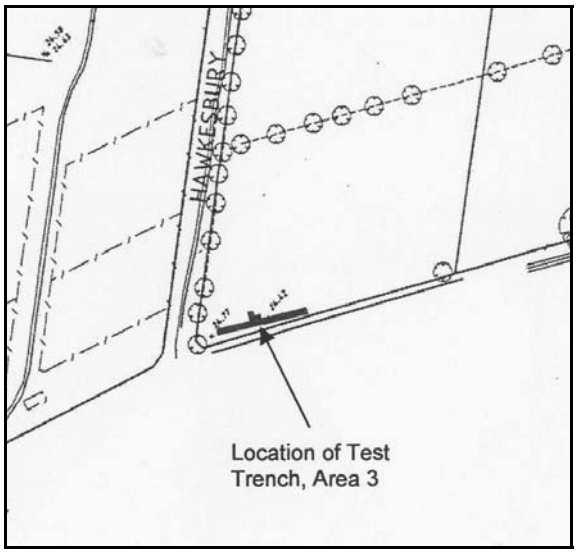


Figure 3.3: Historical Area 3 on the southern boundary of Lot 14 where Historical Archaeology Testing was conducted under a S.140 Permit. Testing in this area was monitored by representatives from DLALC, DTAC and DCAC.

3.3 EXCAVATION METHODS

Excavation methods employed at Hall Street, Pitt Town are set out below:

3.3.1 Excavation

- Twelve 2 x 2metre test trenches were excavated by a mechanical excavator using a 1.2 metre wide bucket. The work was undertaken by a qualified and experienced machine operator under supervision of a qualified archaeologist.

- Sand was removed in 10cm arbitrary spits to a maximum depth of 1.6m below the ground surface.

- Soil samples were retained from each spit for pH testing and soil description.

- If any charcoal or shell had been found within stratified cultural deposits it would have been retained for C14 dating; and

- If human bone had been found, archaeological excavation would have ceased and the DEC, DLALC, DTAC and DCAC notified. If the remains were identified as pre-contact Aboriginal, decisions regarding their management would have been made by DEC in consultation with DLALC, DTAC and DCAC, AHMS Pty Ltd and JPG Pty Ltd.

3.3.2 Sieving

- Excavated soil was transferred directly onto a large 1m x 2m sieve by machine bucket. An estimate of cubic metres of sand in each spit was calculated using trench and depth measurements; and

- Sand was dry-sieved through a 5mm screen. Spits containing high densities of artefacts were sample sieved through a 3mm screen. This ensured that a sample of the full range of lithic material was retrieved.

3.3.3 Recording

- Archaeological material recovered from excavation and sieving was retained in plastic clip-lock bags and labelled with the provenance details including: date, site number, trench number and spit;

- A standard site recording form was used for each excavated spit. Details included site name, date, site recorder, spit number and depth, trench number, description of finds, description of soil, sketch plan of excavation (if relevant to show structure), end of spit levels and soil pH;

- A survey datum (AHD) was established in order to record the levels of deposits and features. Levels established by the surveyor at the NE and NW corners of each trench were used for this purpose;

- A dumpy level was used to measure AHD levels at the end of each excavated spit. Trenches were oriented (where possible) in a north-south alignment. This facilitated accurate recording of the excavation;

- A photographic record was kept of the excavation. An overall site plan was produced and sections of each test trench drawn; and

- Soil pH was measured by Dr. Mitchell as part of his geomorphology analysis.

3.4 COLLECTION METHODS

3.4.1 Site PT3

- Site PT3 was divided into NE, NW, SE and SW quadrants around the newly constructed house.

- A plan was drawn showing the extent of material across the area.

- The collection of surface artefacts within each quadrant was conducted on Day 2 and Day 3 of the excavation by representatives of DLALC.

- Artefacts were retained in plastic clip-lock bags labelled with their provenance details including; date, site number and quadrant.

3.4.2 Historical Area 3: Lot 14

- The recovery of Aboriginal stone artefacts during historical archaeological testing took place on the 20 September 2005

- Representatives of DLALC, DTAC and DCAC monitored the excavation.

- Aboriginal stone artefacts noted in the area were collected, retained in plastic clip-lock bags and labelled with provenance details including: date, trench number and location.

3.5 POST EXCAVATION ANALYSES

The following analyses and their respective methods were completed during and/or following the completion of test excavation and surface collection.

3.5.1 Geomorphic and Soil Analysis

Geomorpologist Dr. Peter Mitchell of Groundtruth Consulting was engaged to analyse excavated profiles and sand deposits recovered during test excavation. The purpose of the analysis was to identify and describe natural soils and sediments present within the study area and interpret them in a geomorphic context. This enabled Aboriginal objects identified during the test excavation to be placed within a geomorphic and pedologic context.

Mitchell conducted fieldwork on the 7th and 20th July 2005, inspecting three open test trenches. Mitchell's analysis of the other trenches relied on soil samples, photographs and section logs provided by AHMS and 25mm auger holes placed adjacent to each trench location. Road cutting and drain sections in the study area locality were also examined.

On completion of the test excavation programme soil samples collected from each spit and photographs of each trench taken before, during and after excavation were provided to Mitchell. The soils and photographs were examined to identify all discrete layers of soil material found across the study area. The samples were examined for field texture grading, colours were

matched to the Munsell chart and pH was determined with an electronic meter using a 1:5 soil water suspension. To assist with the interpretation of the recovered artefact assemblage, soil layer descriptions were linked to archaeological spit numbers and each layer numbered in a relative chronological sequence. Variations of any one layer were ascribed a subscript number. This technique allowed relative stratigraphic correlations to be made between trenches.

On the request of AHMS, Mitchell also analysed variation in soil grain size to test the hypothesis that Aeolian processes had been in operation in the past. Samples from representative profiles that showed variation in soil texture were selected and wet-sieved through 0.063mm mesh and then dry-sieved at half Phi intervals to examine the mineralogy and surface texture of the sand fraction under a binocular microscope. The results were plotted on a line graph.

The results of analyses were discussed in detail by Mitchell and conclusions made on soil materials and the geomorphic history of the study area. A draft report was provided to AHMS for comment. On completion of the stone artefact analysis the report was provided to Mitchell for further comment. Mitchell's report was then finalised.

3.5.2 Stone Artefact Analysis

Emeritus Professor Richard Wright conducted a descriptive and functional recording of recovered artefacts. The analysis aimed to determine:

- Quantity of stone, by counts and weight;
- Suspected origin of the stone (whether from quarries where the rock was in place, or dispersed along riverbeds);
- Identification of artefacts;
- Interpretation of finished implements among the artefacts, including function of the implements and what they indicate about how the makers of the implements lived;
- Patterns in spatial and chronological distribution of the artefacts within the site;
- Age of the site;
- Archaeological research potential and significance of the site

These aims were achieved through analysis of raw material type, core-flake ratio, utilisation, secondary flaking characteristics, reduction sequence, cortex percentage and formal tool / technological identification.

The stone was firstly sorted into the following categories:

Definite Artefacts: Humanly manufactured stone forms recognised by the conchoidal fracturing that characterises deliberately flaked glassy, and fine-grained or grainless, stone.

Probable Artefacts: Stone forms rendered probably (but not definite) by the fresh fracturing of a coarse-grained stone; and

Manuports: Objects which are not flaked, but because of their nature must have been humanly brought to the site (eg. Lumps of sandstone in a windblown sand dune).

Minimum Number of Artefacts (MNA) was calculated by totalling complete flakes, butts of flakes, finished implements (eg. Backed blades and scrapers) and cores.

Due to variation in spit volume within and between trenches, artefact density and artefact counts were standardised by estimating the density per cubic metre.

Following initial sorting all Definite Artefacts were examined under oblique light through x5 Microscope. Any pieces of interest were further examined through a x10 binocular microscope for evidence of use-wear. This included minute chipping of edges, striations and accumulations of silica or polish.

Complete flakes were described using the following attributes: weight, length, width, thickness, percentage of cortex on the back of the flake, width and depth of the striking platform on the flake and material.

Stratigraphic differences were then explored by analysing raw material and the occurrence of backed blades. Raw materials analysed were silcrete, quartz and tuff.

Processes that may have affected the stone artefacts following their abandonment on site were investigated by assessing the integrity of the pieces and possible movement of stone through the deposit. Correlations between (1) depth and weight and (2) depth and shape were examined using complete flakes of silcrete and tuff.

A cursory examination of possible conjoins was also conducted on PT3 and PT12.

3.5.3 Carbon 14 Analysis

No datable samples of carbon were retrieved during test excavations. We were unable to perform this analysis.

3.6 ARTEFACT STORAGE

Following analysis, artefacts recovered during the investigation were placed in plastic clip-lock bags labelled with provenance details (date, site, trench number, spit number), stored in archive boxes and transferred to the Australian Museum for storage, as specified in the conditions of the S.87 Permit. DLALC, DTAC and DCAC agreed that this was the most appropriate storage place at the present time.

3.7 REPORTING

Preliminary results of the investigation were documented in a letter report to JPG following completion of the on-site work and partial completion of post-excavation analyses. Once the analyses were finalised the results were documented in this report. The report is consistent with best practices suggested by the NSW *NPWS Draft Aboriginal Cultural Heritage Standards & Guidelines Kit* published in 1997.

4.0 RESULTS

4.1 PREAMBLE

This chapter presents the results of test excavation and surface collection undertaken at Hall Street, Pitt Town during July 2005. Following sub-sections summarise the results of geomorphic and stone analyses and discuss the temporal and spatial patterning of Aboriginal occupation evident across the study area. The interpretation of results and Aboriginal heritage significance assessment are presented in Sections 5 and 8 respectively.

Photographs, trench descriptions describing stratigraphy, plans and section drawings and supplementary reports are included as separate Appendices to this report.

4.2 GEOMORPHIC AND SOIL ANALYSIS

This section describes soil layers encountered during test excavation. Soils are an important source of information for archaeologists because they provide a context for cultural material deposited by people on the ground. The identification of different types of soil can tell us about the type of deposition, integrity and age of artefacts buried within soils.

Dr. Peter Mitchell of Groundtruth Consulting was commissioned to analyse soils from Hall Street, Pitt Town and prepare a detailed report. This section summarises Mitchell's report. A complete version is included as Appendix 5.

4.2.1 Literature Review

A brief review of geological and geomorphic literature on Hawkesbury River terraces was provided by Mitchell as a context for the Pitt Town investigation. Relevant points raised by Mitchell are reproduced below:

- According to existing mapping the study area extends from the Lowlands Formation on the edge of the river and onto the Pitt Town Sand. There is some double about the presence of any outcrop of Ashfield Shale

- Most authors have recognised a similarity between the materials of the Pitt Town Sand and the Agnes Banks Sand. Both sand bodies are now accepted as having a fluvial original and possibly to have been subject to some reworking by westerly winds. Their surface form may be visualised as levee, or source bordering dunes, or a sand sheet. In the field low dune forms are evident at Agnes Banks but they are not clear at Pitt Town.

- There is agreement that the sand bodies disconformably overlie older clays of the Londonderry Formation.

- No reliable age has been placed on either sand deposit but the general opinion considers them to be early Pleistocene or Pliocene. In either case the age of the sand is substantially

greater than the known period of occupation by Aboriginal people and therefore no archaeology is to be expected on buried land surfaces within the sand.

- Benson[25] and Bannerman and Hazelton[26] both noted a slope relationship between the soil profile, iron/organic pan development and vegetation species linked to lateral soil drainage conditions in the Agnes Banks Sand. A similar sequence was described at Pitt Town by Mitchell[27].

- Both sand bodies and their associated vegetation have been extensively disturbed and partly destroyed by quarry operations although sufficient natural vegetation remains at Agnes Banks to understand the original pattern[28]. This flora list may be a guide to potential Aboriginal plant foods.

- Broader scale vegetation mapping by Bensen[29] provides no information on the Pitt Town Sand. A thesis by Kelly[30] apparently reconstructed the vegetation of the Pitt Town area but Groundtruth Consulting has not been able to obtain a copy of this work.

- The Lowlands Formation is regularly inundated by floodwater and in the study area land below 10m ASL can be regarded as being within the range of the mean annual flood (2.33 years average recurrence interval). The geomorphology of this landscape has been extensively modified by large floods over the past 150 years and any archaeology that the Lowlands Formation originally contained is very likely to have been disrupted by these events.

4.2.2 Soil Analysis

Mitchell identified twelve soil layers across the study area. Each layer was numbered in a chronological sequence. Variations within any one layer were ascribed a subscript number. These are described in detail in Mitchell's report. The summary table is reproduced below.

Table 4.1: Soil Layers in relation to parent material, topographic position with a brief description of their properties.

Test trench #	Elevation: m ASL	Geological Formation	Soil Landscape
PT1	10.0	Lowlands	Freemans Reach
PT2	20.8	Pitt Town Sand	Agnes Banks
PT3	23.9	Pitt Town Sand	Agnes Banks
PT4	24.8	Pitt Town Sand	Agnes Banks
PT5	24.6	Pitt Town Sand	Agnes Banks
PT6	23.1	Pitt Town Sand	Agnes Banks
PT7	24.1	Pitt Town Sand	Agnes Banks
PT8	23.2	Pitt Town Sand	Agnes Banks
PT9	16.9	Pitt Town Sand possibly over Londonderry Clay	Agnes Banks perhaps with a component of Berkshire Park

[25] 1981
[26] 1990
[27] in Comber 2004
[28] Bensen 1981
[29] 1992
[30] 1984

PT10	7.3	Lowlands	Freemans Reach
PT11	15.3	Possibly Ashfield Shale	Possibly Lucas Heights
PT12	~ 24	Pitt Town Sand	Agnes Banks

The technique of analysis used by Mitchell allowed relative stratigraphic correlations to be made between trenches. The vertical sequence and relationship between soil layers was illustrated schematically by Mitchell and is reproduced below.

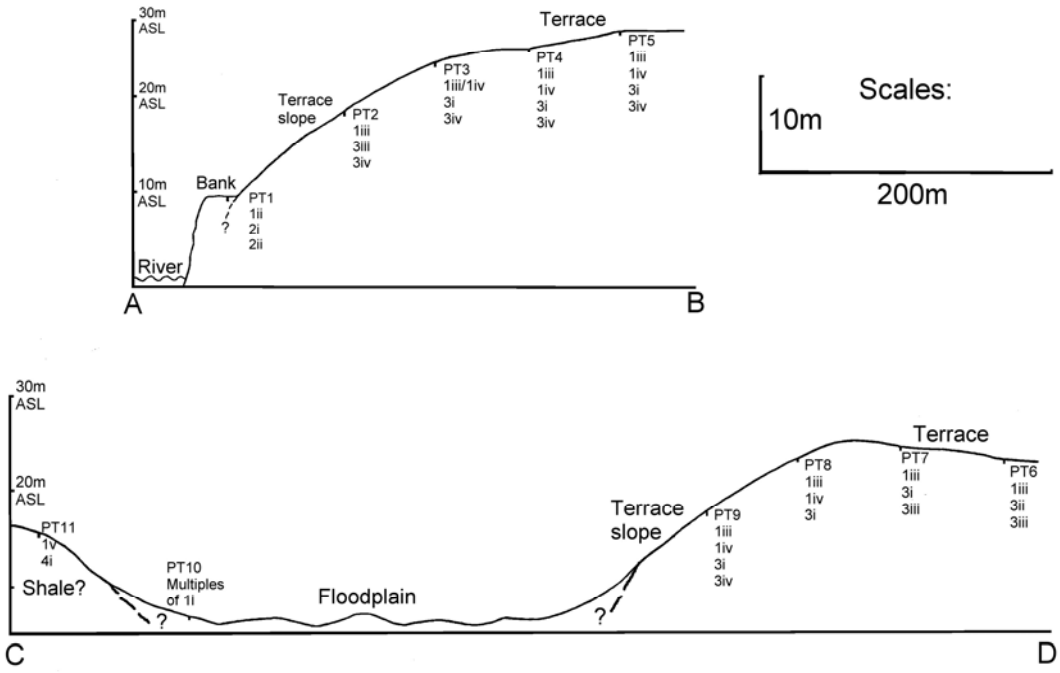


Figure 4.1: Schematic cross section of the terrace and floodplain. The numbers at each trench are the vertical sequence of soil layers.

The results of the analysis confirmed the presence of three distinct landforms across the study area, each with a different suite of soil materials and geomorphic history. A brief discussion of the soil layers and geomorphic history of each landform and Mitchell's predictions for the survival and integrity of Aboriginal archaeology contained within each is outlined below.

River Bank and Modern Floodplain

On the river bank and modern floodplain two separate soil layers with variations within each layer were identified (1i, 1ii, 2i and 2ii). Mitchell interpreted these soils as being recent alluvial deposits. Only slight pedogenesis was evident in layers 1ii and 2i. Both layers were thought to have been affected by severe floods over the past 150 years. Layer 1i showed clear sedimentary bedding. Soil layers within this trench were post-European in age. Layer 1ii was thought to also contain some post-European sediment but was sufficiently modified by pedogenic processes. Mitchell predicted that this layer may contain some disturbed Aboriginal archaeology. Layer 2ii was more difficult to interpret. It is thought that the layer is unlikely to pre-date Aboriginal occupation. Aboriginal objects found in this layer may represent an earlier phase of occupation.

High Ground on the Northern boundary of Lot 18

Soils within this landform were found to be distinctively different from those on the river bank, floodplain and sand terrace. Trench 11 showed a text contrast soil profile contain two soil layers (1v and 4i) thought to be derived from Ashfield Shale. Soil layer 4iv was parent material that pre-dates Aboriginal occupation and was therefore not expected to contain evidence of Aboriginal occupation. Mitchell predicted that if any artefacts were present they would be concentrated at the base of Layer 1v.

Terrace and Terrace Slope

Surface soils on the terrace and terrace slopes were found to be considerably disturbed by cultivation, excavation of drains and tracks, the uprooting of orchard trees and sheet erosion. Given the history of land use Mitchell predicted that Aboriginal artefacts found within Layer 1iii would be disturbed by European land management practices. It is also argued that artefacts found within Layer 1iv would be disturbed and buried by natural bioturbation processes. The lower limit of bioturbation was difficult to determine in the sand body, but was expected to be somewhere near the base of Layers 3i and 3ii. Soil layer 3iv is parent material thought to pre-date Aboriginal occupation. It was therefore predicted that this deposits would not contain Aboriginal artefacts unless they were introduced.

Layer 3i was the most difficult to interpret. It was found to be well bioturbated with an increase in percentage clay with depth. There are two possible explanations for changes in the nature of the artefact assemblage within this layer.

1. That bioturbation operating in this layer has caused some size differentiation in the vertical distribution of artefacts, or

2. Layer 3i does contain some stratigraphy that is not otherwise visible as a primary depositional feature within the alluvium. If this is the case more than one occupation layer may be present. Dating, however, will be extremely difficult unless positively identified cultural feature such as hearths or burials are located. All other dates, especially those based on detrital charcoal and including those based on thermo-luminescence, will be spurious because artefacts and charcoal can move through soil material of any age.

4.2.3 Aeolian Processes on the Terrace

Given the suggestion by previous authors that the crest of the terrace may have been formed by reworking of the fluvial sands by westerly winds an analysis of Aeolian processes was undertaken. If such processes had occurred it is possible that archaeological material of different ages have been buried and preserved within the sand terrace.

The results of grain size analysis showed no uniformity or grain size that might be expected of Aeolian processing. Mitchell therefore concluded that if Aeolian processes occurred, they were only minor and insufficient to create primary depositional features in the profiles.

4.3 STONE ARTEFACT ANALYSIS

This section describes the stone assemblage recovered during test excavation. Stone artefacts are an important source of archaeological information because they survive in the ground for a much longer period of time than other types of artefacts (such as wood, bone and shell) and because they provide evidence of technology and economy in the past. Identification of particular artefact or tool types can tell us about the kind of activities that occurred in the past and provide an indication about how old a particular site might be.

Emeritus Professor Richard Wright was commissioned to analyse the stone artefacts from Hall Street, Pitt Town and prepare a detailed report and artefact catalogue. This section summarises the report prepared by Wright. The full report and catalogue are included in Appendix 4.

4.3.1 Assemblage Recovery

A total of 1153 flaked stone pieces were recovered during the investigation, confirming the presence of archaeological evidence of Aboriginal occupation in soils throughout the study area. 99 of these 1153 pieces were retrieved during surface collection of PT3, around Phil Cleary's house. 1054 stone pieces were recovered during test excavation. One possible manuport of volcanic material was recovered during historical archaeological testing in Lot 14. The rock showed no evidence of being flaked.

Total flaked piece counts and weights by rock type are tabulated below. Counts and weights are for all pieces at least 1cm in dimension. This cut-off point was set deliberately to avoid bias in counting.

Table 4.2: Total flaked piece counts and weights by rock type, in order of prevalence

Tuff count	539
Silcrete count	398
Quartz count	144
Quartzite count	47
Chert count	25
Tuff weight g.	1830.5
Quartzite weight g.	1797.6
Silcrete weight g.	967.8
Quartz weight g.	141.5
Chert weight g.	67.4

The stone used to make the artefacts was predominantly volcanic tuff (46.7%) followed by silcrete (34.5%), quartz (12.5%), quartzite (4.1%) and chert (2.2%). Total Quartzite weight is affected by a few exceptionally large pieces.

Analysis of cortex on the flaked pieces suggests that they were manufactured from river pebbles. There was no evidence that any pieces came from a specific outcrop of rock. Given the study area's location, such pebbles were most easily accessed on exposed river gravel beds along the Hawkesbury River.

4.3.2 Assemblage Distribution

The total number of flaked stone pieces by material type and the average density of flaked pieces recovered from each trench during the test excavation are tabulated below. PT3 contained the greatest density of flaked artefacts (102.77), followed by PT2 (48.21) and PT12 (31.18). The total volume of soil excavated was 51.26m^3

Table 4.3: Flaked piece counts by rock type and average densities of artefacts in trenches excavated across the study area.

Trench	Chert Count	Silcrete Count	Quartzite Count	Quartz Count	Tuff Count	Total No. of Flaked Pieces	Density of Flaked Pieces per cubic metre
PT1	3					3	0.47
PT2	6	91	1	2	8	108	48.21
PT3	5	102	15	106	291	519	102.77
PT4		9	7	1	33	50	10.46
PT5		87	2	1	13	103	21.19
PT6			1	1	3	5	1.43
PT7			1		10	11	3.15
PT8	1	9	2		85	97	20.29
PT9	1		2	1	3	7	1.37
PT10							0
PT11	2				4	6	3.75
PT12	7	35	13	16	74	145	31.18
Total	**25**	**333**	**44**	**128**	**524**	**1054**	-

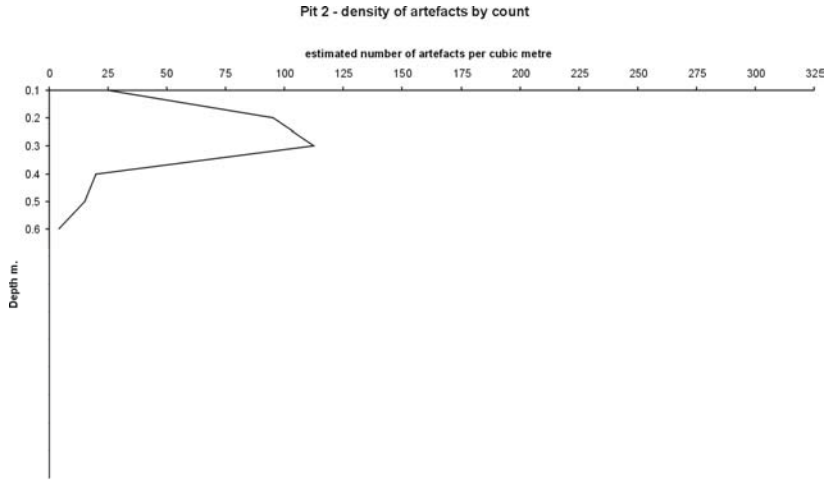
Flaked stone pieces were recovered from all trenches except PT10, situated on low-lying ground. The trench contained multiple sedimentary units of recent alluvium with little soil development. Soil analysis suggests the units are post- European possibly explaining why the trench contained no evidence of Aboriginal occupation.

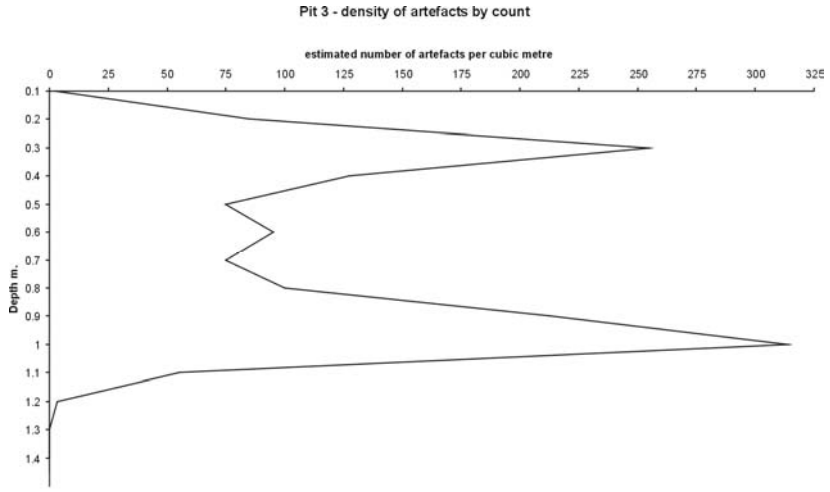
Overall average density of flaked stone above the 1:100 year flood level (17.3m above AHD) was 29.84 pieces per m^3 and below was 1.40 pieces per m^3. The results clearly demonstrate that flaked stone density was highest above the annual flood level, particularly at elevations ranging from 20m to 24m above AHD. PT6, PT7 and PT11 were exceptions to this rule, with the density of artefacts lower than other trenches at similar elevations. There are two possible explanations for this result. The first is relative distance from the Hawkesbury River. Both PT6 and PT7 were significantly further away from the river when compared with their counterparts. The second is variation in geological formation. The soils within PT11 appear to have developed on Ashfield Shale, containing a minor component of alluvium. This was in stark contrast to all other trenches above the annual flood level, which contained sand subsoils formed on an elevated alluvial terrace.

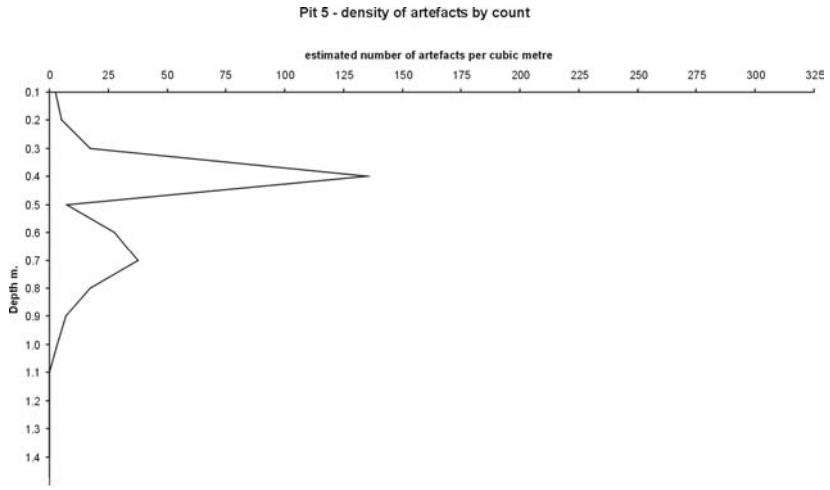
Average flaked stone densities above the 1:100 year flood level are comparable to those recently recovered by Jo McDonald Cultural Heritage Management Pty Ltd in a similar deep sand body at Parramatta along Parramatta River[31]. In general terms, the only trench that demonstrated significantly high densities of flaked stone pieces was PT3 with 102.77 artefacts per cubic metre.

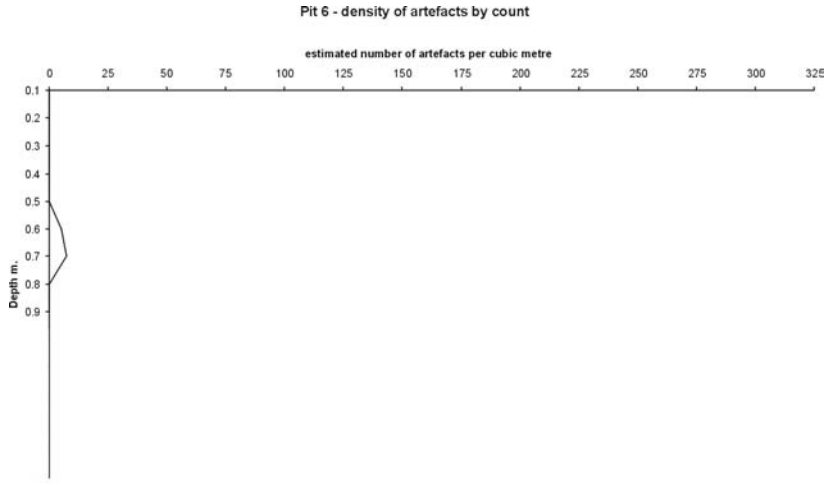
[31] 2003, 2005

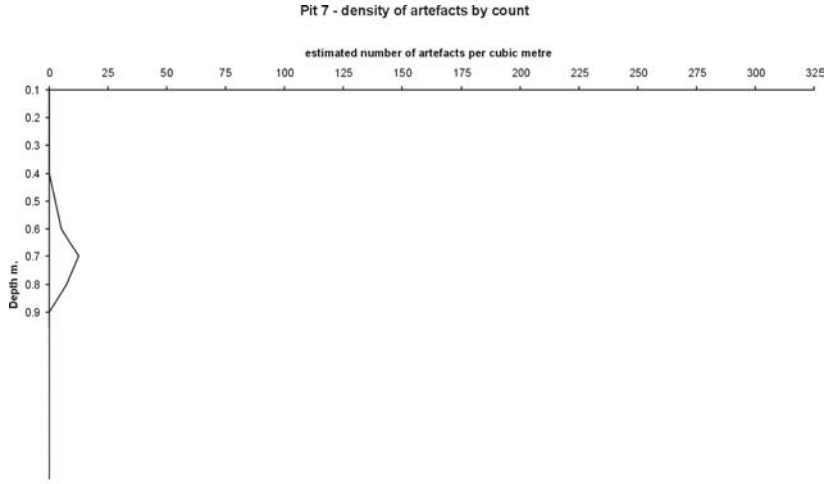
The vertical distribution of flaked stone density within each trench was found to vary considerably with depth. The following graphs show distinct concentrations of flaked stone at various depths within each trench. The most striking variation is seen in Trench PT3. At first glance, such variation suggests either occupation at different times and/or taphonomic processes affecting the site resulting in the vertical movement and/or sorting of flaked pieces thought the deposit. These explanations are explored further in following sub-sections.

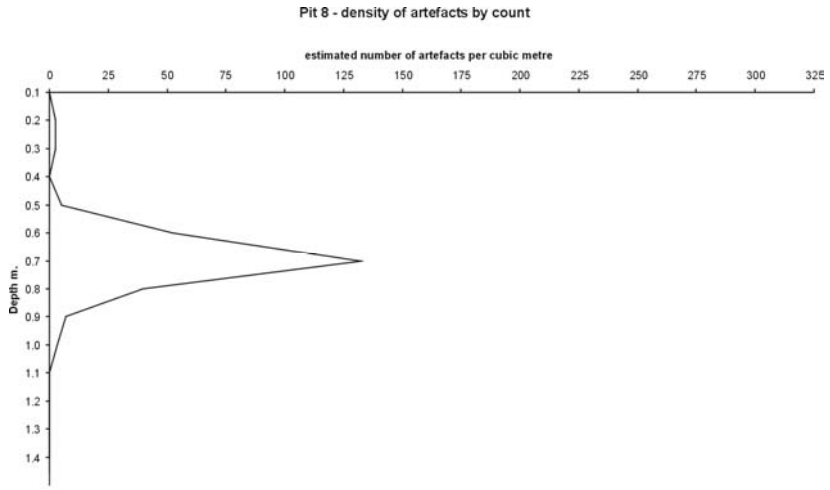







Pit 6 - density of artefacts by count
estimated number of artefacts per cubic metre
0 25 50 75 100 125 150 175 200 225 250 275 300 325
Depth m.
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9


Pit 7 - density of artefacts by count
estimated number of artefacts per cubic metre
0 25 50 75 100 125 150 175 200 225 250 275 300 325
Depth m.
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9


Pit 8 - density of artefacts by count
estimated number of artefacts per cubic metre
0 25 50 75 100 125 150 175 200 225 250 275 300 325
Depth m.
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4

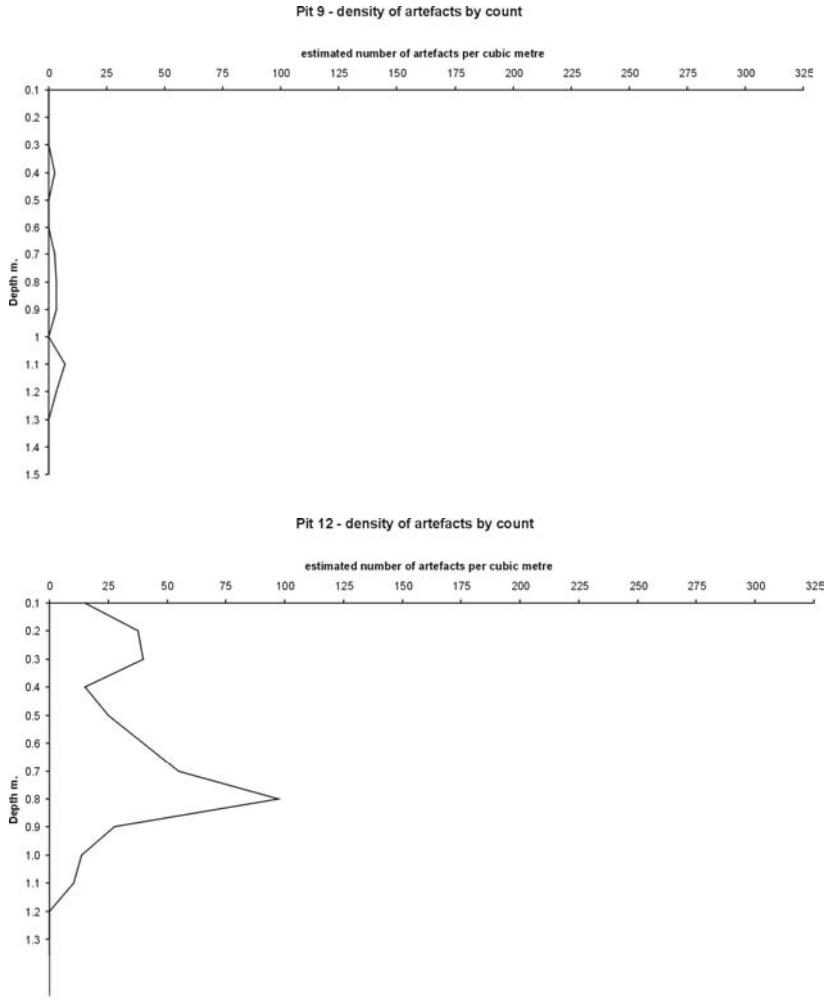


Figure 4.2: Vertical distribution of artefacts in Trenches excavated at Hall Street, Pitt Town.

4.3.3 Artefact Types and Stone Type Variation

As described in Section 3.6.2 The Minimum Number of Artefacts (MNA) for the assemblage recovered at Hall Street, Pitt Town was calculated by totalling the number of complete flakes, butts of flakes, finished implements and cores.

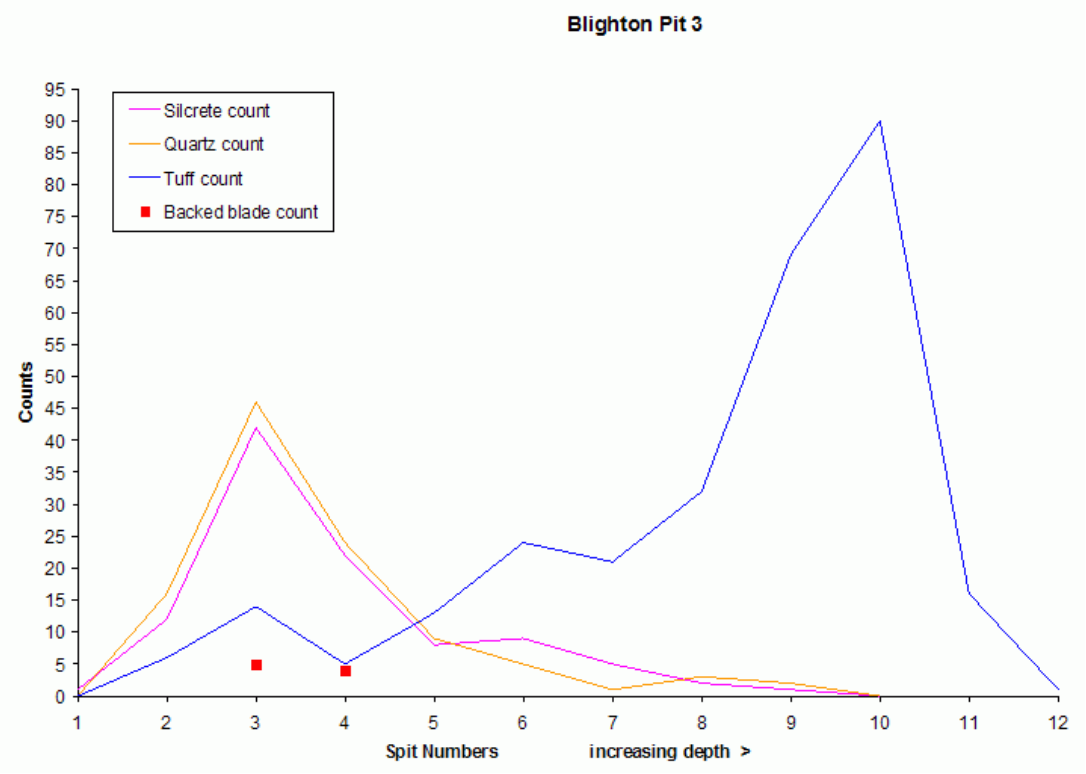
Using these principals Wright concluded that the flaked artefacts excavated at Hall Street, Pitt Town sum to a total of at least 283. To determine how many more than 238 artefacts would require an intensive programme of refitting broken edges. Given time and budgetary constraints such a programme was not possible at this initial stage of the investigation.

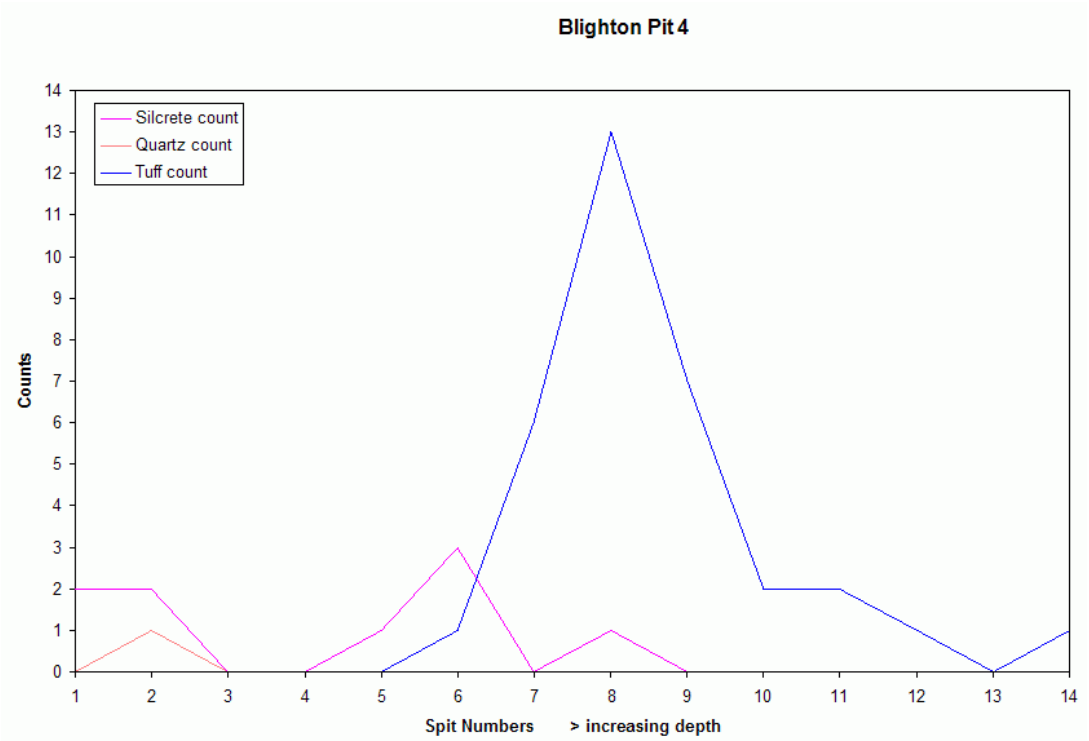
Once sorted, depth variation in definite artefacts by stone material type was analysed in four trenches: PT3, PT4, PT5 and PT12. The stone types analysed were silcrete, quartz and tuff.

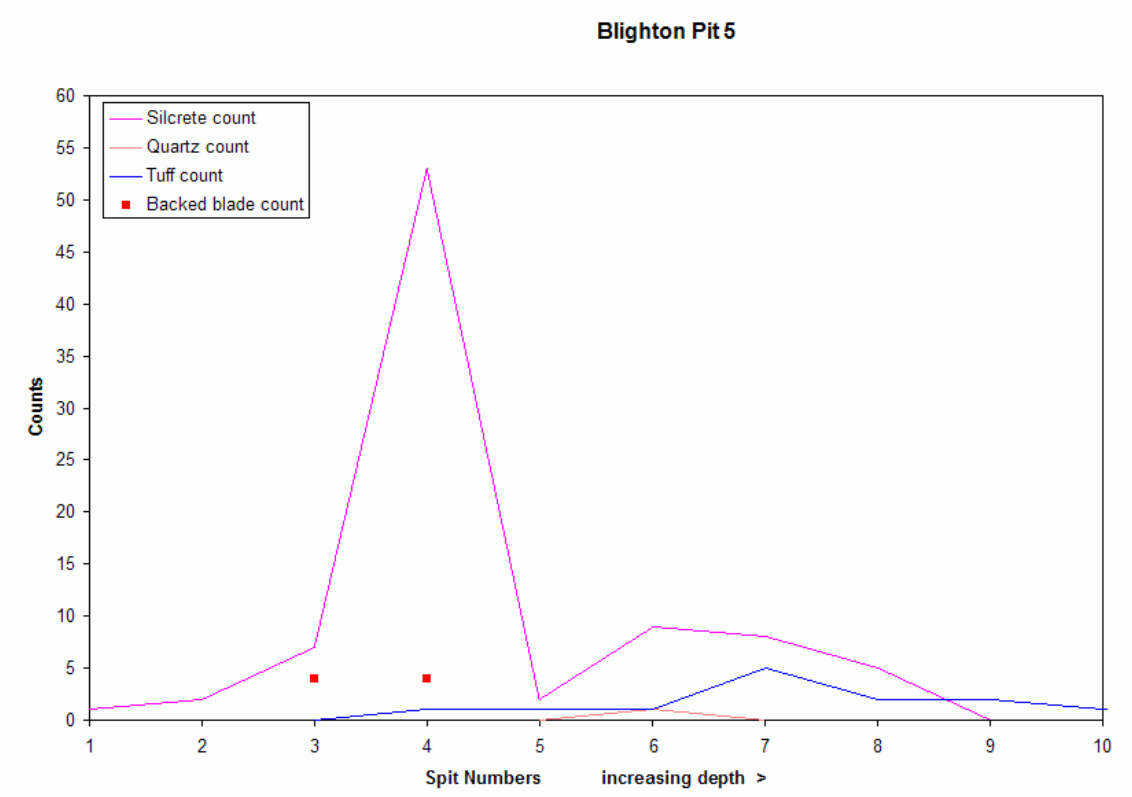
A distinctive diachronic pattern of stone use was found (see Figure 4.3) ie. a clear vertical (time-depth) separation between tuff and silcrete.

Across the trenches analysed the highest density of artefacts was found at approximately 60-110 cm below current ground. The assemblage consisted almost solely of tuff and was generally amorphous ie. non-diagnositic. Very occasional rough scrapers were found. A steeply flaked core reminiscent in form of the flaking of the Kartan industry, but not taking on the form of a classic horsehoof core, was also examined. An analysis of complete flakes from these lower levels showed indications of much simpler flaking than in the upper levels. Successions of primary flakes were typically struck off pebbles of tuff and occasionally one of these flakes was selected for further reduction as a core. Evidence of on-site reduction of artefacts was found.

Between 10 and 50cm a second, less pronounced concentration of artefacts was found. This assemblage was dominated by silcrete and quartz flaked pieces. The upper levels of this unit contained a number of backed blades and one thumbnail scraper. Specialised cores for the production of elongated flakes and platform redirecting flakes, removed while elongated flakes are being struck, were also present. This indicates that stone tools were being manufactured on-site, not merely dropped in the area over time. The assemblage in this upper unit is characteristic of Bondaian technology, reduction techniques, finished forms and raw material use.




Blighton Pit 4
Silcrete count
Quartz count
Tuff count
Counts
Spit Numbers > increasing depth


Blighton Pit 5
Silcrete count
Quartz count
Tuff count
Backed blade count
Counts
Spit Numbers increasing depth >

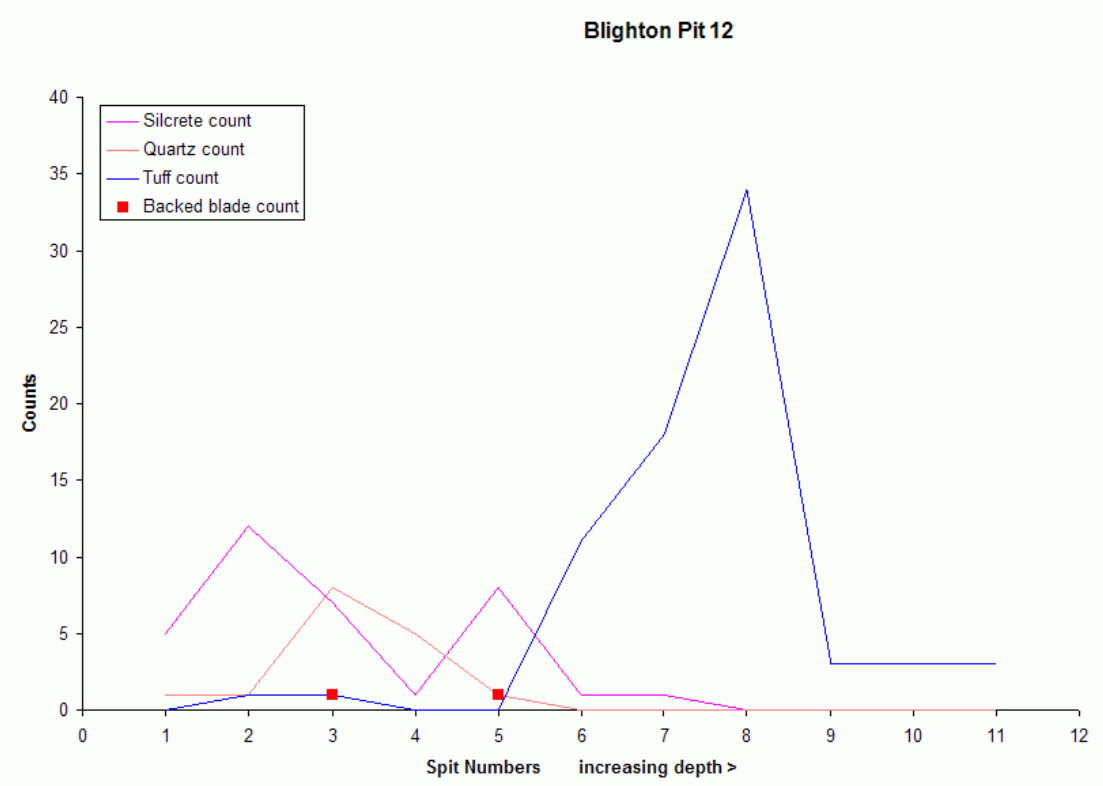


Figure 4.3: Vertical patterns in worked stone types and the density of backed blades within the elevated alluvial sand terrace at Hall Street, Pitt Town.

The presence of backed blades in the assemblage is of particular interest because it is a marker of Bondaian technology and has figured importantly in the literature of Australian archaeology[32]. The artefacts probably served as barbs on spears for hunting or fishing and may have been arranged to form points on a spear. To serve their purpose they would have been attached with gummy resin to the wooden point of the spear. Backed blades are most prolific in assemblages younger than 5000 years BP and rarely found in older assemblages (pre 5000 years BP).

Eloueras are absent from the assemblage and bipolar cores are strikingly low in frequency. These characterise the Late Bondaian eastern coastal industries of NSW. This suggests either occupation and use of the site during this period (the last 1,600 years) was minimal, or evidence of this period has been removed by site formation processes.

Results from PT4, PT5 and PT12 show significant differences in the use of the landscape relating to the upper and lower levels (Figures 4.3). PT3 has good quantities of both the upper Bondaian and lower amorphous industry. PT4 has poor representation of the upper Bondaian industry but good representation of the lower amorphous industry. A similar pattern is seen in PT7 – where the upper industry is absent from the profile. PT5 is characteristically Bondaian with little evidence of the lower industry. PT12 is similar to PT3 and is well-represented by both industries. The results from PT4 are likely to be a result of disturbance. A burnt out tree stump was present in the upper levels of the soil profile.

[32] Mulvaney & Kamminga 1999; Hiscock 2002 & 2002b

4.3.4 Use-wear

Wright examined three basic types of use wear:

- Minute chipping of an edge, due to use in chopping a hard surface;
- Striations (scratches) caused by cutting an abrasive material;
- Accumulations of silica, looking like a polish, due to cutting plants rich in silica.

No significant indications of wear were identified.

4.3.5 Taphonomy

Taphonomic processes considered by Wright included abrasion by wind, natural chemical corrosion in the soil, cracking by fire, damage to artefact edges by trampling and bioturbation in general.

Virtually no evidence of damage by these processes was found. The pieces were in a remarkably pristine condition, apart from the cementation of sand on the surfaces of some of the lower artefacts.

Potlid fractures, caused by heat stress after the flake was detached form the core, were found on some of the flakes. The source of heat, whether it be a campfire or a bush fire, was not able to be determined.

The question of whether artefacts have moved within the sand body was investigated by analysing the correlation between (1) depth and weight of complete flakes (2) depth and flatness of complete flakes. The analysis showed very low correlations, none of which were statistically significant. This indicates there is no significant size or weight sorting of artefacts through the profile.

The integrity of the deposit was examined further by looking for conjoins in Trenches PT3 and PT12. Given time and budgetary constraints only a cursory examination was carried out. The analysis found four pairs of artefacts that fitted together, however flake scars on the artefacts did not match indicated that they were broken flakes rather than conjoins. Only one pair was suggestive of separation in antiquity. Both came from PT3, Spit 9. Finding conjoins within the same spit suggests that the artefact assemblage is relatively intact, with minimal differential movement of artefacts through the deposit.

4.4 SYNTHESIS OF RESULTS

The following conclusions about Aboriginal archaeology at Hall Street, Pitt Town can be drawn from both the stone and soil analyses and observations made in the field during test excavation and surface collection:

- ***Soil disturbance from agricultural land use practices is generally restricted to upper levels of the soil profile (ie. the top 20-30cm)***

  During the initial AHIA disturbance mapping demonstrated that almost all of the study area had been converted to citrus orchards during the last 50 or so years, with agricultural practices concentrated above the 1:100 year flood level. These practices included cultivation, excavation of drains and tracks, uprooting of orchard trees and sheet erosion.

One of the aims of the test excavation program was therefore to explore the impact of such land use practices on soils within the study area, focussing on the effects of ploughing. This information would have direct implications for the integrity of archaeological deposits and features in subsoils.

The results of testing clearly indicate that ploughing has affected the top 20 to 30cm of soil across the study area. Trenches that did not contain a discernable plough zone were restricted to areas below the 1:100 year flood level. Cross-referencing with initial disturbance maps indicates that these areas have not been cultivated during the last 50 years.

On the terrace and terrace slopes a distinctive disturbed plough-zone was evident in all trenches, varying in depth from 20cm to 30cm below the surface (Figure 4.4). Given the nature and duration of ploughing in these areas it is reasonable to assume that archaeological deposits and features within this zone have been significantly disturbed. In essence, ploughing circulates stone artefacts throughout the topsoil. Whilst some artefacts get brought back up to the surface it is likely that, over time, many move down through the deposit to settle on underlying undisturbed soil. This is the most plausible explanation for the concentration of artefacts seen at the 30 to 40 cm level (Spits 3 & 4) in most trenches located on the terrace.

Figure 4.4: Disturbed plough-zone, Trench PT7. A plough-zone was evident in all trenches excavated on the alluvial terrace and terrace slopes

Evidence of deeper disturbance was noted on the terrace in trenches PT4 and PT8. The remains of burnt-out tree stumps were found extending to a depth of up to 80cm below the surface (Figure 4.5). Given that citrus trees were uprooted and removed from the study area the remains are more likely to be those of pre-existing native trees felled during initial land clearance (ie pre 1947). Whilst evidence of tree root activity was noted throughout the sand terrace evidence for the removal of citrus trees was not visible in any of the trenches excavated.

Figure 4.5: Burnt-out tree stump evident in the upper levels of Trench PT4

- ***Bioturbation varied in soils across the study area.***

  Bioturbation is defined as the physical movement of soil material by living organisms and is considered by Mitchell and others to be one of the most important process affecting archaeological deposits. Mitchell's analysis of soil formation processes across the study area demonstrates that bioturbation varies across the study area depending on the age and density of the soil. On the floodplain multiple sedimentary units of recent alluvium showed very little soil development, despite the accumulation of organic sediment on the surface of each alluvial layer. The nearby river bank, on the other hand, showed considerable evidence of faunal mixing and faecal pellets. The topsoil in this area was thought to be pre-European with the incorporation of some more modern alluvium.

  Bioturbation on the alluvial sand terrace and terrace-slopes also varied considerably with depth. Undisturbed alluvium below the plough-zone was strongly bioturbated with a weak earthy soil structure. Below this, the lower limit of bioturbation was difficult to distinguish in subsoils. Mitchell estimated the average depth at 80cm; when the soil density increased and/or there was an increase in ironstone nodules. He then went on to predict that the effects of bioturbation would result in a concentration of artefacts at this level.

  What is particularly interesting is that whilst the stone analysis clearly shows a concentration of artefacts within the 70 to 90cm range, artefact distribution within the sand body does not appear to be the result of bioturbation. There is a distinct change in stone material use evident in the lower levels and no evidence of size sorting of flaked stone.

  The oldest soil layer within the study area was found on high ground on the northern edge of Lot 18. Excavation of trench PT11 showed a distinctively different texture contrast soil. The topsoil within this trench was strongly bioturbated with abundant worm casts evident throughout the soil. A clear bioturbation boundary was present between this layer and underlying pedal clay subsoil; a much denser soil layer.

- *Artefact density varies across landforms*

Perhaps one of the more important conclusions able to be drawn from the test excavation is that artefact density within the study area varies across landforms. As is evident in the table below very few artefacts were found on the river bank and no artefacts were found within the flood channel and flood plain. A low density of artefacts was found within the texture-contrast soils found on the northern edge of Lot 18. Both results contrast sharply with the moderate to high artefact density found on the alluvial terrace and terrace-slopes in the southern portion of the study area.

Table 4.4: Average Artefact Density across landforms within the study area.

Landform	*Average Density of flaked stone per cubic metre*
River-bank, flood channel and flood plain	0.47
The alluvial terrace and terrace slope capped by a low sandy rise of a levee or Aeolian sand sheet at 24m elevation	26.67
An intermediate area of high ground from 12-16m elevation with a texture contrast soil profile on the northern edge of Lot 18.	3.75

A predictive model of artefact density across landforms within the study area is shown on Figure 4.6.

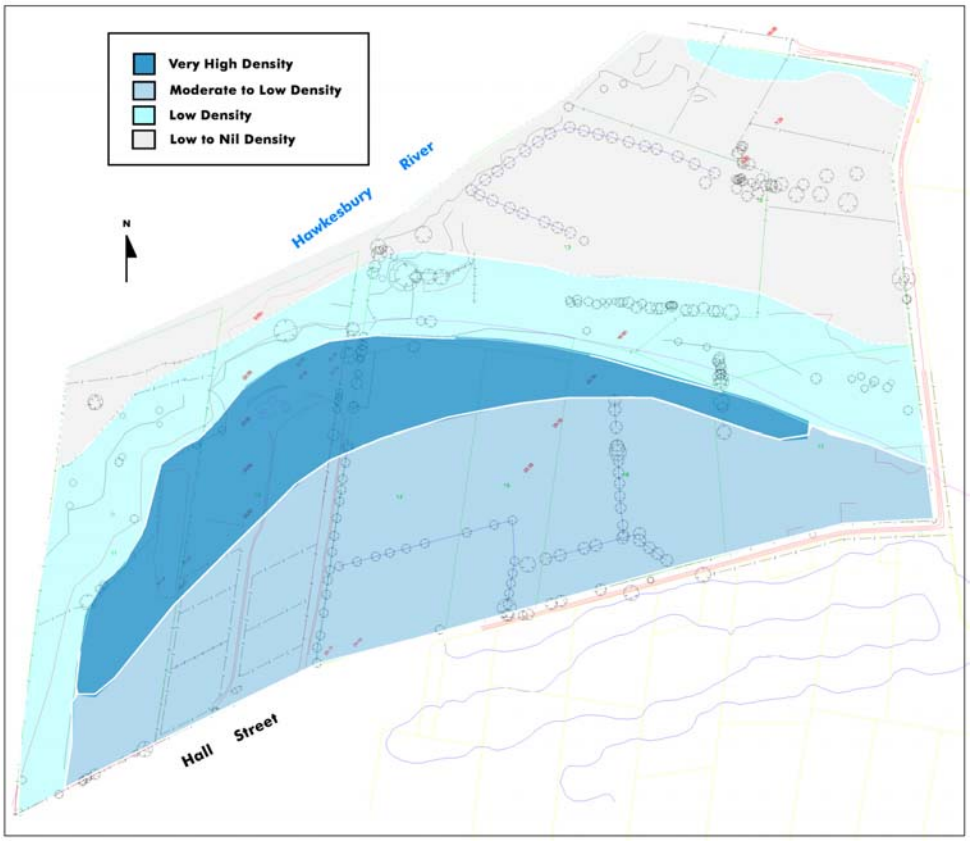


Figure 4.6: Predictive Model of Artefact Density across the study area

The relationship between the average density of flaked stone and elevation is also interesting. Average density above the 1:100 year flood level (17.3m above AHD) was 29.84 pieces per m^3 and below was 1.40 pieces per m^3. The results show a concentration of flaked stone above the 1:100 year flood level between 20m and 24m above AHD.

Both patterns demonstrate a relationship between evidence of Aboriginal occupation and landform. As has been described previously, the age and topographic position of soil layers within the study area varies. The youngest sediments are present on the flood channel and flood plain where multiple layers of alluvium had been deposited in recent years. It is therefore not surprising to find an absence of evidence indicating Aboriginal occupation of this area. If we can assume that the hydrology of the Hawkesbury River was similar during the prehistoric period, any evidence of occupation would have been either washed downstream or buried by flood sediments. Low artefact densities were also evident on the river bank, with only 3 stone flaked pieces found within Trench PT1. Whilst soil layers in this landform appear to have been stable for a longer period of time than those on the flood-plain stone artefacts found in this location are also likely to have been disturbed by regular flooding. Low artefact density in both environments may also be explained by low suitability for intensive occupation. Given the regularity of flooding such low-lying areas may have been damp and prone to insect infestation making them less desirable for long-term camping.

Aboriginal activity appears to have best-survived and been focused on the alluvial terrace and terrace slope above the 1:100 year flood level, particularly within the elevation range of 20m to 24m above AHD. Soils within this range were found to be relatively undisturbed below the plough-zone and contain high densities of stone artefacts. The concentration of Aboriginal activity on this landform is not unexpected, given its topographic position and proximity to the Hawkesbury River. Regional settlement patterning clearly demonstrates that flat, elevated sandy locations adjacent to major water sources contain the highest density of complex Aboriginal occupation sites. What was not expected was the stratified nature of the lithic assemblage and evidence of chronological patterning of site use across the study area. This is discussed in more detail below. Another interesting result is a decrease in artefact density in a southerly direction towards Hall Street. Distance to, and/or views of, the nearby Hawkesbury River were clearly an important factor considered by Aboriginal people when selecting locations to occupy and use.

In contrast to the terrace, elevated ground in the northern portion of Lot 18 showed a distinctly different soil profile containing the oldest subsoils in the study area and no alluvium. Given its topography and soil composition, the landform appears to have been subject to erosion, rather than deposition. The low density of artefacts seen in Trench PT11 may therefore be a result of this process. Alternatively the sample size was too small to pick up concentrations in activity.

- ***The elevated alluvial terrace and terrace slopes contain a deep, stratified stone assemblage with signs of spatial patterning.***

  Analysis of the lithic assemblage recovered from the alluvial terrace and terrace-slopes has shown that the sand body contains a deep stone artefact sequence with indications of some stratigraphic integrity (in the form of at least two distinct occupation phases) with signs of temporal patterning across landforms.

At least two phases of Aboriginal use of the site appear to have survived within the deepest parts of the sand body. The upper levels correspond with a typical Bondaian industry (ie. pre 5000 years) dominated by silcrete, and the lower levels are dominated by tuff and are presumably pre-Bondaian.

As is evident in the Table 4.5 below these two phases can generally be correlated with two distinct soil layers identified by Mitchell: 3i and 1iv.

Table 4.5: Levels of artefact density and corresponding soil layers

Test Trench	Spit Nos. containing the highest density of stone artefacts	Corresponding soil layer classified by Mitchell
PT2	3	3iii
PT 3	3 & 4	1iv / 3i
	9 - 11	3i / 3iv
PT4	1 & 2	1iii
	8 & 9	3i
PT5	3 - 5	1iv
	7 & 8	3i
PT6	5 - 7	1iv
PT7	6 &7	3i / 3iii
PT8	6 & 7	1iv / 3i
PT9	7 & 8	3i
	10 & 11	3i
PT12	2 & 3	1iii / 1iv
	7 - 9	3i

Mitchell describes these two soil layers as follows:

1iv: Relatively undisturbed organic topsoils on the terrace. Brown 7.5YR4/3m, 4/4m to yellowish grey 2.5Y4/1m, loamy sand with slight clay content and moderately high organic matter. Charcoal fragments throughout, strong bioturbation evident and weak earthy to incipient crumb structure. Occasional ironstone nodules to 1cm diameter. Generally located below the cultivated layer in places where the original topsoil was reasonably deep.

3i: Weakly differentiated subsoil on the terrace. Bright brown 7.5YR 5/6m to orange 7.5YR6/6m, fine to medium loamy sand with occasional small gravel fragments. The presence of gravel and the absence of evidence for Aeolian deposition in the grain size analysis indicate that this is an alluvial material, although no clear boundaries are evident in the sections. Single grain to weak earthy fabric with increasing coherence as the clay content increases with depth. This unit may be a separate (and older) depositional body than the overlying topsoils (Layers 1iii and 1iv).

One possible explanation for the concentration of artefacts within soil layer 1iv is vertical movement through plough activity. As discussed previously, stone artefacts deposited on the surface have been circulated within the top 20-30cm of soil by plough action and may have moved downwards and settled above more intact alluvium. This theory is supported by the pattern of artefact frequency in Trenches PT2, PT3 and possibly in PT5, but is not corroborated by the results from Trenches PT4, PT8 or PT12. More detailed open-site excavation and conjoin analysis would be required to clarify this issue.

Artefacts within the lower levels of the sand body (soil layers 3i, 3iii and 3iv) appear to be contained within an older deposition body. Unlike alluvium above, vertical movement does not appear to explain artefact density patterns seen at this lower level. Very low correlations were found between depth and weight of complete flakes and depth and flatness of complete flakes. A pair of conjoins were also found at the same level within soil layer 3i. If the artefacts had moved through the deposit over a long period of time one would expect size-sorting of artefacts and the separation of conjoins through the deposit. The distinct change in stone material with depth, the absence of diagnostic elements typically found at younger sites and general correlations with assemblages recovered from other open sites and shelters in the region suggest that this earlier assemblage may have a reasonable degree of integrity. Some vertical mixing of stone artefacts is to be expected in this type of alluvium. However, the extent of such mixing appears to have been limited. Further conjoin analysis with a larger sample of artefacts is required to confirm this initial result.

Once integrity of the lower levels of the sand body is accepted, differences in the frequency of artefacts in the upper and lower levels between trenches become evident. PT6 and PT7 show an absence of the upper phase of site use, whereas PT5 shows more concentrated use during this period. Evidently, there is considerable temporal patterning across the landscape.

- ***Alluvial, rather than Aeolian processes, are responsible for site formation and preservation on the sand terrace***

  Grain size analysis results provide no evidence for the formation or re-working of the sand terrace by aeolian processes. The analysis demonstrates that the soil is alluvial material. Aeolian processes are therefore not responsible for the preservation of archaeological material on the sand terrace.

  When considered with evidence of a separate earlier occupation unit within the sand body, this result suggest that lower levels may have been sealed by alluvium, presumably during a massive flood event. Such an event is plausible. Evidence for exceptional fluvial activity prior to the last glacial maximum has been found in the Nepean basin[33]. Scientists have classified one particular episode as the 'Cranebrook Pluvial'. Abundant gravels were transported and deposited between 47,000 and 43,000 years BP by a much larger and forceful Nepean River.

  If a similar, more recent, flood event occurred along the Hawkesbury River, it is possible that previous land surfaces on the terrace at Pitt Town were buried. If this is the case, the homogenous sand body must contain separate depositional units that are no longer visible in current soil profiles. Given the degree of leaching that typically occurs within alluvial sands, such a loss of visible stratigraphy is conceivable within the Pitt Town Sands.

[33] Nanson, Young & Stockton, 1987

Future archaeological excavation in the study area should aim to further identify buried landsurfaces within the alluvial terrace soils. This could be achievable by excavating a large area by hand using 5cm spit levels. In addition to identifying buried surfaces, such detailed work would assist in identifying archaeological features, such as knapping floors, hearths, open ovens and stone heat treatment pits. A detailed conjoin analysis of the lithic assemblage recovered from this stage of excavation would also be worthwhile to determine the degree of vertical movement of artefacts through the sand body.

5.0 DISCUSSION

5.1 PREAMBLE

This chapter discusses the research questions presented in Section 3.2 of this report. The research questions were designed to structure the excavation methodology and post excavation analysis, and provide a framework for interpreting the results. The research questions are based on relevant research issues relating to the archaeology of the Hawkesbury / Nepean, with particular reference to Pitt Town and the results of previous excavations at neighbouring properties: Fernadell and Bona Vista. A discussion of the research questions drawing on the results of excavation is presented below, together with a comparison of Aboriginal archaeology at Hall Street, Pitt Town with other local and regional sites.

5.2 RESEARCH QUESTIONS

What impact has ploughing had on the integrity of the archaeological deposit?

As discussed in detail in Section 4.4 the results at Pitt Town clearly indicate that ploughing has disturbed the top 20 to 30cm of soil in cultivated areas - which are generally restricted to the alluvial terrace and terrace-slopes. Given the nature and duration of cultivation, it is concluded that ploughing has significantly disturbed archaeological deposits and features within the plough-zone. It is also concluded that vertical mixing of topsoils within this zone has resulted in a concentration of artefacts on underlying undisturbed soil. This is supported by the peak in artefact density seen at the 30 to 40cm level (Spits 3 & 4) in most trenches located on the terrace.

Artefact density patterning between trenches indicates spatial patterning of Aboriginal use across the landscape. This suggests that, whilst vertical mixing may have resulted in a concentration of artefacts at a particular level within the soil profile, horizontal movement within the plough-zone may be quite limited. Further, more detailed excavation work and conjoin analysis is required to test these conclusions. This work would focus on identifying archaeological features, such as knapping floors, within and directly below the plough-zone.

What impact has flooding of the Hawkesbury-Nepean had on archaeological deposits? Are buried land surfaces present and, if so, how intact are they and what information can be recovered through archaeological excavation?

Flooding of the Hawkesbury River at Pitt Town appears to have had opposing effects on archaeological deposits at Hall Street, depending on their distance from the river and elevation. This ultimately reflects changes in the intensity and frequency of flood events over time and the resulting age of deposits.

Archaeological excavation has demonstrated that landforms closest to the river and below the 1:100 year flood level have been subject to both erosion and deposition. Recent minor floods have resulted in the deposition of alluvium on the flood-plain. These floods, however, do not appear to have reached the height of the current river bank (9m AHD). The soil profile in this area has been stable for long enough to develop top-soil.

In contrast, a major flood event was documented along the Hawkesbury River in 1867. During this event floodwaters reached a height of approximately 20m above AHD at Pitt Town. The extent of floodwater is shown on Figure 5.1 below. A flood at this scale is large and intensive enough to scour deposits from the older alluvial terrace, below 20m AHD. Such events have resulted in the formation of the current terrace-slope.

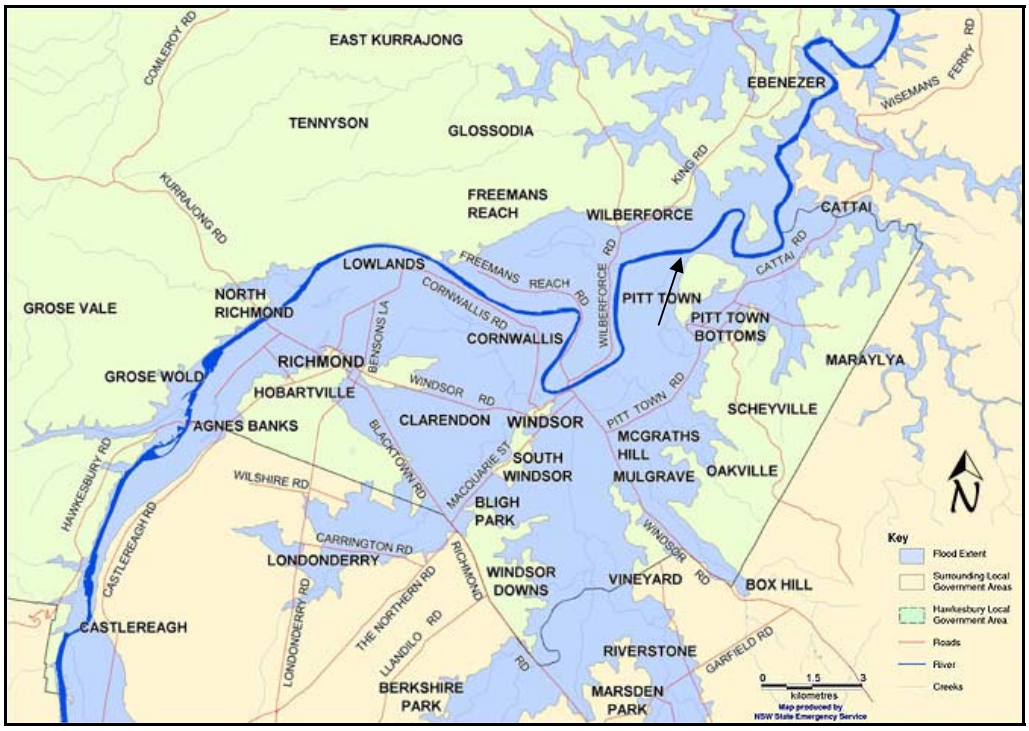


Figure 5.1: Map showing the extent of flooding during the 1867 flood event

Above the 1:100 year flood level the effects of flooding are unknown. The height of the terrace, however, suggests stability and possible deposition rather than erosion. In the historical period flood events did not reach the maximum height of the alluvial terrace (25m AHD). However, given that the terrace is composed of alluvial sand, such events must have reached this height at some stage in the past. Studies on the geomorphology of the Hawkesbury – Nepean river corridor have documented exceptional fluvial activity prior to the last glacial maximum[34]. One such episode classified as the 'Cranebrook Pluvial' transported and deposited abundant gravels between 47,000 and 43,000 years BP. Evidently, the Hawkesbury-Nepean was a much larger and more forceful river during this period. It is plausible that during the more distant past larger-scale flood events have buried previous land surfaces on the alluvial terrace.

The results of test excavation above the 1:100 year flood level generally support this conclusion. The deepest soil profile on the alluvial terrace was found within the elevation range of 20 to 24m above AHD and contained a profile with some evidence for stratigraphic integrity and a relatively intact lithic assemblage. No evidence for the vertical movement of artefacts through the lower levels of the sand body was found during the analysis. This may indicate that previous land surfaces on the terrace were buried by large-scale flood events in the past but that the primary depositional layers are no longer visible within the sand body, presumably due to leaching.

[34] Nanson, Young & Stockton, 1987

Integrity of the artefact assemblage contained within lower levels of the alluvial terrace is supported by:

- the distinctive change in stone material with depth;
- the absence of Bondaian elements found in upper levels of the terrace;
- low correlations between depth and weight of complete flakes and depth and flatness of complete flakes suggesting very little size-sorting of the assemblage;
- the presence of a pair of conjoins at the same level; and
- general correlations with assemblages recovered from other open sites and shelters in the region. This is discussed in more detail in the following Section.

Whilst some vertical movement of stone artefacts is to be expected in such a homogenous low-density sand body, the extent of such movement appears to be limited. Further conjoin analysis with a larger sample of artefacts is required to confirm this result.

Controlled, open-area manual excavation on a portion of the deepest alluvial deposit could recover some valuable information on how Aboriginal people used the area in the past. Manual excavation using 5cm spit levels would assist in identifying discrete knapping floors, hearths, heat-treating pits and other archaeological features and allow for more spatial control during analysis of the recovered assemblage. If present, datable material would also provide a more reliable temporal context for the assemblage. Information such as this is highly valuable to both the Aboriginal and scientific community.

How long did Aboriginal people use the area?

The presence of backed artefacts within the upper levels of the alluvial terrace suggests that Aboriginal use of the site is consistent with a middle Holocene age (up to 6,000 years old). No such diagnostic elements were found in lower levels, however, the predominance of tuff, presence of rough scrapers and simple flaking technology suggests that this phase of Aboriginal use of the site is likely to be pre-Bondaian (pre 6,000 years). No datable organic material was recovered during excavation. OSL dating of quartz crystals at various levels within the sand profile may assist in determining the integrity of the alluvial terrace.

What types of artefacts were produced and what were they used for? **and** ***What stone materials were used and where did they come from?***

The lower levels of the alluvial terrace (roughly 60-110cm below the surface) contained the greatest concentration of artefacts. The assemblage consisted almost solely of tuff and was generally amorphous. Very occasional rough scrapers were found. A steeply flaked core reminiscent in form of the flaking of the Kartan industry, but not taking on the form of a classic horsehoof core, was also found. An analysis of complete flakes from these lower levels showed indications of much simpler flaking than in the upper levels. A succession of flakes was typically struck off pebbles of tuff and occasionally one of these flakes was selected for further reduction as a core. Evidence of on-site reduction of artefacts was found.

In contrast, the upper levels of the alluvial terrace (10 and 50cm below ground) contained a less pronounced concentration of artefacts. This assemblage was dominated by silcrete and quartz flaked stone pieces and contained a number of backed blades and one thumbnail scraper. Specialised cores for the production of elongated flakes and platform redirecting flakes, removed while elongated flakes are being struck, were also present. The assemblage components described above are characteristic of Bondaian technology.

Analysis of cortex on the flaked pieces suggests that they were manufactured from river pebbles. There is no evidence that any pieces came from a specific outcrop of rock. Given the study area's location such pebbles were most easily accessed on exposed river gravel beds along the Hawkesbury River. Changes in the type of stone material used over time (ie. tuff in earlier levels, silcrete and quartz in later levels) are suggestive of either a change in the availability of such gravels, or a shift in the selection of stone. It is possible that different gravel beds, containing a different suite of stone materials, were exposed over time along the river depending on prevailing climatic conditions and their effect on the course of the river.

5.3 SITE COMPARISON

5.3.1 Local Context

Despite disturbance of the top 20-30cm of soil by ploughing, the Pitt Town Sands body at Hall Street appears to contain a relatively intact stone artefact assemblage with some vertical integrity, preserving at least two separate phases of occupation by Aboriginal people. Preservation of multiple periods of occupation within the landform is directly related to the depth of the sand body at this location. The alluvial terrace is elevated and close enough to the Hawkesbury River for deposition of alluvium over time, sealing previous surfaces and associated archaeology. This differs dramatically from results obtained by Comber[35], less than 200m south of the study area.

Comber found that the Pitt Town sand body at Fernadell and Bona Vista was much shallower (generally less than 1 metre deep). The deposit had undergone a substantial degree of vertical disturbance from European farming practices, including land clearance and repetitive ploughing, and bioturbation to a depth of 80 cm below the ground surface. This resulted in the vertical movement of stone artefacts through the soil profile forming a layer above more compact soil (ie. at the base of the ploughing zone. The soil and associated assemblage lacked stratigraphic integrity. Unsurprisingly, temporal differentiation in the artefact assemblage could not be discerned during excavation and analysis, and no cultural features, such as hearths, pits, lenses, shell or other organic material, were identified during excavation. Additionally, no datable material was recovered during the testing program.

Artefact density was found to vary across the study area. An alluvial levee that runs parallel to Bathurst Street contained the highest density of artefacts (between 24 and 148 per square metre). Test trenches to the south east of Johnson Street, in contrast, contained 0-13 artefacts per metre square. This pattern corresponds well with test excavation results and predictive modelling at Hall Street. The levee described by Comber is essentially an extension of the most elevated portion of the alluvial terrace north recorded at Hall Street. It is therefore not surprising to find a concentration of artefacts in this location. South east of Johnson Street, the ground was much less elevated, sloping to the south and east towards Longneck Lagoon. A decrease in artefact density

[35] Comber, 2004

in this area corresponds with the decline in artefact density seen south towards Hall Street, away from the river. Both investigations indicate that Aboriginal people targeted more elevated portions of the Pitt Town Sand body closest to the Hawkesbury River for intensive occupation and the manufacture of stone tools.

The predominant stone material used at Fernadell and Bona Vista was rhyolitic tuff, followed by silcrete, quartz, quartzite, unclassified chalcedony and other volcanic stone types. Artefact size was generally small, consisting of mostly flake debitage and heat fractured pieces of stone. Diagnostic elements included microliths and a possible thumbnail scraper, suggesting an age of less than 4,500 years BP. Whist the predominance of tuff appears to correspond with the assemblage found in the lower levels of the alluvial terrace at Hall Street, the size of the artefacts deviates from the Hall Street lithic assemblage. Tuff artefacts found at the lower levels of Hall Street were generally large primary flakes whereas the tuff artefacts from Fernadell and Bona Vista were Bondaian. Conversely, the Bondaian material seen at Hall Street was dominated by silcrete and quartz. In general terms, the assemblages seem to have little in common. This is likely to be a result of the poor integrity of the assemblage recovered from Fernadell and Bona Vista rather than changes in material use across the landscape during the Bondaian period.

5.3.2 Regional Context

To understand the significance of Aboriginal archaeology at Hall Street, Pitt Town, research was undertaken to find comparable sites within the Sydney Basin. Excavation reports and journal articles published for the following sites were reviewed.

- Shaws Creek KII Shelter site, Nepean River[36]
- Site RS1 at Regentville, Western Sydney[37]
- Landscapes in the Second Ponds Creek Valley[38]
- 109 – 113 George Street, Parramatta[39]
- Site CG1, at the corner of George and Charles Streets, Parramatta[40]
- Darling Mills State Forest 2 shelter site, West Pennant Hills[41]
- An Aboriginal site on the corner of Baker and George Streets, Windsor[42]

Sites excavated in the nearby Hunter Valley were also relevant for their characterisation of Bondaian and pre-Bondaian assemblages and discussion of Aeolian versus alluvial sand deposition[43].

The site most relevant for comparison with the Hall Street lithic assemblage is Site CG1, an open site buried within a sand body at Parramatta, adjacent to Parramatta River and Parramatta CBD. Salvage excavation of the site, was conducted by Jo McDonald Cultural Heritage Management between October 2002 and December 2002. An Excavation Report on the results of the investigation was submitted to DEC in January 2005. More than 6,500 stone artefacts were recovered from the sand body. Although no datable material was recovered during excavation, different tool types and raw materials were found at two levels within the sand body, indicating the preservation of different phases of Aboriginal occupation at the site. The lower level

[36] Kohen *et al.*, 1981
[37] Craib, Bonhomme, Mangold and Williams, 1999
[38] Jo McDonald Cultural Heritage Management, 2005
[39] Jo McDonald Cultural Heritage Management, 2003
[40] Jo McDonald Cultural Heritage Management, 2005
[41] Attenbrow, 1993
[42] Jo McDonald Cultural Heritage Management, 1998
[43] Baker, 1993; Hiscock, Hughes, Shawcross & Paton, 2000; Koettig, 1992

contained an older predominantly tuff assemblage estimated to be between 10,000 and 20, 000 years BP. The more recent phase was thought to date to the last 2,000 years and contained mostly silcrete. The top of the sand was significantly disturbed by 19th and 20th century land use practices, including the demolition of buildings during the historic period. Patterns in the recovered stone assemblage resemble those seen at Hall Street, Pitt Town. Specifically, two distinct periods of occupation, the earlier based on tuff and the later based on silcrete.

As is the case at Pitt Town, the sand body at Parramatta is believed to have been deposited well before humans occupied the landscape. For this reason, McDonald argued that the stratified nature of the deposit resulted from the vertical (downward) movement of artefacts through the sand body at a uniform rate through deflation and bioturbation. "Artefacts are lower in the deposit because they have had longer to move downwards through the sandy matrix"[44]. The presence of living floors within the sand body, however, does not support this interpretation. It was therefore postulated that the site may have been buried at some stage by mobile river sands. This explanation was not favoured because of the homogenous nature of the sand body. No discrete alluvial depositional events were evident within the soil profile. Given that the site was excavated in 20cm spits, further analysis to determine whether discrete depositional events were present was not possible. Subsequently, site formation processes at Site CG1 were not resolved. Future archaeological investigations of the sand body at Parramatta will hopefully attempt to resolve this issue. It would be valuable to compare site formation processes within the Parramatta Sands with those identified during future investigations at Pitt Town.

A very useful discussion of Site CG1 within its regional setting was compiled by Jo McDonald CHM. Other sites in the region that displayed technological signatures were identified, with the results displayed in two tables. Because of their relevance to the lithic assemblage at Hall Street, they are reproduced overleaf.

As highlighted by McDonald, the density of flaked silcrete appears to increase in the upper levels of several sites[45]. These sites include site CG1 at Parramatta (nd), sites RH/CC2, RH/Sc excavated by McDonald at Rouse Hill ADI, Cherrybrook shelter (after c 2,200 years BP) and Devlins Creek shelter (c1,400 – 1,350 years BP). Exceptions include John Curtin Reserve, where silcrete was the dominant material used throughout the last 5,600 years and Darling Mills, where quartz was the dominant raw material in upper levels. The use of silcrete at Darling Mills shelter peaked at c.1,500 years BP. A decrease in the use of silcrete is also seen at Mill Creek after 2,200 BP and Bardens Creek before 1,600BP. At both sites quartz was the preferred stone used for flaking during later periods. McDonald suggests a regional trend for this deviation ie. an increase in the use of silcrete to the north and a decrease in the south.[46]

An early preference for the use of silicified tuff within the Sydney Basin is evident at a number of shelter sites, including Darling Mills 2 (6,700 BP to 10,100BP) and Shaws Creek KII, where tuff was found throughout the sequence. McDonald also refers to a similar pattern at Great Mackeral Rockshelter and Upside Down Man shelter sites[47]. Site CG1 and the assemblage present within the sand body at Hall Street, Pitt Town, fit this pattern. As noted by McDonald, very few open sites with a strong component of silicified tuff have been found to-date.

[44] Jo McDonald CHM, 2005: p58
[45] Jo McDonald CHM, 2005: p40
[46] Jo McDonald CHM, 2005: p88
[47] Jo McDonald CHM, 2005: p40

Table 5.1: Stratigraphic distribution of raw materials at sites in great Western Sydney
(Reproduced from Jo McDonald CHM 2005).

Site Name	Dates or technology	Level	Silcrete	Quartz	S Tuff Chert	Other	Total
RH/CC2	Technology - Bondaian	Top	2,675	253	522	22	3,472
	Probably mixed assemblage	Middle	1,430	119	639	17	2,205
	Technology – Pre-Bondaian	Bottom	419	118	1,498	64	2,099
RH/SC5		Test Ex	228	52	152	3	435
	Technology – Pre-Bondaian	All Open	117	40	676	7	840
		X	25	8	94	1	128
		Y	59	16	321	2	398
		Z	32	16	252	4	304
Jamisons Creek open site	3980±140BP (SUA-1231)	1-3	20	16	137	25	198
		4	7	30	234	61	332
	7010±110BP (SUA-1233)	base					
Shaws Creek KII		I	4%	41%	31%	17%	?
	1580±190BP (SUA-1307) 1840±70BP (Beta-1213)	II	3%	29%	50%	16%	?
	2235±120BP (Beta-1210)	III	4%	19%	59%	16%	?
	4140±180BP (Beta-1211) 7860±220BP (SUA-1398)	IV	3%	24%	54%	18%	?
	12980±480BP (Beta-1209)	V	1%	15%	66%	18%	?
		VI	1%	21%	66%	12%	?
Cherrybrook		1	93	94	21		208
		2-3	497	806	102		1,405
		4	147	129	23		299
		5-6	95	169	14		278
	2200±60BP (Beta-11896)	7-8	20	68	12		100
		9-15	26	73	22		121
Devlins Ck 1		1-7	33	20	1		54
	1340±50 BP (Beta-76605)	8	64	54	11		129
	1410±50 BP (Beta-76606)	9	56	133	4		193
		10-11	23	109	8		140
Darling Mills State Forest site 2		1a, 1 & 2	18	125	9	12	164
		3	28	170	21	20	239
	1560±50 BP (Wk-2962)	4-7	51	130	21	8	210
	6740±120 BP (Wk-2963) 10150±130 BP (Wk-2511)	8-13	5	23	24	7	59
John Curtin Reserve (Shelter)	(Surface collection)	SC	115	75	13	8	211
	1640±60BP (Wk-2084)	1-5	34	28	1		63
		6	47	23	2	5	77
	5640±80BP (Wk-2085)	7-11	25	17	3	6	51
Bardens Creek 9 (Shelter)		SC	12	72	4	1	89
		1	216	834	91	3	1,144
	1630±90BP (SUA-1746)	2	220	938	116	8	1,282
		3	53	272	28	1	354
		4	73	73	5		101
Mill Creek 11		1-2	154	193	109		456
	480±70BP (SUA-2255)	3-4	517	974	464		1,955
	1520±70BP (SUA-2256)	5-6	1,755	2,275	960		4,990
		7	1,121	1,112	831		3,064
	2220±70BP (SUA-2257)	8-11	1,598	978	632		3,208

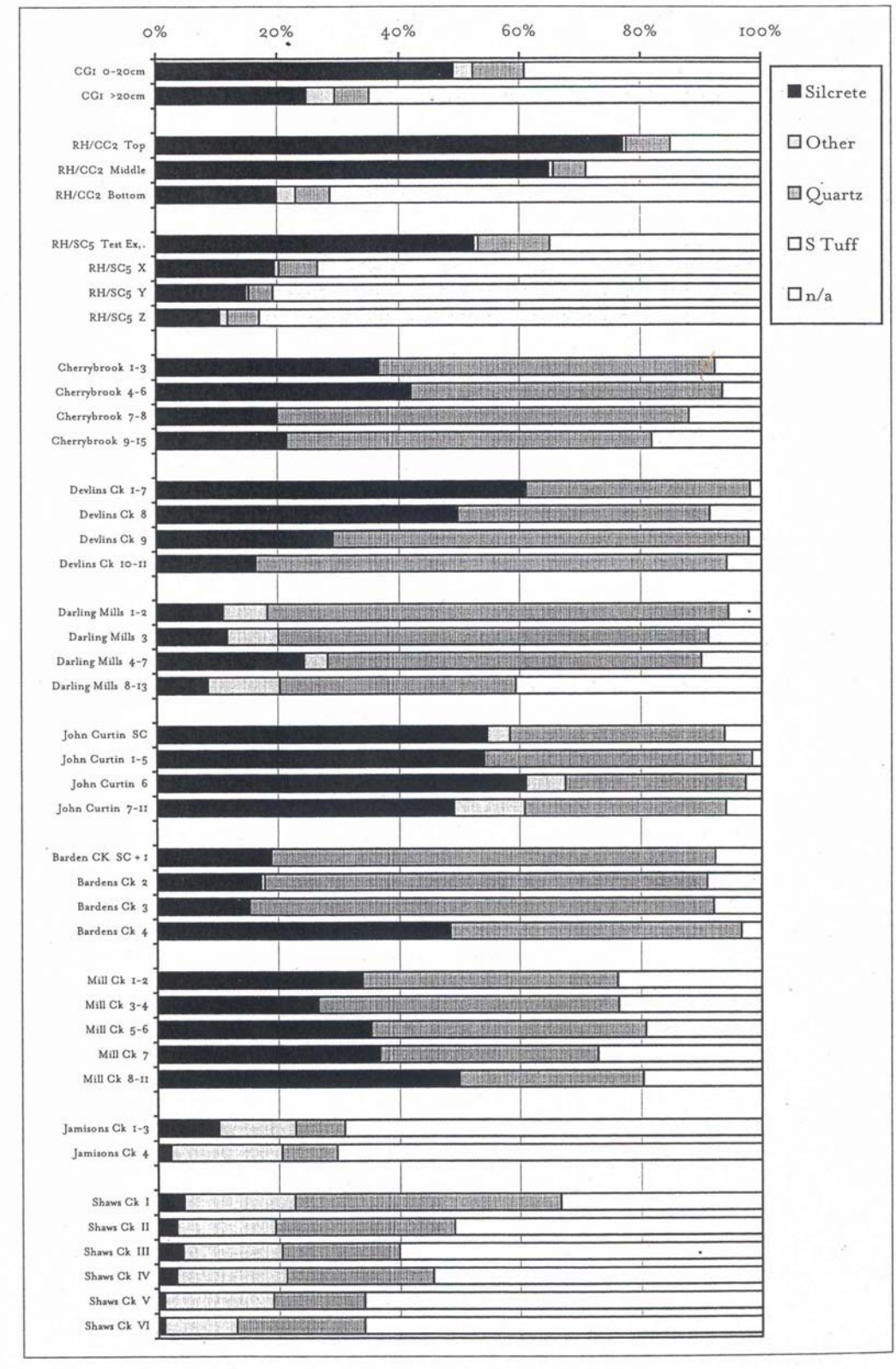


Figure 5.2: Relative percentages of stone assemblages showing change over time in raw material use. (Reproduced from Jo McDonald CHM 2005).

One possible explanation for a shift in stone material use over time is change in the distribution of stone sources and their subsequent access and use by Aboriginal people.[48] A review of dated sites across the Sydney region suggests that the Hawkesbury-Nepean River was a focus for early occupation[49]. Occupation along the river is currently dated to around 13,000 years BP, although is likely to have been much earlier (at last 20,000 years BP). Aboriginal people are thought to have been highly mobile during this period, travelling large distances but staying close to reliable food and water sources[50]. Following the end of the last ice age (22,000 – 18,000 years BP), climatic conditions ameliorated. In response to rising sea levels and greater rainfall, the Hawkesbury-Nepean river level rose, aggrading its respective flood-plain leaving remnant alluvial terraces now seen at Windsor and Pitt Town[51]. During this period extensive river gravel beds were exposed along the Hawkesbury-Nepean River. It is therefore not surprising to find that these gravels became the primary source for making stone tools. Cores and large flakes were carried onto the Cumberland Plain by Aboriginal people and rarely discarded[52]. Tools made from the gravels were used to butcher animals and make wooden implements. Artefacts were rarely backed[53].

Reliance on permanent water sources such as the Hawkesbury-Nepean River appears to have diminished by 6,000 years BP, as sea levels stabilised. The region's population is thought to have continued to grow, with new sites occupied on the Cumberland Plain and surrounding sandstone country[54]. Increases in population are thought to have led to decreased mobility, with more defined subsistence strategies. In many areas, including Pitt Town, silcrete became the predominant stone used for making tools. The stone was often heat-treated to improve its flaking quality. Backed artefacts were manufactured and were either hafted in spears to hunt animals or used by hand to process plant and animal foods. The shift from tuff to silcrete may have occurred as new stone sources were discovered across the Cumberland Plain. Access to river gravels containing tuff may have also become more difficult as the level of the river rose between 18,000 and 6,000 years BP. As is evident from the assemblage recovered at Hall Street, Pitt Town tuff was still being used during later phases of occupation. This suggests that the Hawkesbury-Nepean was still an important source for stone.

[48] Jo McDonald CHM, 2005: p88
[49] ibid
[50] ibid
[51] Kohen et al, 1981
[52] Jo McDonald CHM, 2005: p88
[53] ibid
[54] ibid

6.0 ABORIGINAL COMMUNITY PARTNERSHIP

6.1 DEVELOPMENT OF CONSULTATION

The *Deerubbin Local Aboriginal Land Council* (MLALC), *Darug Custodian Aboriginal Corporation* (DCAC) and *Darug Tribal Aboriginal Corporation* (DTAC) represent the local Aboriginal community on matters relating to cultural heritage in the Pitt Town area. The three organisations have been involved in an on-going process of consultation in regards to the proposed subdivision at Hall Street and participated in each stage of the archaeological investigation. Ongoing consultation and partnership with DLALC, DTAC and DCAC has promoted good faith between the proponent and the local Aboriginal community and facilitated crucial, positive input from the three organisations about the proposed development, the archaeological investigations and Aboriginal heritage management.

The following representatives managed the Aboriginal heritage consultation process and project participation on behalf of the three organisations:

- Mr. Phil Khan and Mr. Kevin Cavanagh for the *Deerubbin Local Aboriginal Land Council*,
- Ms. Leanne Wright for the *Darug Custodian Aboriginal Corporation*,
- Mr. Gordon Morton & Ms. Celestine Everingham for the *Darug Tribal Aboriginal Corporation*,

The following representatives participated in the test excavations, surface collection and monitoring of historical archaeology testing:

- Phil Khan, John Murphy, Lee West, Kerry Marlowe of the *Deerubbin Local Aboriginal Land Council*,
- Leanne Wright, Justine Coplin, Rhiannon Wright and Alyce Mervin of the *Darug Custodian Aboriginal Corporation*,
- Celestine Everingham, Jamie Eastwood and Matthew Morton of the *Darug Tribal Aboriginal Corporation*,

Their roles included surface collection, recording, monitoring, dry-sieving and providing input about the conduct and results of the work. The role played by DLALC, DTAC and DCAC in the archaeological investigation has been instrumental to the success of the project.

During the initial site survey and assessment work, Phil Khan from DLALC expressed concern over the impact of a recently constructed house (Lot12) on Aboriginal surface scatters and subsurface deposits. In response, AHMS, prepared a letter to JPG, immediately registered relevant site cards with DEC and discussed the issue with the land owner. To ensure that surface artefacts were not destroyed during future construction and landscaping works, the site (PT3) was collected during the test excavation.

Following completion of test excavation and surface collection, and initial meetings with JPG, preliminary results of the investigation were drafted in a strategic document and distributed to DLALC, DTAC and DCAC. On the 6 September 2005 a meeting was held with each organisation to discuss the preliminary results of the investigation. Relevant maps and graphs were provided to each organisations and the significance of the lithic assemblage on the alluvial terrace relayed. Conservation and salvage were discussed with each group. A possible Conservation Area, designed to preserve both a significant portion of the Aboriginal archaeology on the alluvial terrace and the historical archaeology, was presented to each group at the meeting. The scale and type of excavation proposed for salvage was also discussed. DLALC, DTAC and DCAC understood the importance of the lithic assemblage contained within the alluvial terrace and were satisfied with the location and size of the Conservation Area and the scale and excavation methods proposed for future salvage work at the site. The other focus of discussion at the meeting was on the monitoring of an historical archaeology testing area located outside the Conservation Area, on the southern boundary of Lot 14. Each group understood the need to test the area and expressed their support for monitoring to recover Aboriginal objects within the plough-zone.

To ensure future investigations and Conservation measures at the site would proceed with full support from the NSW Heritage Office (HO) and Department of Environment and Conservation (DEC), a meeting was held on-site on Thursday 8 September 2005. The meeting was attended by representatives from AHMS, JPG, HO, DEC, DLALC, DTAC and DCAC. Phil Khan was present on behalf of DLALC, Leanne Wright for DCAC and Celestine Everingham for DTAC. The Conservation Area and historical archaeology testing area were the focus of discussions. Margrit Koettig, the archaeologist from DEC, provided advice on how to vary the S.87 Permit to include monitoring of the historical archaeology investigation. A letter requesting the variation was emailed to DEC on the afternoon of the 8 September. Approval to undertake the work was granted on 13 September 2005.

The historical archaeological testing excavation concluded that the former buildings of Bligh's farm exist within Lots 11, 12 & 14 but their integrity and archaeological potential is extremely low[55].

On completion of the historical archaeology testing, a draft Aboriginal Test Excavation Report was distributed to DLALC, DTAC and DCAC on 23 November 2005 for their comment and endorsement. Meetings between AHMS, Paul Hedge (JPG) and representatives from each organisation were held on 6 December 2005 to discuss the recommendations of the report and future conservation options. At the meeting with Deerubbin LALC, Phil Khan, Kevin Cavanagh and Steve Randall expressed their verbal support for conservation of the alluvial terrace on Lots 11 and 12 and archaeological salvage of a representative portion of the terrace on adjacent allotments. However, before providing written endorsement of the draft Aboriginal Test Excavation Report the LALC requested an on-site meeting to discuss the project further. An additional copy of the report was left with Deerubbin LALC. Gordon Morton and Celestine Everingham were present at the second meeting on behalf of DTAC and Leanne Wright for DCAC. Representatives from both organisations expressed their support for the draft Aboriginal report. However, they were also very concerned about possible conservation options particularly private ownership of parts of the proposed Conservation Area. Following further discussion on

[55] As discussed in detail in AHMS 2005

phone with both groups letters supporting the recommendations of the draft Aboriginal Test Excavation Report were received in January from DCAC and DTAC.

A second on-site meeting was held with representatives from Deerubbin LALC and JPG on 8 February 2006. Kevin Cavanagh, Phil Khan and Steve Randall attended the meeting. Kevin Cavanagh voiced his dissatisfaction with archaeologists, references to 'Darug' people in our reports and the involvement of DTAC and DCAC in Aboriginal heritage projects in Western Sydney. General support for the conservation of the alluvial terrace was, however, expressed. The urgency of a written response from Deerubbin LALC was conveyed and it was agreed that a response would be faxed as soon as possible. A written response, however, was not received from Deerubbin LALC by the 20 February 2006 and the report was finalised on the basis of verbal communications. A separate report by Deerubbin LALC will presumably be sent directly to DEC at a later date.

In summary, the recommendations of the final report have been developed in consultation with DLALC, DTAC and DCAC and reflect discussions held with each group during each phase of work. DTAC and DCAC have provided written endorsement of our management recommendations and verbal support for an application for a Heritage Impact Permit under Section 90 of the NP & W Act 1974. Verbal support has also been given by representatives of Deerubbin LALC during various site meetings. Any Section 90 Applications made to DEC for future development of the study area will be compiled as separate documents and distributed to DLALC, DTAC and DCAC for further endorsement.

6.2 OUTCOMES OF CONSULTATION

The outcomes that have emerged as a result of consultation with DLALC, DTAC and DCAC regarding the proposed development, include the following:

- Evidence of Aboriginal occupation at Hall Street, Pitt Town is culturally significant to the local Aboriginal community. Aboriginal objects found within the alluvial terrace are particularly important as they represent the remains of at least two phases of Aboriginal occupation, going back thousands of years. This sort of information is relatively rare and its preservation for their future generations is a priority ;

- DLALC, DTAC and DCAC are concerned about both the proposed subdivision and the on-going effects of cultivation and ploughing on Aboriginal sites within the study area. Similar complex sites have been destroyed along the Hawkesbury – Nepean River. They believe that a combined conservation and mitigation strategy to recover information about Aboriginal occupation of the alluvial terrace is the best strategy to manage Aboriginal heritage at Hall Street, Pitt Town. Aboriginal heritage at the site is very important to the Aboriginal community.

- DTAC expressed the need for interpretation at Hall Street, Pitt Town, so that the public could appreciate the importance and significance of Aboriginal heritage at the site. Public displays would assist in educating future residents and the general public about the Aboriginal history of the study area. Such an outcome is desirable,

given both the presence of a regionally significant Aboriginal site and significant historic relics of 'Blighton' within the study area.

- Following review of the draft Aboriginal Test Excavation Report DCAC provided written endorsement of its recommendations. A letter received from DCAC states that the area at Hall Street, Pitt Town "***has been proven to be a very significant Aboriginal site and we would like to see all of the recommendations for the site carried out***". Conservation of as much of the area as possible was seen as the most important outcome for DCAC.

- Similarly, following a review of the draft report DTAC expressed their support for its recommendations and methodology. In their letter they state that "***the area has proved to be a very significant and important site for the Darug and DTAC would like to see all the recommendations for the site carried out in full***". Once again, "***conservation of this area with no housing or development of any kind***" was declared.

- Although Deerubbin LALC was unable to provide a written report on the archaeological investigation they verbally expressed their support for conservation within Lots 11 and 12 and further archaeological salvage of surrounding areas on the alluvial terrace. Evidently, the site is very significant to the Deerubbin LALC.

Copies of correspondence received from DTAC and DCAC are included in Appendix 6.

7.0 SIGNIFICANCE ASSESSMENT

7.1 BASIS FOR ASSESSMENT

Aboriginal sites are assessed in terms of three significance criteria: Archaeological (scientific), Cultural (Aboriginal) and Public Significance. These criteria recognise that Aboriginal sites are valuable in a number of ways. Namely:

- To the Aboriginal community as an aspect of their cultural heritage and as part of continuing traditions;
- To the broader community, for educational, historical and cultural enrichment values; and
- To the scientific community for potential research value.

The guidelines outlined in the *NSW National Parks and Wildlife* publication *Aboriginal Cultural Heritage: Standards and Guidelines Kit* provide the basis and background for the following discussion regarding evaluation of site significance.

7.2 CULTURAL SIGNIFICANCE

This area of assessment concerns the relationship and importance of sites to the Aboriginal community. Aspects of cultural significance include both people's traditional and contemporary links with a given site or landscape as well as an overall concern by Aboriginal people for sites and their continued protection.

Unmodified natural features in the landscape can signify sacred sites/places of significance. As such they are archaeologically invisible and can only be identified with the aid of Aboriginal interpretation. If such sites are known they may hold particular cultural significance to contemporary Aboriginal communities. Furthermore, sites of significance are not restricted to the period prior to contact with Europeans. Often events related to the Contact-period may be so important to local Aboriginal communities that they have become significant. If these events relate to a specific place in the landscape, then that place (i.e. the site) may become sacred or highly significant to the local Aboriginal communities.

Cultural (Aboriginal) significance can only be determined by the local Aboriginal community. Please refer to Appendix 6 for correspondence received from DTAC and DCAC regarding the importance of the site, their views with respect to the proposed subdivision and development and management of Aboriginal heritage.

The results of Aboriginal community consultation indicate that the study area is highly significant to the Aboriginal community for its cultural heritage values and that conservation of the site is a priority. The archaeological deposit contained within the alluvial terrace is particularly significant because it represents at least two phases of Aboriginal occupation of the site, the earliest of which may have occurred several thousands years ago, prior to the dispossession of Aboriginal land by European settlers.

7.3 PUBLIC SIGNIFICANCE

This category concerns a site's potential to educate people about the past. It also relates to the heritage values of particular sites as being representative examples of past lifestyles, why they are important, and why they should be preserved.

Aboriginal heritage at Hall Street, Pitt Town has considerable public significance for its ability to demonstrate and conserve representative aspects of past Aboriginal life on the Hawkesbury River. Further archaeological investigation of buried Aboriginal sites on the alluvial terrace would significantly increase our current understanding of Aboriginal settlement patterning, subsistence, economy and cultural life along the Hawkesbury River. It would also shed light on geomorphologic and taphonomic processes that have taken place to form the Pitt Town Sand body.

Using a variety of interpretive techniques during and after excavation, this information could be communicated effectively and imaginatively to the general public. Such a display would be a powerful demonstration of the vibrant Aboriginal occupation and life that existed on the Hawkesbury River prior to European colonisation. Conservation of a sample of the alluvial terrace would ensure recognition of the importance of the site to Aboriginal people and its preservation for future generations.

7.4 SCIENTIFIC SIGNIFICANCE

The objective of undertaking Scientific significance assessment for a site is determine its research potential in terms of contribution to knowledge about the past. Criteria used to evaluate scientific potential include condition/integrity, representativeness and rarity. The scientific significance of Aboriginal surface and buried sites at Hall Street, Pitt Town is discussed below.

The results of test excavation indicate that evidence of Aboriginal occupation at Hall Street, Pitt Town is highly significant to the scientific community for its integrity, rarity and representativeness.

The alluvial terrace at Hall Street, Pitt Town contains intact evidence of Aboriginal occupation preserved within a deep sand body that has stratigraphic (vertical) integrity. With the exception of plough disturbance identified in the top 20-30cm of soil, very little vertical mixing and/or size sorting of stone artefacts appears to have occurred within the deposit. At least two separate phases of Aboriginal occupation are present. The upper levels contain a lithic industry dominated by silcrete with diagnostic elements corresponding with a typical Bondaian industry. The lower levels are characterised by large, tuff flaked pieces that are presumably pre-Bondaian.

Buried, stratified open sites dating to more than 6,000 years B.P are rare in the Sydney region. Geomorphic and soil analysis indicates that the preservation of such sites requires a unique set of taphonomic conditions. Finding similar sand terraces with the potential to contain intact, stratified archaeological deposits has become increasingly difficult, as many have been destroyed by mining or their integrity compromised by historic development. For this reason, the terrace sand body at Hall Street, Pitt Town is a rare geo-archaeological resource. It has a high degree of rarity at a regional level.

The Hall Street site is highly representative of settlement patterning, site type and site composition in a deep preserved sand body on the western fringe of the Cumberland Plain. Its representative values are enhanced by the integrity of the archaeological deposits. The stone artefacts found within the alluvial terrace have potential to yield information about stone implement manufacturing techniques, finished tool forms and sourcing of stone over a long period of time encompassing Bondaian and pre-Bondaian occupation. Dating of early phases of occupation using thermoluminescence or optically-stimulated luminescence techniques has potential to provide dates for earliest occupation in the area. As such, the site has potential to provide evidence that is rarely available to archaeologists undertaking research in the Sydney basin.

In summary, intact portions of the alluvial terrace at Hall Street are considered to have archaeological significance at a regional level for their horizontal and vertical integrity, potential antiquity and potential to inform research questions about pre-Bondaian occupation and use that are only available from a very limited number of geo-archaeological settings in the region.

8.0 DEVELOPMENT IMPACT

8.1 PREAMBLE

The results of the site survey and test excavation demonstrate that land within the study area contains physical evidence of Aboriginal use and occupation in the form of surface scatters and buried archaeological deposits. The distribution and nature of the archaeological resource is discussed in detail in Chapter 4. The significance of Aboriginal cultural deposits found within the study area is assessed in Chapter 7.

The following sections provide a description of proposed stages of development envisaged by JPG and an assessment of development impact on Aboriginal heritage. This information is critical in determining the approach to managing Aboriginal heritage during the development process.

8.2 PROPOSED DEVELOPMENT

JPG propose to:

1. re-zone land above the 1:100 year flood level from rural to residential and subdivide it into large residential allotments; and

2. develop land below the 1:100 year flood level for public recreational purposes. This is likely to include playing fields, walking trails and a boat launching facility.

It was envisaged that the results of archaeological testing during this early stage would inform conservation and mitigation measures required during later planning phases. This would guide future planning decisions before and after subdivision and finalisation of residential design plans. It is envisaged that a Re-zoning Application for the land will be lodged with Hawkesbury City Council following the identification of such constraints.

In general terms, subdivision and future development of allotments above the 1:100 year flood level may involve: clearing of selected vegetation; possible removal of topsoil to obtain required levels; establishment of building footings; installation of services below ground; and possible re-introduction of fill to raise ground levels.

8.3 IMPACT ASSESSMENT

The development proposal described above will directly impact on all surface sites and portions of sub-surface archaeological deposits contained within the study area. Test excavation has clearly demonstrated that all landforms have some potential to contain Aboriginal objects, with the possible exception of the active alluvial floodplain extending across Lots 13, 14 & 18. Although no Aboriginal burials were found during test excavation, there is some potential for unrecorded burials within the site. Burials are often found within soft soils, particularly in sand dunes, adjacent to or in association with Aboriginal occupation.

Of particular concern is the subdivision of land above the 1:100 year flood level for urban development. Construction activities may involve levelling, to create residential allotments, and excavation for roads, drainage and services, disturbing the upper levels of the soil horizon. This will effectively disturb and/or destroy Aboriginal objects.

As discussed in previous Sections, the alluvial terrace above the 1:100 year flood level contains highly significant remains of Aboriginal occupation and use, some of which may be older than 6,000 years BP. Intact portions of the alluvial terrace deposit have been assessed as archaeologically significant at a regional level. They are rare and have a high level of research value. The density of artefacts is highest between the elevation range of 20m to 24m above AHD. Conservation of a significant portion of this landform is therefore highly desirable and a best-practice management outcome for a regionally significant archaeological resource.

Following consultation with Aboriginal community organisations, JPG and DEC a significant proportion of the alluvial terrace on Lots 11 and 12 is proposed to be retained as a Conservation Area and excluded from all forms of development. These measures will minimise impacts on Aboriginal heritage and retain a representative sample of the landform to protect Aboriginal heritage values from future development. It will also allow interpretation of Aboriginal heritage and archaeological values to be incorporated into the proposed development and communicated to the public.

From a scientific perspective, salvage of intact areas on the alluvial terrace is also a highly desirable outcome to answer outstanding archaeological research questions about site formation processes and Aboriginal use of the site. Further open area excavation on the terrace has the potential to yield information about stone implement manufacturing techniques, finished tool forms and the sourcing of stone over a long period of time encompassing Bondaian and pre-Bondaian occupation. Dating of early phases of occupation using thermoluminescence or optically-stimulated luminescence techniques has potential to provide dates for earliest occupation in the area. Information about the early Aboriginal occupation is rarely available to archaeologists undertaking research in the Sydney basin.

Whilst development below the 1:100 year flood level has potential to impact on Aboriginal heritage, flood events have scoured much of the area; removing and dislodging Aboriginal objects. The results of test excavation indicate that a low density of Aboriginal stone artefacts will be present below this level. Subsequently, the collection of surface artefacts is recommended prior to the commencement of construction activities.

9.0 RECOMMENDATIONS

9.1 BASIS FOR RECOMMENDATIONS

The following recommendations are based upon:

- Legal requirements of the National Parks and Wildlife Act of 1974 (as amended 2001); in conjunction with
- Results of the archaeological investigations which are documented in this report;
- Potential impacts from proposed subdivision and residential development on Aboriginal heritage; and
- The views of the local Aboriginal community.

9.2 ABORIGINAL COMMUNITY CONSULTATION

It is recommended that:

- Liaison established with Aboriginal community should be maintained throughout the Re-zoning Application process and subsequent Development Application(s) (DA). The Deerubbin Local Aboriginal Land Council (DLALC), the Darug Custodian Aboriginal Corporation (DCAC) and the Darug Tribal Aboriginal Corporation (DTAC) should continue to be identified as key stakeholders in the development process. Accordingly they should be invited to development planning meetings and kept informed about the timing and details of future development schedules.
- Applications for future archaeological salvage work proposed under a S.90 *Heritage Impact Permit* should be prepared in consultation with DLALC, DTAC and DCAC. Representatives from the three organisations should also be invited to participate in the work.
- DLALC, DTAC and DCAC should be consulted regarding interpretation of archaeological information about the site. Consultation with each organisation should be a key component in the Conservation Management Strategy & Interpretation Plan prepared for the study area. Ultimately, the three groups should determine the way in which information about Aboriginal heritage at Hall Street, Pitt Town is communicated to the public.
- A copy of this report should be forwarded to DLALC, DTAC and DCAC at the following addresses:

Deerubbin Local Aboriginal Land Council
Attn: Phil Khan
PO Box 3184
MT DRUIT VILLAGE NSW 2770

Darug Custodian Aboriginal Corporation
Attn: Leanne Wright
PO Box 36
KELLYVILLE NSW 2155

Darug Tribal Aboriginal Corporation
Attn: Gordon Morton
PO Box 441
BLACKTOWN NSW 2148

9.3 ABORIGINAL HERITAGE MANAGEMENT

Recommendations for management of the study area's Aboriginal heritage values during future development are set out below. These recommendations are based on a heritage management approach derived from discussions between Aboriginal community organisations, Johnson Property Group (JPG), NSW Department of Environment and Conservation (DEC), NSW Heritage Office (HO) and Archaeological and Heritage Management Solutions (AHMS).

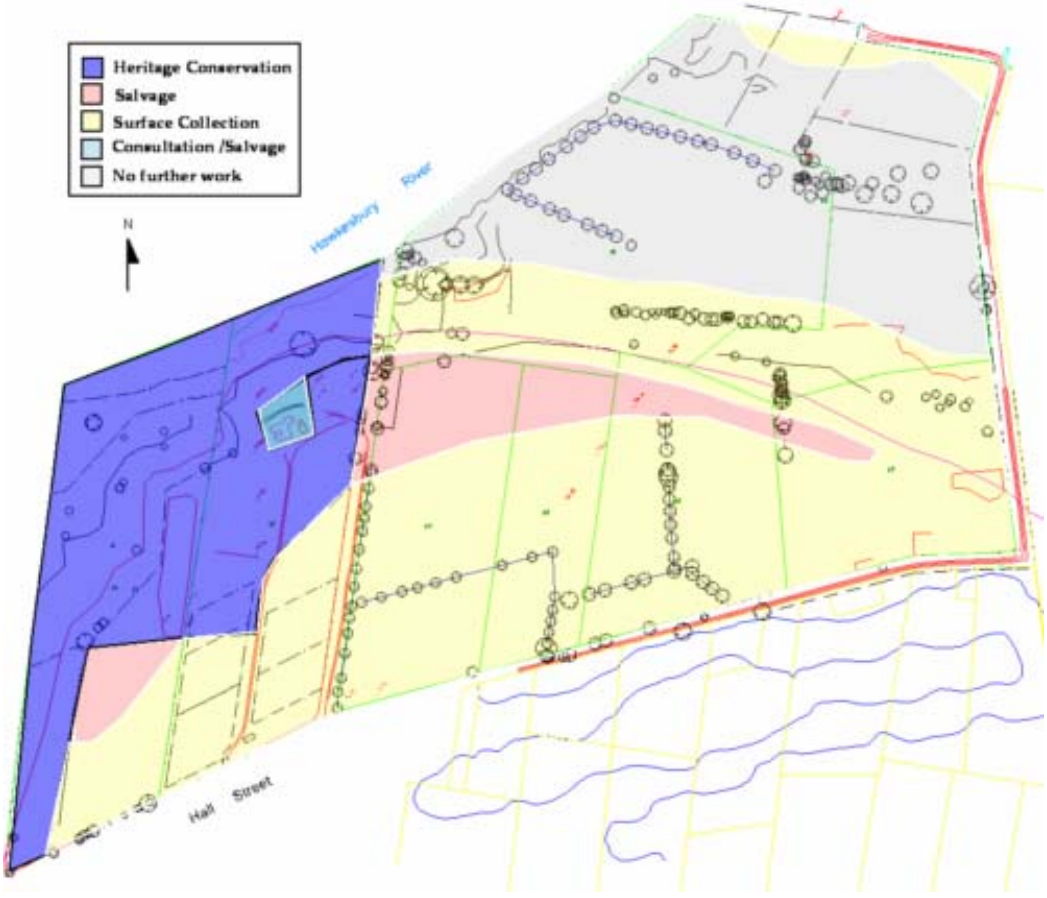


Figure 9.1: Recommended Aboriginal Heritage Mitigation Procedures for the subject land. Procedures include Conservation, Salvage, Consultation /Salvage and Surface Collection.

It is recommended that future development within the study area may proceed, provided that the following Aboriginal heritage mitigation procedures are implemented.

1. The area shown in blue in Figure 9.1 should be a Conservation Area, which is excluded from development. The shape of the Conservation Area is designed to conserve significant Aboriginal and Historical archaeological sites, objects and relics. Vegetation and soil deposits within the Conservation Area should not be removed or disturbed. Measures to prevent erosion of soil deposits should be implemented on the margins of the Conservation Area to prevent the loss of soil deposits containing Aboriginal objects.

2. The Conservation Area should be the subject of a Voluntary Conservation Agreement (VCA) between the current and/or the future land owners, DLALC, DTAC, DCAC and the National Parks and Wildlife Service (NPWS), which is the delegated authority of the NSW Minister for the Environment. Applications for a VCA can be made by contacting the NSW Department of Environment and Conservation (DEC).

3. The Conservation Area should be nominated for listing on the NSW State Heritage Register for its Aboriginal, historical, archaeological and heritage landscape values. The nomination should be made to the Heritage Council of New South Wales.

4. As recommended by the NSW Heritage Office (HO) and Department of Environment and Conservation (DEC), a Conservation Management Strategy (CMS) should also be prepared justifying conservation of the area. The CMS should outline conservation policies for future management and ownership of land contained within the Conservation Area. This CMS should be prepared in consultation with DLALC, DTAC and DCAC.

5. In accordance with Section 90 of the *National Parks and Wildlife Act 1974 (Amended 2001*), Aboriginal objects and Potential Archaeological Deposits (PAD) within the study area can not be destroyed or disturbed without a *Heritage Impact Permit* granted by the NSW Department of Environment & Conservation (DEC). Following Hawkesbury City Council's approval of the Re-zoning Application and Development Application(s), Johnson Property Group should apply for a *Section 90 Heritage Impact Permit* to develop land outside the proposed Conservation Area.

6. The *Section 90 Heritage Impact Permit* should cover archaeological salvage of Aboriginal objects within proposed development areas and be conducted prior to any excavation within the study area. The salvage should include (i) detailed, open-site excavation of a significant sample of the alluvial terrace predicted to contain the highest density of Aboriginal objects (ii) surface collection of Aboriginal objects across the study area following initial ground clearance works and (iii) further consultation and possible savage around the newly constructed house within Lot 12, if additional deep excavation works are proposed. Figure 9.1 shows areas where archaeological salvage, surface collection and consultation / salvage are recommended by AHMS.

7. An Archaeological Research Design and Methodology (ARDM) for salvage should be prepared by a qualified archaeologist in consultation with DLALC, DTAC and DCAC in support of a *Section 90 Heritage Impact Permit*. Approval of the permit by the Department of Environment may take up to 8 weeks and there is a fee for the application.

8. Following submission of the *Section.90 Heritage Impact Permit* Johnson Property Group should consult with DLALC, DTAC and DCAC about site interpretation and public display options. Provision should be made for the preparation of a Public Heritage Interpretation Plan for the site to communicate the heritage significance of the site to the public. Decisions regarding the safe keeping, display and appropriate interpretation of Aboriginal objects recovered from the site will ultimately be made by DLALC, DTAC and DCAC.

9. If human skeletal remains are identified during development, work on site should cease, the remains should be covered with clean fill (eg. sand) and the site should be secured. The following tasks should be undertaken immediately:

    a. Briefing of the development's archaeologist, followed by liaison with DEC, DLAC, DTAC, DCAC and the Office of the NSW Coroner;

    b. Amendment of the design (if possible) to avoid the skeletal remains; and

    c. Discussion of appropriate management and mitigation measures with DEC, DLALC, DTAC and DCAC. Ultimately, the management of Aboriginal burials will be determined by DEC in consultation with the local Aboriginal community. In situ conservation of any such burial(s) may be required.

10. The recommendations set out above should be incorporated as project tasks in development project planning and included in any contracts or scope of work documents provided to project managers and relevant on-site contractors.

11. Two copies of this report should be sent to the DEC Central Aboriginal Heritage Unit (CAHU) at the following address.

Department of Environment and Conservation
Central Aboriginal Heritage Unit
Attn: Mr. Gavin Martin (Archaeologist)
PO BOX 1967
HURSTVILLE NSW 2220

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APPENDICES

APPENDIX 1

Photographs

APPENDIX 2

Test Trench Descriptions

APPENDIX 3

Site Plans & Section Drawings

APPENDIX 4

Stone Artefacts Report by Emeritus Professor Richard Wright

APPENDIX 5

Geomorphic and Pedologic Report by Dr. Peter Mitchell

APPENDIX 6

Correspondence from Aboriginal Community Organisations