SUB-SURFACE ARCHAEOLOGICAL INVESTIGATION OF STAGES 2-4 OF "THE DAIRY", A PROPOSED RESIDENTIAL DEVELOPMENT AT DOLPHIN POINT, NEAR BURRILL LAKE, ON THE SOUTH COAST OF NEW SOUTH WALES

VOLUME A: TEXT

A report to

ELDERSLIE PROPERTY INVESTMENTS Pty Ltd

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On behalf of

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DOLPHIN POINT PROPERTIES Pty Ltd

by

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EXECUTIVE SUMMARY

South East Archaeology Pty Limited has been commissioned by Elderslie Property Investments Pty Ltd, on behalf of Dolphins Point Developments Pty Ltd, Dolphin Point Properties Pty Ltd and Mr John Thomson, to undertake an Aboriginal heritage impact assessment of land subject to residential development at Dolphin Point, near Burrill Lake on the South Coast of New South Wales.

The land comprises Stages 2-4 and associated open space of "The Dairy", a proposed residential subdivision, of which the adjacent Stage 1 has received Development Approval and is under construction. The study area is primarily owned by Dolphins Point Developments Pty Ltd, with a small portion owned by Mr John Thomson, and measures approximately 36.5 hectares in area.

The heritage investigation has proceeded in several phases. Initial surface surveys were conducted in 2003 and 2004, but assessment of the potential impacts of the proposal on Aboriginal heritage was constrained by low conditions of surface visibility. Hence, the program of sub-surface investigation reported herein was conducted in order to retrieve a suitable sample of evidence from within Stages 2-4 and the associated open space to permit:

- Identification of the distribution of heritage evidence across the study area and in relation to hypothetical environmental/cultural contexts and occupation models;

- Identification of the nature of heritage evidence within the study area, including the activities represented and the potential for this evidence to address locally and regionally relevant research questions;

- Clarification of the integrity of deposits and identification of any means in which the effects of post-depositional processes could be controlled for;

- Through this information, permit a robust assessment of the scientific significance of the identified and potential Aboriginal heritage resources of the study area; and

- Provide a satisfactory basis from which to formulate strategies for the management of the Aboriginal heritage resource.

The sub-surface investigation proceeded by recourse to the archaeological and environmental background of the locality, followed by a program of test excavations undertaken with the assistance of the Ulladulla Local Aboriginal Land Council. Section 87 Permit #1952 was issued by the Department of Environment and Conservation (NSW) (DEC) for this purpose. Test excavations were undertaken over 29 days in July and August 2004. Five qualified archaeologists from South East Archaeology were assisted throughout the course of the test excavations by on average five representatives per day from the Ulladulla Local Aboriginal Land Council.

The test excavations were undertaken within sixteen separate areas and involved a sample from each identified 'environmental/cultural context' within the study area. Each test area comprised a sample of units, each measuring 0.5 x 0.5 metres in area, excavated at five metre intervals on a 50 x 5 metre grid. Hence, in all but one of the 16 test areas where dense vegetation presented a constraint, a total of 22 test units were excavated for a total area of 5.5 m^2 in each Test Area. In total, 347 test units each measuring 0.25 m^2 in area were excavated, resulting in a total excavation area of 86.75 m^2. A total volume of deposit of 53.63 m^3 (53,630 litres) was excavated and wet-sieved.

In total, 2142 stone artefacts were recovered from the test excavations, along with shell midden deposits in Test Area 8A. The overall mean count of artefacts per conflated square metre is 24.69. The overall mean density of artefacts per cubic metre is 39.94.

Based on analysis of the history of land use and natural processes, distributions of stone artefacts, and conjoins and inferred associations between artefacts, it is concluded that the identified and potential Aboriginal heritage resources within Stages 2-4 have been affected by a number of post-depositional processes. In limited areas, particularly within Stage 4, the impact levels are high and equate to total destruction of deposits or very low integrity of evidence. Impact levels at many of the identified site loci also tend to be high due to the nature of their exposure within areas of recent ground disturbance or erosion. However, over much of the study area, although widespread, the levels of impacts are not as high. Although evidence from the test excavations indicates that considerable vertical mixing of deposit has generally occurred, primarily through bioturbation, there appears to have been limited post-depositional lateral movement of evidence.

A total of six different categories of stone material were identified in the test excavation assemblage. The combined assemblage is overwhelmingly dominated by silcrete (86.32%), with low frequencies of quartz and rhyolite and very low frequencies of quartzite, chert and other volcanics. Silcrete sources occur around Ulladulla and silcrete is found in the form of pebbles and cobbles washed into coves along the shoreline between Ulladulla and Batemans Bay. Hence, the material was readily available in transportable form, only a short distance from the study area. Evidence exists that a proportion of the silcrete artefacts were made from stone that was intentionally thermally altered, although no specific evidence was recovered to indicate that this process was undertaken on-site.

A total of 19 categories of artefacts were identified. The combined Stage 2-4 test excavation assemblage is overwhelmingly dominated by flakes and flake portions (91.5%). The remainder of the assemblage comprises a very low frequencies of items, including lithic fragments (2.52%), retouched flakes (2.19%), bondi points (1.68%) and ten or less nondescript core fragments, nondescript cores, microblade cores, pebble cores, backing flakes, bipolar flakes, utilised retouched flakes, thumbnail scrapers, geometric microliths, utilised geometric microliths and hammerstones.

While it can be inferred that a proportion of the Aboriginal activity within the study area relates to the production of microblades and microliths (backed artefacts), presumably to arm spears, much of the stone artefact evidence represents debitage from which the specific activities cannot be reliably inferred. No tools or activity areas indicative of encampments or comparable focused occupation were identified.

Three loci of shell midden evidence have been identified, all within the open space near Dolphin Point Road. Midden deposits in Test Area 8A represent the procurement of cockles and other shellfish, primarily from the adjacent lake inlet and to a lesser extent the nearby rock platforms, and the transport of shellfish from those locations to the site where food preparation and consumption occurred. Two clusters of evidence were radiocarbon dated. One appears to possibly represent a single meal event involving a small group of people that occurred between 1080 and 1410 AD. The other is more extensive and may represent a single but major meal event (eg. multiple individuals), or more likely a series of repeated events within a relatively short period of time (eg. a small group of people returning to the same place in a season or over successive seasons) between at most 610 and 1090 AD.

The spatial distribution of evidence within Stages 2-4 has been examined to determine whether there are focal points of activity or particular relationships between Aboriginal behaviour and aspects of the locality's environment. The results demonstrate some distinct patterning of evidence, with a trend for a relatively higher frequency of artefacts and discrete activity areas (backed artefact production events) in the gentle spur crest unit within 200 metres of the basin and the moderate lower slope unit bordering the basin/inlet, indicating a preference for backed artefact production and retooling in these areas. However, resolving finer patterns of spatial distribution is constrained to some extent by the low numbers of artefacts recovered for many of the samples.

Occupation of Stages 2-4 of The Dairy involved transitory movement and hunting/gathering without camping, undertaken in multiple episodes each of short duration. The overall spatial distribution and nature of evidence in Stages 2-4 is a low density distribution of artefacts consistent with background discard, interspersed by a low number of discrete activity areas in which more focused activity has occurred, predominantly in relation to the production of backed artefacts. Backed artefact production is the main activity type identified and occurs widely around the basin. It is assumed to have been undertaken by small parties of men gearing up to hunt with spears along the adjacent estuarine inlet/basin.

On the basis of direct dating of shell midden deposits, artefact typology and geomorphological evidence, it is inferred that the recorded evidence dates to within the last 4,000 years BP. It is speculated that as the estuarine resources of the basin gradually constricted towards the present lake inlet, the focus of Aboriginal hunting/gathering activity may also have shifted closer to the inlet (in the last millenium or so). Within the basal slopes of Stage 3 of The Dairy and possibly other areas fringing the basin, evidence of the early-mid Holocene sea level rise in the form of sand deposits onlapping previous soil horizons has been identified. This context has the potential to host evidence from different temporal periods.

The nature of the evidence from The Dairy has been compared with other sites in the locality in order to provide a framework for interpreting representativeness within a regional context. Despite the numerous problems and constraints, comparison reveals that on a general level a number of similarities and differences can be identified between Stages 2-4 and the other regional evidence. Detailed comparison was possible with evidence retrieved using similar methods in Stage 1 of The Dairy. It is concluded that there is a high degree of similarity between the evidence in Stage 1 and Stages 2-4 and minor differences are satisfactorily explained in relation to differences in the relative sample sizes. No specific aspects of The Dairy Stages 2-4 evidence appear to be rare or unusual or not replicated elsewhere within a regional context.

The significance of the heritage evidence was assessed against criteria widely used in Aboriginal heritage management, derived from the relevant aspects of the ICOMOS Burra Charter and the State Heritage Inventory Evaluation Criteria and Management Guidelines. The test excavation program has overcome the limitations of earlier surface investigations by revealing sufficient information to enable the scientific significance to be assessed.

Sites Dolphin Point 1, 2, 3 and 4 do not surpass the threshold for significance in relation to aesthetic, educational or historic criteria. It is important to observe that all heritage evidence tends to have some contemporary significance to Aboriginal people, because it represents an important tangible link to their past and to the landscape, and representatives of the Ulladulla Aboriginal community have expressed an interest in the evidence. Sites Dolphin Point 1, 2 and 4 are assessed as being of moderate scientific significance within a local context and low scientific significance within a regional context. Site Dolphin Point 3 is assessed as being of low scientific significance within both local and regional contexts.

The Aboriginal heritage evidence recorded within the study area is protected under the terms of the *National Parks and Wildlife Act 1974*. Impacts should not occur within any of the Aboriginal site areas in the absence of a valid Section 90 Consent permit.

Development of the "The Dairy" Stages 2-4 may cause impacts to the identified Aboriginal heritage sites Dolphin Point 1, 2, 3 and 4. The primary recommendations arising from the investigation are that the proponent should seek and obtain from the Director-General of the Department of Environment and Conservation (NSW) a Section 90 Consent with Salvage permit for the development impact area inclusive of all identified Aboriginal heritage evidence within this area, in consultation with the local Aboriginal community. A combination of strategies of salvage, conservation, monitoring and unmitigated impact should be implemented, potentially on a Stage by Stage basis, including:

- Retrieval of samples obtained on a broad scale (through surface scrapes) from within the area of proposed impact in environmental/cultural contexts 4A, 4B, 5A, 5B and 7A, prior to construction, to inspect for and identify if any unexpected or unusual features are present and to permit their salvage (by localised hand excavation);

- Where development impacts will occur to more than say 20% of each context, retrieval of a sample of evidence by controlled broad area hand excavation from within the area of proposed impact in environmental/cultural contexts 5A, 6A, 7A, 8A and 9A to permit a range of research hypotheses to be examined to complement and enhance the program of salvage conducted in Stage 1 and program of testing in Stages 2-4, thereby mitigating the impacts of development on the scientific values of the evidence;

- Retrieval of samples of the identified heritage evidence (ie. from the known site loci by systematic surface collection) to assist in mitigating the impacts of development on the cultural values of the evidence;

- Where development impacts can be avoided to the identified Aboriginal heritage evidence, a set of guidelines should be prepared for these areas specifying policies and actions relating to the ongoing protection of the identified and potential Aboriginal heritage evidence during and after the Stage 2-4 development;

- The proponent should give full consideration to any request by the local Aboriginal community for representatives to be engaged to monitor the initial stages of development in order to inspect for and identify if any unexpected or unusual features are present, and to permit their salvage; and

- Any evidence not directly conserved or salvaged will consequently be subject to unmitigated impact, permissible under a Section 90 Permit (and intending to include all evidence within the areas of proposed development impact in environmental/cultural contexts 1A, 2A, 3A and 3B).

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1. INTRODUCTION

South East Archaeology Pty Limited has been commissioned by Elderslie Property Investments Pty Ltd, on behalf of Dolphins Point Developments Pty Ltd, Dolphin Point Properties Pty Ltd and Mr John Thomson, to undertake an Aboriginal heritage impact assessment of land proposed for residential development at Dolphin Point, near Burrill Lake on the South Coast of New South Wales (Figure 1).

The land comprises Stages 2-4 and associated open space of "The Dairy", a proposed residential subdivision. The study area is primarily owned by Dolphins Point Developments Pty Ltd, with a small portion owned by Mr John Thomson, and measures approximately 36.5 hectares in area (Figure 2).

Elderslie is in the process of developing Stage 1 of "The Dairy" residential subdivision, adjacent to the present study area. Stage 1 has been subject to several heritage investigations subsequent to the initial identification of Aboriginal heritage evidence in March 2003 (Navin Officer 2003a-d, Kuskie *in prep*.).

Stage 2 of the present study area is currently zoned 2(c) for residential development (Residential 'C' {Living Area} Zone). Stage 3 is zoned 6(b) (Open Space - Recreation 'B' {Private} Zone) and application will be made to alter the zoning to 2(c). Stage 4 is largely zoned 3(g) (Business 'G' {Development Area} Zone). Associated open space presently zoned 6(b) may be developed in future for recreational facilities. Part of the open space is also zoned 7(a) (Environmental Protection 'A' {Ecology} Zone) in which several forms of development are permissible (Figure 2).

The design of the residential development has not been finalised. Hence, the heritage assessment has encompassed the entire study area (Stages 2-4 and associated open space) and the assessment of potential development impacts is preliminary in nature.

The heritage investigation has proceeded in several phases. Navin Officer Heritage Consultants (2003a) conducted an initial survey of 'The Dairy' in March 2003, encompassing Stage 1 and the present Stages 2-4 study area. South East Archaeology surveyed the adjoining Ulladulla Local Aboriginal Land Council (LALC) property in October 2003.

In consultation with the Ulladulla LALC, South East Archaeology prepared and submitted a Section 87 Preliminary Research Permit application to the National Parks and Wildlife Service (NPWS), now part of the Department of Environment and Conservation (NSW) (DEC), on 27 November 2003. DEC requested on 10 December 2003 that a formal survey report be prepared prior to further consideration of the Section 87 application. South East Archaeology subsequently resurveyed the current study area and adjoining LALC land in February 2004 and prepared the required survey report (Kuskie 2004a).

A revised survey report (Kuskie 2004a) and Section 87 application, including a detailed research design formulated in consultation with the Ulladulla LALC, were submitted to DEC on 12 March 2004. Section 87 Permit #1952 was subsequently issued on 19 June 2004 to South East Archaeology by the Department of Environment and Conservation (NSW).

The sub-surface investigation proceeded by recourse to the archaeological and environmental background of the locality, followed by a program of test excavations undertaken with the assistance of the Ulladulla Local Aboriginal Land Council. The study was completed in May 2005.

The general aims of the test excavation program were to retrieve a suitable sample of evidence from within Stages 2-4 and the associated open space to permit:

- Identification of the distribution of heritage evidence across the study area and in relation to hypothetical environmental/cultural contexts and occupation models;

- Identification of the nature of heritage evidence within the study area, including the activities represented and the potential for this evidence to address locally and regionally relevant research questions;

- Clarification of the integrity of deposits and identification of any means in which the effects of post-depositional processes could be controlled for;

- Through this information, permit a robust assessment of the scientific significance of the identified and potential Aboriginal heritage resources of the study area; and

- Provide a satisfactory basis from which to formulate strategies for the management of the Aboriginal heritage resource.

Subsequent to testing it was envisaged that the proponent may be in a position to implement one or a combination of heritage management strategies including:

- Conservation: Exclusion of development impacts from portions of specific environmental/cultural contexts or identified sites as part of a regional strategy aimed at conserving a representative sample of identified and potential heritage resources;

- Unmitigated Impact: Obtaining a Section 90 Consent permit from the Department of Environment and Conservation (DEC);

- Mitigated Impact: Obtaining a Section 90 Consent with Salvage Permit from DEC. The purpose of salvage may be to retrieve a representative sample of heritage evidence to mitigate the impacts of development and to address relevant research questions; and/or

- Monitoring: Engaging representatives of the local Aboriginal community and a qualified archaeologist to monitor development works for the presence of heritage items and skeletal remains, under a Section 90 Consent permit obtained from DEC.

Through the excavation and subsequent analysis of the evidence retrieved, the program of test excavations also sought to address a number of specific research hypotheses (refer to Section 4).

2. ENVIRONMENTAL CONTEXT

2.1 Location

The study area is situated at Dolphin Point, near Burrill Lake, within the coastal lowlands of the South Coast of New South Wales (Figure 1). It comprises Stages 2-4 and associated open space of "The Dairy", a proposed residential subdivision. The urban areas of Bungalow Park and Burrill Lake lie immediately to the north of the study area and Dolphin Point to the east. Ulladulla is located five kilometres north-east of the study area. The area under investigation mainly comprises Lots 23 and 82 in the Parish of Woodburn, County of St Vincent. It is situated between Australian Map Grid (AMG) references 266950 and 267700 east and 6079450 and 6080600 north on the Tabourie 8927-II-S 1:25,000 topographic map (Figure 1).

The study area is bordered:

- To the north by Stage 1 of "The Dairy" and the Princes Highway;
- To the east by Dolphin Point Road, a small residential subdivision on Bonnie Troon Place and vacant land owned by the Ulladulla Local Aboriginal Land Council; and
- To the south and west by Meroo National Park.

The study area is primarily owned by Dolphins Point Developments Pty Ltd, with a small portion owned by Mr John Thomson, and measures approximately 36.5 hectares in area.

2.2 Topographic Context

In this section of the coast south of Ulladulla, five major lakes are present, along with coastal hills and a narrow coastal plain (Figure 3). Dolphin Point, east of the study area, features rocky headlands, rock platforms and small embayed beaches, while the more extensive beaches of Burrill Beach and Wairo Beach extend to the north and south respectively.

Burrill, Tabourie, Termeil, Meroo and Willinga Lakes are estuarine lakes that were formed by inundation of river valleys by sea level rises in the early Holocene. Subsequent progressive infilling with sediment accompanied by the formation of coastal barriers (eg. Wairo Beach and Termeil Beach) led to the present-day shallow lakes, most of which are typically closed to the ocean. Rocky headlands and rock platforms are located between the beaches. Burrill Lake formed in a deeper valley and has more inclined slopes than the other coastal lakes. Burrill Lake's catchment area is approximately 78 square kilometres and the lake basin area approximately 4 square kilometres (Allsop & Kadluczka 2001). Burrill Lake is also frequently open to the ocean (Thom *et al* 1978, White 1987b). Salinity in Burrill Lake is typically high, even on the western margins (White 1987b).

The study area largely comprises gently inclined slopes and spur crests interspersed by shallow, ephemeral first and second order drainage depressions, draining generally east and north-east down to a broad level/very gentle basin or flat/wetland. The latter feature has arisen through sediment deposition in the mid-late Holocene and prior to that was inundated by marine and estuarine water (refer to Section 2.6). During Pleistocene low sea levels it would have been a very minor northeast-aligned upper tributary valley. It is a locality sheltered from the ocean, between 300 and 1200 metres west of the coastal scarps fringing

Dolphin Point. The modern inlet of Burrill Lake lies between 100 and 1000 metres north-east of the study area.

The study area can be subdivided into a number of environmental contexts, representing specific combinations of landform element and class of slope (refer below and to Figure 14 and Table 3; *cf*. Kuskie 2000a, 2004a). These include the gentle lower slope (the maximum elevation position of the former mid-late Holocene shoreline), moderate lower slope (former mid-late Holocene shoreline), level/very gentle flat (drained part of the basin and probable former estuarine inlet), level/very gentle wetland (currently inundated part of the basin), gentle drainage depression, very gentle drainage depression, gentle simple slope, gentle spur crest and very gentle ridge crest units. The moderate lower slope, most notable around the eastern margin of Stage 4 and in the adjoining Stage 1 where the slopes meet the wetland basin, represents a former shoreline when water levels were higher than at present. As discussed in Section 2.6, this probably equates to the period around 7,000 to 3,600 years ago.

In palaeogeographic terms, the present slope elements and associated drainage lines are likely to have had much the same morphology, aspects and alignments prior to the Holocene sea level rise and basin infilling. They are older landscape units. In contrast, the basin and the drainage lines across it have probably developed their present morphology and alignments only within the last 2,000 to 3,000 years, and the present surface morphology is likely to be very recent in age and affected by historic clearance and drainage.

2.3 Geology and Soils

The geology of the study area comprises conglomerate, sandstone and silty sandstone of the Permian era Conjola Formation, with Quaternary alluvium in the low-lying areas of open space (Ulladulla 1:250,000 geological map). Mapping of Quaternary alluvium at surface need not imply river-lain unconsolidated sediments to bedrock. In this area deposits from former marine incursions, estuarine conditions and freshwater swamps, including source-bordering aeolian sediments, may interstratify with, or be overlain by, recent catchment-derived alluvium, within areas mapped as Quaternary alluvium adjacent to the coast. A dolerite intrusion occurs nearby at Dolphin Point (White 1987b). Minor sandstone is exposed in places, particularly along the former mid-Holocene shoreline, which indicates that older regolith and soils may have been eroded away when the shoreline was active.

Navin Officer (2003b) report on soil descriptions obtained during their study of Stage 1. Two distinct profiles were noted, one applying to the flat and fringing basal slopes and the other to the elevated terrain. Navin Officer (2003b) describe the soil and sediment stratigraphy on the flats as comprising upper units of fluvial and aeolian sand with various layers of organic material, overlying sandstone bedrock. The soil on the elevated terrain is described as an upper top soil unit of humic sandy loam, which grades rapidly into a silty or loamy sand overlying a lower sandy clay unit. Dense gravel horizons were frequently noted at the transition zone of the silty or loamy sand A unit with the sandy clay B unit.

Detailed soil descriptions were obtained during the course of the present test excavations within Stages 2-4 and are presented in Section 5.2.

2.4 Flora and Fauna

The climate of the region is mesothermic, with rainfall distributed relatively uniformly throughout the year and long and mild summers. Mean annual rainfall at Ulladulla is approximately 1,266 millimetres, distributed over 102 rainy days. The mean minimum temperature is 12º C and the maximum 21º C (White 1987b:8).

Vegetation within the study area varies, but predominantly consists of grasses across Stages 2-4 and the zone 6(b) open space, including native and mostly introduced species, and wetland vegetation, Melaleuca, Casuarinas, Banksias, Bracken and grass in and around the margins of the zone 7(a) wetland (Plates 1-32). Melaleucas are also common along the drainage line between Stages 2 and 3, and in an area of the basin and lower slope of Stage 2. However, judging by an aerial photograph from the early 1980s (Figure 6) virtually all of the shrub and tree vegetation within these areas represents recent regrowth. Minor remnant forest vegetation is present along the basal slope (relic shoreline) in Stage 4, with some Casuarinas and a ground cover of Acacia regrowth, bracken and grasses. Remnant forest is also present on the basal slope (relic shoreline) bordering the eastern margin of the basin and housing along Bonnie Troon Place (Figure 6).

Much of the study area has been used for the agistment of dairy cattle and horses. Pasture grasses such as Italian Rye and Kentucky Blue were introduced to the Ulladulla region in the mid 1800s, with Paspalum and other species such as Kikuyu, Wimmera Rye, Red Clover and Phalaris in the late 1800s and early 1900s (Milton Ulladulla & District Historical Society 1988). Pasture improvement through the use of fertilisers commenced in the 1920s and 1930s (Milton Ulladulla & District Historical Society 1988). Agricultural machinery powered by tractors came into use in the 1950s, prior to which oxen and horses had been used.

Prior to vegetation removal in the 19th and 20th Century, the elevated portions of the study area probably comprised an open dry sclerophyll eucalypt forest, dominated by Spotted Gum (*Eucalyptus maculata*), Blackbutt (*E. pilularis*), Bangalay (*E. botryoides*) and Stringybarks, with an understorey and relatively open ground cover of shrubs, grass and Bracken (*Pteridium esculentum*).

Anderson *et al* (1981) surveyed the vegetation in swamps fringing Burrill Lake and subdivided it into three communities:

- Saltmarsh - where the dominant species are *Sarcocornia quinqueflora* (Samphire or Glasswort), *Juncus kraussi* (Sea Rush) and *Casuarina* spp. (She-Oaks);

- Combined freshwater and brackish marshes, where the dominant species are *Eucalyptus* spp., *Juncus kraussi*, *Scirpus nodosus* (Knobby Club Rush), *Samolus repens* (Creeping Brookweed) and *Casuarina* spp.; and

- Wetlands confined to steep rocky foreshores, where the dominant species is *Baumea juncea* (Bare or Jointed Twig Rush) and also include *Briza maxima* (Quaking Grass) *Gahnia* spp. (Saw-Grass), *Juncus pallidus* (Pale Rush) and *Cotula* spp. (Waterbuttons, Cotula).

The basin portion of the present study area may have been vegetated with saltmarsh vegetation in the late Holocene after sea levels had subsided.

Analysis of pollen in several core samples from Burrill Lake led White (1987b) to conclude that Eucalypt forests have surrounded the lake over the last 7,300 years, and that during the period 1,600-200 BP[1] swamps were present on the fringes and embayments. Swamp development in shallow marginal embayments will reflect the rates at which basins infill, so some aspects of the vegetation change indicated by White (1987b) may well be a function of sedimentation rates. This may be highly relevant to the sedimentary history of the basin in the study area. Despite two centuries of timber harvesting and land clearing for grazing and residential purposes, remnants of native forests still remain around Burrill Lake.

Several historical accounts describe the original native vegetation around Burrill Lake. The Surveyor Thomas Florance (in McAndrew 1993:3) described the area as being thickly timbered with gums, apple, oak and mahogany in poor sandy soil and rock. The vegetation and wildlife around Conjola and Burrill Lakes was described in the *Sydney Mail* of 1 January 1881 (in McAndrew 1993:2) as

> "surrounded by a thick undergrowth and are the haunts of many kinds of wild fowl. They also abound with fish of every description, while oysters, crustacea and cockles are plentifully found . . . the shores are lined with swamp oaks growing to the water's edge, beyond which rise the gigantic species of eucalypti, while the undergrowth scrub is thickly studded with blackwattle".

The abundance and variety of fauna has been recorded by numerous early settlers and explorers, including many species consumed by the local Aboriginal population (*cf.* McAndrew 1993). These accounts document the abundance of ducks, pelicans, swans and numerous other types of birds, fish (particularly snapper, mullet and eels), prawns, shellfish, snakes and the occasional beached whale.

2.5 Land Use History

European contact with the region commenced in 1770 following the sightings of Jervis Bay and Murramarrang by Captain Cook. From the early 1800s cedar cutters entered the Ulladulla district and began removing red cedar, with the first shipment leaving the northern part of the Shoalhaven in 1811 (Antill 1982). McAndrew (1991:90) describes cedar having been felled in large quantities prior to 1875 in the Ulladulla and Conjola areas.

Surveyor Thomas Florance travelled overland from Jervis Bay to St. George’s Basin and further south from April to June 1828, surveying from Burrill Lake to Narrawallee on May 13, 1828 (Bayley 1975:28). On June 30, 1828, Florance explored Burrill Lake to the tidal water near Woodstock (Bayley 1975:28). The Surveyor Robert Hoddle completed a coastal survey between Jervis Bay and Moruya in 1828, in which he also mapped this region (Bayley 1975:28).

Reverend Thomas Kendall arrived at Ulladulla in 1828 and timber extraction and dairying commenced. The region from Burrill Lake to Conjola was first known as 'Ulladulle', while Ulladulla itself was called 'Boat Harbour' (Bayley 1975). By 1856 there was a population of 300 in Ulladulla with a port and a thriving dairy industry. Wheat flourished at Ulladulla in the 1860s. Between 1870 and 1890 was a boom period for the timber industry due to the demand for timber for wharves, mines and railways. From the 1890s sleeper cutting grew to supplement sawmilling (Bayley 1975:105). By 1857 a transport route following the approximate line of the Princes Highway was in use to the north of Ulladulla (Bayley 1975, Kemp 1980). However, south of Ulladulla to Batemans Bay a bridle track that crossed the mouth of Burrill Lake was all that was in operation up until 1873 (Bayley 1975:69).

[1] BP = Before Present as measured in radiocarbon years. 'Present' is defined as the year 1950 AD.

The study area and adjoining Stage 1 consists of land originally surveyed as Portions 23, 80 and 82, Parish of Woodburn, County of St Vincent (Figure 4).

Portion 23 consisted of 30 acres on the western banks of Burrill Inlet, mostly encompassing the open space part of the present study area. It was purchased by Evan Evans of Murramarang, although never permanently occupied. The land was reportedly used as a resting paddock for cattle (McAndrew 1993:129), possibly when the Evans family made the eight hour trip from Murramarang to the shipping/marketing centres of Milton/Ulladulla in the 1800s. The Dolphin Point Tourist Park has subsequently been developed on the eastern (inlet) side of Portion 23.

Portions 80 (40 acres) and 82 (84 acres) were conditional purchases by George Ireland Jnr in 1877 and 1889 respectively (Figure 4). Portion 82 comprises Stages 2 and 3 and part of the open space portion of the present study area and Portion 80 comprises Stage 4. Richard Ireland also took out a conditional purchase on neighbouring Portion 81 (40 acres) in 1877 (later to pass to George Ireland). George Ireland was listed as running 2 horses and 16 head of cattle on his Burrill Lake properties (more extensive than the present study area) in 1885 (Milton Ulladulla & District Historical Society 1988). Richard Ireland was listed in 1885 as running 1 horse and 10 cattle on Portion 81 (Milton Ulladulla & District Historical Society 1988). Portions 80 and 81 have now been largely developed as the Bungalow Park residential area, immediately north of the study area (Figure 1).

George Ireland built the first sawmill in Burrill on Portion 80, on the western side of the (now) Princes Highway, on the south-western side of the (now) bridge. This mill was situated where the present mini-golf course is located at the Bungalow Park caravan park, immediately north of the Stage 4 study area. The mill was listed in the Country Directory of Moore's Almanac in 1877 (McAndrew 1993:38, 77). Bullock teams were used to haul timber to the mill and from there to the home sites being built by local settlers. Logs were also loaded onto punts from thirteen sites around Burrill Lake. Ireland's mill operated until 1912 when the family moved to the North Coast. A new mill was built around 1913 on a rise just north-west of Ireland's old mill by George Thistleton Snr (McAndrew 1993:38-39, 77). Logs for the new mill were brought in by bullock teams, one owned by Jim Jonas who had purchased the Ireland property (including the present study area).

Ireland is also reported in The Town and Country Journal of 1 December 1877 as having cut a road through the bush from Burrill Lake to Woodburn, a distance he thought of about seven miles. Part of this road is now known as 'Wheelbarrow Road' located immediately west of the study area (McAndrew 1993:37).

George Ireland is listed as a farmer and Richard Ireland as a sawmill proprietor on a petition dated 11 December 1896 asking for a second school in the area, Burrill Lake School, to be established on the eastern end of the lake, approximately opposite the present Service Station (McAndrew 1993:64-65). John, Violet and William Ireland, and Richard, George and Aubrey Ireland were among the first pupils of the school in the late 1890s. The school was closed down in 1903 due to low attendance rates.

A bridge across Burrill Lake in the present location of the bridge on the Princes Highway was first built in 1889. Prior to that time the inlet was crossed by fording the channel at low tide, including at a place just east of the present bridge and another location further west (McAndrew 1993:44). The bridge is situated immediately east of Stage 4 of the present study area. The Princes Highway, bordering the north of Stage 1 of "The Dairy", was officially gazetted in 1889 (although not officially named as such until 1921) and quickly became the main route south, replacing an earlier route further to the west along Woodburn Road (McAndrew 1993:45-46).

The Ireland property was purchased by Jim Jonas, who later sold to the Robinsons (possibly after 1926). McAndrew (1993:38) reports that the Jonas family built their home 'up on the hill', where later the two married sons also built their homes. It is unclear if this is in Stage 1 of "The Dairy", or to the north of "The Dairy" and Princes Highway. The Robinsons sold to the Dingley family in 1938.

In the 1920s, the locality was still very sparsely populated, with only six cottages at Burrill. At the approximate location of the current Dolphin Point Road junction with the Princes Highway, there was a large trough with a spear pump for the watering of horses (McAndrew 1993:91). Even at this time, it was a popular tourist destination and tourism was to develop as one of the primary local industries. George Dean established a camping area with bungalows (literally 'Bungalow Park') in 1945 on the site of the present tourist park north of "The Dairy". The Dingley's established a camping ground on the southern side of Burrill Lake east of the Highway, presently known as the Dolphin Point Tourist Park (McAndrew 1993:107). East of "The Dairy" Stage 4 a Public Reserve exists on the flat land bordering the inlet and south of the road bridge. A number of people camped and lived there during the early 20th Century, including Fred Smith and his family from the 1920s to the 1950s (McAndrew 1993). The area is known locally as 'Smithys Point' and also 'Blackie's Point' after a man named Blackman who managed the campground in this area (McAndrew 1993).

Malcolm Dingley (born 1924) recalls that after his parents bought the farm at Burrill in 1938 (present study area), they eventually owned three sections of land, including Portion 23 that originally belonged to Evan Evans. The Dingley family ran a chicken farm on the property with 5,000 laying hens, as well as dairy cattle. Milk was delivered to local residents and businesses for over 26 years (Malcolm Dingley, quoted in McAndrew 1993:130). Former resident Lloyd Butson (born 1936) recalls as a youth that Malcolm Dingley delivered milk in the 1940s and 1950s by horse and cart. The Dairy was known as 'Pacific Park' (McAndrew 1993:139). A piggery was also located on the property (Glen Thomson, *pers. comm*. 2003). The original homestead was located in Stage 1 of "The Dairy" adjacent to the Princes Highway and burnt down during bushfires in 1968 (Malcolm Dingley, quoted in McAndrew 1993:129). It is visible in the 1944 aerial photograph (Figure 5). Remnant garden plants, a concrete slab and a deposit of glass, ceramic and metal fragments mark its location (Navin Officer 2003b).

In 1989 the Dingley family sold to Dolphins Point Developments Pty Ltd, a company associated with the Thomson family (McAndrew 1993:129-130).

Aerial photographs dating to 1944 and 1959 also show a building and farm complex in the Stage 4 study area, adjacent to the Princes Highway (Figure 5). This complex may date to the early 1900s and includes former structures which were moved from a nearby sawmill site by a bullock team (Glen Thomson, *pers. comm*. 2003). The 1959 aerial photograph shows that native vegetation had been largely cleared from the Stage 4 portion of the study area, and considerably thinned in the Stage 2 and 3 areas. Apart from vegetation removal and pastoral and agricultural activities, the study area has also been affected by horse agistment, construction of farm dams, installation of essential services (eg. Telstra cables, water and sewer pipes) and construction and use of the residences in the Stage 4 area.

2.6 Geomorphological History

Reconstructing the landscape prior to non-indigenous settlement assists with understanding the nature of Aboriginal occupation in the region and the post-depositional processes that may have affected any evidence of occupation. As archaeological evidence indicates that Aboriginal people were present in the region within at least the past 20,000 years (Lampert

1971), knowledge of changes to the regional climate, landforms and resources is essential to understanding the nature of that occupation.

Glacio-eustatic fluctuations in sea level have occurred many times over the past million years. These cycles have frequencies of 100,000 years and amplitudes of 100-120 metres. The last cycle began 125,000 years ago with the Last Interglacial phase of high sea levels and warm temperatures. Slow cooling of temperatures and falling sea levels followed, culminating in the last glacial maximum about 24,000 to 17,000 years ago. By the end of the sea regression, the coastline was displaced some 15 kilometres to the east (present continental shelf) (Roy *et al* 1995). Drainage lines therefore extended out to this position and the base level for river valley channels was in excess of 100 metres lower than present. The climate was cooler and drier than at present. Deglaciation and melting of ice sheets occurred rapidly from 18,000 years ago. Post-glacial eustatic sea levels rose rapidly and then stabilised in the mid to late Holocene.

Until recently, the widely accepted model for the Holocene evolution of the coastline of New South Wales (Thom 1974, Thom 1978) has involved:

- A rapid rise in eustatic mean sea level from about -30 metres at 10,000 years ago, stabilising within ±1 metre of its present level around 6,500 years ago;

- This Holocene marine transgression being the main cause of transgressive dune activity between 10,000 and 6,500 years ago;

- With stabilisation of the sea at its present level, and infilling of offshore topography by subtidal sedimentation, net onshore sedimentation produced beach ridges which prograded seaward until the apparent termination of incoming sand around 3,000 years ago ('mid-Holocene stillstand'); and

- Infilling of estuaries and lagoons behind these coastal sand barriers during the 'late Holocene stillstand'.

However, more recent geomorphological evidence has led to the presentation of a revised model for the South Coast (Young *et al* 1993), involving:

- Dune mobilisation during the Late Pleistocene, when the sea level was far below its present level, terminated 14,500 years ago and did not recommence until 10,000 years ago. Regional climate change triggered Early Holocene dune movement, independently of the marine transgression;

- The sea level rose above the present level by 7,000 years ago and was significantly higher than at present for much of the Holocene;

- Higher sea surface temperatures (2º C) than at present 6,000 and 3,000 years ago along the southern New South Wales coastline were associated with a period of general stability, not erosion, during the mid-late Holocene;

- The final stage of the marine transgression led to a rapid progradation of barriers and in some instances (eg. Sussex Inlet) to localised dune migration related to local disruption of vegetation cover; and

- The Holocene record of the South Coast bears the imprint of three catastrophic events, probably tsunamis.

Young *et al* (1993) identify evidence for the large scale movement of dunes having commenced around 10,000 years ago along the southern and central coasts of New South Wales. A dune exposed on the Princes Highway one kilometre north of Burrill Lake yielded a thermoluminescence date of 9.3±2.0 ka. Dune transgression began in the early Holocene after a prolonged period of stability. Although these dunes push inland from the shoreline, some had already climbed rocky headlines and stabilised in positions 1-3 kilometres inland from beaches at the time when the sea was 30-40 metres below its present level and 3-5 kilometres further east than at present. This may represent a climatically induced reworking of older sands, as has been demonstrated further inland (eg. 50-70 kilometres from the modern coast) as occurring on a regional scale in the early Holocene (Young *et al* 1993).

In contrast to the earlier conclusions of Thom and Chappell (1975) and Thom and Roy (1983) for a peak sea level within one metre (above) of the present level between 6,400 and 6,800 years ago, Young (*et al* 1993) present considerable data indicating that the peak was both higher and occurred earlier. Young (*et al* 1993) argue that the peak was reached by 7,000 years ago but rose by at least +2 metres until perhaps as recently as 1,500 years ago. Other researchers, for example Jennings (Appendix 1 in Lampert 1971) speculated decades earlier that a Holocene mean sea level peak of +2 metres was reached at Burrill Lake[2].

Further investigations by Haworth, Baker and Flood (2002) provide a more refined sequence of change in sea levels in the late Holocene. Their extensive research from the east Australian coast demonstrate that radiocarbon dated calcareous skeletons of intertidal organisms are divisible into two clear sets:

- Pre-3,600 years calibrated Before Present (cal BP), from material consistently between 1.5 and 2.2 metres higher than the present sea level; and

- 3,600 - 1,500 years BP, from material generally clustered around 1 metre above the present sea level.

Therefore, the evidence is for a stepped, rather than a smooth decline, in sea level of approximately 1 metre around 3,600 years BP.

Indications of significant changes in the archaeological record dating to around 3,500 years BP have been noted by Rowland (1999) and others.

The effects of catastrophic events such as tsunamis are reported by Young (*et al* 1993) and Bryant (2001). There is clear evidence for such impacts at Cullendulla Creek, near Batemans Bay, Jervis Bay, Mystery Bay and elsewhere along the NSW South Coast. Young (*et al* 1993) concluded that major tsunamis affected the coast around 3,000 and 1,500 years ago, and just prior to non-indigenous settlement. Further research by Bryant (2001) pinpoints these and other major tsunami events on the NSW South Coast to 9,500, 7,000, 5,300, 4,000-2,500, 1,500 and 500 years ago. Bryant (2001) argues that the event 500 years ago (1500 AD) was the largest, possibly as a result of a meteorite impact, and was associated with water reaching over the 130 metre high headland at Steamers Beach, Jervis Bay. Shell samples also allude to a small, but significant, tsunami event on the South Coast in the early 1700s (Bryant 2001). Bryant (2001:114) argues that tsunami would have had a number of effects, including beaches being overwashed, chaotically sorted sediments including gravel and boulders being dumped onto headlands, and bedrock surfaces having been sculpted. Bryant (2001:114) argues that

[2] In shallow embayments such as Burrill Lake geomorphological evidence for former shoreline height datums also needs to consider the consequences of changes in wave energy conditions at the shoreline. Embayment infilling, shallowing and swamp development may lead to *apparent evidence* for mean sea level lowering, which may be largely a loss of reistration of the full tidal effect, and seasonal storm high tide effects on Spring high tides in particular.

much of the Holocene barrier deposits (eg. Burrill Beach) may in fact be the product of tsunami overwash. The implications for the preservation of archaeological evidence in certain contexts remains to be tested, but may be substantially greater than hitherto has been accounted for.

White (1987b) presents a model for the geomorphological history of Burrill Lake, based on the work of Hann (1985), and Thom and Roy (refer above). The recent research of Young *et al* (1993) and others brings a number of aspects of White's (1987b) model into question. White's (1987b:18-22) model involves:

- Phase 1 (late Pleistocene/Early Holocene before 8,000 BP): Sea levels were 3 metres higher than present during the last interglacial marine eustatic high stand (100,000-120,000 years ago). Thick Pleistocene barrier, beach and dune sands from this period now underlie much of the lake and are also exposed on the headland of Blackburn Lookout. As eustatic sea level fell during the last glacial maximum, the lake basin emptied and a creek system re-established itself in the steep-sided valley, draining to a shoreline over 15 kilometres to the east;

- Phase 2 (Lagoonal Phase, 8,000-6,000 BP): Sea-level is assumed to have been about 11 metres lower at this time, but the marine transgression began flooding the Burrill basin. A date obtained from the south-western arm of the lake suggests inundation of this part of the basin began at 7,620±130 BP over a valley soil;

- Phase 3 (Transgressive Phase, 6,000-3,000 BP): The marine transgression brought a large supply of marine sand into the embayment, including reworked Pleistocene sands, which according to Hann ceased around 3,000 BP. Sandy muds replace estuarine muds at 2,390±90 BP on the south-western arm of the lake. Beaches began to prograde seaward;

- Phase 4 (Estuarine Phase, 2,390-1,600 BP): By 2,390 BP the coastal dunes and barrier were in place and the supply of offshore sediment had ceased. Large scale movement of sand sheets occurred within the estuary mouth area; and

- Phase 5 (1,600 BP to present): The barrier has repeatedly opened and closed during this time. A second phase of transgressive dune building began around 1,000 BP due to reworking of mobilised dunes, according to Hann possibly initiated by Aboriginal burning. A thick shell layer is found in the lake at 0.1-0.2 metres depth which coincides with the approximate arrival of non-indigenous people. White (1987b) suggests this could represent clearing of the catchment or be the result of a catastrophic event such as the 1850s floods.

However, the research of Young *et al* (1993) and Haworth *et al* (2002) indicates that many of the assumptions underlying White's (1987b) model may not be correct. For example:

- The timing of Phases 1 and 2, for example mean sea level may have risen to above its present level by 7,000 BP (as supported by Hann's 7,620±130 BP date in the south-western corner of the lake);

- The timing and nature of Phases 3 and 4, for example barrier progradation may have been substantially completed by very early in this period and switched to a more erosive regime around 3,600-3,000 BP as sea temperature and sea levels fell and stormier weather conditions were in operation; and

- Recent reworking of mobilised dunes may be a result of localised disruption of vegetation, not necessarily in association with Aboriginal burning. The thick shell layer in the lake may represent a catastrophic tsunami event (refer above and to Bryant 2001), and almost certainly does not represent the results of early non-indigenous settlement or local flooding.

White (1987b) notes the presence of relic lake shores 1-3 metres above the present lake level, particularly on the southern and western sides of Burrill Lake. White (1987b) speculates that there are three possible ages for the formation of these shores:

1) Remnants of the previous estuary formed in the last interglacial (c. 100,000-120,000 years ago);

2) High stillstand when the sea level supposedly reached its current level 6,000 years ago; or

3) Higher lake levels when a larger barrier was in place 2,400-1,600 BP, when the climate may have been drier.

White (1987b) argues that explanation #2 may be correct. However, in light of more recent evidence, a modified version of this explanation may be more appropriate. The relic shores probably represent the period between 7,000 and 3,600 years cal BP, when the sea level was 1.5 - 2.2 metres higher than at present. This period may also predate full protection of the inner basin from storm effects, so some higher shoreline evidence may reflect higher frequencies of storm wave effects prior to basin infilling/shallowing and progradation of beach barriers across the mouth of the estuary. A relic shore feature is present along the margins of the wetland basin within the present study area.

Hence, the environmental history of study area can be tentatively reconstructed as follows (*cf.* Bryant 2001, Haworth *et al* 2002, Lampert 1971, Mulvaney & Kamminga 1999, Rowland 1999, Roy *et al* 1995, Roy & Boyd 1996, Thom 1974, Thom 1978, Thom & Chappell 1975, Thom & Roy 1983, White 1987b, Young *et al* 1993):

- During the last glacial maximum from about 24,000 to 17,000 years ago, the coastline was located approximately 15 kilometres to the east of Dolphin Point, as the sea level was c. 130 metres below the present level. The climate was cooler (possibly 6-10º C) and drier than at present. The flat within the study area would have comprised a small valley, probably wooded, with soils on a landsurface with a minor ephemeral watercourse (cut down lower than the present basin surface) that drained run-off from the adjacent slopes northward to a river that flowed through what was then a broad valley (now Burrill Lake). Aboriginal people were present within the vicinity of the study area at least 20,000 years ago, as evidenced at the nearby Burrill Lake rock shelter. However, resources of the coastline were located some distance away and potable water was probably not frequently available within the vicinity of the study area. In terms of subsistence resources and potable water, the study area did not represent an environment conducive to Aboriginal occupation;

- Deglaciation and melting of the ice sheets occurred rapidly from 18,000 years ago as temperatures rose. Post-glacial sea levels rose quickly (about one metre per 100 years) up to 8,000 BP, before slowing, but continued to rise above their present level at least 7,000 years ago. Dune mobilisation during the Late Pleistocene terminated 14,500 years ago and did not recommence until 10,000 years ago, when triggered by regional climatic change independent of the marine transgression. The study area would have remained a small valley with limited potable water and resources, while the shoreline approached closer with the rising eustatic sea level. Hence, during the Early Holocene, the study area was still a minor tributary to the main valley. The topography and drainage were still not significantly different to that prevailing for much of the preceding 80,000 years so the area probably was not an environment particularly conducive to Aboriginal occupation;

- Mean eustatic sea level continued to rise, surpassing its present level around 7,000 years ago and remaining between 1.5 and 2.2 metres above the present level until around 3,600 years ago. The barrier beaches (eg. Burrill Beach which encloses the mouth of Burrill Lake) rapidly prograded early during this period. Higher sea surface temperatures (2º C) than at present between about 6,000 and 3,000 years ago were associated with a period of general stability, not erosion, during the mid-late Holocene. The flat/basin within the present study area significantly transformed as it became inundated with marine water and formed a coastal embayment, at least early during this period, while Burrill Lake formed an open bay. Later as the barrier beach formed across the main valley, conditions would have become more sheltered and estuarine and waters would have shifted from saline to brackish as sediment infilled the basin causing shallowing at the margins. The marine transgression brought a large supply of marine sand into the embayment, including reworked Pleistocene sands, up until about 3,000 BP. Much of the sands in the basin of the study area may have been deposited during this period. The possible impacts of tsunami on the local environment cannot be discounted, with probable events around 7,000, 5,300 and several between 4,000-2,500 years ago. The presence of marine and then estuarine resources adjacent to the eucalypt forests provided more abundant subsistence resources in this location than hitherto had been available. For the first time, the area became attractive to Aboriginal people. However, potable water supplies remained limited;

- After about 3,600 years BP a rapid decline in the sea level of approximately one metre occurred, although until 1,500 years BP the sea level still remained about one metre above the present level. A more erosive regime was in place after 3,000 BP as sea temperatures fell, weather conditions were stormier and the wave climate became more erosive. The deposition of transgressive marine sands had largely ceased by around 3,000 BP, due to these factors, and shallowing resulting from basin infilling. As the sea level fell, the western portion of the basin in the study area may have transformed to a saltmarsh or sand flat. It became disconnected from the remainder of the Burrill Lake estuary by the build up of sand deposits in the inlet across the basin mouth, possibly quite late in the Holocene judging by the 940-650 calBP (Wk16145) date obtained during the present investigation for estuarine shell in the sand deposits of the basin entrance (Test Area 8A, Unit EE35, 0.9 - 1.0 metres depth: refer to Appendix 8). The basin's water would have gradually become less saline with the collection of rainwater run-off from the adjacent slopes. On the barrier beach (Burrill Beach) localised dune migration may have occurred in relation to occasional disruption of the vegetation cover. The impacts of probable tsunami events around 4,000-2,500, 1,500, 500 and 300 years ago on the local environment must be considered. The proximity and abundance of subsistence resources would have made the study area favourable for Aboriginal occupation, although the limited supplies of potable water may have constrained more focused habitation (eg. encampments); and

- Since the arrival of non-indigenous settlers significant changes have occurred to the study area (and Burrill Lake environment in general). Within the study area, these include the removal and transformation of the vegetation, partial damming of the basin portion of the study area by the construction of Dolphin Point Road and infilling of the flats east of there by sand dredged from Burrill Lake, along with excavation of artificial drainage channels across the basin.

McAndrew (1993:10) notes that the entrance of Burrill Lake has closed a number of times since the early 1800s and that the present entrance adjoining the rock platform at Dolphin Point represents an artificial channel excavated by the local Clyde Shire Council around 1914. Lions Park, the sand flat east of Dolphin Point Road and the present study area and west of the Burrill Lake inlet, was filled with sand dredged from the channel in the early 1970s (McAndrew 1993:46, 150-151). Banksias and Casuarinas have subsequently been planted in this area (known locally as 'Smithys Point') to minimise erosion of the southern inlet bank

(McAndrew 1993:154). Major floods have been reported since non-indigenous settlement, including in 1962, 1974, 1975 and 1976.

3. ARCHAEOLOGICAL CONTEXT

A number of archaeological surveys and excavations have been undertaken within the Ulladulla region, for commercial contracting purposes and academic research. Discussion of the most relevant investigations will highlight the range of site types and variety of site contents in the locality and broader region, identify typical site locations and present a context for the discussion of the excavation results.

3.1 Previous Archaeological Research Within "The Dairy" Study Area

The proposed 'Dairy' residential subdivision area has previously been subject to archaeological investigations by Feary (1991), Stone (1995), Navin Officer (2003a, 2003b, 2003c, 2003d) and Kuskie (2004a, *in prep*.).

3.1.1 Initial Surveys

The first reported heritage investigation within the study area was a reconnaissance inspection by NPWS archaeologist Sue Feary in 1991, in relation to a proposal to rezone land on the eastern side of Dolphin Point Road. Feary (1991) reported in correspondence to Shoalhaven City Council the location of three archaeological sites and a ceremonial ground, although the evidence was never listed on the DEC site register. The sites included 'Site One' (equating to Dolphin Point 2) in Stage 1 of 'The Dairy', 'Site 3' and 'Site 4' along Dolphin Point Road on the eastern border of the zone 7(b) portion of the present study area (equating to Dolphin Point 4), and a possible ceremonial ground within Stage 2 of the present study area (Figure 7).

Investigations of the study area were also undertaken by Stone (1995) in relation to a Shoalhaven City Council study into the potential for future urban/rural development in the Milton-Ulladulla area. In the course of a low intensity sample survey of a large area, Stone (1995) recorded five artefact scatters and two isolated artefacts. These included Site 2 (DEC #58-1-636) in 'The Dairy' Stage 1 (now referred to as 'Dolphin Point 2') and Isolated Find 1 (IF1 - DEC #58-1-640) in 'The Dairy' Stage 2 (site 'Dolphin Point 1') (Figure 7). Much of the expansion area was concluded by Stone (1995), on very limited evidence, to be of 'low potential'. However the locality of the present study area was noted as being of archaeological sensitivity and 'likely to have been a focus of Aboriginal occupation'.

3.1.2 Navin Officer Survey

'The Dairy' Stage 1 land adjacent to the present study area was purchased by Elderslie Property Investments in February 2003. Shoalhaven City Council advised Elderslie that an archaeological study was required in relation to an application to construct two display homes. Elderslie engaged Navin Officer Heritage Consultants Pty Ltd to conduct this study.

Navin Officer (2003a) surveyed the total area of 'The Dairy' (49 hectares, including the present study area) on 12 March 2003. The survey encompassed Stages 2-4 and the zone 6(b)/7(a) open space area of the present study area, along with Stage 1, but not the LALC property to the east. This survey resulted in the recording of the exposed Aboriginal heritage evidence marked on Figure 7, including within the present study area site Dolphin Point 1

Loci B, C, D and E, site Dolphin Point 2 Locus J, site Dolphin Point 3 Locus F, and site Dolphin Point 4 Locus G. These sites are described in Section 3.1.5.

The evidence located within the Stage 1 area is marked on Figure 7 and summarised below (revised with the results of test excavations presented in Section 3.1.3):

Site Dolphin Point 2 (DEC #58-1-636):

Site Dolphin Point 2 is an artefact scatter and shell midden that is defined by Navin Officer (2003a) as extending across Stage 1 into portions of Stage 4 and Stage 3 of the current study area (Figure 7). The portion of site Dolphin Point 2 within Stage 1 includes Loci A, H and I recorded by Navin Officer (2003a) (including 'Site One' recorded by Feary 1991) and Site 2 recorded by Stone (1995), in addition to the evidence identified during the program of test excavations (Navin Officer 2003b, Figure 8). The site encompasses the gentle drainage depression, gentle simple slope, gentle spur crest, very gentle ridge crest and moderate/steep lower slope environmental contexts.

Locus A was initially recorded by Navin Officer (2003a, 2003b) along exposures created by earthworks associated with the formation of roads to service the Stage 1 subdivision. The upper soil units (to 0.2 metres depth) had been excavated and soil stockpiled adjacent to the road surfaces. Navin Officer (2003a) reported that the maximum dimensions of the exposures were approximately 520 x 240 metres and the incidence of ground surface exposure within the stripped areas was 90% with an average visibility within those exposures of 90%. These exposures were subject to surface collection as part of the test excavation investigation of Stage 1 (Navin Officer 2003b). Approximately 926 artefacts were retrieved from 54 surface collection units measuring about 15 x c.24 metres in area (Navin Officer 2003b:42) at a mean surface density calculated on this data to be in the order of 0.0476 artefacts/m^2.

Locus H was initially recorded by Sue Feary (NPWS) in 1991 as 'Site One'. It was noted as comprising a low density artefact scatter along a rough vehicle track on a low vegetated ridge west of the wetlands. Navin Officer (2003a) recorded this evidence as Locus H. The farm track appeared not to have been regularly used and displayed generally low levels of ground surface visibility during the survey (exposure incidence of 20% and average visibility of 25%). Four artefacts were recorded by Navin Officer (2003a) in the mid-section of the 4 metre wide track, over a distance of 20 metres. The artefacts occurred on a simple slope and comprised a quartz geometric microlith, a hammerstone, a silcrete flake, and an alluvial pebble manuport (possible top grindstone).

Locus I was initially recorded by Navin Officer (2003a) on exposures caused by excavation and stock trampling around a small farm dam. Locus I is situated on the moderate lower slope adjacent to the wetland/flat. Three artefacts were recorded within a 15 metre diameter exposure, a silcrete core, a silcrete flake and a rhyolite flake.

'Site 2' was originally recorded by Stone (1995). It was described as an open scatter of five stone artefacts associated with a clump of trees. Stone (1995) identified the site within an area of 10 x 40 metres. Visibility was low at the time and it was considered likely that the site was larger than indicated by the surface artefacts.

Navin Officer (2003b) excavated 38 test units within site Dolphin Point 2 (Figure 8) and an additional unit was excavated in site Dolphin Point 4. Testing resulted in the recovery of 368 lithic items from site Dolphin Point 2. Many of the test units contained no artefacts or very low numbers of artefacts. However, two units contained moderate numbers of artefacts (64 and 92) indicating that within the low-density background discard across the site there are concentrations of relatively higher density where activities or repeated activities have occurred.

Site Dolphin Point 4 (DEC #58-1-933):

Site Dolphin Point 4 is an artefact scatter/shell midden originally defined by Navin Officer (2003a) as extending across the eastern margin of the open space portion of the present study area. A small portion of site Dolphin Point 4 was included within the Stage 1 Consent area, specifically part of Locus G recorded by Navin Officer (2003a) and Test Unit #30 excavated by Navin Officer (2003b) (Figures 7 & 8). The site encompasses the level/very gentle flat and gentle lower slope environmental contexts (refer to Section 3.1.5 for description).

3.1.3 Navin Officer Test Excavations Within Stage 1

Subsequent to the initial survey and several meetings with the Ulladulla LALC (Officer 2003a, 2003b) it was resolved that further heritage investigation of the Stage 1 land would be undertaken, including sub-surface testing. The program of sub-surface testing in Stage 1 was undertaken by Navin Officer (2003b, 2003c, 2003d) in April and June 2003. The testing included excavation of one unit (#30) within the zone 6(b) open space portion of the present study area (Figure 8). Four lithic items were located in this unit.

In total Navin Officer (2003b) recovered 1,339 artefacts by mechanical excavation of widely-spaced test units (predominantly on a 70 metre grid across Stage 1), surface collection of areas exposed by preliminary construction earthworks, and sieving of samples from spoil mounds associated with these earthworks (Figures 8-10, Table 1).

Approximately 926 artefacts were retrieved from 54 surface collection units measuring about 15 x c.24 metres in area (Navin Officer 2003b:42), at a mean surface density calculated on this data to be in the order of 0.0476 artefacts/m^2. This is a very low density, consistent with background discard, manuport and artefactual material which is insufficient either in number or in association with other material to suggest focused activity in a particular location (*cf.* Rich 1993, Kuskie & Kamminga 2000). It is noted that a significant proportion of the recorded items are classified as 'fire cracked rock', which may in fact be items that are fractured as a result of natural, not human forces, and are therefore not appropriately identified as 'artefacts'. Excluding these items, the calculated density is even lower.

Approximately 364 artefacts were retrieved by Navin Officer (2003b) from 36 test units of variable and largely unreported size or volume of deposit sieved. A further 8 artefacts were retrieved from subsequent excavation of 3 additional test units. Navin Officer (2003b) omit crucial details of the areas of each excavation unit spit and volume of deposit sieved. Hence, it is not possible to corroborate the reported density calculations. However, assuming a general conflated area of between one and two square metres for each mechanically excavated test unit, the density would appear to range between 4.8 and 9.5 artefacts/conflated m^2. No heritage evidence was present in 10 of the 39 units and only 10 units contained more than 10 artefacts, indicating the low-density nature of much of the sample. Two units contained moderate numbers of artefacts (64 and 92) indicating that within the low-density background discard there are concentrations of relatively higher density where activities or repeated activities have occurred. Open artefact scatter sites excavated elsewhere in south-eastern Australia have yielded substantially higher mean artefact densities (eg. Sandon Point, 87/conflated m^2 - Hiscock 2002; The Wool Road, 42.82/m^3 - Kuskie 2000b; Black Hill 1, 190/m^3 - Silcox & Ruig 1995; Black Hill 2, 546.2/m^3 - Kuskie & Kamminga 2000; Woods Gully, 209.5/m^3 - Kuskie & Kamminga 2000).

Midden deposit was identified in two locations:

A) A small discrete scatter of shell, predominantly cockle, exposed at 0.15 metres depth in a grader scrape at the north-eastern area of road works (chainage 315-330, between allotments 1 and 71) (Figure 9). A sample of cockle shell was retrieved from a small excavation for dating. The midden was dated to 938±35 years BP (Wk12904), calibrated to two standard deviations to 660 - 430 BP (1290 AD - 1520 AD); and

B) Situated 210 metres away, *in situ* deposit, predominantly of cockle but including fragments of fish, mammal and bird bone, 0.05 - 0.25 metres below the surface in Test Unit #29 (Figure 8, Table 2). This unit is located several metres down slope from the relic shoreline, on the northern margin of the basin. The midden was dated to 914±35 years BP (Wk12905), calibrated to two standard deviations to 650 - 400 BP (1300 AD - 1550 AD).

Review of the testing program has indicated a number of key concerns, in particular that many of the primary interpretations, conclusions, judgements and recommendations are not substantiated by the project data or by other known evidence. The cumulative result is that much of this work must be set aside. The Stage 1 salvage (Kuskie *in prep*.) is used as the primary data for comparison with the Stage 2-4 testing results of the present investigation.

The primary concerns with the approach utilised by Navin Officer relate to the absence of an explicit research design, including appreciation of the expected nature of the archaeological evidence, and the subsequent use of an inadequate sampling strategy and methodology. A research design is essential, as the scientific research potential of an Aboriginal site can only be realised when the evidence is analysed in relation to specific research questions. Navin Officer (2003b:9) specify one general aim for the testing program, to:

> "ascertain the nature, extent and integrity of Aboriginal archaeological deposits (Aboriginal objects as defined by the NPWS Act), within the development area and associated infrastructure for Stage 1 of The Dairy residential development, Dolphin Point".

Three 'specific' aims are also stated:

1) "Characterise the nature of any archaeological deposits encountered (within the limitations of the sampling and processing methodology)";

2) "Identify the need for any further archaeological work, such as salvage excavation"; and

3) "Provide informed mitigative measures and management recommendations for the Aboriginal cultural resource" (Navin Officer 2003b:9).

However, apart from the general management objectives, the research design did not specify any particular problems or hypotheses to investigate. Without valid research questions, there was no framework for the selection of an appropriate sampling strategy or a methodology for the retrieval of data, nor a framework for the identification of variables required to be collected or analysed. As a result, a sampling strategy and an excavation methodology were applied that were both unsuitable in terms of addressing the project aims and difficult to support if the extensive body of existing archaeological knowledge from south-eastern Australia was taken into consideration.

The nature of Aboriginal heritage evidence that could be expected within Stage 1, and as was partly revealed in the surface exposures created by the initial development works, was a low density distribution of artefacts interspersed by focalised areas of higher artefact density and shell midden loci where activities or repeated activities had occurred. A sample retrieved from test units spaced across a 70 metre grid was insufficient for the purpose of adequately characterising the nature and distribution of the evidence within the study area, as ultimately acknowledged by Navin Officer (2003d). Such a sampling strategy assumes that similar evidence is expected within a 70 metre radius of each test unit, an assumption that is unsupported by the results of numerous major survey and excavation projects in south-eastern Australia (*cf*. Kuskie & Kamminga 2000) and ultimately the results of Navin Officer's own testing and surface collections.

To overcome the identified problems with the methodology, Navin Officer (2003d) undertook a second visit to the site in order to excavate further units which 'aimed to gain a finer scale understanding of the nature of the deposit at the north-eastern end of the study area' (Navin Officer 2003b:10). However these units were spaced so far apart from the others that the probability of intersecting features such as middens or high-density activity focal points was limited. Numerous investigations (*cf*. Kuskie & Kamminga 2000) have demonstrated that features such as small middens, hearths, heat treatment pits and discrete knapping floors typically occupy areas in the order of less than 10 square metres, often only several square metres when horizontally intact. Only the employment of a more closely spaced series of test units would have had any reasonable degree of probability of accurately testing or demonstrating the nature and spatial distribution of evidence within Stage 1.

The use of mechanical equipment (backhoe) to excavate the test units resulted in several constraints with the nature of the data recovered, particularly:

- The size of each test unit could not be adequately controlled and varied substantially between and even within excavation units; and

- The depth of each 'spit' or level excavated could not be adequately controlled and varied widely between and within units.

For example, Navin Officer (2003b:10) stated that test unit sizes ranged between 1.2 and 1.4 metres wide and 1.4 and 1.8 metres long for 30 units and between 0.8 and 0.9 metres wide and 2.0 and 2.5 metres long for 6 units. However, the actual size of each excavation unit spit is not reported. The calculations of artefact density presented by Navin Officer are questionable and cannot be verified in the absence of this critical data.

Navin Officer (2003b: Appendix 3) also report variations in the depths of spits. For example, spit 1 ranges from 0-12/15 (unit #31) to 0-30 centimetres (unit #29) in depth. Spit 2 ranges in starting depth from 12/15 (unit #31) to 30 centimetres (unit #29) below the surface and in finishing depth from 20 (unit #31) to 40/45 centimetres (units #8 & 29) below the surface. The thickness of spit 2 varies from 8 centimetres in unit #31 to 27 centimetres in unit #8.

The volume of excavated deposit sieved does not appear to have been reported and appears to vary between excavated units.

The sample of excavated units therefore involves units of:

- Different sizes;

- Different spit depths and thicknesses;

- Different volumes of deposit sieved; and

- Different finishing depths in relation to the soil horizons (eg. some units excavated further than others into the sterile clay).

These variations render it problematic to accurately compare data between the different test units, even if the deposit sieved was accurately recorded and reported and a constant unit of measure (eg. # artefacts/m^3 of deposit sieved) was used. However, the volume of deposit sieved for each excavated unit spit is not reported. There is no reported basis or justification for the calculations of density which are heavily relied upon by Navin Officer (2003b) to assert a high level of site significance and to recommend specific conservation and salvage areas.

The primary data analysis relates to the stone assemblage. The analysis presented by Clarkson in Navin Officer (2003b) is difficult to substantiate in consideration of the problems with the retrieval methodology and in terms of the objectives of the project. In the absence of a research design, the use of a lithic analysis methodology focused on detailed 'technological attribute analysis' is questionable. The comprehensive studies by Koettig (1994) at Bulga and others have demonstrated that there are major problems inherent with this type of technological attribute analysis. These problems relate to the analyst combining artefacts to form 'an assemblage', which in fact in this particular case represents artefacts from widely separated areas (up to 650 metres apart in Stage 1), potentially from totally unrelated activities and temporally and culturally unrelated episodes of occupation.

Navin Officer's (2003b:43) argument that the surface collection represents a 'richer' (more diverse range of lithic types) assemblage than the excavated assemblage is not necessarily supported when the relative sample sizes are compared. A total of 926 collected artefacts represents a sample size more than twice as large as the 412 excavated artefacts. Kuskie and Kamminga (2000) and others have identified a strong correlation between sample size and range of lithic types. In these studies, the larger the sample size, the greater the range of lithic types that has been identified. Additional problems with measures of 'assemblage richness' result from the nature of the artefact classification (the more types an analyst subdivides or classifies artefacts into, the greater the perceived 'richness' of the assemblage). Almost all excavation and collection units have less than eight assemblage elements. In any case, it is questionable as to what the measure of 'richness' means in relation to Aboriginal activity. A test unit with 10 assemblage elements, all relating to non-specific knapping activity, may not necessarily be 'richer' than a test unit with 5 assemblage elements, each relating to different human activities.

Navin Officer (2003b) extrapolated the results of testing from a low number of widely spaced test units to a broad 12.5 hectare area, using isopleth (contour) maps of artefact distribution/density. However, such interpolations of variable values between small, dispersed sampling units are based on the assumption that the particular values for individual units are representative of the area immediately surrounding them (*cf.* Boismier 1991:20). There is no evidence to justify this conclusion at The Dairy. In fact, evidence to the contrary exists in Stage 1, that there is considerable spatial variation in the density of artefacts on a much finer scale than an assessment using a 70 metre grid would permit identification of.

Navin Officer (2003b) concluded that the Stage 1 site exhibits high levels of vertical integrity. This conclusion cannot be corroborated by review of the reported data. The constraints relating to the analysis of vertical distribution include the mechanical nature of the excavation methodology and absence of reporting of key data for the volume of deposit sieved. The use of a backhoe has resulted in test units of variable size and with spits of variable depths, which reduces the ability to accurately analyse vertical distribution or conduct intra-site comparisons. An attempt to overcome this limitation by analysing artefact numbers by depth below surface is similarly constrained by the nature of the methodology.

Re-examination of the data (eg. Navin Officer 2003b, Appendix 3 & Table 5) indicates a pattern of vertical artefact distribution in which evidence is concentrated in the uppermost levels (Spit 1, 247 or 68% of artefacts, varying in depth below surface from zero to 12 to 30 centimetres). There is a marked decline to spit 2 (55 or 15% of artefacts, varying in depth below surface from 12 to 45 centimetres) and a further gradual decline below this level. The only anomalous test unit to this pattern is unit #35, in which artefacts are absent from spits 1 and 2 (0 - 25/30 cm depth) and peak in the lowest spit 6 (75-95 cm). There are several potential explanations for this anomaly. However, in terms of the 35 other test units, the pattern of vertical distribution is consistent with that of a bioturbated site, in which Aboriginal occupation occurred in the uppermost soil unit and a small proportion of artefacts have subsequently worked their way downwards through bioturbation processes. The sandy nature of the A unit soil, which is conducive to artefact movement, is noted. Navin Officer (2003b) omit any discussion of the effects of bioturbation (*cf.* Dean-Jones & Mitchell 1993, Gollan 1992, Mitchell 1988, Moeyersons 1978) on site integrity.

The analysis and conclusions about the age of the deposit (Navin Officer 2003b:60-63) cannot be corroborated considering the extremely small sample size, wide variations in test unit spit depths and mixed and widely disparate nature of the 'assemblage'. The application of age-depth curves to open sites in the absence of data on the processes and rates of sediment deposition and/or evidence for pedogenesis is questionable, as is the attempt to date the evidence through technological attributes. The rationale developed by Hiscock (1986) twenty years ago to date open sites through analysis of technological attributes has in itself been widely questioned (Haglund 1989). No subsequent researcher has been able to successfully apply Hiscock's methodology to date an open site (*cf.* Haglund 1989, Koettig 1994, Dean-Jones 1992 & Rich 1991).

The examination of the effects of heating on the evidence is equivocal and not directly supported by evidence. The issue of heat treatment of silcrete was not examined and useful indicators such as colour and lustre (*cf.* Kuskie & Kamminga 2000) were not recorded. A natural origin for pebbles on the site appears to have been discounted without sufficient basis.

Conclusions about the representativeness of the evidence and presence or absence of similar evidence on the South Coast (Navin Officer 2003b:81) are not supported by any data.

The conclusion (Navin Officer 2003b:84) that the Stage 1 site is "undoubtedly of major regional and quite likely national significance" is not corroborated by independent review. No evidence is presented in the assessment to establish such a high level of scientific significance.

Navin Officer (2003b:92-93) presented a series of management recommendations involving conservation, salvage and unmitigated impact based on this assessment. However, it can be argued that the significance assessment and subsequent management recommendations were based on an assessment that involved a very small sample of evidence and interpretations of that evidence which are questionable or cannot be corroborated by independent review. None of the key management considerations could be demonstrably supported by review of the data, including:

- The assertion of "high regional and possibly national archaeological significance" of the evidence;

- The assertion that the "Stage 1 area includes areas of high artefact density that do not appear to be replicated in comparable contexts outside the boundaries of the development area"; and

- The assertion that the Stage 1 evidence is "unique" and "could not be represented by reserved lands in adjacent areas".

3.1.4 South East Archaeology Salvage Excavations Within Stage 1

Following a number of meetings and the exchange of considerable correspondence between the key stakeholders, DEC issued a Section 90 Consent permit (#1726) for Stage 1 of "The Dairy" on 19 September 2003. The Consent extends marginally within the zone 6(b)/7(a) open space portion of the present study area to encompass a drainage easement and a proposed realignment of a new access road that will provide access from the Princes Highway to Dolphin Point.

As a condition of the Consent, the implementation was required of a research design prepared by Navin Officer Heritage Consultants on 29 August 2003 entitled *Archaeological Conservation and Salvage Proposal The Dairy Residential Development Area, Dolphin Point, Burrill Lake, NSW*.

However, subsequent to the issue of Consent #1726, independent reviews of the Stage 1 data and reports of Navin Officer Heritage Consultants were undertaken by South East Archaeology and another independent expert (refer to Section 3.1.3). As a result of these reviews, information became available questioning the significance assessment and management recommendations for the Stage 1 heritage resource. At a meeting between the proponent, South East Archaeology and DEC in February 2004, it was agreed that DEC would consider altering or issuing a new Section 90 Consent for Stage 1 involving a revised Conservation and Salvage Proposal. A revised *Aboriginal Heritage Conservation and Salvage Proposal* was subsequently prepared by South East Archaeology and approved by the Ulladulla Local Aboriginal Land Council and Department of Environment and Conservation. Section 90 Consent #1726 was amended accordingly and a program of salvage conducted by South East Archaeology in 2004 (Kuskie *in prep*.).

The program of salvage was undertaken by South East Archaeology according to the methodology approved in the amended Section 90 Consent. Fieldwork was undertaken over a period of 62 days between 13 April and 9 July 2004. Five qualified archaeologists from South East Archaeology were assisted throughout the course of the salvage by on average five representatives per day from the Ulladulla Local Aboriginal Land Council.

The analysis and report preparation for the Stage 1 salvage is currently in progress (Kuskie *in prep*.). However, recording of the lithic items recovered has been completed and sufficient analysis has been undertaken to provide data for comparison with the Stage 2-4 testing results. This information is summarised below and discussed further in Section 5.

The Stage 1 salvage was primarily intended to mitigate the impacts of development upon the cultural and scientific values of the identified and potential heritage evidence within Stage 1 and to retrieve and conserve a sample of evidence from the Dolphin Point 2 site. In addition, the investigation was intended to provide comparative material useful for the Stage 2-4 assessment and permit reassessment of the validity of the proposed conservation measure involving eight individual allotments within Stage 1 (Lots 25, 26, 43, 44, 51, 52, 57 and 58). Through the excavation and subsequent analysis of the evidence retrieved, a number of research hypotheses were also proposed to be addressed.

The methodology involved:

- Two broad area excavations, each measuring 40 x 2 metres and dug by hand in 0.5 x 0.5 metre units and 0.1 metre spits, in the "gentle spur crest further than 200 metres from the wetlands" and "gentle simple slope within 200 metres of the wetlands, easterly aspect" environmental/cultural contexts (Figure 11);

- Mechanical surface scrapes conducted within nine separate portions of the area set aside for archaeological salvage (Figure 11). Each scrape involved the use of a dozer to progressively remove thin layers (eg. 2-5 centimetres) of soil. A grid of 5 x 5 metre collection squares was overlain across each scrape area. After each pass of the dozer, the surface was inspected and any visible evidence collected within the alphanumerically labelled collection squares. The process was repeated for each scrape area until the main cultural horizons had been excavated or the base of the A unit soil or beginning of B unit clay was reached; and

- Hand excavation of localised features of potential significance (eg. dense artefact clusters) that were identified within the surface scrapes (Figure 11). Six localised hand excavations were undertaken, each dug in 1 m^2 units and 0.1 metre spits (below the starting level of the scraped surface).

Soil from each level within an excavation unit was placed into separate buckets, labelled and transported to a sieving station and separately sieved. Wet sieving was used, with water recycled from a farm dam. A sieve mesh of 2.5 millimetres (3.13 mm maximum aperture) was used.

Examination of the salvage sampling strategy in relation to the environmental/cultural contexts of Stage 1 (Table 3) reveals that:

- 12 environmental/cultural contexts are represented in the Stage 1 Consent & Conservation Area;

- 2 of the largest of these 12 contexts (4a & 5b) were subject to salvage by Broad Area Hand Excavation;

- 6 of these 12 contexts (1a, 4a, 4b, 4c, 5a & 5b; including the two subject to Broad Area Hand Excavation) were subject to Surface Scrapes and two (4a & 4b) to Hand Excavations within the Surface Scrapes;

- 1 of these 12 contexts (8a) is almost totally subject to conservation and was not subject to salvage;

- 2 of these 12 contexts (2a & 9a) comprise very small areas of land subject to minor impacts and were not subject to salvage; and

- 3 of these 12 contexts (3a, 3b & 7a) lay outside of the zone that had been reserved by Navin Officer for archaeological salvage under the existing Consent and on that basis could not be subject to salvage. In any event, a substantial part of the 3a context was to be conserved and therefore salvage may not have been warranted. The 3b context comprises a relatively small area of land and on this basis it is also considered that salvage was not warranted. The 7a context comprises a relatively small area of land and a much greater proportion of this context lies within the Stage 4 development area and is subject to further archaeological investigation as part of the Stage 2-4 assessment.

A total area of 160 m^2 was excavated in the two broad area hand excavations, 24 m^2 in the localised hand excavations within the surface scrapes, and a plan area of 8,700 m^2 in the scrapes (Table 4, Figures 11-13). As the surface scrape plan areas were subject to repeated grading and collection (on average 9.9 spits in each area), a total area of 82,875 m^2 was effectively exposed (Table 7). In addition, in order to satisfy a DEC requirement, 2 m^3 of spoil from a surface scrape was sieved to characterise the nature of evidence not identified in the surface scrape process.

A total of 6,337 artefacts were retrieved during the salvage and an additional 41 artefacts from the investigation of the surface scrape spoil (Tables 5 & 6). Due to the nature of the methodology of the latter collection, it is excluded from the combined artefact assemblage for most analyses. A total of 2,315 artefacts were retrieved from the two broad area excavations, 2,090 from the localised hand excavations of dense artefact features within the surface scrapes, and 1,932 from the surface of the scrapes themselves (Tables 5 & 6).

The mean density of artefacts tended to be very low in both the broad area excavations (10.40 artefacts per conflated m^2 or 22.79 artefacts per m^3 in Broad Area A and 18.54/conflated m^2 or 31.25/m^3 in Broad Area B) (Table 6). The mean density of artefacts was also very low in the surface scrapes (0.22 artefacts/m^2 of the plan area or 0.023/m^2 if the total area scraped, combining the different spits, is considered) (Table 7). In contrast, because the localised hand excavations within the surface scrapes were targeted to retrieve identified dense artefact clusters (activity areas), the mean artefact density of these samples was significantly higher (87.08 artefacts/conflated m^2 or 538.80 artefacts/m^3) (Tables 6 & 8). Hence, the overall spatial distribution of evidence and pattern of activity in Stage 1 is consistent with a low density distribution of artefacts (background discard) interspersed by occasional focalised areas of higher artefact density where activities or repeated activities have occurred.

The combined assemblage is dominated by flakes (33.42%) and flake portions (50.23%) (Tables 9 & 10). Apart from lithic fragments (7.51%), a low frequency of other artefact types are present. The combined assemblage overwhelmingly relates to non-specific stone knapping (94.43%), with only minor frequencies of artefacts indicative of microblade production (2.81%), backing retouch/microlith production (0.30%), bipolar flaking (0.19%), loss or intentional discard of microliths (1.80%) and discard of non-microlith tools (0.47%) (Table 11).

The combined assemblage is dominated by the stone material silcrete (88.75% of the combined total) (Table 12). Minor frequencies of other stone materials occur, including quartz (6.56%), rhyolite (1.96%), quartzite (1.85%), chert (0.55%), volcanics 1 and 2 (0.19%) and basalt (0.13%) (Table 12).

The combined Stage 1 assemblage is dominated by small artefacts (96.42% are less than 50 millimetres in maximum dimension) (Tables 13 & 14). However, as noted elsewhere (Kuskie & Kamminga 2000, Kuskie & Clarke 2004) the different collection methods produce different results. A higher frequency of smaller items (eg. less than 20 mm in maximum dimension) are retrieved from the hand excavations and sieving rather than the surface scrapes (Tables 13 & 14).

The results of Stage 1 are discussed in greater detail in relation to the Stage 2-4 results in Section 5.

3.1.5 South East Archaeology Survey

As an outcome of consultation with the Department of Environment and Conservation (DEC) in relation to the November 2003 Section 87 application for Stages 2-4, DEC requested in December 2003 that a formal survey report be prepared for "The Dairy", prior to further consideration of the application. South East Archaeology subsequently undertook a more detailed field survey designed to capture the essential survey coverage and site data and prepared an assessment report (Kuskie 2004a). The area investigated comprised the present Stages 2-4 and open space study area, along with an adjacent property owned by the Ulladulla

Local Aboriginal Land Council, measuring approximately 13.5 hectares (Figure 1). Hence, the total investigation area measured approximately 50 hectares.

The total survey coverage (ground physically inspected for heritage evidence) obtained during the February 2004 survey equated to approximately 8.6% of the study area (Appendix 1). The total effective survey coverage (*visible* ground surface physically inspected with potential to host evidence) equated to just 0.4% of the study area. Very low conditions of surface visibility constrained the ability to effectively assess the Aboriginal heritage resources potentially present within the study area (Kuskie 2004a).

This survey resulted in the recording of much of the exposed Aboriginal heritage evidence marked on Figure 7, including within the present study area site Dolphin Point 1 Loci B, C, D and E, site Dolphin Point 2 Locus J, site Dolphin Point 3 Locus F, and site Dolphin Point 4 Locus G (Appendices 2 & 3). These sites are described below (from Kuskie 2004a):

Site Dolphin Point 1 (DEC #58-1-640):

Site Dolphin Point 1 is an artefact scatter that was defined by Navin Officer (2003a) as extending across much of Stage 2 of the present study area. It comprises four loci of evidence recorded by Navin Officer (2003a) (including Isolated Find 1, reported by Stone in 1995) and one locus of additional evidence identified by South East Archaeology in February 2004 (Figure 7). The site encompasses the very gentle drainage depression, gentle simple slope, gentle spur crest, gentle drainage depression and gentle lower slope environmental contexts.

Locus B is situated around AMG grid reference 267330:6079820 on the Tabourie 8927-II-S 1:25,000 topographic map. It was initially recorded by Navin Officer (2003a) as 'Exposure B'. Locus B has been exposed within a broad area of earthmoving works south of a farm dam, undertaken in relation to the initial Stage 1 residential development. Approximately 80% of the area has been excavated and comprises a compacted clay base, with minimal potential for visible evidence. The remainder forms a semi-circular shaped spoil mound with a mix of clay B unit and sandy A unit soil. Almost all of the identified artefacts are visible on the spoil mound and are not *in situ*. Locus B is exposed within an area of approximately 95 x 50 metres with 20% archaeological visibility. A total of 67 artefacts and 9 lithic fragments were recorded during the February 2004 survey, mainly on the spoil mound (Kuskie 2004a). The assemblage is dominated by silcrete (71% of total lithic items), with lesser frequencies of porphyritic rhyolite (10.5%), quartz (8%), quartzite, acid volcanic and chert stone materials. Flakes (49%) dominate the artefact assemblage, followed by cores (24%), flake portions (12%) and several core fragments and hammerstones and a single anvil, microblade portion, manuport, retouched piece and utilised flake. Navin Officer (2003a) reported an artefact density of between 0.2 and 4 artefacts per square metre, with an apparent trend for higher density closest to the flat. A mean artefact density of about $0.07/m^2$ is calculated on the basis of the effective survey coverage obtained in the February 2004 survey (Kuskie 2004a). Although levels of disturbance are high at the visible locus, there was considered to be a high potential for sub-surface deposits to occur in the adjacent A unit soil, including evidence that may be *in situ* (Kuskie 2004a).

Locus C is situated around AMG grid reference 267000:6079700 on the Tabourie 8927-II-S 1:25,000 topographic map on a very gentle drainage depression. It was initially recorded by Navin Officer (2003a) as 'Exposure C'. Locus C is visible within a 10 x 5 metre area of exposures associated with a farm dam and erosion on the western border of the study area. Archaeological visibility averages approximately 15% at the locus. One artefact (an acid volcanic hammerstone) and one silcrete lithic fragment were recorded during the February 2004 survey (Kuskie 2004a). Navin Officer (2003a) had originally reported a single silcrete flake. Although levels of disturbance are moderate at the visible locus, there was considered to be a high potential for sub-surface deposits to occur in the adjacent A unit soil, including evidence that may be *in situ* (Kuskie 2004a).

Locus D is situated around AMG grid reference 267060:6079510 on the Tabourie 8927-II-S 1:25,000 topographic map on a gentle spur crest. It was initially recorded by Navin Officer (2003a) as 'Exposure D'. Locus D is visible within a 10 x 5 metre area of exposures on the southern border of the study area adjoining Meroo National Park. Archaeological visibility averages approximately 40% at the locus. Two artefacts (acid volcanic and silcrete flake portions) were recorded during the February 2004 survey (Kuskie 2004a). Navin Officer (2003a) had originally reported a broken alluvial pebble (manuport) and a silcrete microblade core at this locus. Although levels of disturbance are moderate at the visible locus, there was considered to be a high potential for a shallow sub-surface deposit to occur in the adjacent A unit soil, including evidence that may be *in situ* (Kuskie 2004a).

Locus E is situated around AMG grid reference 267300:6079710 on the Tabourie 8927-II-S 1:25,000 topographic map on a gentle drainage depression. It was initially recorded by Navin Officer (2003a) as 'Exposure E'. Locus E is visible within a 23 x 10 metre area of exposures associated with saline seepage and erosion. Archaeological visibility averages approximately 20% at the locus. No evidence could be identified during the February 2004 survey (Kuskie 2004a). However, Navin Officer (2003a) had originally reported a silcrete flake portion, within a 15 x 6 metre exposure. Navin Officer (2003a) consider that this evidence may equate to Stone's (1995) Isolated Find 1, given the similar description. However, the grid reference provided by Stone places IF1 100 metres further to the north in Locus B. Although levels of disturbance are moderate at the visible locus, there was considered to be a high potential for a sub-surface deposit to occur in the adjacent A unit soil, including evidence that may be *in situ* (Kuskie 2004a).

Locus K is situated around AMG grid reference 267050:6079730 on the Tabourie 8927-II-S 1:25,000 topographic map on a gentle simple slope. Locus K is visible on a small exposure along a stock trail, 27 metres south of the very gentle drainage depression. One artefact (a porphyritic rhyolite pebble core) was recorded during the February 2004 survey (Kuskie 2004a). Although levels of disturbance are moderate at the visible locus, there was considered to be a high potential for sub-surface deposits to occur in the adjacent A unit soil, including evidence that may be *in situ* (Kuskie 2004a).

Site Dolphin Point 2 (DEC #58-1-636):

Site Dolphin Point 2 is an artefact scatter that was defined by Navin Officer (2003a) as extending across Stage 1 adjacent to the present study area, but including Stage 4 and part of Stage 3 of the present study area (Figure 7). The portion of site Dolphin Point 2 within the present study area includes Locus J recorded by Navin Officer (2003a), Site 2 recorded by Stone (1995) and Locus L identified by South East Archaeology in February 2004 (Figure 7). The site encompasses the gentle drainage depression, gentle simple slope, very gentle crest and moderate/steep lower slope environmental contexts.

Locus J is situated around AMG grid reference 267540:6080430 on the Tabourie 8927-II-S 1:25,000 topographic map on a very gentle ridge crest. It was initially recorded by Navin Officer (2003a) as 'Exposure J'. Locus J is visible on stock tracks/exposures within a 30 x 30 metre fenced enclosure in Stage 4 of the present study area, south of an access road off the Princes Highway. Archaeological visibility averages approximately 10% at the locus over an exposed area of about 180 square metres. No evidence was identified during the February 2004 survey (Kuskie 2004a). However, Navin Officer (2003a) had originally reported a rhyolite bondi point portion, silcrete retouched flake, rhyolite core fragment and silcrete and rhyolite flakes. Although levels of disturbance are high at the visible locus, there was considered to be a high potential for sub-surface deposits to occur in the adjacent A unit soil, including evidence that may be *in situ* (Kuskie 2004a).

Locus L is situated around AMG grid reference 267610:6080460 on the Tabourie 8927-II-S 1:25,000 topographic map on a very gentle ridge crest. Locus L is visible on a small exposure on the edge of the access driveway leading from the Princes Highway to the main residence in Stage 4. One artefact (a silcrete core) was recorded during the February 2004 survey (Kuskie 2004a). The artefact is possibly eroding from the margin of the driveway or has been imported with road base material. Levels of disturbance are high at and around the visible locus and there was considered to be minimal potential for sub-surface deposits to occur, particularly evidence that may be *in situ* (Kuskie 2004a).

Locus 'Stone Site 2' primarily occurs within the adjacent Stage 1 development area and was originally recorded by Stone (1995). However, an extension of this locus has been identified marginally within the present application area around AMG grid reference 267100:6080040 on the Tabourie 8927-II-S 1:25,000 topographic map. The locus occurs on a gentle drainage depression. Artefacts are visible eroding from the margin of the drainage depression along the fence bordering Stage 1. Three artefacts were identified within a 1 x 1 metre portion of a 12 x 10 metre exposure (Kuskie 2004a). The artefacts comprise a silcrete core, silcrete core fragment and silcrete flake portion. Although levels of disturbance are moderate at the visible locus, there was considered to be a high potential for sub-surface deposits to occur in the adjacent A unit soil, including evidence that may be *in situ* (Kuskie 2004a).

Site Dolphin Point 3 (DEC #58-1-947):

Site Dolphin Point 3 is an artefact scatter that was delineated by Navin Officer (2003a) within the eastern corner of Stage 2 of the present study area, adjoining the Ulladulla LALC land. Site Dolphin Point 3 comprises Locus F recorded by Navin Officer (2003a) (Figure 7). The site encompasses the gentle simple slope and gentle lower slope environmental contexts.

Locus F is situated around AMG grid reference 267500:6079810 on the Tabourie 8927-II-S 1:25,000 topographic map on a gentle lower slope (former shoreline). It was initially recorded by Navin Officer (2003a) as 'Exposure F'. Locus F is visible within a 5 x 2 metre portion of a 50 x 10 metre area of erosion exposures with 10% archaeological visibility. Two artefacts (chert core and quartzite hammerstone/anvil) were recorded during the February 2004 survey (Kuskie 2004a). Navin Officer (2003a) had originally reported a quartzite hammerstone (possible top grindstone) and a volcanic flake at this locus. Although levels of disturbance are moderate at the visible locus, there was considered to be a high potential for a sub-surface deposit to occur in the adjacent A unit soil, including evidence that may be *in situ* (Kuskie 2004a).

Site Dolphin Point 4 (DEC #58-1-933):

Site Dolphin Point 4 is an artefact scatter/shell midden that was defined by Navin Officer (2003a) as extending across the eastern margin of the open space portion of the present study area. Site Dolphin Point 4 comprises Locus G recorded by Navin Officer (2003a), Test Unit #30 excavated by Navin Officer (2003b), Site 3 and Site 4 recorded by NPWS archaeologist Sue Feary (1991) (unrecorded on DEC AHIMS register) and loci M and N identified by South East Archaeology in February 2004 (Kuskie 2004a, Figure 7). The site encompasses the level/very gentle flat, level/very gentle wetland and gentle lower slope environmental contexts.

Locus G is situated around AMG grid reference 267580:6080020 on the Tabourie 8927-II-S 1:25,000 topographic map on a gentle lower slope (former shoreline). It was initially recorded by Navin Officer (2003a) as 'Exposure G'. Locus G is visible within a 65 x 30 metre area of exposures associated with horse agistment enclosures and erosion. It borders existing housing along Bonnie Troon Close. Archaeological visibility averages approximately 20%. Thirteen artefacts and one lithic fragment were recorded during the February 2004 survey (Kuskie 2004a). The assemblage comprises the stone materials silcrete, quartz, quartzite and porphyritic rhyolite and is dominated by flakes (38%) and flake portions (31%). Two cores and two manuports were also recorded. Navin Officer (2003a) had originally reported a quartz flake and a pebble manuport at this locus. Although levels of disturbance are moderate at the visible locus, there was considered to be a high potential for a sub-surface deposit to occur in the A unit soil particularly lower down on the slope, including evidence that may be *in situ* (Kuskie 2004a).

Test unit #30 was excavated by Navin Officer (2003b) along the route of a proposed pipeline within the zone 6(b) open space portion of the present study area (Figure 8). Four lithic items were located in this unit. Navin Officer (2003b) reported these as a 'fire cracked rock', two 'broken flakes' and a 'retouched flake piece'. The test unit is situated marginally west of Locus G and can be classified as an extension of site Dolphin Point 4.

Feary (1991) reported that 'Site 3' and 'Site 4' were exposed within a road cutting and cleared area adjacent to Dolphin Point Road. The evidence was described as a very low density artefact scatter. Midden shell was noted along the western margin of the road but may have been imported as fill from elsewhere (Feary 1991). This evidence partially lies marginally to the east of the present study area within the Dolphin Point Road Reserve (Figure 7).

Locus M is situated around AMG grid reference 267650:6080170 on the Tabourie 8927-II-S 1:25,000 topographic map on a gentle lower slope (former shoreline). Locus M is a midden with artefacts, exposed within an unfilled backhoe pit measuring 5 x 2 metres. The cultural deposit occurs between 0.15 and 0.45 metres below the present surface. The shell comprises mostly whole and fragmented cockle, with minor mud whelk, mud oyster and nerites. Three stone artefacts (sandstone split pebble/manuport, silcrete microblade and quartz flake) were recorded during the February 2004 survey (Kuskie 2004a). Although levels of disturbance are high at the visible locus, there was considered to be a very high potential for sub-surface deposits to occur in the adjacent A unit soil, including evidence that is *in situ* (Kuskie 2004a).

Locus N is situated around AMG grid reference 267650:6080150 on the Tabourie 8927-II-S 1:25,000 topographic map on a gentle lower slope (former shoreline). Locus N is a midden exposed within a 7 x 3 metre area of minor earthworks. It is located 15 metres south of Locus M and approximately 25 metres from the fence of housing along Bonnie Troon Close (Kuskie 2004a). The minor scatter of shell comprises mostly cockle, with turban and oyster fragments. Although levels of disturbance are moderate at the visible locus, there was considered to be a very high potential for sub-surface deposits to occur in the adjacent A unit soil, including evidence that may be *in situ* (Kuskie 2004a).

Possible Ceremonial Ground:

Feary (1991) initially reported the possible presence of a ceremonial ground within the study area (Figure 7). Feary (1991) reported that an Aboriginal community member, Mr Jim Butler, had informed Mr Rod Wellington (NPWS) about his knowledge of second hand reports that there was an area near a drainage line where grass sometimes would not grow, thought to be indicative of a ceremonial ground (Navin Officer 2003b). Such an area, possibly a location of saline seepage, is present in the general vicinity of the area marked by Feary (1991) (Figure 7). However, this recording is based on generalised, second hand accounts and more direct evidence was considered essential to assess the potential for this site type within the Stage 2 study area (Kuskie 2004a). No physical evidence (eg. raised earthen rings or depressions) were identified within the study area that may be indicative of a *bunan* ring, even though the grass height at the time of the survey was very low (Kuskie 2004a).

Kuskie (2004a) concluded that within the broad site areas and across the remainder of the study area in which visible evidence was not identified there remained a high potential for further heritage evidence to occur in the form of stone artefact and shell midden deposits. Insufficient information was available from which to adequately assess the scientific significance of the evidence. On a preliminary basis, Kuskie (2004a) concluded that sites Dolphin Point 1, 2, 3 and 4 could be assessed as potentially being of significance within a local context, primarily on the basis of possible research potential. Further investigation was noted as being required to clarify the level of scientific significance of these sites (Kuskie 2004a).

The primary conclusion of the assessment was that in order to adequately assess the potential impacts of the proposal on Aboriginal heritage and to select appropriate management strategies, further assessment should be undertaken by a qualified archaeologist in consultation with the local Aboriginal community (Kuskie 2004a). A program of sub-surface testing was recommended to overcome the limitations posed by low conditions of surface visibility and to enable an adequate assessment of the nature, extent, integrity and significance of the Aboriginal heritage resources of the study area (Kuskie 2004a). This program of sub-surface testing is reported on herein.

3.2 Previous Archaeological Research Within the Region

The South Coast has been a focus of research for Honours students in archaeology from the Australian National University (ANU). Between 1981 and 1983 the ANU research focused on the large midden complexes and artefact scatters at the Murramarang Aboriginal Area. Subsequently, this research has focused on the forested hinterland of the wider Batemans Bay - Ulladulla region, including the Burrill Lake locality.

Knight (1996) compiled a synthesis of the research reports of the area prepared by ANU students. The research has primarily focused on locating and recording and analysing any visible evidence of Aboriginal occupation within the survey areas. Typically survey transects were inspected along unsealed roads and tracks, within State Forests, National Parks and private property, while other areas of exposure were included in an opportunistic manner.

Knight (1996) reports that over 5,000 person hours of field survey was undertaken by the ANU students, resulting in coverage of over 1,000 kilometres of roads and tracks. The surveys have resulted in the recording of approximately 2,207 Aboriginal heritage sites, comprising 1,142 artefact scatters, 678 isolated artefacts, 349 shell middens, 24 rock shelters (10 including art), 11 grinding groove sites and 3 scarred trees (Knight 1996:6). A total of 18,783 stone artefacts have been recorded within the survey areas. Many of these Aboriginal sites had not been recorded onto the DEC AHIMS register by 1996.

In total, 78% of the sites recorded in the ANU study area were identified in the hinterland zone (land between the narrow belt of coastline inland to the Clyde River) and 22% in the coastal zone (including offshore islands).

Significantly, 59% of the total number of recorded sites occur on high points (ridges, hills and peaks). Of these sites, 57% occur on ridges, 18% on spurs, 12% on saddles, 10% on knolls and 2% on peaks. Knight (1996) attributes the high frequency of sites recorded on high points to:

- Sampling bias (surveys have focused on exposures such as roads that have tended to predominantly follow ridgelines in the hilly to mountainous terrain of the ANU study area) and;

- Genuine patterns of Aboriginal occupation (ridgelines functioned as access routes or corridors for movement, spurlines enabled access to and from the ridges, and the flat areas of saddles, knolls and spur/ridge junctions may have been locally preferred camp site locations).

Over 12% of the recorded ANU sites occur on slopes, predominantly foot slopes (57% of this total), followed by upper slopes (23%), mid-slopes (18%) and cliff features (2%). Knight (1996) observes that general predictions that slopes will not host substantial evidence of Aboriginal occupation are not supported by the ANU survey results. Knight (1996) attributes these results to the:

- Broad range of topographic contexts encompassed by this category (includes locations that may have been more favourable for occupation including gently undulating terrain and low gradient slopes bordering valley floors); and

- Incorporation of minor scarps and sandstone outcrops that host rock shelter sites (micro-topographical features boosting the site tally).

Valley locations were identified for 6.4% of the total number of ANU sites recorded, including creek banks (56% of this total), flats (38%) and river banks (6%). Of the total number of ANU sites recorded, 22% occur in the coastal zone, which Knight (1996) subdivides into the ocean shoreline, estuarine features and offshore islands.

Approximately 13.5% of the total number of sites recorded (or 61% of the coastal zone sites) occur in the ocean shoreline zone. This includes dunes (48% of the ocean shoreline total), headlands (36%), rock ledges (13%), shoreline cliff tops (2%) and shoreline cliff bases (2%).

About 7.4% of the total number of sites recorded (or 34% of the coastal zone sites) occur in the estuarine features zone. This includes lake shores (76% of the estuarine sites total), river banks (18%) and mangrove swamps (5%). Differences in the environmental contexts of the various lakes sampled (eg. Durras, Meroo, Willinga, Termeil, Burrill and Tabourie) are used by Knight (1996) as explanations for variations in the density of sites around the respective lake shorelines.

Nine offshore islands formed part of the ANU study area, with 1% of the total number of sites recorded on them. Sites were recorded on five islands (northern Tollgate Island, Wasp Island, Grasshopper Island, Brush Island and Crampton Island). Knight (1996) notes that Aboriginal access to these islands by canoe would not have been difficult and the sites all contained midden material, indicating the primary activity involved procurement and consumption of food resources.

Knight (1996) analysed the ANU survey results in relation to a range of environmental factors. In terms of gradient, nearly 90% of all sites occur on landform units with a gradient of less than 6º, with 73% of the total occurring on gradients of less than 3º.

In terms of proximity to potable water, 40% of sites occur less than 60 metres from a source, but it is noted that the ANU study area is relatively well watered and the distance to a watercourse from any point in the landscape is generally not too substantial. As Kuskie (1989) concluded, proximity to ephemeral streams may not have been a factor in site location, however larger, more complex sites tend to occur in close proximity to permanent sources of potable water in the hinterland zone (Knight 1996).

Knight (1996) analysed site distribution in relation to general current vegetation types as obtained from 1:100,000 Landsat mapping. Generally the frequency of site occurrences is proportional to the frequency a particular vegetation type occupies the study area, with the exceptions of higher site frequencies in the dry forest and coastal woodland complexes. Knight (1996) speculates that the higher frequency in dry forests could be a result of survey/sample bias (higher visibility conditions) or greater suitability of this vegetation type for occupation (eg. ease of movement, dry camping conditions, less insect problems). The higher frequency of sites in the coastal woodland complex is attributed to the coincidental distribution of this vegetation type alongside important marine and estuarine subsidence resources. Midden sites represent over 70% of the sites in this vegetation complex.

Knight (1996) analysed site distribution in relation to the underlying geological units. Site distribution is relatively uniform in the units, apart from a higher frequency of sites in the Termeil Essexite unit. However, Knight (1996) attributes this result to the presence of low relief, low gradient headlands with abundant and diverse subsistence resources (eg. Bawley Point, O'Hara Head and Murramarang Point). Geology is, however, an important determinant in the location of rock shelter and grinding groove sites, with a strong association between these site types and sedimentary rock.

Knight (1996) reports that artefact scatters ranging in artefact count from 2 to 534 artefacts have been recorded in the ANU study area. Each scatter is defined by the presence of two or more artefacts within 50 metres of each other. In total, 95% of the artefact scatters contained less than 50 artefacts, with the average number of artefacts in these sites being 7. The majority of sites exhibit little evidence of a sub-surface deposit, a result largely attributable to the skeletal nature of the A unit soils in much of the coastal hinterland. However, sites in depositional contexts, such as creek and river terraces, exhibit a high potential for sub-surface deposits. Knight (1996) concludes on the basis of artefact morphology (eg. presence of diagnostic items of the Australian Small Tool Tradition) that many of the artefact scatters may relate to occupation within the last 5,000 years. However, the possible occurrence of older evidence is noted, as has been demonstrated at the Burrill Lake rock shelter.

Isolated artefacts were recorded by the ANU students as individual artefacts further than fifty metres from any other artefact. As identified by Knight (1996), often these may be the only visible evidence of a larger scatter and the category is largely redundant. Re-surveys over subsequent years have often confirmed that a scatter is present where initially only an isolated artefact had been recorded (Knight 1996).

Middens were primarily recorded in the coastal, lacustrine and estuarine zones and included a variety of shellfish species, and often incorporated marine and land animal remains, stone and bone artefacts, and even human remains. Approximately 69% of the 349 middens contained only the remains of shellfish and occasionally other faunal remains. The remaining 31% of middens also contained stone artefacts, with 89% of these containing less than 100 artefacts (mean of 11 artefacts per midden). However, some middens are associated with very high numbers of artefacts (eg. at Murramarang Beach and Murramarang Point). Midden 'complexes', where multiple middens and artefact scatters are located in close proximity to each other, are noted by Knight (1996), with the Murramarang Point evidence one example which extends over an area of 65,000 m^2.

Rock platform species of shellfish dominated 44% of the recorded midden total, including *Cabestana, Ninella, Subninella, Haliosis, Cellana, Mytilus, Melanerita, Austrocochlea* and *Dicathais* species. Estuarine/lacustrine species of shellfish dominated 41% of the study area's middens, including *Anadara, Ostrea, Pyrazus, Mytilus, Velacumantis* and *Connuba* species. Sandy beach species (*Plebidonax* or pipi) are rarely dominant within middens in the ANU study area and pipi is the only sandy beach species recorded (Knight 1996). Bone occurs relatively frequently in the recorded middens, although in low quantities. Fish, bird, land mammal and sea mammal bones have been identified. Human skeletal remains have also been recorded at Murramarang Point and Nunderra Point (Knight 1996).

Knight (1996) analysed the combined stone artefact assemblage for the recorded ANU sites. The combined assemblage is dominated by items classified as 'debitage' (ie. represent non-specific stone flaking) such as flakes, flaked pieces, chips and modified pebbles. These items comprise 80% of the assemblage. About 14% of the combined assemblage comprise cores, hammerstones and anvils, classified by Knight (1996) as 'production tools'. Over half of these items are cores which could be classified as non-specific knapping or microblade production items. 'Formal tools' such as backed blades, scrapers, eloueras and blades are identified by Knight (1996) as comprising 5% of the assemblage. However, the blades (which comprise 62% of this subtotal) represent microblade production, rather than discard of microlith or non-microlith tools. Ground edge axes and axe preforms comprise 0.5% of the assemblage as do manuports (unmodified out-of-context items).

The stone materials used were predominantly silcrete and volcanics, but also quartz, chert and other less common items such as quartzite. Knight (1996) observes that the predominant emphasis appear to have been on the use of locally available stone. Within the ANU study area variation in the frequency of use of different stone materials is apparent, with silcrete more frequent in the northern sites and volcanics more frequent in the southern sites.

Knight (1996) concludes that the hinterland landscape displays evidence of intensive Aboriginal occupation, contrary to earlier theories. It is postulated that the hinterland between Batemans Bay and Ulladulla may have supported a permanent Aboriginal population which undertook a seasonal round of dispersal and congregation in this environment (Treloar 1985). It has also been postulated that the coastal zone supported year-round occupation (Vallance 1983).

Between 1981 and 1983 the ANU research focused on the large midden complexes and artefact scatters at the Murramarang Aboriginal Area, south of Bawley Point. Since 1983 the surveys spread to the coastal hinterland and north to Burrill Lake. The most relevant investigations to the present study area are those by Macfarlane (1987a, 1987b) and White (1987a, 1987b).

Macfarlane (1987a) reports on a survey of the Tabourie, Termeil, Meroo and Willinga Lake systems, conducted with Denise White as part of ANU Honours student course-work. A total of 25 sites (including 17 artefact scatters and 8 middens examined by White), along with 11 isolated artefacts, were located. The artefact scatters contained between 3 and 37 artefacts each. Macfarlane (1987a) concluded that the coastal lake systems were subject to more occupation than the coastal ridgelines, due to the greater availability of subsistence resources.

Macfarlane (1987b) prepared an Honours Thesis examining inter-site variability on the south coast, focusing on coastal stone artefact scatters. Macfarlane's study area encompassed the areas presently under investigation. Macfarlane (1987b) recorded 6 isolated finds and 148 sites (most of which had previously been recorded), comprising 40 artefact scatters, 94 middens, and an additional 14 middens with dense artefact content.

White (1987a) reports on a survey of the Tabourie, Termeil, Meroo and Willinga Lake systems, conducted with Macfarlane as part of ANU Honours student course-work. The survey focused on vehicle tracks and shorelines and other exposures. Eleven shell middens were identified. White (1987a) analysed the shell middens and concluded that at each midden, the shellfish species represented were those that could be obtained from within the immediate environmental zone.

White (1987b) further expanded on the ANU students work around Ulladulla with an Honours thesis focusing on Burrill Lake. White's (1987b) study area extended from north of Wheelbarrow Road (southern side of lake) to Milton, east of Woodburn Road and west of the Princes Highway. A total of 63 Aboriginal sites were recorded, including 55 shell middens and 8 artefact scatters, in addition to 5 isolated artefacts. The middens around Burrill Lake were found to be typically dominated by cockle, with low frequencies of whelks and mud oyster. White (1987b) interpreted the results as indicating that occupation of the lake's shores was intensive and possibly year-round, due largely to the availability of abundant and diverse food resources. On the coastal shores, occupation was considered to be more focused where abundant resources were present. White (1987b) concluded that occupation was focused on the coastal zone in summer and the estuarine and forest zones year-round, with minimal population-scale seasonal movement.

One site located by ANU students, BL3 (Burrill Lake 3), is a midden situated immediately east of the study area and Dolphin Point Road on the reserve west of the lake inlet (Macfarlane 1987b). However, White (1987b) reports that this site (White's #8) appeared to be the result of natural shell deposition from storms.

McAndrew (1993:8) reports that ANU students who stayed at the Bungalow Park Caravan Park, immediately north of "The Dairy" Stage 4, sought the permission of park managers Tom and Margaret Priestley to excavate trenches there in the late 1960s and early 1970s.

A number of locals also retain knowledge of middens and artefacts within the dunes of Burrill Beach and around the lake (McAndrew 1993). Several early explorers also reported on the presence of midden sites around Burrill Lake. For example, Townsend (1848) observed "on the banks of the lake were immense heaps of cockle-shells, the accumulation of which is difficult to account for". The early settler James King called King's Point 'Shell Point' because of the abundant middens (McAndrew 1993:36). However, the collection of shells for use as shellgrit and lime in building mortar probably has resulted in major impacts to midden sites around Burrill Lake (*cf*. McAndrew 1993:83-84, Barry Carriage, *pers. comm*. 2003). John George Kelly, one of the earlier and most prominent operators, owned the Portion immediately east of the present study area in the early 1900s. An above ground rotary kiln was established on this property at Dolphin Point. Kelly extracted 1,470 tonnes of shellgrit from Little Wairo Beach, which equated to most of the entire New South Wales state output (McAndrew 1993:84).

Elsewhere in the Burrill Lake locality, Officer and Navin (1998) surveyed pipeline routes and a treatment plant site for the Milton/Ulladulla Sewerage Scheme between the Burrill Lake and Ulladulla urban areas. Four sites were identified, two small artefact scatters and two "possible" scarred trees. An additional survey of pump stations and pipeline routes undertaken by Navin and Officer (2001) resulted in the identification of two shell middens at Narrawallee Inlet and Bannisters Point and two isolated artefacts. A 'Potential Archaeological Deposit' (PAD9) on the western side of Dolphin Point Road, bordering the present study area, was also identified.

Navin (1996) also surveyed an extension to the West Ulladulla Sporting Complex in this locality, without locating any heritage evidence. Nearby, a survey for the 11.5 hectare expansion of the Ulladulla Industrial Estate did not result in the location of any additional heritage evidence (Navin Officer 2004). A scarred tree previously recorded by Officer and Navin (1998) was assessed as being of natural origin. Sub-surface investigation was recommended for a "Potential Archaeological Deposit" in the vicinity of Racecourse Creek (Navin Officer 2004).

Nearby, Kuskie (2004c) investigated the 4.2 hectare Lot 232 DP 755967, Princes Highway, Ulladulla, for a proposed tourist resort. The study area encompassed a simple slope and an adjacent wetland and dunes bordering Racecourse Beach, between Burrill Lake and Ulladulla. No Aboriginal heritage evidence was identified.

Kuskie (1995) undertook a predictive archaeological study of five options for the proposed Southern Shoalhaven Landfill. Option 13 is located several kilometres west of the present study area at Burrill Lake and Option 8 is immediately west of the Tabourie Lake urban area. Additional options at Kings Point Drive, north of Burrill Lake, and Romney Park Road were assessed as an addendum to this report.

An extended version of the Romney Park Road Option (#112/113) was investigated by Kuskie (1996). A rare stone arrangement site (Romney Park Road 2) and an isolated artefact (Romney Park Road 1) were located during a survey of this landfill option. The stone arrangement site was located on a knoll, at the junction of a major ridgeline leading from the coastline inland along Kingiman Ridge to Mount Kingiman and further north-west to the Tianjara Plateau, and a spur crest leading south from Romney Park Road to Lucy King Creek. This same ridgeline terminates at Burrill Lake adjacent to the present study area. The site comprised a mound of stone and soil and a nearby oblong shaped arrangement of sandstone cobbles. Kuskie (1996) concluded that the site conformed to the general recorded characteristics of Aboriginal stone arrangements (*cf.* Stead 1987) but the slim possibility of a non-Aboriginal origin could not be discounted. Kuskie (1996) also reports that forestry workers had identified another stone arrangement site, on the northern side of Brandaree Creek, near the Tabourie Lake urban area.

The Burrill Lake rock shelter site (DEC #58-1-24) is located adjacent to the Bungalow Park urban area, less than 0.5 kilometres west of "The Dairy". It lies approximately 180 metres back from the present lake shore and was first investigated in 1930 by J. S. Rolfe and F. D. McCarthy. In 1931, substantial quantities of deposit were excavated by the Anthropological Society of New South Wales (Thorpe 1931).

Lampert (1971) excavated 35 m^2 of the shelter and recovered 6,509 artefacts from Trenches A and B. Lampert (1971) classified the artefact assemblage into a Pre-Bondaian and two Bondaian phases. Much of the assemblage was regarded as debitage, with only 221 implements exhibiting retouch and/or use-wear. The implements included various categories of 'scrapers', backed artefacts (bondi points and geometric microliths), eloueras and utilised flakes. Quartz, rhyolite, porphyritic rhyolite, 'quartz-felspar-porphyry' and 'fine-grain quartzite' were the common stone materials, the latter two possibly equating to silcrete. The earliest dated occurrence of unifacial pebble tools in eastern Australia is from the Burrill Lake rock shelter and the earliest backed artefacts in the Burrill Lake excavation were dated to around 5,300 BP (Lampert 1971).

One *Anadara* spp. shell found in the Pleistocene level is assumed to have been transported a considerable distance (13-16 kilometres) to the site as an implement, rather than for consumption. Faunal and shell material were recovered from the last 1,660 years or so of the upper deposit, including wallaby, kangaroos, possum, bandicoot, gliders, rats, tiger cat, birds (eg. shearwater, prion and petrel), fish (eg. snapper, bream, blackfish, flathead, wrasse and leatherjacket) and shellfish (predominantly cockle {80±7% of total shells), with minor Hercules club whelk and 14% of rocky shore species). One fish hook file was identified. Lampert (1971) concluded that the site represented a mixed economy, with the woodland, lake shore and sea shore all exploited.

Dating of deposits excavated by Lampert (1971) has revealed that Aboriginal occupation first occurred at Burrill Lake at least 20,000 years ago. The basal date of 20,760±800 years BP (ANU 336) makes this the oldest dated site and first Pleistocene age site identified on the South Coast of New South Wales. The site provided evidence for 'intensive seaboard exploitation of resources allowing optimum density of settlement' (Mulvaney 1975:244).

Other sites of Aboriginal significance have also been reported in the vicinity of the present study area. McAndrew (1993:129) reports that skeletal material was found in the area of

Wyoming Drive, Bungalow Park, by the Dingley family accompanied by Fred and Christina Carriage. At 'Billy Boy Point', opposite Kings Point on Burrill Lake, oral tradition documents this as the location of a historic camp site of 'King Billy-Boy of Burrill' and his wife Coomee Nullanga (McAndrew 1993:27). Both lived on the shores of Burrill Lake up until the time of Billy's death around 1908. Although their main camp was apparently at Billy Boy Point, it is reported that they also lived in bark huts on the waters edge below Thistleton House, near present-day Maria Avenue, on the south side of the lake, where they traded fish for tobacco and flour (McAndrew 1993:27).

Boot (1994, 1996, 2002) reports on surveys and excavations undertaken in the vicinity of the present study area as part of his PhD thesis research. A rock shelter site, Burrill Shelter 2 (#58-1-357) on the western side of Burrill Lake was excavated. A single square metre was excavated to a depth of 0.6 metres to reveal a midden deposit with several stone artefacts, ash, shell (predominantly hairy mussel, but also cockle and mud oyster), fish bone, fish scales, mammal bone, hair and scats in the upper deposit. This evidence was dated to 360±60 BP (ANU-8421) and reflects occupation on the edge of the shallow waters of a coastal estuarine lake (Boot 1994:335). However, the lowest portion of the deposit contained several stone artefacts and charcoal and was dated to 3,280±70 BP (ANU-8422). This earlier occupation would have occurred when the shelter lay on the margin of a deep coastal bay.

Kuskie (2003a & 2003b) undertook two archaeological assessments within Meroo National Park and the Barnunj State Conservation Area, immediately adjacent to the present study area, in relation to various works proposed by DEC (Ulladulla Area). Stage one involved an assessment of proposed works at Meroo Head, Termeil Beach, Termeil Point and Burrill Lake (Kuskie 2003a). Kuskie (2003a) located five sites at Meroo Head and Termeil Point several kilometres south of the present study area. These sites comprise nine spatially separate loci of evidence and incorporate various previous recordings. Four of the sites are shell middens/artefact scatters and one site is an artefact scatter. A total of sixteen lithic items were recorded by Kuskie (2003a), predominantly silcrete and rhyolite flakes and cores, and sparse scatters of predominantly rock platform shell species were located. One of the sites (MH6) was assessed as being of potentially high archaeological significance, while another (TP1) was considered to have potentially moderate to high significance within a local context.

Stage two of the assessment involved examination of specific previously recorded Aboriginal heritage sites situated between Nuggan Point and Burrill Lake that may be affected by the continued use of the Meroo National Park and Barnunj Conservation Area (Kuskie 2003b). In particular, information and management recommendations were required for 24 known Aboriginal heritage sites and one previously unrecorded site located by Kuskie (2003b).

Kuskie (2002a, 2002b & 2002c) conducted three assessments within Murramarang National Park, extending further south of the present study area to Maloneys Beach near Batemans Bay. Stage one of the assessment involved proposed works by DEC (Ulladulla Area) at Pebbly Beach, Durras North, Durras Lake, Honeysuckle Beach, North Head and Acheron Ledge and resulted in the identification of seven stone artefact scatters (Kuskie 2002a). A total of 54 artefacts were recorded, predominantly comprising flakes and cores of volcanic stone such as rhyolite. The second stage of the assessment involved modifications to the Oaky Beach Camping Area (Kuskie 2002b). A comprehensive survey of this locality resulted in the identification of two Aboriginal heritage sites, both scatters of stone artefacts. A total of 83 lithic items were recorded by Kuskie (2002a). Stage three of the assessment involved examination of specific previously recorded sites that may be affected by continued use of Murramarang National Park (Kuskie 2002c). Three previously unrecorded sites were identified during the investigation.

A study by Williams (1998) of the Termeil Coastal Reserves for Shoalhaven City Council encompassed portions of Meroo National Park at Termeil Point, Termeil Beach and Meroo

Head. Williams (1998) identified seven Aboriginal sites, including five shell middens and two isolated artefacts. A shell midden was located at Stokes Headland, comprising mostly rock platform species of shellfish and several artefacts (Williams 1998). At Termeil Point and immediately to the north, Williams (1998) located two shell middens. An isolated artefact was located at Termeil Beach. At Meroo Head, Williams (1998) located several isolated artefacts and relocated several previously recorded middens. Williams (1998) also surveyed a 4 hectare area termed 'Meroo Lake' on the south side of Meroo Head and north side of the Meroo Lake inlet. Approximately 11% of this area was inspected but no heritage evidence was identified.

Also south of the present study area, Oakley (1994) surveyed the proposed widening of two sections of the Princes Highway near Tabourie Lake and Burrill Lake. One section extends north from Wheelbarrow Road to the Burrill Lake urban area (Bungalow Park), adjacent to The Dairy Stages 1 and 4, and the other adjacent to Tabourie Lake north of the urban area. No sites were located within the extensively disturbed road reserves (Oakley 1994).

Cane (1985) surveyed four proposed water pipeline routes for Shoalhaven City Council. One route extends for several kilometres immediately west of the Tabourie Lake urban area. An isolated artefact was located.

Kuskie (2004b) surveyed the four hectare Lot 7 DP 569372, Princes Highway, Lake Tabourie, for a proposed residential subdivision. No Aboriginal heritage evidence was identified, a result attributed to the extensive impacts of recent non-Aboriginal land use practices.

Paton (1992) investigated a proposed electricity transmission line route from Ulladulla south to Moruya. Only a few sections of high potential were inspected on foot. Seven artefact scatters, a shell midden and five isolated artefacts were found along the route.

Sullivan (Sullivan & Gibney 1978) undertook an archaeological study of the neighbouring Eurobodalla Shire, with the primary goal of identifying and recording locations containing evidence of Aboriginal occupation. Two hundred and eleven sites were listed during their survey. Sullivan analysed the relationship between the coastal midden sites and various environmental factors. Her PhD Thesis was subsequently completed on the nature and distribution of coastal middens in New South Wales (Sullivan 1982).

Of the 145 midden deposits, 59% consisted almost entirely of rock platform shellfish species, 36% consisted of various combinations of rock platform, beach and/or estuarine species, and 5% consisted of estuarine species (Sullivan & Gibbney 1978). Many of the shell deposits appeared to have been disturbed in some manner, including reworking by storm waves or tidal action. Middens tended to occur in close proximity to potable water, except where a particularly rich source of shellfish was being exploited (Sullivan & Gibbney 1978:200). More than 80% of middens were recorded on the hind portions of rock platforms, on rocky headlands or within the dune systems immediately adjacent to these headlands. 79% of the middens recorded by Sullivan were located on sand (including many comprised almost entirely of rock platform species) and 21% were located on a rock surface, typically in a formation sheltered from the prevailing southerly and south-easterly winds.

Lampert (1971), after excavating the rock shelter on Burrill Lake established that occupation on the South Coast commenced at least 20,000 years ago. A site excavated at Bass Point near Wollongong yielded a similar date of 17,000 BP (Before Present) (Bowdler 1970, 1976). Boot (1994) has excavated ten sites in the hinterland ranges of the South Coast. Bulee Brook 2 (#58-1-378), near Sassafras, yielded a date of 18,810±160 BP, which replaces Flood's (1980) 3,770±150 BP date at Sassafras 1 as the oldest evidence for occupation in the coastal ranges. These results indicate that from at least 20,000 years ago Aboriginal people were exploiting the coastal zone and from 18,000 years ago the coastal ranges.

The nature of Aboriginal occupation on the South Coast has been a matter of considerable academic debate (*cf*. Boot 1994:320-321). Until recently, researchers have identified higher site densities in the coastal zone than in the coastal hinterland.

Several models have been forwarded to account for this pattern of recorded site distribution (Boot 1994:320-321). Bowdler (1970) argued that occupation of the coast during summer was intensive, with some exploitation of the hinterland when coastal resources were less abundant. Lampert (1971) proposed a mixed economic regime on the coast, involving exploitation of littoral, estuarine and land resources, but with a greater emphasis on the littoral component. Poiner (1976) produced a model of occupation based on a strict seasonal regime: abundant coastal resources were exploited during summer, and the coastline and hinterland were both exploited during winter when resources were far less abundant. Flood (1980) argued that the hinterland was only used when coastal resources were in short supply during the winter season.

Attenbrow (1976) proposed a model in which the coast and hinterland were occupied all year round and that movement between the two zones occurred at the family or small group level, rather than at the large population level suggested by Poiner (1976). Attenbrow's model incorporates a higher proportion of terrestrial animal foods in the diet during winter. Hinterland river valleys and highland areas would have been occupied during summer. In winter, the population distribution would have been widespread, based on family groups.

Moving away from the seasonal model of exploitation, Vallance (1983) argued that a range of subsistence strategies would have existed, that varied both within and between seasons and even from year to year. Following Vallance's model, Boot (1994) suggested that if this were the case, larger archaeological sites could be expected in areas where large quantities of food were available on a single occasion or on a regular basis, and smaller sites would be the result of short term occupation during movement between such locations.

Surveys by Byrne (1983, 1984) of forests within the hinterland, began to reveal evidence challenging models of occupation focused primarily on the coastline. While the highest site densities were still identified near the coast, high densities were also found in the hinterland 13-18 kilometres from the coastline. Byrne (1983) found there was an absence of sites 3-10 kilometres from the coastline in the Five Forests study. Several researchers developed theories to account for this apparent paucity of evidence. Walkington (1987) suggested campsites were focused along the coastline and this section of the hinterland (3-10 kilometres distance) was only exploited on daily return journeys. Distances further than 10 kilometres inland would have required overnight camps in the hinterland (Walkington 1987).

More recently, surveys focused on the hinterland zone north of Batemans Bay, by Australian National University Honours students and PhD candidate Philip Boot, have revealed a vastly different body of evidence (*cf*. Knight 1996, refer above, Boot 2002). Thousands of sites have been located within the hinterland areas, dramatically changing the pattern of recorded site distribution. As discussed above, it is apparent that the intensity of utilisation of the coastal hinterland is far greater than previously believed and previous researchers may have inadequately accounted for the coastal bias of earlier surveys (*cf*. Boot 1994:320-321).

The research of Boot (2002) has demonstrated that the currently available evidence does not lend support to many of the models listed above, with the exception of Vallance (1983). Boot's (2002) research has suggested that Aboriginal occupation tends to be more focused in areas of higher biodiversity and along the boundary or in close proximity to multiple resource zones.

3.3 Local Aboriginal Culture

Traditional Aboriginal culture in south-eastern Australia was complex and varied. The present state of knowledge is based partially on studies of contemporary Aboriginal communities in northern and central Australia and on observations of the south-eastern communities after the immense disruption caused by European settlement (Thompson 1985).

Peterson (1976) describes Aboriginal society as being comprised of a hierarchy of organisational levels and groups, with fluid boundaries between them. The smallest group in the hierarchy are 'families'; a man with one or more wives, their children and frequently some of their parents. The second level are bands; small groups consisting of members of several nuclear families, who perform the normal hunting and gathering tasks together for most of the year (Peterson 1976). At the next level are regional networks consisting of a number of bands. Members of these regional networks usually share beliefs in a common ancestor and/or have a common language dialect. Network members assemble for specific ceremonies, when the subsistence resources of a locality are plentiful enough to support a large number of people over a period of time. The 'tribe' is at a higher level in the organisational hierarchy. 'Tribes' are generally recognised as a linguistic unit with flexible territorial boundaries. At the broadest level of social organisation, or the pinnacle of the hierarchy, is the 'cultural area'. All groups within a 'cultural area' share cultural characteristics, such as a common initiation ceremony, and speak closely related languages (Peterson 1976).

The nature of organisation of Aboriginal groups along the South Coast is unclear, due to the limited ethnohistorical records, lack of anthropological expertise of the recorders and the immense disruption to traditional culture that had already occurred by the time many of these observations were made. Peterson's advice about the fluid nature of Aboriginal group boundaries is also pertinent.

Tindale (1974) describes the territory of the Wandandian as extending from the Lower Shoalhaven to the Ulladulla area, and inland to the Shoalhaven River north of Braidwood. The Walbanga people are described as occupying land between Narooma and Ulladulla and inland to Braidwood (Tindale 1974). Local Aboriginal people view themselves and the present study area as within an area belonging to a separate clan ('Murramarang') placed between these groups (S. Carriage, *pers. comm*. 2005). The Wandandian and Walbanga people spoke the Dhurga language, which was spoken over an area ranging from the Shoalhaven District south to Narooma (Eades 1976). They were probably local land owning clans of the Yuin Nation (Boot *pers. comm*. 2004). Howitt (1904:81) stated that the Yuin people occupied the South Coast between the Shoalhaven River in the north and Cape Howe in the south. Howitt (1904:81) believed that the Yuin were subdivided into two main groups, the Kurial-Yuin in the north (the present study area) and the Guyangai-Yuin in the south.

Boot (2002) has undertaken a wide-ranging study of ethnohistorical observations relating to the south coast region, based on original archival sources. Boot (2002) lists the following faunal and floral species which have been recorded in the ethnohistorical sources as having been utilised: fish species including bream, trumpeter, whiting, salmon and shark, eel, whales, seals, marine worms, shellfish including oysters and mussels, possum, kangaroo, wombat, birds, goanna, grubs, honey, kangaroo apple, native cranberry, honeysuckle, pigface, macrozamia, cabbage tree, fruit and yams. Observations of use of these food sources were made within ten kilometres of the coast (Boot 2002).

The material culture of the local Aboriginal population would have included a range of items related to subsistence, cultural and social activities and shelter. Ethnohistorical observations along the coast have been made of the following items: huts, gunyahs, canoes, spears, shell-barbed spears, fishing spears, bark/wood shields, waddy/clubs, spear throwers, boomerangs, hatchets, fish-traps, stone heat retainers, kangaroo teeth adornments, pierced nose adornments, bark drawings, possum skin cloaks, shell fish hooks and grass tree resin (Boot 2002). In the archaeological record few of these items survive. Stone, bone and shell are the materials most frequently represented in archaeological sites.

The Shoalhaven region was frequented by non-indigenous people from 1770, following its sighting by Captain Cook. Aboriginal people were sighted by Captain Cook at Murramarrang, 15 kilometres south of Burrill Lake, in 1770 (White 1987b). During the contact period, Aboriginal people were described as being armed and numerous (Cane 1988:29). Cane (1988) characterises the period between 1810 and 1840 as one of exploitation and hostility. This occurred in relation to the early cedar-getting and occupation of Aboriginal land.

The effects of the European arrival were adverse for the local Aboriginal people. The rapid spread of European diseases, which the Aboriginal population had not hitherto been exposed to or developed immunity to, was a major issue. Cambage (1916) estimates the total Aboriginal population of the Ulladulla region to have been in the order of six hundred people at the time of non-indigenous settlement. Through disease and disintegration of the traditional social structure, the population rapidly declined. Violence may also have been a factor in population decline (*cf.* Turner & Blyton 1995). In three census returns of the entire Shoalhaven District in 1834, 1838 and 1839, the total Aboriginal population was recorded as 170, 242 and 180 respectively (Berry 1834, 1838, 1839).

By the 1840s the Aboriginal population had been reduced to small remnant groups along the coast or subsisting around the fringes of the now permanent non-Aboriginal settlements. There were a number of substantial Aboriginal camps or reserves in the region, including ones at Ulladulla, Orient Point, Wreck Bay and Currambene Creek. The reserve at Ulladulla was located at Warden Head and was gazetted in 1892 and revoked some time early in the twentieth century (Navin Officer 2002:8). This locality ('Darkie's Hill') was also the main camping place for the local Aboriginal community for many years (McAndrew 1995).

A number of observations were made of Aboriginal people around Ulladulla by early non-indigenous settlers and explorers, for example:

- The Surveyor Thomas Florance noted a group of gunyahs by a small freshwater creek in Ulladulla Harbour in 1828 (McAndrew 1995:31);

- Joseph Phipps Townsend (1848:96) noted during his visit to the Ulladulla District between 1842 and 1846 that the people at Ulladulla were 'divided into two classes, the fishermen and the hunters';

- Townsend (1848:23, 31) also noted the exploitation of prawns at Burrill Lake and eels by canoe in a small fresh-water creek two kilometres upstream from the lake;

- Townsend (1848:36, 96) noted that Aboriginal people still could obtain possums, bandicoots, kangaroos, fish and wild fowl, and that possums would be 'cut or smoked out' of trees;

- Jack Wilford (quoted in McAndrew 1993:13-14) recounted his ancestors observations that whales were not infrequently stranded on the coast during winter, and on one occasion were feasted upon by the local Aboriginals;

- Methods of obtaining parrots were observed by Townsend (1848:39-40), particularly cutting notches in bark to climb trees;

- Methods of catching kangaroo were observed by Townsend (1848:97): 'They would either shoot it or spear it, the point of which would remain in its body, whilst the handle broke off and then they traced it by the blood. Others again, when they found a kangaroo, formed a circle round it, and drove it from place to place by shouting - thus puzzling it greatly and waited for an opportunity of knocking it down by throwing a tomahawk';

- The local material culture was observed by Townsend (1848:104, 108) who noted that cloaks were made out of possum skins and a belt ('maro') was made from kangaroo fur and used to assist with carrying a tomahawk;

- Townsend (1848) also noted the use of canoes in Burrill Lake, made of 'a sheet of bark, tied at each end and stretched by cross-sticks. On a lump of clay at the bottom is carried a small fire';

- German visitor Hermann Lau, who assisted Surveyor James Larmer, reported in 1855 detailed observations of a corroboree in the Ulladulla area (in McAndrew 1993:23-24);

- Dancing Point, on the western side of Burrill Lake, was a known location of corroborees (Mrs Pearl Ewin's parents, reported in McAndrew 1993:28);

- Emma Thistleton (1887-1969) is noted in McAndrew (1993:27) as knowing that Aboriginal people had a permanent route from Narrawallee Lake across Kingiman Mountain to the inland (eg. Braidwood); and

- Flannigan (NSW Legislative Council 1846:38) reported in a response to the NSW Legislative Council that although non-indigenous settlement had adversely impacted the number of kangaroos, "most of the natives in this district depend more upon the sea than the bush for food".

Substantial oral history also resides with the Aboriginal community, some of which has been documented in reports. For example, at 'Billy Boy Point', opposite Kings Point on Burrill Lake, oral tradition documents this as the location of a historic camp site of 'King Billy-Boy of Burrill' and his wife Coomee Nullanga (McAndrew 1993:27). Both lived on the shores of Burrill Lake up until the time of Billy’s death around 1908. Although their main camp was apparently at 'Billy Boy Point', it is reported that they also lived in bark huts on the waters edge below Thistleton House, near present-day Maria Avenue, on the south side of the lake, where they traded fish for tobacco and flour (McAndrew 1993:27). Emma Thistleton (1887-1969) is also noted in McAndrew (1993:27) as recalling that they also camped closer to the entrance of Burrill Lake when convenient.

A large and vibrant Aboriginal population remains on the South Coast today and takes an active interest in the management of their heritage.

4. METHODOLOGY

Prior to testing, the research design accompanying the Section 87 application was formulated in consultation with the Ulladulla Local Aboriginal Land Council. The Ulladulla Local Aboriginal Land Council reviewed a copy of and endorsed the Section 87 application (refer to Section 6 and Kuskie 2004a).

The program of testing proceeded according to the methodology proposed in the Section 87 application, and approved by the Department of Environment & Conservation with Permit #1952, as outlined below.

Fieldwork was undertaken over 29 days from 19 July to 27 August 2004. Five qualified archaeologists from South East Archaeology were assisted throughout the course of the test excavations by on average five representatives per day from the Ulladulla Local Aboriginal Land Council. The LALC representatives who participated in the test excavations included Barry Carriage, Shawn Carriage, Shann Carriage, Graeme Carriage, Anne Carriage, Kirsty Carriage, Matt Carriage, Tom Avery Jnr, Craig Butler, Philip Fernando and Hilton Ridgway (refer to Section 6).

<u>Research Design:</u>

The use of a 'broad-area' or 'cultural landscape' approach was preferred in the context of the present investigation so that the testing could contribute most effectively to the development of mitigation and management strategies for the identified and potential heritage resources. This approach involved:

1) Identification of the specific environmental/cultural characteristics of the study area;

2) Construction of a model of Aboriginal occupation for the locality;

3) Definition of the expected nature and distribution of evidence;

4) Formation of a methodology to test the predictive model, in consideration of the expected nature and distribution of evidence;

5) Analytical techniques for the evidence recovered that are appropriate to address the research questions and project objectives;

6) Refinement/modification of the predictive model and extrapolation of results to comparable environmental/cultural contexts that were not directly sampled; and

7) An area based approach to the formation of mitigation and management strategies based on a holistic view of the entire landscape, including potential as well as identified heritage resources.

1) Environmental/Cultural Characteristics of the Study Area:

The use of land systems and environmental factors in predictive modelling is based upon the assumption they provided distinctive sets of constraints which influenced Aboriginal land use patterns. Following from this is the expectation that land use patterns may differ between each zone, because of differing environmental constraints, and that this may result in the physical manifestation of different spatial distributions and forms of archaeological remains (Hall & Lomax 1993:26).

Archaeologists have frequently subdivided the landscape into different environmental contexts for the purposes of survey and analysis. Extensive excavations and surveys by Kuskie (2000a), Kuskie (*in prep*.), Kuskie and Clarke (2004), Kuskie and Kamminga (2000), Silcox and Ruig (1995), Rich (1993), Hall (1991, 1992), Hall and Lomax (1993), Packard (1991, 1992) and others have demonstrated distinct patterns of artefact distribution relating to environmental variables and provide substantive justification for the use of this approach.

A best practice approach can involve the subdivision of the landscape on the basis of landform pattern, then at a much finer scale, landform units and class of slope. At the Mount Arthur North Coal Lease, Kuskie (2000a) defined 'Archaeological Terrain Units' as discrete, recurring areas of land for which it is assumed that the Aboriginal land use and resultant heritage evidence in one location may be extrapolated to other similar locations. Archaeological Terrain Units can be defined on the basis of two environmental variables:

- Firstly, *landform element* (following the definitions of McDonald *et al* 1984) (eg. ridge crest, spur crest, simple slope, drainage depression, etc.); and

- Secondly, *class of slope* (following McDonald *et al* 1984) (eg. level to very gently inclined slopes of less than 1°45′; gently inclined slopes greater than 1°45′ and less than 5°45′, etc.).

Archaeological terrain units consist of all of the *survey areas* with a particular combination of landform element and slope (eg. five separate survey areas may be combined to form a 'level/very gentle ridge crest' terrain unit). As each *survey area* is by definition part of a single *archaeological terrain unit* (although a number of similar 'survey areas' can make up a total 'archaeological terrain unit'), it is possible to compare and analyse other environmental variables on a fine-scale between each survey area and on a broader-scale between each archaeological terrain unit (Kuskie 2000a).

Nine distinct environmental contexts ('archaeological terrain units') can be identified within the study area (Figure 14, Table 3). These include the gentle lower slope (former shoreline), moderate lower slope (former shoreline), level/very gentle flat, level/very gentle wetland, gentle drainage depression, very gentle drainage depression, gentle simple slope, gentle spur crest and very gentle ridge crest units. It is assumed that heritage evidence may vary in terms of density and contents between the different archaeological terrain units, presumably representing different patterns of occupation/utilisation.

However, evidence within a single archaeological terrain unit can also vary, in relation to different usage of the area by Aboriginal people. This classificatory system tends to emphasise similarity and mask differences. The use by Aboriginal people of each survey area that makes up an archaeological terrain unit may differ, for cultural, environmental or other reasons. For example, a particular spur crest may lead from a ridgeline used for transitory movement to a camp site bordering a food resource, whereas another spur crest may lead to a stone material source. Individual survey areas on these spur crests may host different types and proportions of evidence, reflecting different ways in which these landforms were utilised.

Hence, a series of cultural sub-contexts can be identified in an attempt to encompass the potential range of variation in heritage evidence within each environmental context (Figure 14, Table 3). These units are termed *environmental/cultural contexts* (after Kuskie 2000a). This list is not necessarily proscriptive or preclusive, particularly in relation to the cultural sub-contexts. Further investigation may reveal other cultural sub-contexts, or some of those listed may not be significantly different from others. However, the list broadly covers the range of contexts present within the study area.

2 & 3) Proposed Model of Occupation and Expected Nature and Distribution of Evidence:

Over the past few decades, several broad regional models of occupation have been forwarded to account for the pattern of recorded site distribution on the South Coast (refer to Section 3.2). These include for example:

- Bowdler (1970) argued that occupation of the coast during summer was intensive, with some exploitation of the hinterland when coastal resources were less abundant;

- Lampert (1971) proposed a mixed economic regime on the coast, involving exploitation of littoral, estuarine and land resources, but with a greater emphasis on the littoral component;

- Poiner (1976) produced a model of occupation based on a strict seasonal regime: abundant coastal resources were exploited during summer, and the coastline and hinterland were both exploited during winter when resources were far less abundant;

- Flood (1980) argued that the hinterland was only used when coastal resources were in short supply during the winter season;

- Attenbrow (1976) proposed a model in which the coast and hinterland were occupied all year round and that movement between the two zones occurred at the family or small group level, rather than at the large population level suggested by Poiner (1976). Attenbrow's model incorporates a higher proportion of terrestrial animal foods in the diet during winter. Hinterland river valleys and highland areas would have been occupied during summer. In winter, the population distribution would have been widespread, based on family groups;

- Vallance (1983) argued that a range of subsistence strategies would have existed, that varied both within and between seasons and even from year to year. Boot (1994) suggested that if this were the case, larger archaeological sites could be expected in areas where large quantities of food were available on a single occasion or on a regular basis, and smaller sites would be the result of short term occupation during movement between such locations;

- Byrne (1983, 1984) after surveying hinterland forests and finding relatively high site densities 13-18 kilometres inland, challenged the assumption that occupation was focused primarily on the coastline. Byrne (1983) found there was an absence of sites 3-10 kilometres from the coastline in the Five Forests study;

- Walkington (1987) suggested campsites were focused along the coastline and this section of the hinterland (3-10 kilometres distance) was only exploited on daily return journeys. Distances further than 10 kilometres inland would have required overnight camps in the hinterland (Walkington 1987); and

- Boot (1994, 2002) and Knight (1996) report on the thousands of sites located within the hinterland zone between Moruya and Ulladulla, identified during surveys by Australian National University Honours students and Boot (2002) during doctoral research. These recordings dramatically change the pattern of recorded site distribution and are used to support arguments that the intensity of utilisation of the coastal hinterland is far greater than previously believed and previous researchers may have inadequately accounted for the coastal bias of earlier surveys.

The research of PhD scholar Philip Boot (2002) has demonstrated that the currently available evidence does not lend support to many of the models listed above, with the exception of Vallance (1983). Boot's (2002) research has suggested that Aboriginal occupation tends to be more focused in areas of higher biodiversity and along the boundary or in close proximity to multiple resource zones.

These models tend to focus on population and settlement patterns on a regional level, an issue that cannot necessarily be investigated in a small, focalised study area such as the present one. However, a more local model of occupation can be constructed based on the known pattern of site distribution, ethnohistorical and ethnographical evidence, and the results of archaeological work undertaken to date in the locality (refer to Section 3). Such a model can attempt to explain Aboriginal activity and settlement patterns at a local level, and the results used to re-examine regional models such as those proposed by Vallance (1983) and Boot (2002). Given the relative paucity of detailed archaeological investigation in the locality (eg. excavation), the model may largely involve hypotheses to be tested by further research, including that to be undertaken as a component of the present heritage impact assessment. The local occupation model can be substantially refined through the results of the testing and the results can also be used to re-examine the previously proposed regional models.

In general terms, the nature of occupation within the study area could represent a variety of circumstances:

- Transitory movement;
- Ceremonial activity;
- Hunting and/or gathering (without camping);
- Camping by small hunting and/or gathering parties;
- Nuclear/extended family base camp;
- Community base camp; or
- Larger congregation of groups.

The evidence could represent a single episode or multiple episodes of one or more of the above types of occupations. The episodes of occupations could have occurred at different times over the entire time-span of occupation in the region. Each episode of occupation could also have been for a different duration of time.

Unless the archaeological evidence for individual activity events is readily identifiable, it can be highly problematic to determine the types of occupation, number of episodes, and times and duration represented by evidence at a particular site. Suitable circumstances are rarely present in open sites, due to mixing of evidence by post-depositional processes and the superimpositioning of evidence caused by repeated episodes of occupation.

Listed below is a brief description of the nature of each type of occupation and the material circumstances or evidence that may relate to such occupation types within the present study area (*cf*. Kuskie & Kamminga 2000):

<u>Transitory movement:</u>

- May occur when an individual or group of people are moving between base camps, or from a campsite to resources or a ceremonial or other special purpose site;
- Duration would be less than a day and probably less than a few hours;
- Total numbers of people would be relatively small;
- Could occur on most topographical units and classes of slope, but possibly more frequently on ridge and spur crests and along watercourses and valley flats;
- Proximity to potable water was probably not important;
- Proximity to food resources was probably not important;

- Evidence may represent accidental discard, repair of hunting or gathering equipment, children's play or knapping activity;
- Quantity and density of evidence and range of artefact and stone types are expected to be low, consistent with 'background discard', unless repeated episodes have occurred causing superimpositioning.

<u>Ceremonial activity:</u>

- May occur when a group of people gathers at a particular location to perform a ceremony;
- Evidence may be present of ceremonial site features such as earthen rings or stone arrangements, or ochre;
- Evidence of large encampments (similar to that expected for the 'larger congregation of groups' listed below) may be present nearby, particularly in locations with an aspect towards the ceremonial site;

<u>Hunting and/or gathering (without camping):</u>

- May occur when an individual, or more likely a small group of closely related people, engage in hunting activities (more likely to be a party of men) or gathering activities (more likely to be women and children);
- Duration would be less than a day, with people returning to a base to sleep;
- Total numbers of people would be relatively small;
- Would be expected to occur where food resources were available, which for different foods may be a seasonal or annual occurrence;
- Proximity to potable water was probably not important;
- Evidence may represent accidental discard, loss during use, repair of hunting or gathering equipment, children's play or knapping activity;
- Quantity and density of evidence and range of artefact and stone types are expected to be low, consistent with 'background discard'. Loss or discard of specific tool types may be a useful indicator (particularly items with use-wear/residue that are not in association with evidence of their manufacture or maintenance). Repeated visits to particularly food sources may cause a build up of unrelated evidence over a period of time in a specific location.

<u>Camping by small hunting and/or gathering parties:</u>

- May occur when an individual, or more likely a small group of closely related people, that are engaged in hunting activities (more likely to be a party of men) or gathering activities (more likely to involve women and children) camp overnight near the resource being procured;
- Duration would be one or several days;
- Total numbers of people would be relatively small;
- Would be expected to occur close to where food resources were available, which for different foods may be a seasonal or annual occurrence;
- Proximity to potable water probably was important, although temporary sources may have been sufficient;
- Evidence may represent accidental discard, repair of hunting or gathering equipment, children's play, stone knapping activity, food processing or temporary camp fires;
- Quantity and density of evidence and range of artefact and stone types are expected to be low to moderate, and distinguishable from 'background discard'. A reasonably broad range of artefact and stone types may be discarded (although not as diverse as expected at a base camp). Items likely to be cached for future use at a base camp, or unlikely to be carried around on a hunting or gathering journey (eg. grindstones) are not expected to occur. Time-consuming activities like construction and use of ovens or heat treatment pits are also unlikely to have occurred.

Nuclear/extended family base camp:

- May occur when a single nuclear family or extended family camps together;
- Duration uncertain but probably dependent on availability of food resources and potable water in the locality;
- Total numbers of people would be relatively small;
- Probably situated on level or very gently inclined ground;
- Probably situated close to potable water;
- Probably situated close to food resources (eg. conjunction of wetlands and forest zones);
- The encampment area may consist of a several small huts, dispersed in a spatial patterning depending on the social mix of the people;
- Evidence may represent accidental discard, repair of equipment, children's play, stone knapping activity, food processing, campfires, heat treatment of silcrete and manufacturing of tools;
- Quantity and density of evidence and range of artefact and stone types discarded are expected to be high. Repeated visits to a camp site or stays of long duration may cause a build-up of evidence over a period of time in a specific location. Items are likely to have been cached for future use at a base camp. Specific artefact indicators include grindstones. Evidence of casual knapping and production of tools is expected to be common. The significant differences with a temporary hunter/gatherer's camp include the possible presence of features such as heat treatment pits and ovens, broader range of artefact and stone types, presence of specific artefact indicators, higher density of evidence (reflecting more activity and longer duration of use) and relatively common evidence for the production of tools.

Community base camp:

- May occur when a number of nuclear families camp together;
- Duration uncertain but probably dependent on availability of food resources;
- Total numbers of people could be relatively large (30+);
- Probably situated on level or very gently inclined ground;
- Probably situated close to potable water;
- Probably situated close to food resources (eg. conjunction of wetlands and forest zones);
- The encampment area may exceed 100 m^2 and consist of a number of individual groups and huts, dispersed in a spatial patterning depending on the social mix of the groups;
- Quantity and density of evidence and range of artefact and stone types discarded are expected to be high. Spatially discrete evidence of individual camp sites would be expected (if the resulting evidence has not been affected by disturbance or superimpositioning). Items may not have been cached for future use. Specific artefact indicators include grindstones, relatively more common evidence of food processing and possibly ochre. Evidence of casual knapping and production of tools is expected to be common. However, features such as heat treatment pits may not occur.

Larger congregation of groups:

- May occur in relation to special events (eg. major ceremonies) or when a particularly desirable food was most abundant (eg. a beached whale);
- Probably of short duration (eg. <1-2 weeks) but potentially for longer duration (eg. 3 months);
- Total numbers of people could vary widely, but possibly exceed 100;
- Probably situated on level or very gently inclined ground;
- Probably situated close to potable water;
- Probably situated close to food resources;
- A large area or areas of encampments would be expected, possibly covering hundreds of square metres or more;

- Spatially discrete evidence of individual camp sites would be expected (if the resulting evidence has not been affected by disturbance or superimpositioning);
- Quantity and density of evidence and range of artefact and stone types discarded are expected to be high (similar to community base camp). Items may not have been cached for future use. Specific artefact indicators include grindstones, relatively more common evidence of food processing and possibly ochre, and possibly evidence of processing uncommon foods for which the gathering may be related (eg. whale). Evidence of casual knapping and production of tools is expected to be common. However, features such as heat treatment pits may not occur.

To distinguish whether single or multiple episodes of occupation occurred, several factors can be examined. Multiple episodes of occupation would tend to exhibit superimpositioning of evidence (eg. mix of unrelated stone materials and artefact types and activity areas). However, identifying which items belong to which activity events can be problematical. Also, distinguishing the effects of post-depositional disturbance from cultural superimpositioning is problematical (*cf*. Koettig 1994). The analysis of distributions of stone material and artefact types is of benefit in some circumstances.

Another indicator of multiple occupation is an expectation of a relatively higher density of artefacts within a locality (combined with superimpositioning as discussed above). Larger areas of occupation may also result, when occupations only partially overlap (eg. Camilli 1989).

Identification of different episodes of occupation over time would require *in situ* deposits with stratified or vertically separated evidence of activity events and datable material.

Identification of the duration of individual episodes of occupation may prove very difficult. Where a single episode of occupation has occurred, a greater quantity of items and frequency of discrete activity events may be indicative of a longer stay.

Identification of the types of occupations when multiple episodes have occurred may prove highly problematical. Unless specific artefact indicators for different types of occupation are present, the superimpositioning of evidence from unrelated occupations (eg. transitory movement over a nuclear family base camp) may not be possible to determine.

In terms of the present study area, a program of testing could identify to some extent the types of occupation that may have occurred, and therefore be useful in examining the role of the locality within the broader regional context. At present, based on ethnographic evidence and the results of surveys and excavations in the locality, including in the adjacent Stage 1, a number of hypotheses about Aboriginal occupation in the locality can be postulated. The program of testing can be used to address these research questions (refer below).

4 & 5) Aims and Methodology and Analytical Techniques:

Project Aims:

The program of sub-surface test excavation will contribute substantially to a heritage impact assessment of the subject land. Much of the subject land exhibits conditions of very low surface visibility. The heritage evidence currently exposed within areas of ground disturbance represents only a fraction of the potential resource of the study area. Neither the nature, extent, integrity or significance of the potential Aboriginal heritage evidence could be satisfactorily addressed through surface survey alone (Kuskie 2004a). Sub-surface testing will retrieve a suitable sample of evidence to permit the primary aims of the project to be addressed:

- Identification of the distribution of heritage evidence across the study area and in relation to hypothetical environmental/cultural contexts and occupation models;

- Identification of the nature of heritage evidence within the study area, including the activities represented and the potential for this evidence to address locally and regionally relevant research questions;

- Clarification of the integrity of deposits and identification of any means in which the effects of post-depositional processes could be controlled for;

- Through this information, permit a robust assessment of the scientific significance of the identified and potential Aboriginal heritage resources of the study area; and

- Provide a satisfactory basis from which to formulate strategies for the management of the Aboriginal heritage resource.

Through the excavation and subsequent analysis of the evidence retrieved, the research hypotheses listed below will also be addressed to the extent that is possible given the nature of the evidence and present limitations of methodological and theoretical knowledge. This list is not intended to be prescriptive or preclusive:

- What Aboriginal activities occurred on-site?
- What types of Aboriginal occupation occurred within the study area (eg. camping, hunting/gathering, transitory movement, etc.)?
- Were the types of activity and nature of occupation related to environmental factors (eg. landform element, slope, soils, proximity to potable water, proximity to wetlands/estuary)?
- Does spatial patterning of activity areas occur?
- Were the types of activity and nature of occupation related to cultural or behavioural factors (eg. performance of ceremonies)?
- If a ceremonial site was present, did its presence influence the patterning of cultural material across the study area?
- Did the nature and location of occupation vary over time with changing environmental conditions (eg. transformation from sheltered coastal embayment to estuarine water to brackish and freshwater swamps)?
- Did single or multiple episodes of occupation occur?
- Did episodes of occupation occur at different times over the entire time-span of occupation of the region?
- What duration of time did each episode of occupation last?
- Is there potential for older (ie. early Holocene or late Pleistocene) evidence?
- How intensive was occupation of the study area, in both a local and regional context?
- What were the primary subsistence resources used/discarded within the study area and where were they obtained from?
- Did food processing occur on-site?
- Did microblade and microlith production occur on-site?
- Did thermal alteration of silcrete occur on-site?
- Were other stone tools manufactured on-site?
- Was knapping of flakes largely casual and opportunistic, meeting requirements on an 'as needed' basis?
- Was maintenance of stone tools conducted on-site?
- Were wooden implements produced and/or maintained on-site?
- To what extent did bipolar knapping occur and did this vary over time?
- What stone materials were favoured for use and why?
- Where were the stone materials procured?

- Is the 'distance-decay' model a valid explanation of stone material use and discard in this locality?
- Did ceremonial activity occur on-site (eg. the speculated ceremonial ground)?
- How does the evidence and human behaviour represented in the study area compare with the evidence obtained by Navin Officer through testing of Stage 1?
- How does the evidence and human behaviour represented in the study area compare with evidence from other locations in the region? and
- How does the evidence from the study area relate to regional models of occupation?

<u>Project Methodology:</u>

In order to address the research and management aims, a sampling strategy must be devised that is likely to sample and recover the required evidence. It was proposed to:

- Excavate test units measuring 0.5 x 0.5 metres in area on a 5 x 5 metre grid across a portion of each environmental/cultural context, with additional samples obtained from three of the contexts in order to address research questions pertaining to aspect and the potential ceremonial site. Sampling was to occur along a grid measuring around 5 x 50 metres in area in each sampling location, as per the methodology specified below;

- Retrieve samples and obtain radiometric dates where feasible;

- Record and plot the location of the excavations; and

- Record and analyse the cultural material as specified below.

The approximate locations of the test units are marked on Figure 14. The sampling strategy involved testing within one sample area in each of the environmental/cultural contexts identified, with additional samples obtained from three of the contexts in order to address research questions pertaining to aspect and the potential ceremonial site:

- Context 1a: A substantial portion of this moderate lower slope (former shoreline) unit has been conserved as part of the Stage 1 heritage protection measures, including remnant forest areas that may be of higher integrity than the portion of this context within the present study area. However, testing will overcome the limitations of the Stage 1 methodology and provide a comparable sample for analysis within the framework of the present investigation. Notwithstanding some vegetation constraints, test units were excavated along the portion of this context within Stage 4 of the study area (Figures 14 & 15);

- Context 2a: Test units were excavated on the level/very gentle flat immediately west of site Dolphin Point 4 Locus G and around Navin Officer's (2003c) Test Unit #30 (Figures 14 & 16);

- Context 3a (i): Test units were excavated on the first order drainage depression in Stage 2, near the reported location of site Dolphin Point 1 Locus E. Part of this context is conserved in Stage 1 as a component of the Stage 1 heritage protection measures. A second reason for testing in this location was to sample this context where the aspect faces away from the possible ceremonial site (Figures 14 & 17);

- Context 3a (ii): Test units were also excavated on the first order drainage depression in Stage 3, in order to sample this context where the aspect faces towards the possible ceremonial site (Figures 14 & 18);

- Context 3b: Test units were excavated on the same first order drainage depression in Stage 2 as for context 3a, but a further distance from the wetland (Figures 14 & 19);

- Context 4a (i): Test units were excavated on the east facing side-slope of the gentle simple slope in Stage 3, within 200 metres of the wetland/flat. A second reason for testing in this location was to sample this context where the aspect faces towards the possible ceremonial site (Figures 14 & 20);

- Context 4a (ii): Test units were also excavated on the gentle simple slope within 200 metres of the wetland/flat, west of the excavation on the spur crest in Stage 2, in order to sample this context where the aspect faces away from the possible ceremonial site (Figures 14 & 21);

- Context 4a (iii): Test units were also excavated on the gentle simple slope within 200 metres of the wetland/flat in Stage 2, in order to sample this context where the aspect faces towards the possible ceremonial site (Figures 14 & 22);

- Context 4b (i): Test units were excavated on the side-slope of the main spur line in Stage 2 west of the excavation on the spur crest, further than 200 metres from the wetland/flat. A second reason for testing in this location was to sample this context where the aspect faces away from the possible ceremonial site (Figures 14 & 23);

- Context 4b (ii): Test units were also excavated on the gentle simple slope further than 200 metres from the wetland/flat in Stage 2, in order to sample this context where the aspect faces towards the possible ceremonial site (Figures 14 & 24);

- Context 5a: Test units were excavated on the crest of the main spur-line in Stage 2, extending south from site Dolphin Point 1 Locus B in the vicinity of the possible ceremonial ground (Figures 14 & 25);

- Context 5b: Test units were excavated on the crest of the main spur-line in Stage 2, a further distance from the wetland margin towards site Dolphin Point 1 Locus D (Figures 14 & 26);

- Context 6a: Test units were excavated across the very gentle drainage depression, through a strip cleared of vegetation near site DP1 Locus K (Figures 14 & 27);

- Context 7a: Test units were excavated on the very gentle ridge crest adjacent to site Dolphin Point 2 Locus J in a cleared, grassed area where levels of ground disturbance appear lower than in the surrounding built-on areas (Figures 14 & 28);

- Context 8a: Test units were excavated on the level/very gentle wetland on land bordering the present water body, in the vicinity of site Dolphin Point 4 Loci M & N and Feary's Site 3 & 4, west of Dolphin Point Road (Figures 14 & 29); and

- Context 9a: Test units were excavated on the gentle lower slope (former shoreline) immediately west of site Dolphin Point 1 Locus B (Figures 14 & 30).

Hence, a total of 22 units (5.5 m^2) were to be excavated in each of 16 sample areas. All twelve environmental/cultural contexts were to be sampled, with three contexts sampled more than once to address research questions relating to the possible ceremonial site. Hence an overall total of 352 units (88 m^2 or 0.024% of the study area) were to be excavated (refer to Section 5).

The methodology involved clearing the surface of vegetation by use of a brush-cutter and pegging out units at every 5 metre interval on each 5 x 50 metre grid. Each 0.5 x 0.5 metre (0.25 m^2) excavation unit was labelled using an alphanumerical grid and dug by shovel and trowel to the depth of the A unit soil/top of B unit soil or visible or predicted cultural deposits. Excavation units were dug in successive levels ('spits') of 10 centimetres depth in order to investigate integrity. Data was recorded for each excavation unit on an 'Excavation Unit Recording Form' (refer to database in Appendix 4).

Soil from each level within an excavation unit was placed into separate buckets, labelled and transported to a sieving station to be separately sieved. Wet sieving was used, with water recycled from a farm dam. A sieve mesh of 2.5 millimetres (3.13 mm maximum aperture) was used. After each bucket was sieved, all material (both natural and cultural) remaining in the sieve was dried and bagged with the provenance label. Each bag of material was subsequently sorted by a qualified archaeologist who retained all probable and potential cultural items and disposed of the natural items. This represents application of the 'total sieve retrieval' methodology (Kuskie & Kamminga 2000).

Lithic item recording was undertaken by a qualified archaeologist with expertise in lithic analysis (Edward Clarke) in laboratory conditions. All lithic items retrieved from the hand excavations were inspected under a low-magnification microscope, which assisted in the accurate identification of stone materials, artefact types, use-wear, retouch and other attributes.

A minimal level of information was recorded for every artefact (provenance, reference number, stone material type and colour, lithic item type, size, weight, nature and quantity of cortex, presence and nature of any use-wear or residues, and attributes of heat treatment) (refer to lithic database, Appendix 5). In addition, other specific attributes were recorded where necessary (eg. initiation surface, number of platforms, number of flake detachments and flaking pattern for cores, and initiation surface, initiation type, termination type, percussion length, width and thickness, platform width and thickness and overhang removal/faceting for whole flakes).

All shell and bone material was recorded, with identification to genus or species level where possible and counts of minimum numbers undertaken (refer to shell database, Appendix 6). Minimum numbers of individuals (MNI) were calculated by counting whole shells, and in the case of bivalves by comparing left and right pairs. For fragmented shells, hinges in bivalves and apices in gastropods were used to signify an individual.

Following recording of artefacts and shell into a computer database, individual artefacts were bagged separately in resealable, labelled plastic bags, while the shell items within each excavation unit were bagged together for each species. Provenance information was recorded on waterproof ink on the plastic bag label strips. At the completion of the analysis, all remaining cultural evidence has been returned to the Ulladulla Local Aboriginal Land Council for their custodianship, as per the conditions of the Section 87 and Care Agreement.

Shell samples suitable for radiocarbon dating were obtained and submitted to The University of Waikato Radiocarbon Dating Laboratory for dating (results are presented in Appendix 8). Soil samples were also retained. Radiocarbon dates of suitable shell samples were obtained from the only midden deposits identified during testing, in Context 8a. No other material (eg. charcoal) suitable for radiometric dating was retrieved.

6 & 7) Refinement of Predictive Model and Selection of Mitigation and Management Strategies:

Following completion of the investigation and analysis, management of the heritage resources in relation to the potential development impacts can be considered within a regional context (refer to Sections 5, 9 and 10).

5. RESULTS AND DISCUSSION

5.1 Introduction

The results of the test excavations and analysis and discussion of these results is presented in Section 5.

A summary of the excavation sample is presented in Section 5.2. A revised description of the heritage sites is presented in Section 5.3. Discussion of the integrity of the evidence is presented in Section 5.4. The nature of stone materials, their potential sources and the possible use of heat treatment is discussed in Section 5.5. The types, categories and characteristics of lithic items identified are discussed in Section 5.6. Spatial patterning of evidence and activity areas are discussed in Section 5.7. The potential age of the evidence is discussed in Section 5.8. The regional context of the evidence is discussed in Section 5.9 and the constraints to this type of analysis are outlined. Interpretation of the archaeological evidence is presented in Section 5.10 and a synthesis of the results is presented in Section 5.11.

5.2 Excavation Data

Summary:

The test excavations were undertaken within 16 separate Test Areas, as per the proposed research design (refer to Section 4). The locations of the Test Areas are marked on Figure 14 (overall plan) and Figures 15-30 (each Test Area). The test excavation data is summarised in Table 15 and the details of each excavation unit spit are presented in Volume B: Appendix 4. Photographs of each test area and a sample of individual test units are presented in Volume B (Plates).

Each test area comprised a sample of units, each measuring 0.5 x 0.5 metres in area, excavated at 5 metre intervals on a 50 x 5 metre grid (Figures 15-30). Hence, in all but one of the 16 test areas, a total of 22 test units were excavated for a total area of 5.5 m^2 in each Test Area. Due to the presence of dense forest vegetation in Test Area 1A, it was not possible to excavate five of the proposed test units (Figure 15).

In total, 347 test units each measuring 0.25 m^2 in area were excavated, resulting in a total excavation area of 86.75 m^2. In total, 1562 separate excavation unit spits (0.5 x 0.5 metre area x 10 centimetre deep 'spit') were excavated. On average, 4.5 spits (each to a thickness of 10 centimetres) were excavated at each test unit.

A total volume of deposit of 53.63 m^3 (53,630 litres) was excavated and wet-sieved. On average, about 34.3 litres of deposit was excavated from each unit spit.

In total, 2142 stone artefacts were recovered from the test excavations, along with shell midden deposits in Test Area 8A (Table 15). Each artefact is described in a database for the test excavations in Volume B: Appendix 5. The shell evidence is described in Volume B: Appendix 6.

The number and proportion of artefacts for each Test Area is presented in Tables 15 and 16 and the spatial distribution plotted in Figures 40 to 54. On average, 6.173 artefacts were located in each test unit and 1.37 artefacts in each excavation unit spit. The overall mean count of artefacts per conflated square metre is 24.69. The maximum artefact count in a single 0.25 m^2 test unit is 128 (unit BB45 in Test Area 1A). The maximum artefact count in a single excavation unit spit is 76 (unit BB45 spit 3 in Test Area 1A).

The overall mean density of artefacts per cubic metre is 39.94. Artefact density per individual excavation unit spit varied substantially, from nil to a peak of 2451.61 artefacts/m^3 in spit 3 of unit BB45 in Test Area 1A (Appendix 4).

As evident in Tables 15 and 16, the counts and densities of artefacts varied substantially between the different test areas and environmental/cultural contexts. The mean artefact density ranged from nil in Test Area 4B2 to 189.81/m^3 in Test Area 5A. This issue and the remainder of the data is discussed in greater detail in subsequent sections.

Individual Test Areas:

Each Test Area is described briefly below, including an updated soil description undertaken during the test excavations.

<u>Test Area 1A</u>

Test Area 1A is located within environmental/cultural context 1A (Table 3) on the moderate lower slope (former shoreline) in Stage 4 of "The Dairy" (Figures 14 & 15, Plates 1 & 2). The slope borders a flat (Lions Park) that comprises recent Holocene estuarine sands and sand fill dredged from the Burrill Lake inlet in the early 1970s (McAndrew 1993:46, 150-151). The present inlet of Burrill Lake is situated adjacent to (east of) this flat (Figure 1).

The slope represents the former shoreline during the mid-late Holocene period when sea levels were higher than at present. During this time, Test Area 1A was situated immediately adjacent to subsistence resources of the estuary and forest.

This locality also represents the termination of a subsidiary ridge of a major ridgeline that leads from Dolphin Point inland along Kingiman Ridge to Mount Kingiman, and further north-west to Little Forest Plateau on the Tianjara Plateau. This ridgeline may have provided the most accessible route for travel between the plateau and coastal zone at Burrill Lake.

Many of the test units were located on the verge of mown grass associated with the adjacent residence in Stage 4 and a number extended into the tall native grass and small shrubs of a stand of coastal forest. Surface visibility was very low (1%) due to the vegetation cover. Three Telstra cables bisect the northern end of the test area. All units were excavated on the moderate slope (8-10º to the east), although the BB series were on the upper part of the slope (less steep in places) and the AA series on the mid to lower part of the slope (particularly at the northern end) (Figure 15). The aspect is essentially to the east over the flat and Burrill Lake inlet, although any tall vegetation on the flat would have limited these views.

The soil profile was very similar across the test units, with each excavation often ceasing on top of decomposed sandstone bedrock (Plates 33-35). Some variability in the weathering and freshness of buried bedrock boulders was noted. In AA15, for example, the hard clean nature of the buried bedrock boulders and immaturity of the surrounding soil profile suggest recent burial of a former rocky slope surface by soil accumulation (Plate 33). In other deeper sequences (eg. BB0, Plate 34) pedogenically immature colluvial soils overlay both *in situ* bedrock boulders and unconformities with denser residual soil profile at depth. The typical profile from unit BB10 comprised:

- A unit: thin 10 YR 2/2 very dark brown heavily bioturbated humic sandy loam grading into a 10 YR 3/3 dark brown or 10 YR 4/6 dark yellowish brown sandy loam (pH 6.5), typically between 0 and 20 to 40 centimetres depth; overlying
- Decomposed sandstone bedrock.

Generally, the rocky nature of the soils are interpreted as reflecting higher energy erosive wave energy conditions at the lower slope during the Holocene transgression, when this area was an unprotected exposed shoreline. Slopes were then subject to net fine-grain sediment loss, were rocky and were influenced by salt-spray and probably poorly vegetated. Such conditions would not have facilitated preservation of older occupation evidence on these lower slopes. Subsequent infilling of the lake entrance and beach barrier development has resulted in soil accumulation and limited profile development over these previously more dynamic slopes.

Test Area 2A

Test Area 2A is located within environmental/cultural context 2A (Table 3) on the level/very gentle flat (infilled Holocene sediments) in the open space portion of "The Dairy" (Figures 14 & 16, Plates 3 & 4). The sandy flat would only have formed in the mid-late Holocene after estuarine transgressive/regressive sands infilled the small basin. Major floods have been reported since non-indigenous settlement, including in 1962, 1974, 1975 and 1976, that have inundated this flat. The presence of salt marshes or wetlands in the late Holocene on portions of the flat is highly probable. Hence, subsistence resources of the estuary, wetlands/swamps and forest would have been in very close proximity of the test area, with the rock platforms also nearby.

Test units were excavated immediately west of site Dolphin Point 4 Locus G and in the vicinity of Navin Officer's (2003c) Test Unit #30 (Figure 16). The area is presently vegetated by native and pasture grasses and used for horse agistment. Previous cultivation is evident from a series of pronounced ridge and furrows, with the crests typically about 1.2 metres apart and 0.1 metres higher than the troughs. Surface visibility was nil at the time of the test excavations. An artificial drainage channel is present 50 metres west of the test units and a deep sand deposit is exposed in its banks. The moderate lower slope (former shoreline) is located immediately east of the site.

Almost all units were excavated on the flat, which grades marginally at c.0.5º to the west. Units CC0 and DD0 were located on the basal portion of the adjacent slope and are marginally elevated above the other units. The site aspect is open, but would have been substantially limited by any tall vegetation and is limited to the east by the forest on the slope.

The soil profile was very similar across most of the test units (DD10-50, CC15-50), with each excavation typically ceasing in the A_2 sand just above or into the present water table (Plates 36-39). The typical profile from unit CC50 (Plate 37) comprised:

- A unit: very humic, compact 10 YR 2/1 black sandy clay loam A_1 with roots and rootlets (pH 6.5), overlying a moist 10 YR 6/2 light brownish grey to 10 YR 7/2 light grey sand A_2 (pH 6.5), with some mottling (10 YR 6/8 brownish yellow, 10 YR 5/8 yellowish brown, 10 YR 4/1 dark grey). The A_1 is typically between 0 and 20 to 30 centimetres depth, with the water table rising through the A_2 unit around 0.5 metres below the surface.

Although bioturbation along deeper roots has mixed some of the overlying organic loam into underlying sands (Plate 37), soil contacts are generally very sharp onto the underlying sands. This suggest that the environmental change which led to the initiation of a swamp over the sand flats was quite rapid, and may relate to a shift in the beach barrier/basin entrance after a major storm event. Persistent high water tables until very recently are also indicated. The highly organic and clayey A_0/A_1 units may have arisen through oxidation of formerly less well drained peaty facies, when the artificial drainage channel was constructed. At the landward end of the transect (Plate 38), the former wetland organic soils unconformably onlap older soils of the adjacent slopes, suggesting encroachment of the swamp off the sand flat and onto the adjacent slope margin. Overall land surface datums may have dropped in this area recently following oxidation of organic matter in the soils.

The soil profile across the eastern most units (DD0-5, CC0-10) adjacent to the former shoreline (lower slope) was different, with each excavation typically finishing on top of sandstone bedrock. The typical profile from unit DD5 comprised:

- A unit: humic, compact 10 YR 3/1 very dark grey sandy clay loam A_1 with roots and rootlets (pH 6.5), grading into a strongly mottled 10 YR 5/8 yellowish brown, 5 YR 5/2 olive grey and 10 YR 4/1 dark grey clay loam, sandy (pH 6-6.5). The A_1 is typically between 0 and 17 to 27 centimetres depth, with the A_2 unit extending to 30 to 40 centimetres below the surface; overlying
- Sandstone bedrock.

These stratigraphic sequences are interpreted as the former tidally wave-washed margins of the basin entrance and more recently flood-prone areas. Limited *in situ* evidence would be expected in this area, including out onto the former sand flats. The sequences probably represent only small intervals of time, with a substantial unconformity within the top of the sand sequence, and unconformities deeper within the sands. Older clayey soils that underlie peaty topsoils (eg at DD5, Plate 38) may extend out deep under the transgressive/regressive sands as buried surfaces.

<u>Test Area 3A1</u>

Test Area 3A1 is located within environmental/cultural context 3A (Table 3) on the first order gentle drainage depression in Stage 2 of "The Dairy" (Figures 14 & 17, Plates 5 & 6). The test units are located within 200 metres of the basin. When sea levels were higher than at present during the mid-late Holocene period Test Area 3A1 was situated adjacent to subsistence resources of the estuarine basin and forest.

The test units were excavated adjacent to the reported location of site Dolphin Point 1 Locus E (erosion scour on Figure 17). This erosion scour was very wet and possibly a saline water seepage. Test units were excavated across the minor creek channel (0.3 metres deep and 1 metre wide) and on either side of the channel on the gentle (2º) sloping sides. Units S-T-30-35 border the channel (Figure 17). Surface visibility was very low at the time of testing (nil, apart from a minor area on the creek channel) due to the cover of pasture and native grasses.

A second reason for testing in this location was to sample this context where the aspect faces away from the possible adjacent ceremonial site. The aspect is predominantly to the south and south-west up the drainage depression and north and north-east down the drainage to the basin. Views to the east and west were probably limited by the adjacent spurs and elevated slopes. However, with a dense coastal forest present, any views would have been limited.

The soil profile was very similar across the test units, with each excavation often ceasing within the B unit clay (Plate 40). The typical profile from unit T15 comprised:

- A unit: moist, compact 10 YR 4/1 dark grey silty clay loam with rootlets and some mottles of 7.5 YR 3/3 dark brown, pH 5.5, typically between 0 and 20-35 centimetres depth; overlying
- B unit: moist 10 YR 6/2 light brownish grey light clay, with minor mottles of 7.5 YR 3/3 dark brown, pH 6.5.

The limited pedostratigraphic and typically thin soil development over clay is consistent with the area being subject to some soil loss and slope instability against, but probably just above, a low energy shoreline/tidal lagoon in the mid-Holocene, and subsequently waterlogged conditions as the basin infilled.

<u>Test Area 3A2</u>

Test Area 3A2 is located within environmental/cultural context 3A (Table 3) on the first order gentle drainage depression in Stage 3 of "The Dairy" (Figures 14 & 18, Plates 7 & 8). The test units are located within 200 metres of the basin. When sea levels were higher than at present during the mid-late Holocene period Test Area 3A2 was situated adjacent to subsistence resources of the estuarine basin/embayment and forest. A second reason for testing in this location was to sample this context where the aspect faces towards the possible ceremonial site (in contrast to Test Area 3A1 in the same environmental/cultural context, which faces away from the possible site).

Surface visibility was very low at the time of testing (nil) due to the cover of pasture and native grasses and weeds. The locality is currently grazed and the surface is uneven in places, possibly from previous tree removal. The aspect is predominantly to the north-east, east and south-east over the basin and to the spur with the possible ceremonial site, but is limited to the north and south by spurs and simple slopes and north-west up the drainage depression.

Microtopographical variations occur within the test area. Test units A0, B0 and B5 are situated on the southern margin of the broad, shallow drainage depression on the 2-2.5º basal slope, and lie 0.3 metres above the adjacent creek channel. Units B5 and A10 occur in the current drainage channel, which slopes at 2º to the south-east. Units B10 and A15 are on the northern bank of the channel and between here and A30 and B30 the units are situated on a 1º slope leading north-east away from this channel to a second, shallow depression. Units A-B-35-40 are situated in the second shallow depression which grades at 1º to the south-east and borders the basin. Units A-B-45-50 are situated on the northern side of the drainage depression, on a 6º basal slope grading south from the spur crest in Stage 1.

The soil profile development is complex in this test area and varies considerably between test units, due to the infill of the basin with marine and estuarine sand and colluvial slopewash (Plates 41-45). The soil sequences include very well stratified units of water lain sands and silts which exhibit limited subsequent soil development or bioturbation. Some of the fine sand/silt units are laminated and/or very thinly bedded and where well preserved, as in Test Units A15 and B0 (Plates 42 and 44), show increasingly wet conditions/rising energy levels in sand/silt couplets followed by brief sand deposition then a sudden return to lower energy. The preservation of the vertical sorting and textural trends in the laminates suggests water saturation/minimal root bioturbation following deposition. This test area therefore appears to provide observations at datums which closely approximate the former “high” marine transgression limits, but where stratigraphy has been well preserved, perhaps because of the protected south-east facing aspect of the embayment/drainage line. The typical profile from Unit A50 on the northern side of the drainage depression comprised:

- A unit: humic 10 YR 3/1 very dark grey sandy loam A_1 with roots and rootlets and minor charcoal (pH 6.5), over a slightly mottled 10 YR 5/1 grey and 10 YR 6/2 light brownish grey loamy sand (pH 6.5) A_2 unit. The A_1 is between 0 and 30 centimetres depth in unit A50, with the A_2 unit extending from 30 to 53 centimetres below the surface; transitioning through a very thin B unit to
- C unit: 10 YR 4/6 dark yellowish brown and minor 5 YR 4/6 yellowish red decomposed sandstone with a 10 YR 4/1 dark grey to 10 YR 4/2 dark greyish brown soil infilling voids.

Units A-B-30-50 had a similar soil profile, with the depth of the A_1 unit ranging from 18 to 36 cm below the surface, and the A_2 from 35 to 67 cm (maximum depth). However, a B unit of 10 YR 3/2 very dark greyish brown sandy loam (pH 6.5) tended to be present, of 6 to 21 cm thickness above the C unit decomposed sandstone.

The typical profile from Unit B25 on the 1º slope leading north-east away from the main channel to a second, shallow depression comprised:

- A unit: 10 YR 3/1 very dark grey sandy loam A_1, over a slightly mottled 10 YR 4/1 dark grey and 10 YR 6/2 light brownish grey sandy clay loam A_2. The A_1 is between 0 and 23 centimetres depth in unit B25, with the A_2 unit extending from 23 to 34 centimetres below the surface; overlying a
- B unit: 10 YR 4/1 dark grey light clay, sandy, with minor quartz gravel and rootlets from 34+ cm.

Units B30, B20, B15, A25 and A20 tended to comprise a similar profile.

Units A15, B10 and B0 exhibit clear marine sand incursions. The preservation of the laminates, together with evidence of erosion/truncation on the lower contacts associated with dipping contacts (Plate 42), suggests some erosion prior to deposition in low-energy conditions. The sequences therefore are consistent with a rising water surface and gentle wave energy rising against and onlapping the slope. Radiocarbon dating and assessments of the microfossils present within and through these well preserved vertical sequences would potentially provide a tight control on the nature and timing of the marine transgression.

In A15, the marine sand occurs as a 10 YR 6/2 light brownish grey sand between 19 and 27 cm depth, overlying a buried surface of 10 YR 3/1 very dark grey sandy clay loam or clay loam, sandy, from 27-43 cm depth. In unit B10, the marine sand intrusion is from 15-18 cm depth. In unit B0, the marine sand incursion is from 17-25 cm depth but towards the base comprises a series of thin layers alternating with the A_1 soil.

Units B5 and A10 could not be described due to the influx of water.

Unit A5 comprised:

- A unit: 10 YR 3/2 very dark greyish brown sandy loam A_1, over a 10 YR 3/1 very dark grey sandy clay loam A_2 and a mottled 10 YR 4/1 dark grey and 10 YR 6/2 light brownish grey sandy loam A_3. The A_1 is between 0 and 20 centimetres depth, with the A_2 unit extending from 20 to 48 cm below the surface and the A_3 from 48-58 cm; overlying a
- B unit: 10 YR 2/1 black friable sandy loam from 58-68 cm; overlying
- C unit: sandstone at 68 cm depth.

<u>Test Area 3B</u>

Test Area 3B is located within environmental/cultural context 3B (Table 3) on the first order gentle drainage depression in Stage 2 of "The Dairy" (Figures 14 & 19, Plates 9 & 10). The test units are located further than 200 metres from the basin (in contrast to Test Area 3A1). The coastal forest represents the only resource zone within the immediate proximity of the test area.

The test units were excavated across the very broad, shallow drainage depression, which does not host a formed creek channel. Units Q-R-0-10 are on the western side of the drainage, on a 1-1.5º slope to the north-west. The aspect is open but curtailed to the west by the spur, south by a rise in the National Park and east over the drainage by another spur. Hence, the aspect is predominantly north-east down the drainage, but would have been considerably limited by the previous forest. Units Q-R-15-35 occur in the depression, which grades at 1.5-2º to the north-east. As above, the aspect was probably considerably limited by the forest. Units Q-R-40-50 occur on the eastern side of the drainage, on a slope that grades at 2-2.5º to the north-west. Likewise, the aspect would have been limited by the forest (Figure 19). Surface visibility was very low at the time of testing (nil) due to the cover of pasture and native grasses and weeds. The ground surface was quite uneven.

The soil profile was very similar across the test units, with each excavation often ceasing at the B unit clay. There is clear evidence of major roots and bioturbation in the A unit, with the dark A_1 extending down to the B unit clay in places. The typical profile from unit Q30 (Plate 46) comprised:

- A unit: 10 YR 3/2 very dark greyish brown or 2/2 very dark brown sandy loam A_1 (pH 6.5) over a 10 YR 5/2 greyish brown sandy clay loam A_2 (pH 6.5) that becomes increasingly mottled with depth with 10 YR 5/6 yellowish brown. The A_1 is between 0 and 15 centimetres depth, with the A_2 unit extending from 15 to 40 cm below the surface; overlying a
- B unit: gradually from 40+ cm depth a 10 YR 5/6 yellowish brown light medium clay (pH 5.5-6.0) with minor 10 YR 5/2 greyish brown.

Across the test area, the transition from the A to B unit varied from 30 to 58 cm depth below surface (but was typically 40-50 cm deep). The stratigraphy (refer to Plate 46) indicates good pedogenic development, with soil properties and depth consistent with position on a slope with minimal regolith loss. Bioturbation is considerable, and fairly poor drainage appears to be typical of soils in this area.

Test Area 4A1

Test Area 4A1 is located within environmental/cultural context 4A (Table 3) on the east facing side-slope of the gentle simple slope in Stage 3 of "The Dairy" (Figures 14 & 20, Plates 11 & 12). The test units are located within 200 metres of the basin. When sea levels were higher than at present during the mid-late Holocene period Test Area 4A1 was situated adjacent to subsistence resources of the estuarine basin/embayment and forest.

Test units C-D-0-35 were excavated on a simple slope of 3-3.5º gradient to the east. Test units C-D-40-50 occur on the basal slope which grades at approximately 5º to the east. A further 12 metres east of the test area lies a small flat, where the nearby drainage depression enters the basin (Figure 20). A farm track and fence bisect the test area between units 35 and 40. Surface visibility was very low at the time of testing (nil) due to the cover of pasture and native grasses and weeds. The surface was uneven in places.

A second reason for testing in this location was to sample this context where the aspect faces towards the possible adjacent ceremonial site. The aspect is predominantly to the east, south and north but is limited to the west as the slope rises. Despite the former presence of a forest, the basin would have been visible.

The soil profile was very similar across most of the test units, with each excavation often ceasing at or within the B unit clay (Plates 47-50). There is clear evidence of major bioturbation in the A unit, including rabbit burrows deep in the A_2 soil. The typical profile from unit C40 comprised:

- A unit: humic 10 YR 3/1 very dark grey sandy loam A_1 (pH 6.5) with roots and charcoal over a mottled 10 YR 4/4 dark yellowish brown, 4/3 brown and 5/2 greyish brown sandy clay loam A_2 (pH 6.5) that becomes increasingly mottled with depth. The A_1 is between 0 and 14 centimetres depth, with the A_2 unit extending from 14 to 44 cm below the surface; overlying a
- B unit: from 44 cm depth a mottled 10 YR 5/8 yellowish brown and 5/3 brown clay loam, sandy, to medium clay further upslope (pH 6.5), with occasional sandstone rocks and abundant gravel.

The B unit typically commences at around 35-45 cm depth. One unit, D50, exhibited a different soil profile, in which a light grey beach sand marine transgression is evident between 17 and 35 cm depth. This is significant as it provides a potential datum and position on which to map the "upper transgression limit" across from Test Area 3A2.

Other profiles in this area, such as C45, show high charcoal and burnt clay frequencies within colluvial clayey units 0.1 to 0.2 metres below the surface (Plates 48 and 50), in a relatively less bioturbated horizon. There also appears to be evidence of increased colluviation post-dating the slope deposit in units in which charcoal is abundant. This is provisionally interpreted as representing clearance of the forest vegetation and subsequent land-use in the historic period. If correct, this interpretation indicates sufficient historic sediment movement on the slopes in this test area to have considerably disturbed artefact spatial distributions.

Test Area 4A2

Test Area 4A2 is located within environmental/cultural context 4A (Table 3) on the gentle simple slope in Stage 2 of "The Dairy" (Figures 14 & 21, Plates 13 & 14). The test units are located within 200 metres of the basin, as with Test Area 4A1. When sea levels were higher than at present during the mid-late Holocene period Test Area 4A2 was situated adjacent to subsistence resources of the estuarine basin/embayment and forest. However, in contrast to Test Area 4A1, this area faces away from the possible ceremonial site.

All test units were excavated on a simple slope of 3º gradient to the north-west. The test area is parallel to the drainage depression (context 6A) (Figure 21). A shallow excavated area cum erosion scour with wooden and metal remains is situated adjacent to the test area. Surface visibility was very low at the time of testing (nil) due to the cover of pasture and native grasses and weeds. The surface was uneven in places.

A reason for testing in this location was to sample this context where the aspect faces away from the possible ceremonial site. The aspect is predominantly to the north and north-west although extends to the west and north-east. The area overlooks the western end of the basin, however previous views may have been substantially limited by the forest.

The soil profile was very similar across the test units, with each excavation often ceasing at or within the B unit clay (Plates 51 & 52). There is clear evidence of bioturbation in the A unit, including tree bowls and roots infilled with topsoil. The typical complete soil profile from unit I10 comprised:

- A unit: humic 10 YR 2/2 very dark brown sandy loam A_0 (pH 6.5) with roots and rootlets, over a 10 YR 4/2 dark greyish brown sandy loam A_1 (pH 6.5) and a gradual transition to a 10 YR 5/6 yellowish brown sandy clay loam (becoming increasingly so with depth) A_2 (pH 6.5). The A_0 is between 0 and 14 centimetres depth, the A_1 between 14 and 20 cm depth and the A_2 from 20 to 40 cm below the surface; overlying a
- B unit: gradual transition from 40 cm depth to a 10 YR 5/8 yellowish brown medium heavy clay (pH 6.0).

In other soil profiles (Plate 52) there is evidence of pronounced truncation from a combination of erosion and disturbance associated with tree removal, indicating significant localised disturbance.

Test Area 4A3

Test Area 4A3 is located within environmental/cultural context 4A (Table 3) on the gentle simple slope in Stage 2 of "The Dairy" (Figures 14 & 22, Plates 15 & 16). The test units are located within 200 metres of the basin, as with Test Areas 4A1 and 4A2. When sea levels were higher than at present during the mid-late Holocene period Test Area 4A3 was situated adjacent to subsistence resources of the estuarine basin/embayment and forest. However, in contrast to Test Area 4A2, this area faces toward the possible ceremonial site.

All test units were excavated on a simple slope of 3º gradient to the north. The test area is located immediately upslope of a dam and tea-tree vegetation (Figure 22). The dam has probably been formed across an area of saline water seepage, and the surrounding area is moist and the test units retained standing water. Surface visibility was very low at the time of testing (nil) due to the cover of pasture and native grasses and weeds. The surface was uneven in places.

A reason for testing in this location was to sample this context where the aspect faces towards the possible ceremonial site. The aspect is predominantly to the north over the basin, but extends to the east and west. However, previous views, even to the nearby location of the possible ceremonial site, may have been substantially limited by the forest.

The soil profiles were shallow and very similar across the test units, with each excavation often ceasing at or within the B unit clay. The typical profile from unit V5 (Plate 53) comprised:

- A unit: humic 10 YR 3/2 very dark greyish brown sandy clay loam (pH 6.5) with roots and rootlets and minor mottles of 7.5 YR 3/4 dark brown from decaying organic matter, between 0 and 20 cm depth; overlying a
- B unit: a predominantly 10 YR 4/1 dark grey light clay, sandy, (pH 6.0), with minor rootlets and some mottling of 7.5 YR 4/6 strong brown, between 20 and 36 cm depth, over a strongly mottled 10 YR 4/1 dark grey, 10 YR 6/1 grey and 7.5 YR 5/6 strong brown medium heavy clay from 36+ cm.

As in the adjacent Test Area 3A1 the limited pedostratigraphic development and thin soil depth over clay is consistent with the area being subject to some soil loss and slope instability close to a low energy shoreline/tidal lagoon in the mid-Holocene, and subsequent waterlogged conditions.

Test Area 4B1

Test Area 4B1 is located within environmental/cultural context 4B (Table 3) on the gentle simple slope in Stage 2 of "The Dairy" (Figures 14 & 23, Plates 17 & 18). The test units are located further than 200 metres from the basin, on the side-slope of the main spur line in Stage 2. Test Area 4B1 was situated adjacent to subsistence resources of the forest.

All units were excavated on a simple slope of 3º gradient to the north-west. Surface visibility was very low at the time of testing (nil) due to the cover of pasture and native grasses and weeds.

A second reason for testing in this location was to sample this context where the aspect faces away from the possible ceremonial site. The aspect is predominantly to the north and west and at present a glimpse of the ocean is available to the north-east. However, the former presence of a forest would have substantially limited most views.

The soil profile was very similar across the test units, with each excavation often ceasing at or within the B unit clay (Plates 54-60). There is clear evidence of major bioturbation in the A unit, including existing and decomposed tree roots and tree bowls and possibly mixing from recent land clearing. The typical profile from unit H10 comprised:

- A unit: humic 10 YR 3/2 very dark greyish brown sandy loam A_1 (pH 6.5) over a 10 YR 6/3 pale brown and 10 YR 6/6 brownish yellow sand or loamy sand A_2 (pH 6.5). The A_1 is between 0 and 18 cm depth, often indicating recent reactivation with charcoal and evidence of mixing into the underlying A_2 unit extending from 18 to 30 cm below the surface; overlying a
- B unit: from 30 cm depth a 10 YR 5/6 yellowish brown medium heavy clay (pH 6.0), but becoming predominantly 2.5 YR 4/8 dark red in other units (while retaining 10 YR 5/6 yellowish brown mottles).

The B unit typically commences between 15 and 37 cm depth. The lower A_2 horizons were typically relatively rich in gravel clasts in this area, suggesting bedrock or developed C horizons near-surface, and possibly fine sediment stripping from this part of the slopes. As seen in Plate 55, major tree root burnouts have occurred in this area, suggesting significant impacts on the soil profiles from vegetation clearing. Reactivation and recent deepening of A_2 profiles, as seen in Plates 58 and 60, is common and some profiles indicate the recent burial of former active rill-lines. Unit H35, for example (Plate 59), shows major truncation and gravel linings to a rill or drainage soakway, infilled by over 0.3 metres of poorly sorted colluvium, showing weak and probably recent pedogenesis. The potential for *in situ* lithic deposits on slopes with this level of recent disturbance is limited.

<u>Test Area 4B2</u>

Test Area 4B2 is located within environmental/cultural context 4B (Table 3) on the gentle simple slope in Stage 2 of "The Dairy" (Figures 14 & 24, Plates 19 & 20). The test units are located further than 200 metres from the basin. Test Area 4B2 was situated adjacent to subsistence resources of the forest.

Units W-X-10-50 were excavated on a simple slope of 2-2.5º gradient to the north-west and north. Units W-X-0-5 were excavated on a simple slope of 2º gradient to the north, which could be interpreted as a possible spur crest. Surface visibility was very low at the time of testing (1%) due to the cover of pasture and native grasses and weeds. The present surface is very uneven and may represent an erosion scour that has subsequently become revegetated, as indicated by numerous shallow drainage rills leading downslope.

A second reason for testing in this location was to sample this context where the aspect faces towards the possible ceremonial site. The aspect is predominantly to the north and over the possible ceremonial site and basin. However, the former presence of a forest would have substantially limited most views.

The soil profile was very similar across the test units, with each excavation often ceasing at or within the B unit clay (Plates 61 & 62). There is clear evidence of major bioturbation in the A unit in several units. The typical profile from unit X0 comprised:

- A unit: humic 10 YR 4/2 dark greyish brown sandy loam A_1 (pH 6.5) with roots and rootlets and organic matter over a 10 YR 5/3 brown sandy clay loam A_2 (pH 6.0-6.5) with mottles of yellowish brown. The A_1 is between 0 and 14 cm depth, with the A_2 unit extending from 14 to 23 cm below the surface; overlying a

- B unit: predominantly 10 YR 5/6 yellowish brown medium heavy clay (pH 6.0), but minor mottles of 7.5 YR 5/8 strong brown and grey staining and minor rootlets and fibres around large clay peds.

The B unit typically commences between 23 and 30 cm depth.

<u>Test Area 5A</u>

Test Area 5A is located within environmental/cultural context 5A (Table 3) on the gentle spur crest that dominates Stage 2 of "The Dairy" (Figures 14 & 25, Plates 21 & 22). The test units extend south-west from the area excavated in relation to initial construction of Stage 1 of "The Dairy" and the adjacent dam and wetland basin. This area hosts site Dolphin Point 1 Locus B and is in the immediate vicinity of the possible ceremonial site (Figure 7). During the mid-late Holocene period when sea levels were higher than at present, Test Area 5A was situated immediately adjacent to subsistence resources of the estuary and forest.

All units were excavated on the spur crest which grades at 1.5-2º to the north-north-east. Surface visibility was very low at the time of testing (nil) due to the cover of pasture and native grasses and weeds. The aspect is open and the crest provides a good vantage point north and north-east over the adjacent basin, although some views would have been limited by the previous forest vegetation.

The soil profile was very similar across the test units, with each excavation often ceasing at or within the B unit clay (Plates 63 & 64). There is clear evidence of bioturbation in the A unit, including existing and decomposed tree roots and other mixing. The typical profile from unit M0 comprised:

- A unit: humic 10 YR 2/2 very dark brown sandy loam A_1 (pH 6.5) with roots and rootlets over a 10 YR 3/2 very dark greyish brown sandy clay loam A_2 (pH 6.5) with abundant gravel and some mottling with 10 YR 5/6 yellowish brown. The A_1 is between 0 and 16 cm depth, with the A_2 unit extending from 16 to 28 cm below the surface; overlying a
- B unit: from 28 cm depth a 10 YR 5/6 yellowish brown heavy clay (pH 5.5) with 10 YR 3/2 very dark greyish brown around peds and where roots have penetrated.

The B unit typically commences between 28 and 40 cm depth.

<u>Test Area 5B</u>

Test Area 5B is located within environmental/cultural context 5B (Table 3) on the gentle spur crest that dominates Stage 2 of "The Dairy" (Figures 14 & 26, Plates 23 & 24). The test units are located further than 200 metres from the basin, towards site Dolphin Point 1 Locus D (Figure 7). Test Area 5B was situated immediately adjacent to subsistence resources of the forest.

All units were excavated on the spur crest which grades at 1.5-2º to the north-north-east. Surface visibility was very low at the time of testing (nil) due to the cover of pasture and native grasses and weeds. The aspect is towards the east, north and west over the basin and possible ceremonial site, but the previous forest vegetation would have substantially limited any views.

The soil profile was very similar across the test units, with each excavation often ceasing at or within the B unit clay (Plates 65 & 66). There is minor evidence of bioturbation in the A unit, including tree roots, insect/worm burrowing and other mixing. The typical profile from unit O0 comprised:

- A unit: 10 YR 3/2 very dark greyish brown sandy loam A_1 (pH 6.5) over a 10 YR 4/1 dark grey clayey sand or loamy sand A_2 (pH 5.5). The A_1 is between 0 and 14 cm depth, with the A_2 unit extending from 14 to 28 cm below the surface; overlying a
- B unit: from 28 cm depth a predominantly 10 YR 6/6 brownish yellow medium heavy clay (pH 5.5) with some 2.5 YR 4/6 dark red mottling and greyish discolouration around peds or root/worm infiltration.

The B unit typically commences between 20 and 31 cm depth. The relative presence of some texture contrast development (eg. Unit P0, Plate 66) indicates that recent historic soil loss has been minimal and the soils are better drained.

<u>Test Area 6A</u>

Test Area 6A is located within environmental/cultural context 6A (Table 3) on the second order very gentle drainage depression between Stages 2 and 3 of "The Dairy" (Figures 14 & 27, Plates 25 & 26). The test units are located within 200 metres of the basin. When sea levels were higher than at present during the mid-late Holocene period Test Area 6A was situated adjacent to subsistence resources of the estuarine basin and forest.

Test units were excavated across the very gentle drainage depression, through a strip cleared of vegetation near site DP1 Locus K (Figure 27). Units E-F-0-20 occur on the eastern side of the channel, on a gradient of 2-3º to the north-west. Units E25 and F25 occur in the 0.3-0.5 metre deep channel. Units E-F-30-50 occur on the western side of the channel, on a 1.5º gradient to the south-east. Surface visibility was very low at the time of testing (nil, apart from a minor area of 2% visibility in the creek channel) due to the cover of pasture and native grasses and tea-tree shrubs. The aspect would have been very limited by the adjacent elevated slopes and previous vegetation.

The soil profile varied across the test area, with each excavation often ceasing within the B unit clay (Plates 67-70). The typical profile from unit E0 (and similar for units E5-15 and F0-10) comprised:

- A unit: 10 YR 3/1 very dark grey sandy loam A_1 with roots and charcoal, over a 10 YR 4/1 dark grey and 10 YR 6/4 light yellowish brown mottled sandy loam A_2. The A_1 is between 0 and 20 cm depth, with the A_2 unit extending from 20 to 42 cm below the surface; overlying a
- B unit: from 42 cm depth a mottled 10 YR 6/3 pale brown and 10 YR 6/6 brownish yellow clay loam, sandy.

Units F15 and E20 varied. Unit F15 comprised:

- A unit: predominantly 10 YR 3/1 very dark grey sandy clay loam with roots and charcoal and several thin bands of 10 YR 4/2 dark greyish brown which may represent the marine transgression, extending to 35 cm below the surface; overlying a
- B unit: from 35 cm depth a predominantly 10 YR 3/1 very dark grey medium clay.

Unit E20 comprised:

- A unit: 10 YR 3/2 very dark greyish brown sandy loam A_1 from 0 to 17 cm depth, over a band of mottled 10 YR 4/1 dark grey and 10 YR 6/4 light yellowish brown sandy clay loam A_2 (possible marine transgression) between 17 and 23 cm depth. A buried unit lies below this, from 23 to 42 cm depth, comprising a 10 YR 2/1 black silty clay loam with charcoal;
- B unit: from 42 cm depth a predominantly 10 YR 4/2 dark greyish brown heavy clay.

Unit F20 (Plate 70) comprised a similar profile to E20, but with deeper and more complex banding between 22 and 47 cm depth. Here the thin stratified lenses of gravel clearly indicate deposition by water flowing down the creek line and also show that the former creek line was deeper and has infilled recently. Upper parts of the profile have been infilled by colluvial wash deposits. This indicates that in the historic period drainage lines have aggraded, becoming clogged by colluvial wash from adjacent slopes.

In contrast, other units in and adjacent to the watercourse (E25, E30 and F25) comprise (at E25):

- A unit: 10 YR 2/2 very dark brown clay loam from 0 to 17 cm depth; overlying a
- B unit: from 17 cm depth a 10 YR 3/1 very dark grey heavy clay.

Units F30-40 and E35-40 exhibit a similar profile (as at E35), comprising:

- A unit: 10 YR 3/2 very dark greyish brown clay loam with charcoal from 0 to 11 cm depth; overlying a
- B unit: from 11 cm depth a 10 YR 4/2 dark greyish brown heavy clay.

Units E-F-45-50 exhibit a similar profile (as at E50), comprising:

- A unit: 10 YR 3/1 very dark grey sandy clay loam A_1, over a predominantly 10 YR 4/1 dark grey sandy clay loam A_2. The A_1 is between 0 and 8 cm depth, with the A_2 unit extending from 8 to 30 cm below the surface; overlying a
- B unit: from 30 cm depth predominantly a 10 YR 5/2 greyish brown lightly clay, sandy.

Test Area 7A

Test Area 7A is located within environmental/cultural context 7A (Table 3) on the very gentle ridge crest in Stage 4 of "The Dairy" (Figures 14 & 28, Plates 27 & 28). The test units extend east-west through site Dolphin Point 2 Locus J in a cleared, grassed area where levels of ground disturbance appear lower than in the surrounding built-on areas (Figure 28).

This locality represents the termination of a subsidiary ridge of a major ridgeline that leads from Dolphin Point inland along Kingiman Ridge to Mount Kingiman, and further north-west to Little Forest Plateau on the Tianjara Plateau. This ridgeline may have provided the most accessible route for travel between the plateau and coastal zone at Burrill Lake. The nearby slope represents the former shoreline during the mid-late Holocene period when sea levels were higher than at present. Test Area 7A was situated adjacent to subsistence resources of the estuary and forest.

All units were excavated on the ridge crest which grades at 0.5-1º to the east. Surface visibility was very low at the time of testing (nil) due to the cover of pasture and native grasses and weeds, apart from a metre wide horse trail along the inside margin of the fenced horse enclosure. The aspect is open and views are currently available to the inlet and lake, although were probably limited in the past by the previous forest vegetation.

The soil profile was very similar across the test units, with each excavation often ceasing at or within the B unit clay or on the sandstone bedrock (Plates 71 & 72). There is clear evidence of disturbance in the A unit, including considerable mixing in some units. The typical profile from unit Z20 comprised:

- A unit: 10 YR 3/1 very dark grey sandy loam A_1 (pH 8.0, possibly affected by fertiliser) with roots and rootlets, over a mottled 10 YR 5/6 yellowish brown and 10 YR 5/3 brown sandy loam A_2 (pH 7.0) with abundant sandstone gravel and rocks and rootlets. The A_1 is between 0 and 24 cm depth, with the A_2 unit extending from 24 to 47 cm below the surface; overlying a
- B unit: from 47 cm depth a predominantly 10 YR 4/4 dark yellowish brown mottled with 7.5 YR 5/8 strong brown clay loam, sandy (pH 7.0) with sandstone gravel.

The B unit typically commences between 37 and 56 cm depth. In some cases, the test units terminated on sandstone bedrock. The soils are residual sandy gravel soils with significant C horizon input.

Test Area 8A

Test Area 8A is located within environmental/cultural context 8A (Table 3) on the level/very gentle wetland. It is situated on land bordering the present water body, in the vicinity of site Dolphin Point 4 Loci M & N and Feary's Site 3 and 4, west of Dolphin Point Road in the open space portion of "The Dairy" (Figures 14 & 29, Plates 29 & 30).

Essentially the locality currently comprises a sandy flat that is elevated approximately 0.5 to 1 metre above the adjacent inundated wetland. The sandy flat only formed in the late Holocene after estuarine sands infilled the small basin, as attested to by the radiocarbon date obtained for marine shell at 0.9 to 1.0 metres depth in Unit EE35. This sample was dated to 1252±41 years BP (Before Present) (*Wk16145*), which equates to an age calibrated to two standard deviations (95.4% probability) of 940-650 calBP (1010-1300 AD) (Appendix 8, Table 17). Hence, the mouth of the basin at "The Dairy" was still forming with estuarine sand around 650 to 940 years calBP (calibrated Before Present). However, fringing the sand flat were beach sand deposits, in which Aboriginal shell midden evidence has also been sampled and radiocarbon dated to between 540 and 1340 years calBP (Appendix 8, Table 17). The midden dates and contents are consistent with their location on elevated sand deposits close to an estuarine water body. Hence, subsistence resources of the estuary, wetlands and forest would have been in very close proximity of the test area, with the rock platforms also nearby.

Major floods have been reported since non-indigenous settlement, including in 1962, 1974, 1975 and 1976, that have inundated this flat. The area is presently vegetated by native and introduced grasses and bracken, Acacia regrowth and Banksia. Tree plantings exist immediately east of the test units, bordering the fence alongside Dolphin Point Road. The surface is uneven, possibly as a result of previous vegetation removal and construction of nearby Dolphin Point Road and installation of a sewer main. A recently constructed sewer pump station is located immediately south of the Test Area. Surface visibility was nil at the time of the test excavations.

The site aspect is mainly north to the basin and east to the Burrill Lake inlet, although views may have been limited by any previous vegetation. Units EE-FF-15-50 occur on the flat, which is very gently inclined (c. 0.5-1^o) to the north. Units EE-FF-0-10 occur on the basal slope which is very gently inclined (c. 1^o) to the east and north and elevated marginally above the other units.

Each test unit was excavated into the second layer of white sand, with two units dug to one metre depth. Two distinct soil profiles were evident across the Test Area (Plates 73-77). The typical profile from unit FF0 (and similar to units EE0-10 and FF5-15) comprised:

- Dark humic 10 YR 2/1 black to 10 YR 3/1 very dark grey loamy (dune) sand with abundant roots and rootlets and shell midden lenses (pH 6.0), between 0 and 45 cm depth; overlying
- A 10 YR 6/4 light yellowish brown sand (pH 7.0), representing a beach dune, from 45 to 90 cm depth; over
- A 10 YR 7/6 yellow to 10 YR 7/4 very pale brown (dune) sand, with minor organic matter and some small sandstone rocks at the base, along with minor hardened mottled iron-manganese? ped aggregates (buckshot gravel), from 90 to 100+ cm depth.

The soil profile across the remaining units on the flat, as at EE35, comprised:

- Dark humic 10 YR 3/1 very dark grey to 10 YR 6/2 light brownish grey sand with abundant roots and rootlets and shell midden lenses (pH 6.5), between 0 and 32 cm depth; overlying
- A 10 YR 6/4 light yellowish brown sand (pH 7.0), with some rootlets, from 32 to 60 cm depth; over
- A 7.5 YR 3/4 dark brown sand, with a coffee like iron stain, with minor rootlets and very minor quartz gravel and shell fragments, between 60 and 73 cm depth; over
- A moist compact 10 YR 6/6 brownish yellow (marine/estuarine) sand, with abundant small estuarine shells and angular shell fragments (pH 8-8.5) from 73 to 100+ cm depth.

The soil profiles in Test Area 8A indicate that there may be a hiatus in some sequences, with possibly older more compact transgression/regression sand deposits (showing a tendency to produce iron-pans and organic “coffee-rock” type aggregates) with significant pedogenesis, lying as a more compact unit under heavily bioturbated younger sands.

<u>Test Area 9A</u>

Test Area 9A is located within environmental/cultural context 9A (Table 3) on the gentle lower slope (former shoreline) in Stage 2 of "The Dairy" (Figures 14 & 30, Plates 31 & 32). The slope represents the former shoreline during the mid-late Holocene period when sea levels were higher than at present. During this time, Test Area 9A was situated immediately adjacent to subsistence resources of the estuary and forest. Later in the Holocene the basin transformed to a sandy flat and salt marshes or wetlands were probably present.

Test units were excavated immediately west of site Dolphin Point 1 Locus B (Figure 30). The area is presently vegetated by native and pasture grasses and weeds and is used for horse agistment. Surface visibility was nil at the time of the test excavations. Water retained by a nearby dam approaches to within several metres of the Test Area. Microtopographical variation occurs within the area. Most units were excavated on the basal slope, which grades at 3^{o} to the north and north-west. Units K0-20 and L0-15 were excavated on the adjacent flat where a drainage depression (6A) enters the basin (2A). This area is still elevated above the adjacent basin and grades at 0-1^{o} to the north-east. The aspect is to the north, but also the north-east, north-west and west, away from the possible ceremonial site. Irrespective of the presence of previous vegetation, the location would have enjoyed views over the basin.

All units were excavated either into the clay soil or deep into the sand and onto the water table. Two distinct soil profiles were evident across the Test Area (Plates 78 & 79). The typical profile from unit L5 (and similar to units K0-20 and L0-15) on the flat comprised:

- A unit: humic 10 YR 3/1 very dark grey silty clay loam or light clay (pH 6-6.5) with roots and rootlets and charcoal, between 0 and 30 cm depth.

The soil profile across the remaining units, as at L35, comprised:

- A unit: humic 7.6 YR 3/1 very dark grey sandy loam A_1, with roots and rootlets and charcoal (pH 6.5), over a 10 YR 6/2 light brownish grey loamy sand A_2 (pH 6.5-7). The A_1 is typically between 0 and 33 cm depth, with the A_2 unit extending from 33 to 52 cm. These overlie a moist, compact 10 YR 4/2 dark greyish brown sandy soil (pH 7.0) from 52+ cm which grades into a B unit clayey soil.

The differences in the profiles probably reflect differences in drainage and local perched water table effects.

5.3 Revised Site Descriptions

Description of the nature of the Aboriginal heritage evidence within the present study area, as known prior to the conduct of the test excavations, is presented in Section 3.1.5 and the site locations as then known are marked on Figure 7 (following Navin Officer 2003b).

Additional descriptions of the recorded Aboriginal heritage sites within the present study area, based on the results of the test excavations, are presented below. An updated site location map is presented in Figure 31. Due to the existence of earlier site definitions (Navin Officer, as registered by DEC), the revised site definitions have followed this format in order to ensure consistency and avoid confusion. A preferential system would have been to define each Aboriginal site by the presence of identified evidence within a single, discrete environmental unit (eg. one or more loci of evidence within the gentle spur crest unit would lead to definition of this unit as a 'site'), following Kuskie (2000a). In this case, the boundaries of the site would be defined by the boundaries of the environmental unit, rather than the somewhat arbitrary definition of boundaries under the system utilised by Navin Officer (2003b).

Site Dolphin Point 1 (DEC #58-1-640):

Site Dolphin Point 1 is an artefact scatter that was initially defined by Navin Officer (2003a) as extending across much of Stage 2 of the present study area. It now comprises (Figure 31):

- Four loci of evidence recorded by Navin Officer (2003a) (Locus B, including Isolated Find 1 reported by Stone in 1995, and Loci C, D and E) (refer to Section 3.1 for descriptions);

- One locus of additional evidence identified by South East Archaeology in February 2004 (Locus K, refer to Section 3.1 for description); and

- Ten loci of evidence associated with Test Areas 4A1, 6A, 9A, 4A2, 4B1, 5A, 5B, 3A1, 3B and 4A3 excavated during the present Stages 2-4 project (refer to Section 5.2 and Appendix 5 for descriptions).

The site encompasses the very gentle drainage depression, gentle drainage depression, gentle simple slope, gentle spur crest and gentle lower slope environmental contexts and extends across Stages 2 and 3 of The Dairy. A gentle drainage depression in the east corner of Stage 2, in which no heritage evidence has been identified, separates the site from Navin Officer's 'Dolphin Point 3'.

Site Dolphin Point 2 (DEC #58-1-636):

Site Dolphin Point 2 is an artefact scatter and shell midden that was initially defined by Navin Officer (2003a) as extending across Stage 1 adjacent to the present study area, but includes Stage 4 and part of Stage 3 of the present study area (Figure 7). It now comprises (Figures 8, 10, 11 and 31):

- 'Stone Site 2', originally recorded by Stone (1995) with additional evidence recorded by Kuskie (2004a) (refer to Section 3.1 for description);

- Four loci of evidence initially recorded by Navin Officer (2003a) (Locus A, subsequently subject to surface collection along the exposed road surfaces by Navin Officer 2003b and including shell midden deposit; Locus H, expanding an original recording by Feary in 1991 as 'Site One'; and Loci I and J) (refer to Section 3.1 for descriptions);

- One locus of additional evidence identified by South East Archaeology in February 2004 (Locus L, refer to Section 3.1 for description);

- 29 spatially separate test units within Stage 1 of The Dairy that were excavated by Navin Officer (2003b) and are marked on Figure 8, which contain artefacts and include one unit (#29) with shell midden deposit (refer to Section 3.1 for description);

- Spoil mounds created by the initial Stage 1 development works adjacent to and effectively representing an extension of Locus A that were subject to some collection and sieving by Navin Officer (2003b) (locations marked on Figure 10);

- Two broad area excavations, each measuring 40 x 2 metres (Trench A and Trench B) conducted by South East Archaeology in 2004 as part of the Stage 1 salvage (refer to Section 3.1.4 for descriptions, locations marked on Figure 11);

- Surface scrapes conducted within nine separate areas in Stage 1 (Scrapes A-I) by South East Archaeology in 2004 as part of the Stage 1 salvage, with six localised hand excavations in scrapes B and H (refer to Section 3.1.4 for descriptions, locations marked on Figure 11); and

- Three loci of evidence associated with Test Areas 7A, 3A2 and 1A excavated during the present Stages 2-4 project (refer to Section 5.2 and Appendix 5 for descriptions).

The site encompasses the gentle drainage depression, gentle simple slope, gentle spur crest, very gentle ridge crest and moderate lower slope environmental contexts.

Site Dolphin Point 3 (DEC #58-1-947):

Site Dolphin Point 3 is an artefact scatter that was initially defined by Navin Officer (2003a) as extending across the eastern corner of Stage 2 of the present study area. It comprises (Figure 31):

- One locus of evidence recorded by Navin Officer (2003a) (Locus F) (refer to Section 3.1 for description).

The site encompasses the gentle simple slope and gentle lower slope environmental contexts.

Site Dolphin Point 4 (DEC #58-1-933):

Site Dolphin Point 4 is an artefact scatter/shell midden that was initially defined by Navin Officer (2003a) as extending across the eastern margin of the open space portion of the present study area. It now also extends across the basin/flat and comprises (Figure 31):

- One locus of evidence recorded by Navin Officer (2003a) (Locus G) (refer to Section 3.1 for description);
- Two loci of additional evidence identified by South East Archaeology in February 2004 (Loci M and N, refer to Section 3.1 for descriptions);
- Two loci of evidence identified by Feary (1991) ('Site 3' and 'Site 4', refer to Section 3.1 for descriptions);
- One test unit (#30) excavated by Navin Officer (2003b) (refer to Section 3.1 for description); and
- Two loci of evidence associated with Test Areas 2A and 8A excavated during the present Stages 2-4 project (refer to Section 5.2 and Appendix 5 for descriptions).

The site encompasses the level/very gentle flat, level/very gentle wetland and gentle lower slope environmental contexts and extends across the open space portion of The Dairy.

Possible Ceremonial Ground:

Feary (1991) initially reported the possible presence of a ceremonial ground within the study area. Feary (1991) reported that an Aboriginal community member, Mr Jim Butler, had informed Mr Rod Wellington (DEC) about his knowledge of *second hand* reports that there was an area near a drainage line where grass sometimes would not grow, *thought* to be indicative of a ceremonial ground (Navin Officer 2003b). Such an area, possibly a location of saline seepage, is present in the general vicinity of the location marked by Feary (1991) (Figure 7).

However, this recording is based on generalised, second hand accounts and more direct evidence was considered essential to assess the potential for this site type within the Stage 2 study area (Kuskie 2004a).

No physical evidence (eg. raised earthen rings or depressions) was identified within the study area that may be indicative of a *bunan* ring, even though the grass height at the time of the survey (Kuskie 2004a) and during the period of salvage and test excavations was very low.

Furthermore, additional oral and historical research has been conducted in consultation with the local Aboriginal community to seek any relevant information pertaining to this issue. No historical records or documents could be located that mention the possible existence of this ceremonial site.

Many senior knowledge holders and traditional Aboriginal owners of the Ulladulla area were interviewed on behalf of South East Archaeology to identify if they had any knowledge of the purported ceremonial ground or if they knew of anyone else that might hold such knowledge. These senior Aboriginal people included Sonny Butler, elder brother of Jim Butler, Merle Rook, Fred Carriage, Lorraine Carriage and Vicki Carriage. None of the people interviewed proclaimed any personal knowledge of the purported ceremonial ground or knew of anyone who held such knowledge. Local Aboriginal people have lived on and worked at 'The Dairy' for many years during the 20th Century, when it operated as a dairy, chicken farm and piggery (Shane Carriage, *pers. comm*. 2004). Had a ceremonial site been present in Stage 2, which until the mid-1900s still appeared to be forested, it is a reasonable assumption that these people working on the property may have known of its existence.

In consideration of the oral and historical research, absence of physical evidence, and hearsay, third-hand nature of the original report, it is concluded that there is no evidence supporting the existence of a ceremonial ground directly within Stage 2 of 'The Dairy'.

However, it is feasible that ceremonial sites were once located elsewhere on Dolphin Point, as suggested by Mr Craig Butler. A major ridgeline immediately south of the study area that terminates at the coastal cliffs of Dolphin Point/Lagoon Head (Figure 1) represents the coastal end of a major ridgeline that leads from Little Forest Plateau on the Tianjara Plateau south-east to Mount Kingiman and to the coast via Kingiman Ridge. This ridgeline may have provided the most accessible route for travel between the plateau and coastal zone at Burrill Lake. An early non-indigenous resident, Emma Thistleton (1887-1969), is noted in McAndrew (1993:27) as knowing that Aboriginal people had a permanent route from Narrawallee Lake across Kingiman Mountain to the inland (eg. Braidwood). Mount Kingiman is known to be associated with ceremonial activity (Barry Carriage *pers. comm*. 2004, Kuskie 1996) and ceremonial sites are known to occur on prominent headlands elsewhere on the South Coast.

5.4 Site Integrity

One primary objective of the study was to clarify the integrity of the deposits and identify any means in which the effects of post-depositional processes could be controlled for. Assessing the effects of post-depositional impacts on the spatial context and site contents is important in determining the types of scientific information that may be suitably examined and identifying issues relevant to the interpretation of the evidence.

The integrity of the identified and potential heritage evidence within the study area has been investigated by various means, including:

- Examination of land-use history and natural processes;
- Horizontal and vertical distributions of stone artefacts; and
- Conjoins and inferred associations between individual stone artefacts.

<u>Land-use History and Natural Processes:</u>

Once deposited, evidence of human occupation can be affected by a range of processes including natural factors (erosion, weathering and bioturbation) and cultural factors (impacts by site occupants and impacts from recent land use practices). As Gollan (1992:44) observed, the archaeological resource is 'constantly in a state of flux, being made (exposed and discovered) and un-made (by impacts, random and non-random, cultural and natural), but generally trending towards loss of systematic informational content'. It is important to identify the range of processes that may have affected a site, in order to account for possible effects to the horizontal and vertical spatial distribution of evidence.

Various forms of human activity and natural processes can disturb archaeological evidence after it is deposited. These include:

- Occupational disturbance (*cf.* Hughes and Lampert 1977: mixing about of a deposit at a site by the inhabitants during the course of their daily activities; eg. trampling, 'scuffage' and 'treadage', camp fires {may unintentionally thermally alter artefacts and digging of pits for fires can disturb deposits} and re-use of artefacts);

- Bioturbation (disturbance to the soil profile by the growth and activities of plants and animals; eg. animal burrows, ant and termite mounds, tree fall causing pits and mounds, plant growth and the promotion of sheet-wash erosion in combination with rainwash processes);

- Erosion (physical movement of soil down-slope; eg. sheet-wash facilitated by rain-splash that enables the detachment of soil particles, which can then be entrained and fine material is transported in suspension);

- Vegetation removal (which can promote erosion);

- Pastoral/rural activities (grazing, etc; eg. trampling of artefacts by cattle causes breakage or damage to artefact margins thereby complicating use-wear analysis, and cattle can compact the soil and promote erosion);

- Agriculture (cultivation of crops or orchards; eg. ploughing, which can break artefacts, affect spatial structure and promote erosion); and

- Focalised impacts (such as installation of essential services, construction, maintenance and use of vehicle tracks, housing, etc., which can result in total destruction of evidence).

The probable influence of each of these factors on the evidence within The Dairy Stages 2-4 is discussed below.

Occupational disturbance may result in damage to artefacts or vertical or horizontal dislocation of artefacts through trampling, 'scuffage' or 'treadage', thermal alteration of artefacts by camp fires, or re-use of artefacts during a later episode of occupation. In circumstances where site integrity is particularly high, this subsequent activity may be identified with some degree of accuracy. However, where bioturbation or more recent post-depositional impacts have occurred, the ability to identify subtle and specific movements of material by the human occupants of the site can be substantially diminished. While it is highly probably that some impacts to the deposited evidence occurred at The Dairy during occupation and subsequent re-use of the area, no specific evidence for such impacts could be identified in the hand excavations.

Bioturbation (disturbance to the soil profile by plants and animals) is important in three ways: through mineral turnover in the nutrient cycle, physical movement of soil by mixing and mounding, and the creation of micro-relief (ant and termite mounds, tree-fall pits and mounds) (Mitchell 1988:52). Gollan (1992:44) highlights the impact of tree growth as a bioturbational process affecting artefact scatter sites. Gollan (1992:44) hypothesises that in a forest of 100 trees per hectare, the time for every part of the forest floor to be disturbed by new tree growth would be approximately 2,500 years. However, Dean-Jones and Mitchell (1993:43-44) note that while tree fall tends to cause the movement of stone upwards, a large proportion of Australian trees do not disturb the soil by falling, because the trunks break after weakening by fire, fungi and termites and remain *in situ*.

Dean-Jones and Mitchell (1993:43) argue that another important effect of bioturbation and rainwash processes is the development of stone layers between A and B horizons/units of texture-contrast soils. These processes thicken the topsoil and bury larger fragments at the level where the bioturbation agents usually cease operating. In general, Dean-Jones and

Mitchell (1993:43) claim that stones larger than the diameter of burrows will 'sink' through the soil in time. Experiments by Moeyersons (1978) confirm that mixing by worms and termites can result in different sizes and shapes of stone fragments sinking into the soil at different rates and eventually ending up on the same level (normally the lower limit of bioturbation).

Bioturbation is likely to have affected the integrity of the identified and potential evidence in Stages 2-4 of The Dairy in various ways and to varying extents, depending partially on the time period that has elapsed since the evidence was deposited and the nature of the soils. However, the primary effects are likely to have been to the vertical integrity of evidence, not the horizontal spatial distribution.

Clear evidence exists in a number of test areas and test units for the disturbance of the soil deposit through bioturbation (refer to details of each excavation unit in Appendix 4). The effects of soil mixing are also facilitated by the sandy nature of much of the deposit, particularly the soils of Test Areas 2A and 8A, but also the sandy loams of the elevated Test Areas:

- Rabbit burrows were clearly visible in several units, including Test Area 3A2 Unit B45 (Plate 45) and deep in the A_2 soil in Test Area 4A1;

- Large tree roots were evident in a number of units, including Test Area 4B1 Unit H35 (Plate 59) and H40 (Plate 60) and Test Areas 3B, 4A2, 4B1, 5A and 5B;

- Other disturbance was notable, including major dips of the A unit soil into the B unit clay, such as in Test Area 4A2 Unit J45 (Plate 52), possibly from tree bowls;

- The infiltration of roots into the B unit clay is evidenced in a number of units (eg. in Test Area 3B);

- Minor bioturbation effects from tree roots and rootlets and insects burrowing and ant activity (although the cumulative effect of these over time is considerable in terms of vertical mixing) were evident in the walls of many test units (eg. Plate 58, Test Area 4B1 Unit H10, and Plate 75, Test Area 8A Unit FF0, but elsewhere, particularly in Test Areas 5B and 7A).

Considering Gollan's (1992) estimate that all soil within a forest of 100 trees per hectare would be disturbed within 2,500 years, it is possible that any evidence of this age at the site has been affected by tree growth. The impacts would primarily consist of small-scale vertical and lateral movement of artefacts. The shallow nature of much of the deposit (<0.3 metres) and the presence of numerous remaining roots and rootlets attests to the impacts of bioturbation on the deposits. However, as examined further below, these impacts are primarily likely to have been to the vertical integrity of evidence, not the horizontal distribution.

The processes of erosion and sedimentation can affect archaeological deposits by:

- Altering the horizontal and vertical relationship of artefacts;

- Altering assemblage contents through the differential effects on various artefact size classes (eg. greater movement of smaller items down-slope);

- Dispersal of features such as hearths and middens; and

- Deposition of sediments burying (and therefore obscuring) archaeological evidence.

The physical movement of soil down-slope can be facilitated by various agencies including rainsplash, hillwash, soil creep, tillage and bioturbation (Allen 1991). Rainsplash is important because the physical kinetic energy of rain drop impact enables the detachment of soil particles which can then be entrained (Allen 1991). Sheetwash, where water washes off the soil surface in sheets, enables fine material to be transported in suspension once entrained and coarser particles to be moved down-slope by gravitational force (Allen 1991:44). Small stones (<6 mm), of low density, can also be moved by sheetwash. Sheetwash erosion can be facilitated by removal of vegetation or other disturbance to the ground surface.

Allen (1991) argues that sheetwash erosion will probably not result in significant down-slope movement of artefacts, but will cause an overall decrease in soil depth on crests and slopes and a gradual increase on basal slopes. Thus artefacts would be artificially concentrated (per unit of volume) on crests/upper slopes because the soil has been removed, while artefact density down-slope would become artificially lower. Only in circumstances where steeper slopes (eg. >10°) and more significant erosion (eg. rills) are present, is there likely to be greater lateral movement of artefacts. Experimental studies by Allen (1991) on an 11° slope indicate that relatively thin pieces with flat surfaces (eg. blades) will be preferentially transported down-slope. However, with minor or moderate sheet erosion, some lateral displacement of artefacts would be expected and all artefacts from the upper part of the topsoil may be collapsed into a single stratigraphic level (Resource Planning 1991:27-28). More substantial lateral displacement of artefacts could be expected where severe sheet erosion, in which the subsoil (B unit) is exposed, has occurred (Resource Planning 1991:28).

Examination of aerial photographs taken in 1944 and the early 1980s and 1990s (Figures 5 & 6) provides an indication of the possible effects of erosion on the heritage evidence within Stages 2-4 of The Dairy. A number of clearings and erosion scours are evident, particularly within Stage 4 and Stage 2. In the 1980s photograph, bare ground and erosion is evident within Stage 2 and the basin. During the test excavations, the possible effects of widespread sheet and rill erosion in the vicinity of Test Area 4B2 was noted. The present surface is very uneven and may represent an erosion scour that has subsequently become revegetated, as indicated by numerous shallow drainage rills leading downslope. The 1980s aerial photograph (Figure 6) confirms this interpretation. Significantly, no Aboriginal artefacts were identified within Test Area 4B2. The effects of erosion are also evident in the soil profiles of a number of test areas, particularly those on or adjacent to the drainage depressions.

At present, the effects of erosion are also immediately apparent on a number of the identified Aboriginal site loci. For example, site DP1 loci C, D and E and site DP3 Locus F are identified within erosion scours (refer to Section 3.1.5).

Hence, it is concluded that a number of the identified site loci and portions of the deposits now covered by pasture grasses have been subject to impacts from erosion. It is problematic to determine the full extent of these impacts, but they are likely to include small-scale horizontal and vertical displacement of artefacts, and in more severe cases, larger movement.

Recent human activities have caused impacts to the identified evidence and deposits within The Dairy Stages 2-4. These impacts are both widespread in nature (eg. vegetation removal, establishment of pasture grasses, livestock agistment and cultivation) and focalised in nature (eg. vehicle tracks, fences, essential services, houses and other buildings).

Removal of the native vegetation and establishment of pasture improved grasses for livestock agistment is attested to by the aerial photographs of 1944 and the early 1980s and 1990s (Figures 5 & 6), along with Plates 1-32. The virtual absence of tree stumps indicates that the primary vegetation removal, which occurred in Stages 2 & 3 and the basin after the 1940s, probably involved methods that had significant impacts on the surface, such as the use of dozers to push over vegetation, grubbing (uprooting and removal of smaller stumps and roots with a blade) and chain pulling. The potential impacts of vegetation removal on the soil profile were noted in a number of test areas, including horizons with abundant charcoal from burnt vegetation below a rapidly developed upper 'historical' soil horizon.

Subsequent to the main period of vegetation removal, pasture improved grasses were established, probably involving ploughing and sowing. While this activity probably caused some impacts to the soil deposits and heritage evidence, the depth and frequency of ploughing may not have been sufficient to cause major horizontal displacement of evidence.

More intensive ploughing certainly occurred on the basin flat, as evidenced by a series of pronounced ridge and furrows, with the crests typically about 1.2 metres apart and 0.1 metres higher than the troughs. Minor cultivation is also likely to have occurred in Stage 4, in the vicinity of the residence. The effects of cultivation on heritage evidence vary, depending upon the equipment used, frequency and direction of ploughing, degree of slope and size of artefacts present. Without broad-scale excavation and conjoining or lithic item association, the exact level of impacts on open artefact sites can be problematic to ascertain.

Various experimental studies have been undertaken into the effects of ploughing on open sites (*cf*. Clark & Schofield 1991, Lewarch 1979, Lewarch & O'Brien 1981a, 1981b, Roper 1976). Lewarch and O'Brien (1981a, 1981b) have demonstrated that five types of impact can occur:

- Horizontal displacement of artefacts;
- Vertical displacement of artefacts;
- Changes in artefact class frequencies after ploughing;
- Changes in the condition and preservation of assemblages; and
- Destruction or alteration of features and layers.

These studies have shown that horizontal displacement is related to artefact size, equipment type and slope. For all types of equipment, artefacts >40 mm are moved the greatest horizontal distance (Boismier 1991). Lewarch (1979:112) states that for disc ploughs, lateral movement of small and large artefacts occurs both in the direction of and away from the equipment. Lateral movement of small objects also occurs in both directions, but for large objects only in the direction of the equipment (Boismier 1991). Hence, the frequency and direction of equipment passes is important (*cf*. Lewarch & O'Brien 1981b).

The lateral movement of artefacts may only be minor, except for on slopes (Bowen 1980). Roper (1976) identified in Illinois, USA, that lateral movement of artefacts affected by ploughing over 20-30 years was not as great as anticipated. Broken artefacts were separated by distances of 3-10 metres (Roper 1976). The patterning of ploughing is directly related to possible lateral movement of topsoil. Patterns are often reversed so that ridges eliminate furrows and vice versa, with the basic effect of moving topsoil laterally one way and then back the other. On a level site, over a long period of time with reverse ploughing, buried objects may not be moved a great distance from their original position (Nicholson 1980). Roper (1976) suggests that after several decades of ploughing, artefacts can be displaced by anything between 0.2 and 10 metres. However, Gingell and Schadla-Hall (1980:111) suggest that although artefacts are lifted by ploughing, they are not widely spread. Lewarch and O'Brien (1981:309) conclude that the magnitude of lateral movement caused by ploughing is less serious than assumed, particularly if controlled for. Their experiments indicated minimal transverse displacement and variable amounts of longitudinal displacement, depending on the artefact size, duration of ploughing, direction of ploughing and number of artefacts present.

The use of different types of equipment affects the extent of disturbance. Lambrick (1980:19) noted that mouldboard ploughing and chisel ploughing with rigid or leaf-spring tines disturbs everything down to the level to which they penetrate. The mouldboard plough consists of a disc or knife coulter which makes a vertical cut in the soil. A share attached to the mouldboard undercuts the furrow, and the mouldboard serves to invert the furrow slice. The basic action of the plough is to turn the furrow slice through approximately 140 degrees, simultaneously moving the soil laterally through 0.25-0.35 metres and slightly forwards in the direction of the plough (Nicholson 1980).

Lewarch (1979:116-122) demonstrates that tillage implements tend to segregate soil particles, with large objects being displaced to higher levels and smaller objects to lower levels. With more frequent ploughing, vertical displacement decreases until equilibrium is reached in which further ploughing does not alter the soil structure. A 'size effect' (Baker 1978) happens in which a higher relative frequency of larger artefacts occurs on the surface. Other researchers have also noted this effect and the consequence that there is no inevitable relationship between surface artefacts and deeper *in situ* deposits (*cf*. Haselgrove *et al* 1985).

Ploughing equipment can cause the dispersal of features such as hearths or middens and breakage and damage to individual artefacts. There is no evidence at The Dairy from which to infer that ploughing has affected the midden evidence in Test Area 8A. Damage to artefacts can take the form of complete breakage or damage to cutting edges and can also result from trampling by humans or animals (Byrne 1993). Damage to cutting edges can preclude or complicate analysis of use-wear patterns on artefacts and renders decisions difficult on whether edge-damage is the result of Aboriginal retouch or recent human impact (Byrne 1993:31). Experimental tests by Shea and Klenck (1993), measuring the effects of trampling on preservation of use-wear, indicated that moderate amounts of human trampling may significantly alter the appearance of traces of use-wear. Trampling by hoofed animals and humans can cause significant abrasion and microfracturing (isolated scars and clusters of scars) of stone tools on the surface. Edge damage was determined not to be a reliable indicator of the duration of trampling, although 'scuff marks' could be (Shea & Klenck 1993:185).

The sample of lithic items with use-wear retrieved from the Stage 2-4 test excavations is very small and does not appear to have been affected by post-depositional disturbance. However, a number of artefacts do exhibit modern damage or breakage. Generally, the fresh surfaces made this relatively straightforward to identify. Much of the minor damage is inferred to have occurred during the excavation and wet-sieving process, rather than from previous post-depositional impacts. However, impacts from cultivation, vegetation removal and livestock agistment (trampling) to individual lithic items has probably occurred in a low frequency.

Other recent human impacts within the study area have been more focalised in extent, but have probably resulted in higher levels of disturbance to artefact deposits and individual artefacts. These impacts include the construction of a house and other buildings in Stage 4, the access road in Stage 4, vehicle tracks elsewhere in Stages 2 and 3, fences, farm dams between Stages 3 and 1 and on the basin (which has been enlarged as part of the Stage 1 works) and on the simple slope in the eastern part of Stage 2 (adjacent to Test Area 4A3), Telstra cables (bisect Test Area 1A), water and sewerage pipelines (eg. adjacent to Test Area 8A), artificial drainage channels excavated through the basin (eg. near Test Area 2A), and an excavated area with wooden and metal refuse near Test Area 4A2. Due to the lengthy residential use of Stage 4, substantial portions of this area have been subject to high levels of ground disturbance. However, the focalised impacts have affected far smaller portions of the remainder of the study area.

Several items were identified in the excavated deposits relating to non-indigenous settlement (Table 18). These include plastic, glass, rubber, metal and masonite items and are inferred to relate to mid to late 20th Century non-indigenous use of the study area. Many of these items occur between 10 and 30 centimetres below the present surface, indicating some vertical mixing of deposit. Several items (two pieces of metal in Test Area 8A unit EE0 and one piece of glass in Test Area 9A unit L20) occur as deep as spit 5 (0.4-0.5 metres below the surface). The results are consistent with disturbance to the vertical integrity of deposits from bioturbation. Given the relatively short time period in which these objects (Table 18) have worked down into the deposit, the effects of bioturbation over longer periods of time on stone artefacts are likely to be significant.

Features such as shell midden deposits (Test Area 8A) are useful in assessing integrity. The nature and distribution of this evidence is presented in Appendix 6 and the radiocarbon dates in Appendix 8 and summarised in Table 17. The distribution of shell for combined spits and then for each spit individually is presented in Figures 32-39.

Analysis of this evidence indicates that midden deposits occur in two distinct areas, in the mid-section of the Test Area around units FF25 and EE25, and at the southern end of the Test Area around units EE-FF-0-10 and FF15 (Figure 32). A low number of shells occur outside of these clusters, possibly representing post-depositional horizontal movement.

The cluster around FF-EE-25 is relatively discrete and has not been subject to much lateral disturbance. The evidence in FF25 is predominantly at 10-20 cm depth in spit 2 (Figure 34, Appendix 6), but a proportion of shell has probably moved vertically subsequent to deposition, both above and below the main deposit, with items still occurring at 40-50 cm depth in spit 5 (Figures 33, 35-37). A sample from spit 2 was radiocarbon dated to 1137±48 years BP (*Wk16145*), which equates to an age calibrated to two standard deviations (95.4% probability) of 870-540 calBP (1080-1410 AD) (Appendix 8, Table 17). Assuming the shell in units FF25 and EE25 represents the same cultural event, it can be inferred that a modest amount of predominantly vertical movement of evidence has occurred over the 600 to 900 year period that has elapsed since deposition.

The midden deposit around EE-FF-0-10 and FF15 is distributed over a wider area (Figures 32-39), possibly representing either spatially separate, unrelated meal events, or a single but more widespread event (multiple individuals), or greater post-depositional lateral dispersal of evidence. Three radiocarbon dates were obtained for this evidence, from FF0 spit 4, EE0 spit 5 and FF5 spit 5 (Appendix 8, Table 17). The ages calibrated to two standard deviations overlap between 1220 and 1000 calBP (730 and 950 AD). Hence, this cluster of evidence may represent a single event. It remains unclear as to whether significant horizontal displacement occurred after deposition, but there was almost certainly vertical movement of evidence. The evidence is clustered between 20 and 50 cm depth (spits 3-5) with items both above and below these levels.

Various forms of weathering such as chemical, mechanical and thermal may also cause impacts to archaeological evidence. In particular, bone and shell in open sites will not tend to be preserved in acidic soils. The preservation of shell midden deposits in Test Area 8A (in neutral to marginally acidic soils) indicates limited impacts from this form of weathering, at least in this location.

Thermal weathering includes the effects of unintentional heating, which may also damage artefacts. The impacts on The Dairy Stage 2-4 assemblage appear to be minor, as only 36 items (1.7%) exhibit convoluted or rugose fracture surfaces, potlid fractures or geometric or planar fracturing. All of these items are silcrete apart from single chert and rhyolite pieces. It contrasts to other sites, such as Mount Arthur North in the Hunter Valley (9% of 32,866 items exhibiting unintentional heating characteristics). It is inferred that these artefacts were exposed to heat either when on the surface (by bush fires or camp fires) or below the surface (eg. by burning tree roots/boles or superimposed campfires). Partly this may be a result of natural bush fire, partly a result of burning of vegetation after non-indigenous settlement, and possibly partly a result of controlled burning undertaken by Aboriginal people.

Horizontal and Vertical Distribution of Stone Artefacts:

The spatial configuration of stone artefact distribution patterns can be examined to assess the integrity of deposits. This is particularly useful for broad area excavations, where the evidence of entire activity events can be identified. However, smaller test excavations can also be useful, especially for assessing the vertical distribution of artefacts.

On-site stone knapping, repair of other artefacts and processing of food and materials is often evident from the spatial distribution of knapping debitage and discarded implements. This is particularly the case for discard patterns not complicated by subsequent discard of similar stone debris at the same location (superimpositioning). Activities during prehistoric times may result in disturbance of a pristine discard pattern. In particular, cores and other large items of stone may be translocated or reused in various activities. Microdebitage, which is least likely to have been effected by many subsequent prehistoric human activities, is particularly useful in identifying original activity areas. If individual clusters and concentrations of stone discard are identified, the degree of subsequent lateral and vertical disturbance by bioturbation and other post-depositional processes may be inferred in a broad area excavation. However, in relation to small test units, assessment of lateral movement may not be possible.

However, examination can be made of the vertical distribution of artefacts attributed to identified activity areas on the basis of stone material categories, artefact type and other intrinsic and contextual attributes, and associations between lithic items determined during examination of the assemblage. The primary associations were identified during lithic item recording and are discussed in the following sub-section.

Examination of the vertical distribution by spit of artefact frequencies in size classes has also been undertaken, as a comparison of percentages and counts per unit spit (Table 19, Figure 55). The vertical distributions of artefact numbers and size classes provide an indication of the possible original stratigraphic level at which the items were discarded, and the extent and nature of subsequent vertical movements within sediments.

Within the Stage 2-4 assemblage, the pattern of vertical distribution is similar to many open sites (*cf.* Kuskie & Kamminga 2000, Kuskie & Clarke 2004). Approximately 14% of items occur in spit 1 (0-10 cm depth), peaking at 38.4% of items (N=822) in spit 2 (10-20 cm depth) and 36.6% of items (N=785) in spit 3 (20-30 cm depth). Thereafter, artefact numbers decline substantially with depth, with 7.7% of items in spit 4, 2.6% in spit 5 and very low numbers in the test units that were excavated to greater depths. Notably, smaller artefact sizes tend to occur more frequently at depth than larger size classes, which may reflect the preferential movement of smaller items downwards, possibly as a result of bioturbation.

However, given the different soil profiles between the test areas on elevated land and those on the basin, examination of the vertical artefact distribution between these may reveal further information (Table 20). In almost all test areas with more than 50 artefacts, artefacts peak in spits 2 and 3 (10-30 cm depth) and in every test area artefacts are present in moderate to low frequencies in the upper spit (0-10 cm depth). In all test areas, a low frequency of artefacts appears to have worked their way down in the deposit below the main concentrations, including in the deeper test areas (8A and 9A) and to a lesser extent 6A and 7A.

On the basis of overall artefact counts and vertical distributions, it is inferred that modest vertical mixing of evidence has occurred, probably through the processes of bioturbation.

Conjoins and Inferred Associations between Individual Stone Artefacts:

The use of conjoining as a technique of analysis has been undertaken primarily for major site salvages (*cf.* Baker and Gorman 1992, Koettig 1992, 1994, Rich 1995). Conjoin analysis involves physically fitting back together objects broken in antiquity (Hiscock 1986:159). Objects which are fitted together are said to be conjoined, and a number conjoined together are termed a conjoin set (Hiscock 1986:159). In Australia, conjoin analysis has been used to examine site integrity (vertical or horizontal artefact displacement) and to reconstruct stone working technology. Limitations of the method include the substantial amount of time required to refit artefacts, the difficulty involved in refitting small artefacts, and the inability to concisely describe conjoined artefacts and their relationships other than by lengthy discussion, photos and/or drawings.

Conjoining of artefacts is highly labour intensive and is therefore a preferred method of analysis only when significant results are likely to be obtained. The potential for successful application of the conjoining method significantly decreases when artefacts are less than 20 millimetres in size (Schick 1986:34).

For the present study, potential conjoins between artefacts were identified during examination and recording of the items. Several conjoins were made (Appendix 5):

- Reference #72 and 73 (grey silcrete flake proximal and flake distal portions) conjoin, both occur in Test Area 1A Unit BB10 Spit 2; and

- Reference #1395 and 1396 (red silcrete flake longitudinal portions) conjoin, both occur in Test Area 5B Unit P20 Spit 2.

These results indicate that in at least these particular locations, minimal horizontal or vertical displacement of artefacts has occurred post-deposition.

An alternative and sometimes complementary analytical method to conjoin analysis is that of 'artefact association'. This method is appropriate for lithic assemblages comprising a high proportion of microdebitage (*cf.* Kuskie & Kamminga 2000). The fundamental difference between the two methods is that a conjoin constitutes proof that the an artefact derives from a particular knapping or heat treatment event, an 'association' of a lithic item is inferential in nature and is therefore less certain. Associations are recorded in the comments section of the assemblage database (Appendix 5).

During the lithic recording, inferences were made about the 'association' of individual items based on a number of criteria such as spatial proximity, similarity of stone material and shared technological and typological attributes (Appendix 5). The degree of confidence in inferring associations between lithic items varies. The associations noted include:

- Reference #433 and 434 (grey silcrete bondi points), both occur in Test Area 4A1 Unit D0 Spit 2; and

- Reference #1093 and 1097 (grey silcrete longitudinal flake portions), both occur in Test Area 5A Unit N25 Spits 1 and 2.

The latter association indicates some vertical movement of evidence post-deposition.

In addition, a number of other associations can be inferred in individual test units on the basis of similar stone material type, particularly for the less common stone materials, for example:

- Five varicoloured and yellow chert items in Test Area 1A Unit BB40 Spit 3;
- Nine white quartz flakes and flake portions in Test Area 2A Unit DD0 Spits 2 and 3;
- Four white quartz flakes and flake portions in Test Area 3A2 Unit B25 Spit 3;
- Four white quartz flakes and flake portions in Test Area 4B1 Unit G20 Spit 2;
- A translucent quartz flake and retouched flake in Test Area 5A Unit M15 Spits 2 and 3;
- Three white quartz flake portions in Test Area 5A Unit N40 Spit 2;
- Four white quartz flake portions in Test Area 5A Unit N45 Spits 2 and 3;
- Five brown rhyolite flakes and flake portions in Test Area 5A Unit M50 Spits 2 and 3;
- Four brown quartzite flakes and flake portions in Test Area 5B Unit P30 Spit 3;
- Seven grey rhyolite flakes and flake portions in Test Area 5B Unit P10 Spit 3;
- Three white quartz flakes and flake portions in Test Area 6A Unit E0 Spits 2 and 3;
- Five white quartz flakes and flake portions in Test Area 6A Unit F0 Spits 3 and 4;
- Four various coloured chert items (flake portions, core fragment and microblade core) in Test Area 7A Unit Z25 Spits 1, 3 and 5;
- Three white quartz flakes in Test Area 7A Unit Y0 Spits 3 and 5;
- Five quartz flakes and flake portions in Test Area 7A Unit Y50 Spits 1, 2 and 3;
- Eleven white quartz flakes and flake portions in Test Area 8A Unit EE0 Spits 1, 3, 4 & 5;
- Six white quartz flakes and flake portions in Test Area 8A Unit FF0 Spits 1, 2, 4 & 5;
- Five translucent quartz flakes and flake portions in Test Area 8A Unit EE5 Spits 2 and 3;
- Eleven white quartz flakes and flake portions in Test Area 8A Unit FF5 Spits 3, 4, 5 & 6;
- Four translucent quartz flakes and flake portions in Test Area 8A Unit FF5 Spits 3 and 4;
- Five white quartz flakes and flake portions in Test Area 8A Unit EE10 Spits 3 and 4;
- Three grey quartzite flakes and flake portions in Test Area 8A Unit EE5 Spit 3; and
- Four grey quartzite flakes and flake portions in Test Area 8A Unit FF5 Spits 4 and 5.

The above associations, of varying degrees of confidence, indicate that some vertical mixing of deposit, presumably through bioturbation, has occurred in most units.

Conclusion:

Conclusions about the integrity of deposits and heritage evidence within The Dairy Stages 2-4 can be made on the basis of the evidence discussed above, including the history of land use and natural processes, vertical distributions of stone artefacts and conjoins and inferred associations between artefacts.

It is concluded that the identified and potential Aboriginal heritage resources within Stages 2-4 have been affected by a number of post-depositional processes. In limited areas, particularly within Stage 4, the impact levels are high and equate to total destruction of deposits or very low integrity of evidence. Impact levels at many of the identified site loci also tend to be high due to the nature of their exposure within areas of recent ground disturbance or erosion. However, over much of the study area, although widespread, the levels of impacts are not as high. Although evidence from the test excavations indicates that considerable vertical mixing of deposit has generally occurred, primarily through bioturbation, limited post-depositional lateral movement of evidence may have occurred. Importantly to note however, in terms of the research potential of the deposits, the impacts of post-depositional processes can be identified and controlled for (*cf.* Koettig 1989, Kuskie & Kamminga 2000).

Reanalysis of the adjacent Stage 1 test excavation results of Navin Officer (2003b) indicates a similar pattern of vertical artefact distribution that may be consistent with that of a bioturbated site. These results are also comparable to those obtained from large-scale archaeological investigations of open artefact sites within similar landform units in the Hunter Valley (*cf.* Kuskie & Kamminga 2000, Kuskie & Clarke 2004).

5.5 Stone Materials

The nature of the stone materials present in the assemblage is discussed in Section 5.5, including their relative frequencies and sources and the potential use of heat treatment.

A total of six different categories of stone material were identified in the test excavation lithic item assemblage (Tables 21, 22 & 23, Figure 56, Appendix 5). The combined assemblage was overwhelmingly dominated by silcrete (86.32%), with low frequencies of quartz (7.33%) and rhyolite (4.53%) and very low frequencies of quartzite (0.70%), chert (0.65%) and other volcanics (termed 'volcanic 1') (0.47%) (Table 21, Figure 56).

These results are in addition to the total of 104 lithic items recorded within the study area during the survey by South East Archaeology in February 2004. That assemblage was also dominated by silcrete (64%), with lower frequencies of quartz (11.5%), porphyritic rhyolite (10.5%), quartzite (5%), acid volcanic (5%), chert and sandstone (Kuskie 2004a).

Silcrete:

Silcrete is a brittle, intensely indurate rock composed mainly of quartz clasts cemented by a matrix which may be well-crystallised quartz, cryptocrystalline quartz or amorphous (opaline) silica (Langford-Smith 1978:3). The texture of silcrete reflects that of the host rock (eg. sandstone) and clasts may range in size from very fine grains to boulders.

Silcrete is produced by an absolute accumulation of silica, which can be precipitated from solution by evaporation, cooling, the neutralisation of strongly alkaline solutions, reaction with cations, adsorption by solids and the life-processes of organisms (Summerfield 1983:76). In weathered profiles, downward percolation of silica released through bedrock weathering and clay mineral authigenesis, together with water-table fluctuations, are suitable conditions for formation (Summerfield 1983:80).

Mineral composition of silcrete is highly variable and silcrete cannot be precisely characterised by its bulk chemical composition, other than a minimum silica content of 85% weight as an arbitrary lower limit. In addition to silicon, minor traces of aluminium, iron or titanium may be present. Iron occurs both within the matrix and as a late-stage precipitate on weathering surfaces and in voids. Trace element abundance tends to be related to the composition of the host material.

Silcrete is normally grey in colour, but can be whitish/cream, red, brown or yellow. It shatters readily into sharp, angular pieces with a conchoidal fracture and newly broken rocks have a semi-vitreous sheen (Langford-Smith 1978:4). It was an attractive material to the local Aboriginal people because of its flaking properties and availability. Flakes have reasonably sharp, durable edges, and therefore the stone was used for a variety of tasks, including heavy-duty woodworking and for small spear barbs.

Silcrete dominated the combined test assemblage (86.32%) and also the assemblage from each test area, with the exception of 2A. The anomalous result in 2A may be discounted because of the small nature of that sample (N=20). The suitability of silcrete and its proximity in local sources explain its predominance in the assemblage. Silcrete sources occur around Ulladulla and silcrete is found in the form of pebbles and cobbles washed into coves along the shoreline between Ulladulla and Batemans Bay. Hence, the material was readily available in transportable form, only a short distance from the study area. The major silcrete outcrops at Bendalong form the northern extent of occurrences outcropping along the coast south to Narooma. Callender (1978:216) describes the Bendalong silcrete as typically grey and highly indurated, with poorly sorted angular quartz clasts grading into a fine-grained authigenic quartz cement.

The silcrete retrieved from the test excavations is predominantly grey in colour (66.4%), consistent with the local sources (Table 24). However, 14.5% of silcrete exhibits pink or red colouration, indicative of thermal alteration (refer below).

The silcrete from the test excavation assemblage is notably devoid of cortex. Cortex was only identified on 2.4% of silcrete lithic items, and included waterworn and terrestrial cortex (Table 25). Both of these forms are consistent with an origin at the local terrestrial outcrops or alluvial sources. However, a low incidence of cortex can be an indicator that a stone material has been transported further from its source and has been subject to greater reduction (eg. applying a distance-decay model). Examination of the size of the lithic items for each stone type (Table 26) reveals that the silcrete items tends to be highly reduced, with most items less than 50 millimetres in maximum dimension and weighing only 1.4 grams on average per item. The two largest silcrete artefacts (Ref. #1124 and 2121) both exhibited waterworn cortex. Two large silcrete cores identified in the survey (Kuskie 2004a) exhibited rough terrestrial cortex. Factors other than stone material rationing are inferred to be involved in the high rate of reduction and consequent low incidence of cortex, given the nearby and high quality nature of the silcrete sources, which must certainly have been exploited. An explanation may relate to the nature of the activities silcrete was utilised for (eg. microlith and microblade production) (refer to Section 5.7), which tends to produce a high proportion of small debitage.

Quartz:

Quartz is one of the commonest types of stone used for making flake tools in Australia. There are three main forms of massive quartz: veins, geodes and macro-crystals. For the purposes of flaking, these varieties are essentially similar, although vein or reef quartz is more likely to contain major pre-existing flaws. Quartz is composed of extremely small hexagonal crystals of silicon dioxide (SiO_2), which give it a glossy texture. When pure it is translucent, but minute traces of minerals may add colours such as smoky grey, pink or yellow. Most quartz has microscopic gas or liquid filled vacuoles that give it a milky appearance. While this does not affect the rock's strength, clay minerals in ground water, particularly iron compounds, may seep into the minute flaws and weaken the stone, leading to natural fracturing. It can also break with a conchoidal fracture.

Because quartz exhibits a small degree of cleavage and tends to have internal flaws, it ranges in flaking quality from very poor to acceptable. Internal cracking of quartz often occurs during flaking and its fracture path is usually much less predictable than stone which breaks with a strong conchoidal fracture. For these reasons quartz is generally a low-quality flaking material. However, because of its abundance and availability, in some regions it is the main stone type used for flaking. Its other advantage is that it provides small flakes with very sharp edges, which are suitable for light-duty work such as skinning, light butchering and cutting plant matter.

Quartz is the second most common stone material in the Stage 2-4 test excavations, but comprises only 7.33% of the total number of lithic items (Tables 22 & 23). Most of the quartz (84%) is described as white in colour, with the remainder translucent (Table 24). The quartz artefacts are small (all less than 40 mm in maximum dimension), but 14.65% exhibit cortex (entirely the waterworn variety) (Tables 25 & 26). The mean weight of individual quartz items, 0.79 grams, is the lowest of all the six stone materials. A relatively higher frequency of quartz occurs in Test Areas 2A and 8A (Table 23, refer to Section 5.8 for discussion).

Quartz occurs as background gravels (eg. derived from conglomerate of the Conjola Formation) and within alluvial gravels in many parts of the region, some of which is of sufficient quality for knapping. Quartz artefacts within the study area may have been procured from such terrestrial gravel sources or from alluvial gravels.

Rhyolite:

Rhyolite is an extrusive, fine-grained igneous rock with the same general composition as granite (rich in quartz and alkali-feldspars). However, unlike granite, glass is often a major component of rhyolite and biotite mica is present. The rapid cooling of lava forms banded rhyolite. Flow banding is common in this form of rhyolite, involving swirling layers of different colour and texture. Another form of rhyolite, porphyritic rhyolite, contains small widely spaced crystal inclusions.

Rhyolite comprised 4.53% (N=97) of the Stage 2-4 test excavation assemblage (Tables 22 & 23). It tended to be grey (56%) or brown (33%) in colour (Table 24). The artefacts range in size up to a maximum dimension of 80 millimetres and 30 items possess waterworn cortex and one item rough/weathered cortex (Tables 25 & 26). The mean weight of individual rhyolite artefacts (4.19 grams) is higher than for silcrete, chert and quartz items.

Rhyolite occurs in the Upper Devonian era Comerong Volcanics in the region (Ulladulla 1:250,000 geological map). As with silcrete, rhyolite pebbles and cobbles are also found along the coastline and probably represent the locally available source for this material.

Quartzite:

Quartzite is a hard, silica rich metamorphic stone formed from sandstone (often quartz arenite - sandstone composed almost entirely of quartz grains) that has been recrystallised by heat (metaquartzite) or strengthened by slow infilling of silica in the voids between sand grains (orthoquartzite). The essential difference between sandstone and quartzite is that a major fracture will propagate around the larger grains in sandstone and through the grains in quartzite. The critical factor for both overall strength and resistance to abrasive wear is the bond strength between the crystals or grains that constitute the stone matrix. Mechanical variation of quartzite is considerable, but specimens of the two varieties may appear similar.

Quartzite comprised only 15 artefacts (0.7% of the Stage 2-4 test excavation assemblage) (Tables 22 & 23). The quartzite is described as grey, brown or white in colour (Table 24). The quartzite artefacts tend to be relatively small, although the small sample size is noted (Table 26). Four of the artefacts (26.7%) exhibit cortex (entirely the waterworn variety) (Table 25).

Glacial erratics, stones deposited by melting ice-rafts during the Permian era, have become incorporated into the local bedrock (eg. Permian Era Conjola Formation) and are a possible source of this stone. Quartzite may have also become incorporated into alluvial gravels and as pebbles and cobbles washed into coves along the shoreline.

Chert:

Chert is a highly siliceous sedimentary rock, with a chemical composition of silicon dioxide (SiO_2) and major constituent minerals of chalcedony, quartz and opal. Chert is formed by a chemical process, from silica derived from the compaction and precipitation of single-celled organisms (such as diatoms - a small algae, and radiolarians). These organisms remove silica from water to make their shells. After dying, shells accumulate at the bottom of a water body, and if in sufficient quantity, form a silica-rich ooze. Following burial, the silica-rich ooze becomes cemented and hardened into rock (diatomite or radiolarite). As these rocks become strongly lithified, they recrystallise to a very fine-grained rock composed of microcrystalline quartz (chert). Chert is also commonly found as nodules in limestone. Chert was a favoured material for manufacturing artefacts, as it breaks by the process of conchoidal fracture and provides flakes that have sharp, durable edges.

Chert comprised only 14 artefacts (0.65% of the Stage 2-4 test excavation assemblage) (Tables 22 & 23). The chert is described as grey, brown, red, yellow or varied in colour (Table 24). The chert artefacts tend to be relatively small, with a maximum dimension of 40 millimetres and mean weight of 3.74 grams per item, although a small sample size is noted (Table 26). Four of the artefacts (28.6%) exhibit a rough/weathered cortex and one exhibits a waterworn cortex, indicating several different sources (Table 25). The source of this stone material is unclear, but pebbles may occur within conglomerate bedrock and colluvial and alluvial gravels in the region.

Other Volcanics:

The only other stone material identified within the test excavation assemblage is termed 'volcanic 1' and represents a fine-grained igneous rock that could not be more accurately classified. Ten artefacts (0.45% of the Stage 2-4 test excavation assemblage) were classified as 'volcanic 1'. These items were grey, black, brown or red in colour and 80% possessed waterworn cortex (Tables 24 & 25). These items also tended to be larger than artefacts made from other stone materials, with a maximum dimension of 130 mm (Table 26). The mean weight per item of 94.24 grams is significantly higher than for any of the other stone materials (quartzite being next at 4.59 grams per artefact). Considering the size of these items and the extent of cortex, a local source in the form of pebbles and cobbles washed into coves along the shoreline between Ulladulla and Batemans Bay can be inferred.

Heat Treatment:

Heat treatment, or thermal alteration, refers to deliberate alteration of stone by heating. In one of the earliest, yet most relevant studies on heat treatment, Crabtree and Butler (1964) noted that deliberate heating can improve the working qualities of a stone. While many materials (particular isotropic, homogenous stone such as tuff or chert) can be readily flaked in their natural state, some more coarsely micro-granular materials such as silcrete can be difficult to carefully reduce. As Flenniken and White (1983:45) note, the 'most significant effect of heat treatment is that it improves the flakability of rocks, thus allowing the knapper to reach his or her goal with less expenditure of effort and greater economy in raw material use'. It would also allow some materials to be used for purposes they otherwise would not have been suitable for. Hence, more stone materials were available and effort involved in transportation would be less.

Technically, heat treatment reduces point tensile strength, which makes flaking easier, particularly the manufacturing of long, thin flakes (eg. microblades). Rick (1978) noted a decrease in edge angle for tools made from heat treated material. This results in increased sharpness and cutting ability. However, experiments by Rick (1978) revealed that the heat treated edges are less durable (in cutting tasks involving wood) and quickly blunted or dulled, while the untreated edges continued to cut at their initial rate. Rick (1978) argues that thermally altered material was best suited for tasks involving cutting, penetrating as in projectile points, or light duty scraping (without extreme edge stress).

Hanckel (1983:84) argues that heat treatment was used preferentially in the manufacture of certain implement types (backed blades, end scrapers and thumbnail scrapers) at Burrill Lake and Currarong rock shelters on the South Coast, close to the present study area. Hanckel (1983) argues that this is evidence for a functional relationship between artefact type and heat treatment. Scrapers were involved in tasks with minimal potential for intensive stress on the working edges (eg. light duty scraping and trimming).

Hanckel (1983:85) also argues that the importance of heat treatment varied over time. In the pre-Bondaian, the need for a sharp functional edge was paramount. In the Bondaian, a sharp edge and the need to produce long, thin and narrow blades was important, while in the post-Bondaian, producing a sharp edge on small flakes was most important. Hanckel (1983:51) used scanning electron microscopy to reveal that silcrete artefacts from all levels at Burrill Lake rock shelter, close to the present study area and extending back in age to 20,000 years BP, were heat treated. At the Currarong site, heat treated silcrete was identified in the 'Bondaian and post-Bondaian phases' (Hanckel 1983:59). Flenniken and White (1983:43) also suggest that the technique was known throughout Australia from the late Pleistocene.

After identifying that heat treatment was a common practice at two sites in the lower Hunter Valley, Kuskie and Kamminga (2000) concluded that part of the reason for heat treatment may also have been to obtain a desired colour, as well as to improve the knapping properties of the stone. Part of the rationale for this explanation lies in the important symbolic meaning colours had in Aboriginal society. Specific colours (eg. red, pink and purple) may have been especially important for armatures of fighting and hunting spears. The production of microliths (used to arm spears) involves high costs of time and energy and is very wasteful of stone material. Alternative options were available to achieve more or less the same products and material outcomes for less expenditure of time and energy. Therefore Kuskie and Kamminga (2000) postulated that these activities occurred because a spear armed with stone barbs was an important component of a man's equipment and may have had considerable social value. In such circumstances, it is feasible that men would have invested time and energy in producing spear barbs, even transforming the colour of stone for reasons other than purely utilitarian ones.

Heat treatment, both to procure and reduce stone, has been observed ethnohistorically and successfully replicated experimentally (*cf.* Akerman 1979, Crabtree & Butler 1964, Hanckel 1983, Kuskie & Kamminga 2000, Rowney 1992). The primary process of heat treatment appears to involve the use of a pit dug in sandy sediment, with cobbles or large primary flakes heated to a certain temperature and cooled in a controlled manner. Rapid raising or lowering of the temperature usually results in cracking or crazing.

The effects of heat treatment on siliceous stone reportedly include alterations to texture/structure, lustre, colour, water content, heat damage, conchoidal rippling on flake scars, compressive strength and point tensile strength. These changes relate to the constituency of the stone, the temperature of heating and the rate of heating and cooling (Hanckel 1983:7). However, few reliable tests or procedures for identifying thermal alteration in stone are available (Kuskie & Kamminga 2000). One exception is the tests developed by Domanski and Webb (1992) for changes in fracture toughness. However, the time intensive and costly nature of these methods, the size of the individual samples required, the need to identify the silcrete source and test it also, and the need to destroy part of the sample, are all constraints to their widespread application.

Colour change can be a reliable method for detecting thermal alteration (although not necessarily distinguishing from intentional and unintentional heating) (*cf.* Kuskie & Kamminga 2000, Kuskie & Clarke 2004). Colour change results from alteration to minute quantities of iron oxides present in the intercrystalline spaces of siliceous materials. In silcrete samples that contain iron oxide, a distinctive colour change from yellow to red will occur at temperatures associated with thermal alteration, attributable to hydrous iron oxide ($HFeO_2$) changing to haematite (Fe_2O_3). However, the silcrete from the sources nearby to the present study area at Bendalong appears to contain minimal iron oxide and therefore colour change may not occur (Hanckel 1983:28). Heat treatment experiments by Hanckel (1983) did not produce colour changes in grey Bendalong silcrete.

The silcrete artefacts retrieved from The Dairy Stages 2-4 test excavations is predominantly grey in colour (66.4%), consistent with the local sources (Table 24). However, 8.8% of the silcrete items exhibit pink and 5.8% exhibit red colouration, indicative of thermal alteration involving colour change. Pink is a pristine haematite colour and could result from high temperature heating (c.350-400°C+) in an oxidising environment, such as in a bed of porous sand. However, red colouration can result from rapid intense heating and is thus less indicative of intentional thermal alteration.

Examination of heat effects typically arising from unintentional heating indicates that only 36 items (1.7%) exhibit convoluted or rugose fracture surfaces, potlid fractures or geometric or planar fracturing. All of these items are silcrete apart from single chert and rhyolite pieces. Of the silcrete items with these characteristics, only three exhibit red colouration (the remainder being the natural colours). Hence, the effects of unintentional heating (eg. bush fires and camp fires) on the assemblage appears to be very low and is unlikely to account for the majority of colour change. It can be inferred that much of the colour change resulted from deliberate thermal alteration. However, the observations of Hanckel (1983) that silcrete from Bendalong, near Ulladulla, and one of the potential sources of The Dairy material, appears to contain minimal iron oxide and therefore colour change may not occur, is highly relevant. If this is the case, the true proportion of heat treated silcrete may be under-represented by these characteristics alone.

To investigate this issue further, the colour of silcrete artefacts can be compared with artefact types to determine if heat alteration is more likely to have occurred in relation to specific activities (eg. microblade and microlith production) (Table 27). The comparison is limited because of the majority of silcrete artefacts are non-specific types, that may represent evidence of stone knapping to produce microblades or knapping for other purposes. Notably however, 4.1% of pink and red silcrete items are bondi points, as opposed to 1.6% of other silcrete colours and 4.46% of pink and red silcrete items are retouched flakes, as opposed to 2.0% of other silcrete colours. These results indicate preferential use of heat treated silcrete for bondi points (spear barbs) and retouched flakes.

No specific evidence was identified within Stages 2-4 of The Dairy that suggests heat treatment occurred on-site. This may reflect sampling issues, the potentially minimal 'archaeological signature' of this practice, or that heat treatment was undertaken in sandy soils in other locations (eg. possibly at or close to the source of the stone).

5.6 Lithic Item Types

The nature and range of lithic item types is discussed in this section, including artefact typological categories, characteristics and functions.

A total of 19 categories of artefacts were identified (Tables 28-30, Figure 57), within four main technical classes. The combined Stage 2-4 test excavation assemblage is overwhelmingly dominated by flakes (40.8%) and flake portions (50.7%) (including proximal, distal, medial and longitudinal portions). The remainder of the assemblage comprises a very low frequencies of items, including lithic fragments (synonymous with 'flaked pieces', 2.52%), retouched flakes (2.19%), bondi points (1.68%) and ten or less nondescript core fragments, nondescript cores, microblade cores, pebble cores, backing flakes, bipolar flakes, utilised retouched flakes, thumbnail scrapers, geometric microliths, utilised geometric microliths and hammerstones.

Many of the categories represent debris from stone knapping (eg. flakes and flake portions). The knapping can be non-specific (eg. flakes) or demonstrably relate to the production of microliths. A number of the artefact categories denote formal tool types (eg. bondi point and hammerstone). These can provide relatively more information for interpretation, as they allow for greater assessment of on-site activities and traditional Aboriginal culture. The occurrence of each lithic item type is discussed below.

<u>Lithic Fragments:</u>

A total of 54 lithic fragments were identified, representing 2.52% of the combined assemblage (Tables 29 & 30). These are flaked pieces of stone which lack sufficient morphological attributes to identify them as a flake (a positive scar) or a core (only negative flake scars), but which are inferred to derive from knapping. As per the overall assemblage, lithic fragments predominantly occur in silcrete (92.6%), but also in chert and rhyolite (Table 31). The interpretive value of lithic fragments is primarily confined to the circumstantial evidence they provide regarding intensity of site use.

<u>Flakes:</u>

A total of 874 flakes were identified (excluding other typological categories such as backing flakes and bipolar flakes), representing 40.8% of the combined assemblage (Tables 29 & 30). Flakes include complete or substantially complete flakes which have technologically diagnostic features and a ventral (sometimes termed positive) surface, usually with evidence of hard indenter initiation, or occasionally bending initiation. This class of artefacts may represent:

- The fragmented debris of on-site knapping of primary flakes and microblades;

- Flakes with an elongation ratio of 2 or greater (ie. percussion length/percussion width) with parallel sides that can alternatively be identified as 'microblades';

- Possibly backing retouch of implements; and

- A small proportion of sundry, other on-site fracture of siliceous stone, such as accidental breakage of implements.

As per the overall assemblage, flakes predominantly occur in silcrete (85.01%), but also in quartz (7.78%), rhyolite (5.84%) and very low frequencies of chert, quartzite and volcanic 1 (Table 31).

Flakes range in size from class 1 to 7 (ie. up to 70 mm in maximum dimension), consistent with the overall small size of items in the artefact assemblage (Table 32). Size class 2 (10-20 mm maximum dimension) is the modal class and 95% of flakes are less than 40 mm in maximum dimension. The mean percussion length ranges between 9 and 20 mm for each Test Area (Figure 58).

Despite the high frequency of flakes and the thorough nature of the lithic recording (using a microscope in laboratory conditions), no items with use-wear or residue were identified. On this basis, it is inferred that most, if not all the flakes (and consequently the knapping activity on-site) represents debitage.

The nature of flake initiation and termination can reveal information regarding the potential strategies employed by Aboriginal people for both manufacturing particular kinds of artefacts as well as strategies for managing particular stone materials.

Four main types of flake platform were identified on the flakes from The Dairy Stages 2-4 (Table 34):

- *Cortical initiation surface* - an initiation surface on a pebble or cobble;

- *Focused initiation surface* - an initiation surface area defined by a complete or partial Hertzian cone, sometimes with lateral extensions forming a narrow platform which less than twice the area of the ring crack;

- *Multiple scars fracture initiation surface* - an initiation surface which comprises more than one flake scar, including fracture surfaces that are faceted; and

- *Plain fracture initiation surface* - an initiation surface which comprises a single flake scar or continuous cortex surface.

Plain fracture initiation surfaces are the most common in the Stage 2-4 test excavations, comprising 67.8% of items that retain the initiation surface and 68.8% of whole flakes (Table 34). Lower frequencies of multiple scar (17.7% of all items that retain the initiation surface), focused (10.46%) and cortical (2.6%) platforms occur (Table 34). Significantly, 30% of flakes which were selected for retouch (and still retained their platform) had multiple flake scarred platform surfaces, even though only 17.7% of all artefacts retaining platforms had multi-scarred platforms. A possible explanation is that having a multi-scarred platform improves the predictability of the flake path and subsequently the ensuing flake. Multiple-scarred platforms (such as faceted) may also have permitted slightly thicker flakes to be more readily removed (which may be more favourable for retouch). This hypothesis is partially supported by data showing that of the bondi points still retaining sufficient platform for clear identification, 69% (N=9 of 13) had multi-scarred platforms (refer to Table 34).

Similarly, an increased flake path predictability (potentially assisted by faceted platforms), could have ensured that flake paths extended the length of the core and at a relatively high-angled platform. This may also have ensured that optimum or near optimum core morphology was retained, hence extending the use of a core without employing potentially wasteful core rejuvenation technology such as rotation or even bipolar flaking.

Three forms of fracture or flake initiation, the point or area defining the beginning of a flake-forming fracture, were identified: Hertzian, bending and wedging (Table 33). Hertzian initiation is predominant (87% of items retaining the initiation surface), which arises from percussion and leads to the formation of a conchoidal flake. Bending initiation (commonly associated with soft hammer percussion and pressure flaking) was identified on 4.9% of items with an initiation surface present. Wedging initiation, at the tip of a flaw on the surface of a core and common in bipolar flaking, was identified on only three items (all bipolar flakes).

Four main types of terminations were identified on the flakes from Stages 2-4 of The Dairy (Table 35):

- *Feather termination* - a normal ending to a flake, in which the fracture turns slightly to meet the fresh surface of the core at a very low angle, as in the ending of a feather;

- *Hinge termination* - when the end of the flake or fracture continuously turns at ninety degrees to the surface of the core or outside surface of the flake;

- *Outrepassé termination* - (also 'plunging') a flake with a thick ending caused by the flake-forming fracture turning inwards within the core. This occurs when the fracture front approaches the bottom of a core; and

- *Step termination* - when the end of the flake turns sharply at ninety degrees to the surface of the core or outside surface of the flake.

The most readily distinguished feature of the fracture path in the formation of a flake is the manner in which it terminates. The fracture path itself is governed by two components of force – compression and bending. Because siliceous stone is extremely stiff, the bending component decays rapidly as the fracture forming the flake grows, especially after it forms the bulb of force. This leaves the compressive component of the force as the predominant control on the fracture path and is the reason why long, thin flakes can be detached from siliceous stone (Kuskie & Kamminga 2000).

When the fracture profile is without discontinuities in its slope, there are two basic terminations: feather and hinge. Feather is the most common and normally desirable termination. Feather terminations were recorded on 84.1% of items with terminations (and 81.8% of whole flakes) in Stages 2-4 (Table 35). Hinge terminations are more likely to occur when the line of force responsible for the fracture has a larger bending component (Cotterell & Kamminga 1979:104-105, 1987, 2000). Hinge terminations were recorded on 6.4% of items with terminations (and 6.4% of whole flakes) in Stages 2-4 (Table 35).

A flake (or flake scar) which terminates abruptly in a break that essentially is at right angles to the previous fracture path is termed a step flake (or fracture). Two varieties can be recognised. One occurs in microblade knapping, when the pressure is insufficient to cause a complete flake to be removed from the core. To form this type of termination, the fracture must come to rest and be reinitiated, although the duration of the rest may be as short as a millisecond. Another possible cause for this kind of halt is the fracture encountering a flaw in the stone. The second type occurs if the flake is thin and bends or buckles under the flaking force, which results in the flake snapping in half by a second, transverse fracture (Kuskie & Kamminga 2000). Step terminations were recorded on 8% of items with terminations (and 9.8% of whole flakes) in Stages 2-4 (Table 35).

An outrépasse (or plunging) termination on a flake results from the abrupt turning inwards within the nucleus of a flake-forming crack. This termination may occur when the fracture front approaches the base of the nucleus and must turn because of imbalance in stresses on either side of the fracture front (Cotterell *et al* 1985:207). Such a flake takes off part of the base of the nucleus. If the fracture front turns sharply in the other direction the flake will terminate in a hinge. Outrépasse terminations are occasionally evident on microblades (and the negative scar on microblade cores), both in Australia and overseas. These fractures are caused by striking the core too far from its edge (Cotterell & Kamminga 1979:106, 1987, 2000). Outrépasse terminations were recorded on just 1.5% of items with terminations (and 1.9% of whole flakes) in Stages 2-4 (Table 35).

<u>Flake Portions:</u>

A total of 1,085 flake portions were identified, representing 50.7% of the combined assemblage (Tables 29 & 30). Flake portions include:

- *Distal* - the end of a flake (the opposite to that of the point of fracture origin on the ventral [or inside] surface);

- *Longitudinal* - a flake longitudinally fractured from its proximal to its distal end. The breakage may be slightly tangential but are mostly axial in orientation. Such breakages tend to occur during knapping (such as longitudinal cone splits) rather than through post-depositional processes;

- *Medial* - a mid portion of a flake, exhibiting more than one breakage and no platform or termination; and

- *Proximal* - the portion of a flake comprising the point of fracture origin on the ventral [or inside] surface.

As for flakes, these artefacts predominantly represent the fragmented debris of on-site knapping of primary flakes and microblades (debitage). As per the overall assemblage, flake portions predominantly occur in silcrete, but also in each of the other stone materials (Table 31). Significantly, a much higher frequency of quartz (19.01%) exhibits longitudinal breakage compared with the other stone materials, a result of the fracture properties of the stone.

<u>Bipolar Flakes:</u>

Only three bipolar flakes and no bipolar cores were identified in the Stage 2-4 test excavations, in Test Areas 3A2, 4A1 and 5B (Tables 29 & 30). All three bipolar flakes are comprised of quartz and are relatively small (maximum dimension 40 mm) (Tables 31 & 32).

Bipolar technology is a strategy which may be employed for two main reasons:

- Core body size becomes too small to be hand held and thus needs to be rested on an anvil for further reduction; and/or

- The platform angle becomes too high (moving away from acute and obtuse angled platforms towards oblique) to allow easy flake propagation.

Bipolar flaking may also occur in an attempt to remove aberrant terminations on a core body or when commencing the reduction of a rounded river pebble/cobble. For whichever reason bipolar flaking is used, it can be regarded as a strategy to potentially extend the life or begin the use of a core, whereas it otherwise might have been discarded, rejected or regarded as exhausted or unusable in normal flaking practices.

Backing Flakes:

A total of 9 backing flakes were identified in the Stage 2-4 test excavations, in Test Areas 1A, 4A1, 4A2, 4B1 and 5A (Tables 29 & 30). All are comprised of silcrete and are small in size (maximum percussion length of 5 mm) (Tables 31 & 32, Appendix 5).

Microdebitage (eg. backing flakes) is least likely to have been effected by many subsequent prehistoric human activities and is particularly useful in identifying original activity areas, especially those relating to backed artefact manufacture (Kuskie & Kamminga 2000). More tiny flakes (214 have a maximum dimension of 10 mm) may in fact have been formed by backing retouch, but could not be specifically identified as such during the lithic recording. It is noted that while the absence of backing flakes does not preclude backed artefact manufacture in a particular area (as extremely small items may pass through the sieve mesh), the presence of such flakes at a site is conclusive evidence of this activity.

Nondescript Cores and Core Fragments:

A total of 6 nondescript cores and 10 nondescript core fragments were identified in the Stage 2-4 test excavations (Tables 29 & 30). They are comprised of a range of stone materials and tend to be moderate in size (maximum dimension 90 mm) (Tables 31 & 32). The nondescript cores and core fragments tend to have multiple initiation surfaces (up to four) and multiple flake removal scars (range between 1 and 11, mean of 5.9 per core) (Appendix 5). Unidirectional, bidirectional, multidirectional and alternating platforms are present (refer to Appendix 5 for definitions).

This group of artefacts probably represents on-site knapping to produce flakes, possibly including to an extent ones useful for making into microliths.

Pebble Cores:

A single pebble core was identified in the Stage 2-4 test excavations (Tables 29 & 30). It is a large (maximum length 130 mm) elongated 'volcanic 1' river pebble with at least 2 flakes removed unidirectionally from one end. This core may represent exploitation of colluvial or alluvial pebbles, such as the stones washed into the coves of the nearby headlands.

Microblade Cores:

A total of three microblade cores were identified in the Stage 2-4 test excavations (Tables 29 & 30). Two are comprised of silcrete and one of chert (Table 31). All items are size class 4 (Table 32). Each core exhibits several distinct elongated parallel sided negative flake scars (Appendix 5). The microblade cores have between 2 and 4 multiple initiation surfaces and 5 or 6 flake removal scars. Bidirectional and multidirectional platforms are present (refer to Appendix 5).

Microblade cores represent on-site manufacture of microblades and flakes, with the elongated flakes possibly then selected for use as preforms for making bondi points and other microliths.

Retouched Flakes:

A total of 47 retouched flakes and 4 utilised retouched flakes were identified in the Stage 2-4 test excavations (Tables 29 & 30). As per the assemblage in general, 93.6% of the retouched flakes and all of the retouched flakes with use-wear are comprised of silcrete (Table 31). The remainder are comprised of rhyolite and quartz. Most retouched flakes are small (<40 mm in maximum dimension), although a low frequency are larger in size (up to 90 mm; Table 32).

Four retouched flakes exhibit use-wear (0.19% of the Stage 2-4 assemblage). Along with a single utilised geometric microlith, these are the only items in the entire assemblage for which visible evidence of use-wear was identified, despite the thorough nature of the lithic recording (including inspection of every item under a microscope in laboratory conditions).

Retouched flakes are artefacts that have minimal analytical value, because the purpose of the retouch they exhibit is not known. Some appear to be associated with backed artefact production and six items (Reference #386, 521, 638, 803, 1053 & 1140) from Test Areas 3A2, 4A2, 4B1 and 5A appear to represent the failed production of backed artefacts. These items could be termed 'bondi point preforms' and probably represent initial backing retouch of elongated flakes that were then discarded as unsuitable for further backing retouch and transformation into microliths.

Thumbnail Scrapers:

Only two thumbnail scrapers were identified in the Stage 2-4 test excavations, in Test Areas 3A2 and 6A (Tables 29 & 30). Both are comprised of silcrete and are small in size (maximum dimension 20 mm) (Tables 31 & 32).

Thumbnail scrapers are tiny retouched tools, made from flakes struck from microblade cores. Generally, thumbnail scrapers are uncommon implements in any assemblage. It is unlikely they were commonly used to scrape wood or other resistant materials, since they seldom exhibit abrasive smoothing and use-rounding wear on their retouched edges, and few are repeatedly resharpened to an exhausted 'slug' form, which is common for flake scrapers and adzes (Kuskie & Kamminga 2000). Mulvaney and Kamminga (1999:236-37) suggest that a proportion of those identified in microlithic assemblages may have been components of a spear armature ensemble.

Bondi Points:

A total of 36 bondi points, representing 1.68% of the combined assemblage, were identified in the Stage 2-4 test excavations (Tables 29 & 30). Significantly, these are all comprised of silcrete (Table 31). The bondi points range in maximum dimension from up to 10 to 50 mm, but are typically less than 30 mm in length (Table 32). Consistent with the very low frequency of evidence of use-wear in the overall assemblage, no use-wear was identified on any of the bondi points.

Bondi points are a form of microlith often found in artefact scatter sites dating to the mid-late Holocene. While the function of these finely fashioned implements is not known with certainty, most archaeologists consider that they were used in armatures of hunting and fighting spears (Mulvaney & Kamminga 1999:235-36). Microliths may have served as barbs, or else as lacerators intended to disable an enemy or prey by causing haemorrhage. It is possible that different microlith types were designed to serve these different functions. Alternative uses have been proposed for bondi points, including their use as cutting implements (*cf*. Sokoloff 1977). Most recently, Fullagar (*et al* 1994) has inferred from residues on a small sample of bondi points from the Hunter Valley that they served as multi-functional tools. However, the evidence for use in spear armatures is persuasive and it could easily account for the range of residues observed. Summarising the evidence for spear armatures (Kuskie & Kamminga 2000):

- The microliths are very small and often have very delicate shapes that are unsuitable for most tool-use activities;

- A use-wear study (Kamminga 1980) has suggested that most specimens in museum collections have not been used, but were lost during and after manufacture of batches of them, and that the occasional use-wear observed was at least consistent with spear armature use and inconsistent with a number of other possible activities;

- Traces of resin have been detected on excavated bondi points from the New England and Pilbara regions and the Hunter Valley (*cf*. Fullagar in Koettig 1994:48, McBryde 1985, Mulvaney & Kamminga 1999:236), suggesting that normally they were cemented onto a wooden shaft or handle;

- Specimens and associated manufacturing debris are commonly found in large quantities at archaeological sites (and in landscape units) across southern Australia, indicating that large numbers were required, more so than any other formally shaped implement type, which is consistent with an interpretation of spear armatures;

- Australian microliths are directly comparable to microliths fixed onto spears and arrows preserved in Stone Age and Metal Age sites in Europe and Africa; and

- The closest ethnographic analogue postulated for microliths is the barbing of the 'death spear' or 'dread spear', which was commonly used along the southern coasts of Australia for hunting and/or fighting (Mulvaney & Kamminga 1999:292-93). Small jagged fragments of stone (usually quartz) were embedded in series into a layer of resin (sometimes referred to as gum) smeared on the head of a single piece wooden shaft. In some cases, grooves were carved into the wooden shaft to accommodate the stone barbs, but this was not a universal practice. It is not known if the sharp flakes cemented onto these spears were 'backed' by careful knapping, but such a practice would have allowed them to be fixed in a groove incised into the spear shaft, or maximised adhesion of the resinous cement. The barbed point of death spears was about 15 to 30 centimetres long, with up to about 7 to 14 sharp stone flakes or fragments for single-sided armature and about 14 to 28 fragments for double-sided armature. For a spear armed with bondi points, the ranges may have varied from these figures.

<u>Geometric Microliths:</u>

A total of 6 geometric microliths and one utilised geometric microlith were identified in the Stage 2-4 test excavations, the latter item occurring in Test Area 5B (Tables 29 & 30). As per the assemblage in general, all of the geometric microliths are silcrete, apart from the single utilised item which is comprised of rhyolite (Table 31). The items are small (maximum dimension 30 mm) (Table 32). They are a type of microlith that was probably also used as a spear barb.

<u>Hammerstones:</u>

A single hammerstone (Ref. #641) was identified in the Stage 2-4 test excavations, in Test Area 4B1 (Tables 29 & 30). It comprises an elongated river pebble of 'volcanic 1' stone, with localised pitting at one end and some modern damage and cortical exfoliation at the opposing end. It represents one of the largest artefacts identified in the test excavations (maximum length 100 mm, weight 292.8 grams) and exhibits 90% waterworn cortex.

Hammerstones were used as percussive instruments to flake pieces of stone ('cores') or in applying controlled pressure to retouch a tool's edge.

5.7 Activity Areas and Spatial Patterning

The evidence from The Dairy Stage 2-4 test excavations is analysed in this section in relation to hypothesised activity types. Comparisons are made between the various test areas and also between the evidence and a range of factors, such as the environmental/cultural contexts, landform units, classes of slope, distance to the wetland basin and aspect.

<u>Shell Middens:</u>

Three loci of shell midden evidence have been identified within Stages 2-4 of The Dairy, all within the open space portion near Dolphin Point Road and Bonnie Troon Close (Figure 31).

Previously Recorded Midden Loci

Loci M and N of Site Dolphin Point 4 are middens identified by South East Archaeology in February 2004 (refer to Section 3.1.4 for complete descriptions). Locus M is a midden with artefacts, exposed within an unfilled backhoe pit measuring 5 x 2 metres. The cultural deposit occurs between 0.15 and 0.45 metres below the present surface. The shell comprises mostly whole and fragmented cockle, with minor mud whelk, mud oyster and nerites. Locus N is a midden exposed within a 7 x 3 metre area of minor earthworks, 15 metres south of Locus M and approximately 25 metres from the fence bordering housing along Bonnie Troon Close (Kuskie 2004a). The minor scatter of shell comprises mostly cockle, with turban and oyster fragments. Midden shell located by Feary (1991) as 'Site 3' and 'Site 4' lies marginally to the east of the present study area within the Dolphin Point Road Reserve (Figure 7).

Test Area 8A

A third locus of midden deposit was identified during the present test excavations (Test Area 8A). The nature and distribution of this evidence is presented in Appendix 6 and summarised in Tables 36 and 37. The radiocarbon dates are presented in Appendix 8 and summarised in Table 17. The distribution of shell for combined spits and then for each spit individually is presented in Figures 32-39.

Analysis of the Test Area 8A evidence indicates that midden deposits occur in two distinct areas, in the mid-section of the Test Area around units FF25 and EE25, and at the southern end of the Test Area around units EE-FF-0-10 (Figure 32). A low number of shells occur outside of these clusters, possibly representing post-depositional horizontal movement.

A total of at least 15 shell species were identified in Test Area 8A. Using minimum number estimates, these predominantly comprise cockle (*Anadara trapezia*) (63.7% of the MNI total), and to a lesser extent mud whelk (*Pyrazus ebeninus*) and rock oyster (*Saccostrea glomerata*) (each representing 8.8% of the MNI total) (Table 36). By total weight of whole items and fragments, cockle was also predominant (62.2% of the total weight of shells in Test Area 8A). However, by virtue of their relatively large individual size, cartrut (*Thais orbita*) was next most common in terms of weight (20.2%) and Turban Shell (*Turbo torquatus*) were also relatively more represented (4%) than purely by MNI estimates (Tables 36 & 37). Minor frequencies of other shells were present as outlined below.

Test Area 8A - EE-FF25 Cluster

The cluster around EE-FF25 is relatively discrete and has not been subject to much lateral disturbance. The evidence in FF25 is predominantly at 10-20 cm depth in spit 2 (Figure 34, Appendix 6), but a proportion of shell has probably moved vertically subsequent to deposition, both above and below the main deposit, with items still occurring at 40-50 cm depth in spit 5 (Figures 33, 35-37). Assuming the shell in units FF25 and EE25 represents the same cultural event, it can be inferred that a modest amount of predominantly vertical movement of evidence has occurred over the 600 to 900 year period that has elapsed since deposition.

A sample of cockle from spit 2 in unit FF25 was radiocarbon dated to 1137±48 years BP (*Wk16145*), which equates to an age calibrated to two standard deviations (95.4% probability) of 870-540 calBP (1080-1410 AD) (Appendix 8, Table 17). At around this time, the midden would have been deposited on a sand body bordering a shallow estuarine entrance to the basin, and was very close to the inlet of Burrill Lake itself. Estuarine marine shell (non-cultural) from 0.9 to 1.0 metres depth in Unit EE35 was dated to 1252±41 years BP (Before Present) (*Wk16145*), which equates to an age calibrated to two standard deviations (95.4% probability) of 940-650 calBP (1010-1300 AD) (Appendix 8, Table 17). Hence, the mouth of the basin at The Dairy was still forming with estuarine sand at about the same time or just prior to the Aboriginal inhabitants depositing the midden evidence in FF25.

Unit FF25 contains a Minimum Number of Individuals (MNI) estimate of approximately 344 shellfish (Appendix 6). These are predominantly cockle (N=242, 70.3% of MNI), which primarily occur in spits 2 and 3 (10-30 cm depth below present surface). The total weight of cockle whole items and fragments in unit FF25 is 4549 grams. Rock oyster is the next most common, with an MNI of 43 (12.5%), but these tend to occur in spits 4 and 5 (30-50 cm depth). The total weight of rock oyster whole items and fragments in unit FF25 is 452 grams. Minor frequencies of other shell types occur in unit FF25, including mud oyster (*Ostrea angasi*), black nerites (*Nerita atramentosa*), cartrut, mud whelk, top shell or striped-mouth conniwink (*Bembicium nanum*), periwinkle (*Austrocochlea* spp.), chiton (*Chiton* spp.), littorinid snails (often called 'periwinkle') (*Nodilittorina pyramidalis*) and Juke's keyhole limpet (*Diodora jukesii*). The total weight of whole items and fragments of these other species (excluding cockle and rock oyster) in unit FF25 is only 172 grams (3.3% of the total weight of shell from this unit). Nine stone artefacts were directly associated with the shell midden in unit FF25, all flakes or flake portions of silcrete, quartz or rhyolite.

Hence, the cluster of midden evidence in unit FF25 has primarily been procured from the adjacent estuarine inlet and water body of Burrill Lake. Cockles thrive in estuarine water where the wave action is gentle, sandy to muddy flats are present, near-shore water depths are less than five metres and frequently less than one metre where the cockle can be particularly prolific, and the salinity and temperature levels are suitable (*cf.* Sullivan 1982, White 1987b). Due to its concentration in beds, it would have been relatively easy to collect a large number by hand in a short period of time. The rock oyster habitat is also likely to have been the adjacent estuarine inlet (White 1987b). The remaining nine identified species, which comprise by weight a very small proportion of the deposit, include those probably procured from the adjacent sandy/muddy estuarine inlet and intertidal flats (mud oyster, mud whelk), intertidal rocky shores along the inlet and/or nearby rock platforms of Dolphin Point (black nerites, littorinid snails, Juke's keyhole limpet, periwinkle and top shell/striped-mouth conniwink) and from the nearby sublittoral zone of the rock platforms of Dolphin Point (chitons, cartrut).

Five metres to the west of unit FF25, an MNI estimate of 25 is present in unit EE25. A total of 23 of these individuals are cockle and this species accounts for 72% of the total weight of shell (only 143 grams) in this unit. It is inferred that the evidence in EE25 represents an extension of the midden deposit in FF25. The extent to which the midden may extend eastward to within the Dolphin Point road reserve is uncertain, but may not be significant given the virtual absence of evidence five metres to the north or south of unit FF25.

Test Area 8A - EE-FF-0-10 Cluster

The midden deposit around EE-FF-0-10 in Test Area 8A is distributed over a wider area (Figures 32-39). At around the time of occupation, the midden would have been deposited on a sand body bordering a shallow estuarine entrance to the basin immediately to the north, and was very close to the inlet of Burrill Lake itself to the east.

Three radiocarbon dates were obtained for this evidence, from samples of cockle in units FF0 spit 4, EE0 spit 5 and FF5 spit 5 (Appendix 8, Table 17). The ages calibrated to two standard deviations overlap between 1220 and 1000 calBP (730 and 950 AD). Hence, this cluster of evidence may represent a single but widespread event (eg. multiple individuals), or more likely a series of repeated events within a relatively short period of time (eg. a small group returning to the same place in a season or over successive seasons). The evidence is clustered between 20 and 50 cm depth (spits 3-5) with items both above and below these levels. It remains unclear as to whether significant horizontal displacement occurred after deposition (although it is not inferred to have occurred), but there was almost certainly vertical movement of evidence post-deposition.

Although the MNI estimates are lower for each unit than the EE-FF25 cluster (ranging from a total of 18 in FF10 to 94 in FF5), it is probable that significant midden deposits are distributed in the 50 m^2 between these six test units, extending into adjacent areas that were not sampled (Figures 32-39). Extrapolating the MNI estimate of 291 for the EE-FF-0-10 test units (1.5 m^2 area) to the intervening 50 m^2 would result in a total MNI of approximately 9700. Similar extrapolations for weight of shells (4113 grams in these units) would result in a total weight of around 136.9 kilograms in this 50 m^2 area. Clearly this is a substantial quantity of shell that must have derived from multiple meal events and the activity of a number of people.

This cluster predominantly contains cockle (N=178, 61% of MNI). The total weight of cockle whole items and fragments in these units is 2101 grams. Cartrut shell is the next most common in terms of weight (1293 grams), although the MNI estimate of 23 is less than the estimate for mud whelk (MNI = 51, weight 476 grams). Mud oyster fragments weigh 120 grams and the MNI estimate is 10. Low numbers of individuals or total weights are present for other species in this cluster, including rock oyster, chiton, limpet, edible mussel (*Mytilus planulatus*), black nerite, periwinkle (*Austrocochlea* spp.), top shell and possibly pipi (*Plebidonax deltoides*). The total weight of whole items and fragments of these other species (excluding cockle, cartrut, mud whelk and mud oyster) in these units is only 115 grams (2.8% of the total weight of shell from these units).

Associated with the shell midden in this cluster were 179 stone artefacts, predominantly flakes, flake portions and lithic fragments, but including one nondescript rhyolite core and four retouched flakes. Although silcrete is dominant (57%), in contrast to the overall Stage 2-4 assemblage, quartz is relatively common (26.8%).

Hence, like the cluster of midden evidence in unit FF25, the evidence in EE-FF-0-10 has primarily (eg. cockle, mud oyster and mud whelk) been procured from the adjacent estuarine inlet and water body of Burrill Lake. However, the cartrut shells have probably been procured from in the vicinity of the rock platforms at nearby Dolphin Point, and several of the other less frequent species have also been procured from rocky habitats either in the inlet or around the rock platforms.

Test Area 8A - Interpretation

The two primary clusters of midden evidence in Test Area 8A represent the procurement of shellfish primarily from the adjacent lake inlet and to a lesser extent the nearby rock platforms, and transport of the shellfish from those locations to the site where food preparation and consumption occurred. However, the two clusters vary in that:

- Cluster EE-FF25 is a relatively small, focalised activity event (ie. possibly a single meal event involving a small group of people for a short duration) that occurred between 870-540 calBP (1080-1410 AD); whereas

- Cluster EE-FF-0-10 is more extensive in area and probably contains significantly higher quantities of shell, along with more evidence of stone knapping. It may represent a single but major meal event (eg. multiple individuals), or more likely a series of repeated events within a relatively short period of time (eg. a small group of people returning to the same place in a season or over successive seasons) between 1220 and 1000 calBP (730 and 950 AD) where the radiocarbon dates overlap (or at most, between 1340 and 860 calBP).

Shellfish gathering was presumed to be predominantly an activity undertaken by women and children, although men have been seen by early observers in some parts of Australia and more recently in ethnographic observations gathering shellfish (Meehan 1982, 1988). The proportion of shellfish species selected for procurement reflects both their abundance and relative ease of collection from the margins of the nearby lake inlet and rock platforms. Given the numbers of shell, it is assumed that some sort of carrying bag was used to transport them from the lake to the site. Ethnohistorical observations along the South Coast have been made of the collection of shellfish such as mussels and oysters (Clark 1797:763, 765; Evans 1812:3 April; Berry 1822: 9 January; in Sullivan 1982) and the use of containers (eg. 'bark buckets' by Robinson 1844:212 at Twofold Bay, in Sullivan 1982).

<u>Activity Types and Activity Areas:</u>

Identification and assessment of variations in spatial patterning of human occupation can assist greatly with interpretation of the evidence at The Dairy and provide meaningful information about the human behaviour that created this evidence.

In order to assess the research questions relating to both internal and comparative site structure, an analysis will be utilised that Kuskie and Kamminga (2000) developed and used with success at the Black Hill/Woods Gully (F3) salvage. Primarily this analysis is conducted by examining the distribution of certain artefact and stone material types to determine notional activity types and areas. These activity areas are hypothetical frameworks which were developed to potentially reflect the way that people may have organised their use of space in relation to other activities and other factors (Boismier 1991:19, Kuskie & Kamminga 2000:449). In this way an 'activity' refers to specific behaviour which results in the discard of a certain item. It should be noted that many Aboriginal activities will be ephemeral or invisible within the archaeological record and cannot be strictly verified through archaeological means. It is also noted that application of this technique is more suitable to large-scale broad area hand excavations, rather than small test units.

An 'activity area' refers to a single location in which one or more activity events have resulted in the discard of items that constitute archaeological evidence. Activity events are synonymous with discard events, that is, the discard of lithic item(s) resulting from a single action performed during an activity. Activity areas represent concentrations of artefacts produced by activities carried out by people following some form of organisational strategy during a particular occupation (Boismier 1991:19). These activities include tool manufacture and repair, cooking, food processing and the disposal of refuse (Kuskie & Kamminga 2000:449-452). The lithic item indicators of specific human activities are listed in Table 38.

One of the fundamental ways of identifying specific prehistoric activity areas is through analysis of the composition and patterning of lithic assemblages. Optimum results are obtained when the artefacts represent a single episode of activity or occupation and the patterns are not obscured by repeated cultural discard during subsequent use of the site (superimpositioning). Even when there are long intervals between reoccupation, the artefacts from different periods may become mixed because of low rates of sedimentation and processes of bioturbation. However, while such mixed assemblages pose considerable problems in interpretation, as several studies have demonstrated, meaningful interpretations may still be derived from activity analyses (Kuskie & Kamminga 2000:449-452, Kuskie & Clarke 2004).

Various taphonomic processes can affect open sites. The nature of post-depositional disturbance to the test excavation evidence is outlined in Section 5.4. Significantly, it is inferred that the horizontal spatial patterning of evidence is largely intact, although considerable vertical mixing of deposit has occurred (probably due largely to bioturbation).

The sorts of problems and issues that arise with interpretation of activity areas *(cf* Boismier 1991, Binford 1991, Schick 1986) include the:

- Effects of post-depositional processes;
- Effects of chronological variations (time of occupation when discard occurred);
- Effects of multiple occupations on the form and content of sites and activity areas;
- Effects of extended-length occupations on the form and content of sites and activity areas;
- The extent to which artefact class distributions represent patterning of occupation;
- The extent to which qualitative and quantitative differences represent different functions;
- Import of items on-site and removal of items off-site; and
- Effects of human behaviour such as 'tossing' or 'dumping' artefacts (Kuskie & Kamminga 2000:449-452).

Boismier (1991:19) suggests that to address these problems, temporally diagnostic classes, technological classes and morphological and functional classes are needed. We have attempted to control for these issues to the extent possible in this analysis and interpretation, following Kuskie and Kamminga (2000).

Binford (1978:356) has suggested that spatial patterning of discard material does not necessarily mirror the distribution of activities, since dispersal patterns arising from 'tossing' or 'dumping' may produce distributions that are inversely related to the patterns of use activity. However, while artefacts may have been moved around a camp and away from the location where they were knapped or used, or even off-site, small flakes and lithic fragments (flaked pieces) from implement production and tool-use tends to be incorporated rapidly into the sediment, and in the main are not significantly translocated by human agency during occupation. Elements of these small artefacts are therefore the essential markers of activity areas and foci. The process of linking larger artefacts to this associated microdebitage by criteria such as specific spatial context and attributes of technology can assist in overcoming Binford's (1978) concerns (Kuskie & Kamminga 2000:449-452).

Six basic categories of activities were defined for the analysis and individual artefacts were assigned to each (Table 38). In general, these categories express the range of activities evident from the identifiable artefacts in the lithic assemblages:

- Non-specific stone flaking: general or non-specific knapping activity (artefacts do not identify a more specific activity; includes debitage from primary knapping events and from flake manufacture);

- Bipolar flaking: a method of core reduction or flake retouch by resting a piece of stone on a hard (usually stone) surface and striking it from above with a hammerstone, so that the force applied is essentially compressive;

- Microblade production: a method of making small microlithic implements (eg. for backed artefacts) from regular elongated parallel sided flakes struck from a small core;

- Backing retouch of microliths;

- Loss or intentional discard of microliths (complete and broken): the discard of backed artefacts either during manufacture, after use or unintentionally; and

- Loss or intentional discard of non-microlith tools (including portions of tools): intentional discard after use or caching for future use of implements other than microliths.

The lithic item indicators of activity types are outlined in Table 38. For the purposes of analysis, flakes with an elongation ratio of 2 or greater (ie. percussion length/percussion width) with parallel sides can be identified as 'microblades' and are hence excluded from the 'non-specific stone flaking' activity and included within the 'microblade production' activity type.

In relation to the activity classes, it is important to note that different activities result in the production of different quantities of evidence. For example, microblade production can result in hundreds of artefacts from a single reduction event. Bipolar flaking can also result in substantial debitage, if the core is substantially reduced. Non-specific stone flaking can involve anything from a single to tens or even hundreds of discarded items. Different stone materials can also result in different quantities of discarded artefacts due to the mechanical and fracture properties of the stone. Fragmentation studies (Kuskie & Clarke 2004) demonstrate greater fracture of materials such as porcellanite and petrified wood, in relation to tendencies to fracture easily along faults during initial reduction as well as post-depositionally. The techniques of reduction (eg. way blows are applied) can also result in substantially different numbers of artefacts.

In contrast with the categories of non-specific stone flaking, bipolar flaking and microblade production, the categories of loss or intentional discard of microliths and discard of non-microlith tools generally involve very low numbers of discarded artefacts, which may correspond more closely with the number of activity events performed at a particular area.

The category of loss or intentional discard of non-microlith tools is a diverse group comprising utilised retouched flake, thumbnail scraper and hammerstone artefacts. While this group of tools constitutes a numerically minor component of the assemblage, it is usually of far more value for site interpretation than other categories. This is because it represents a diverse range of tool-use activities, such as food procurement and processing and artefact manufacture and repair, and may include a number of chronological indicators. The spatial patterning and associations of non-microlith implements may be further examined on an individual basis to infer specific activity foci and site functions.

As is consistent with the artefact types (refer to Section 5.6), the overall Dairy Stage 2-4 test excavation assemblage and each Test Area assemblage is overwhelmingly dominated by items representing non-specific stone flaking (Table 39). On average, these items represent 94.4% of the combined assemblage (N=2022) and between 90% and 100% of each Test Area assemblage (Table 39).

Specific activities are represented in the test excavation assemblage in very low frequencies. Microblade production is represented by 2.71% of items (N=58) and is present in many of the test areas. Microlith production (backing retouch) is represented by 0.42% of items (N=9) and is present in seven test areas. As discussed above, these items are key indicators of backing retouch having occurred directly in these locations. Microliths are discarded in many test areas but in low frequencies, representing on average 2.01% (N=43) of the combined assemblage. Bipolar flaking was infrequently identified (occurs in only three test areas) and only represents 0.14% (N=3) of the combined assemblage. A low frequency of non-microlith tools occurs (0.33% of the combined assemblage, N=7) and they are present in seven of the test areas (Table 39).

Therefore while it can be inferred that a proportion of the Aboriginal activity within the study area relates to the production of microblades and microliths, presumably to arm spears, much of the stone artefact evidence represents debitage from which the specific activities cannot be reliably inferred. A proportion of this evidence (eg. particularly where it is associated with backed artefact production activity events) probably relates to the production of microblades and microliths. No tools indicative of encampments or focused occupation were identified.

Reconstruction of individual activity areas within the test excavations is limited by the small and spatially separate nature of the units. Typically a 0.25 m^2 test unit only intersects a small portion of an activity area (where present, and as distinct from background discard) and broad area hand excavation is typically required to effectively identify and delineate discrete activity areas. However, from examination of the distribution of artefacts and their nature (Figures 40-54, Appendix 5) a number of activity areas can be inferred, including:

- Test Area 1A, Unit BB45: silcrete microblade and microlith production;
- Test Area 3A2, Unit A10: grey silcrete non-specific stone flaking;
- Test Area 3A2, Unit A40: grey silcrete non-specific stone flaking and discard of non-microlith tool (possibly thumbnail scraper produced and discarded);
- Test Area 3A2, Unit B25: quartz bipolar flaking;
- Test Area 4A1, Unit C15: quartz bipolar flaking;
- Test Area 4A1, Unit D10: grey/pink silcrete microblade and microlith production;
- Test Area 4A2, Unit I40: probable silcrete microblade and microlith production;
- Test Area 4A2, Unit J20: probable silcrete microlith production;
- Test Area 4A2, Unit J30: grey/brown silcrete non-specific stone flaking;
- Test Area 4B1, Unit G10: grey silcrete non-specific stone flaking and discard of non-microlith tool (hammerstone), possible microblade and microlith production;
- Test Area 4B1, Unit G15: probable silcrete microblade and microlith production;

- Test Area 4B1, Unit G20: quartz non-specific stone flaking;
- Test Area 4B1, Unit G25: probable silcrete microblade and microlith production;
- Test Area 4B1, Unit G50: rhyolite non-specific stone flaking;
- Test Area 5A, Unit M5: probable grey/pink silcrete microblade and microlith production;
- Test Area 5A, Unit M10: grey silcrete microlith production;
- Test Area 5A, Unit M35: grey/pink silcrete microlith and probably microblade production;
- Test Area 5A, Unit M45: probable grey silcrete microblade and microlith production;
- Test Area 5A, Unit M50: silcrete microblade and probably microlith production;
- Test Area 5A, Unit N5: probable silcrete microblade and microlith production;
- Test Area 5A, Unit N30: probable silcrete microblade and microlith production;
- Test Area 5A, Unit N35: probable silcrete microblade and microlith production;
- Test Area 5A, Unit N40: silcrete microlith and probably microblade production;
- Test Area 5A, Unit N45: grey silcrete non-specific stone flaking;
- Test Area 5A, Unit N50: possible silcrete backed artefact production and discard of non-microlith tool;
- Test Area 5B, Unit O10: discard of grey silcrete microliths (no apparent production);
- Test Area 5B, Unit O15: discard of grey silcrete microlith (no apparent production);
- Test Area 5B, Unit P10: grey/brown rhyolite non-specific stone flaking;
- Test Area 5B, Unit P20: red silcrete non-specific stone flaking;
- Test Area 5B, Unit P30: brown quartzite non-specific stone flaking;
- Test Area 6A, Unit E35: grey silcrete non-specific stone flaking;
- Test Area 6A, Unit E45: grey/pink silcrete non-specific stone flaking;
- Test Area 6A, Unit F0: probable silcrete microblade and microlith production;
- Test Area 7A, Unit Y10: possible grey/pink silcrete backed artefact production and discard of microliths;
- Test Area 7A, Unit Y15: silcrete non-specific stone flaking;
- Test Area 7A, Unit Y50: quartz non-specific stone flaking;
- Test Area 7A, Unit Z15: grey silcrete non-specific stone flaking and discard of microlith (possible backed artefact production);

- Test Area 7A, Unit Z20: probable silcrete microblade and microlith production;
- Test Area 7A, Unit Z25: chert microblade production;
- Test Area 8A, Unit EE0: rhyolite, silcrete and quartz non-specific stone flaking in association with shell midden;
- Test Area 8A, Unit EE5: silcrete, quartz and quartzite non-specific stone flaking in association with shell midden;
- Test Area 8A, Unit EE25: grey silcrete non-specific stone flaking in association with shell midden;
- Test Area 8A, Unit FF0: silcrete and quartz non-specific stone flaking in association with shell midden;
- Test Area 8A, Unit FF5: silcrete, quartz, rhyolite and quartzite non-specific stone flaking in association with shell midden;
- Test Area 9A, Unit L20: silcrete microblade production and discard of non-microlith tool; and
- Test Area 9A, Unit L25: grey silcrete non-specific stone flaking.

In a number of other test units, the evidence is indicative of further backed artefact production (eg. a single bondi point amidst a small quantity of non-specific flaking debitage of the same stone material) but the activity could only be confidently inferred if a greater sample of the assumed event was recovered by excavation of a wider area.

<u>Spatial Distribution of Evidence:</u>

The spatial distribution of the evidence within The Dairy Stages 2-4 is examined to determine whether there are focal points of activity or particular relationships between Aboriginal behaviour and aspects of the locality's environment. A range of factors are analysed, including class of slope, landform unit, environmental/cultural context and distance to the wetland/basin. However, it is emphasized that the nature of the sample (in terms of area/volume excavated and/or quantity of artefacts retrieved) is often small and therefore caution must be applied in making inferences from such data.

Class of Slope

Three classes of slope or gradient are delineated after McDonald *et al* (1984) (Table 40):

- Class 1 (level/very gentle) - level to very gently inclined slopes <3% (1°45´);
- Class 2 (gentle) - gently inclined slopes >3% (1°45´) and <10% (5°45´); and
- Class 3 (moderate/steep) - moderately inclined and steep slopes >10% (5°45´).

Eleven of the test areas comprise gentle slopes, with an overall mean artefact density of 31.72 artefacts/m^3 (20.07 artefacts/conflated m^2). Four of the test areas comprise level/very gentle slopes, with an overall mean artefact density of 46.18 artefacts/m^3 (28.82 artefacts/conflated m^2). A single test area on the moderate slope yielded a mean artefact density of 180.31 artefacts/m^3 (69.18 artefacts/conflated m^2) (Table 40).

Significantly, these results are the inverse of the expected trend. There is typically a strong correlation between higher artefact density and lower gradient (particularly 5° or less) reflecting a greater focus of Aboriginal activity on level to gently inclined ground (*cf.* Kuskie 2000a). However, rather than reflecting an unusual pattern of Aboriginal activity, the results are interpreted as arising from the small sample size in the moderate slope unit. Only a single test area (1A) encompassed this class of slope and a high number of artefacts (128) were located within a single test unit, in effect biasing the overall result. Notably, this unit was located on the less steep upper portion of the slope, whereas the steeper lower portion (8-10º) contained far fewer artefacts (Figures 15 & 40).

To further address this issue, examination can be made of the site contents (eg. artefact and activity types) between the different classes of slope (Tables 41-44). The general numbers of different artefact types within the different classes of slope are consistent with the size of each sample. There tends to be a strong correlation between the size of a sample and the range of different artefact and stone types (ie. the larger the sample, the greater the range or diversity: Kuskie & Kamminga 2000, Kuskie & Clarke 2004). The Dairy Stage 2-4 assemblage is no different, with the gentle slope class bearing both the highest artefact numbers and greater diversity of types.

The frequency of artefact types varies, but not in any apparently significant trend (Tables 41 & 42). Flakes and flake portions are dominant within each class of slope. The frequency of artefacts by activity type also shows minimal variation, with non-specific stone flaking dominant in every class of slope and minor frequencies of the other activities represented in each, apart from bipolar flaking only being present on gentle slopes (Tables 43 & 44). Only three bipolar items were identified in the entire assemblage so this difference is attributable to sample size.

The stone materials of the combined assemblage are dominated by silcrete. However, one notable difference between the three classes of slope is in the frequency of quartz, which tends to be relatively high (14.8%) in the level/very gentle slope assemblage compared to the gentle slope (5%) and moderate slope (0.7%) (Table 45). It arises from a higher frequency of quartz on the flat in Test Area 2A and in the midden bordering the wetland in Test Area 8A. It could be speculated that a higher frequency of quartz in these areas, which on geomorphological and radiocarbon evidence are inferred to have been occupied relatively late in the Holocene, is consistent with the perceived increase in use of quartz (particularly through bipolar flaking) in south-eastern Australia in the last 1,000 years (*cf.* Mulvaney & Kamminga 1999). As it contrasts with the remainder of the study area, it could be inferred that the other areas (with a lower frequency of quartz) were occupied earlier (eg. when the basin was inundated with marine or estuarine water). Notably, backed artefacts are also absent from Test Areas 2A and 8A. However, such a conclusion remains speculative until direct dating of evidence can be obtained from more widely across the study area.

Hence, gradients within The Dairy Stages 2-4 tends to be low (all <10° and predominantly less than 6°) and the assemblage composition or density does not appear to vary significantly in relation to the class of slope, with the exception of the frequency of quartz (which may relate to chronological factors).

Landform Unit

Following the definitions of McDonald *et al* (1984), the study area can be subdivided into specific types of topographical features referred to as landform elements or landform units. Stages 2-4 of The Dairy includes simple slope, lower slope, spur crest, ridge crest, drainage depression and flat/wetland units (refer to Appendix 7 for definitions and Figure 14 for location plan).

The majority of the study area comprises simple slopes and this landform unit was also subject to a higher number of test areas (six) (Table 40). An overall mean artefact density of 26.85 artefacts/m^3 (16.42 artefacts/conflated m^2) occurs on the simple slopes. Only two lower slopes were tested (Test Areas 1A and 9A), with a mean artefact density of 72.21 artefacts/m^3 (37.13 artefacts/conflated m^2). As identified above, the density is inflated by inclusion of a single test unit in Test Area 1A that contains 128 artefacts (an unusually high count compared to the remainder of the study area).

Two test areas were excavated on the flat/wetland[3], with a mean artefact density of 32.64 artefacts/m^3 (21.82 artefacts/conflated m^2). The density on the flat/wetland is comparable to the simple slope, but there is significant internal variation on the flat/wetland. Test Area 8A comprised over 90% of this artefact sample, in association with midden deposits. Minimal evidence was present in Test Area 2A further distant from the Burrill Lake inlet.

Two test areas were excavated on the spur crest that dominates Stage 2, with a mean artefact density of 126.51 artefacts/m^3 (62.0 artefacts/conflated m^2), the highest density of any of the landform units. The ridge crest in Stage 4 was also excavated, with a mean artefact density of 53.71 artefacts/m^3 (34.73 artefacts/conflated m^2), which is also relatively higher than the slopes or flat/wetland.

Four test areas were excavated in drainage depressions, with a mean artefact density of 19.77 artefacts/m^3 (13.32 artefacts/conflated m^2). Notably, this is the lowest mean density of the six landform units.

Hence, the results indicate a strong trend for increased Aboriginal activity (resulting in artefact discard) on the spur crest landform unit. Artefact density is relatively low on the other units, particularly the drainage depressions, consistent with background discard. To assess this variable further, examination can be made of the site contents (eg. artefact and activity types) between the different landform units (Tables 46-49).

Although the nature of the samples are generally small and therefore caution must be applied in making inferences from this data, it is apparent that backing flakes, a clear indicator of on-site microlith production, were only identified on the elevated landform units (simple slopes, spur crest and lower slope). Similarly, microblade cores were only identified on the spur crest, ridge crest and lower slope. However, elongated flakes (microblades) were identified on all of the landform units, with higher frequencies on the ridge crest and spur crest. It can tentatively be inferred that backed artefact production occurred predominantly on the elevated landform units (where views of potential game on the basin/wetland may have been available and the soils may have been better drained). This may be in relation to small parties of male hunters preparing to hunt game with spears armed with barbs (backed artefacts) around the margins or within the basin.

The distribution of the finished product (eg. bondi points and geometric microliths) is more widespread across the landform units, including the drainage depression, but not the flat/wetland. Bondi points can be discarded away from their location of manufacture/hafting for several reasons, including accidental loss (eg. during transit or hunting).

Retouched flakes, often associated with backed artefact production, occur widely across the landform units. Six items appear to represent the failed production of backed artefacts and these occur on the drainage depression, simple slope and spur crest units. However, the only utilised retouched flakes occur on the lower slope and spur crest (Table 46).

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[3] The flat and wetland units can effectively be combined due to their similarity, particularly considering the environmental changes that have occurred during the late Holocene.

Comparison of the relative frequency of artefact types within each landform unit is constrained by the often small nature of the samples (eg. low numbers of specific types) (Table 47).

The frequency of artefacts by activity type shows minimal variation, with non-specific stone flaking dominant in every landform unit and minor frequencies of the other activities represented, including microblade production and discard in every landform unit (Tables 48 & 49). Non-microlith tool discard occurs in most landform units (apart from the ridge crest).

Environmental/Cultural Contexts

As discussed in Section 4, the landscape of The Dairy can be subdivided into discrete, recurring areas of land for which it is assumed that the Aboriginal land use and resultant heritage evidence in one location may be extrapolated to other similar locations. These 'environmental contexts' or 'archaeological terrain units' are defined on the basis of two environmental variables:

- Firstly, *landform element* (following the definitions of McDonald *et al* 1984); and
- Secondly, *class of slope* (following McDonald *et al* 1984).

However, evidence within a single archaeological terrain unit can also vary, in relation to different usage of the area by Aboriginal people. Hence, a series of cultural sub-contexts can be identified in an attempt to encompass the potential range of variation in heritage evidence within each environmental context (Figure 14, Table 3). These units are termed *environmental/cultural contexts* (after Kuskie 2000a) and a total of 12 have been identified within the study area (Table 3). An assessment of the density and nature of evidence within each of the contexts is presented below.

The mean artefact densities within each environmental context and each environmental/cultural context are compared in Table 50. In terms of environmental context (combination of landform unit and class of slope), there is a substantially higher artefact density in the moderate lower slope (context #1) and gentle spur crest (context #5) than in the other contexts. However, as discussed above, to some extent a significantly higher count within a single unit on the moderate lower slope may have biased these results. Nevertheless, the results indicate a trend for increased human activity (resulting in artefact discard) on the moderate lower slope that borders the wetland/basin and on the main spur crest in Stage 2. Artefact densities are slightly above average on three of the four level/very gentle environmental contexts (#6, 7 and 8), including the drainage depression, ridge crest and wetland. Notably, densities are very low on the level/very gentle flat (#2) and gentle drainage depression (#3) and below average on the gentle lower slope (#9) and gentle simple slope (#4) environmental contexts (Table 50).

These results indicate a degree of spatial patterning of evidence within The Dairy on the basis of environmental context (landform unit combined with class of slope). Further subdivision of the environmental contexts on the basis of hypothesised cultural criteria ('environmental/cultural contexts') allows examination of these results within individual environmental units (Table 50). The primary subdivision has occurred on the basis of distance (within or further than 200 metres) from the margin of the basin (Table 3). Significantly, these results reveal that environmental/cultural context 5A (gentle spur crest within 200 metres of the basin) exhibits the highest mean artefact density (93.45/conflated m^2 or 189.81/m^3). The density in this environmental context (gentle spur crest) is significantly higher within 200 metres of the basin than further than 200 metres from the basin (Table 50 and refer below). Similarly, the density in the gentle drainage depression environmental context is also substantially higher closer to the basin than further away (although the mean densities are far below the study area averages). The only other environmental context subdivided into separate environmental/cultural contexts was the gentle simple slope, which does not exhibit significant differences in terms of artefact densities either closer to or further from the basin.

For further assessment, examination can be made of the site contents (eg. artefact and activity types) between the different environmental contexts and environmental/cultural contexts (Tables 51-58).

Consistent with the results for the different landform units, flakes and flake portions dominate both in terms of counts and frequencies each of the different environmental contexts and each of the different environmental/cultural contexts (Tables 51, 52, 55 & 56). Although the nature of the samples are generally small and therefore caution must be applied in making inferences from this data, backing flakes, a clear indicator of on-site microlith production, only occur in three environmental contexts (#1, 4 and 5), but within the gentle simple slope occur in both cultural sub-contexts (#4a and 4b, both within and further than 200 metres from the basin). The end product, bondi points, occur more widely (in environmental contexts #1, 3, 4, 5, 6 and 7 and in environmental/cultural contexts #1a, 3a, 4a, 4b, 5a, 5b, 6a and 7a).

Comparison of the relative frequency of artefact types within each context is constrained by the often small nature of the samples (eg. low numbers of specific types) (Tables 52 & 56).

The frequency of artefacts by activity type shows minimal variation, with non-specific stone flaking dominant in every context and minor frequencies of the other activities occasionally represented (Tables 53, 54, 57 & 58). Microblade production occurs in every environmental context apart from #3 (gentle drainage depression) and every environmental/cultural context apart from #3a, 3b and 5b. No tools are evident in environmental contexts #2 and 8 (level/very gentle flat and level/very gentle wetland) or environmental/cultural contexts #2a, 3b and 8a.

Hence, as identified with analysis of the individual environmental factors, the results demonstrate some distinct patterning of evidence within The Dairy Stages 2-4. However, resolving finer patterns of spatial distribution or variations in evidence between different units is constrained to some extent by the size of the samples recovered. As informative artefact types (eg. tool types and key indicators such as backing flakes) typically comprise <5% of any assemblage, substantially larger artefact totals would be required for each unit of analysis to enable confident identification of statistically significant variations.

Distance to the Basin

The primary subdivision of environmental contexts occurred on the basis of distance (within or further than 200 metres) from the margin of the basin (Table 3). Excavation of a sample from each environmental/cultural context thereby has enabled samples for comparison in relation to this variable. It is assumed that Aboriginal activity would be focused closer to the basin due to the presence of resources from multiple zones.

The majority of the study area and consequently most of the Test Areas are located within 200 metres of the basin. Only Test Areas 4B1, 4B2, 5B and 3B occur further than 200 metres from the basin. As such, most of the assemblage (1815 artefacts or 84.7% of the total) occurs within 200 metres of the basin. However, despite the variation in artefact counts, the range of types present is generally similar (17 types within 200 metres compared with 15 types further than 200 metres) (Table 59).

The mean density of artefacts within 200 metres of the basin is a relatively low 28.03/conflated m^2 (43.48/m^3). However, the mean density of artefacts further than 200 metres from the basin is an even lower 14.86 artefacts/conflated m^2 (27.51/m^3). Hence, the results indicate a greater focus of Aboriginal activity within 200 metres of the basin in the study area.

Comparison of the relative frequency of artefact types and activity indicators with distance to the basin is constrained by the often small nature of the samples (eg. low numbers of specific types) (Tables 59 & 60). However, there appears to be no significant variation in terms of frequency of artefact or activity types relative to distance from the basin.

Aspect

The sampling strategy involved one sample area in each of the 12 environmental/cultural contexts identified, with an additional four samples obtained at the request of DEC from three of the contexts in order to address research questions pertaining to aspect and the potential ceremonial site. Test Areas 3A1, 4A2 and 4B1 have aspects away from the reported location of the possible ceremonial site and Test Areas 3A2, 4A1, 4A3 and 4B2 face towards it (refer to Section 4 for further details). Boot (*pers. comm*. 2004) proposes that the presence of a ceremonial site may have influenced the spatial evidence of occupation, with encampments located in respect of views toward or away from such a site and toward other culturally significant sites in the region such as Pigeon House Mountain. Boot (*pers. comm*. 2004) also suggests that large area, high density artefact scatters and/or middens representing longer term encampments may be expected in the vicinity of a ceremonial site.

Feary (1991) initially reported the possible presence of a ceremonial ground within the study area. However, in consideration of the oral and historical research, absence of physical evidence, and hearsay, third-hand nature of the original report, it is concluded that there is *no* evidence supporting the existence of a ceremonial ground directly within Stage 2 of 'The Dairy' (refer to Section 5.3).

Nevertheless, further examination of the artefact and activity types and frequencies between these Test Areas (in comparable environmental/cultural contexts to control for other factors) is presented in Tables 61-64. This comparison reveals various contradictions and no clear trends in the numbers or frequencies of artefacts, artefact types or activity types. For example, in environmental/cultural context #3A, only 1 artefact is present in Test Area 3A1 facing away from the purported ceremonial site, but 86 artefacts are present in Test Area 3A2 facing towards it. However in contrast, in environmental/cultural contexts #4A and 4B the inverse occurs, with 146 artefacts in 4A2 and 156 in 4B1 facing away from the purported ceremonial site, but only 61 in 4A1, 11 in 4A3 and zero in 4B2 facing towards it (Table 63).

No evidence is present in The Dairy Stages 2-4 for large area, high density artefact scatters and/or middens representing longer term encampments, or indeed for any form of encampment. The elevation, slope and extent of forest vegetation within the study area would have severely limited any vantage/views to just the immediate surrounding forest. Combined with the absence of views to Pigeon House Mountain, absence of evidence supporting the existence of a ceremonial site and further theoretical problems outlined below, it is concluded that this issue is essentially untestable in open-site archaeology. While in general terms it is quite possible that aspect to features such as sacred mountains may have been important in the location of some Aboriginal activities, such spiritual landscape concepts are at best scientifically difficult to assert and largely impossible to falsify.

Numerous other problems exist in relation to the issue of aspect, both in terms of potential views to or away from the ceremonial site, other culturally significant landmarks in the region (eg. Pigeon House Mountain) and as a factor in the choice of location of encampments. Theoretically, any inference that variations in the nature and density of evidence within an area relates to the presence or otherwise of a ceremonial site would be problematic to substantiate, unless the evidence could be demonstrated to be temporally contemporaneous.

Such an inference would be extremely difficult to assert without reliable direct dates. The dense forest vegetation would not only have substantially limited views from each location but also limited the amount of direct solar radiation. Levels of solar radiation (presumed to relate to the occupants comfort levels at an encampment or activity area) would vary depending on the time of day, time of year and local weather conditions. The excavation results demonstrate that evidence exists in contexts with a variety of aspects.

It is concluded that while aspect *may* have been a consideration to the local Aboriginal people, due to the myriad of variables potentially influencing activity location (economical, seasonal, social, cultural, spiritual, etc.) it is essentially unprovable in open-site archaeology.

5.8 Chronology

The potential age of the heritage evidence within Stages 2-4 of The Dairy can be assessed in relation to four criteria: direct dating, artefact typology, geomorphology and stratigraphical association.

<u>Direct Dating:</u>

Radiocarbon dates were obtained for five samples of shell from Test Area 8A (Appendix 8, Table 17).

A sample of marine shell at 0.9 to 1.0 metres depth in Unit EE35 was dated to 1252±41 years BP (Before Present) (*Wk16145*), which equates to an age calibrated to two standard deviations (95.4% probability) of 940-650 calBP (1010-1300 AD) (Appendix 8, Table 17). This date indicates that the mouth of the basin at The Dairy (adjoining the Burrill Lake inlet) was still forming with estuarine sand around 650 to 940 years calBP.

Two clusters of midden deposit in the adjacent beach sand deposits were dated to between 540 and 1340 years calBP (Appendix 8, Table 17). A sample from spit 2 in unit FF25 was radiocarbon dated to 1137±48 years BP (*Wk16145*), which equates to an age calibrated to two standard deviations (95.4% probability) of 870-540 calBP (1080-1410 AD) (Table 17). Radiocarbon dates were also obtained from units FF0 spit 4, EE0 spit 5 and FF5 spit 5 (Appendix 8, Table 17). The ages calibrated to two standard deviations overlap between 1220 and 1000 calBP (730 and 950 AD) and extend to between 1340 and 860 calBP. Hence, this cluster of evidence may represent a single event dating to this period, or a series of events between about 1340 and 860 calBP.

No samples of charcoal suitable for direct dating were identified in the test excavations. Although the evidence in Test Area 8A appears to be relatively recent (<1,000 years), other factors can be considered to assess the potential age of evidence from the remainder of the study area.

<u>Artefact Typology:</u>

Spear points fashioned by finely executed pressure flaking heralded the beginning of the "Australian Small Tool Phase". The best estimate for the first appearance of these points is 6,000-5,000 years Before Present (BP), which is the age range for specimens excavated from Nauwalabila rock shelter in Kakadu National Park, Northern Territory. The first appearances of the other implement types are spread over the succeeding millennia, and some even appear to be less than a thousand years old (Mulvaney & Kamminga 1999).

While there are claims of 6,000 years BP for microblade technology and delicately retouched microliths, their more certain first common occurrence in different regions dates to about 4,000 years BP. In the thousand years that followed, microlithic technology diffused across southern Australia, and became well established in south-eastern Australia, where microliths and knapping debris occur extensively in the uppermost sediments of Aboriginal camping localities. Microblade technology and microliths disappear at many archaeological sites in Australia between about 1,000-2,000 years BP, but in some regions of the east coast they may have continued until only a few hundred years ago. However, in the south-east generally, microliths disappeared about a thousand years ago (Mulvaney & Kamminga 1999).

The appearance of the "Small Tool Phase" in the South Coast region is distinguished primarily by the production of microblades and microliths, but the dating of this is imprecise. Perhaps the best estimate for the region, based on the general pattern of radiocarbon dates for south-eastern Australia, is 3,500 or possibly 4,000 years BP.

Test Areas 1A, 3A2, 4A1, 4A2, 4B1, 5A, 5B, 6A, 7A and 9A contain direct evidence of microliths (bondi points, geometric microliths) and therefore at least these items, if not also the associated deposits, are inferred to date to within the last 4,000 years BP (Table 29). Other evidence assumed to relate to microlith production and be of similar antiquity (eg. backing flakes and microblade cores) has also been identified in several of these test areas.

Notably however, of the five test areas[4] without direct evidence of microliths[5] (2A, 3A1, 3B, 4A3 and 8A), two are located on sand deposits assumed on the basis of radiocarbon dates and geomorphological evidence to date to the late Holocene (2A and 8A). There is also a higher frequency of quartz items in these test areas. Very low numbers of artefacts were present in the other test areas (1 in 3A1, 3 in 3B and 11 in 4A3). Although highly speculative, these data lend support to inferences that this evidence (in 2A and 8A) is more recent in age compared to the remainder of the study area. Such a hypothesis assumes that the decrease in the production of microliths and increase in the frequency of quartz proposed for the last thousand years accurately characterises the changing nature of lithic technology in south-eastern Australia (and this premise may be proved incorrect by future studies[6]). However, if correct in relation to the present study area, the hypothesis that evidence surrounding the basin is older than the evidence on the basin would fit comfortably with a hypothesis of Aboriginal activity having been undertaken around the margins of the basin when it was inundated with marine/estuarine water (eg. mid-late Holocene, c. 4,000 - 1,000 years ago). It could be inferred that after the basin transformed to a sandy flat, with more limited resources, the focus of occupation shifted closer to the inlet and the receding estuary. However, without further evidence, particularly direct dates from the sites further from the inlet, this inference remains highly speculatory.

Geomorphology:

A second type of indirect evidence on the age of the evidence is the sedimentological context. The geomorphological reconstruction and direct dates from Test Area 8A indicate that the sand deposits of the basin are relatively recent in age, thereby confining the potential for heritage evidence to the late Holocene.

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[4] Excluding Test Area 4B2 in which no artefacts were identified.
[5] Notwithstanding that two elongated, parallel side flakes ('microblades') occur in Test Area 2A (Ref. #303 & 304) and four occur in Test Area 8A (Ref. #1902, 1968, 2041 & 2070).
[6] Kamminga notes that there is evidence for the continued production of microliths in south-eastern Australia right up until the time of contact (eg. along the Darling River) (Kuskie & Kamminga 2000) and Kuskie (2004d) has identified a microlith within midden deposit dated to 540-290 calBP (*Wk14110*) at Merimbula. Hence, the technology may still have been used, albeit much less frequently.

However, the upper soil deposits on the elevated land surrounding the basin are inferred to extent back further in age than this. It is assumed that the formation processes of the upper unit of these soils are polygenetic and that the soils reflect the influence of both pedological and sedimentary depositional phenomena. The A unit soils are in a constant state of formation and transformation, through *in situ* weathering processes of underlying bedrock and subsequent downslope movement through bioturbation/erosion processes. Subsequently, the lower portions of slopes exhibit a deeper A unit than the upper slopes.

However, the extent to which these soils extend back in age is uncertain. Such soils are generally assumed to form relatively quickly (*cf*. Hughes 2000, Dean-Jones & Mitchell 1993) and date to the late Holocene. Earlier A horizon deposits formed partially by deposition of products of rainwash erosion and bioturbation themselves are being reworked and progressively moved downslope by the same processes. Hence at any given time in the past say - 50,000 years, the A horizon soils may have been essentially the same as those occurring today. There may be no surviving stratigraphic signature of these earlier events. Locally, the A horizons from time to time may have been partially or entirely stripped by extreme erosion events, to be replaced by new materials transported from upslope or formed *in situ* by bioturbation (Hughes 2000). This may be the case in Test Area 4B2, where no artefacts were identified.

Unless the A horizons are thick (at least 300 mm) and incorporate *in situ* older, dateable deposits in their basal levels, it will not be possible stratigraphically to distinguish older artefact assemblages from mid to late Holocene assemblages. Of course, the possibility that artefacts survive in the modern A horizon soil which are older than the sedimentological age of the unit itself cannot be discounted, although would be very difficult to determine archaeologically (*cf*. Hughes 2000).

<u>Stratigraphy:</u>

In The Dairy Stage 2-4 excavations several deeper soil deposits were identified with potential stratigraphy. These were identified in several of the units in the drainage depression bordering the western extent of the basin (Test Area 3A2) and the lower portion of the simple slope bordering the western extent of the basin (Test Area 4A1) (Appendix 4). The potential for heritage evidence that may, on the basis of stratigraphical association, be inferred to be of different ages to other evidence is discussed below. However, the significant effects of bioturbation on the vertical integrity of the evidence is noted.

In Test Area 4A1, unit D50 lowest on the slope exhibits a marine sand incursion around 17-35 cm depth below surface, below which the soils predate this event (Plate 50, Appendix 4). No heritage evidence was located in this unit.

In Test Area 3A2, units A15, B10 and B0 exhibit clear marine sand incursions (Appendix 4, Plates 42 & 44). In unit A15 this occurs between 19 and 27 cm depth, overlying a buried colluvial surface from 27-43 cm depth. Four grey silcrete artefacts occur in spit 1 (0-10 cm depth), including a bondi point. However, one grey silcrete flake portion (size class 3) occurs in spit 3 (20-30 cm depth) which is inferred to be within this area of marine sand incursion. Given the sandy nature of the deposit and the possible association of this artefact with the other grey silcrete items in spit 1, it is inferred that the artefact may rest on top of the marine sand (which undulates slightly) or has moved downwards by bioturbation.

In unit B10, the marine sand incursion is from 15-18 cm depth. Two grey silcrete flake portions occur in spit 2 (10-20 cm depth). Two grey silcrete flake portions and a grey silcrete lithic fragment (size classes 1 and 2) occur in spit 3 (20-30 cm depth), below this marine sand incursion. Also below this level are a white silcrete flake portion (size class 2) in spit 4 and a grey silcrete flake portion (size class 1) in spit 5. It is possible these items have migrated downwards through bioturbation or represent an earlier episode of occupation. If the latter is correct, it would presumably predate the marine sand and hence may be mid-Holocene in age.

In unit B0, the marine sand incursion is from 17-25 cm depth but towards the base comprises a series of thin layers alternating with the A_1 soil (Plate 44). Two silcrete artefacts occur in spit 2 (10-20 cm depth) and one in spit 3 (20-30 cm depth). All have a maximum dimension of 10 mm (size class 1). Hence, it is possible that the items in spit 2 occur above the marine sand incursion and the item in spit 3 has worked its way down through bioturbation.

Hence, within the basal slopes of Stage 3 of The Dairy and possibly other areas fringing the more sheltered side of the basin, evidence of the early-mid Holocene sea level rise in the form of sand deposits onlapping previous soil horizons has been identified. This context has the potential to host evidence from different temporal periods. Radiocarbon dating and assessments of the microfossils present within and through these well preserved vertical sequences would potentially provide a tight control on the nature and timing of the marine transgression.

5.9 Regional Context

The nature of the evidence from Stages 2-4 of The Dairy and the conclusions derived from the present study can be compared with those from studies of other sites within both the Burrill Lake locality and the broader South Coast region. The primary purpose is to identify similarities and differences with other reported evidence, in order to provide a framework for interpreting representativeness.

There are however, numerous problems and constraints in comparing evidence and conclusions from the present study with those of other studies, including different:

- Standards and quality of reporting;
- Unspecified or different methods of calculation (eg. artefact counts, density);
- Excavation methodology;
- Sampling strategies;
- Methods of artefact retrieval during sieving (including sieve mesh size);
- Identification of stone materials;
- Identification of artefact types and classes (eg. nomenclature, criteria and consistency in artefact classification);
- Identification of backing retouch; and
- Identification of use-wear and residue.

Despite these constraints, comparison is made below to the extent possible of The Dairy Stage 2-4 evidence with that from other sites in the locality and broader region.

Comparison with The Dairy Stage 1

Stage 1 of The Dairy lies immediately adjacent to the present study area (Figure 1). Salvage excavations undertaken by South East Archaeology using comparable techniques to the Stage 2-4 test excavations provide suitable data for comparison (Kuskie *in prep*., Figures 11-13, Tables 4-14; refer to Section 3.1.4 for description).

A substantially higher number of artefacts (6337 compared with 2142) was obtained in the Stage 1 salvage than the Stage 2-4 testing, a result of the more extensive hand and mechanical excavation area sizes. The two broad area hand excavations provide the most suitable data for comparison with the test excavations, because it was retrieved by controlled hand excavation in similar sized units and spits, using identical sieving and recording procedures. The localised hand excavations within the surface scrapes are less suitable for comparison because the sampling strategy differed (ie. it focused on significant clusters of evidence identified in the scrapes, rather than representing a targetted systematic stratified sample within specific contexts). The evidence retrieved by mechanical surface scrapes is generally not suitable for direct comparison with the test excavation results, due to the substantially different retrieval and sampling methodology.

Broad Area A (40 x 2 metres) was excavated in environmental/cultural context #5b (gentle spur crest further than 200 metres from the basin). The mean density of artefacts was very low (10.40 artefacts per conflated m^2 or 22.79 artefacts per m^3), which is even lower than the 30.55/m^2 or 59.26/m^3 identified in Test Area 5B in Stage 2 (same environmental/cultural context) (Tables 6 & 50).

Broad area B (40 x 2 metres) was excavated in environmental/cultural context #4a (gentle simple slope within 200 metres of the basin). The mean density of artefacts was very low (18.54/conflated m^2 or 31.25/m^3), but still marginally higher than the average of 13.21/m^2 or 17.88/m^3 identified in the three test areas in the same environmental/cultural context in Stages 2-4 (Test Areas 4A1, 4A2 and 4A3) (Tables 6 & 50).

The reasons for the differences may relate to sampling issues (the testing sample sizes are much smaller in comparison) or reflect marginally different intensity of Aboriginal use of the various areas. Comparison of the range and frequency of artefact and activity types can be undertaken to identify if there are any significant differences in the nature of evidence between these areas.

For environmental/cultural context 5B, there are 16 artefact types in Broad Area A compared to 13 in Test Area 5B, but this probably reflects the comparative differences in artefact counts (Table 65). Flakes and flake portions dominate both assemblages, with very low frequencies of other items. Bipolar flaking evidence is located in both assemblages, but backing flakes only are present in Broad Area A. Bondi points and geometric microliths occur in both assemblages (Table 65). Considering the relatively small sample sizes, both assemblages in context 5B appear to be substantially similar.

For environmental/cultural context 4A, there are 16 artefact types in Broad Area B compared to 11 in the 4A test areas, but this probably reflects the comparative differences in artefact counts (1483 v 218; Table 66). Flakes and flake portions dominate both assemblages, with very low frequencies of other items. Bipolar flakes, backing flakes and bondi points are located in both assemblages (Table 66). Considering the relatively small sample sizes, both assemblages in context 4A appear to be substantially similar.

Hence, direct comparison of evidence in similar environmental/cultural contexts and excavated using similar methods reveals a high degree of similarity between the assemblages in Stages 1 and 2-4. Although differences in artefact density occur, given the inverse relationships between the different contexts and the small sample sizes, it is inferred that these differences are not significant and are probably a result of the relative sample sizes.

In more broader terms, the combined evidence from Stage 1 can be compared with Stages 2-4, particularly in terms of stone and artefact type presence or absence and frequencies of use (Tables 67 & 68).

There are 25 artefact types identified in Stage 1 compared with 19 in Stages 2-4 (Table 67). However, the Stage 1 assemblage is three times larger (6337 v. 2142) and this result probably reflects the comparative differences in artefact counts. Both combined assemblages are dominated by flakes and flake portions (83.6% of Stage 1 v. 91.5% of Stages 2-4), with minor frequencies of other artefact types. Backing flakes, bipolar items, bondi points, geometric microliths, hammerstones, microblade cores, pebble cores, thumbnail scrapers, retouched flakes and utilised retouched flakes occur in both assemblages and often in similar frequencies (Table 67).

Comparison of the stone materials also reveals a marginally greater range in Stage 1, which can also be attributed to the larger sample size (Table 68). Significantly, both assemblages are overwhelmingly dominated by silcrete and in similar proportions (88.75% in Stage 1 v. 86.32% in Stages 2-4) and quartz is the next most common material, also in a similar proportion (6.56% v. 7.33%).

Comparison of the frequency of activity type indicators between the combined Stage 1 and combined Stages 2-4 assemblages also reveals a strong degree of similarity between the nature and frequency of these indicators (Table 69).

The sizes of the lithic items is also very comparable (Table 70). The evidence in the Stages 2-4 test excavations occurs in a similar vertical distribution to the Stage 1 broad area excavations, with a modest frequency in spit 1 (13.96% v. 19.91% in Stage 1), peak counts in spit 2 and a progressive decline with greater depth. However, the peak density appears to be more evenly spread over 10-30 cm depth in Stages 2-4, whereas it more clearly occurs in 10-20 cm depth in Stage 1. This probably reflects sampling factors, with the Stage 1 excavations only occurring in two locations, compared with the 16 locations (and in some cases, much deeper soil profiles) for the Stages 2-4 testing.

In overall terms, it is concluded that there is a high degree of similarity between the evidence in Stage 1 and Stages 2-4 and the minor differences are satisfactorily explained in relation to differences in the relative sample sizes.

<u>Comparison with the Burrill Lake Rock Shelter</u>

The Burrill Lake rock shelter site (DEC #58-1-24) is located less than 0.5 kilometres west of The Dairy, approximately 180 metres back from the present lake shore. It was first investigated in 1930 by J. S. Rolfe and F. D. McCarthy and later by Thorpe (1931) and Lampert (1971) (refer to Section 3.2). Lampert (1971) excavated 35 m^2 of the shelter and recovered 6,509 artefacts from Trenches A and B.

Although direct comparisons are constrained by the issues referred to above, including different methods, terminologies and sampling strategies, an assessment can be made of the general similarities and differences of this evidence with The Dairy Stages 2-4.

The most striking differences between the two assemblages include the:

- Environmental context (rock shelter compared with open artefact sites at The Dairy);

- Age of some of the evidence (c.20,000 years BP at the Burrill Lake rock shelter compared with dated or inferred late Holocene evidence at The Dairy); and

- Nature of the contents (considerable faunal and fish material preserved in the last 1,660 years or so of deposit in the Burrill Lake shelter, whereas none present in The Dairy).

In general terms however, there are also some similarities between the evidence, including:

- Cockle dominating the midden deposits of the late Holocene in both the Burrill Lake shelter and Test Area 8A of The Dairy;

- Similar stone materials, including silcrete, quartz and rhyolite;

- Predominance of items represent non-specific stone flaking (debitage);

- Low frequency of items with retouch and/or use-wear (3.4% at Burrill Lake shelter compared with 4.5% at The Dairy Stages 2-4);

- Presence of 'scrapers' and backed artefacts in both assemblages; and

- Probable similar utilisation of the forest, lake and sea for subsistence resources.

In reality the mere context of the Burrill Lake rock shelter, with its depositional and stratified deposits, along with its dated Pleistocene evidence, establishes it as significantly different from the open artefact sites of The Dairy.

<u>Comparison with Other Regional Evidence</u>

As outlined above, there are numerous constraints in comparing evidence within a regional context, but on a general level a number of similarities and differences can be identified between Stages 2-4 of The Dairy and other regional evidence outlined in Section 3.2:

- Predominance of stone artefact evidence, but also the presence of shell midden deposits in estuarine fringing coastal sand contexts;

- Predominance of cockle in the Test Area 8A midden deposits, with a range of other estuarine and also rocky shore species in lower frequencies, similar to some middens but also contrasting to other middens around Burrill, Tabourie, Termeil, Meroo and Williga Lakes (*cf.* White 1987a, 1987b);

- Similar stone material and artefact types to those generally reported in the region (*cf.* Knight 1996);

- Predominance of evidence relating to non-specific stone flaking, but also evidence of microblade and microlith production, along with non-microlith and microlith tool use;

- Generally small size of artefacts;

- Low artefact density; and

- Presence of evidence in similar environmental contexts in the coastal lowlands (eg. gradient and landform units).

No specific aspects of The Dairy Stages 2-4 evidence appear to be rare or unusual or not replicated elsewhere within a regional context.

Although few open artefact sites have been subject to controlled hand excavation in the Ulladulla area, comparison with open sites in similar environmental contexts from further afield may be useful in identifying the relative intensity of occupation (using artefact density as a basic measure) of the Stages 2-4 evidence. The mean artefact density of 39.94/m^3 (or 24.69 per conflated m^2) in Stages 2-4 is low in absolute terms, but also relatively low when compared with a number of sites excavated in similar coastal lowland contexts:

- At site #58-2-261, located on the level/very gentle termination of a spur crest and adjacent very gentle to gentle simple slopes at St. Georges Basin, near Tomerong Creek and a wetland, Kuskie (2000b) excavated 7.88 m^2 (3.059 m^3) to recover 131 artefacts and 45 lithic fragments. The overall mean density of lithic items was marginally higher than The Dairy Stages 2-4 at 57.5/m^3 (22.33 conflated/m^2);

- At site #38-4-376 (Black Hill 2), located in the coastal lowlands on a level/very gentle to gently inclined ridge crest and simple slopes bordering Hexham Swamp near Newcastle, a former estuary that transformed to saltwater then freshwater swamps in the late Holocene, Kuskie and Kamminga (2000) excavated 364 test units (22.75 m^2 or 7.319 m^3) and two broad areas (totalling 63 m^2 or 14.496 m^3), along with surface scrapes and smaller hand excavations. A total of 12,222 artefacts (excluding lithic fragments) were retrieved from the test units and broad areas. The overall mean density of these artefacts was substantially higher than The Dairy Stages 2-4 at 560.26/m^3 (142.53 conflated/m^2);

- At site #38-4-410 (Woods Gully), located in the coastal lowlands on a gentle drainage depression and simple slopes 0.8-1.0 kilometres inland from Hexham Swamp, Kuskie and Kamminga (2000) excavated 248 test units (15.5 m^2 or 7.507 m^3) and one broad area (87 m^2 or 33.997 m^3), along with surface scrapes. A total of 8,694 artefacts (excluding lithic fragments) were retrieved from the test units and broad area. The overall mean density of these artefacts was substantially higher than The Dairy Stages 2-4 at 209.47/m^3 (84.82 conflated/m^2);

- At Black Hill, Silcox and Ruig (1995) excavated site Black Hill 1, #38-4-375, located on a level to gently inclined ridge crest and slopes bordering Hexham Swamp. A total of 218 test units (3.507 m^3) were excavated to reveal 663 artefacts at a mean density of 190/m^3 (48.7 conflated/m^2), also significantly higher than The Dairy; and

- At Sandon Point, Hiscock (2002) recalculates Navin Officer's data at 87 artefacts/conflated m^2, also substantially higher than The Dairy.

5.10 Interpretation

In general terms, the nature of occupation within the study area could represent a variety of circumstances as outlined in detail in Section 4:

- Transitory movement;
- Ceremonial activity;
- Hunting and/or gathering (without camping);
- Camping by small hunting and/or gathering parties;
- Nuclear/extended family base camp;
- Community base camp; or
- Larger congregation of groups.

The evidence could represent a single episode or multiple episodes of one or more of the above types of occupations. Multiple episodes of occupation would tend to exhibit superimpositioning of evidence (eg. mix of unrelated stone materials and artefact types and activity areas). However, identifying which items belong to which activity events can be problematical. Also, distinguishing the effects of post-depositional disturbance from cultural superimpositioning is problematical (*cf.* Koettig 1994). Another indicator of multiple occupation is an expectation of a relatively higher density of artefacts within a locality (combined with superimpositioning). Larger areas of occupation may also result, when occupations only partially overlap (eg. Camilli 1989).

The episodes of occupations could have occurred at different times over the entire time-span of occupation in the region. Identification of such episodes would require *in situ* deposits with stratified or vertically separated evidence of activity events and datable material.

Each episode of occupation could also have been for a different duration of time. Identification of the duration of individual episodes of occupation may prove very difficult. Where a single episode of occupation has occurred, a greater quantity of items and frequency of discrete activity events may be indicative of a longer stay.

Each of the Test Areas is assessed below in relation to the criteria presented in Section 4 for the above occupation types. It is noted that the hypothesised occupation types and criteria, although derived from numerous studies and empirical evidence, involve many assumptions which may be subject to reassessment in relation to the results of future studies.

An explicit assumption of the cultural landscape approach is that the evidence and interpretations from one location (eg. a single test area within a specific environmental/cultural context) may be extrapolated to other similar locations (ie. applied to the environmental/cultural context unit as a whole).

<u>Test Area 1A:</u>

It is inferred that the evidence in Test Area 1A, on the moderate lower slope, represents transitory movement and/or hunting and/or gathering without camping, undertaken in multiple episodes each of short duration. Silcrete backed artefact production occurred, possibly by small parties of men gearing up to hunt with spears along the adjacent estuarine inlet/basin, at a location where they may have had a vantage over their prey. Microliths were discarded, some in apparent association with their location of manufacture and others possibly away from their location of manufacture. Minor food processing and/or equipment maintenance tasks may have been undertaken, as inferred by the presence of several utilised artefacts.

<u>Test Area 2A:</u>

It is inferred that the evidence in Test Area 2A, on the level/very gentle flat, represents transitory movement and/or hunting and/or gathering without camping, undertaken in multiple episodes each of short duration. Microblade production using quartz may have occurred at the base of the slope joining the sandy flat. It is inferred from the higher frequency of quartz utilised and recent formation history of the sand flat, that occupation of this context only occurred in the late Holocene. Almost all evidence is located in two test units on the basal-most portion of the adjacent slope. Hence, the intensity of use of the vast majority of the infilled basin is inferred to have been very low, possibly as a result of dense vegetation and/or the frequent presence of standing water.

Test Areas 3A1 and 3A2:

It is inferred that the evidence in Test Area 3A1, on the lower portion of a gentle drainage depression in Stage 2, represents possibly only a single episode of transitory movement. It is inferred that either dense vegetation or poor drainage conditions made this locality unfavourable for use.

In contrast, it is inferred that the evidence in Test Area 3A2, on the lower portion of a gentle drainage depression between Stage 1 and Stage 3 at the western end of the basin, represents transitory movement and/or hunting and/or gathering without camping, undertaken in multiple episodes each of short duration. Microliths were discarded, possibly during the course of movement or hunting. A silcrete thumbnail scraper appears to have been produced and discarded. Minor bipolar flaking of quartz has occurred. On the basal slopes, evidence of activities from different temporal periods (before and after the mid-late Holocene sea level rise/deposition of fringing sand deposits) is possible.

Test Area 3B:

It is inferred that the evidence in Test Area 3B, on the portion of the gentle drainage depression in Stage 2 more distant from the basin, represents possibly only several episodes of transitory movement. It is inferred that either dense vegetation or poor drainage conditions made this locality unfavourable for use.

Test Areas 4A1, 4A2 and 4A3:

It is inferred that the evidence in Test Area 4A1, on the gentle simple slope in Stage 3 at the western end of the basin, represents transitory movement and/or hunting and/or gathering without camping, undertaken in multiple episodes each of short duration. Silcrete backed artefact production occurred, possibly by small parties of men gearing up to hunt with spears along the adjacent basin, at a location where they may have had a vantage over their prey. Microliths were discarded, some in apparent association with their location of manufacture and others possibly away from their location of manufacture. Minor bipolar flaking of quartz has occurred.

It is inferred that the evidence in Test Area 4A2, on the gentle simple slope flanking the spur crest in Stage 2 at the western end of the basin, represents transitory movement and/or hunting and/or gathering without camping, undertaken in multiple episodes each of short duration. Silcrete backed artefact production occurred, possibly by small parties of men gearing up to hunt with spears along the adjacent basin, at a location where they may have had a vantage over their prey. Microliths were discarded, some in apparent association with their location of manufacture and others possibly away from their location of manufacture.

It is inferred that the evidence in Test Area 4A3, on the gentle simple slope in the eastern portion of Stage 2, represents transitory movement and/or hunting and/or gathering without camping, undertaken in multiple episodes each of short duration. It is inferred that either dense vegetation or poor drainage conditions made this locality unfavourable for greater use.

Test Areas 4B1 and 4B2:

It is inferred that the evidence in Test Area 4B1, on the gentle simple slope flanking the spur crest in Stage 2 but further than 200 metres from the basin, represents transitory movement and/or hunting and/or gathering without camping, undertaken in multiple episodes each of short duration. Silcrete backed artefact production occurred, possibly by small parties of men gearing up to hunt with spears along the nearby drainage and basin. A hammerstone was discarded at one location of backed artefact manufacture, possibly to be re-used at a later time. A microlith was discarded, apparently away from its location of manufacture.

No evidence was identified in Test Area 4B2, on the gentle simple slope in the south-eastern portion of Stage 2. It is inferred that the absence of evidence primarily represents the effects of previous erosion events. However, dense vegetation and/or the distance of this area (greater than 200 metres) from the basin may also have contributed to this result by making this locality generally unfavourable for use.

Test Area 5A:

It is inferred that the evidence in Test Area 5A, on the lower portion (within 200 metres of the basin) of the gentle spur crest that dominates Stage 2, represents transitory movement and/or hunting and/or gathering without camping, undertaken in multiple episodes each of short duration. Silcrete backed artefact production occurred, probably by small parties of men gearing up to hunt with spears along the adjacent basin, at a location where they may have had a vantage over their prey. In fact, this context appears to have been the most favoured location in the study area for the production of backed artefacts and has potentially been repeatedly visited over time. Microliths were discarded, mainly in apparent association with their location of manufacture, with a low frequency possibly discarded away from their location of manufacture. Minor food processing and/or equipment maintenance tasks may have been undertaken, as inferred by the presence of one utilised artefact.

Test Area 5B:

It is inferred that the evidence in Test Area 5B, on the portion of the gentle spur crest that dominates Stage 2 further than 200 metres from the basin, represents transitory movement and/or hunting and/or gathering without camping, undertaken in multiple episodes each of short duration. Some production of backed artefacts may have occurred (although direct evidence was not strong) and several microliths were discarded in these locations. However, other microliths (including a utilised item) were apparently discarded away from their location of manufacture, probably during hunting events. Minor bipolar flaking of quartz has occurred.

Test Area 6A:

It is inferred that the evidence in Test Area 6A, on the level/very gentle drainage depression between Stage 2 and Stage 3 at the western end of the basin, represents transitory movement and/or hunting and/or gathering without camping, undertaken in multiple episodes each of short duration. Silcrete backed artefact production occurred, possibly by small parties of men gearing up to hunt with spears along the adjacent basin. Microliths were discarded, some in apparent association with their location of manufacture (along with a thumbnail scraper) and others possibly away from their location of manufacture.

Test Area 7A:

It is inferred that the evidence in Test Area 7A, on the level/very gentle ridge crest in Stage 4, represents transitory movement and/or hunting and/or gathering without camping, undertaken in multiple episodes each of short duration. Silcrete and chert backed artefact production occurred, possibly by small parties of men gearing up to hunt with spears along the adjacent estuarine inlet/basin, at a location where they may have had a vantage over their prey. Microliths were discarded, mostly in apparent association with their location of manufacture.

Test Area 8A:

It is inferred that the evidence in Test Area 8A, on the level/very gentle wetland (but effectively sand deposits bordering the estuarine inlet/basin), represents the procurement of shellfish primarily from the adjacent estuarine lake inlet and to a lesser extent the nearby rock platforms, and transport of the shellfish from those locations to the estuarine fringing sand deposits, where food preparation and consumption occurred, along with stone knapping. A single meal event involving a small group of people for a short duration occurred between 870-540 calBP (1080-1410 AD). A more extensive event, either a single but major meal event (eg. multiple individuals), or more likely a series of repeated events within a relatively short period of time (eg. a small group of people returning to the same place in a season or over successive seasons) occurred between 1340 and 860 calBP.

Test Area 9A:

It is inferred that the evidence in Test Area 9A, on the gentle lower slope fringing the basin, represents transitory movement and/or hunting and/or gathering without camping, undertaken in multiple episodes each of short duration. Silcrete backed artefact production occurred, possibly by small parties of men gearing up to hunt with spears along the adjacent estuarine basin. A microlith was discarded, possibly away from its location of manufacture. Minor food processing and/or equipment maintenance tasks may have been undertaken, as inferred by the presence of a single utilised artefact.

General Inferences - Local Model of Occupation:

As outlined in Sections 3.2 and 4, several broad regional models of occupation have been forwarded to account for the pattern of recorded site distribution on the South Coast. In a small spatially discrete study area such as The Dairy, it is not possible to retrieve adequate data to test or reassess these broader models. However, a more local model of occupation (of which the basic tenets for the study area are proposed below) can be constructed based on the known pattern of site distribution, ethnohistorical and ethnographical evidence, and the results of archaeological work undertaken to date in the locality (refer to Section 3). Such a model can attempt to explain Aboriginal activity and settlement patterns at a local level. Given the relative paucity of detailed archaeological investigation in the locality (eg. excavation), the model involves hypotheses to be tested by further research.

It is inferred from the evidence obtained during the survey and test excavations of The Dairy Stages 2-4 and from other sources that:

- Members of the Murramarang people, a clan of the Yuin related to the Walbanga and Wandandian groups, predominantly occupied the locality, within the past 4,000 years. Occupation of the region extended as far back as at least 20,000 years Before Present, however prior to inundation of the basin with marine/estuarine water in the early to mid Holocene (c. 7,000 - 6,000 years ago), the study area did not represent an environment conducive to Aboriginal occupation;

- As the sea level rose, the basin transformed from a small valley into initially a coastal embayment, while Burrill Lake formed an open bay, and later to an estuarine extension of Burrill Lake. For the first time, the area became attractive to Aboriginal people as the presence of marine then estuarine resources adjacent to the eucalypt forests provided more abundant subsistence resources in this location than hitherto had been available. However, potable water supplies remained limited, essentially confining much of the Aboriginal activity to transitory movement and hunting/gathering without camping, around the margins of the drowned basin;

- After about 3,600 years BP a rapid decline in the sea level of approximately one metre occurred, although until 1,500 years BP the sea level still remained about one metre above the present level. As the sea level fell, the western portion of the basin may have transformed to a saltmarsh or sand flat. The basin eventually became disconnected from the remainder of the Burrill Lake estuary by the build up of sand deposits in the inlet across the basin mouth, possibly quite late in the Holocene. The availability of estuarine resources would have gradually constricted towards the present lake inlet. As such, the focus of Aboriginal hunting/gathering activity may also have shifted closer to the inlet (in the last millenium or so). Around the basin, potable water supplies remained limited, essentially confining much of the Aboriginal activity to transitory movement and hunting/gathering without camping;

- Occupation of Stages 2-4 of The Dairy involved transitory movement and hunting/gathering without camping, undertaken in multiple episodes each of short duration. The overall spatial distribution and nature of evidence in Stages 2-4 is a low density distribution of artefacts consistent with background discard, interspersed by a low number of discrete activity areas in which more focused activity has occurred, predominantly in relation to the production of backed artefacts;

- The spatial patterning and relatively low density of artefacts and activity areas indicates that occupation of the study area was of a relatively low intensity (ie. episodic, short duration, low numbers of people and/or very infrequent over time) and that occupation by large numbers of people, for long durations or repeated major activity is unlikely to have occurred. There is no direct evidence for encampments having been situated within the study area (which is consistent with the generally absence of potable water), although the possibility of temporary encampments by small parties of hunters and/or gatherers cannot be discounted;

- Backed artefact production is the main activity type identified and occurs widely around the basin. It is assumed to have been undertaken by small parties of men gearing up to hunt with spears along the adjacent estuarine inlet/basin. Retooling (eg. refitting of spear barbs onto spear shafts) occurred in discrete areas typically in association with the production of new backed artefacts. Backed artefact production appears to have often occurred in contexts where the hunters may have had a vantage over their prey. Activity areas involving backed artefact production typically only involved a single stone material, silcrete, and resulted in the discard of some finished products (microliths) at the site of production. However, microliths were also discarded away from production areas, potentially indicating loss during use or intentional or accidental discard in these locations;

- The gentle spur crest within 200 metres of the basin (environmental/cultural context 5A) and the moderate lower slope bordering the basin/inlet (environmental/cultural context 1A) exhibit a relatively higher frequency of artefacts and discrete activity areas (backed artefact production events), indicating a preference for backed artefact production and retooling in these contexts;

- The stone material silcrete was strongly favoured for stone-working activities. Silcrete was probably procured from local sources around Ulladulla, including coves along the shoreline where it is found in the form of pebbles and cobbles. Other stone materials (eg. quartz, rhyolite, quartzite, chert and other volcanics) were also used, but in much lower frequencies;

- A proportion of the silcrete used was intentionally thermally altered, although no specific evidence was recovered to indicate that this process was undertaken on-site. This process may have been undertaken to improve the fracture properties of the stone and possibly to produce desired colours that had symbolic meaning; and

- Bipolar knapping occurred infrequently and represents opportunistic, casual knapping of quartz as an alternative to the preferential use of silcrete.

<u>Further Inferences and Hypotheses - Regional Model of Occupation:</u>

In relation to the broader Ulladulla region, it can further be inferred or hypothesised that:

- Occupation was predominantly focused on the relatively more abundant and diverse resource rich zones within the tribal territory (eg. the junction of multiple resource zones) particularly along the margins of the coast, estuaries, lakes and rivers. Within the *primary resource zones*, such occupation could include nuclear/extended family base camps, community base camps and occasional larger congregations of groups where resources permitted. Encampments in more favourable locations (eg. abundant resources and water) may have been the subject of stays of longer duration and more frequent episodes of occupation than in other areas (eg. secondary resource zones, refer below);

- Not withstanding the point above, widespread, generally low intensity, usage of the entire tribal territory;

- Outside of the primary resource zones sporadic occupation of *secondary resource zones*, focused on the watercourses, particularly within close proximity (eg. 50 metres) of higher order watercourses and associated flats and terraces. These zones were utilised for encampments by small parties of hunters/gatherers and nuclear/extended family groups during the course of the seasonal round. There was a strong preference for camping on level ground, adjacent to reliable water sources and more abundant subsistence resources. A greater range and frequency of activities were undertaken at the encampments, rather than in the surrounding landscape. Camp sites along the watercourses were occupied by these small groups of people for varying lengths of time (but of typically short duration), during both the course of the seasonal round and in different years. Occupation of these camp sites was predominantly sporadic, rather than continuous;

- Occupation outside of the primary resource zones and secondary resource zones tended to involve hunting and gathering activities by small parties of men and/or women and children, along with transitory movement between locations and procurement of stone materials. However, the utilisation of these areas (eg. typically simple slopes, ridge crests, spur crests and lower order watercourses) was far less intense than along the higher order watercourses or lake/estuary margins where encampments were situated and potable water and more abundant resources present. These areas outside of the primary and secondary resource zones were probably typically exploited during the course of the normal daily round by inhabitants of encampments located in the primary or secondary resource zones, foraging within an area of up to ten kilometres radius from their campsites;

- Occupation outside of the primary and secondary resource zones also involved special purpose journeys (eg. to procure stone from a known source or to access an area for ceremonial/spiritual purposes) and non-secular activities (eg. ceremonial activities);

- Thus, occupation extended over the entire tribal territory, with varying intensities and involving different activities, and occurring at different times of the year and different periods within the overall time-span of occupation;

- Activities such as food procurement (hunting, gathering and land management practices such as burning-off), food processing, food consumption, maintenance of wooden and stone tools, production of stone tools (including systematic production of types such as backed artefacts, as well as hafting of implements and casual, opportunistic production of other items on an as needed basis), production of wooden tools and other implements, procurement of stone, erection of shelters, children's play, ceremonial activity, spiritual activity, human burials and social and political activity are among the types of pursuits engaged in by the local Aboriginal people across the tribal territory;

- Activities varied in frequency and occurrence within the landscape (and between the different occupation site types), probably in relation to numerous variables such as topography, distance to resource zones, distance to water, aspect, slope and cultural choice. However, few activities are evident within the archaeological record other than those involving the use of stone, or where preservation conditions permit, other materials such as bone, shell and wood. The majority of evidence within an archaeological context will relate to the reduction of stone, but some evidence will exist of hearths, food processing, food procurement and ceremonial and other activities;

- The stone materials silcrete, volcanics such as rhyolite and quartz were favoured for stone working activities, with the relatively intensity of use of each material dependent upon the proximity of local sources;

- Stone was typically procured during the course of normal daily and seasonal movements, without the need for special purpose trips. The conservation of the most commonly used stone materials was not a priority. However, high quality less commonly utilised materials may have been procured from more distant sources by special purpose journeys and/or trade;

- Heat treatment of silcrete was undertaken to improve flaking qualities and possibly to obtain desired colours. Kuskie and Kamminga (2000) speculate that colours had important symbolic meaning in Aboriginal society, and part of the reason for heat treatment may have been to obtain a desired colour as well as to improve the flaking properties of the stone. This may have been especially important for armatures of fighting and hunting spears;

- Production of backed artefacts was time-consuming and resulted in a considerable quantity of stone debitage at localities where it was undertaken. It is speculated that the end purpose (hunting or fighting spears armed with stone barbs) must have been highly desirable and socially valuable (*cf.* Kuskie & Kamminga 2000). Hunting larger animals with spears was also a high-risk subsistence activity (in terms of invested time, energy and the price of failure), whereas most dietary requirements could be adequately met through low-risk means (ie. more reliable in terms of time, energy and return). Global scale analyses have demonstrated that in lower latitudes, with longer plant-growing seasons, plants and small land fauna are prominent in the economy of hunter-gatherer people *(cf.* Binford 1980, Torrence 1983), along with seafood along the coast. The investment of considerable time and energy in the production and hafting of backed artefacts to hunting and fighting spears may well have been undertaken as much in relation to the social value of these items and tasks as strictly utilitarian need (Kuskie & Kamminga 2000);

- Casual and opportunistic reduction of stone or selection of flakes to meet requirements on an 'as needed' basis was a widespread occurrence. Suitable flakes (sometimes after being retouched) were used in domestic tasks such as fashioning or repairing a wooden implement, while a higher proportion of flaked products were simply discarded at the site of their manufacture, without use;

- A low frequency of items was knapped using bipolar technology. This technology is largely, although not entirely, restricted to the reduction of quartz. It is likely that this technology was mainly employed to reduce small pebbles rather than as strategy to prolong the life-use of existing cores;

- Plant foods were processed and consumed at temporary hunter/gatherer encampments, at family base camps, and where larger groups of people congregated, as well as at the sites of procurement. A range of plant resources was available in the region. Women played a much larger role than men in obtaining and processing plant foods; and

- Animal and seafoods were processed and consumed at temporary hunter/gatherer encampments, at family base camps, and where larger groups of people congregated, as well as at the sites of procurement. Men hunted for larger game and fish, while women played a key role in obtaining smaller game, fish and shellfish.

The proposed model of occupation for the broader Ulladulla region has been derived from archaeological, ethnographic, ethnohistorical and anthropological information. However, as these data are generally scant and subject to biases and other constraints, the proposed model is highly inferential and speculative in nature and subject to reassessment by more detailed future investigations throughout a wide range of environmental/cultural contexts in the South Coast region.

5.11 Synthesis of Results

General Summary:

Test excavations within Stages 2-4 of The Dairy were undertaken within 16 separate Test Areas, as per the proposed research design (refer to Section 4, Figure 14). Each test area comprised a sample of units, each measuring 0.5 x 0.5 metres in area, excavated at five metre intervals on a 50 x 5 metre grid (Figures 15-30). In all but one of the 16 test areas, a total of 22 test units were excavated for a total area of 5.5 m^2 in each Test Area.

In total, 347 test units each measuring 0.25 m^2 in area were excavated, resulting in a total excavation area of 86.75 m^2. A total of 1562 separate excavation unit spits (0.5 x 0.5 metre area x 10 centimetre depth) were excavated. A total volume of deposit of 53.63 m^3 (53,630 litres) was excavated and wet-sieved.

A total of 2142 stone artefacts were recovered from the test excavations, along with shell midden deposits in Test Area 8A. Artefacts occurred at a relatively low overall mean density of 39.94/m^3 (or 24.69 per conflated m^2). Artefact density per individual excavation unit spit varied substantially, from nil to a peak of 2451.61 artefacts/m^3 in spit 3 of unit BB45 in Test Area 1A (which also represents the maximum artefact count in a single excavation unit spit of 76).

Based on analysis of the history of land use and natural processes, distributions of stone artefacts, and conjoins and inferred associations between artefacts, it is concluded that the identified and potential Aboriginal heritage resources within Stages 2-4 have been affected by a number of post-depositional processes. In limited areas, particularly within Stage 4, the impact levels are high and equate to total destruction of deposits or very low integrity of evidence. Impact levels at many of the identified site loci also tend to be high due to the nature of their exposure within areas of recent ground disturbance or erosion. However, over much of the study area, although widespread, the levels of impacts are not as high. Although evidence from the test excavations indicates that considerable vertical mixing of deposit has generally occurred, primarily through bioturbation, there may have been limited post-depositional lateral movement of evidence.

A total of six different categories of stone material were identified in the test excavation assemblage. The combined assemblage was overwhelmingly dominated by silcrete (86.32%), with low frequencies of quartz (7.33%) and rhyolite (4.53%) and very low frequencies of quartzite (0.70%), chert (0.65%) and other volcanics (termed 'volcanic 1') (0.47%). Silcrete sources occur around Ulladulla and silcrete is also found in the form of pebbles and cobbles washed into coves along the shoreline between Ulladulla and Batemans Bay. Hence, the material was readily available in transportable form, only a short distance from the study area. Evidence exists that a proportion of the silcrete artefacts were made from stone that was intentionally thermally altered, although no specific evidence was recovered to indicate that this process was undertaken on-site.

A total of 19 categories of artefacts were identified (Tables 28-30, Figure 57). The combined Stage 2-4 test excavation assemblage is overwhelmingly dominated by flakes (40.8%) and flake portions (50.7%) (including proximal, distal, medial and longitudinal portions). The remainder of the assemblage comprises a very low frequencies of items, including lithic fragments (synonymous with 'flaked piece', 2.52%), retouched flakes (2.19%), bondi points (1.68%) and ten or less nondescript core fragments, nondescript cores, microblade cores, pebble cores, backing flakes, bipolar flakes, utilised retouched flakes, thumbnail scrapers, geometric microliths, utilised geometric microliths and hammerstones.

Many of the categories and much of the evidence represents debris or debitage from stone knapping (eg. flakes and flake portions). The knapping can be non-specific or demonstrably relate to the production of microliths. A number of the artefact categories denote formal tool types (eg. bondi point and hammerstone). Therefore while it can be inferred that a proportion of the Aboriginal activity within the study area relates to the production of microblades and microliths, presumably to arm spears, much of the stone artefact evidence represents debitage from which the specific activities cannot be reliably inferred. No tools or activity areas indicative of encampments or comparable focused occupation were identified.

Three loci of shell midden evidence have been identified, all within the open space near Dolphin Point Road and Bonnie Troon Close. These include loci M and N of Site Dolphin Point 4 identified by South East Archaeology in February 2004 and a third locus of midden deposit identified during the present excavations in Test Area 8A. A total of at least 15 shell species were identified in Test Area 8A, but the midden is predominantly comprised of cockle. Two primary clusters of midden occur in Test Area 8A, representing the procurement of shellfish primarily from the adjacent lake inlet and to a lesser extent the nearby rock platforms, and the transport of shellfish from those locations to the site where food preparation and consumption occurred. The two clusters vary in that:

- Cluster EE-FF25 is a relatively small, focalised activity event (ie. possibly a single meal event involving a small group of people for a short duration) that occurred between 870-540 calBP (1080-1410 AD); whereas

- Cluster EE-FF-0-10 is more extensive in area and probably contains significantly higher quantities of shell, along with more evidence of stone knapping. It may represent a single but major meal event (eg. multiple individuals), or more likely a series of repeated events within a relatively short period of time (eg. a small group of people returning to the same place in a season or over successive seasons) between 1220 and 1000 calBP (730 and 950 AD) where the radiocarbon dates overlap (or at most, between 1340 and 860 calBP).

The spatial distribution of evidence within Stages 2-4 has been examined to determine whether there are focal points of activity or particular relationships between Aboriginal behaviour and aspects of the locality's environment. The results demonstrate some distinct patterning of evidence, with a trend for a relatively higher frequency of artefacts and discrete activity areas (backed artefact production events) in the gentle spur crest unit within 200 metres of the basin (environmental/cultural context #5A) and the moderate lower slope unit bordering the basin/inlet (environmental/cultural context #1A), indicating a preference for backed artefact production and retooling in these areas. However, resolving finer patterns of spatial distribution is constrained to some extent by the low numbers of artefacts recovered for many of the samples.

On the basis of direct dating of shell midden deposits, artefact typology (presence of a number of microliths) and geomorphological evidence relating to the formation of the basin, it is inferred that the recorded evidence dates to within the last 4,000 years BP. It is speculated that as the estuarine resources of the basin gradually constricted towards the present lake inlet, the focus of Aboriginal hunting/gathering activity may also have shifted closer to the inlet (in the last millenium or so). Within the basal slopes of Stage 3 of The Dairy and possibly other areas fringing the basin, evidence of the early-mid Holocene sea level rise in the form of sand deposits overlapping previous soil horizons has been identified. This context has the potential to host evidence from different temporal periods.

The nature of the evidence from The Dairy has been compared with other sites in the locality in order to provide a framework for interpreting representativeness within a regional context. Despite the numerous problems and constraints, comparison reveals that on a general level a number of similarities and differences can be identified between Stages 2-4 and the other regional evidence. Detailed comparison was possible with evidence retrieved using similar methods in Stage 1 of The Dairy. It is concluded that there is a high degree of similarity between the evidence in Stage 1 and Stages 2-4 and minor differences are satisfactorily explained in relation to differences in the relative sample sizes. In contrast, the mere context of the Burrill Lake rock shelter, with its depositional and stratified deposits, along with its dated Pleistocene evidence, establishes it as significantly different from the open artefact sites of Stages 2-4 of The Dairy. No specific aspects of The Dairy Stages 2-4 evidence appear to be rare or unusual or not replicated elsewhere within a regional context.

Occupation of Stages 2-4 of The Dairy involved transitory movement and hunting/gathering without camping, undertaken in multiple episodes each of short duration. The overall spatial distribution and nature of evidence in Stages 2-4 is a low density distribution of artefacts consistent with background discard, interspersed by a low number of discrete activity areas in which more focused activity has occurred, predominantly in relation to the production of backed artefacts. Backed artefact production is the main activity type identified and occurs widely around the basin. It is assumed to have been undertaken by small parties of men gearing up to hunt with spears along the adjacent estuarine inlet/basin.

<u>Summary of Research Questions:</u>

The program of test excavations in Stages 2-4 of The Dairy also sought to address a number of specific research questions, to the extent possible given the nature of the evidence and present limitations of methodological and theoretical knowledge. These issues have been addressed in the preceding sections of this report and are summarised below.

What Aboriginal activities occurred on-site?

Stone knapping was the predominant activity identified on-site, including non-specific stone flaking, bipolar flaking, microblade production, backing retouch (microlith production), discard of microlith tools and discard of non-microlith tools. While it can be inferred that a proportion of the Aboriginal activity within the study area relates to the production of microblades and microliths, presumably to arm spears, much of the stone artefact evidence represents debitage from which the specific activities cannot be reliably inferred. No tools or activity areas indicative of encampments or on-site intentional thermal alteration of silcrete were identified.

The procurement of shellfish primarily from the adjacent lake inlet and to a lesser extent the nearby rock platforms, and the transport of shellfish from those locations to the site where food preparation and consumption occurred, is evidenced in Test Area 8A near Dolphin Point Road.

What types of Aboriginal occupation occurred within the study area (eg. camping, hunting/gathering, transitory movement, etc.)?

Occupation of Stages 2-4 of The Dairy involved transitory movement and hunting/gathering without camping, undertaken in multiple episodes each of short duration. The overall spatial distribution and nature of evidence in Stages 2-4 is a low density distribution of artefacts consistent with background discard, interspersed by a low number of discrete activity areas in which more focused activity has occurred, predominantly in relation to the production of backed artefacts.

Were the types of activity and nature of occupation related to environmental factors (eg. landform element, slope, soils, proximity to potable water, proximity to wetlands/estuary)?

The spatial distribution of evidence within Stages 2-4 demonstrates some distinct patterning, with a trend for a relatively higher frequency of artefacts and discrete activity areas (backed artefact production events) in the gentle spur crest unit within 200 metres of the basin (environmental/cultural context #5A) and the moderate lower slope unit bordering the basin/inlet (environmental/cultural context #1A). The results indicate a preference for backed artefact production and retooling in these areas. However, resolving finer patterns of spatial distribution is constrained to some extent by the low numbers of artefacts recovered for many of the samples.

Does spatial patterning of activity areas occur?

The test excavation results indicate spatial patterning of activity areas within Stages 2-4 of The Dairy. Although the overall spatial distribution of evidence is consistent with background discard, manuport and artefactual material which is insufficient either in number or in association with other material to suggest focused activity in a particular location (*cf.* Rich 1993, Kuskie & Kamminga 2000), it is interspersed by a low number of discrete activity areas in which more focused activity has occurred (predominantly the production of backed artefacts).

Were the types of activity and nature of occupation related to cultural or behavioural factors (eg. performance of ceremonies)? If a ceremonial site was present, did its presence influence the patterning of cultural material across the study area?

In consideration of oral and historical research, the absence of physical evidence, the hearsay, third-hand nature of the original report, and artefact/activity area analyses, it is concluded that there is no evidence supporting the existence of a ceremonial ground directly within Stage 2 of 'The Dairy'.

While in general terms it is quite possible that aspect to features such as sacred mountains may have been important in the location of some Aboriginal activities, such spiritual landscape concepts are at best scientifically difficult to assert and largely impossible to falsify. It is concluded that while aspect may have been a consideration to the local Aboriginal people, due to the myriad of variables potentially influencing activity location (economical, seasonal, social, cultural, spiritual, etc.) it is essentially unprovable in open-site archaeology.

However, it is inferred that cultural or behavioural choice were factors in the location of at least some activities within Stages 2-4, particularly the preferential use of the gentle spur crest unit within 200 metres of the basin (context #5A) and the moderate lower slope unit bordering the basin/inlet (context #1A), including with regard to the location of backed artefact production areas. Also, a proportion of the silcrete used was intentionally thermally altered, a process that may have been undertaken to improve the fracture properties of the stone and possibly to produce desired colours that had symbolic meaning.

Did the nature and location of occupation vary over time with changing environmental conditions (eg. transformation from sheltered coastal embayment to estuarine water to brackish and freshwater swamps)?

Occupation of the region extended as far back as at least 20,000 years BP, however prior to inundation of the basin with marine/estuarine water in the early to mid Holocene (c. 7,000 - 6,000 years ago), the study area did not represent an environment conducive to Aboriginal occupation. No direct or circumstantial evidence exists for occupation older than the mid-Holocene within the study area.

However, as the sea level rose, the basin transformed from a small valley into initially a coastal embayment, while Burrill Lake formed an open bay, and later to an estuarine extension of Burrill Lake. For the first time, the area became attractive to Aboriginal people as the presence of marine then estuarine resources adjacent to the eucalypt forests provided more abundant subsistence resources in this location than hitherto had been available. However, potable water supplies remained limited, essentially confining much of the Aboriginal activity to transitory movement and hunting/gathering without camping, around the margins of the drowned basin, probably from around 4,000 years ago.

As the sea level fell, the western portion of the basin may have transformed to a saltmarsh or sand flat. The basin eventually became disconnected from the remainder of the Burrill Lake estuary by the build up of sand deposits in the inlet across the basin mouth, possibly quite late in the Holocene. The availability of estuarine resources would have gradually constricted towards the present lake inlet. As such, the focus of Aboriginal hunting/gathering activity may also have shifted closer to the inlet (in the last millenium or so). However, potable water supplies still remained limited, essentially confining much of the Aboriginal activity to transitory movement and hunting/gathering without camping.

Hence, there is evidence for changes in the nature of occupation over time, from potentially no occupation in and prior to the early-mid Holocene, to low intensity transitory movement and hunting/gathering without camping from possibly 4,000 years ago to the present. In the most recent millenium, the focus of occupation may also have shifted closer to the inlet.

Did single or multiple episodes of occupation occur?

The evidence clearly indicates that multiple episodes of occupation occurred, both throughout the entire study area and usually also within individual test areas.

Did episodes of occupation occur at different times over the entire time-span of occupation of the region?

On the basis of direct dating of shell midden deposits, artefact typology and geomorphological evidence, it is inferred that the recorded evidence dates to within the last 4,000 years BP. However, various data lend support to inferences that the evidence in Test Areas 2A and 8A is more recent in age compared to the remainder of the study area. Such a hypothesis assumes that the decrease in the production of microliths and increase in the frequency of quartz proposed for the last thousand years accurately characterises the changing nature of lithic technology in south-eastern Australia (and this premise may be proved incorrect by future studies). However, if correct in relation to the present study area, the hypothesis that evidence surrounding the basin is older than the evidence on the basin would fit comfortably with a hypothesis of Aboriginal activity having been undertaken around the margins of the basin when it was inundated with marine/estuarine water (eg. mid-late Holocene, c. 4,000 - 1,000 years ago). It could be inferred that after the basin transformed to a saltmarsh or sandy flat, with more limited resources, the focus of occupation shifted closer to the inlet and the receding estuary. However, without further evidence, particularly direct dates from the sites further from the inlet, this inference remains highly speculatory.

Within the basal slopes of Stage 3 of The Dairy and possibly other areas fringing the basin, evidence of the early-mid Holocene sea level rise in the form of sand deposits onlapping previous soil horizons has been identified. This context has the potential to host evidence from different temporal periods.

What duration of time did each episode of occupation last?

It is inferred from the low density of evidence, its spatial distribution and interpretation of the nature of activities (where identified, typically backed artefact production which results in high quantities of debitage within a very short period) that all episodes of occupation were of very short duration (eg. typically less than one day). Even the cluster of midden evidence around units EE-FF-0-10 in Test Area 8A may represent a single but major meal event (eg. multiple individuals), or more likely a series of repeated events within a relatively short period of time (eg. a small group of people returning to the same place in a season or over successive seasons), but still less than a single day's duration for each episode.

Is there potential for older (ie. early Holocene or late Pleistocene) evidence?

No direct or circumstantial evidence exists for occupation older than the mid-Holocene within the study area.

Considering the recent formation history of the basin (infilling with sand in the late Holocene) and evidence of the early-mid Holocene sea level rise in the form of sand deposits onlapping previous soil horizons identified in several excavation units, there is some potential for stratification (and older evidence) within the basal slopes of Stage 3 of The Dairy and possibly other areas fringing the basin. However, considering the nature of soil formation processes (constant state of formation and transformation of the A unit through pedological and sedimentary processes and in relatively quick fashion), the potential for substantially older evidence (ie. early Holocene or older) below the onlapping sand appears limited.

Nevertheless, the potential that archaeological evidence survives in the modern A unit soil that is older than the sedimentological age of the A unit itself cannot be discounted. However, dating or distinguishing such older (eg. Pleistocene age) artefacts within a modern soil unit from late Holocene artefacts may be virtually impossible.

How intensive was occupation of the study area, in both a local and regional context?

Occupation of Stages 2-4 of The Dairy was of a low intensity, involving transitory movement and hunting/gathering without camping, undertaken in multiple episodes each of short duration and probably infrequently over time by low numbers of people. The overall spatial distribution and nature of evidence is a low density distribution of artefacts consistent with background discard, interspersed by a low number of discrete activity areas in which more focused activity has occurred, predominantly in relation to the production of backed artefacts.

Although minimal quantitative data is available for comparison within a local or regional context, in relation to a hypothesised regional model of occupation and the available evidence it is inferred that the study area does not encompass a primary or secondary resource zone, but rather an area that was probably typically exploited during the course of the normal daily round by inhabitants of encampments located in the primary or secondary resource zones, foraging within an area of up to ten kilometres radius from their campsites.

As such, within both local and regional contexts, there exist similar environmental/cultural contexts to The Dairy that were also lightly exploited and different environmental/cultural contexts that were more intensively utilised.

What were the primary subsistence resources used/discarded within the study area and where were they obtained from?

The only direct evidence for the consumption of subsistence resources relates to the shell midden in Test Area 8A and Loci M and N of Site Dolphin Point 4. A total of at least 15 shell species were consumed in Test Area 8A, predominantly cockle (*Anadara trapezia*) (on the basis of minimum number estimates and weight), but also mud whelk (*Pyrazus ebeninus*), rock oyster (*Saccostrea glomerata*), cartrut (*Thais orbita*) and turban (*Turbo torquatus*). The midden evidence in Test Area 8A represents the procurement of shellfish primarily from the adjacent estuarine lake inlet and water body of Burrill Lake and to a lesser extent the nearby rock platforms at Dolphin Point.

Did food processing occur on-site?

It is inferred that some food processing occurred at the shell midden loci in site Dolphin Point 4 (ie. cooking and preparation of shell fish). However, there is very little evidence for other food processing on-site. Only four utilised non-microlith tools (retouched flakes) were identified, although their function has not been specifically identified (eg. wood-working or slicing/scraping animal or plant materials).

Did microblade and microlith production occur on-site?

Microblade and microlith (backed artefact) production occurred on-site and was the main specific activity identified. A proportion of the non-specific stone flaking evidence probably also relates to the production of backed artefacts. Backed artefact production is evident in at least eight of the Test Areas (7 of the 12 environmental/cultural contexts) and hence occurred relatively widely around the basin, although with a possible preference for the gentle spur crest within 200 metres of the basin (environmental/cultural context 5A) and the moderate lower slope bordering the basin/inlet (environmental/cultural context 1A). It is assumed to have been undertaken by small parties of men gearing up to hunt with spears along the adjacent estuarine inlet/basin. Retooling (eg. refitting of spear barbs onto spear shafts) occurred in discrete areas typically in association with the production of new backed artefacts. Backed artefact production appears to have often occurred in contexts where the hunters may have had a vantage over their prey. Activity areas involving backed artefact production typically only involved a single stone material, silcrete, and resulted in the discard of some finished microliths at the site of production.

Did thermal alteration of silcrete occur on-site?

A proportion of the silcrete assemblage has been subject to intentional thermal alteration ('heat treatment') prior to knapping. The results indicate a possible preferential use of heat treated silcrete for bondi points and retouched flakes.

However, no specific evidence was identified within Stages 2-4 of The Dairy that suggests heat treatment occurred on-site. This may reflect sampling issues, the potentially minimal 'archaeological signature' of this practice, or that heat treatment was undertaken in sandy soils in other locations (eg. possibly at or closer to the source of the stone).

Were other stone tools manufactured on-site?

Apart from bondi points, and several retouched flakes that may represent the 'preform' stage of bondi point production, the activity area analysis demonstrates that a thumbnail scraper was probably manufactured on-site. In addition, the purpose of much of the non-specific stone flaking debitage cannot be identified. A portion of it could relate to the production of other tools that were removed from the site or not retrieved by the sample.

Was knapping of flakes largely casual and opportunistic, meeting requirements on an 'as needed' basis?

Core reduction strategies are inferred to have been largely expedient, to produce flakes for immediate use (ie. largely casual and opportunistic, meeting requirements on an 'as needed' basis). However, it is inferred by the presence of evidence for backed artefact production within discrete activity areas, often involving the production of items in quantity and from the same stone material, along with the possible trend for preferential use of certain locations for this activity (eg. context 5A), that backed artefact production involved a specialised technology and was a planned and organised activity that occurred during the course of hunting expeditions.

Was maintenance of stone tools conducted on-site?

There is no direct evidence that specific stone tools were maintained (ie. repaired) on-site (eg. rejuvenation of ground-edge hatchets). The backing flakes are assumed to relate to microlith production.

Were wooden implements produced and/or maintained on-site?

A very low incidence of use-wear (0.19%) was identified in the assemblage. Four retouched flakes exhibit use-wear, although their function has not been specifically identified and may relate to wood-working or slicing/scraping animal or plant materials.

To what extent did bipolar knapping occur and did this vary over time?

Bipolar flaking was infrequently identified (single quartz bipolar flakes occur in only three test areas) and only represents 0.14% of the combined assemblage. There is no evidence to assess potential variations in this practice over time.

What stone materials were favoured for use and why?

Silcrete was strongly favoured as a stone material for stone knapping (representing 86.32% of the combined assemblage) and apart from its suitable flaking properties, the reason probably relates to its local availability. Silcrete sources occur around Ulladulla and silcrete is also found in the form of pebbles and cobbles washed into coves along the shoreline between Ulladulla and Batemans Bay. Hence, the material was readily available in transportable form, only a short distance from the study area. Minimal use was made of other materials, with low frequencies of quartz (7.33%) and rhyolite (4.53%) and very low frequencies of quartzite (0.70%), chert (0.65%) and other volcanics (termed 'volcanic 1') (0.47%).

Where were the stone materials procured?

Silcrete was probably procured from sources that occur around Ulladulla and/or from the pebble and cobble sources in the nearby coves along the shoreline. Rhyolite pebbles and cobbles are also found along the coastline and probably represent the local source for this material. Quartz may have been procured from background gravels (eg. derived from the conglomerate of the Conjola Formation) or from alluvial gravels. Quartzite may have been obtained from glacial erratics or from alluvial gravels or pebbles and cobbles washed into coves along the shoreline. The source of chert is unclear, but pebbles may occur within conglomerate bedrock and colluvial and alluvial gravels in the region. A local source in the form of pebbles and cobbles washed into coves along the shoreline between Ulladulla and Batemans Bay can be inferred for the 'volcanic 1' items.

Is the 'distance-decay' model a valid explanation of stone material use and discard in this locality?

Silcrete dominates the test excavation assemblage and local sources are strongly inferred. However, the silcrete from the assemblage is notably devoid of cortex and the silcrete items tend to be relatively small. These factors can be indicators that a stone material has been transported further from its source and has been subject to greater reduction (eg. applying a distance-decay model). However, explanations other than stone material rationing are inferred to be involved in the use and discard of silcrete in this locality. A more probable explanation relates to the nature of the activities silcrete was utilised for (eg. microlith and microblade production), which tends to produce a high proportion of small debitage.

Did ceremonial activity occur on-site (eg. the speculated ceremonial ground)?

In consideration of oral and historical research, the absence of physical evidence, the hearsay, third-hand nature of the original report and artefact/activity area analyses, it is concluded that there is no evidence supporting the existence of a ceremonial ground directly within Stage 2 of 'The Dairy'.

How does the evidence and human behaviour represented in the study area compare with the evidence obtained by Navin Officer through testing of Stage 1?

Review of the testing program conducted by Navin Officer in Stage 1 has indicated a number of key concerns, in particular that many of the primary interpretations, conclusions, judgements and recommendations are not substantiated by the project data or by other known evidence. The cumulative result is that much of this work must be set aside. The Stage 1 salvage (Kuskie *in prep*.) is used as the primary data for comparison with the Stage 2-4 testing results of the present investigation. In overall terms, it is concluded that there is a high degree of similarity between the evidence in Stage 1 and Stages 2-4 of The Dairy and minor differences are satisfactorily explained in relation to differences in the relative sample sizes.

How does the evidence and human behaviour represented in the study area compare with evidence from other locations in the region?

Despite the numerous constraints in comparing evidence within a regional context, on a general level a number of similarities and differences can be identified between Stages 2-4 of The Dairy and other regional evidence outlined in Section 3.2. These include the:

- Predominance of stone artefact evidence, but also the presence of shell midden deposits in estuarine fringing coastal sand contexts;

- Predominance of cockle in the Test Area 8A midden, with a range of other estuarine and also rocky shore species in lower frequencies, similar to some middens but also contrasting to other middens around Burrill, Tabourie, Termeil, Meroo and Williga Lakes;

- Similar stone material and artefact types to those generally reported in the region (*cf.* Knight 1996);

- Predominance of evidence relating to non-specific stone flaking, but also evidence of microblade and microlith production, along with non-microlith and microlith tool use;

- Generally small size of artefacts;

- Low artefact density; and

- Presence of evidence in similar environmental contexts in the coastal lowlands (eg. gradient and landform units).

No specific aspects of The Dairy Stages 2-4 evidence appear to be rare or unusual or not replicated elsewhere within a regional context.

How does the evidence from the study area relate to regional models of occupation?

Several broad regional models of occupation have been forwarded to account for the pattern of recorded site distribution on the South Coast. In a small spatially discrete study area such as The Dairy, it is not possible to retrieve adequate data to test or reassess these broader models. However, a more local model of occupation (of which the basic tenets for the study area are proposed above) has been constructed based on the known pattern of site distribution, ethnohistorical and ethnographical evidence, and the results of archaeological work undertaken to date in the locality. The model attempts to explain Aboriginal activity and settlement patterns at a local level and involves hypotheses to be tested by further research.

In addition, a model of occupation is also proposed for the broader Ulladulla region. However, the proposed model is highly inferential and speculative in nature and subject to reassessment by more detailed future investigations throughout a wide range of environmental/cultural contexts in the South Coast region.

6. ABORIGINAL CONSULTATION

The study area lies within the boundaries of the Ulladulla Local Aboriginal Land Council (LALC).

Consultation with this organisation has been undertaken by the proponents (Elderslie Property Investments Pty Ltd and Dolphins Point Developments Pty Ltd) and consulting archaeologists engaged by the proponent (Navin Officer Heritage Consultants and South East Archaeology) throughout the course of 2003, 2004 and 2005.

Investigations of the study area were initially undertaken by Stone (1995) with representatives of the Ulladulla LALC, in relation to a Shoalhaven City Council study into the potential for future urban/rural development in the Milton-Ulladulla area.

The first survey specifically in relation to "The Dairy" proposal was undertaken by Navin Officer (2003a) on 12 March 2003, accompanied by a representative of the Ulladulla LALC. The survey encompassed Stages 2-4 and the zone 6(b)/7(a) open space area of the present study area, along with the adjacent Stage 1.

Subsequent to this survey, Elderslie (represented by David Bowman), archaeologists Kerry Navin and Kelvin Officer, Elderslie's project manager Graham Beasley (P. W. Rygate & West), Gary Currey and Rod Wellington (DEC), Kerry Rourke (Shoalhaven City Council) and Shane Carriage, Fred Carriage and David Mills of the Ulladulla LALC met on 18 March 2003 to discuss the project (Officer 2003a). It was resolved that further heritage investigation of the Stage 1 land would be undertaken, including sub-surface testing (Officer 2003a). A second meeting was held on 26 March 2003 to discuss the project further (Officer 2003b). The Ulladulla LALC sent by facsimile a letter of support for the testing program of the Stage 1 land on 27 March 2003 (ULALC 2003a).

The program of sub-surface testing in Stage 1 (adjacent to the present study area) was undertaken by Navin Officer (2003b, 2003c, 2003d) in April and June 2003, with the participation of representatives of the Ulladulla LALC. The testing included excavation of one unit (#30) within the zone 6(b)/7(a) open space portion of the present study area. The results were presented to a meeting of the Ulladulla LALC on 6 May 2003 (Officer 2003c).

Subsequent to the completion of the testing program, extensive consultation with the Ulladulla LALC has been undertaken by the proponent (Elderslie) and their heritage consultants (Navin Officer and South East Archaeology) in relation to a Section 90 Consent application for the Stage 1 development area. The Ulladulla LALC sent by facsimile a letter of conditional support and comment on the initial Consent application on 31 May 2003 (ULALC 2003b).

Following a number of meetings and the exchange of considerable correspondence between the key stakeholders, DEC issued a Section 90 Consent permit (#1726) for Stage 1, adjacent to the present study area, on 19 September 2003. The Consent extends marginally within the zone 6(b)/7(a) open space portion of the present study area to encompass a drainage easement and a proposed realignment of a new road that will provide access from the Princes Highway to Dolphin Point.

In relation to Stage 1 of "The Dairy", adjacent to the present study area, further consultation between South East Archaeology, Elderslie Property Investments, Ulladulla LALC and the Department of Environment & Conservation (NSW) resulted in the LALC agreeing to a revised research design for the Section 90 Consent. An amended Section 90 Consent was subsequently approved by DEC and a program of salvage undertaken by South East

Archaeology and the Ulladulla LALC over a period of 62 days between April and July 2004 (Kuskie *in prep*.).

In relation to the present Stage 2-4 investigation, further consultation with the LALC was undertaken by Elderslie and South East Archaeology from October 2003. Consultation included meetings, telephone conversations and correspondence. A preliminary inspection of Stages 2-4 and the adjoining LALC land was undertaken on 14 October 2003 by Peter Kuskie, South East Archaeology, accompanied by Mr Shane Carriage and Mr Barry Carriage of the Ulladulla LALC. Further detailed survey of the study area and adjoining LALC land was undertaken on 5 and 6 February 2004 by Peter Kuskie, South East Archaeology, and Mr Barry Carriage, Ulladulla LALC.

It was agreed that due to the constraints posed by limited conditions of surface visibility and in order to adequately address management of the identified and potential heritage resources, a program of sub-surface testing should be conducted within the study area (comprising Stages 2-4 and open space of 'The Dairy'). A research design was prepared by South East Archaeology and provided to the Ulladulla LALC for their review and comment, along with copies of the draft version of the survey report (Kuskie 2004a). Peter Kuskie, of South East Archaeology, consulted further with the Executive of the LALC to discuss the proposed work. A revised copy of the draft survey report and entire Section 87 application was provided to the LALC for comment in February 2004. The Ulladulla LALC forwarded correspondence that supporting the findings and recommendations of the survey report and endorsed the proposed program of testing (Kuskie 2004a).

Subsequent to approval of the Section 87 Permit (#1952), test excavations were undertaken over 29 days from 19 July to 27 August 2004. South East Archaeology was assisted throughout the course of the test excavations by on average five representatives per day from the Ulladulla Local Aboriginal Land Council. The representatives who participated in the test excavations included Barry Carriage, Shawn Carriage, Shann Carriage, Graeme Carriage, Anne Carriage, Kirsty Carriage, Matt Carriage, Tom Avery Jnr, Craig Butler, Philip Fernando and Hilton Ridgway.

At the completion of the investigation, all cultural material is being returned to the custody of the Ulladulla Local Aboriginal Land Council as per the terms of the Permit and Care Agreement.

A copy of the draft archaeological report was forwarded to the Ulladulla LALC for their review and comment.

Correspondence from the Ulladulla LALC has been received and is attached in Appendix 9. The Ulladulla LALC concurred with the conclusions and recommendations of the report.

A copy of the final report will be forwarded to the Ulladulla LALC.

7. SIGNIFICANCE ASSESSMENT

7.1 Criteria

The information contained within this report, along with an assessment of the significance of the Aboriginal heritage evidence, provides the basis for the Department of Environment and Conservation (DEC) to make informed decisions regarding the management and degree of protection which should be afforded to specific Aboriginal heritage sites.

The significance of Aboriginal heritage evidence can be assessed along the following criteria, widely used in Aboriginal heritage management, derived from the relevant aspects of the ICOMOS Burra Charter and the NSW Department of Infrastructure, Planning and Natural Resources 'State Heritage Inventory Evaluation Criteria and Management Guidelines':

I. Scientific (Archaeological) value;
II. Importance to Aboriginal people (Cultural value);
III. Educational value;
IV. Historic value; and
V. Aesthetic value.

Greater emphasis is generally placed on scientific and cultural criteria when assessing the significance of Aboriginal heritage evidence in Australia.

SCIENTIFIC (ARCHAEOLOGICAL) VALUE:

Scientific value refers to the potential usefulness of heritage evidence to address further research questions, the representativeness of the evidence, the nature of the evidence and its state of preservation.

Research Potential:

Research potential refers to the potential for information derived from further investigation of the evidence to be used for answering current or future research questions. Research questions may relate to any number of issues concerning past human culture, human behaviour generally or the environment. Numerous locations of heritage evidence have research potential. The critical issue is the threshold level, at which the identification of research potential translates to significance/importance at a local, regional or national level.

Several key questions can be posed for each location of heritage evidence:

- Can the evidence contribute knowledge not available from any other resource?
- Can the evidence contribute knowledge, which no other such location of evidence can?
- Is this knowledge relevant to general questions about human history, past environment or other subjects?

Assessing research potential therefore relies on comparison with other evidence in local and regional contexts. The criteria used for assessing research potential include the:

a) Potential to address locally specific research questions;
b) Potential to address regional research questions;
c) Potential to address general methodological or theoretical questions;
d) Potential deposits; and
e) Potential to address future research questions.

In terms of meeting a threshold level to have significant research potential, the particular questions asked of the evidence should be able to contribute knowledge that is not available from other resources or evidence (either on a local or regional scale) and are relevant to general questions about human history, past environment or other subjects.

Representativeness:

Representativeness is generally assessed at local, regional and national levels. It is an important criterion, because the primary goal of cultural resource management is to afford greatest protection to a representative sample of Aboriginal heritage evidence throughout a region. The more unique or rare evidence is, the greater its value as being representative within a regional context.

The main criteria used for assessing representativeness include:

a) The extent to which the evidence occurs elsewhere in the region;
b) The extent to which this type of evidence is subject to existing or potential future impacts in the region;
c) The integrity of the evidence compared to that at other localities in the region;
d) Whether the evidence represents a prime example of its type within the region; and
e) Whether the evidence has greater potential for educational or demonstrative purposes than at other similar localities in the region.

Nature of Evidence:

The nature of the heritage evidence is related to representativeness and research potential. The less common the type of evidence is, the more likely it will have representative value. The nature of the evidence is directly related to its potential to be used in addressing present or future research questions. Criteria used in assessing the nature of the evidence include the:

a) Presence, range and frequency of stone materials;
b) Presence, range and frequency of artefact types; and
c) Presence and types of other features.

A broader range of stone and artefact types generally equates to the potential for information to address a broader range of research questions. The presence of non-microlith and microlith tool types also equates to higher potential to address relevant research questions. The presence and frequency of particular stone or artefact types or other features also has relevance to the issue of representativeness (eg. a rare type may be present).

Integrity:

The state of preservation of the evidence (integrity) is also related to representativeness and research potential. The higher the integrity of evidence, the greater the level of scientific information likely to be obtained from its further study. This translates to greater importance for the evidence within a local or regional context, as it may be a suitable example for preservation within a sample representative of the entire cultural resources of a region.

The criteria used in assessing integrity include:

a) Horizontal and vertical spatial distribution of artefacts;
b) Preservation of intact features such as midden deposits, hearths or knapping floors;
c) Preservation of site contents such as charcoal and shell which may enable accurate direct dating or other analysis; and
d) Preservation of artefacts which may enable use-wear/residue analysis.

Generally, many of these criteria can only be applied to evidence obtained by controlled excavation. High levels of ground disturbance limit the possibility that the evidence would surpass the threshold of significance on the basis of integrity (ie. the area would be unlikely to possess intact spatial distributions, intact features, *in situ* charcoal or shell, etc).

ABORIGINAL (CULTURAL) SIGNIFICANCE:

Aboriginal (cultural) significance refers to the value placed upon Aboriginal heritage evidence by the local Aboriginal community.

All heritage evidence tends to have some contemporary significance to Aboriginal people, because it represents an important tangible link to their past and to the landscape. Heritage evidence may be part of contemporary Aboriginal culture or be significant because of its connection to spiritual beliefs or as a part of recent Aboriginal history.

Consultation with the local Aboriginal community is essential to identify the level of Aboriginal significance.

EDUCATIONAL VALUE:

Educational value refers to the potential of heritage evidence to be used as an educational resource for groups within the community.

HISTORIC VALUE:

Historic value refers to the importance of heritage evidence in relation to the location of an historic event, phase, figure or activity.

AESTHETIC VALUE:

Aesthetic value includes all aspects of sensory perception. This criterion is mainly applied to art sites or mythological sites.

7.2 Significance of Heritage Evidence Within "The Dairy" Stages 2-4

The significance of the heritage evidence recorded within Stages 2-4 of "The Dairy" can be assessed in relation to the criteria presented in Section 7.1.

Sites Dolphin Point 1 (DEC #58-1-640), Dolphin Point 2 (#58-1-636), Dolphin Point 3 (#58-1-947) and Dolphin Point 4 (#58-1-933) do not surpass the threshold for significance in relation to aesthetic criteria, educational or historic criteria. Partially this is a result of the cover of vegetation and soil that obscures the evidence, the unobtrusive nature of the evidence itself and the levels of existing impacts to the natural context of the sites.

All heritage evidence tends to have some contemporary significance to Aboriginal people, because it represents an important tangible link to their past and to the landscape. Consultation with the local Aboriginal community was undertaken to identify the level of Aboriginal significance. Representatives of the Ulladulla Aboriginal community expressed a strong interest in the identified heritage evidence.

In acknowledgment that the Aboriginal community themselves are in the best position to identify levels of cultural significance, the remainder of this assessment focuses on the potential scientific values of the heritage evidence. The statement of scientific significance is in no way intended to prioritise scientific values over cultural values or to lessen the importance of the views of the Aboriginal community.

Site Dolphin Point 1 (DEC #58-1-640):

Site Dolphin Point 1 is assessed as being of moderate scientific significance within a local context and low scientific significance within a regional context on the basis that:

- The site has some research potential within a local context, but this is primarily limited to yielding additional information pertaining to research questions about the nature and extent of Aboriginal activities (particularly regarding hunting/gathering and backed artefact production around the margins of estuaries), local models of occupation and the nature of technological strategies utilised in and spatial organisation involved with stone knapping behaviour (particularly backed artefact production). However, similar contexts also exist within the region from which these issues could be satisfactorily addressed;

- The site is of low representative value within a regional context. Similar environmental/cultural contexts exist elsewhere around existing and infilled estuarine basins on the South Coast (refer to Table 71). The contexts present and the nature of the identified heritage evidence within site Dolphin Point 1 are not unique within the locality or the region;

- The site exhibits a relatively limited range of artefact and stone material types and limited range of inferred activity types, with no particularly rare or unusual items; and

- The site has been affected by a number of post-depositional processes and the deposits are generally of low vertical integrity. However, the deposits are typically of moderate to high horizontal spatial integrity, and where the impacts of post-depositional processes can be identified and controlled for, are therefore largely of sufficient integrity to enable the research potential of the site to be realised through further investigation.

Site Dolphin Point 2 (DEC #58-1-636):

The portion of site Dolphin Point 2 within the study area is assessed as being of moderate scientific significance within a local context and low scientific significance within a regional context on the basis that:

- The site has some research potential within a local context, but this is primarily limited to yielding additional information pertaining to research questions about the nature and extent of Aboriginal activities (particularly regarding hunting/gathering and backed artefact production around the margins of estuaries), local models of occupation and the nature of technological strategies utilised in and spatial organisation involved with stone knapping behaviour (particularly backed artefact production). However, similar contexts also exist within the region from which these issues could be satisfactorily addressed;

- The site is of low representative value within a regional context. Similar environmental/cultural contexts exist elsewhere around existing and infilled estuarine basins on the South Coast (refer to Table 71). The contexts present and the nature of the identified heritage evidence within this portion of site Dolphin Point 2 are not unique within the locality or the region;

- The site exhibits a relatively limited range of artefact and stone material types and limited range of inferred activity types, with no particularly rare or unusual items; and

- The site has been affected by a number of post-depositional processes and the deposits are generally of low vertical integrity. In limited areas, particularly within Stage 4, the impact levels are high and equate to total destruction of deposits or very low integrity of evidence. However, excluding these areas, the deposits are typically of moderate to high horizontal spatial integrity, and where the impacts of post-depositional processes can be identified and controlled for, are therefore largely of sufficient integrity to enable the research potential of the site to be realised through further investigation.

Site Dolphin Point 3 (DEC #58-1-947):

Site Dolphin Point 3 is assessed as being of low scientific significance within a local context and low scientific significance within a regional context on the basis that:

- The site has limited research potential within either a local or regional context, comprising just a single locus of identified evidence and a small spatial area;

- The site is of low representative value within a regional context. Similar environmental/cultural contexts exist elsewhere around existing and infilled estuarine basins on the South Coast (refer to Table 71). The contexts present and the nature of the identified heritage evidence within site Dolphin Point 3 are not unique within the locality or the region;

- The site exhibits a very limited range and quantity of artefacts; and

- The site has been affected by a number of post-depositional processes and is generally of moderate to low integrity.

Site Dolphin Point 4 (DEC #58-1-933):

Site Dolphin Point 4 is assessed as being of moderate scientific significance within a local context and low scientific significance within a regional context on the basis that:

- The site has some research potential within a local context, but this is primarily limited to yielding additional information pertaining to research questions about the nature and extent of Aboriginal activities (particularly regarding shellfish consumption around the margins of estuaries), local models of occupation and possible variations in stone knapping technology in the last millenium (compared with preceding millenia). However, similar contexts also exist within the region from which these issues could be satisfactorily addressed;

- The site is of low representative value within a regional context. Similar environmental/cultural contexts exist elsewhere around existing and infilled estuarine basins on the South Coast (refer to Table 71). The contexts present and the nature of the identified heritage evidence within site Dolphin Point 4 are not unique within the locality or the region;

- The site exhibits a relatively limited range of artefact and stone material types and limited range of inferred activity types, with no particularly rare or unusual items, along with common shell species; and

- The site has been affected by a number of post-depositional processes and the deposits are generally of low vertical integrity. However, the deposits are typically of moderate to high horizontal spatial integrity, and where the impacts of post-depositional processes can be identified and controlled for, are therefore largely of sufficient integrity to enable the research potential of the site to be realised through further investigation.

8. STATUTORY OBLIGATIONS

The NSW *National Parks and Wildlife Act 1974* (as amended) provides the primary basis for the legal protection and management of Aboriginal sites within New South Wales. Implementation of the Aboriginal heritage provisions of this Act is the responsibility of the Cultural Heritage Division of the NSW National Parks and Wildlife Service (part of the Department of Environment and Conservation NSW). The rationale behind the Act is to prevent unnecessary or unwarranted destruction of Aboriginal objects and to protect and conserve objects where such action is considered warranted.

With the exception of some artefacts in collections, the Act generally defines all Aboriginal objects to be the property of the Crown. The Act then provides various controls for the protection, management and destruction of these objects. An 'Aboriginal object' is defined as

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

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

Under the terms of the NSW *National Parks and Wildlife Act 1974* (as amended), it is an offence for a person to:

- Knowingly destroy, damage or deface an Aboriginal object or place, or knowingly cause or permit the destruction, defacement or damage to an Aboriginal object or place, without first obtaining the consent of the Director-General of the Department of Environment and Conservation (NSW);

- Disturb or excavate any land, or cause any land to be disturbed or excavated, for the purpose of discovering an object, without first obtaining the consent of the Director-General of the Department of Environment and Conservation (NSW); and

- Collect on any land an object that is the property of the Crown, other than an object under the control of the Australian Museum, without obtaining appropriate authorisation from the Director-General.

Penalties for infringement of the Act include up to 50 penalty units or imprisonment for six months, or both (or 200 penalty units in the case of a corporation).

Consents regarding the use or destruction of objects are managed through a Department of Environment and Conservation permit system. The issuing of permits is dependent upon adequate archaeological assessment and review, together with an appropriate level of Aboriginal community liaison and involvement. To excavate or disturb land for the purposes of discovering an Aboriginal object, approval of a Section 87 'Preliminary Research Permit' application is typically required. To enable unmitigated destruction of objects, a 'Section 90 Consent Permit' must be obtained. To enable the mitigated destruction of objects, involving measures such as collection and/or salvage excavation, a 'Section 90 Consent with Salvage Permit' is required. The Director-General may attach any terms and conditions seen fit to any

Consent granted for the above activities. Failure to comply with a term or condition is deemed to be a contravention of the Act.

An appeals process is available whereby an applicant, dissatisfied with the refusal of the Director-General to grant Consent, or with any conditions or restrictions attached to Consent, may appeal to the Minister. The Minister may refuse to grant an appeal or partially or wholly grant an appeal. The decision of the Minister on the appeal is final and is binding on the Director-General and the appellant.

The Minister also has substantial powers under Section 12 to direct DEC to carry out works and activities, either generally or in a particular case, in relation to the identification, conservation and protection of, and prevention of damage to, Aboriginal objects and places.

Under the *National Parks and Wildlife Act 1974*, ‘Aboriginal areas’ may also be declared over private land, where Aboriginal objects or places are located, with the consent of the owner or occupier. The purpose of reserving land as an 'Aboriginal area' is to identify, protect and conserve areas associated with a person, event or historical theme, or containing a building, place, object, feature or landscape of natural or cultural significance to Aboriginal people, or of importance in improving public understanding of Aboriginal culture and its development and transitions (Section 30K).

Under Section 91AA of the Act, if the Director-General is of the opinion that any action is being, or is about to be carried out that is likely to significantly affect an Aboriginal object or Aboriginal place or any other item of cultural heritage situated on land reserved under the Act, the Director-General may make a stop-work order for a period of 40 days. A person that contravenes a stop-work order may be penalised up to 1,000 penalty units and an additional 100 units for every day the offence continues (10,000 units and 1,000 units respectively in the case of a corporation).

While the primary legislation offering protection to Aboriginal heritage in New South Wales is enacted by the state, several Acts administered by the Commonwealth may also be relevant.

The *Aboriginal and Torres Strait Islander Heritage Protection Act, 1984*, provides for the protection of areas and objects which are of significance to Aboriginal people in accordance with Aboriginal tradition. The Act allows Aboriginals to apply to the Minister to seek protection for significant Aboriginal areas and objects. The Minister has broad powers to make such a declaration should the Minister be satisfied that the area or object is a significant Aboriginal area or object and is under immediate threat of injury or desecration. An ‘emergency declaration’ can remain in force for up to thirty days. It is an offence under the Act to contravene a provision of a declaration. Provisions are made for penalties of up to $50,000 for a corporation found guilty of contravening the Act and up to $10,000 and imprisonment for a maximum of five years, for a person found guilty of contravening the Act.

Under the Act, ‘Aboriginal tradition’ means:

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

A ‘significant Aboriginal area’ refers to:

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

A ‘significant Aboriginal object’ refers to:

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

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

> a) in the case of an area, it is used or treated in a manner inconsistent with Aboriginal tradition; or the use or significance of the area in accordance with Aboriginal tradition is adversely affected by reason of anything done in or near the area; or passage through or over, or entry upon the area by any person occurs in a manner inconsistent with Aboriginal tradition; and
>
> b) in the case of an object, it is used or treated in a manner inconsistent with Aboriginal tradition (Section 3).

Under the *Aboriginal and Torres Strait Islander Heritage Protection Act, 1984*, the discovery of Aboriginal burials must be reported to the Minister.

A new national heritage system commenced on 1 January 2004, largely replacing the previous *Australian Heritage Commission Act 1975*. Its primary features under the amended *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*) and the *Australian Heritage Council Act 2003* include:

- A National Heritage List of places of national heritage significance;
- A Commonwealth Heritage List of heritage places owned or managed by the Commonwealth;
- Creation of the Australian Heritage Council – an independent expert body to advise the Minister on the listing and protection of heritage places; and
- Continued management of the Register of the National Estate, a list of more than 13,000 heritage places around Australia that has been compiled by the former Australian Heritage Commission since 1976.

The study area does not contain any heritage items registered for indigenous values under the *Aboriginal and Torres Strait Islander Heritage Protection Act, 1984*, the *Environment Protection and Biodiversity Conservation Act 1999* or the *Australian Heritage Council Act 2003*.

The *Heritage Act (NSW) 1977* provides the legislative framework for protecting and maintaining the historic heritage of NSW. The *Heritage Act 1977* is concerned with all aspects of the protection and conservation of environmental heritage, including buildings, works, places or relics that are over fifty years of age and are of historic, scientific, cultural, social, archaeological, architectural, natural or aesthetic significance to the State of New South Wales (but not being related to aboriginal settlement). Under the Act, a historic archaeological ‘relic’ is defined as ‘any deposit, object or material evidence relating to the settlement of the area that comprises New South Wales, not being Aboriginal settlement; and which is fifty or more years old’ [Section 4(1)]. In accordance with Section 139 of the *Heritage Act 1977*, a permit or exemption must generally be obtained from the Heritage Council of NSW before undertaking excavation or any works of disturbance if it is likely that a relic will be disturbed, discovered or exposed during the work.

9. MITIGATION AND MANAGEMENT STRATEGIES

Elderslie Property Investments Pty Ltd, on behalf of Dolphins Point Developments Pty Ltd and Dolphin Point Properties Pty Ltd, proposes to develop Stages 2-4 of "The Dairy" residential subdivision at Dolphin Point. Although plans have not been finalised, development of Stages 2-4 would likely involve the provision of roads, essential services, drainage control works, recreational facilities, housing, commercial facilities and other buildings. Impacts may result to the identified and potential Aboriginal heritage resources, including the portions of sites Dolphin Point 1, 2, 3 and 4 within the study area (Figure 31).

Specific strategies are considered below for the management of the identified and potential Aboriginal heritage resources within the study area. A key consideration in selecting a suitable strategy is the recognition that Aboriginal heritage is of primary importance to the local Aboriginal community, and that decisions about the management of the sites should be made in consultation with the local Aboriginal community.

Strategy A (Further Investigation):

In circumstances where a site is identified, but the extent of the site, the nature of its contents, its level of integrity and/or its level of significance cannot be adequately assessed solely through surface survey (generally because of conditions of low surface visibility or sediment deposition), sub-surface testing may be an appropriate strategy to further assess the site.

Testing is also appropriate in locations where artefact or midden deposits are predicted to occur through application of a predictive model of site location, in order to identify whether such deposits exist and their nature, extent, integrity and significance.

Test excavations can take the form of auger holes, shovel pits, mechanically excavated trenches or surface scrapes. A Section 87 permit is required from the Department of Environment and Conservation (NSW) (DEC) to undertake sub-surface testing. Approval can take up to eight weeks, following receipt by DEC of all necessary information. A research design specifying the aims and methods is an essential component of a Permit application and therefore requires approval from DEC. A letter of comment is also required from the relevant local Aboriginal community.

This is a pro-active strategy, which should result in the identification, assessment and management of the Aboriginal heritage resource prior to any development activity occurring. Following assessment of each Aboriginal site, management strategies as outlined below (B - E) can be applied.

In relation to the study area, the requirement for further investigation by sub-surface testing is negated by the conduct of the present investigation. Sufficient evidence has been obtained through this program to address the project objectives and permit informed consideration of management strategies for the heritage resources (refer below).

Strategy B: Conservation:

The suitability of conservation as a management option has long been recognised (*cf.* Burton, Koettig & Thorpe 1990:8). This strategy is suitable for all heritage sites, but particularly those of high archaeological significance and/or high cultural significance. Conservation is also highly appropriate for landform units or specific archaeological/environmental contexts as part of a regional strategy aimed at conserving a representative sample of identified and potential heritage resources.

Options exist within development proposals that could be utilised for the conservation of identified or potential Aboriginal heritage resources, including exclusion of development from zones of high heritage significance or potential, or preservation of areas within formal conservation zones.

In relation to the study area, it is anticipated that a sample of the heritage resource will be subject to conservation through avoidance of development impacts arising from compliance with other planning requirements. As the development concept plan has not been finalised, it is not possible to identify the specific nature of this sample. However, on the basis of the excavation results and significance assessment, the imperative for implementation of specific conservation measures for a representative sample or specific resources can be assessed.

The study area can be subdivided into a total of nine distinct environmental contexts (*archaeological terrain units*) (Table 3, Figure 14). These are discrete, recurring areas of land for which it is assumed that the Aboriginal land use and resultant heritage evidence in one location may be extrapolated to other similar locations. These include the gentle lower slope (former shoreline), moderate lower slope (former shoreline), level/very gentle flat, level/very gentle wetland, gentle drainage depression, very gentle drainage depression, gentle simple slope, gentle spur crest and very gentle ridge crest units. In order to encompass the potential range of variation in heritage evidence within each environmental context, a series of cultural sub-contexts has also been identified (Table 3, Figure 14). These units are termed *environmental/cultural contexts*. A total of 12 environmental/cultural contexts have been identified within the study area and these could form the basis for selection of any representative sample. Of course, in the ultimate selection of a representative sample for conservation or mitigation purposes, other factors would need to be considered, including the:

- Views of the Aboriginal community;
- Views of the regulatory authority (DEC);
- Nature of the development proposal;
- Comparative levels of integrity of the survey units;
- Nature of the evidence;
- Significance of the evidence;
- Extent to which the particular contexts are represented elsewhere in the region;
- Extent to which the particular contexts have been subject to investigation elsewhere in the region;
- Extent to which the particular contexts are conserved or have been impacted elsewhere in the region; and the
- Connectivity of contexts.

A key goal of cultural resource management is to ensure conservation of a representative sample of Aboriginal heritage evidence throughout a region. A primary consideration in the assessment of the imperative for specific conservation measures within Stages 2-4 of The Dairy is the extent to which these environmental/cultural contexts (ie. comparable identified and potential heritage resources) exist elsewhere and are already subject to conservation within a regional context. Several factors can be examined, including:

1) The extent to which the study area's environmental/cultural contexts and range of evidence are represented elsewhere in the region;

2) The level of existing impact on these contexts elsewhere in the region;

3) The land tenure of these contexts elsewhere in the region;

4) The potential future impacts of land use on these contexts elsewhere in the region; and

5) The extent to which the loss of these contexts within the study area will impact on the proportion of surviving evidence in the region.

However, the absence of quantitative baseline data is a serious constraint to addressing these issues. Desktop analysis, involving examination of topographical and land tenure mapping and aerial photographs from the region, is undertaken here to address these issues to the extent possible. This assessment is presented in Table 71.

It is concluded that similar environmental/cultural contexts to those identified in the study area occur elsewhere within the region. Most significantly, representative samples of these contexts are already subject to conservation within:

- The Dairy Stage 1 main conservation reserves (excluding the individual allotments 25-26, 43-44, 51-52 and 57-58) adjacent to the present study area, which includes samples of environmental/cultural contexts 1A, 3A, 4A and 8A;

- Meroo National Park, which extends south from Burrill Lake to Bawley Point, and encompasses the southern margin of much of Burrill Lake, along with Tabourie Lake, Termeil Lake, Meroo Lake and Willinga Lake;

- Murramarang National Park, further to the south between Kioloa and Long Beach, which includes Durras Lake;

- Narrawallee Creek Nature Reserve, to the north of Burrill Lake between Narrawallee and Lake Conjola, which includes major infilled estuarine basins around Narrawallee and Croobyar Creeks; and

- Conjola and Cudmirrah National Parks, between Lake Conjola and Sussex Inlet, which includes Swan Lake and the northern margin of much of Conjola Lake.

Examination of the heritage evidence from Stages 2-4 of The Dairy within a regional context indicates that the nature and context of the evidence is comparable with other localities. No specific aspects of the evidence appear to be rare or unusual within a regional context. Hence, there is no imperative for conservation on the basis of the presence of regionally rare or representative evidence.

The heritage evidence within Stages 2-4 of The Dairy is assessed as being of low to moderate scientific significance within a local context and low scientific significance within a regional context.

In conclusion, the imperative for adoption of specific conservation measures aimed at conserving selected heritage resources or a representative sample of heritage resources within Stages 2-4 of The Dairy is low.

Strategy C: Mitigated Impact (Salvage):

In circumstances where a site is of moderate or high significance within a local context, but the options for conservation are limited and the surface collection of artefacts or excavation of deposits could yield benefits to the Aboriginal community and/or the archaeological study of Aboriginal occupation, the strategy of salvage can be considered.

Salvage may include the collection of surface artefacts or systematic excavation of artefact or midden deposits, as part of a Section 90 Consent Permit obtained from the Department of Environment and Conservation. This strategy is the primary means of minimising impacts to Aboriginal heritage from development projects where the option of conservation is not feasible.

The specific aims of any salvage project and the methodology could only be finalised after consultation with the Aboriginal community and DEC, in relation to an application for a Section 90 Consent Permit. The application would need to address the views and policy and legislative requirements of these key stakeholders.

In relation to the present study area, the imperative for salvage investigation can be assessed in relation to the nature of the expected evidence and its research potential (ie. the potential for salvage to provide additional, useful evidence that will enhance the overall understanding of the nature of human occupation in this locality) (refer to Table 72). The views of the local Aboriginal community are also essential to consider, as salvage may be warranted to minimise the impacts on the cultural values of the evidence. Other key considerations include the extent to which samples of the contexts have been salvaged or conserved in the adjacent Stage 1 and the extent of potential development impacts (not specifically known at present). Hence, similar criteria can be examined as outlined in the preceding section.

Sites Dolphin Point 1 and 2 are assessed as being of some research potential within a local context, pertaining to research questions about the nature and extent of Aboriginal activities (particularly regarding hunting/gathering and backed artefact production around the margins of estuaries), local models of occupation and the nature of technological strategies utilised in and spatial organisation involved with stone knapping behaviour (particularly backed artefact production). Site Dolphin Point 4 is assessed as being of some research potential within a local context, pertaining to research questions about the nature and extent of Aboriginal activities (particularly regarding shellfish consumption around the margins of estuaries), local models of occupation and possible variations in stone knapping technology in the last millenium (compared with preceding millenia).

The imperative for salvage in identical environmental/cultural contexts to those subject to salvage in Stage 1 may be limited. In particular, controlled broad-area hand excavations were conducted in contexts 4A and 5B in Stage 1 (Kuskie *in prep.*), which effectively act to off-set potential development impacts to these contexts in Stages 2-4. The imperative for further salvage of these contexts in Stages 2-4 is low.

Surface scrapes and in some areas, localised hand excavations, were also conducted in Stage 1 in contexts 1A, 4A, 4B, 5A and 5B, potentially minimising the imperative for further salvage investigation within these contexts in Stages 2-4. Several contexts are also subject to conservation in the main Stage 1 conservation reserves (1A, 3A, 4A and 8A), thereby also potentially minimising the imperative for salvage investigation of these contexts within Stages 2-4.

In consideration of these factors, it can be concluded that salvage in the form of controlled hand excavation is particularly warranted in contexts 5A, 6A, 7A, 8A and 9A to offset any proposed development impacts and provide samples complementary to Stage 1 to enhance the overall research objectives. In contexts 4A, 4B and 5B some form of salvage such as surface scrapes may be very appropriate to enable the inspection for, identification of, and salvage prior to development impact of any unexpected or unusual features (eg. a program of surface scrapes and localised hand excavations) (Table 72).

Assuming the primary focus of salvage is to enhance the research conducted to date in Stages 1 and 2-4, adoption of a similar methodology would be highly appropriate. This could involve:

- Comparable research questions, particularly focusing on the key issues identified above;

- Excavation of a broad-area trench by hand measuring in the order of 40 x 2 metres in each key context (5A, 6A, 7A, 8A and 9A) should development impacts be proposed. Excavation could proceed by shovel and trowel in 0.5 x 0.5 metre square units and successive levels ('spits') of 10 centimetres depth. Additional areas adjacent to the main trench may be excavated to trace out the extent of any activity areas or significant features if necessary. Soil from each level within an excavation unit can be wet sieved. After each bucket is sieved, all material (both natural and cultural) remaining in the sieve can be dried and sorted by a qualified archaeologist to retain all cultural items;

- Excavation of mechanical surface scrapes within samples of other areas subject to impact (4A, 4B, 5A, 5B and 7A). A dozer or similar machinery can be used to systematically expose the surface in each of the scrape areas by progressively removing thin layers (eg. 2-5 centimetres) of soil. A grid of 5 x 5 metre collection squares can be overlain across each scrape area. After each pass of the dozer, the surface can be inspected on foot and any visible evidence collected for washing, drying, recording and curation, with its location recorded within the 5 x 5 metre collection squares. Any features of potential significance can be subject to hand excavation (refer below);

- Where features of potential significance (eg. hearths, heat-treatment pits, middens or dense artefact clusters) are identified within the surface scrapes, hand excavations can be conducted in order to retrieve the evidence that comprises the feature in a manner consistent with obtaining maximum possible information to address the project research aims. For many features, this may involve excavation within 1 m^2 units and 0.1 metre spits; and

- Retrieve samples and obtain radiometric and/or optically stimulated thermoluminescence dates where feasible.

<u>Strategy D: Unmitigated Impact:</u>

The strategy of unmitigated impact involves the proponent making application to the Department of Environment and Conservation for a Section 90 Consent Permit for any known Aboriginal objects that will be affected by the proposal. This permit must be obtained prior to the commencement of works affecting the evidence, because all objects are protected under the terms of the *NSW National Parks and Wildlife Act, 1974*.

The support of the local Aboriginal community should be obtained through further liaison, for any Section 90 Consent application. DEC guarantees to process Permit applications within eight weeks, subject to receipt of all necessary information. This strategy is typically suitable when a site is of low scientific significance, the local Aboriginal community holds no objections, and it is unfeasible to implement any other strategy.

In relation to the present study area, considering the low scientific significance of site Dolphin Point 3, unmitigated impact is a feasible strategy. The strategy may also be applied to sites Dolphin Point 1, 2 and 4 where other mitigation (salvage) measures are not enacted or to samples of environmental/cultural contexts for which other samples are being adequately protected through conservation (eg. 1A, 2A, 3A and 3B; Table 72).

Strategy E (Monitoring):

An alternative strategy for zones where archaeological deposits are predicted to occur is to monitor construction, particularly any initial earthmoving and soil removal works, for the presence of artefacts, shell or skeletal remains.

Monitoring is the primary strategy for managing the possible occurrence of Aboriginal skeletal remains. Monitoring for the presence of shell and stone artefacts is also often of value to the Aboriginal community, who may be seeking to identify and salvage material that was not visible on the surface during a preliminary study. The sieving of graded deposits is also a practical measure that enhances the benefits of monitoring for artefacts.

Monitoring for artefacts or shell (in preference to sub-surface testing) is not a widely accepted method within the context of a scientific investigation, because it could result in substantial and costly delays to construction, late revisions to development plans, and/or cause undesirable impacts to sites of cultural or scientific significance. However, when Development Consent is granted, monitoring for the presence of artefacts and other features during initial earthworks can be of scientific benefit and benefit to the Aboriginal community. Monitoring undertaken in this circumstance may enable the identification and retrieval of cultural evidence that may not otherwise have been recorded or salvaged.

In relation to the present study area, the potential for skeletal remains is generally assessed as low, but cannot be discounted. Deeper sand deposits are present in contexts 2A and 8A. Monitoring of the initial development works in these contexts may assist with the rapid identification of any skeletal remains should they be present, and thereby facilitate assessment of their nature and significance. Hence, monitoring may be warranted for this purpose.

Monitoring may also represent a suitable strategy as a final salvage measure after development and Section 90 Consent is granted (in lieu of surface scrapes), to enable Aboriginal community representatives to inspect for and identify if any unexpected or unusual features are present, and to permit their salvage. Monitoring and collection may also permit Aboriginal community representatives to mitigate the impacts of development on the cultural values of the identified heritage evidence (ie. the recorded loci of surface evidence).

10. RECOMMENDATIONS

Elderslie Property Investments Pty Ltd, on behalf of Dolphins Point Developments Pty Ltd and Dolphin Point Properties Pty Ltd, proposes to develop Stages 2-4 of "The Dairy" residential subdivision at Dolphin Point. Although plans have not been finalised, development of Stages 2-4 would likely involve the provision of roads, essential services, drainage control works, recreational facilities, housing, commercial facilities and other buildings. Impacts may result to the identified and potential Aboriginal heritage resources, including the portions of sites Dolphin Point 1, Dolphin Point 2, Dolphin Point 3 and Dolphin Point 4 within the study area (Figure 31).

The following recommendations are made on the basis of legal requirements under the *NSW National Parks and Wildlife Act 1974*, the results of the investigation and consultation with the local Aboriginal community:

- Development of the "The Dairy" Stages 2-4 may cause impacts to the identified Aboriginal heritage sites Dolphin Point 1, 2, 3 and 4 (Figure 31). The proponent should seek and obtain from the Director-General of the Department of Environment and Conservation (NSW) a Section 90 Consent with Salvage permit for the development impact area inclusive of all identified Aboriginal heritage evidence within this area, in consultation with the local Aboriginal community. A combination of strategies of salvage, conservation, monitoring and unmitigated impact should be implemented as outlined below (Table 72), potentially on a Stage by Stage basis:

  - In order to mitigate the impacts of development on the scientific and cultural values of the Aboriginal heritage resource and to obtain additional, useful evidence that will enhance the overall understanding of the nature of human occupation in this locality, a program of salvage should be undertaken within the Stage 2-4 development impact areas. The aims, methodology and scope of the salvage must be formulated in consultation with the Ulladulla Local Aboriginal Land Council and Department of Environment and Conservation. The recommended strategy comprises:

    Objectives:

    A) To examine samples obtained on a broad scale from within the area of proposed impact in environmental/cultural contexts 4A, 4B, 5A, 5B and 7A, prior to construction, to inspect for and identify if any unexpected or unusual features are present and to permit their salvage;

    B) Where development impacts will occur to greater than say 20% of each context, to retrieve a sample of evidence by controlled broad area hand excavation from within the area of proposed impact in environmental/cultural contexts 5A, 6A, 7A, 8A and 9A to permit a range of research hypotheses (specified in Section 9) to be examined to complement and enhance the program of salvage conducted in Stage 1 and program of testing in Stages 2-4, thereby mitigating the impacts of development on the scientific values of the evidence; and

    C) To retrieve samples of the identified heritage evidence (ie. from the known site loci) to assist in mitigating the impacts of development on the cultural values of the evidence;

Methodology and Scope:

A) To address objective 'A', a program of mechanical surface scrapes should be conducted across samples of each of environmental/cultural contexts 4A, 4B, 5A, 5B and 7A within the area of proposed development impact. Where features of significance are identified within the surface scrapes, controlled hand excavation should be undertaken to retrieve the feature, consistent with the methodology employed in the Stage 1 salvage and outlined in Section 9;

B) To address objective 'B', a 40 x 2 metre broad area hand excavation should be conducted within the area of proposed development impact in each of environmental/cultural contexts 5A, 6A, 7A, 8A and 9A (where development impacts will occur to more than say 20% of each context) consistent with the methodology employed in the Stage 1 salvage and outlined in Section 9; and

C) To address objective 'C', in addition to the above excavations, existing identified evidence within the impact area should be subject to systematic surface collection;

- Where development impacts can be avoided to the identified Aboriginal heritage evidence, as may be the case with portions of sites Dolphin Point 1, 2, 3 and 4, a set of guidelines should be prepared for these areas specifying policies and actions relating to the ongoing protection of the identified and potential Aboriginal heritage evidence during and after the Stage 2-4 development. The guidelines should identify:

  - Where and to what extent development impact is permitted within these zones (eg. reticulation of essential services and vegetation regeneration);

  - Temporary protective measures (eg. fencing) required to prevent inadvertent impacts during and after the construction period; and

  - Measures to ensure all relevant staff and contractors and subsequent allotment buyers are aware of the presence of the evidence and their legal responsibilities (eg. specification of the identified evidence on plans and appropriate signage and inductions);

- The proponent should give full consideration to any request by the local Aboriginal community for representatives to be engaged to monitor the initial stages of development in order to inspect for and identify if any unexpected or unusual features are present, and to permit their salvage. Any impact to or collection of Aboriginal objects must be undertaken with the appropriate permit from the Department of Environment and Conservation (NSW) (eg. a Section 90 Permit, as specified above). Monitoring will also address the possible (albeit generally low) potential for skeletal remains to occur, particularly within the deeper sand deposits of environmental/cultural contexts 2A and 8A. However, if skeletal remains are identified during monitoring or construction, the proponent is required to immediately stop work and notify the appropriate authorities, including the State Coroner, DEC and the Minister responsible for the Commonwealth *Aboriginal and Torres Strait Islander Heritage Protection Act, 1984*;

- Any evidence not directly conserved or salvaged will consequently be subject to unmitigated impact, permissible under a Section 90 Permit (and intending to include all evidence within the areas of proposed development impact in environmental/cultural contexts 1A, 2A, 3A and 3B);

- Further consultation should be pursued with the Ulladulla Local Aboriginal Land Council in relation to the Stage 2-4 development proposal and the contents and recommendations of this investigation. The continued involvement of the Ulladulla LALC in the ongoing management of the heritage resources within the study area should be promoted;

- Archaeological investigations should only be undertaken by an archaeologist qualified and experienced in Aboriginal heritage, in full consultation with the local Aboriginal community and with the appropriate permit from the Department of Environment and Conservation (NSW). The Aboriginal community should be afforded the opportunity to comment on the research design of any future studies and to be involved in all site management decisions and field investigations;

- Should any previously unrecorded Aboriginal sites or objects be detected during the course of development which are not covered by a Section 90 Consent, work should cease immediately and the finds be reported to the Department of Environment and Conservation (NSW) and advice sought as to the appropriate course of action;

- The proponent is reminded that under the terms of the *National Parks and Wildlife Act, 1974* it is an offence to knowingly destroy, damage or deface an Aboriginal object without obtaining the prior written permission of the Director-General of the Department of Environment and Conservation (NSW). Therefore, no activities or work should be undertaken within any of the Aboriginal site areas as described in this report and marked on Figure 31 in the absence of a valid Section 90 Consent;

- Three copies of this report should be forwarded to:

  Manager
  South Branch
  Environment Protection and Regulation Division
  Department of Environment and Conservation (NSW)
  PO Box 2115
  Queanbeyan NSW 2620

- A single copy of this report should be forwarded to:

  Mr Shane Carriage
  Coordinator
  Ulladulla Local Aboriginal Land Council
  PO Box 520
  Ulladulla NSW 2539.

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The information contained within this report is based on sources believed to be reliable. Every effort has been made to ensure accuracy by using the best possible data and standards available. The accuracy of information generated during the course of this field investigation is the responsibility of the consultant.

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