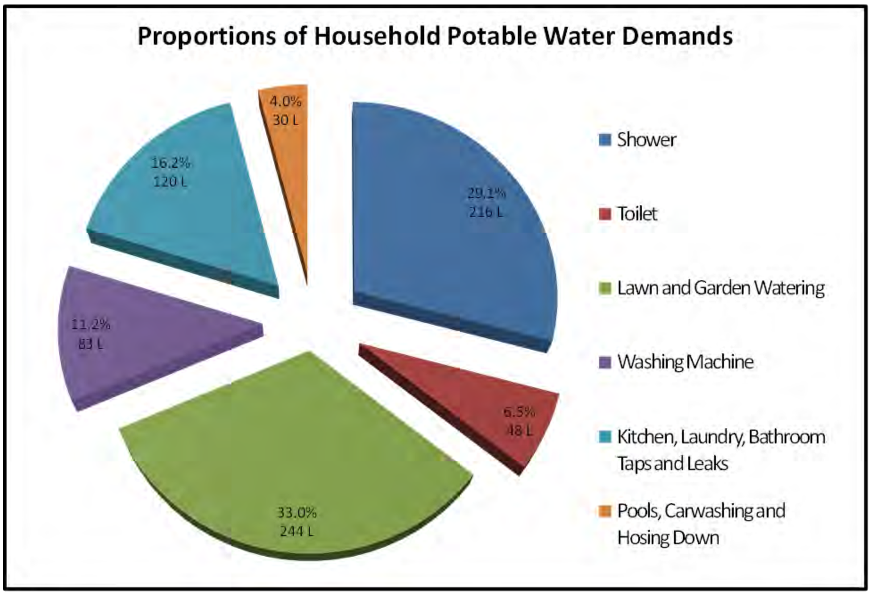

Figure 12 Proportions of Household Potable Water Demand

Site Irrigation Requirements

A report by Water Wise Consulting in 2013 stated that the Site will consist of 41.5-52.5 hectares of area that will require 200ML/year of water for irrigation. The breakdown of these areas is presented in Table 5. The demand of 200ML/years is conservative at it allows for times of below average rainfall.

Table 6 Surface Area Requiring Irrigation

Feature	Area (Hectares)
Greens (Practice and Chipper)	1.2-2.0
Green Surrounds	2.0-4.0
Tees	0.8-1.0
Mown Fairways	15.0-18.0
Irrigated Rough	10.0-12.0
Driving Range	1.5-2.0
Resort Landscaping	1.0-1.5
Road Verges	10.0-12.0
Total	41.5-52.5

From this, it is possible to derive estimates of the potential demand for recycled water returned to the Site in a dual-reticulation (third pipe) scenario. The total reuse potential (indoor and outdoor) based on an 'average' scenario is approximately 705,737 L/day. A breakdown of this demand is presented in Table 6.

Table 7 Recycled Water Demand

Accommodation Type	ET Occupancy Rate	Number	Recycled Water Demand (L/ET/Day)	Total Demand (L/day)	Notes
5 Star Hotel	3 for 90% of rooms 4 for 10% of rooms	50	48 for 90% of rooms 64 for 90% of rooms	2,480	Recycled water demand is for toilet flushing only
Luxury Short Stay Villas	2 for 70% of rooms 3 for 30% of rooms	250	32 for 70% of rooms 48 for 30% of rooms	9,200	Recycled water demand is for toilet flushing only
Permanent Residential Dwellings	5	300	96	144,000	Recycled water demand is for toilet flushing, cold laundry washes and garden watering
Restaurants	277 (guests and Staff)	-	8 for staff 4 for guests	3,648	Recycled water demand is for toilet flushing only
Community Centre/Pool/Spa)					
Golf Course and landscaped areas Irrigation	18 Holes	-	-	547,945	Equates to 200ML/year
		Total (L/day)		705,737	
		Total (ML/Year)		258	

9.2 Private Irrigation District License

The Site currently holds a license with the Pokolbin PID to extract up to 100ML/year, and for an additional cost of **$55,000** per year an additional 100ML can be extracted. As it stands, the total volume of water that can be extracted from the PID is short by 58ML/year. Other possible sources of water are discussed below.

9.2.1 Limitations/Disadvantages

The Pokolbin PID extracts water directly from the Hunter River; as such, over extraction can have a detrimental impact on the environment. Consequently, the PID is not a guaranteed allocation and can be reduced or halted by the governing body or the regulator (WaterNSW). Furthermore no infrastructure currently exists on the Site and would require additional costs.

9.3 Decentralised Wastewater Recycling

The decentralised treatment system discussed in Section 6 would produce up to 178.9ML a year of recycled water that could be utilised for non-potable supplies. This is short of the required 258ML/year demand.

9.3.1 Limitations/Disadvantages

The recycled water would have to meet the strict quality requirements discussed in Section 9.7 which would require the construction of a MBR. The costs and requirements to run an MBR are outlined in Section 7.2.5.

9.4 Cessnock WWTW

Hunter Water made it known to the Client that the Cessnock WWTW could currently supply 200,000kL[2] per annum (200ML per annum) of recycled water to the Site. The Cessnock WWTW is located approximately 13km to the south of the Site in Nulkaba.

9.4.1 Limitations/Disadvantages

As discussed in Section Approximately 13km of return recycle line from the WWTW to the Site would have to be constructed to transport the recycled water back to the Site. Furthermore the recycled water from the Cessnock WWTW does not meet the quality standards from the Department of Primary Industries Office of Water Recycled Water Guidance Document and Australian Guidelines for Water Recycling and would therefore require further treatment at the Site by a MBR. Table 8 below presents the current water quality of recycled water from the Cessnock WWTW and the required standard from the Australian Guidelines for Water Recycling.

Table 8 Cessnock WWTW Water Quality and NSW / AGWR Requirements

	Virus	Protozoa	Bacteria	E.coli.
Australian Guidelines for Water Recycling Reduction Requirements for Dual Reticulation, Toilet Flushing, Washing Machines, Garden Use	6.5 Log Reduction (NSW Department of Primary Industries Requirement)	5.1 Log Reduction (NSW Department of Primary Industries Requirement)	5.3 Log Reduction (NSW Department of Primary Industries Requirement)	<1 per 100mL (Australian Guidelines for Water Recycling)
Recycled Water Quality from Cessnock WWTW	2 Log Reduction	4 Log Reduction	4 Log Reduction	100 per 100mL

[2] Supply dependent on availability of on-site storage, availability of flows during dry weather, existing environmental flow requirements and the timing and progression of other development in the vicinity wishing to access the supply of recycled water

9.5 Sewer Mining

There is an option to mine the sewer that currently services the Vintage opposite the Site on Wine Country Drive. Mining the sewer would involve extracting wastewater from the sewer infrastructure and pumping it to the Site to undergo further treatment. The treated wastewater would then be used for irrigation and internal reuse on-site. During wet weather when irrigation demand is low, wastewater would flow as normal through the current sewer infrastructure to be treated at the Cessnock WWTW.

9.5.1 Limitations/Disadvantages

RPS made it known to W&A that wastewater flows from the sewer network would be in the order of 3-4L/s which equates to 259,200-345,600 L/day, meaning the treatment plant would nearly double in size and therefore costs. Furthermore wastewater in a sewer is highly concentrated and would mean the reticulation for the Site would have to be a conventional sewer so both flows could be treated in the same on-site treatment plant.

9.6 Rainwater Capture

Capturing the rainwater that falls on the Site can be utilised to help meet the recycled water demand and reduce the potable demand. Rainwater can be utilised by capturing roof run-off and surface run-off. The Site has an approximate area of 240hectares and receives 716.1mm annual rainfall. Surface run-off capture can be maximised by strategic placing of dams. A summary of the rainwater capture potential is presented in Table 9.

Table 9 Rainfall Capture Potential

	Surface Area (m^2)	Possible Annual Capture (m^3)[3]
Houses	90,000	64,449
Short Stay Villas	25,000	17,903
Hotel	5,000	3,581
Restaurants/Club/Bar/Community Hub	2,000	1,432
Surface Run-off Area	1,900,000[4]	14,250[5]
	Total (m^3/year)	101,615
	Total (ML/year)	101.6

9.7 Recycled Water Quality Requirements

Treated wastewater can pose a threat to human health and the quality of the natural environment. Accordingly, various standards, guidelines and other publications, produced at

[3] Rainwater volume capture for proposed buildings is based on the surface area multiplied by the average annual rainfall for Cessnock (Nulkaba BoM)
[4] Total approximate area of the Site not be developed
[5] Based on results from DPI maximum harvestable rights calculator

both state and national levels have been developed to improve our understanding of the risks and to promote a best management approach to design, operation and management of community effluent management systems. Several of the more important guidelines relating to recycled water use at a community scale are listed below:

- NSW Guidelines for Recycled Water Management Systems (NSW Department of Primary Industries – Office of Water, 2015).
- Environmental Guidelines – Use of Effluent by Irrigation (NSW Department of Environment and Conservation, 2004).
- Interim NSW Guidelines for the Management of Private Recycled Water Schemes (NSW Department of Water and Energy, 2008).
- Australian Guidelines for Water Recycling: Managing Health and Environmental Health Risks (Phase 1) (Natural Resource Management Ministerial Council and Environment Protection and Heritage Council, 2006).
- ANZECC Guidelines for Fresh and Marine Water Quality (Australia and New Zealand Environment Conservation Council, 2000).

These guidelines provide important information that would be used in designing and then assessing any proposal to reuse water from a community wastewater treatment system within the development.

9.7.1 Matching Water Quality to Reuse Option

The guidelines present water quality targets for different reuse applications according to the level of risk associated with reuse. These targets are generally specified in terms of physical, chemical and microbial water quality parameters.

Where the general public is unlikely to come into contact with recycled water (e.g. agricultural irrigation), lower levels of treatment may be used in combination with appropriate controls and safeguards (e.g. controlling access to the reuse area). Conversely, for reuse applications where there is a relatively high risk of contact (e.g. residential garden watering, golf course irrigation and internal reuse) a higher quality of recycled water is required and similarly, the testing and monitoring required to validate and maintain quality control over the recycled water supply are expected to be more rigorous. Table 10 presents the water quality and monitoring requirements for recycled water that will have a high level of human contact from the Interim NSW Guidelines for the Management of Private Recycled Water Schemes (NSW Department of Water and Energy, 2008).

Table 10 Water Quality and Monitoring Requirements for Recycled Water with High Level Human Contact

Exposure Risk Level	Potential End Use	Validation (and Verification) Monitoring			
		Parameter	Effluent Compliance Value	Influent Monitoring Frequency	Effluent Monitoring Frequency
	End Uses with a high level of human contact: -Residential dual reticulation -Multi-unit dwellings,	**E.coli**	< 1cfu/100 mL	Weekly	2 times/week
		BOD	<10 mg/L	Not Required	2 times/week
		SS	<10 mg/L	Not Required	2 times/week
		pH	6.5-8.5	Continuous online (or	Continuous online

High	internal reuse and external irrigation -Agricultural irrigation-unprocessed foods (e.g. salad crops) -Urban irrigation with unrestricted access and application			weekly)	
		Turbidity	< 2 NTU (95%ile) < 5 NTU (Maximum)	Continuous online (or weekly)	Continuous online
		Disinfection	Cl: 0.2-2 mg/L residual UV: TBA Ozone: TBA	NA	Continuous online
		Coliphages	<1 pfu/100 mL	Fortnightly	Weekly
		Clostridia	<1 cfu/100 mL	Fortnightly	Weekly

The major risk to human health from contact with treated wastewater, or recycled water is infection from micro-organisms such as viruses, bacteria, protozoa and helminths that may remain in the water. It is not practical to specify water quality targets completely in terms of all micro-organisms and so indicator organisms have been selected that are expected to be representative of the microbial population within a water sample. Thermotolerant coliforms (or faecal coliforms) are most commonly used.

For high risk reuse applications there may be a requirement to also demonstrate compliance with target levels set for viruses and other parasites, for example “<2 virus’ per 50L for unrestricted residential use”.

Chemical and physical water quality targets are also specified that may vary depending on the proposed reuse application. For example, it may be important to establish minimum criteria for turbidity and colour to ensure a high level of public acceptance where recycled water reuse is proposed for domestic non-potable purposes. Such criteria may be irrelevant for lower level uses like irrigation of parks and playing fields.

Acceptable criteria for other parameters such as suspended solids (SS), biochemical oxygen demand (BOD), nutrients (nitrogen and phosphorus), salinity and pH are important, to manage risks associated with environmental pollution and soil degradation.

9.7.2 Buffers

Buffer zones (setbacks) from irrigation areas are recommended as they provide a form of mitigation against unidentified hazards and minimise risk to public health, maintain public amenity and protect sensitive environments. The AGWR (2006) guideline recommends restricted access and 25-30m (Table 3.5 & 3.8) buffer zones from irrigation areas to the nearest point of public access for spray irrigation of high-quality recycled water suitable for domestic non-drinking water use, as is the case with the Site.

The application of the recommended buffer zones will provide a minimum 1-log (equivalent) reduction in pathogen loads from the irrigation areas. Recommendations to prevent off-lot discharge also include the use of low-throw sprinklers, part-circle (180º inward-throwing) sprinklers and/or tree or shrub screens. Other measures include irrigating the golf course at night to further reduce any chance of human contact and to reduce pathogen levels.

W&A also recommends the following environmental buffers for spray irrigation based on NSW DEC (2004) guidelines;

- 250 metres from domestic groundwater bores;
- 50-100 metres from permanent watercourses; and
- 40 metres from intermittent watercourses and dams.

It should be noted that once development commences, relevant setbacks from dwellings, in accordance with AGWR (2006), will need to be applied.

The recommended buffers will be achievable, Figure 2 presents the development site with the above buffers applied.

9.8 Site Irrigation Techniques

Surface irrigation using fixed (pop-up) sprays

A ‘fixed’ (pop-up) irrigation system would comprise the installation of a subsurface (buried) distribution manifold beneath the entire irrigation zone to be serviced. The manifold would be constructed PVC pressure pipe or HDPE, with final pipe sizing determined following detailed hydraulic design. For optimal performance the manifold would be divided into manageable units (zones) to reduce pumping requirements and allow for better control of irrigation rates.

Hydraulically operated ‘pop-up’ sprinklers would be fitted at determined locations throughout each zone (depending on distribution radius and coverage requirements) with the ultimate aim of delivering consistent and complete coverage to the area serviced. There are a large number of sprinkler types available on the market suitable to this type of ‘agricultural’ application.

There are some issues with pop-up sprays that can be potentially problematic, particularly when used in areas with high maintenance needs. Pop-up sprays raise under hydraulic pressure and fall below the ground surface on completion of each irrigation cycle, however, experience notes that the extension tubes often “stick” after they have worn in and can be easily damaged by maintenance machinery (mowers) if not properly re-seated. Also, animal contact with exposed fittings can be troublesome; therefore it is important to ensure that sprinklers are adequately protected from damage.

Surface irrigation using fixed (impact) sprinklers

The use of fixed impact sprinklers on a raised tripod is a much more traditional method of open space irrigation on sites such as golf courses and public parks. Similar to the pop-up arrangement, the system would comprise the installation of a buried (PVC/HDPE) distribution manifold beneath the entire irrigation zone to be serviced. Because impact sprinklers generally operate at ‘relatively’ higher pressures and generate a larger throw-radius, the sprinkler intervals would be larger (less sprays), but would still require detailed hydraulic design.

Impact sprinklers typically comprise a one or two nozzle arrangement allowing for both long and short throw coverage. They typically operate in a 360° configuration, but can easily be limited to other arrangements (e.g. 180° or 90°) for edge or corner operations. Even irrigation application is marginally more difficult with impact sprinkler systems and careful irrigation design is required to ensure optimal performance.

Other than controlling coverage, the main issue associated with impact sprinkler systems is spray-drift. Because of the style of discharge, impact sprinkler are prone to generating fine sprays or aerosols which can be readily captured in wind current. This presents a risk for off-site impacts (including unintended contact risk). These risks can be managed by ensuring adequate buffers are maintained between the irrigation area(s) and receptors, or by increasing the droplet size and reducing the throw radius of the individual sprinklers.

10 Preliminary Assessment of Servicing Options

Based on the information from Sections 4 to 9, different options were formulated to provide wastewater treatment services and to supply the Site with recycled water. The options all underwent an assessment to determine the most cost effective solution to service the Site. A summary of the Site's requirements is presented in Table 11.

Table 11 Summary of Site's Requirements

Site Parameter	Amount	Rate
Wastewater Produced at Site	490,000	L/day
Recycled Water Demand (Golf Course)	548,000	L/day
Recycled Water Demand (Dwellings, hotels, villas, restaurants, community hub)	158,000	L/day
Total Recycled Water Demand	706,000	L/day
Available Recycled Water from Cessnock WWTW	548,000	L/day
Approx. distance to Cessnock WWTW sewer	13	km
Approx. distance to Cessnock WWTW sewer connection point	2.5	km
On-Site internal reticulation length	9	km
Mined Wastewater from the Vintage	260,000-346,000	L/day
Water from PID license	274,000-548,000	L/day

10.1 Assessment Criteria

Based on the details of wastewater treatment and recycled water reuse options, an options analysis's was carried out to determine the most efficient and cost effective method of treating wastewater and providing a non-potable water supply. Particular reference has been made to a number of key assessment criteria for each alternative. These are reproduced here along with additional supporting information.

-3 strong limiting constraint	+3 strong positive opportunity
-2 moderate limiting constraint	+2 moderate positive opportunity
-1 slight limiting constraint	+1 slight positive opportunity
0 neutral constraint/opportunity	

10.1.1 Relative Cost

Preliminary costs have been derived from recent information for similar sized systems in NSW (where available) or elsewhere. Functional and concept design costings represent +/-30% possibility for variation from standard costs.

10.1.2 Deliverability

Cursory examination was given to the likely capability for delivering each of the identified options within the context of available technology/service provider experience, expertise and project history. Consideration is also given to the difficulty associated with construction and the suitability for options to integrate successfully with existing or proposed management frameworks.

10.1.3 Environmental

The effect the proposed servicing option on the surrounding environment the demand of potable water and drought proofing of the development was considered.

10.1.4 Suitability to staged development and Growth

Assesses whether the option will be able to service a staged development and how suitable it is to any increased loads from future development.

10.2 Option 1

Option 1 involves treating wastewater produced by the Site in a decentralised system that utilises a conventional gravity sewer collection system and an extended aeration treatment system. The recycled water demand will be met by reusing the treated wastewater from the Site and also capturing rainwater as outlined in Section 9.6. To supplement the recycled water demand and to drought proof the Site, the existing sewer at the Vintage will be sewer mined and treated to a suitable standard.

10.3 Option 2

Option 2 involves the use of common effluent sewer as outlined in Section 7.1.3 to collect the wastewater produced by the Site. The wastewater would then be treated by textile filters and further treated by an MBR to produce a water quality suitable for internal reuse and irrigation. Supplementing the recycled water demand and providing drought security would be met by constructing a return line from the Cessnock WWTW and providing further treatment via a MBR and utilising the rainwater capture techniques outlined in Section 9.6.

10.4 Option 3

Option 3 involves constructing a conventional sewer system and having all wastewater flows directed to the Cessnock WWTW. The recycled water demand would then be met by implementing the rainwater capturing methods outlined in Section 9.6 and building a return line from the Cessnock WWTW. The Site would also connect to the Pokolbin PID infrastructure to supplement any recycled water requirements. An MBR system would have to been constructed onsite to ensure the recycled water meets the reuse quality requirements.

Tables 12 presents the results of our preliminary assessment of each of the identified options for wastewater servicing and supplying the recycled water demand at the Site.

Table 12 Options Analysis Assessment Criteria

Assessment Criteria		Option 1	Option 2	Option 3
Developer Costs	Capital	**-2** **$21.4M**	**0** **$16.7M**	**+2** **$12.2M**
	Annual Costs	**0** **$310K**	**+3** **$190K**	**+1** **$263K**
Home Owner Costs (per house)	Capital	**-2** **$6,500**	**-2** **$6,500**	**+1** **Small fee to connect to sewer and return line to house**
	Annual Costs	**+2** **$300**	**+2** **$300**	**+1** **$518**
Suitability to Staged Development		**+1**	**+2**	**+1**
Deliverability		**+0**	**+2**	**+1**
Environmental		**+2**	**+3**	**-1**
Overall		**+1**	**+9**	**+6**

10.5 Preferred Servicing Solution

The preferred servicing option is Option 2 with a total score of 9. A more detailed description is given below.

10.5.1 Collection and Reticulation

Option 2 will utilise a STEP/STEG system to collect the wastewater from the Site. CGS (and MGS) is not considered the most appropriate reticulation option for the development. Conventional reticulation systems, whilst technically feasible, require substantial capital expenditure to design and construct. The significance of the expenditure is often compounded by difficult terrain or hydraulic control requirements (e.g. trenching depths). Much of this expenditure must be completed at the beginning of subdivision development, resulting in a large amount of dedicated infrastructure to be operated (and maintained) during an extended payback period as subdivision buildout occurs.

CGS can also limit available treatment technologies to only those suitable for a combined wastewater stream. Additionally this type of reticulation would be subject to a much larger hydraulic load due to required design allowances for storm inflows and groundwater infiltration

(I/I), adding substantially to upfront capital costs. Cost, acceptance and ability to manage staged servicing are all moderate negative drivers for implementing CGS/MGS reticulation at the Site.

On preliminary assessment, a PS reticulation system is considered suitable for further examination as an alternative wastewater servicing solution for the Site. Implementation of a PS reticulation network allows for some delay in capital expenditure as individual (on-lot) components can be added to the network incrementally as the subdivision develops. However, a PS would require a higher level of treatment at the treatment plant site to accommodate the substantial macerated solids load from the individual on-lot storage vessels. Integration, deliverability and ability to manage staged servicing are all moderate positive drivers for implementing PS reticulation for the development. Sydney Water and ACTEW (and SCA to a lesser extent) all have positive experience in the construction and operation of pressure sewer systems, with the technology readily available and well understood.

A CES (STEP/STEG) community reticulation system is considered the preferred collection and reticulation option for the Site. The STEP/STEG option provides the added benefit of primary treatment of effluent on-lot, reducing the hydraulic requirements (solids control and minimum velocities) of the effluent sewer, and overall treatment requirements at the community treatment plant. Although this option is relatively more expensive than the PS option it provides a great deal more flexibility in design, construction and operation, making it well suited for the Site

Maintenance costs, integration, deliverability and ability to manage staged servicing are all strong positive drivers for implementing CES (STEP/STEG) reticulation.

10.5.2 Treatment

The preferred treatment technology for a (STEP/STEG) common effluent sewer system at the Site is a commercial media or ‘textile’ filter with disinfection. Because of their modular nature, textile filters can be expanded progressively as the needs of the community increase. This presents an attractive option for the Site which may experience progressive growth for a number of years. This also provides the flexibility that if a significant increase in demand were to occur the system would be readily expandable to meet the demand.

The use of on-lot primary treatment (interceptor) tanks greatly reduces the need for large primary facilities at the centralised treatment location and utilising a ‘recirculating’ treatment process results in exceptional treatment performance (high quality effluent) and significant flexibility in nutrient removal. Depending on the final layout design on the hotel, villas, restaurants and community hub a large interceptor tank(s) may be required.

From the textile filters, wastewater would undergo further treatment by an MBR system to create an effluent quality that is suitable for internal re-use and irrigation in zones where access is not controlled (golf course). Treated wastewater from the Cessnock WWTP would also transported to the Site to undergo treatment in the MBR to meet the Site’s non potable water demand.

10.5.3 Effluent Management

To reduce the demand of potable water and make the Site more environmentally friendly, W&A propose that the treated wastewater from the MBR be reused for internal household uses (toilet flushes, cold laundry washes and lawn irrigation) and for the Site/golf course irrigation.

The preferred solution for irrigation would comprise the installation of a surface irrigation system using a fixed impact sprinkler system. This option would also require construction of an effluent holding tank that has enough capacity for wet-weather storage (2ML-3ML) within vicinity of the irrigated land.

Development and implementation of an Irrigation Management Plan (IMP) for the proposal in accordance with AGWR (2006) would ensure safe and sustainable operation of the system.

10.5.4 Costs

Off-lot capital expenditure for construction of the servicing solution, up to and including the boundary kit on each subdivision lot (CES reticulation, Interceptor Tanks, textile filters, MBR, return line from Cessnock WWTW, pump stations, storage and irrigation scheme) would be borne by the developer (proponent) and/or management entity.

Off-lot operational expenditure for ongoing maintenance/management of the community servicing solution, up to and including the boundary kit on each subdivision lot would be borne by the developer (proponent) and/or management entity.

All on-lot expenditure (capital and operational) for implementation of this community servicing solution would be borne by the individual homeowner.

10.5.5 Consent

Consent for the implementation of a community servicing solution at the Site will require approval from the Cessnock City Council under the zoning and community title provisions of the local environmental plan (LEP).

Operating approvals for this approach would be coordinated (by Council) under Section 68 (Part B) of LG Act 1993 for the installation and operation of a sewage management system, including private recycled water schemes, that produce and/or use recycled water. The NSW DPI (Office of Water) and NSW Health would act in a referral capacity to Council for any application.

10.5.6 Management and Responsibility

Ongoing operation of a community servicing solution would require establishment of an authorised management entity (i.e. body corporate, strata committee etc.) who would assume responsibility for the day-to-day operation of the scheme.

Whilst this approach has become more common in NSW in recent years through the WICA (2006) licensing process, commonly these smaller systems are regulated under the local planning scheme (LEP) and DA process through the application of consent conditions.

As guidance, the US EPA (2003) has developed a system of management models for on-site and decentralised sewage management systems with the aim of maximising the management and performance of these systems. Each of the models represents an increasing removal of householder responsibility for system maintenance and management, as well as increasing sensitivity of the environment in which the systems are located.

The preferred model is discussed here as an example of the type of management approach the developer (proponent) could consider.

*The **Responsible Management Entity (RME) – Operation and Maintenance** Model is useful where the servicing solution must meet specific water quality requirements (environmental sensitivity) or public health is a priority. Frequent and highly reliable operation and maintenance is required to ensure optimal operating conditions are maintained. Issuing the operating permit (Approval to Operate) to an RME instead of the property owner provides greater assurance of control over performance compliance.*

For a service fee, an RME takes responsibility for the operation and maintenance of key system components. In the case of the development, this may include the CES reticulation, STP, MBR, storage and irrigation scheme. This approach can reduce the number of permits and the administration functions performed by the regulatory authority. System failures are also reduced as a result of routine and preventive maintenance.

Under the preferred servicing scenario, the homeowner would remain responsible for all on-lot components (individual interceptor tanks and house drains).

11 Conclusions and Recommendations

Three (3) potential servicing solutions were investigated in a desktop analysis to determine the most suitable option to provide wastewater treatment and to meet the non-potable water demand of the Site. Each option was examined based on its relative cost, deliverability, environmental sensitivity and its suitability for staged development and future growth.

Option 2 was deemed to be the most suitable option to service the Site. Option 2 involves the use of a common effluent sewer to collect the wastewater produced at the Site. Wastewater would then be treated by textile filters and an MBR to produce high quality effluent suitable for internal reuse and irrigation of areas when access is unrestricted. A return line from the Cessnock WWTW and pump station will also be built to provide additional recycled water and to also drought proof the Site. The water from the Cessnock WWTW will undergo further treatment in the MBR to ensure it meets quality requirements. Option 2 may not be the cheapest option for upfront capital costs when compared to Option 3, however the annual ongoing costs for Option 3 are greater. The environmental benefits for Option 2 also far outweigh Option 3. Option 2 will also capture as much rainwater as possible through the use of rainwater tanks on all buildings and capturing surface run off in dams.

Lastly, we highlight that the cost estimates provided here are preliminary only, and suitable for initial consideration of options. The estimates should be revised and tightened as more information comes to hand and the subdivision design proceeds.

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Appendix A
Water and Nutrient Balance

Irrigation Area Water Balance & Storage Calculations

Whitehead & Associates
Environmental Consultants

Site Address: **1184 Wine Country Drive**

INPUT DATA

Design Wastewater Flow	Q	864,000	L/day	
Design Irrigation Rate	DIR	2.0	mm/day	Litres/m^2/day - based on Table M1 AS/NZS 1547:2012 for secondary effluent. Assumed a Loam sub soil from aluvial soil in Branxton soil landsca
Available Land Application Area	L	936,235	m^2	Used for iterative purposes to determine storage requirements for nominated areas
Crop Factor	C	0.5-0.8	unitless	Estimates evapotranspiration as a fraction of pan evaporation; varies with season and crop type
Runoff Coefficient	RC	0.9	unitless	Proportion of rainfall that remains onsite and infiltrates; function of slope/cover, allowing for any runoff
Rainfall Data		Cessnock (Nulkaba) 061242		Mean Monthly data (1966-2012)
Evaporation Data		Cessnock (Nulkaba) 061242		Mean Monthly data (1966-2012)

Soil Category (AS1547:2012)	DIR	Units
Gravels and Sands (1)	5	mm/day
Sandy Loams (2)	5	mm/day
Loams (3)	4	mm/day
Clay Loams (4)	3.5	mm/day
Light Clays (5)	3	mm/day
Medium to Heavy Clays (6)	2	mm/day

Parameter	Symbol	Formula	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total
Days in Month	D		days	31	28	31	30	31	30	31	31	30	31	30	31	31	28	31	30	31	30	**546**
Rainfall	R		mm/month	87.9	105.1	86.1	58.2	53.2	60.9	32.6	36.5	43.8	59.3	72.7	70.7	87.9	105.1	86.1	58.2	53.2	60.9	**767.0**
Evaporation			mm/day	5.7	4.9	3.9	2.8	1.9	1.5	1.7	2.5	3.5	4.3	5.0	5.7							
Evaporation	E		mm/month	176.7	137.2	120.9	84.0	58.9	45.0	52.7	77.5	105.0	133.3	150.0	176.7	176.7	137.2	120.9	84.0	58.9	45.0	**1317.9**
Crop Factor	C			0.80	0.80	0.70	0.60	0.55	0.50	0.55	0.60	0.70	0.80	0.80	0.80	0.80	0.80	0.70	0.60	0.55	0.50	
OUTPUTS (LOSSES)																						
Evapotranspiration	ET	ExC	mm/month	141.4	109.8	84.6	50.4	32.4	22.5	29.0	46.5	73.5	106.6	120.0	141.4	141.4	109.8	84.6	50.4	32.4	22.5	**958.03**
Percolation	B	DIRxD	mm/month	62.0	56	62.0	60.0	62.0	60.0	62.0	62.0	60.0	62.0	60.0	62.0	62.0	56.0	62.0	60.0	62.0	60.0	**730.0**
Outputs		ET+B	mm/month	203.4	165.76	146.6	110.4	94.4	82.5	91.0	108.5	133.5	168.6	180.0	203.4	203.4	165.76	146.6	110.4	94.4	82.5	**1688.0**
INPUTS (GAINS)																						
Retained Rainfall	RR	RxRC	mm/month	79.11	94.59	77.49	52.38	47.88	54.81	29.34	32.85	39.42	53.37	65.43	63.63	79.11	94.59	77.49	52.38	47.88	54.81	**690.3**
Effluent Irrigation	W	(QxD)/L	mm/month	28.6	25.8	28.6	27.7	28.6	27.7	28.6	28.6	27.7	28.6	27.7	28.6	28.6	25.8	28.6	27.7	28.6	27.7	**336.8**
Inputs		RR+W	mm/month	107.7	120.4	106.1	80.1	76.5	82.5	57.9	61.5	67.1	82.0	93.1	92.2	107.7	120.4	106.1	80.1	76.5	82.5	**1027.1**
STORAGE CALCULATION (Δ)																						
Storage Remaining from Previous Month			mm/month	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Storage for the Month	S	(RR+W)-(ET+B)	mm/month	-95.6	-45.3	-40.5	-30.3	-17.9	0.0	-33.0	-47.0	-66.4	-86.7	-86.9	-111.1	-95.6	-45.3	-40.5	-30.3	-17.9	0.0	
Cumulative Storage	M		mm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Maximum Storage for Nominated Area	N		mm	0.0																		
Storage Volume required	V	(NxL)/1000	m^3	0.0																		
LAND AREA REQUIRED FOR ZERO STORAGE			m^2	215565	339919	387388	446743	575814	936078	434488	354052	275510	232359	226237	191684	215565	339919	387388	446743	575814	936078	

MINIMUM AREA REQUIRED FOR ZERO STORAGE: **936,078** m^2 This value is based on the worst month of the year, so the balance overestimates the area/storage requirements and is therefore conservative for all other months

Nutrient Balance

Site Address: 1184 Wine Country Drive

Whitehead & Associates
Environmental Consultants

Please read the attached notes before using this spreadsheet.

SUMMARY - LAND APPLICATION AREA REQUIRED BASED ON THE MOST LIMITING BALANCE = 826,184 m^2

INPUT DATA [1]

Wastewater Loading			Nutrient Crop Uptake					
Hydraulic Load	864,000	L/day	Crop N Uptake	130	kg/ha/yr	which equals	35.62	$mg/m^2/day$
Effluent N Concentration	20	mg/L	Crop P Uptake	25	kg/ha/yr	which equals	6.85	$mg/m^2/day$
% Lost to Soil Processes (Geary & Gardner 1996)	0.2	Decimal	Phosphorus Sorption					
Total N Loss to Soil	3,456,000	mg/day	P-sorption result	384	mg/kg	which equals	3,226	kg/ha
Remaining N Load after soil loss	13,824,000	mg/day	Bulk Density	1.4	g/cm^3			
Effluent P Concentration	15	mg/L	Depth of Soil	0.6	m			
Design Life of System	50	yrs	% of Predicted P-sorp. [2]	0.5	Decimal			

METHOD 1: NUTRIENT BALANCE BASED ON ANNUAL CROP UPTAKE RATES

Minimum Area required with zero buffer

Nitrogen	388,135	m^2
Phosphorus	826,184	m^2

Determination of Buffer Zone Size for a Nominated Land Application Area (LAA)

Nominated LAA Size	936,235	m^2
Predicted N Export from LAA	-7125.30	kg/year
Predicted P Export from LAA	-630.11	kg/year
Phosphorus Longevity for LAA	63	Years
Minimum Buffer Required for excess nutrient	0	m^2

PHOSPHORUS BALANCE
STEP 1: Using the nominated LAA Size

Nominated LAA Size	936,235	m^2				
Daily P Load	12.96	kg/day	→	Phosphorus generated over life of system	236520	kg
Daily Uptake	6.412568493	kg/day	→	Phosphorus vegetative uptake for life of system	0.125	kg/m^2
Measured p-sorption capacity	0.32256	kg/m^2				
Assumed p-sorption capacity	0.161	kg/m^2	→	Phosphorus adsorbed in 50 years	0.161	kg/m^2
Site P-sorption capacity	150995.98	kg	→	Desired Annual P Application Rate	5360.507	kg/year
				which equals	14.68632	kg/day
P-load to be sorbed	2389.81	kg/year				

NOTES

[1]. Model sensitivity to input parameters will affect the accuracy of the result obtained. Where possible site specific data should be used. Otherwise data should be obtained from a reliable source such as,

- *Environment and Health Protection Guidelines: Onsite Sewage Management for Single Households*
- *Appropriate Peer Reviewed Papers*
- *EPA Guidelines for Effluent Irrigation*
- *USEPA Onsite Systems Manual.*

[2]. A multiplier, normally between 0.25 and 0.75, is used to estimate actual P-sorption under field conditions which is assumed to be less than laboratory estimates.

APPENDIX P

DRAFT ABORIGINAL HERITAGE ASSESSMENT

MYALL COAST ARCHAEOLOGICAL SERVICES 2013

PRELIMINARY ARCHAEOLOGICAL INVESTIGATIONS

BURRAMOKO ARCHAEOLOGICAL SERVICES 1998

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Aboriginal Heritage Assessment

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1. Introduction

1.1 Background

This report has been prepared at the request of Hunter Development Brokerage, Maitland NSW, to assess the possible impact a proposed Planning Proposal and subsequent development may have on Aboriginal Cultural Heritage over Rothbury. The land had been previously assessed and a report compiled; *Preliminary Archaeological Investigations of the Proposed Rothbury Country Resort Development Area, near Cessnock, NSW* by James and Brennan of Burramoko Archaeological Service. The report was lodged and accepted by the then National parks and Wildlife Service (NPWS) (Now Office of Environment and Heritage (OEH)) in 1998. It is catalogued with as report no. C4300.

It is an extensive and well researched report that makes several recommendations in particular the establishment of Aboriginal Cultural Heritage Conservation zones over the site that would allow development to proceed unfettered by Archaeological Constraints. (Appendix A). Support for they conservation areas rather than further intrusive archaeological investigations was supported by Mindaribba Local Aboriginal land Council and the then NPWS. (Appendix B)

For various reasons, the project was not proceeded with at that time. The proponent is now wishing to proceed the matter.

The report suggested further archaeological work (test activations) is undertaken if the sensitive archaeological areas were to be disturbed.

The proponent and the MLALC discussed the options and it was agreed that the areas of sensitivity would be set aside and conserved.

Notwithstanding the above, Cessnock Council believed the recommendations for test excavations were required.

Phone contact was made with Rosalie Neeve OEH Archaeologist in February 2013 to determine OEH's position regarding test excavation. Rosalie confirmed that the preferred option is always conservation and if the area is not going to be impacted and conserved through a management plan in conjunction with the Land Council and Aboriginal community.

Her advice was to implement the due diligence requirements and obtain evidence of discussion and agreement with the Land Council.

The report has been requested in order to demonstrate due diligence by:
1. Determining whether or not their activities are likely to harm Aboriginal objects (if present); and
2. Determining whether an Aboriginal heritage Impact Permit (AHIP) application is required.

1.2 Legislative Context

The *National Parks and Wildlife Act 1974*, administered by DECCW, is the primary legislation for the protection of some aspects of Aboriginal cultural heritage in NSW. Section 86 of that act has been amended and deals with harming and desecrating Aboriginal Objects.

'*Aboriginal object* means 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.'

Under section 86 of the NPW Act, it is an offence to 'harm' an Aboriginal object. 'Harm' means any act or omission that:

- destroys, defaces, damages or desecrates the object
- moves the object from the land on which it had been situated, or
- causes or permits the object to be harmed.

The NPW Act provides several defences to prosecution for an offence. Where a person either knows or does not know they are harming an Aboriginal object, a person has a defence under section 87 where:

- The harm or desecration concerned was authorised by an Aboriginal heritage impact permit, and the conditions to which that Aboriginal heritage impact permit was subject were not contravened.
- Due diligence was undertaken and it was reasonably determined that no Aboriginal object would be harmed.
- Was work on land that has been disturbed for maintenance of existing roads, fire and other trails and tracks, maintenance of existing utilities and other similar services
- Land is disturbed if it has been the subject of human activity that has changed the land's surface, being changes that remain clear and observable.

Harm does not include something that is trivial or negligible.

2. The Due Diligence Process

Due diligence amounts to taking reasonable and practicable steps to protect Aboriginal objects. The Department of Environment Climate Change and Water (DECCW) has developed a generic code that provides one process for satisfying the due diligence requirements under the National Parks and Wildlife Act 1974 (as amended). It is not mandatory to follow this code. An individual or corporation can take other measures, provided that such measures are objectively reasonable and practicable and meet the ordinary meaning of exercising due diligence.

The purpose of due diligence is to identify whether Aboriginal objects are present in an area, and to determine whether a proposed activity will have impacts on Aboriginal objects. Therefore it is essential to identify and understand all the expected impacts of the proposed activity. There are two categories of activity used for assessing impacts:

- Activities involving no additional surface disturbance
- Activities causing additional surface disturbance.

For activities causing additional surface disturbance, it is necessary to determine whether an activity is proposed for:

a) A developed area or a previously disturbed area, or
b) An undisturbed area.

For activities in previously developed or disturbed areas, it is then necessary to determine whether the new activity will create significant additional surface disturbance. If it will, then the process for undisturbed areas will apply.

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Disturbed land has been defined in the DECCW due diligence process as Land that has been previously subjected to any activity that has resulted in clear and observable changes to the land's surface.

OEH will not approve or certify a person's compliance with their due diligence requirements carried out under this or any other code. It is the responsibility of the individual or proponent to ensure that they have undertaken due diligence.

According to the OEH Due diligence Code of practice at 7.7 it states that:

"You can follow your own due diligence process and manage your own risk. Due diligence amounts to taking reasonable and practicable steps to protect Aboriginal objects. This generic code provides one process for satisfying the due diligence requirements of the NPW Act.

It is not mandatory to follow this code. An individual or corporation can take other measures, provided that such measures are objectively reasonable and practicable and meet the ordinary meaning of exercising due diligence."

This Due Diligence Assessment follows the DECCW generic due diligence code.

2.1 Assessment Personnel

The research, visual assessment and report were undertaken by Len Roberts, (BA [Arch.], Grad. Dip. Comp., Dip Sp. Ed.,) who also holds a certificate in Archaeological fieldwork, from Tel Aviv University, Israel. Len has worked on archaeological projects in Australia and overseas. Len is a member (since 1990) and was Deputy Chairperson (2007 -2011) of Karuah Local Aboriginal Land Council. He has over 20 years' experience as a local government councillor on city and regional councils. He is currently Deputy Mayor of Great Lakes Council. He was appointed, in 1977, (under S32AV of the Local government Act 1919) as a part time, non- judicial expert (having, special knowledge of and experience in law, local government administration or town planning administration) member of the Local Government Appeals Tribunal from 1977 until it was replaced by the Land and Environment Court in 1980. He has been an expert witness before the Land and Environment court on Aboriginal heritage matters. Len has also taught English and Society (Australiana) at Beifang University, Yinchuan, China as an invited lecturer in second semester 2011.
Len is currently undertaking a Masters in Indigenous Knowledge through Charles Darwin University (traditional Aboriginal law, society and practices).

Len has undertaken archaeological work for various planning and surveying companies, as well as large organizations such as AMP, Department of Public Works, RTA, Local Government Authorities, Energy Australia, Australian Rail and Track Corporation, Rio Tinto, Woolworths and numerous other clients. The projects have ranged from small aquaculture (at sea), industrial and residential projects to large rezoning proposals, as well as linear surveys for sewerage treatment upgrades, pipelines, transmission lines, wind farms, rail line upgrades and highways.

The assessments have included Due Diligence assessments, gateway determinations, as well as assessments under, Parts 3A, 4 and 5 of the EP & A Act.

Len has completed various S90 applications, as well as identifying and recording in excess of 1,000 Aboriginal objects and has authored in excess of 120 reports in the last 15 years.

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3.0 The Assessment

3.1 Description of Land and Activity

The proposed development area (hereafter referred to as the study area) is located at Rothbury, a suburb approximately 12 km to the north of the City of Cessnock.

The proposed Rothbury Country Resort development area is located on the floodplain of Black Creek, about 12 kilometres north of Cessnock, NSW and 15 kilometres north of Black Creeks headwaters in the Broken Back Range. Black Creek is a north flowing tributary of the Hunter River which it joins about 12 kilometres north of the proposed development area.

The study area is bounded by Black Creek to the north and east, by Allandale Road on the west and by property farmland to the south.

The study area lies in the central lowland sub region of the Hunter "Valley. The IHunter Valley Central Lowlands are a belt of flats or floodplain on relatively weak sedimentary rocks of the Permian Singleton coal measures-—-which extends from Newcastle in the east to Murrurundi in the west. In the development area, Black Creek is bounded by a strip of alluvial flats comprising gravel, sand, silt and clay derived from the Permian shales and sandstones (Singleton 1:2S0,000 Geological Series Sheet 5156-1).

The proposed development site fails on the floodplain on the west bank of Black Creek and, within the study area, the landscape primarily consists of a level plain (less than 1% slope) with extremely low (about 5 m) relief in the immediate locality

The majority of the proposed development area lies on the Quaternary sediments of the floodplain of Black Creek.

The primary water source in the development area is Black Creek which presently flows in a deeply incised, narrow approximately 20m. wide and a relatively straight U shaped channel cut at least four metres into its own alluvial deposits.

There are two other streams depleted on the topographic map and are referred to as Grinding Stone Gully and ‘Kangaroo gully

A former house site, Rose Mount homestead, exists in the central north of the study area. And a newer house exists in the North west corner.

The study area has been moderately disturbed by settlement and agricultural practices over many decades. This is evidenced by the reduction in natural vegetation. The study area consists of the following landforms:

Although the proposed development is at a preliminary stage, a number of components are envisaged:

• internal road system
• lot subdivision
• installation of services (drainage, electricity, sewerage).

Insert Figure 1 Location of Study Area

Figure 2 Study area

THE PROPOSED DEVELOPMENT
The proposal is to subdivide the study area into resort style accommodation, golf course and ancillary development.

A concept lot layout is shown at figure 3.

Insert Figure 3 Proposed Development

EXTENT OF PROPOSED IMPACTS UPON THE STUDY AREA
The development of the land may require excavations for housing, landscaping and internal road foundations and associated trenching and backfilling for underground pipes and cables. Retention drains may be required during construction. All of these processes will have a direct impact on the landscape from trucks, bulldozers and construction equipment.

3.2 Is the Land defined as "Disturbed Land" or an exempt or complying development?

The proposal is not exempt or complying development and although the land can be considered disturbed through anthropological processes associated with past land use, it cannot be totally regarded as disturbed under the definition of disturbed land under the NPW Act.

3.3 Is the activity exempt?

No

3.4 Will the activity involve harm that is trivial or negligible?

No

3.5 Is the activity in an Aboriginal Place or are you already aware of Aboriginal objects on the land?

Yes. A Previous study recommended "provisions to facilitate the conservation of Aboriginal Heritage identified through the Aboriginal heritage assessment."

The Aboriginal Heritage Assessment identified the known Objects and areas of sensitivity or potential and recommended that they be set aside from the proposed development. The recommendation from the Mindaribba Local Aboriginal Land Council (MLALC) was for a conservation or archaeological buffer zone.

3.6 Is the activity a low impact activity for which there is a defence in the regulation?

No

3.7 Will the activity disturb the ground surface?

Yes

3.8 Does the Aboriginal Heritage Information Management System suggest potential?

Yes. The AHIMS searches are attached at appendix C.

Locally, several archaeological surveys have been conducted between Cessnock and Branxton. Many of the Aboriginal Objects identified on the AHIMS were observed during those surveys and discussed below.

Brayshaw (1988) had surveyed a 225-hectare study area in 1988 for Rothbury Country Club Resort. The survey was undertaken on foot and by vehicle. Virtually all exposures on the ridge slopes and ridge crests were inspected (Brayshaw l988: 4) No evidence of Aboriginal occupation was located. Brayshaw (1988:4) notes that conditions of surface visibility were extremely low and limited the potential to identify artefact scatter sites. Brayshaw (1988:5) recommended that in the absence of evidence of Aboriginal occupation there were no archaeological constraints to the proposed development proceeding.

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Davies (1991) has surveyed the route of a proposed Telecom optical fibre cable between Cessnock and Scone. The route traverses land adjacent to Allandale Road, along the eastern boundary of the Brayshaw 1988 study area and through the current study area. No sites were located in this area.

North of the current study area near Branxton, Brayshaw (1994) surveyed the route of the proposed Highway connection from the F3 to the New England Highway. In the vicinity of current study area, an artefact scatter was located adjacent to Black Creek, two kilometres west of Branxton. The site comprised eleven artefacts of silcrete, chert, quartz and mudstone, and a probable sub-surface deposit. Sub-surface investigation was recommended to determine the nature and extent of the site (Brayshaw 1994:20).

Koettig (1988) surveyed the sixty-eight hectares of Portion 147, Pokolbin where a tourist facility was proposed. It is located at the base of the Broken Back Range and comprises a number of similar landform units to those within the current study area. Koettig (1988) located five artefact scatters and twenty-two isolated artefacts. Conditions of surface visibility varied, but included a number of exposures in the form of vehicle tracks, erosion and gullying, across the range of landform units present.

The sites comprised between seven and sixty-seven artefacts at densities between one and ten artefacts per square metre. Raw materials were predominantly silcrete, indurated mudstone and quartz, but chert, quartzite, volcanic and other materials were also present. The sites were located on creek banks or basal slopes within one hundred metres of a watercourse (Koettig 1988). Through application of a technological analysis methodology developed by Hiscock at Sandy Hollow, Koettig (1988) assessed the sites as being up to 1,300 years of age. At three sites, evidence of reduction activities was present.

Test excavations were undertaken by Koettig (1989) which revealed a continuous distribution of artefacts along the basal slopes of' the main watercourse. A range of artefact types and raw materials were recorded, including backed blades and artefacts with retouch or use wear. A hearth consisting of a number of large sandstone cobbles, packed into a circular shape measuring 0.5 x 0.6 metres in area was located. Charcoal obtained from this hearth has been dated to 2820 years Before Present (BP) (Brayshaw 1994, p.15).

While ploughing for lucerne crops has affected the ground surface of much of the area Koettig (1989: p.4) estimated that the extent of disturbance was limited to a depth of 0.12 metres. The hearth and majority of artefacts were located below 0.12 metres in depth. Koettig (I989) identified most of the sites as having high research potential and recommended that salvage of these sites was necessary to conserve the archaeological values.

Dean-Jones (1989) investigated the proposed Pokolbin Country Club site, at the junction of Allandale Road and Lovedale Road, some 7 kilometres southeast of the current study area. The fifty-hectare property borders Black Creek. It consists of low gradient landform units, with soils mostly derived from weathered bedrock rather than alluvial sources. Despite conditions of low surface visibility, three artefact scatters and two isolated artefacts were recorded. The artefact occurrences were located within ten metres of Black Creek or its tributaries. Raw materials present included silcrete, chert, mudstone and fine-grained volcanics. The sites contained between seven and eleven artefacts each. Dean-Jones (1989) assessed the sites as being of moderate archaeological significance primarily on the criterion of representativeness and recommended that conservation measures be implemented for each of the sites.

Brayshaw (1985) surveyed the 377-hectare, Pokolbin Park Estate at Nulkaba adjacent to Black Creek and with similar landform units to those within the SSS study area. No archaeological sites were located. Similar results were obtained from a survey of an area proposed for residential development west of Cessnock (Brayshaw 1982).

Ruig (1995) surveyed a ten-hectare site for proposed extensions to the Cessnock landfill and located one isolated artefact. No sites were located within an adjacent twenty-five hectare property, Dean-Jones (1987), or within an adjacent four hundred-hectare property (McIntyre 1984). The latter result was attributed to conditions of extremely low surface visibility (McIntyre 1984).

Kuskie (1996) and (2002) surveyed the same area as Brayshaw and located at different time intervals a total of 30 sites. Kuskie in conjunction with Parkes (2002) surveyed a trunk sewer line from the development and located another 6 sites.

Kuskie in 2002 undertook extensive archaeological investigations for the Vintage Resort development. The Vintage area is also part of the Black Creek Flood Plain. It differs to the current study area in that it is flatter and contains a more significant drainage pattern of lagoons and creek lines. In general the sites are low-density artefact scatters with low numbers of artefacts; 12 of the sites only containing one artefact. The predominant make-up of the artefacts is silcrete, siltstone quartz and volcanic materials. Many of the silcrete artefacts show use of heat treatment. The Kuskie and Parkes study (2002) identified a possible silcrete quarry at VS6. Most of the artefacts occur on basal slopes within 50-60m of a watercourse.

White (2002) prepared a Management plan over the Vintage development and commented on the significance of the archaeological record as follows (p9):
"In general, most of the development area appears to be of low archaeological significance. Individual sites and most of their landscape settings have been heavily disturbed by previous landuse and development works. Some locations … can be enhanced …Site VS6 is a possible silcrete quarry … no other sites of this type is known in the Cessnock area

Hardy (2004) and Roberts (2004)) independently surveyed parts of the study area on the western side of Wine Country Drive and Roberts (2005a) surveyed the entire study area . Hardy identified 10 Objects whilst Roberts identified a geological feature and associated PAD. They concluded that the areas of significance regarding Aboriginal heritage centre on Black Creek and its tributaries along with a rock outcrop parallel with a tributary of Black Creek.

More recently, 4 linear surveys have been conducted along infrastructure corridors passing through or alongside the study area. The benefit of a linear survey is it considers a cross section and variety of landform types rather than an areal survey which may only consider one or two landform types. These surveys were re assessment of generally previously assessed areas for upgrade works or re-alignment. The surveys found additional Objects. This is not surprising given the lapse of time and difference in visibility conditions. They were the Rail corridor (Kuskie), the freeway corridor (Umwelt) and 2 Transmission Line easements (AMBS) and (Besant)

Part of the freeway corridor Branxton- F3 link traversed the northern section of the study area (Umwelt 2006a; 2006b). Excavations at sites along the entire corridor recovered 1545 artefacts across 9 creek catchments (Umwelt 2006b). Wallis Creek, Black Creek and Anvil Creek catchments had particularly high quantities of artefacts.

Archaeological test excavation of landforms adjacent to creeks where no surface artefacts had previously been identified was also undertaken. A significant result of this testing was that, although there were no surface artefacts in some areas, sub-surface artefacts were present in others.

Landform testing also gave an indication of the spatial distribution of artefacts within each catchment area. The testing suggested that artefacts were concentrated on the creek terrace and lower slope landforms. Umwelt suggest that this distribution pattern may have been caused by erosion and downslope movement of topsoil (Umwelt 2006b: 4.38).

Prior to the excavation, 135 surface artefacts were collected in the Anvil Creek catchment with just as many after. This suggests that the quantity of artefacts on the surface reflects of the frequency of subsurface artefacts extant in this local area.

The Swamp Creek area, located approximately 1.5 km southwest of the current study area, was also investigated by (Umwelt 2006b). A lower frequency of surface artefacts were collected in the Swamp creek catchment than at in the Anvil creek catchment (Umwelt 2006b:4.4-4.5). Although only a small area of the Swamp creek catchment was tested, the results suggest that lower frequencies of artefacts may be expected, when compared to other sites in the region, such as Anvil Creek (Umwelt 2006b).

The work by Umwelt shows that whilst artefacts are extremely likely to be found in creek catchments it will not always be the case as there are other factors which affect the density and distribution including Aboriginal land use and occupation. It is probable that the concentration is not necessarily indicative of extensive use of the area of deposit, but more indicative of the landscape, terrain and run off and depositional qualities of the catchment. This observation was supported in an assessment for a mining development at Mt Pleasant (Roberts 2007) which found that the absence of artefacts on a flat depositional area compared to other similar depositional areas was correlated with the existence of contoured bunds on the slopes, and the existence of artefacts behind the bunds. This was also similar to observations of an assessment at Bridgeman Road, Singleton, (Roberts 2005b).

Besant 2007 undertook a 14 km survey of an upland area for proposed feeder routes just south of the study area and identified 8 Aboriginal sites. Aboriginal site frequency was 0.57 per kilometre surveyed. Identified sites include four isolated finds and four artefact scatters. Artefact raw materials included indurated mudstone, silcrete, basalt, chert and porcellanite. All sites were located within 500m of drainage lines.

AMBS (2009) undertook an assessment of a 54km transmission line easement between Kurri and Redbank part of which traversed the southern portion of the study area from east west. As a result of field investigations, 65 Aboriginal sites were identified, including two previously recorded sites. 5 objects were observed within the current study area. Of significance, the artefacts were identified near the PAD identified by Roberts in 2004 and were visible due to substantial sheet erosion that had occurred within the easement. It was believed that the artefacts were not in situ and considered of low significance. It would appear that the artefacts were washed down from near the geological feature and PAD identified by Roberts.

Kuskie 2009 undertook inspections for the rail upgrade between Maitland and Minimbah. Visual inspection confirmed that negligible potential for heritage evidence existed within the study corridor as it had been extensively impacted by earthmoving works and construction of the existing railway line and New England Highway. Stone artefact occurrences, were recorded prior to and during the

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assessment. Whilst isolated artefacts were identified adjacent to the study area they add little to the information base.

3.9 Is there archaeological potential because the proposal is:

- **within 200m of waters;**
  Yes. Black Creek forms part of the study area and has Aboriginal cultural significance.
- **located within a sand dune;**
  No
- **located on a ridge top, ridge line, or headland;**
  No
- **located within 200m below or above a cliff face;**
  No
- **within 20m of or in a cave, rock shelter, or a cave mouth;**
  No

3.10 Can harm be avoided to the object or disturbance of the landscape feature?

Yes. All cultural and archaeological objects as well as areas of potential are conserved within conservation areas and any proposed development will not impact those areas.

3.11 Is Desktop assessment and visual inspection required?

No. An additional visual assessment is not required as a previous field assessment has identified Aboriginal Heritage constraints which will be protected from and not harmed by the proposed development.

3.12 Are Further investigations and impact assessment required?

No. The a cultural constraints have been identified, protected and an Aboriginal heritage management plan will be developed in consultation with the Mindaribba Aboriginal Land Council and the Wonnaruah people

Figure 4 shows the proposed development, the known Aboriginal Objects and the conservation areas established to avoid harm to those objects and areas of significance.

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Insert figure 4

4.0 Impact Assessment

An Aboriginal Heritage investigation was undertaken by Burramako Archaeological Service in 1998. Since that time to the present there has been intermittent but ongoing consultation with Mindaribba Local Aboriginal land Council and the Wonnaruah People.

The investigation covered some 237 ha of which 23.5% of the area was intensively surveyed.

In all, 61 exposures were recorded during the survey, with artefacts being found in only 28 of them. All exposures recorded' were found on walking transects. Taking visibility conditions into account, less than 1% at each land unit was effectively surveyed.

Twenty-two open artefact scatters were found. About 59% of these artefact scatters (13) were found in areas of deep disturbance and the remaining 41% {9} were found at locations where the artefacts appeared to be exposed from close beneath the surface. Locations with artefacts were found in all land units, but it tentatively suggested that more sites are likely to be located in the secondary terrace than in other land units. The simple slope and secondary terrace revealed a larger proportion of artefact scatters in relation to their area, possibly indicating preferential use.

There were two particularly interesting artefact scatters. Artefact scatter "BC1 is located on the banks and levee above Black Crack on the secondary terrace. This -artefact scatter probably has as many as 800-I000 artefacts currently exposed. There are -also scattered charcoal fragments eroding out of the sediments from just below the Surface

Artefact scatter D3 is on the overburden of a clam built on Grinding Stone Golly, in the northwest of the development area. 'This is, on the secondary terrace. Initial impressions are that this location was used to exploit the lag deposit of river cobbles by splitting with further reduction to produce large flakes which were sometimes subsequently used as cores. There is obviously also evidence of 'blade technology but it is impossible to know how much mixing of deposits has occurred.

Whilst these artefacts are in a very disturbed context (i.e. sediments redeposited during dam construction they do indicate the potential for subsurface archaeological material in the area.

Burramako attributed extreme scientific significance to the find and recommended test excavations to help determine the age and historical context.

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However, best practice, now dictates that conservation rather than intrusive exploration is a far better archaeological and cultural outcome. Excavation destroys the archaeological and cultural intactness for no appreciable scientific gain.

The Aboriginal community prefers that significant areas of subsurface deposits are left intact.

This outcome is best achieved by designing the development to avoid the cultural objects and that the protection of the significance be achieved through a cultural and artefact management plan.

5.0 Recommendations

1. Under the NPW Act 1974, it is the responsibility of all persons to ensure that harm does not occur to an Aboriginal object. Whilst undertaking works, if an Aboriginal object is found, work must stop and DECCW notified. An application for an AHIP may also be required. Some works may not be able to resume until an AHIP has been granted. Further investigation may be required depending on the type of Aboriginal object that is found. If human skeletal remains are found during the activity, work must stop immediately, the area secured to prevent unauthorised access and the NSW Police and OEH contacted. The NPW Act requires that, if a person finds an Aboriginal object on land and the object is not already recorded on AHIMS, they are legally bound under s.89A of the NPW Act to notify OEH as soon as possible of the object's location. This requirement applies to all people and to all situations.

2. An Aboriginal Cultural Education Program should be developed by the proponent for the induction of personnel involved in the construction activities in the project area. Local Aboriginal Land Councils may be able to assist in delivery of such induction.

3. That the consent authority should advise the applicant that any consent for construction/development is not an approval to harm an Aboriginal Object and the proponent should be reminded of a person's obligations under the NPW Act 1974 (as amended)

4. Development works **must** be avoided within the known areas containing Aboriginal cultural material an appropriate buffer should be instigated. If Development works which constitute a sub-surface disturbance cannot be avoided or may potentially occur adjacent to the areas of significance, then subsurface investigation under the Archaeological Code should be conducted to determine whether an Aboriginal Heritage Impact permit will be required for such development works.

5. An Aboriginal cultural management plan must be developed in consultation with the MLALC and the Wonnaruah people. Such plan must be in place prior to commencement of any ground works.

6.0 Certification

This report was prepared in accordance with the brief given by HDB to assess of the impact of the proposed development on Aboriginal heritage and was undertaken to demonstrate due diligence.

To the best of our knowledge the report accurately reflects the archaeological survey, findings and results, as well as the input and recommendations of the Local Aboriginal Land Council and the registered Native Title Holders the Wonnaruah people.

Whilst every care has been taken in compiling this report to determine the impact the proposal may have on Aboriginal Heritage and to demonstrate a due diligence process, neither MCAS. It is the responsibility of the individual or proponent to ensure that they have undertaken due diligence.

Signed

L B Roberts

(Archaeologist)
12/03/2013

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7.0 References

Current Study Area

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APPENDIX

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Preliminary Archaeological Investigations of the Proposed Rothbury Country Resort Development Area, near Cessnock, NSW.

A report to New Horizons International Ltd
304 Kent St, Sydney NSW 2000

Prepared by Rosalind James and Wayne Brennan
for Burramoko Archaeological Service
Grace Hill, 108 Narrowneck Road,
Katoomba NSW 2780
Tel: (02) 4782 5495
Fax: (02) 4787 8514

April 1998

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Executive Summary

This is a report on preliminary archaeological investigations of the proposed Rothbury Country Resort development area, near Cessnock, in the Hunter Valley region of New South Wales (NSW). The development site is situated approximately 12 km north of Cessnock on the eastern side of Allandale Rd, which heads towards the township of Branxton.

The proposed development encompasses approximately 237 hectares of rural landscape which previously was used for grazing dairy cattle. There is evidence of extensive ploughing and agricultural work on the property and eight farm dams have been placed within the boundaries of the development area.

In the absence of detailed information from the proponent, some aspects of the development can be described on the basis of the development plan supplied. The proposed Rothbury Country Resort will be a major tourist recreation facility. The development comprises 706 condominiums, one five star hotel, four motels, a golf club, an 18 hole golf course, licensed premises, shopping complex, community and recreation facilities including playing fields and swimming pool, large dams, vineyards, walking tracks, roads, car parking and associated support infrastructure such as sewerage treatment plants and grounds maintenance facilities. The entire area is to be landscaped and the "creeks" (actually erosion gullies, as explained below) are to be reconstituted. The whole site will be disturbed to a greater or lesser extent by the development.

The main objectives of this preliminary archaeological investigation of the proposed Rothbury Country Resort development area was to survey the study area to determine whether any Aboriginal sites could be detected on the surface; to carry out geomorphological inspection in order to identify processes of sedimentation and stream channel formation, geomorphic processes which have contributed to the formation of the site structure, the potential for subsurface archaeology, as well as some indication of the degree of disturbance present at sites; and to advise on the necessity for further investigations. This work was not intended to constitute the archaeological component of an environmental impact survey.

Environmental background, ethnographic context and review of other archaeological work in the region are presented. The geomorphologist's report is included as Part II of this volume. In summary, he suggested dividing the area into four major land units—primary (lower) terrace, secondary (middle) terrace, tertiary (upper) terrace and simple slope—although there are also other topographic features such as relic billabongs and backswamps which may relevant to the archaeology and geomorphology of the floodplain. The geomorphologist raised some interesting propositions about the lag cobble deposit underlying the secondary terrace. Dr Haworth suggests it is indicative of a very different stream regime and a very different climate and stream gradient to now: steeper gradient suggests a time of lower sea level, which at the last glacial maximum (18 000 years ago) was 130 m lower. Surface evidence suggests that Aboriginal people have exploited this lag deposit in the past as a rich resource of stone raw material.

The review of previous archaeological work in the region and some of the ethnographic literature illustrate that any models for Aboriginal occupation of the very generalised. The available sample is heavily biased towards creeklines and thus is not particularly suited to formulation of landscape models. What has been demonstrated is that stone artefacts will be the most commonly found evidence of past Aboriginal occupations but occasionally other features will also be found; that there is considerable variation in attributes and spatial distribution within assemblages from the one site as well as between assemblages from different sites; and that ascertaining unequivocal evidence of chronological change in stone tool technology remains a vexing problem. The Hunter Valley Central Lowlands were inhabited by Aboriginal people from at least 20,000 years ago and there is considerable evidence of occupation from 3,000 years ago to the present. Artefact scatters and features can be confined in space (ie in small clusters) or spread over very large areas, but whether these distributions are indicative of the number of people, length of stay or re-use of camping locations remains uncertain. Establishing the relationship between the available archaeological material evidence and past Aboriginal behaviour is exacerbated by taphonomic processes.

Over most of the development area, visibility was reduced to about 10% or less by dense cover of grasses, exotic weeds, rabbit and cattle droppings, leaf/bark litter and large areas covered with thistles that were at least knee-high. In some places, there were pebbles or rocks the same colour or material as artefacts, which also hindered identification. Surveys were conducted on foot or by vehicle as appropriate. Walking transects emphasised areas with the greatest possibility of providing good visibility. Vehicle surveys were conducted only across heavily grassed fields where visibility was known to be extremely poor. The primary purpose when surveying from the vehicle was to target exposures in the fields and then inspect those for artefacts.

The development area is about 237 hectares, of which 23.5% or 557,669 m^2 were surveyed. In order to assess the effective survey coverage, it is necessary to take account of the visibility conditions. In all, 61 exposures were recorded during the survey, with artefacts being found in only 28 of them. All exposures recorded were found on walking transects. Taking visibility conditions into account, less than 1% of each land unit was effectively surveyed. The survey was reasonably proportional on the upper (tertiary) terrace and on the simple slope. The primary (lower) terrace was slightly over-sampled and the secondary (middle) terrace was slightly under-sampled.

Twenty-two open artefact scatters were found. About 59% of these artefact scatters (13) were found in areas of deep disturbance and the remaining 41% (9) were found at locations where the artefacts appeared to be exposed from relatively close beneath the surface. Locations with artefacts were found in all land units, but it is tentatively suggested that more sites are likely to be located in the secondary terrace than in other land units. The simple slope and secondary terrace revealed a larger proportion of artefact scatters in relation to their area, possibly indicating preferential use, preferential artefact survival, preferential artefact detection conditions or some combination of these causes in the two land units. The primary and tertiary terraces did reveal artefact scatters, but less than would have been expected in relation to their area. These trends are particularly marked in instances where the disturbance resulting in the detection of artefacts was surficial, and this might suggest some temporal element to the causes for this patterning postulated above. The relationship between site location and land unit requires further investigation.

was not attempted.

There were two particularly interesting artefact scatters. Artefact scatter BC1 is located on the banks and levee above Black Creek on the secondary terrace. This artefact scatter probably has as many as 800-1000 artefacts currently exposed. There are also scattered charcoal fragments eroding out of the sediments from just below the surface and, although it is not possible at this stage to discount bushfire activity as their source, it does suggest that within this context there is the potential for preservation of culturally provenanced charcoal which may be datable.

Artefact scatter D3 is on the overburden of a dam built on Grinding Stone Gully, in the northwest of the development area. This is on the secondary terrace. Initial impressions are that this location was used to exploit the lag deposit of river cobbles by splitting them, with further reduction to produce large flakes which were sometimes subsequently used as cores. There is obviously also evidence of blade technology but it is impossible to know how much mixing of deposits has occurred. Whilst these artefacts are in a very disturbed context (ie sediments redeposited during dam construction), they do indicate the potential for sub-surface archaeological material in the area.

It is conventional to discuss significance in six contexts: Aboriginal significance, public significance, historical significance, aesthetic significance, educational significance and scientific significance. Each is discussed. It is explained that scientific significance is also often referred to as the archaeological significance of a site and the criteria most often applied to assess scientific significance are research potential, antiquity, data quality, diversity, rarity and representativeness.

The Aboriginal community have not provided a statement of Aboriginal significance. The Wonnarua Tribal Council have indicated support for only one recommendation at this stage. No written response was received from the Mindarriba LALC.

It was not within the scope of this project for Burramoko Archaeological Service (BAS) to carry out the work necessary to allow assessment of public significance, aesthetic significance, educational significance, or historical significance.

It is not possible to assess the scientific significance of the development on the basis of this survey. The true nature of archaeological material in the area remains unknown due to the sampling biases outlined in subsequent chapters. Assessment of the scientific significance would require sub-surface investigation and more detailed research into the ethnography of the region and previous archaeological work which could be used together to formulate a model of occupation for the area. What has been demonstrated by this preliminary investigation is that subsurface archaeological material is likely to exist within the development area. It has been suggested that there is the potential for this area to be deeply stratified, for datable material to be preserved, for sites which possibly contain Pleistocene occupation evidence, and for the presence of both pre- and post-blade production technologies.

Such material could assist to answer many of the questions still remaining about Aboriginal occupation of the Hunter Valley Central Lowlands. If such material does

It is concluded that the proposed development site has not been researched sufficiently to determine its significance. The evidence presented in this report suggests that the development area has the potential to exhibit archaeological significance in a number of ways—sites with deep archaeological deposits and datable material, particularly open sites, are rare in this region. In these circumstances, our recommendations would be as follows:

- further subsurface investigations should be carried out to determine the nature and extent of archaeological material within the development area and to attempt to resolve the questions raised by the geomorphological study carried out during this first phase of investigation;
- the NSW National Parks and Wildlife Service (NPWS) Cultural Heritage Unit, the Wonnarua Tribal Council and the Mindaribba Local Aboriginal Land Council should be consulted regarding the research design for the subsurface work;
- more detailed review of the ethnography, historical records and previous archaeological work in the region should be undertaken and input to the research design for the subsurface survey;
- the boundaries of land units and other geomorphic features should be accurately mapped so that they can be used as the basis for the subsurface sampling ;
- larger area excavation should be undertaken at suitable targetted find locations found either during this survey or during the second phase of subsurface survey;
- dating should be a priority if suitable samples can be obtained;
- artefact analysis (if appropriate artefact samples are recovered) would be integral to interpreting this site within a regional context;
- the appropriateness of using other techniques (such as pollen and phytolith analysis) which may assist in reconstructing palaeoenvironmental conditions should be considered;
- all artefacts located during the surface survey should be collected except at artefact scatter BC1, which should not be disturbed during the preliminary subsurface investigations;
- anthropological recording of oral histories and traditional stories should be carried out to enable the Aboriginal significance of the site to be assessed; and
- an historical archaeologist should be consulted regarding the historical value of the remains of European buildings on the property and the appropriateness of recording or investigating these further.

Chapter One

1.0 Project Summary

1.1 Introduction

This is a report on preliminary archaeological investigations of the proposed Rothbury Country Resort development area, near Cessnock, in the Hunter Valley region of New South Wales (NSW) (see Figure 1.1). The development site is situated approximately 12 km north of Cessnock on the eastern side of Allandale Rd (MR220), which heads towards the township of Branxton about 7 km to the north, and falls within Lots 1, 2, 3 and 4 of Dp 869651.

The proposed development encompasses approximately 237 hectares of rural landscape which previously was used for grazing dairy cattle. There is evidence of extensive ploughing and agricultural work on the property and eight farm dams have been placed within the boundaries of the development area.

1.2 History of the project

On 10th September 1997, Burramoko Archaeological Service (BAS) received a fax from Mr Ian Power of John M Daly and Associates Pty Ltd (see Appendix A) requesting submission of a tender for archaeological survey of a site near Cessnock proposed for development. This letter indicated that a previous archaeological report prepared by Andrews Neil had stated that no archaeological evidence had been found during their site survey, but Cessnock City Council had requested a more detailed investigation. A map showing the location of the proposed development site was attached to this fax. Jonn M Daly and Associates Pty Ltd were acting on behalf of the developer, Mr Samual Ng of New Horizons International Pty Ltd, Crows Nest, NSW.

On 24th September 1997, BAS initially tendered for preparing a plan for preliminary surface survey of the development site. The tender was accepted on 25th September 1997 by Mr Ian Power on behalf of Mr Samuel Ng. On 3rd October 1997, the development site was inspected by Wayne Brennan (BAS) in the company of Victor Perry and John Miller of the Wonnarua Tribal Council. The purpose of this inspection was to determine the potential for finding Aboriginal sites within the project area and to familiarise the consultant with ground conditions which might affect the survey methodology, logisitics and timeframes. Rick Griffiths of the Mindaribba Local Aboriginal Land Council (LALC) was unable to attend on this date but had agreed to walk the project area separately, so that he would be familiar with the site and could help to formulate an approach to archaeological investigations.

Subsequent to this site visit, Wayne Brennan (BAS) prepared a report (see Appendix A) for Georg Straesser in which he outlined the need for the proponent to apply for permits for consent to destroy Aboriginal sites and the usual process involved in the assessment of Aboriginal heritage which would act as the basis for such consent. He also advised the proponent that the NSW National Parks and Wildlife Service

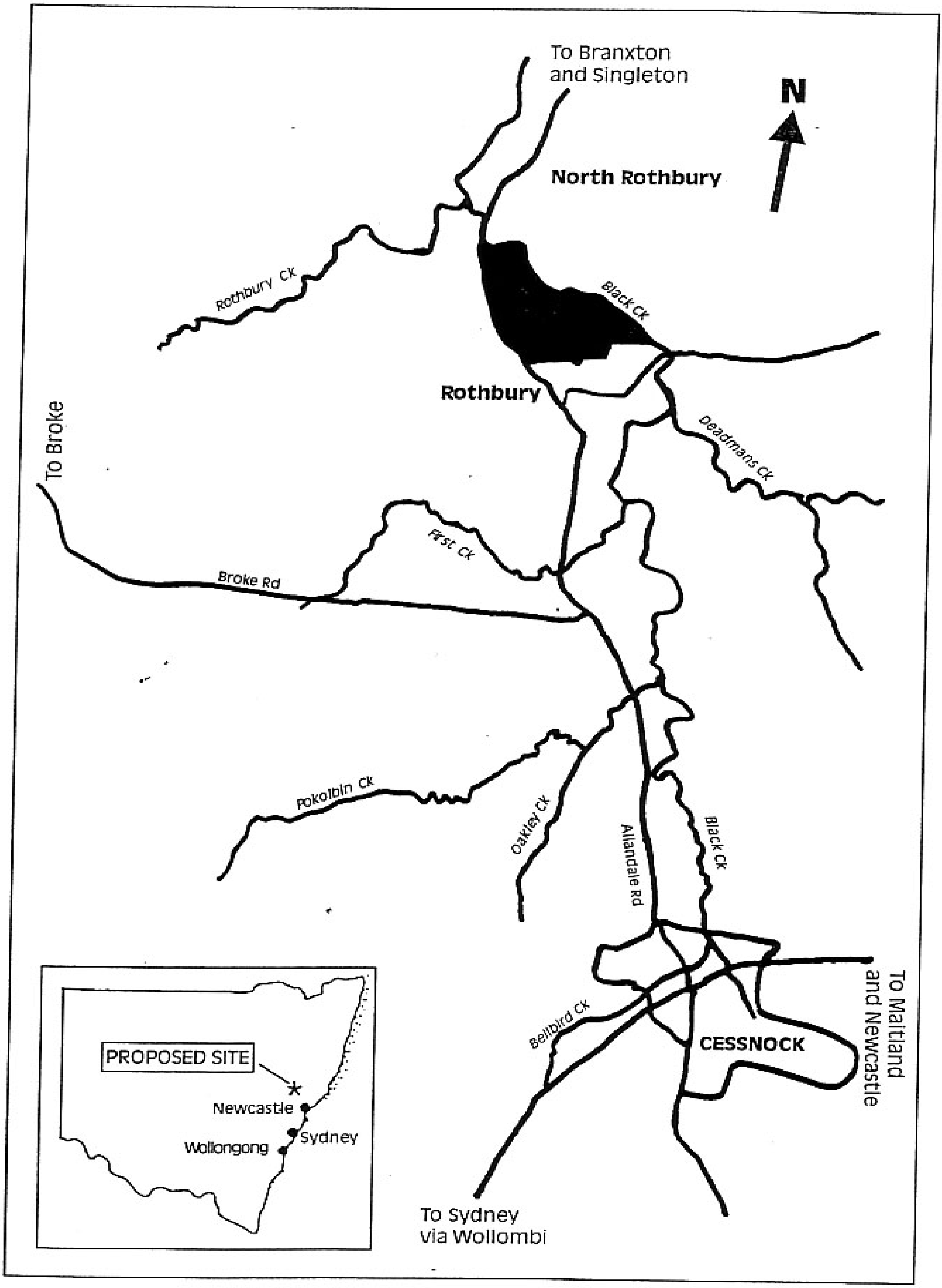

Figure 1.1: General location of the development site.

(NPWS) would usually require subsurface investigation in circumstances where archaeological visibility was low and that the proposed development site fell into this category. Brennan mentioned that permits must be issued by NPWS authorising subsurface testing and that preparation of a research design would be required to apply for such permits. The proponent was also advised that the Aboriginal community must be consulted regarding the proposed development and must be actively involved in any archaeological fieldwork and assessment of the significance of sites found in the project area. Both the Mindaribba LALC and the Wonnarua Tribal Council had suggested that the total surface area should be surveyed, however, the report documents that there was tacit agreement during this site visit that, considering field conditions, it would be more appropriate if the boundaries were walked, erosion scars along the creeks were examined and roads, tracks or any other disturbed areas were targetted. On 13th October 1997, Wayne Brennan (BAS) attended a meeting with the proponent (see minutes Appendix A) to present the major findings outlined in the report. It was agreed at this meeting that BAS should prepare a research design and tender for a preliminary surface survey.

A meeting was arranged for 24th October 1997, to be held on the development site. The purpose of this meeting was to initiate contact between the Aboriginal community and the proponent, provide a forum for the Aboriginal community to have input to the research design, and to allow Ros James to familiarise herself with ground conditions. Unfortunately, the proponent's representative, Georg Straesser (from The EGO Group, architects for the project) was not able to attend this meeting as arranged. Present at the meeting were Rick Griffiths and Steve Talbott from the Mindaribba LALC, Victor Perry and John Miller from the Wonnarua Tribal Council, and Wayne Brennan, Ros James and Chel Roxburgh from BAS. The outcome of the meeting was constrained by Georg Straesser's absence and input from both Aboriginal groups was minimal. Concern was expressed regarding BAS' intention to sample the area rather than carry out a total survey of the surface. BAS attempted to explain that this was only a preliminary survey and that its purpose was not to identify every artefct remaining on the property, but rather to assess whether archaeological material existed and was most probably buried, thus requiring subsurface testing to recover it.

This difference of opinion over methodology often arises in such circumstances. For the Aboriginal community, locating all artefacts that are symbols of their culture is often considered important. This is especially true when there is a perception that the archaeological assessment process is operating under a legislative system which only protects heritage or issues permits for consent to destroy sites on the basis of what is actually found, not with regard to what may be predicted to exist within a development area (although in reality the latter is taken into account when conservation zones, monitoring or salvage are required). The archaeologist, on the other hand, is operating under temporal and financial constraints as well as attempting to meet NPWS requirements and the wishes of the Aboriginal communty. The methodology adopted must be justified with regard to all these factors. Experience shows that in well-grassed areas of low archaeological visibility, artefacts will mostly be found in exposed areas where the deposits have been disturbed so that buried artefacts are revealed. Carrying out a total survey of the surface in such circumstances is not a very efficient methodology—the extra few isolated artefacts that might be found will invariably not alter the outcomes substantially with respect to assessment of significance or recommendations regarding the appropriateness of further subsurface survey or other mitigative work.

On 27th October 1997, BAS received a faxed memo (see Appendix A) from Georg Straesser requesting a report confirming that

- there were no burial grounds or other significant Aboriginal sites within the development area which would prevent the project from proceeding or alter its configuration,
- in areas where Aboriginal sites were found and no development was intended no further action other than recording the finds was necessary,
- in areas where sites were found and development was proposed, the only action necessary was to collect and store the finds, and
- other information relating to the research design and tender which were in preparation.

Mr Sraesser asked that urgent attention be given to this request as the information was required for a Council Development Approval.

A research design for preliminary surface survey and tender (see Appendix A) was sent to New Horizons International Pty Ltd by Ros James (on behalf of BAS) on 30th October 1997. This document outlined the survey strategy, analyses which would be carried out, experience of the personnel involved, standards for documentation of results, possible contingencies affecting completion and project costs and timeframes. It was again stressed that in BAS' opinion NPWS would require subsurface investigation of this development site due to the lack of archaeological visibility caused by substantial groundcover over most of the area. Georg Straesser (The EGO Group) contacted Wayne Brennan (BAS) by phone on 6th November 1997 to inform him that the tender had been successful and that the proponent wanted the work to proceed.

BAS responded to the memo dated 27th October 1997 on 4th November 1997 (see Appendix A) stating that it was not possible to provide the requested confirmation as any action required in relation to Aboriginal sites within the development area could not be ascertained until the necessary field work had been completed and the significance of the sites assessed. Legislative requirements pertaining to the assessment process were reiterated and a summary of these extracted from the NPWS guidelines along with copies of the relevant acts were forwarded.

On 9th November 1997, at the request of Georg Straesser, BAS forwarded a memo outlining the terms of reference for the preliminary survey and a payment schedule (see Appendix A and Section 1.3 below for details). This letter detailed the information about the project design and implementation that the proponent would be required to supply BAS and again outlined the usual archaeological assessment process.

Fieldwork commenced on 14th November 1997 and concluded on the 16th November 1997. On the first day of fieldwork, a meeting was held on-site in the morning. Present at this meeting were Victor Perry and John Miller representing the Wonnarua Tribal Council, Trevor Mason and Steve Talbott representing the Mindaribba LALC, Wayne Brennan, Ros James, Dr Bob Haworth and Chel Roxburgh on behalf of BAS and Georg Straesser (The EGO Group) for the proponent. Mr Straesser discussed the project and presented plans for the proposed development. BAS outlined the methodology to be used during the preliminary surface survey.

On 19th November 1997, Wayne Brennan represented BAS at a team meeting to finalise planning issues for the project (see meeting agenda in Appendix A). No minutes of this meeting were supplied to BAS. Mr Brennan discussed the possible outcomes of the archaeological investigations and tabled a map showing the location of artefact scatters found during the surface survey. In particular, he made the point that an archaeological conservation zone may be necessary and this would probably require alteration of the development plans so that any disturbance of this area was avoided.

On 17th December, a memo (see Appendix A) was forwarded to Mr Samuel Ng via Georg Straesser. This constituted a progress report on work to date, with Dr Haworth's draft report on the geomorphology attached. The results of the field survey were briefly outlined. Mention was made of BAS' initial impression that most artefact scatters had been found in association with ground disturbance, that this almost certainly was an indication that subsurface archaeological material was present and that it was probably at great depth in some places. The memo stated that BAS would recommend that further sub-surface testing of the development area would be required before the archaeological significance of the area could be determined.

A draft copy of the report on the preliminary archaeological survey was sent to the Wonnarua Tribal Council, Mindaribba LALC and New Horizons International Pty Ltd on 29th December 1997. BAS advised that this report should not become a public document until it was completed and incorporated some response from the Aboriginal community. However, against the wishes of BAS, this draft report was placed on public display as part of the development application on 7th January 1998.

The Environmental Impact Statement (EIS) for the Rothbury Country Resort Wastewater System prepared by Perram & Partners in December 1997 indicated that BAS' preliminary investigations had located 22 artefact scatters (p 5.11). It also noted that the development area had the potential to be archaeologically sensitive and that BAS would be recommending more detailed investigation. However, there appears to be some misunderstanding about the nature of archaeological significance, as the EIS (p 5.12) also states that the "...general area where the proposed wastewater treatment plant is to be located is not one of the more significant archaeological areas of the property (R James – pers. comm.)." This is a misrepresentation of the conversation between Terry Perram and Ros James. Whilst Ros James did inform Mr Perram that, on the basis of the results of the surface survey, only possibly one artefact scatter would be impacted by the wastewater treatment plant (for the location nominated at that time), it was not her intention to give the impression that this meant that this area was not archaeologically significant. Ms James also stressed that the area in question provided very restricted opportunity for archaeological visibility on the surface (ie there were very few exposures with low groundcover in this area), that it was probable that subsurface investigation would reveal further archaeological evidence in this area, and that it was not possible on the basis of the preliminary investigations to assess the archaeological significance of the development area as a whole nor of particular areas within the development area.

The process for obtaining Aboriginal comment on the results of the preliminary archaeological survey and recommendations put forward in the draft report has been more drawn out than was expected. The final Aboriginal response to the draft report was not available until 23rd March 1998.

1.3 Objectives of the investigation

The main objectives of this preliminary archaeological investigation of the proposed Rothbury Country Resort development area were to survey the study area to determine whether any Aboriginal sites could be detected on the surface; to carry out geomorphic inspection in order to identify processes of sedimentation and stream channel formation, geomorphic processes which have contributed to the formation of the site structure, the potential for subsurface archaeology, as well as some indication of the degree of disturbance present at sites; and to advise on the necessity for further investigations. This work was not intended to constitute the archaeological component of an environmental impact survey.

The terms of reference for this study were outlined by BAS as follows:

- surface survey of the proposed development area in order to locate and identify any archaeological sites;
- collation of background information relating to the development area from the NPWS Site Register and associated reports, relevant ethnographic literature and research articles and publications;
- recording of locations with artefacts and the routes/locations of surveys as appropriate to meet NPWS standards;
- basic description, summary statistics and analysis of artefacts located during fieldwork;
- incorporation of geomorphic report and Aboriginal community reports into our final report;
- evaluation of the archaeological and cultural significance and conservation value of any Aboriginal sites located within the proposed development area, if possible;
- recommendations regarding the necessity of further investigation of the development area or salvage, protection or conservation of Aboriginal sites within the development area; and
- presentation of our findings in a report which will meet NPWS requirements and preparation of 12 copies to be distributed to the Wonnarua Tribal Council (1 copy), the Mindarriba LALC (1 copy), to BAS personnel involved in the work (3 copies), to NPWS (3 copies) and to New Horizon International Pty Ltd (1 copy).

1.4 Potential impacts of the project

The proponent was informed that to meet NPWS standards, this report should include a description of how the proposed development is to be implemented, flexibility of the project design, timing and staging of the proposal and identification of direct and indirect impacts (both short and long term). These things must be taken into account when making recommendations about the Aboriginal heritage in the development area. BAS requested information about details of the planned construction methods, what type of machinery will be used, access roads, what types of foundations will be erected for proposed buildings, how extensive changes to dams and other waterways will be, how the proposed golf course will be prepared, whether any areas will be excluded from development, and so on. The only information supplied by the proponent was a map of the proposed development (see Figure 1.2) and verbal confirmation that the entire area would be disturbed to a greater or lesser extent by the development. The proponent also indicated that minor adjustments could be made to the development plan to incorporate a conservation zone, if appropriate.

In the absence of detailed information from the proponent, some aspects of the development can be described on the basis of the development plan supplied. The proposed Rothbury Country Resort is a major tourist recreation facility. The development comprises 706 condominiums, one five star hotel, four motels, a golf club, an 18 hole golf course, licensed premises, shopping complex, community and recreation facilities including playing fields and swimming pool, large dams, vineyards, walking tracks, roads, car parking and associated support infrastructure such as sewerage treatment plants and grounds maintenance facilities. The entire area is to be landscaped and the "creeks" (actually erosion gullies, as explained below) are to be reconstituted.

Chapter Two

2.0 Aboriginal involvement in the project

Experience has shown that communities often have a wealth of knowledge about heritage, and communities and other interest groups also have strong opinions about heritage significance and conservation. For these reasons, Aboriginal participation in this project was important.

Discussions with the Mindarriba LALC were facilitated by Rick Griffiths and discussions with the Wonnarua Tribal Council were facilitated by Victor Perry. The aim of these consultations were to:

- outline the purpose of the project and its objectives;
- involve the communities in the identification of significant heritage places and to develop a forum to enable the community to provide information on cultural values and places of significant traditional and contemporary associations for inclusion in later stages of the project;
- encourage the communities to use the process to suggest avenues of investigation;
- give the communities the opportunity to comment on the process of identifying culturally important data and assessment methods; and
- ensure consideration of community concerns.

Close contact was maintained with both these groups via our Aboriginal assistants throughout the fieldwork period.

Three on-site meetings with the Aboriginal community were held on the following dates 3rd October 1997, 24th October 1997, and 14th November 1997. Details of attendees, the purpose and the outcomes of these meetings are provided in Section 1.2 above which outlines the history of the project.

A copy of the draft of this report and all site cards was given to the Mindaribba LALC and the Wonnarua Tribal Council for ratification and comment. The findings and recommendations presented in the draft report were discussed at separate meetings with the two Aboriginal groups involved, that is, with the Rick Griffiths at the Mindaribba LALC on 5th February 1997 and with Victor Perry of the Wonnarua Tribal Council in Cessnock on 6th February 1997. Wayne Brennan and Ros James both attended these meetings.

2.1 Aboriginal participation in fieldwork

At various times during the survey assistance with fieldwork was provided by members of the Wonaruah Tribal Council—Tracy Miller (3 days), Leanne Miller (3 days)—and the Mindaribba LALC—Ricki Jo Griffiths (1 day), Ron Griffiths (2 days), Tanille Griffiths (2 days), and Joby Patten (1 day).

2.2 Aboriginal response to this report

Although a draft copy of this report was provided in December 1997 to both the Wonnarua Tribal Council and the Mindaribba LALC for comment and input to the recommendations, only the Wonnarua Tribal Council provided a formal written response for inclusion in the final report. Numerous attempts have been made over the ensuing three months to obtain a formal response from the Mindaribba LALC; however, due to circumstances beyond our control (for example, key LALC people on sick leave, attending funerals or preoccupied with other important LALC business) and the need to finalise this report, a written response was not received from the Mindaribba LALC in time to be included in this report. Nor was any direction regarding the appropriateness of providing an outline of conversations between BAS and the Mindaribba LALC forthcoming.

A full copy of the Wonnarua Tribal Council response in provided in Appendix A. Much of the response is devoted to a discussion about the need for clarification about which Aboriginal group has control over management and/or consent to destroy for sites in the Cessnock area. The Wonnarua Tribal Council expressed concern about the manner in which Mr Straesser had approached Aboriginal consultation during this project, primarily because he had informed Aboriginal groups in the area other than the Wonnarua Tribal Council and Mindaribba LALC about the project and the Wonnarua Tribal Council do not consider these other groups should have been involved.

With regard to specific comments regarding the archaeological survey, report and its recommendations, the Wonnarua Tribal Council suggest that the findings are "interesting" and basically agree with their ideas about Aboriginal occupation and use of the area. Nonetheless, they will only consider supporting the recommendation for a more detailed review of the ethnography, historical records and previous archaeological work in the region—this is, in fact, suggested by BAS to provide input to the research design for the second phase of subsurface archaeological investigations. The Wonnarua Tribal Council's letter does not make it clear whether they think the purpose of the more detailed review is to act as a basis for the research design of the second phase of archaeolgical work suggested by BAS.

Chapter Three

3.0 Background to the Archaeology

3.1 Environmental Background

3.1.1 Geographical Setting

The proposed Rothbury Country Resort development area is located on the floodplain of Black Creek, about 12 kilometres north of Cessnock, NSW and 18 kilometres north of Black Creek's headwaters in the Broken Back Range (see Figure 1.1). Black Creek is a north-flowing tributary of the Hunter River which it joins about 12 kilometres north of the proposed development area (Haworth, Part II, this volume). The study area is bounded by Black Creek to the north and east, by Allandale Road (Branxton-Cessnock) in the west and by property fencelines in the south.

3.1.2 Geology

The Rothbury Country Resort development area lies in the central lowland subregion of the Hunter Valley. The Hunter Valley Central Lowlands are a belt of lower relief country developed on relatively weak sedimentary rocks—the softer sandstones, shales, mudstones and conglomerates of the Permian Singleton coal measures—which extends from Newcastle inland to Murrundi. In the development area, Black Creek is bounded by a strip of alluvial flats comprising gravel, sand, silt and clay derived from the Permian shales and sandstones (Singleton 1:250,000 Geological Series Sheet SI 56-1).

3.1.3 Sectors within the Development Area

In order to standardise the decription of locations within the development area, the site was divided into four sectors based on the major geomorphological features: northwest sector, central/north sector, central/southwestern sector and southeastern sector (see Figure 3.1).

3.1.4 General Topography

Upper Black Creek floodplain is contained within a long narrow south-north trending depression stretching over a length of 12 kilometres and ranging in width from one to two kilometres. The floodplain begins just south of the town of Cessnock and terminates where Black Creek passes through a narrow defile just north of the development site, after which the creek continues on its northward course to the Hunter River through a different floodplain regime. This defile consists of two relatively gentle bedrock slopes just north of the bridge over Allandale Road on the northern border of the property, and just below the confluence of Black Creek with a major tributary (Rothbury Creek) coming in from the southwest about one kilometre northwest of the development area.

The valley of upper Black Creek is surrounded on the south, west and northeast by steeply scarped ranges between 200 m and 580 m in altitude above sea level (ASL) (see Plates C.1 and C.2). As the bed of Black Creek ranges from between 40 m and 80 m ASL, this creates considerable local relief in the surrounding region. The result has been an exceptional buildup of sediment on the floodplain for a stream of this size. Much of the floodplain of Black Creek from Cessnock to the Rothbury Country Resort development area is now cultivated and covered by extensive vineyards. It is likely that the valley sediment is thickest at the northern end of the floodplain, and especially in the developmemt area, where sediment carried by floodwaters falls out of suspension as these waters bank up and slow after being checked by the narrowness of the defile and the incoming tributary stream, Rothbury Creek (see Plates C.1 and C.2). In particular, bedload in the form of rounded cobbles and pebbles have formed extensive but now largely buried deposits during past higher velocity fluvial regimes (Haworth, Part II, this volume, see Plate C.3).

The proposed development site falls on the floodplain on the left bank of Black Creek and, within the study area, the landscape primarily consists of a level plain (less than 1% slope) with extremely low (about 5 m) relief in the immediate locality. It also incorporates a small area of simple slope. Eighty five percent (85%) of the proposed development area lies on the Quaternary sediments of the floodplain of Black Creek. The present landscape mostly derives from the evolution by erosion and reworking of the different levels of fluvial terraces and associated landforms. The only parts of the development area that do not originate from past or present fluvial deposition are the narrow segment of bedrock slope in the southwest adjacent to Allandale Road (Branxton-Cessnock), and occasional bedrock residuals (Triassic sandstones) such as that underlying the former homestead site of "Rose Mount" in the central/north sector of the study area (see Plate C.4). There is also some possible aeolian modification of sand deposits (probably derived from weathering sandstone outcrops) on the floodplain in the southeastern sector of the development site (Haworth, Part II, this volume, see Plates C.5 and C.6).

3.1.5 Water Resources

The primary water source in the development area is Black Creek which presently flows in a deeply incised, narrow (~ 20 m wide) and relatively straight U-shaped channel cut at least four metres into its own alluvial deposits. At only one point does it cut into bedrock—this is on the bend 600 m above the road bridge that marks the northern boundary of the development area. The stream appears to have reached equilibrium with its present discharge, exhibiting a stable pool and riffle sequence (see Plate C.7), with pools dominant. These pools extend for 60-80 m and are up to two metres deep, while riffles are much shorter, rarely exceeding five metres in length. The stream at average flow (November 1997) ranges between five and ten metres in width of wetted perimeter, and usually fills the whole base of the incised channel. The top of the U-shaped channel averages between 20 m and 25 m in width; thus the slopes of the incised channel are extremely steep, having a gradient of between 50% and 25% (Haworth, Part II, this volume).

There are two other streams depicted on the topographic map and, in this report, these are referred to as Grinding Stone Gully and Kangaroo Gully (see Figure 1.2 and Plates C.8-C.10). The term "gully" is used in preference to "creek" because "creek" in the sense of a semi-permanent stream with a defined channel would probably be a misnomer, as the evidence suggests that these side channels are erosion gullies formed since European settlement and in some cases artificially modified for water storage (see Plate C.10). Haworth (Part II, this volume) suggests that these gullies have been formed by headward erosion of lateral percolines (intermittent underground throughflow) by groundwater sapping (see Plate C.11). Gullies of this kind are usually the result of frequent water table fluctuation caused by mass removal of native vegetation, and consequent concentration of groundwater through uncompacted sediments with less resistance to hydraulic flow.

Prior to European settlement these gullies were probably grassy meadows occupying gentle depressions. After vegetation clearing, groundwater would have diffused throughout the semi-consolidated sediments of the floodplain. (In fact, the sediments range from completely unconsolidated on the newer, lower terrace deposits to near-lithification in the ferruginised deposits in parts of the older, upper (tertiary) terrace). Removal of mature trees after European settlement raised water tables and activated the gully erosion—artificial drains, banks, and hard hoof compaction would have directed flow and, combined with increased groundwater seepage, set off the present cycle of headward erosion through piping and sapping (see Plates C.12 and C.13). The gullies worked back from the stream at first along the confluence points with the old infilled billabongs, which are at the lowest level and probably contain the loosest sediments, thus providing the easiest path for groundwater. They then turned inland and cut either into the secondary terrace as at Grinding Stone Gully or, in the case of Kangaroo Gully, followed the boundary of the secondary terrace until it met overland flow coming from the bedrock slopes. It is significant that both these gullies have much more water and well defined beds only towards the west of the development site, near the road and the slopes: before European settlement they probably disappeared underground when they reached the edge of the semi-consolidated floodplain sediments (Haworth, Part II, this volume).

3.1.6 Climate

The central lowlands fall in the marginally semi-arid core of the Hunter Valley where mean annual rainfall is as low as 350 mm (Story *et al* 1963, p 64). The average rainfall for the Cessnock area is about 670 mm with the wettest period occurring from December to April. However, despite this being the period of highest rainfall, it is also the period of highest temperatures so that the period when the soil moisture is adequate for unrestricted growth is reduced to the six winter months from April to September. Winter and summer rainfall are about equal on average, but erratic enough to cause intermittent droughts and floods—these can be characteristic of the winter rain-summer drought of southern Australia or of the summer rain-winter drought of the north depending on the origin of dominant climatic influences. Winter climates are strongly influenced by southern maritime air masses, which enter the Upper Hunter from the west dehydrated by their passage across the southern coast and inland, resulting in clear, dry weather with cold westerly winds and a high risk of frost. In summer, occasional inflows of moist warm air from the northeast increases the prospect of thunderstorms. Maximum day temperatures sometimes exceed 38°C with little relief at night. The hottest month is usually January when the average temperature is 24°C (with an average daily range of 15°C-30°C). The coldest month is usually July which experiences an average temperature of 10°C and about seven frost days. High summer temperatures and moderate rainfall bring a seasonal moisture stress for floral and faunal life in summer and frost hazards and low temperatures interfere with the growing season for flora in the winter (Story *et al* 1963, pp 8, 62-3, 67).

3.1.7 Geomorphology

A detailed report on the geomorphology produced by Dr Robert Haworth is included as Part II of this volume, so only an overview of the geomorphology is presented here. Haworth has identified eight floodplain geomorphic units comprised of a typical fluvial depositional assemblage as follows:

- stream bed
- stream bank
- levee
- primary (lower), secondary (middle) and tertiary (upper) alluvial terraces (see Plates C12, C.13 and C.14)
- oxbow lakes ("billabongs")
- backswamps
- fossil relics of some of these forms (see Plates C.15-C.18)
- possible aeolian modification of sand deposits in the southeastern sector of the property on the floodplain (see Plates C.5 and C.6).

Along the reach of Black Creek on which the development area is situated, the floodplain is up to 2 km in width, with sediments ranging in thickness from over five metres deep in the primary and secondary terraces to less than a metre in the backswamps and interface with bedrock at the floodplain's margins. There are various deposits of different sediment grain sizes, from fine silts and clays, sands, and extensive gravel and cobble beds. Laterisation and pedogenesis have taken place in much of the older depositional facies (eg see Plates C.18 and C.19), and some of the very oldest remnant deposits higher up the valley sides have developed ironstone nodule beds.

Downstream of the property the floodplain narrows as the river cuts its way between two parallel ridges in its flow towards the Hunter River 12 km to the north. The floodplain on the right bank, which is not part of the proposed development site, has the simplest structure, of bank, levee and active primary terrace less than 0.5 km wide and sharply demarcated on its outer edge by the escarpment of a branch of the Molly Morgan Range (see Plate C6). The right bank of the river cuts into the bedrock of this escarpment in the last bend on the northernmost part of the development area. On the left bank, which is the proposed Rothbury Country Resort site, the floodplain consists of the numerous relic forms which are often one to two metres higher than the opposite bank.

The present fluvial regime is one of a straight, single thread, deeply incised stream where bankfull discharge would not be common. There is little sign of extensive exceed 38°C with little relief at night. The hottest month is usually January when the average temperature is 24°C (with an average daily range of 15°C-30°C). The coldest month is usually July which experiences an average temperature of 10°C and about seven frost days. High summer temperatures and moderate rainfall bring a seasonal moisture stress for floral and faunal life in summer and frost hazards and low temperatures interfere with the growing season for flora in the winter (Story *et al* 1963, pp 8, 62-3, 67).

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The present fluvial regime is one of a straight, single thread, deeply incised stream where bankfull discharge would not be common. There is little sign of extensive recent deposition on the flood plain except for the levees on either side of the stream which are probably still receiving sediment during overbank discharge events. Beyond the presently aggrading levees, the floodplain appears to have entered a degrading, erosional phase.

There is ample evidence that this present phase has replaced a previous regime of a meandering and possibly multi-thread stream that overtopped its much lower banks more frequently and was actively cutting a flood plain out of a higher level, secondary terrace. Beyond this secondary terrace there are remnants on the distal edge of the flood plain of a third and much older terrace formed at a higher level than the two younger terraces. This older terrace also extends for up to 500 m in width.

Apart from the present regime, there is therefore sedimentary evidence for three depositional phases building and reworking to produce a complex flood plain, probably over many thousands of years. The three depositional phases will be designated phases 1, 2 and 3, from the river outwards, or from the younger to the older, and their relic forms discussed in order to allow them to be fitted into the context of the archaeological finds.

Phase 1

The youngest depositional episode comprises the primary (or lowest) terrace (see Plates C.12-C.14), and other landforms produced by the meandering stream phase, which appears to have been cut out of an older, higher relic terrace (the middle, or secondary terrace: see below). The banks of Black Creek and the associated levees topping them represent the present fluvial regime; however, these banks have cut through two earlier phases of deposition. The lower, primary terrace is traversed by relic infilled billabongs (oxbow lakes), which are now moist grassy depressions (for example, Plate C.18), filling only in 1 in 100 year floods. These fossil billabongs are usually within 50 m of the present stream, which cuts through their original arcuate form leaving remnants on either side of the stream, although far more of these relics are preserved on the left bank (the Rothdale Country Resort side) than on the right bank. Associated with this phase are extensive sand deposits on that part of the floodplain contained within the southeastern sector of the property (see Plate C.6). These deposits appear to have been reworked by the wind to form a low, broad west-east trending dune, covered with scanty grass and infested with large rabbit warrens (see Plate C.5).

Phase 2

The second phase is evidenced by the higher (and therefore probably the older) secondary (or middle) terrace (see Plates C.12, C.13, C.17, C.19 and C.20) covering lag gravels. The existing farmhouse and silos and the older, now abandoned, homestead site at "Rose Mount" (see Plate C.21) are situated on remnants of this feature. This higher terrace must represent the culmination of an earlier phase of river development, during most of which time the river flowed at a higher level to the present. Recorded 1 in 100 year floods (for example, 1954) have never covered this terrace. The base of this terrace, so far as could be ascertained from dam extraction material and erosion front profiles (see Plate C. 3), consists of rounded gravels (mostly in the cobble range) of varied lithologies, and occasional, extremely large , angular sandstone slabs. This large fluvial cobble assemblage is set approximately 3 m above the present base of the Black Creek incision, and the evidence suggests that it has a wide extension, scattered in lenses for the length of the floodplain underneath the second terrace.

The interface of the first (lower) terrace and the secondary terrace is usually sharply demarcated by a bank that rises one to two metres above the primary terrace (see Plates C.12-C.14). In a few places in the middle section of the valley, this boundary bank also forms the bank of the present stream, that is, no lower terrace has developed on this side of the stream. However, the demarcation bank between the two terraces is mostly situated further inland from Black Creek, as the lower terrace has cut extensively into the higher terrace in most places. However, On the Rothbury Estate side of Black Creek, the second, middle terrace is generally much wider than the lower terrace, extending as much as 500 m inland. On its distal side, the middle terrace declines gently into a long lateral depression that represents a former backswamp (now largely drained or modified: see Plates C.29-30), and the limit of the products of the depositional regime that produced this sedimentary unit.

Phase 3

Between the termination of the second terrace at the backswamp depression and the bedrock slopes (see Plate C.22) in the far west of the development area is what is interpreted as a third, older terrace, with most of its features obscured by a gentle slope development on deep alluvium. On the distal edge of this third, highest terrace, in the far southwest of the study area, there is an exposed lag deposit of fluvial gravels at a height of eight metres above the base of the present streambed, and approximately two metres above the middle terrace. This lag gravel appears different in nature to that under the middle terrace. It is associated with an extensive lens of ironstone gravels. This ferruginisation may have taken place at a time when the terrace was intact and iron could move up and down the water table, or the iron may have moved laterally and downslope from the adjacent bedrock rise.

The extreme southwest portion of the development area (southwest central sector) adjacent to Allandale Road has colluvial-derived soils formed on a bedrock slope (see Plate C.22), which have probably developed on a different and much longer timescale to the floodplain deposits. However, the changing base level of the river must have influenced the development of the slope in its later stages, that is, probably during Quaternary time.

Possible time frames of landscape unit formation

It is probable that the present river form is very recent, and may post-date the beginning of European settlement. Good preservation of the remnant billabongs (eg see Plates C.15 and C.16), the development of the lateral erosion gullies initiated along part of the channel of former billabongs (eg see Plate C.8), and the absence of pedogenesis (or soil formation into an A and B horizon profile) which is widespread in the middle terrace (compare Plates C.12 and C.13 with Plates C.19 and C.20) suggest that the lower terrace has been actively forming until fairly recently, and some deposition still occurs in one in 100 year floods.

Pinpointing the age of the fine sediment that makes up the top layers of the middle terrace (see Plate C.20) and the age at which the lag fluvial gravels were covered by these fine upper layers of sediment is more problematic. The sheer extent of the middle terrace compared to the generally narrower lower terrace suggests that either it was deposited over a much longer timeframe or that it was the product of a series of extreme climatic and environmental events. Either possibility points to the mid or the early Holocene (5000 to 10 000 years ago), both dates when the climate was changing rapidly and the landscape probably adjusted to the change with more intense erosion and deposition. However, the fineness of the upper sediments of the secondary terrace is consistent with a long and stable regime of high discharge, which suggests the climatic optimum of the full 5000 years of the early Holocene Dodson (1986) described warmer and wetter conditions at Barrington Tops on the opposite side of the Hunter Valley for this period, and conditions were probably similar in Black Creek's source area in the Broken Back Range.

More problematic are the lag deposits themselves. The well rounded nature of the rock material (see Plate C.23) suggests that it had traveled some distance, at least as far as from the Broken Back Range (~ 12 km). This would still require much higher discharge and velocity, and therefore a considerably higher rainfall than today, as well as a steeper gradient in Black Creek. The middle terrace lag beds are about 3 m above the present streambed, which today only has the competency to carry and deposit silt and limited amounts of small angular gravel.

The cobble material underlying the second terrace is indicative of a very different stream regime and a very different climate and stream gradient to now: only a steeply graded, high velocity stream could possibly rework rock from the ranges a mere 12 km away to such smooth and rounded forms. There is less small pebble material, which is consistent with the short distance available for reworking.

Steeper gradient would suggest a time of lower sea level, which at the last glacial maximum (18 000 years ago) was 130 m lower: Black Creek is sufficiently close to the present tidal limit of the Hunter (Maitland) to be affected by eustatic changes in sea level. But this period was also generally believed to be a time of lower rainfall, though possibly the lower temperatures (- 5 ^{0}C from present) provided a better water balance and a higher effective precipitation in the Black Creek catchment. Snow may have fallen on the higher peaks (~ 500 m) of the Broken Back Range, and the spring thaw may have induced mass wasting and the transport and tumbling of large rocks.

Another factor to be added to the climatic effects is a geomorphic one: the defile to the immediate north of the development area, as well as the large incoming tributary (Rothbury Creek), would have slowed down floodwaters and forced deposition, particularly of the heavier, larger bedload. This may have occurred over a very long period of time through several cycles of deposition and erosion, and where all kinds of climatic effects could have acted on the upper catchment material or on the lower base level. During the erosion phases the finer sediments would be carried away, gradually building up (and rounding) the gravel beds buried today under a later deposit of fine sediment, itself in the early stages of being eroded away. Some of the large boulders suggest they had been fixed in the streambed for some time, as they have been rounded only on the upper side.

Occasional boulders are also exposed in the present stream banks, but they tend to be more angular and suggest a nearby source, such as the residual at "Rose Mount". But they also indicate that the stream may, even today, be able to occasionally shift big rock slabs in exceptional floods if it can tap a suitable source. Such sources have presumably been closed off by the development of the flood plain smothering any residual rock outcrops with fine silt, as at the site of the abandoned "Rose Mount" homestead (see Plate C.4).

The gravel beds under the secondary terrace lie ~ 3 m above the bed of the present stream, which itself has an unknown depth of alluvium below it. Only the main thread of any stream would have the necessary velocity to move large rocks. This suggests that the location of the lag gravels was the site of a palaeo-version of Black Creek that could be characterised as a steep, single thread mountain stream, responding directly to the local relief of ~ 500m, with little flood plain development above or below, and a much lower base level at its confluence with the Hunter River.

It must be assumed that the upper, third terrace is of a greater age than the rest of the flood plain, from its location at a higher level and its erosion to a gentle incline (1 in 300 gradient).

3.1.8 Vegetation

The vegetation has been changed greatly by the clearing of the original woodland and destruction of many of its grasses through intensive grazing (Story *et al* 1963, p 9). Much of the study area is thickly grassed. Over the entire area there is a very sparse distribution of trees. Along the banks of Black Creek there is healthy regrowth of Casuarina/Allocasuarina *sp.* and White Cedar (*Melia azederach*), with some other remnant rain forest , as well as Angophora species. It is likely that the banks supported a gallery rainforest at the time of European settlement. The lower terrace is mainly pasture mixed with wet meadow, with semi-denuded sandy rises on the southern end of this zone infested with rabbits. The middle terrace is almost all open pasture, but with an important remnant of mature paperbark tea tree (Melaleuca *sp.*). Introduced species were planted around the old homestead, "Rose Mount" (see Plate C.21). The backswamp zone contains some important wet meadow species and some dense groves of *Casuarina glauca* (swamp oak). Several species of birds common to open grasslands were observed in this zone, as well as numerous species of waterfowl in the wetter areas. The uppermost (tertiary) terrace contains the best remnant of the original vegetation association on the property, and significant amounts of regrowth of canopy and understorey species as well as a rich herb layer. This area, in the central southwest sector of the property is underlain by ironstone gravels, and was probably regarded as unsuitable for cultivation for this reason, so has been used as a woodlot. It is probably the only part of the property which has not at one time or another been ploughed. While many of the large canopy trees have been removed, the integrity of the vegetation association has survived, although the extent of their original distribution is unclear. Up to six native ground cover plants were flowering at the time of observation, including one orchid (Haworth, Part II, this volume).

For at least the last 40 years, European activity within the development area has been restricted to cattle grazing for dairy farming and at present the only land use activity within the development area is cattle agistment. It is also likely that most of the development area has been cleared (not even any tree stumps remain) and ploughed in the recent past for cultivation purposes. The exception is a small area used as a woodlot (mentioned in preceding paragraph).

As outlined in the methodology, landform and basic vegetation data were collected on all archaeological survey transects. Only preliminary descriptions of the local environment are offered here and for the most part, these are merely general, qualitative impressions of the development area. However, it can be seen that within a day's walk (about 15 km radius) there is a variety of vegetation and other resources and stone raw material sources would have been available within the development area at various times in the past.

3.2 Archaeological Background

Archaeological work in the Central Lowlands has been dominated by Environmental Impact Surveys. Koettig (1990a) referenced 114 survey reports and Holdaway (1993) adds 11 more recent reports to the list as well as two other special assessments of archaeological work in the Hunter Valley. The University of New England has been carrying out research on the Bayswater mining lease since 1994. In the past 4 years, there have been at least 80 further consultancies completed in the Hunter Valley. Despite over 20 years of archaeological investigations in the Hunter Valley, very little of this work has been published (cf Hiscock 1986, 1993). It is not within the scope of this first phase to review all of this background material; however, an overview of the major hypotheses put forward for the region can be presented.

The most common type of archaeological sites found in the Hunter Valley Central Lowlands are open stone artefact scatters (Koettig 1990a). Occasionally these sites also reveal evidence of other, rarer cultural feature types such as heat treatment pits, ovens (Koettig 1992) and stone hearths (Brayshaw McDonald 1992; Koettig1992). Archaeological investigations have also provided some information on the distribution of archaeological evidence across the landscape, the spatial arrangement of features and artefacts within sites, the composition of artefact and raw material types to be found in stone artefact assemblages and the manufacturing processes used by Aboriginal stone knappers.

Most archaeological survey to date has been focussed along creeklines. This has as much to do with the higher archaeological visibility afforded by these unstable, eroding locations as anything else. Artefacts in such contexts often form a virtually continuous scatter over hundreds of square metres (eg Hiscock and Koettig 1985) rather than discrete clusters, which could be demarcated, as "sites". Any apparent clustering is more probably a product of the areas of exposures revealing artefacts than an indication of the real distribution of archaeological material (see Davidson *et al* 1993). Stone artefacts have also been found on slopes and along ridgetops (see, for example, Davidson *et al* 1993) but this evidence has not been described in detail. The suggestion that the distribution of cultural features varies along different creek systems, being more frequent along more permanent watercourses than along more ephemeral ones (Hughes 1984), remains undemonstrated. Koettig and Hughes (1983, 1985) have also suggested that backed blades are found in sites along all creek systems, whereas retouched/used/edge damaged (R/U/ED) artefacts were more frequently associated with sites along minor creeks. However, Rich (in Haglund 1993) found the distribution of backed blades to be more restricted, their production and use being confined to major creeklines. R/U/ED artefacts were spread across the landscape, although she concurred that they were more frequent along minor creeks.

Knapping floors are the most commonly recorded features. Their identification has been defined in various ways by different researchers but a common theme in all these definitions is the concept of a concentration, within a restricted space, of stone artefacts which are derived from the working of one or more cores. Where such distribution patterns have been observed on the surface (ie mostly in exposures caused by erosion), some caution must be exercised in accepting their identification, as explained above. Evidence from excavations is equally confusing and this is at least partially due to the lack of specific research into the internal structure of knapping floors or surrounding distributions. Koettig (1990b, 1994) found hammerstones and anvils were usually located on the edge of stone reduction areas. Backed blades and R/U/ED artefacts occurred together on knapping floors, indicating that core reduction and subsequent processing of flakes into backed blades were not spatially distinct activities. However, Rich (in Haglund 1993) suggested that artefacts exhibiting use wear or retouch (other than backed blades) tended to be discarded away from the knapping floor. Heat treatment of silcrete and its subsequent reduction were carried out in adjacent areas rather than the same area. There is far too little evidence to draw any firm conclusions about these different findings.

Very few hearths or other features have been recorded during surface survey. Excavations during the last two decades have revealed hearths (eg Brayshaw McDonald 1992; Haglund 1993; Hiscock and Koettig 1985; Koettig 1992, 1994). These have usually been less than 1 m in diameter with varied structures. Most of them range in date from 3,000 to 200 years ago, but one was found to be over 20,000 years old (Koettig 1986). One large stone feature has been interpreted as an oven and hearths incorporating stones as heat retainers have been identified (Koettig 1992). The available data does not lend itself to the formulation of a model of the relationships between these features which might describe site structure.

Stone artefacts from sites in the Central Lowlands have primarily been classified as blade technology, also referred to as the "small tool tradition", which is predominantly characterised by the production of retouched flakes called backed blades. The introduction of this distinctive technology is commonly used as a chronological marker indicating a change in production methods in the mid-Holocene around 5-6,000 years ago. More recently, stone artefact analyses have focussed on technological attributes in an attempt to understand the manufacturing processes involved in stone tool making and to investigate variation through time (eg Haglund 1989; Hiscock 1986, 1993; Baker 1992; Hiscock and Koettig 1985; Koettig 1992; Witter 1988, 1992). However, these studies have concentrated on backed blade production with little consideration of the strategies used prior to the introduction of this manufacturing process. Evidence of earlier occupation in the Hunter Valley has rarely been recorded (Hiscock 1986; Koettig 1986).

In particular, Hiscock (1986) published an influential paper in which he determined the relative chronology of open artefact scatters based on the artefact sequences from an excavated rockshelter at Sandy Hollow. He proposed a three-phase chronology:

- Pre Bondaian Phase, ending 1300 years ago, with no backed blades,
- Bondaian Phase I, 1300 years ago, introduction of backed blades and an increase in platform preparation, particularly faceted platforms, and

- Bondaian Phase II, 800 years ago, with fewer backed blades, less platform preparation and a preference for overhang removal rather than faceting.

Hiscock identified the "tranchet" reduction techniques as a characteristic feature of Bondaian assemblages.

Many researchers have had difficulty replicating Hiscock's results (eg Haglund 1989). Critiques elsewhere have pointed out some of the problems with Hiscock's findings (Baker 1992; Davidson *et al* 1993).

Witter (1992), drawing on his research throughout NSW, has proposed two technological industries, the Microblade industry and the Core and Flake Tool (Utilitarian) industry. Within the Microblade industry, he identifies eight different reduction strategies. Witter also mentions that earlier assemblages (ie preBondaian) are highly variable locally and represent strategies relating to minimisation of stone material transport.

Baker (1992) modified Hiscock's original thesis and presented three main stone-working strategies based on his technological analysis of the Narama assemblage. These may be described as

- *a specialised alternating platform strategy* identified by cores with alternating platforms, which was characteristic of backed blade production. This method incorporates Witter's eight reduction strategies and Hiscock's tranchet retouch.
- *an opportunistic unidirectional flaking strategy* identified by unidirectional cores.
- *heat shattering of blocks of silcrete* and reduction of the resultant pieces, a strategy often used to produce flakes for backed blade production.

Koettig has carried out extensive research of artefacts retrieved from large area excavations at Camberwell (1992) and Bulga (1994). Her findings were too detailed to discuss at length here, but they provide a viewpoint which is at odds with some of the proposals summarised above. For example, Koettig (1994) found that Baker's (1992) contention that backed blades were produced using specialised reduction strategies and flakes for other uses were produced by more opportunistic reduction strategies was not supported at Bulga. Furthermore, she agreed with Haglund (1989) that facetted platforms appear to persist as a reduction strategy in recent Bondaian assemblages.

Koettig makes several other salient points which should be mentioned here. Firstly, she (1994) raises the issue of the comparatively limited sample sizes retrieved from archaeological investigations in the Central Lowlands and notes that any observed differences in the range of archaeological evidence in particular areas could consequently be misleading. Koettig also suggests it is possible that there may be regional variation and that presumably could account for the different findings of various researchers. In relation to the significance of variation in certain attribute states, Koettig warns that variation between artefacts from the different reductions which occurred *within* a knapping floor and were apparently contemporaneous could sometimes be as great as the variation often argued to be key indicators of chronological change or standardisation for backed blade production. She concluded that, without independent information derived from conjoin analysis, recording of technological attributes may describe an assemblage but could not necessarily provide an interpretative framework. Comparison of Bondaian and non-Bondaian assemblages is necessary in order to determine whether the range of variation in flake morphology said to be indicative of the Bondaian was significantly different to the range of variation apparent in assemblages from other types of production cycles used before the introduction of backed blades.

It can be seen from the above discussion that any models for Aboriginal occupation of the Central Lowlands derived from current knowledge must perforce be very generalised. The available sample is heavily biased towards creeklines and thus is not particularly suited to formulation of landscape models. What has been demonstrated is that stone artefacts will be the most commonly found evidence of past Aboriginal occupations but occasionally other features will also be found; that there is considerable variation in attributes and spatial distribution within assemblages from the one site as well as between assemblages from different sites; and that ascertaining unequivocal evidence of chronological change in stone tool technology remains a vexing problem. The Central Lowlands were inhabited by Aboriginal people from at least 20,000 years ago and there is considerable evidence of occupation from 3,000 years ago to the present. Artefact scatters and features can be confined in space (ie in small clusters) or spread over very large areas but whether these distributions are indicative of the number of people, length of stay or re-use of camping locations remains uncertain. Establishing the relationship between the available archaeological material evidence and past Aboriginal behaviour is exacerbated by taphonomic processes.

3.3 Ethnographic Background

3.3.1 Aboriginal Heritage

There is little detailed information about the nature of Aboriginal ecology in the Hunter River region. Brayshaw (1986), Curr (1887), Miller (1986) and Wood (1972) have given well-integrated accounts from primary sources for the region.

A large portion of the ethnographic evidence of the area draws from the accounts about Aboriginal people on the coast (Threlkeld 1974; McKieran 1911) and the surrounding areas (White 1934).

There are also some early reports by settlers (Bridges 1959) as well as accounts by some of the early explorers (Breton 1883; Cunningham 1966; Howe 1974; Mitchell 1848).

In southeastern Australia, including the Hunter Valley, there is evidence of occupation for at least the last 20,000 years (Brayshaw 1995).

Attenbrow (1982, cited in Brayshaw 1986 but not included in list of rederences) in a study of shelter sites in the Mangrove Creek catchment just south of the watershed of the Hawkesbury and Hunter Rivers found that most of the evidence for occupation of the valley dated from the last 5,000 years. Of the 16 rockshelters she investigated three contained evidence of older occupation. One site at Loggers extended back beyond 11,000 years BP. Other dates of occupation sites have been recorded as follows:

- at Glennies Creek from an excavated hearth at a depth of over one metre, Koettig (1986) obtained a date of >20,000 years BP;
- from a dune at Moffit Swamp east of Raymond Terrace, Baker (1993) obtained a date of just over 17,000 years BP.

Most of the sites within the region of the study area are open campsites. These are very difficult to date and are problematic in developing a temporal sequence due to bioturbation and other heavy disturbance of surface material, as has been explained above.

3.3.2 Demographics and the distribution of Aboriginal groups in the Hunter Valley Region

The study of the way Aboriginal groups moved through the landscape has in most cases been difficult for archaeologists to assess. Early attempts by Tindale (1974) to work out distributions of Aboriginal groups spatially were based primarily on language groups and, though an extremely valuable work, it fails to take into account several important factors.

Firstly, after European occupation, the numbers and the way Aboriginal people moved through the landscape was drastically altered and had been even before direct contact with Europeans. Highly infectious diseases such as small pox and cholera were introduced along the traditional trade routes and tribal interfaces and this no doubt reduced the numbers of groups and individuals within these groups (Brennan 1994). In many cases, there could have been a merging of the smaller bands and therefore inaccurate recordings by the settlers and explorers during early contact with Aboriginal groups in the area.

Secondly, in some cases, there can be common languages spoken by particular tribal groups associated with each other within a region. This can be confusing if linking language group with a particular portion of the landscape.

There are no records to explain the possible tribal distribution of Aboriginal people occupying the Hunter Valley prior to the mid to late 1800s (Davidson and Lovell-Jones 1993). Brayshaw (1986) has identified the Wanaruah as occupying the central Hunter Valley to Merriwa in the west, with the Geawegal, a separate language group, occupying the eastern side of the Hunter Valley from Ravensworth to Murrurundi.

Davidson and Lovell-Jones (1993) in their ethnographic study of the Hunter Region concluded from their communication with John Miller and study of his work (Miller 1986) that the main language group was the Wanaruah and that the Gawegal, Awakaba and Gringai were sub-groups or kinship groups of the Wanaruah, each having their own dialects.

Brayshaw (1995) suggests that the Wanaruah were a sub group of the Kamilaroi, who were centred on the Liverpool Plains. Breton (1883, pp 203-204) described the burial of four men and two women of the Kamiloroi tribe who were killed near Wollombi Brook.

Brayshaw also explains occupation by the various groups at the time of European contact:

> ...coastal areas of the Hunter Region were occupied by the Awabakal, centred on Lake Macquarie and its mountainous hinterland. To the north were Gaddhang speaking people, including the Gringai of the Dungog area and the Worimi of Port Stephens. Higher up the Hunter Valley were the Wanaruah extending from the Singleton area to Merriwa.
>
> (Brayshaw 1986, p38)

Linguistic studies undertaken by Threlkeld (1892) indicate that the Awabakal may have more in common with the Wanaruah and possibly were a sub group of the Wanaruah. The suffix "kal" (or gal) perhaps indicates a kinship group rather than a full "tribe". This would suggest links from the coast through to the Liverpool Plains (Brayshaw 1995).

Barrallier also suggests a tradition of contact and trade between tribal groups. Upon finding hatchets of English manufacture in a canoe near Newcastle in June 1801, he commented:

> ...it is not improbable they obtain them in their incursions having communication with the natives of the Hawkesbury passing the mountains near Mount York or with the natives of the Hawkesbury.
>
> (Barrallier 1974, p 82)

Moore (1981) also refers to a trade route along the Boree Track, which met the Hunter Valley near Milbrodale. McCarthy notes that another route which Aboriginal groups used from as far north as Singleton travelling to Brisbane Waters for marine resources was along the Wollombi Brook and the Macdonald River to Mangrove Mountain in the south east (McCarthy 1939).

There are also other accounts of Aboriginal links between the coast and the hinterland.

The Awabakal made reed spears and exchanged them inland for possum skin rugs and fur cord (Threlkeld 1974 pp 42, 61, 206).

Dawson (1830, pp 136-136, cited in Brayshaw 1995 but not included in list of references) recorded similar accounts in the Port Stephens area. Aboriginal groups from the interior, in particular from the upper districts of the Hunter River or its branches, exchanged possum skins, belts of yarn and net headbands for iron axes, seashells and pieces of glass from the coastal Aboriginal groups.

Although these accounts are few, they tend to support the claims regarding coastal and interior contact made by Aboriginal groups in other areas, such as the Daruk and the Gundungurra of the Blue Mountains/Cumberland Plain region who had regular contact through ceremony and trade as documented by Mathews (1896), Brennan (1994), Stockton (1995), and Meridith (1990).

Other written records that document Aboriginal movement in the area at the time when Europeans first arrived are sparse but a few are recounted below. Breton described a number of Aborigines that he encountered enroute to Wollombi:

> Some miles from the inn we fell in with several of the Aborigines , and farther we rode the more we saw until at length there were not less than sixty with us....These people consisted of the two tribes, one from Illarong , the other belonging to the Wallombi [sic] and were on their way to wage war with another tribe. Some of them were diligently employed in painting their

> sable bodies in a most fantastic manner, with a substance that resembled pipeclay. (Breton 1883, pp 203-204)

On the 11th of February 1830 near Broke (approximately 25 km southwest of the study area), Felton Mathew noted in his journal:

> Visited the first camp of the natives I have seen. There were about 60 men women and children. I remained with them about an hour, and saw them retire for the night, each party or family kindling its own separate fire apart from the others. The place where they were camped in was a romantic spot on the bank of the Wollombi. (Mathew 1829- 1832)

Large proportions of open campsites are found along creek systems and river terraces as opposed to locations further from water sources. As previously explained, this may have to do with preservation and exposure rather than patterns of movement or location of campsites. Further review of the ethnography may help to determine the extent and the nature of occupation patterns within the Hunter Valley Central Lowlands region.

Chapter Four

4.0 Fieldwork

4.1 Landscape context

The major land units identified by the geomorphologist have not yet been accurately delineated with surveying instruments and they were often difficult to identify in the field, depending on where the transect traversed the development area. From some vantage points and in some places, they were obvious; in others, they were not. However, Dr Haworth plotted the approximate extent of the three terraces and the simple slope on a 1:25,000 topographic map. These plots were transferred to a 1:4000 scale development plan (see Figure 4.1) and the area of each land unit was estimated from that plan. This plan was also used to stratify the sampling sub-units during the analysis phase. Allowing for the inherent inaccuracies in such a method, it does provide some basis for assessing how balanced the survey was with regard to testing each of the four major land units and these results are presented below.

The study area is estimated to be about 237 hectares. This is comprised of about 63 hectares of primary terrace (26.58%), about 96.5 hectares of secondary terrace (40.72%), about 54.5 hectares of tertiary terrace (23%) and about 23 hectares of simple slopes (9.7%).

The *primary (lower) terrace* (see Plates C.12-C.14) is at its widest in the northwestern and southeastern sectors of the development area, where it forms extensive lower levels several hundred metres wide. In its middle section, the primary terrace has made less substantial inroads into the earlier secondary terrace, and is often less than 50 m wide. A number of disturbance factors that could assist or hinder artefact detection or affect the integrity of archaeological remains are operating within this land unit. These include periodic flooding and alluvial aggradation, stream bank erosion, gully erosion, sheetwash erosion, pastoral damage caused by land clearing, ploughing and water management, and animal disturbance in the form of rabbit droppings and burrows, cow manure, and hoof damage caused by cattle.

The *secondary (middle) terrace* (see Plates C.12, C.13, C.17, C.19 and C.20) is much wider than the primary terrace, extending as much as 500 m inland. The edge of the secondary terrace is sharply demarcated and rises one to two metres above the primary terrace. In its middle section, it still at places forms the banks of Black Creek. The disturbance factors which could assist or hinder artefact detection or affect the integrity of archaeological remains within this land unit include past periodic flooding and alluvial aggradation, stream bank erosion, gully erosion, sheetwash erosion, pastoral damage caused by land clearing, ploughing, water management, roads/tracks and farm constructions, infrastructure development, insect damage caused by ant mounds and trails, and animal disturbance in the form of rabbit droppings and burrows, cow manure, and hoof damage caused by cattle. The damage caused in some places by rabbits and cows is far more extensive and

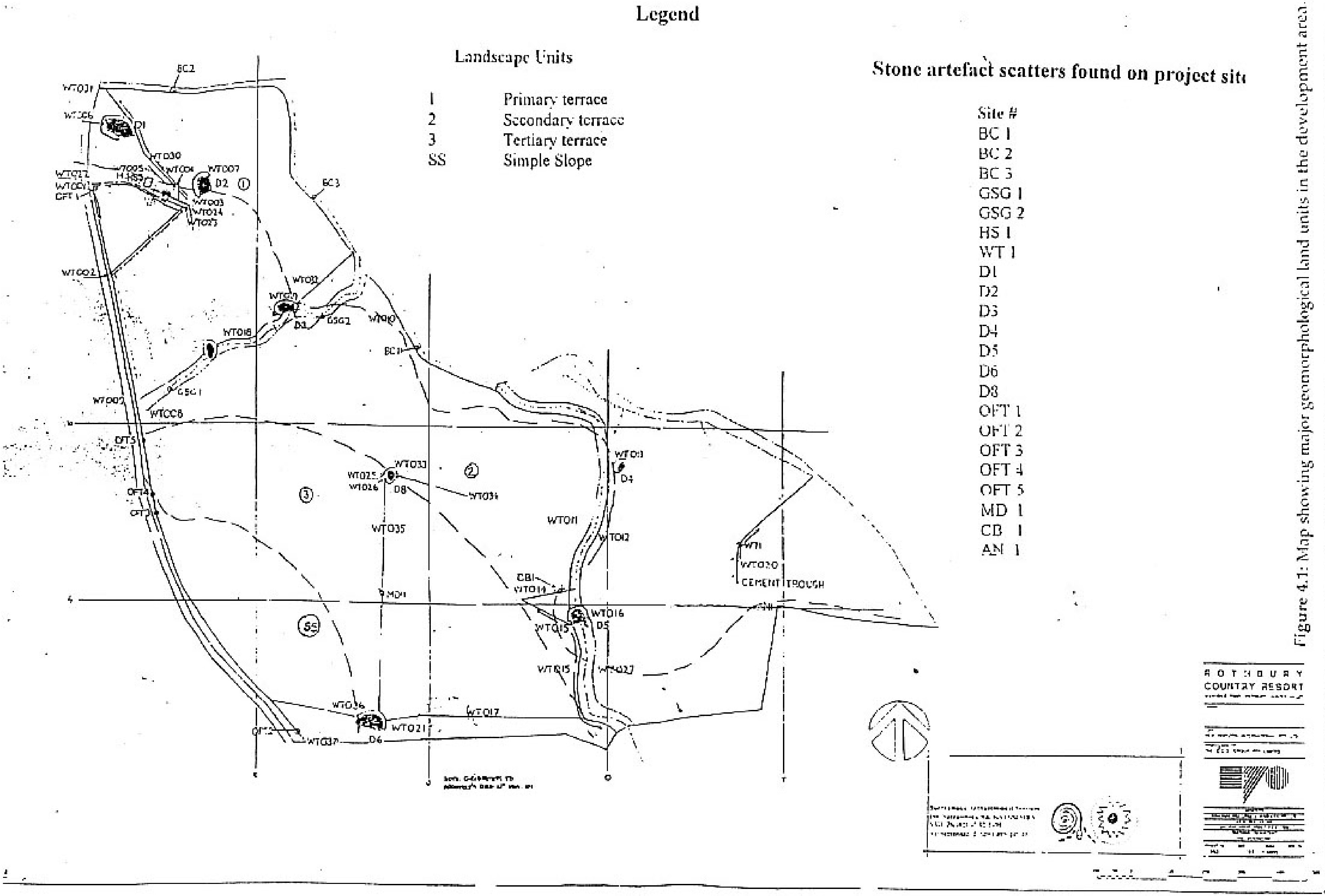

Figure 4.1: Map showing major geomorphological land units in the development area.

more severe in the secondary terrace than anywhere else in the development area. There is also more disturbance caused by other pastoral activities, particularly water management, roads/tracks and farm constructions, infrastructure development and gully erosion.

The *tertiary (upper) terrace* lies between the termination of the secondary terrace and the bedrock slopes (see Plate C.22) in the central/southwest sector of the development area, with most of its features obscured by a gentle slope development of its deep alluvium. The most severe disturbance in this land unit has been caused by pastoral activities such as water management, land clearing and ploughing, and by gully erosion. Other disturbance factors include trampling and hoof damage by cattle, rabbit and cow droppings, ant nests and trails, sheet wash erosion, farm constructions and roads and tracks.

The *simple slope (bedrock)* (see Plate C.22) is defined as an area in the central/ southwest portion of the development area, adjacent to Allandale road. It has colluvial-derived soils formed on a bedrock slope, which have probably developed on a different and much longer timescale to the terraces. The major impacts on this land unit have been caused by land clearing, ploughing, water management, and infrastructure development and to a lesser degree rabbit and cattle droppings and hoof damage by cattle.

Details of the disturbance factors and their severity in relation to sampling sub-units are presented in Table D.6 in Appendix D.

4.2 Survey Strategy and Recording Procedures

It was anticipated that in most places, the degree of ground cover would obscure material evidence of Aboriginal occupation and mask any surface sites. Initial reconnaissance of the development area confirmed that visibility would make any attempt at total survey an ineffective and inefficient methodology. Over most of the 237 hectares, visibility was reduced to about 10% or less by dense cover of grasses, exotic weeds, rabbit and cattle droppings, leaf/bark litter and large areas covered with thistles which were at least knee-high. In some places, there were pebbles or rocks the same colour or material as artefacts, which also hindered identification. Under conditions such as these, the detection of archaeological materials and definition of the extent of their distribution is largely determined by factors affecting surface visibility.

It was decided that detection of stone artefacts would primarily be afforded in those areas which had experienced erosion or disturbance. Therefore, the survey was concentrated in bare patches and any areas of 'disturbance' with minimal ground cover (such as vehicle tracks, animal pads, pathways, fencelines, junctions of tributaries and main channels, waterwash, dam overburdens and eroded banks or gullies) where it was more likely for archaeological artefacts to be exposed. Some locations, even though 'bare', had pebbly ground layers which further confounded the identification of stone artefacts. Attention was also be paid to large trees for scars, bedrock exposures for grinding grooves, and natural rock outcrops which may have provided sources of raw material for stone artefact manufacture.

Surveys were conducted on foot or by vehicle as appropriate. Walking transects emphasised areas with the greatest possibility of providing good visibility. A large proportion of the left bank of Black Creek and the entire length of both banks of Kangaroo Gully and Grinding Stone gully were walked, as were a number of fencelines, a long section near Allandale Road which had been disturbed by the digging of an optical fibre trench, all dam overburdens, several drainage ditches, a water management contour bank and a sample across heavily grassed fields to verify our suspicion that these environments would provide few exposures with the visibility suitable for successful detection of artefacts. Vehicle surveys were conducted only across heavily grassed fields where visibility was known to be extremely poor. The primary purpose when surveying from the vehicle was to target exposures in the fields.

A pedestrian parallel transecting method was employed. The length of transects varies, their end being determined by boundaries such as fencelines or the extent of a landscape feature. The sides of drainage lines and about 25 m away from the edges were covered. When an artefact was located, an area around it came under scrutiny. In practice, the size of this area was defined by either decline in artefact density or lack of visibility. The width of walking transects varies according to the number of people in the survey team. Past experience indicates that a realistic estimate of survey coverage is 1 m either side of each walker's path. Vehicle transects were always 60 m wide. Initial experiments confirmed that it was possible to see exposures up to distance of 30 m from the side of the vehicle. When an exposure was observed, the vehicle stopped and the exposure was inspected and recorded in the same manner as on walking transects.

The major sampling unit was the transect. The sampling unit recording form outlined location details, length/width, land system, slope class, local relief, and landform pattern. Each sampling unit could be divided into a number of sampling sub-units. Where the environment changed considerably, sampling sub-unit summaries were completed. These recorded length/width and location of sampling unit, landform, nature of the land surface, percentage and type of rock outcrop, type and extent of disturbance, agents of disturbance, type and percentage of groundcover, other detection limiting factors, height, extent and kind of foliage for tallest vegetation stratum, understorey and ground layer, and whether artefacts were found. Similar details were recorded for exposures—type of exposure, length/width, percentage and type of rock outcrop, type and percentage of groundcover, other detection limiting factors, and whether artefacts were found. At places where artefacts were found, details of the location, length/width, criteria for determining site boundary, type and percentage of groundcover, site condition, and a count of artefact types in different raw material groups were recorded.

All survey routes (indicating survey method) and observed locations with artefacts were marked on a 1:25,000 topographic map (see Appendix B). Transects surveyed are shown in Figure 4.2 and their surface conditions and vegetation are described in Tables D.4 - D.5 in Appendix D. Locations with artefacts are also plotted in Figure 4.3 and salient features of the geomorphic/land units, surface conditions, relationship to survey transects, artefact density, artefact type and raw material are noted in Tables F.1 and F.2 in Appendix F.

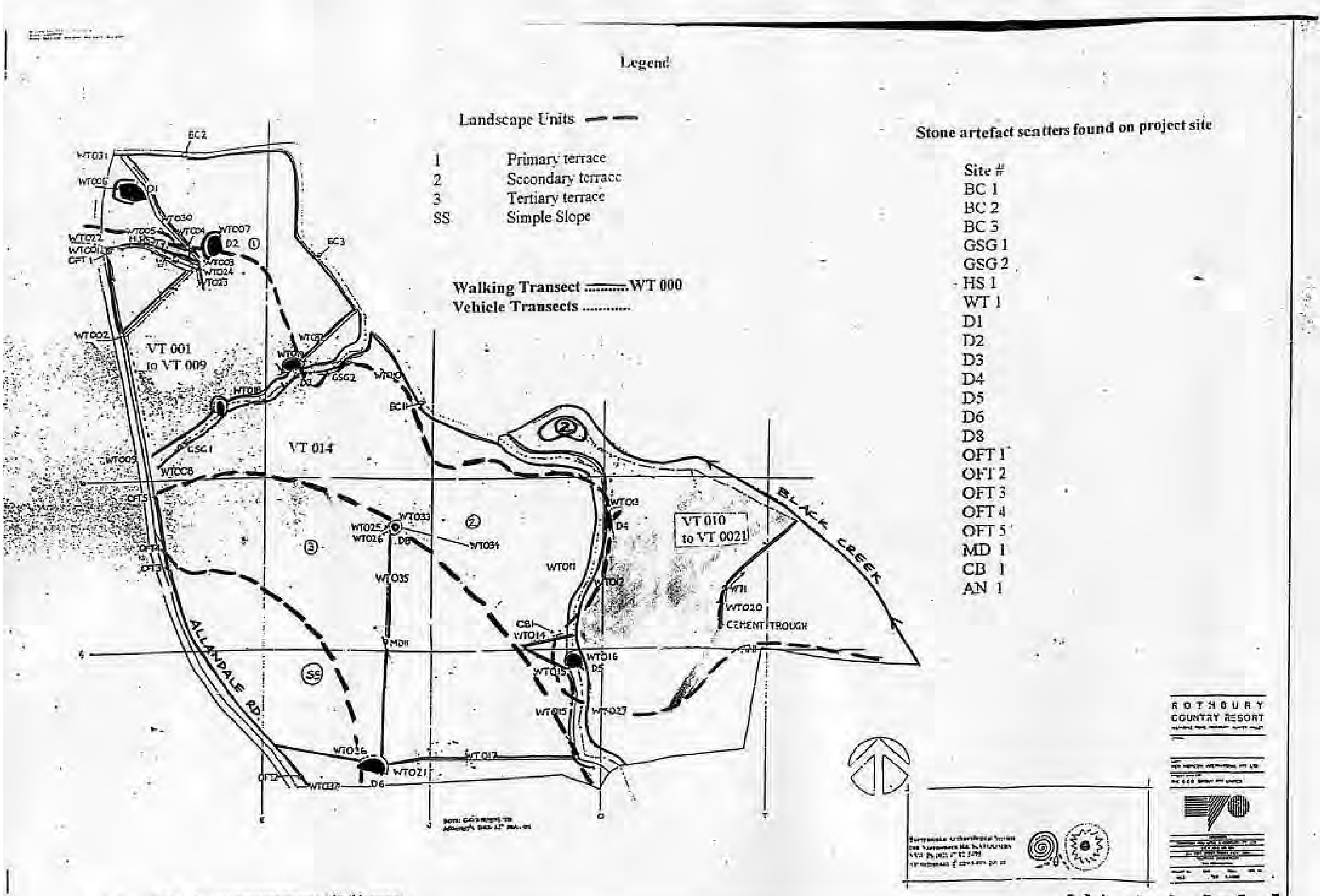

Figure 4.2: Map showing transects surveyed for this report.

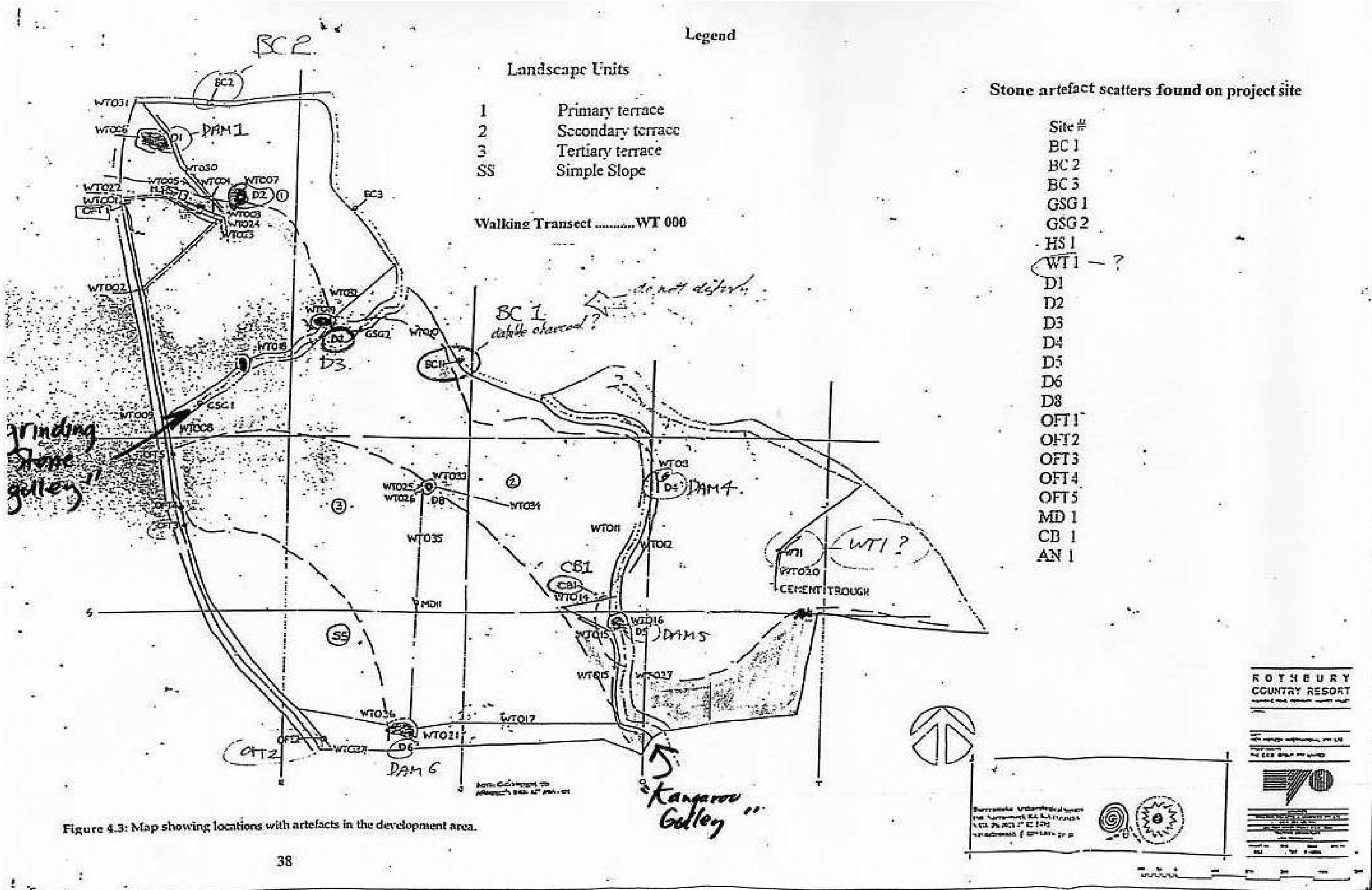

Figure 4.3: Map showing locations with artefacts in the development area.

4.3 Fieldwork and Project personnel

Fieldwork commenced on 14th November 1997 and concluded on the 16th November 1997. Ros James, Wayne Brennan and Chel Roxburgh carried out the survey over three days. At various time during the survey assistance with fieldwork was provided by members of the Wonnarua Tribal Council—Tracy Miller (3 days), Leanne Miller (3 days) —and the Mindarriba LALC—Ricki Jo Griffiths (1 day), Ron Griffiths (2 days), Tanille Griffiths (2 days), and Joby Patten (1 day). A geomorphologist, Dr Bob Haworth, carried out three days fieldwork concurrently.

4.4 Definition of a site

For the purposes of site recording, a site was defined as any location yielding surface exposure of archaeological material. If it was an isolated artefact find, an arbitrary site size of 1 m x 1 m was assigned. In all other cases, the criterion for determining the site boundaries was either decline in artefact density or visibility. Throughout this report, when referring to places where archaeological material was found during this surface survey, the terms "find locations", "artefact locations" or "artefact scatters" are used rather than the term "site/s". The authors prefer this terminology to avoid the usual connotation of "sites" as "campsites" because it is not possible to determine on the basis of surface evidence alone whether small exposures revealing artefacts are individual campsites or whether those in close proximity to each other might be associated with each other and thus constitute the one campsite.

4.5 Survey Coverage Data

The development area is about 237 hectares, of which 23.5% or 557,669 m^2 were surveyed. This is made up of 5.9% (140,699 m^2) walking transects and 17.6% (417,000 m^2) vehicle transects (see Figure 4.2).

	Total Transects		Walking Transects		Vehicle Transects	
Sampling Unit Location	Area (sq m)	% Total Area Surveyed	Area (sq m)	% Total Area Surveyed	Area (sq m)	% Total Area Surveyed
Off track - fenceline	16,314	2.93%	16,314	2.93%		
Off track - watercourse	63,797	11.44%	63,797	11.44%		
Off track - across field	466,635	83.67%	49,635	8.90%	417,000	74.77%
Off track - dam overburden	8,682	1.56%	8,682	1.56%		
Off track - drainage ditch	2,120	0.38%	2,120	0.38%		
Off track - contour bank	151	0.03%	151	0.03%		
Total	557,699		140,699	5.90%	417,000	17.6%

Table 4.1: Summary of location of survey transects.

Table 4.1 summarises the survey transects according to their location and survey method (see also Figure 4.2). The walking transects were concentrated in areas of higher visibility such as watercourses, dam overburdens, water management contour banks, drainage ditches and fencelines. About 9% of the walking transects traversed fields with generally low visibility and confirmed our suspicions that few opportunities for artefact detection would be available in these locations. Thereafter, fields were surveyed by vehicle.

In order to assess the effective survey coverage, it is necessary to take account of the visibility conditions. NPWS have suggested that one way of doing this is to quantify all the exposures encountered and then, by taking account of the visibility conditions, calculate the proportion of them that provided potential for the detection of artefacts. For example, if an exposure had an area of 100 m^2 but the visibility was only 10% then the effective survey area would be 10 m^2 (ie calculated as 10% of 100 or 100 divided by 10). Whilst this method is likely to slightly underestimate the true survey coverage (because some transects may have had reasonable visibility but no areas which would necessarily be recorded as exposures and because estimation of visibility is very subjective), it does give a more accurate picture of the amount of the area surveyed which had conditions suitable for the detection of artefacts. In all, 73 exposures were recorded during the survey, with artefacts being found in only 29 of them. Details of all the exposures in relation to land units is presented in Tables E.3 in Appendix E. Table 4.2 below provides a summary of the effective survey coverage calculated according to the NPWS formula as explained above.

Land Unit	Area (sq m)	% Total Study Area	Effective Survey Area (sq m)	% Total Effective Survey Area	% Total Study Area
simple slope	230,000	9.70%	1,002.25	9.18%	0.04%
primary terrace	630,000	26.58%	4,073.73	37.30%	0.17%
secondary terrace	965,000	40.72%	3,355.83	30.73%	0.14%
tertiary terrace	545,000	23.00%	2,488.67	22.79%	0.11%
Total	2,370,000		10,920.47		0.46%

Table 4.2: Summary of effective survey coverage per land unit.

All exposures recorded occurred on walking transects. One exposure which contained an artefact was noted on a vehicle transect but this was where the vehicle transect crossed over a walking transect. Although the exposure was recorded in the field during the vehicle transect, it was determined to be a duplicate during data entry and was entered into the database for only the walking transect so as not to confound the numbers. However, this does offer some security that the vehicle transecting method was capable of detecting exposures and artefacts in them if they existed.

Taking visibility conditions into account, less than 1% of each land unit was effectively surveyed. The survey was reasonably proportional on the tertiary terrace and simple slope. The primary terrace was slightly over-sampled in that this land unit constituted 26.6% of the total study area but accounted for 37.3%of our total effective survey area. Conversely, the secondary terrace was slightly under-sampled, as 40.7% of the study area is secondary terrace but only 30.7% of our effective survey area was in this land unit.

It seemed pertinent to consider whether the extent of archaeological visibility or the amount of disturbance involved in forming the exposures had any effect on the detection of artefacts. Table 4.3 summarises some information about the extent of archaeological visibility in exposures in relation to land units. It summarises

	Exposure Area (sq m)		Visibility (%)		Effective Survey Area (sq m)				Total (sq m)	
	Overall Range	With Artefacts Range	Overall Range	With Artefacts Range	Overall Range	With Artefacts Range	No of Exposures	No with Artefacts	Total Exposure Area	Total Effective Survey Area
Simple Slope										
surficial disturbance	1.0 - 210.0	1.0 - 4.0	25 - 80	25	0.25 - 168.0	0.25 - 1.0	4	2	255.00	201.25
deeper disturbance	890	890	90	90	801	801	1	1	890.00	890.00
Primary Terrace										
surficial disturbance	2.5 - 3040	30 - 200	10 - 95	70 - 95	6.3 - 480	28.5 - 140	20	3	5746.00	1998.93
deeper disturbance	726 - 1170	726 - 1170	50 - 90	50 - 90	363 - 1053	363 - 1053	3	3	2628.00	2074.80
Secondary Terrace										
surficial disturbance	1.5 - 537	1.5 - 195	10 - 100	35 - 100	0.75 - 450	0.75 - 140.76	27	12	2557.56	1501.93
deeper disturbance	151 - 786	151 - 786	40 - 90	50 - 90	120.8 - 628.8	120.8 - 628.8	6	4	2532.00	1853.90
Tertiary Terrace										
surficial disturbance	2 - 600	2 - 472.5	10 - 100	25 - 80	0.5 - 378	0.5 - 378	10	2	2002.51	919.67
deeper disturbance	900 - 1320	900 - 1320	35 - 95	35 - 95	315 - 1254	315 - 1254	2	2	2220.00	1569.00

Table 4.3: Summary of factors relating to artefact detection and severity of disturbance causing exposures per land unit.

information in two categories—those exposures exhibiting only surficial disturbance and those exposures with deeper disturbance—indicating the range in exposures with artefacts and the overall range for exposure areas, visibility and effective survey area, as well as the number of exposures, the number of exposures with artefacts, the total exposed area and the total effective survey area. There is some suggestion that surficial disturbance revealed artefacts less often than deeper disturbance in the all land unit contexts except the secondary terrace. Visibility did not appear to be a major factor affecting artefact detection except perhaps in the case of surficial distrubance on the primary terrace where artefact detection seemed to be aided by higher visibility. The lateral extent of the exposure also seemed to be of little importance; in fact in the case of surficial disturbance on the primary and secondary terraces, if anything, the range of exposure areas revealing artefacts was smaller. This could be a result of the disturbance in smaller exposure areas perhaps being slightly deeper than in larger areas of sheetwash erosion, for example, but this cannot be confirmed as this level of detail was not recorded specifically for exposures (severity of disturbance was recorded to the sampling sub-unit level only. In some cases, this may coincide with exposure, but not always).

4.6 Results of Survey

As already mentioned above, over most of the development area, visibility was extremely low due primarily to a dense cover of grass, and detection of artefacts was also complicated by exotic weeds, rabbit and cattle droppings, leaf/bark litter, large areas covered with thistles which were at least knee-high, and in some places, pebbles or rocks the same colour or material as artefacts. Under such conditions, the discovery of locations with artefacts is largely determined by the extent of groundcover.

Conversely, animal activity in the form of ant hills and trails, rabbit burrows, and areas trampled by cattle often provided an opportunistic increase in visibility and thus perhaps increased potential for detection of artefacts. This pattern of land surface exposure clearly imposes constraints on surface sampling of the landscape for archaeological evidence, especially with respect to modelling site location (as opposed to site detection potential).

Twenty-two open artefact scatters were found (see Figure 4.3). Find location details are listed in Table F.1 in Appendix F. About 59% of these artefact scatters (13) were found in locations of deep disturbance. Limited testing of the dams indicated they had been excavated to a depth of about 2-2.5 m. The optical fibre cable trench had been dug to about 2 m. The contour bank was about 1 m high. However, the remaining 41% (9) were found at locations where the artefacts appeared to be exposed from relatively close beneath the surface—on an ant mound about 0.25 m high, in areas trampled by cattle, on eroding cattle pads, on the aeolian sand patch and in small shallow exposures caused by erosion. Grinding Stone Gully provided a transect passing through the deposits of the primary and secondary terraces and was quite deeply incised in places, it banks ranging fro 0.5 m to 3 m. Despite these facies having 90-100% visibility, surprisingly no artefacts were visible in them. Yet the overburden of a dam straddling this gully yielded 52 artefacts scattered in a 2490 m² area along its top and down its sloping sides.

Land Unit	% Total Study Area	Number of Sites	% Sites	Sample Size
simple slope	9.70%	3	13.60%	
primary terrace	26.58%	6	27.30%	over-sampled
secondary terrace	40.72%	9	40.90%	under-sampled
tertiary terrace	23.00%	4	18.20%	
Total		22		

Table 4.4: Summary of number of artefact scatters per land unit.

Locations with artefacts were found in all land units (see Table F.1 in Appendix F and Figure 4.3). Assuming we had sampled each land unit proportionally, if locations with artefacts were evenly distributed across the landscape, then the proportion of artefact scatters in each land unit would be equal to the proportion of that land unit within the study area. Of course, this is a little simplistic and takes no account of the different find locations or types of sites or variable visibility conditions etc. As can be seen from Table 4.4 above, the artefact scatters do not appear to be evenly distributed, although the usual disclaimer about small sample sizes applies here.

Considering that the secondary terrace was under-sampled and yet 40.9% of artefact scatters were found here, it seems reasonable to tentatively suggest that more artefact scatters are located in the secondary terrace than in other land units. This assertion is also supported by the summary in Table 4.3 which indicates that even though a far greater area was exposed due to disturbance on the primary terrace and the primary terrace was over-sampled, far fewer exposures revealed artefacts. This is particularly true if the disturbance resulting in the exposure was surficial, and the same pattern is evident on the teritary terrace although the sampling in this land unit was proportional. This might suggest that there are more younger (ie closer to the surface) sites surviving in the secondary terrace or perhaps that the surficial disturbance in the secondary terrace is actually of a deeper nature than on the primary terrace or tertiary terrace, although there is no indication that this is the case when looking at the severity of disturbance recorded for the sampling sub-units.

There are also more artefact scatters on the simple slope than might have been expected. In summary, the simple slope and secondary terrace revealed a larger proportion of artefact scatters in relation to their area, indicating possibly preferential use, preferential artefact survival, preferential artefact detection conditions or some combination of these causes in these two land units. The primary and tertiary terraces did reveal artefact scatters but less than would have been expected in relation to their area. These trends are particularly marked in instances where the disturbance resulting in the detection of artefacts was surficial and this might suggest some temporal element to the causes for this patterning postulated above. Of course, this can only be offered as a preliminary hypothesis which requires more testing, as there are many factors (such as visibility and lateral or vertical extent of exposure) which could be potentially affecting these results.

As all of these artefact scatters occur in disturbed contexts and, in deed, many of them in very disturbed locations with a considerable amount of artefact displacement, any comparison of their sizes or artefact densities would be fairly meaningless at this stage of the investigations.

4.7 Archaeological Recording of Artefact scatters

Location, ground surface conditions, land unit, find location condition and a tally of stone artefacts within artefact types and raw material groupings was recorded for all artefact scatters. These details are listed in Table F.1 in Appendix F. Artefact counts are presented in Table F.2 in Appendix F.

Before describing the artefact scatters and their contents, it is necessary to discuss the raw material groupings used. Each raw material type has been allocated a code rather than a name. A geologist, Dr Nick Stephenson, from the University of New England assisted with identification of raw material types. A guide to the raw material codes is provided at the end of Table F.2 in Appendix F. Identification of most of the raw materials was straight forward, however, three of the groupings require explanation. Raw material type 102 is a hard, brown, siliceous material which could be either a chert or a mudstone. It was inspected macroscopically and using a 5x magnification hand lens. It was not possible to classify it more exactly using these methods; more accurate classification would require thin sectioning which was not possible. Raw material type 103 is a hard, white siliceous material which is also possibly a chert or a mudstone; however, its grain size is smaller than that of raw material type 102 so it has been assigned to a different raw material group. Raw material type 105 is a hard, white siliceous material with a larger grain size, so it is probably a chert grading into a siltstone. These three raw material types differ from those classified as cherts (Code 100), the latter being more fine-grained and lustrous in appearance and often variegated in colour.

Raw material type 104 is a quartz sandstone of a very cohesive nature (ie it is not crumbly as sandstone would usually be thought of) and thus is of reasonable flaking quality. This may be what some researchers refer to as silicified sandstone. The silcrete of which artefacts have been manufactured varies greatly in quality, ranging from a very coarse-grained variety which is almost conglomeritic through intermediate varieties to a reasonably fine-grained variety. These varieties may have different flaking qualities but are quite likely to have the same source, and so at this stage have been classified as the one raw material type.

The source of the silcrete and, indeed, of all of the raw materials found in the study area, is most probably river cobbles, including those which underlie the secondary terrace in a lag deposit. However, the lag deposit underlying the secondary terrace would have been covered by silt during some flooding episode in the past and from that time to the present would not have been readily available as a raw material source (although it is not unheard of for Aboriginal people to dig down to a known raw material source, assuming it was not too deeply buried). Therefore, the source of raw material for artefacts in later levels remains unknown, although it is probable that there are layers of smaller pebbles/cobbles scattered throughout the deposits within the development area, both vertically and horizontally, as a result of stream channel movement during the past. All that can be said is that coarse clasts are not obvious in the present fluvial regime; pebbles and cobbles are infrequent in the current creek. At various times in the past, raw materials would have been available on site either as lag deposits dumped by the stream or as pebbles/cobbles constituting the bedload of the stream and these would have offered a greater variety of raw material types than would have been available locally from the surrounding ridges (see Plate C.23).

The artefact scatters are listed below in alphabetical order (see also Tables F.1 and F.2 in Appendix F and Figure 4.3).

4.7.1 Artefact scatter AN1

This artefact scatter is situated on the secondary terrace in a paddock in the southeastern sector of the development zone. It has been exposed by ant activity and the artefacts are lying on the ant mound. It is comprised of at least five stone artefacts that lie within an exposed area of approximately 2 m x 1 m. The assemblage is comprised of two flakes and three broken flakes and all are manufactured on chert. The ant mound is quite bare of grass and other detection limiting factors, but the surrounding area has a dense cover of grass, consequently there is potential for the artefact scatter to be larger. It is possible that there are subsurface archaeological deposits in this area.

4.7.2 Artefact scatter BC1

This artefact scatter is located on the banks and levee above Black Creek (see Plate C.24). This is the only place within the development area where Black Creek cuts into the secondary terrace in the central/north sector of the development site. The artefacts are exposed in an area about 51m x 10m on the levee above Black Creek and this has been taken as the artefact scatter area. However, artefacts are also strewn down the steep stream banks. These artefacts could be eroding out of the secondary terrace which forms the stream bank or conversely they could have been dislodged from the levee above by cattle activity. Cattle pads crisscross the levee and stream banks and the majority of artefacts in both contexts are exposed on these pads.

The deposits at the find location were very powdery silt and walking across the artefact scatter without disturbing the sediments was impossible; hence only a sample of the artefacts at this find location were recorded. One hundred and ten artefacts were counted in an 8 m x 10 m area—extrapolating from this tally, the scatter probably has as many as 800-1000 artefacts currently exposed. There are also scattered charcoal fragments eroding out of the sediments from just below the surface and although it is not possible at this stage to discount bushfire activity as being their source, it does suggest that within this context there is the potential for preservation of culturally provenienced charcoal which may be datable.

There is good visibility at this find location with only about 10% grass cover, however, detection was also hindered by pebbles/rocks same colour or material as artefacts. The sample of this assemblage which was recorded indicates that there are cores, flakes, broken flakes, retouched flakes, and flaked pieces. In the recorded area of the find location, silcrete was the dominant raw material type, but chert, mudstone, indurated mudstone and quartz were also present. There is evidence for blade technology at this find location in the form of blade cores, backed blades, flakes which had been used as blade cores and flakes retouched using the tranchet technique (see Plate C.25). Since the artefact scatter area has been determined by the extent of the erosion and cattle disturbance, there is potential for the artefact scatter to be larger. It is possible that there are deep archaeological deposits in this area.

4.7.3 Artefact scatter BC2

This artefact scatter is exposed by erosion of a cow pad tracing the edge of the primary terrace which forms the banks of Black Creek in the northwestern sector of the development area. It is about 165 m southeast of Allandale Road and the bridge which crosses Black Creek. This is an isolated find of one silcrete flake. Groundcover was only 5% grass in this area. Artefact detection was also limited by leaf litter/bark having the colour/sheen/shape of artefacts. There is potential for the artefact scatter to be larger. It is also possible that there are archaeological deposits in this area.

4.7.4 Artefact scatter BC3

This artefact scatter is exposed on a cow pad tracing the edge of the primary terrace that forms the banks of Black Creek. It is about 1km southeast of Allandale Road and the bridge that crosses Black Creek in the northwestern sector of the development area. It is comprised of a scatter of seven artefacts—cores, flakes, broken flakes and flaked pieces—all manufactured on silcrete. Visibility was reasonable with 30% groundcover of grass. Thistles also hampered detection. There is potential for the artefact scatter to be larger. It is also possible that there are archaeological deposits in this area.

4.7.5 Artefact scatter CB1

Two silcrete flakes and one silcrete retouched flake (tranchet retouch) were found in an area 15 m x 1 m on a water management contour bank near Dam 5 in the central/southwest sector of the development area. This artefact scatter is on the secondary terrace and about 20% of the ground was covered by grass. Coarse fragments were common on the exposed overburden and these pebbles/rocks the same colour or material as artefacts hindered artefact detection. Whilst these artefacts are in a very disturbed context (ie sediments redeposited during contour bank construction), they do indicate the presence of sub-surface archaeological material in the surrounding area.

4.7.6 Artefact scatter DAM1

This artefact scatter is comprised of a scatter of 17 artefacts found in an area 60 m x 5 m on the overburden of a dam in the northwestern corner of the development area near Allandale Road. This is on the primary terrace. Visibility was about 50% and detection was also limited by cowpats and vegetation. The assemblage consists of cores, flakes, broken flakes, flaked pieces and retouched flakes including tranchet retouch. Whilst these artefacts are in a very disturbed context (ie sediments redeposited during dam construction), they do indicate the potential for sub-surface archaeological material in the area surrounding the dam.

4.7.7 Artefact scatter DAM2

This artefact scatter is comprised of three artefacts found in an area 16.5 m x 1 m on the overburden of a dam on the secondary terrace, behind the new house on the access driveway in the northwestern sector of the development area. Visibility was extremely good with no groundcover. The overburden was littered with fine to coarse gravels so detection was hampered by pebbles/rocks the same colour or material as artefacts. The assemblage consists of a chert flaked piece, a silcrete flake, and a quartz sandstone flake. Whilst these artefacts are in a very disturbed context (ie sediments redeposited during dam construction), they do indicate the potential for sub-surface archaeological material in the area surrounding the dam.

4.7.8 Artefact scatter DAM3

This artefact scatter is comprised of a scatter of 52 artefacts found in an area 83 m x 6 m on the overburden of a dam on Grinding Stone Gully in the northwestern sector of the development area (see Plates C.8, C.26 and C.27). This is on the secondary terrace. Visibility was about 50%, with groundcover being grass. The overburden was littered with clasts ranging between pebbles and cobbles in size.. Artefact detection was also limited by cowpats, thistles and pebbles/rocks the same colour or material as artefacts. The assemblage includes 24 cores, 12 flakes, 6 broken flakes, 6 flaked pieces, 2 backed blades, a split cobble which has no flakes removed from it and a broken bottom grindstone (see Plate C.28). Silcrete is the dominant raw material type but chert, the hard, white, siliceous material, quartzite and crystalline quartz are also present.

Many of the cores derive from river cobbles and some are blade cores. Some of the cores are quite large (eg a silcrete core with length 150 mm, width 110 mm, thickness 110 mm) with flakes of matching proportions present. Some blade cores were also fairly large; for example, one crystalline quartz core measured 67.2 mm in length, 30.9 mm in width and 20.3 mm in thickness. There are also flakes used as blade cores and again these were often quite large—one silcrete flake used as a blade core was 92 mm long. Even some of the backed blades were a reasonable size (eg one manufactured on silcrete measured L39.2 mm x W16 mm x T12.9 mm). The grindstone portion was made on the hard, white siliceous material and was 180 mm long, 110 mm wide and 70 mm thick. Initial impressions are that this location was used to exploit the lag deposit of river cobbles by splitting them, with further reduction to produce large flakes which were sometimes subsequently used as cores. There is obviously also evidence of blade technology but it impossible to know how much mixing of deposits has occurred.

Whilst these artefacts are in a very disturbed context (ie sediments redeposited during dam construction), they do indicate the potential for sub-surface archaeological material in the area surrounding the dam.

4.7.9 Artefact scatter DAM4

This artefact scatter is comprised of two artefacts found in a 1 m x 1 m square on the overburden of a dam on the primary terrace, in the southeastern sector of the development area near Kangaroo Gully. Visibility was extremely good with no groundcover. The overburden was littered with fine to medium gravels. The assemblage consists of one silcrete core and one silcrete broken flake. Whilst these artefacts are in a very disturbed context (ie sediments redeposited during dam construction), they do indicate the potential for sub-surface archaeological material in the area surrounding the dam.

4.7.10 Artefact scatter DAM5

This artefact scatter is comprised of four artefacts found in a 1 m x 1 m square on the overburden of a dam on the primary terrace, in the southeastern sector of the development area on Kangaroo Gully. Visibility was extremely good with no groundcover. The overburden contained some fine to medium gravels. The assemblage consists of two silcrete broken flakes and two mudstone flakes. Whilst these artefacts are in a very disturbed context (ie sediments redeposited during dam construction), they do indicate the potential for sub-surface archaeological material in the area surrounding the dam.

4.7.11 Artefact scatter DAM6

This artefact scatter is comprised of 11 artefacts found in an area 220 m x 6 m square on the overburden of a dam on the tertiary terrace, near the southern perimeter fence in the central/southwest sector of the development area. Visibility was extremely good with only 5% grass cover. The overburden contained many fine to medium gravels so that detection was hindered by pebbles/rocks the same colour or material as artefacts. The assemblage consists of cores, flakes, broken flakes, flaked pieces and one hammerstone. All were manufactured on silcrete. Whilst these artefacts are in a very disturbed context (ie sediments redeposited during dam construction), they do indicate the potential for sub-surface archaeological material in the area surrounding the dam.

4.7.12 Artefact scatter DAM8

This artefact scatter is comprised of six artefacts found in an area 30 m x 30 m square on the overburden of a dam on the tertiary terrace, in the middle of the development area (see Plate C.29). Visibility was poor with 65% grass cover. The overburden contained many fine to medium gravels. The assemblage consists of two silcrete flakes and four silcrete broken flakes. Whilst these artefacts are in a very disturbed context (ie sediments redeposited during dam construction), they do indicate the potential for sub-surface archaeological material in the area surrounding the dam.

4.7.13 Artefact scatter GSG1

This artefact scatter is located on an erosion patch in the middle of the dry bed of Grinding Stone Gully, about 200 m from Allandale Road (see Plate C.30) in the northwestern sector of the development area. This is secondary terrace. Visibility was extremely good with only 10% grass cover and no other detection limiting factors. This is an isolated find of one flake manufactured on the hard, white siliceous material.

4.7.14 Artefact scatter GSG2

This artefact scatter is located on an erosion patch on the banks of Grinding Stone Gully, about 485 m from Allandale Road in the northwestern sector of the development area. This is secondary terrace. Visibility was extremely good with only 10% grass cover and no other detection limiting factors. This is an isolated find of one silcrete flake.

4.7.15 Artefact scatter HS1

This artefact scatter is located in the disturbed area around the cattleyards and sheds near the new house on the access driveway in the northwestern sector of the development area (see Plate C.31). Eleven artefacts were found in an area 65 m x 52 m. Visibility was extremely good with only 10% grass cover but the area has been heavily disturbed by cattle trampling and detection was also limited by the numerous cowpats. The artefacts include seven silcrete flakes and four silcrete flaked pieces.

4.7.16 Artefact scatter MD1

This artefact scatter is located on the tertiary terrace in the southeastern sector of the development area, midway between Dam 6 and Dam 8. This was an isolated find of a flaked piece manufactured on the hard, brown, siliceous material. It measured L5 mm x W5 mm x T2 mm. Visibility was very poor, only about 10%, even though the groundcover of grass was little more than 20%, visibility was further reduced by other vegetation and logs.

4.7.17 Artefact scatter OFT1

This artefact scatter is located on the secondary terrace, in an area that has been trampled by cattle near Allandale Road and the access driveway in the northwestern sector of the development area. Twelve artefacts were found in an area 23.5 m x 6.3 m. Visibility was not very good with grass covering 50% of the ground but there were no other detection limiting factors. The artefacts include five flakes and three retouched flakes, three broken flakes and one flaked piece; all manufactured on silcrete. There is potential for the artefact scatter to be larger. It is also possible that there are archaeological deposits in this area.

4.7.18 Artefact scatter OFT2

This artefact scatter is located on the simple slope near Allandale Road in the northwestern sector of the development area, in an area that has been disturbed by the digging of an optical fibre trench. It is an isolated find of one quartzite core.

Visibility was not very good with grass covering 85% of the ground. There were scattered fine to medium gravels. There is potential for the artefact scatter to be larger. It is also possible that there are archaeological deposits in this area.

4.7.19 Artefact scatter OFT3

This artefact scatter is located on the simple slope near Allandale Road in the central/southwest sector of the development area, in an area that has been disturbed by the digging of an optical fibre trench. It is an isolated find of one silcrete flake. Visibility was very good with grass covering only 15% of the ground and no other detection limiting factors. There is potential for the artefact scatter to be larger. It is also possible that there are archaeological deposits in this area.

4.7.20 Artefact scatter OFT4

This artefact scatter is located on the simple slope near Allandale Road in the central/southwest sector of the development area, in an area that has been disturbed by the digging of an optical fibre trench. It is an isolated find of one quartzite flake. Visibility was very good with grass covering only 15% of the ground and no other detection limiting factors. There is potential for the artefact scatter to be larger. It is also possible that there are archaeological deposits in this area.

4.7.21 Artefact scatter OFT5

This artefact scatter is located on the tertiary terrace near Allandale Road in the central/southwest sector of the development area, in an area that has been disturbed by the digging of an optical fibre trench. It is an isolated find of one silcrete flake. Visibility was not very good with grass covering 85% of the ground but there were no other detection limiting factors. There is potential for the artefact scatter to be larger. It is also possible that there are archaeological deposits in this area.

4.7.22 Artefact scatter WT1

This artefact scatter is located on the primary terrace near a cement water trough in the southeastern sector of the development area (see Plate C.32). This is an area of aeolian sand that has been heavily disturbed by rabbit activity (see Plate C.4). There were three artefacts in an area 15 m x 2 m—one broken silcrete flake, one broken mudstone flake and one mudstone core. Visibility was good with only 5% groundcover of grass and there were no other detection limiting factors. There is potential for the artefact scatter to be larger. It is also possible that there are archaeological deposits in this area.

Chapter Five

5.0 Significance:

Significance is not an absolute quality attached to sites or artefacts; rather it is derived from the context in which significance is assessed. The definition of significance and principles of significance assessment outlined by the Australian International Council on Monuments and Sites (ICOMOS) Burra Charter 1979 has attempted to avoid bias by providing firm guidelines for cultural significance assessment. The ICOMOS definition of cultural significance is:

> "...the concept which helps in estimating the values of places. The places that are likely to be of significance are those which help an understanding of the past or enrich the present, and which will be of value to future generations." ICOMOS 1988

The term "cultural significance" embraces aesthetic, historic, scientific and social value for past, present or future generations and even though the Burra Charter primarily relates to historical and architectural features, the same principles can be applied to assessment of the significance of prehistoric artefacts and features.

It is conventional to discuss significance in six contexts: Aboriginal significance, public significance, historical significance, aesthetic significance, educational significance and scientific significance. As will be discussed below, we do not consider that in all cases it is useful to consider sites in isolation as the focus for assessment of significance.

5.1 Aboriginal Significance

Aboriginal significance can be related to Criterion G.1 used for assessment for nomination to the Register of the National Estate—importance as a place highly valued by a community for reasons of religious, spiritual, symbolic, cultural, educational, or social associations. This criterion refers to the social value of a place and indicates the qualities for which a place has become a cultural landmark to a majority or minority group within the community. Such places have become a focus for religious, spiritual, symbolic, educational, political, national or other cultural sentiments or are remembered with fondness for their associations with other personal or community activities carried out there.

Aboriginal significance is taken as the perceived and expressed view of significance to the Aboriginal community in the present as part of their living culture and as such can only be determined by Aboriginal people themselves. The recording of oral traditions (by Aboriginal people or an anthropologist) can assist with respect to this criterion.

5.2 Public significance

Public significance can also be related to Criterion G.1 used for assessment for nomination to the Register of the National Estate as outlined above. It may also be the case that public significance can arise from the scientific and educational values of a place rather than its intrinsic values (ie the public can be educated into an understanding of the significance of an archaeological sites which may not be immediately apparent to them) and in this way different types of significance are not always independent.

The public must determine public significance. Public reaction to the future of a site could be one method of determining public significance. Community workshops might be another way of assessing this significance criterion.

5.3 Historical significance

Several criteria used for assessment for nomination to the Register of the National Estate relate to historical significance. These include Criterion A.4—importance for association with events, developments or cultural phases which have had a significant role in human occupation and evolution of the nation, State, region or community; Criterion B. 2—importance in demonstrating a distinctive way of life, custom, process, land-use, function or design no longer practised, in danger of being lost, or of exceptional interest; and Criterion H.1—importance for close associations with the life or works of individuals whose activities have been significant within the history of the nation, State or region.

This means a place may have historical significance if it is associated with an historically important person, cultural group, event, or phase or if it illustrates past human activities that are now rare, endangered or uncommon. Documentary research of historical records and recording of oral local historical information would be necessary to link a place with historical themes and/or regional or individual histories.

5.4 Aesthetic Significance

Criterion E.1 used for assessment for nomination to the Register of the National Estate includes importance for a community for aesthetic characteristics held in high esteem or otherwise valued by the community.

This criterion refers to the aesthetic value of a place, that is, when a place is widely recognised for its visual qualities or design and is generally taken to mean the visual beauty of the place. Aesthetic value is not inherent in a place but arises from the response people have to it. Nostalgia can also contribute to aesthetic value where affection and attachment to a place have been built up over time. Planning decisions sometimes take account of how a development will affect any aesthetic significance attributed to the surrounding environment. Aesthetic significance cannot be decided upon by the archaeologist alone but must be attributed to the site by the wider community. It may be necessary to conduct workshops for local community groups with respect to assessing any perceived aesthetic significance of a place.

5.5 Educational significance

Educational significance considers the significance of particular Aboriginal sites in terms of their suitability for education of the general public (both Aboriginal and non-Aboriginal communities) about the Aboriginal past and as such can provide a bridge between scientific significance or Aboriginal significance and public significance. In this sense all sites have some capacity to be used for educational purposes to inform people about the scientific results of their analysis or of the importance of sites as indicators of Aboriginal occupation of and use of the land. However, to assess a site as having educational significance, there must be some indication that there is a requirement for education. This might require canvassing public demand for education about a place. If demand is apparent, this might be met by public meetings in the region to publicise research results or the preparation of educational packages for use by schools, Aboriginal groups, tourism operators or the general public.

5.6 Scientific significance

Scientific significance is also often referred to as the archaeological significance of a site and the criteria most often applied to assess scientific significance are research potential, antiquity, data quality, diversity, rarity and representativeness. All these criteria are, in fact, interrelated.

The research potential of the evidence varies in relation to the research questions that are relevant at a particular time and under a particular paradigm (Schiffer and Gummerman 1977: 241). Research potential is usually assigned to particular sites with the potential to yield information that will contribute to an understanding of Australia's cultural history (National Estate Criterion C) or to a wider understanding of the history of human occupation of Australia (National Estate Criterion C.2). It should also be stressed that, taken in conjunction with other sites, a site may have a research potential that it would not have in isolation so assessment of research potential often involves considering complexes or suites of sites rather than individual sites. Research questions can be formulated at a number of levels—local, regional, national, or global—and their nomination requires extensive research of survey reports for the region and archaeological literature and consultation with NPWS regarding current research priorities.

The potential of a site to provide a chronology extending back into the past is also important. If datable, a site's research potential is enhanced. In some areas, stratified deposit may be a sufficiently rare occurrence to assign a high research potential rating to any locations exhibiting this trait. Likewise, the demonstrated antiquity of a site may be sufficient reason.

Assessing the intactness or integrity of a site involves considering the preservation of the material as well as stratigraphic integrity and taphonomic processes acting on the site. Naturally higher integrity improves the research potential but this does not necessarily mean that disturbed sites do not afford any research potential. Each location must be assessed in terms of the questions that it could address and their relative importance.

Diversity can be assessed in terms of artefacts and features within a site; in terms of different types or classes of sites within the study area; or in terms of different types or classes of sites within some larger area (usually from a regional perspective but also possibly inter-regionally or at a state or national level).

Representativeness is only meaningful in relation to the conservation principle—that is, by deciding whether conservation of this site would assist in ensuring a representative sample of the archaeological record is being conserved. This involves defining variability and knowing what is already conserved. For a site to be considered to be conserved, it must be in a formal protected area (such as a National Park) or it must be actively managed for conservation. Describing the current reserve of sites will require consultation with NPWS. Representativeness must also take into consideration the connectivity of sites and may involve conserving a network of sites (which may or may not be contiguous in space). A representative sample of different types of natural environment will not necessarily contain a representative sample of Aboriginal site types and for this strategy to be put forward as the basis of a conservation zone proposal some justification for the connection between environmental units and representative Aboriginal site types must be demonstrated. As with most of the other criteria used to assess scientific significance, representativeness is usually determined within a regional (or larger area) perspective which can only be gained by researching the NPWS site register, survey reports for the region and archaeological literature.

The rarity or distinctiveness of a site is also linked to National Estate Criterion B. 2—importance in demonstrating a distinctive way of life, custom, process, landuse, function or design no longer practised, in danger of being lost, or of exceptional interest. This criterion cannot be easily distinguished from representativeness and many of the same factors must be taken into account. The criterion of rarity should be assessed at a range of levels: local, regional, state, national, global.

5.7 Assessment of significance

The Aboriginal community have not provided a statement of Aboriginal significance. The Wonnarua Tribal Council have indicated support for only one recommendation at this stage. No written response was received from the Mindarriba LALC.

It was not within the scope of this project for BAS to carry out the work necessary to allow assessment of public significance, aesthetic significance, educational significance, or historical significance.

It is not possible to make an assessment of the scientific significance of the development on the basis of this survey. The true nature of archaeological material in the area remains unknown due to the sampling biases outlined in previous chapters. Assessment of the scientific significance would require sub-surface investigation and more detailed research into the ethnography of the region and previous araeological work which could be used together to formulate a model of occupation for the area. What has been demonstrated by this preliminary investigation is that subsurface archaeological material is likely to exist within the development area. It has been suggested that there is the potential for this area to be deeply stratified, for datable material to be preserved, for sites which possibly contain Pleistocene occupation evidence, and for the presence of both pre- and post-blade production technologies.

As outlined above, such material could assist to answer many of the questions still remaining about Aboriginal occupation of the Central Lowlands. If such material does exist, this site has the potential to meet several of the criteria on which scientific significance is based and, therefore, to be determined to be highly significant.

Chapter Six

6.0 Recommendations

Depending on the results of archaeological investigations and the type of significance assigned to sites, various management options might be recommended to proponents. These could include:

- further survey perhaps including sub-surface testing,
- altering development plans to mitigate impacts on sites;
- the preparation of educational packages for use by schools, Aboriginal groups, tourism operators or the general public;
- conservation of particular sites, suites of sites or zones within the development area;
- salvage of particular sites where all alternatives to impact have been exhausted or where further investigation would provide a substantial or unique contribution to current knowledge;
- monitoring of areas during the construction/earthworks stage; or
- destruction of sites.

The proposed development site has not been researched sufficiently to determine its significance. The evidence presented in this report suggests that the development area has the potential to exhibit archaeological significance in a number of ways—sites with deep archaeological deposits and datable material, particularly open sites, have been shown to be rare in this region. In these circumstances, our recommendations would be as follows:

- further subsurface investigations should be carried out to determine the nature and extent of archaeological material within the development area and to attempt to resolve the questions raised by the geomorphological study carried out during this first phase of investigation;
- the NSW NPWS Cultural Heritage Unit, the Wonnarua Tribal Council and the Mindaribba LALC should be consulted regarding the research design for the subsurface work;
- more detailed review of the ethnography, historical records and previous archaeological work in the region should be undertaken and input to the research design for the subsurface survey;
- the boundaries of land units and other geomorphic features should be accurately mapped so that they can be used as the basis for the subsurface sampling ;
- larger area excavation should be undertaken at suitable targetted find locations found either during this survey or during the second phase of subsurface survey;

- dating should be a priority if suitable samples can be obtained;
- artefact analysis (if appropriate artefact samples are recovered) would be integral to interpreting this site within a regional context;
- the appropriateness of using other techniques (such as pollen and phytolith analysis) which may assist in reconstructing palaeoenvironmental conditions should be considered;
- all artefacts located during the surface survey should be collected except at artefact scatter BC1 which should not be disturbed during the preliminary subsurface investigations;
- anthropological recording of oral histories and traditional stories should be carried out to enable the Aboriginal significance of the site to be assessed; and
- an historical archaeologist should be consulted regarding the historical value of the remains of European buildings on the property and the appropriateness of recording or investigating these further.

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Our Ref: 97126
Date: 9 September 1997

Mr Wayne Brennan
Consultant Archaeologist
Burramoko Archaeological Services
108 Narrowneck Road
KATOOMBA NSW 2780

Dear Wayne,

Re: Rothbury Country Resort/Hunter Valley

I refer to our previous discussion on the above project, formally named New Hunter Valley Resort.

Cessnock City Council has requested an Archaeological Survey providing greater information than that delineated in the report prepared by Andrews Neil which staed in part: "During the vegetation assessment, the site was searched for the occurrence of archaeological artefacts. In particular, along Black Creek and other locations determined from aerial photographs. The NPWS Database was also checked for records in the vicinity of the site......The field surveys did not establish the presence of any archaeological sites or artifacts. A subsequent search of hte NPWS database also did not reveal the presence of archaeological sites within the vicinity of the site. The nearest record on the database is approximately 10 kilometres away".

Please provide me urgently with a fee submission, inclusive of timeframe, for undertaking the Archaeological Survey for the site. On receipt it will be forwarded to our client with an appropriate recommendation.

Yours faithfully,

Ian R Power

SURVEYING
John M Daly Regd. Surv M.I.S.(Aust)
Paul M Daly B.Surv Regd. Surv M.I.S.(Aust)
Michael J Gordon B.Surv(Hons) Regd. Surv M.I.S.(Aust)

PLANNING
Ian R Power
B.App Sc (Env.Planning) A.T.C.E
Cert.T&CP(URB.I.D) M.R.A.P.I.

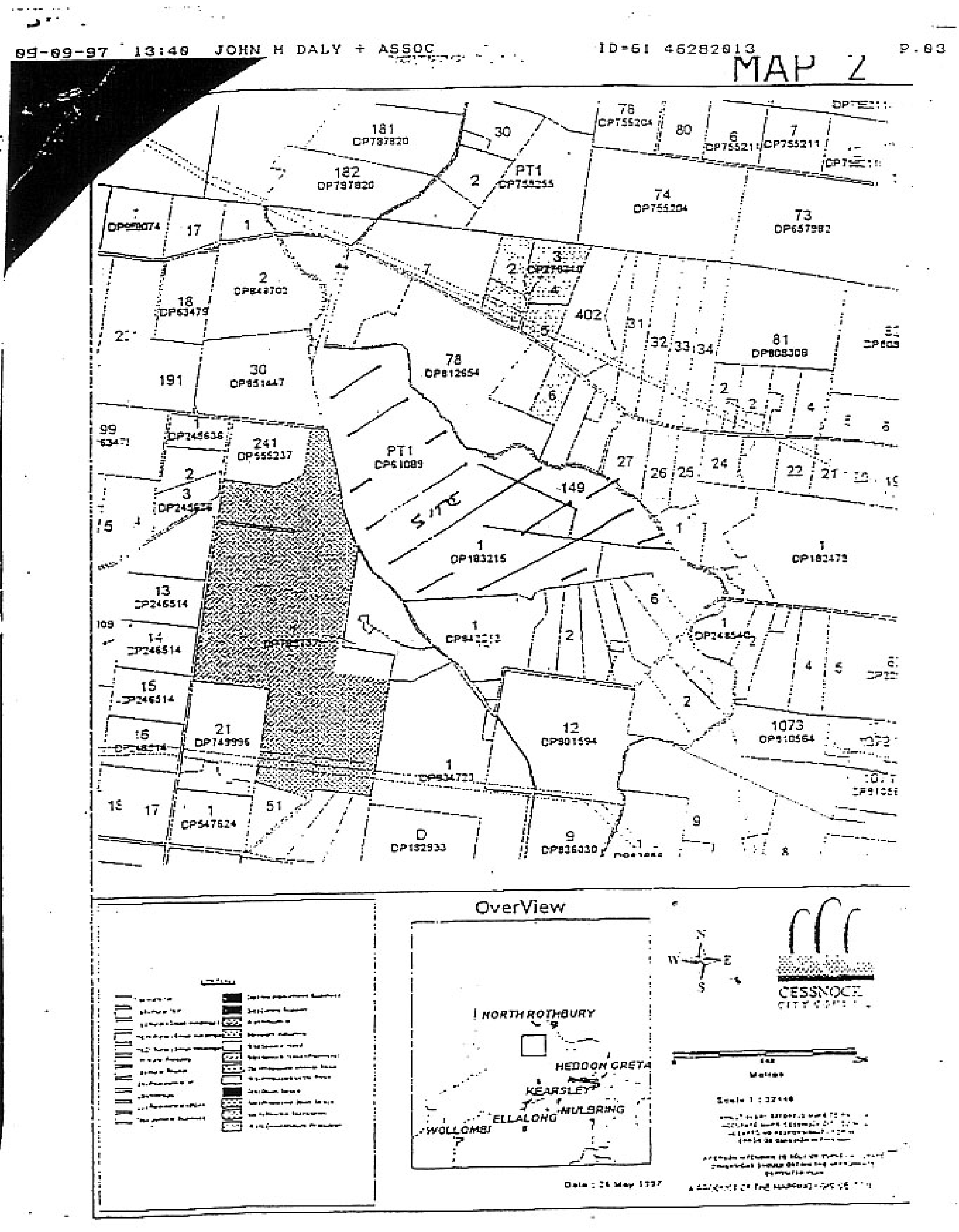
ENGINEERING
Terrence Hagu B.E.(Civil)

09-09-97 13:40 JOHN M DALY + ASSOC ID=61 46282013 P.02

MAP 1

SITE LOCATION PLAN

NTS.


09-09-97 13:40 JOHN H DALY + ASSOC
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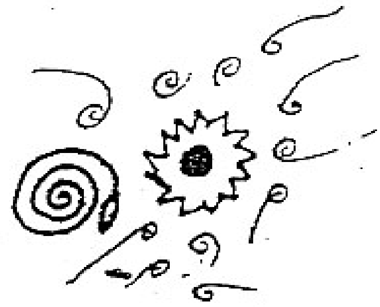
P.03
MAP 2
SITE
OverView
NORTH ROTHBURY
HEDDON GRETA
KEARSLEY
MULBRING
ELLALONG
WOLLOMBI
CESSNOCK



Preliminary Archaeological Report
Rothbury Resort Hunter Valley
October 1997

1.0 Preamble:

The mining industry in the Hunter Valley has been expanding quite rapidly over the last five years and this has resulted in the destruction of over 70% of the sites recorded in the region (Burton, Koettig and Thorp 1990: p8, Holdaway 1993:p1)

The National Parks and Wildlife Service has been actively involved in research in the region together with the Department of Archaeology and Paleoanthropology at the University of New England Armidale and many various consultants. More recent publications of the archaeological research undertaken in the region as part of Environmental Impact Statements and reviews of these reports, have indicated that there has been extensive recording of Aboriginal "sites" and isolated finds in the Hunter Valley. A check of the NPWS sites register reveals that the nearest recorded site is over 10 km away from the resort site. This a reflection not of the occurrence of sites or isolated finds in the area but rather that this particular area of the Hunter region has not been surveyed.

On discussion with Victor Perry, Cultural Heritage Officer for the Wonnarua Tribal Council the traditional owners of the area, the Black Creek Catchment has high potential for the existence of Aboriginal sites. The existence of sites within the project area would mean that permits for *consent to destroy* may have to be given by the NPWS for the project works to go ahead or amendments made to overall project plan.

The Director of the NPWS is responsible for approving consents to destroy Aboriginal sites, and her decision is made with close consultation with the Zone Archaeologist from NPWS, (Margret Koettig for the Hunter Valley) and the Aboriginal Land Council and Tribal Council of the area. The report by the archaeologist is the reference point for making the decision of granting consents to destroy.

1.1 Site Location

The site is located approx 20 km north of Cessnock on the eastern side of Allandale Rd which heads north towards the township of Braxton in the Hunter Valley NSW.

The Development is bounded on the Northern and eastern side by Blacks Creek, on the western side by the Allandale Rd and the southern side by private land holder. It encompasses approx 250 hectares and has been used for grazing livestock, notably dairy cattle and possibly some sheep.

2.0 Requirements of NPWS

As mentioned in section 1.0, If sites are found within the development area where buildings, earth works may have impacts on any of the sites NPWS may require consents to destroy based on the Archaeological field work report and recommendations by the Archaeologists and the Aboriginal Land Council and Tribal Council.

On discussions with Margret Koettig, (NPWS Archaeologist Sydney Zone), which takes in the Hunter Valley, it may be a requirement in Phase I of the survey to do subsurface testing to indicate site presence, taphonomy and to establish significance. This has a lot to do with the way the area has been disturbed and the bioturbulance of the area and in turn, this affects the distribution of the artefacts and the interpretation of the archaeological record.

The question also arises that the area should be totally surveyed and this would involve at least 2 weeks field work.

When any field work is undertaken that involves subsurface testing, permits are required from the NPWS before work commences. These permits require a research design and methodology which must be approved by the NPWS.

2.1 Consultation and negotiation with Aboriginal Community

As part of NPWS requirements for Archaeological Consultants the Aboriginal Community needs to be actively involved and consulted in the survey and field work assessment. Normally it is with the Local Aboriginal Land Council in the case here the Mindarriba L.A.L.C. as well as the traditional owners of the area in this case the Wonnarua Tribal Council. Both groups would be asked to produce a report that the Archaeologist will incorporate into the survey report.

These groups will be required to have two field workers each in the field with the Archaeologist and contribute in formulating research design and methodology for the survey. I have contacted both groups with the Wonnarua Tribal Council able to meet me at the site for an preliminary inspection of the area on October 3rd and to establish dialogue in relationship to the survey. My contact for the Mindarriba LALC Rick Griffiths who will also walk the project area and help formulate an approach and time frame for doing the field work.

3.0 Methodology

The methodology is yet to be finally established, though a framework has been discussed with the Tribal and Land Council.
A total survey of the area is required and this will involve both the Wonaruah Tribal Council and Mindarriba L.A.L.C. with two field workers each.
The project area will be searched for artefacts on the surface mainly at erosion scars. vehicle and animal tracks and dam sites as well as other areas of potential site locations where sufficient surface visibility is present.
As part of phase one of the survey, subsurface testing may be required. The areas targeted will mainly depend on the results from the intial surface survey and the topography and will inlude a variety of landscape units and environmental zones within the project area.
The type and nature of the subsurface testing will depend again on what questions are asked concerning the archaeology, despostion and taphonomic considerations of the survey area.
The two main methods are mechanical or hand excavation depending on the magnitude of the subsurface testing required and the distribution of artefacts.
Mechanical subsurface testing seems more liklely at this stage. There is predominately only "A" horizon and skeletal soils present in the study area so mechanical scrapes on targeted areas would be most probably be undertaken followed by hand excavation where possible if artefact densities were very high.
Permits would have to be applied for and the methodology and research design would be submitted to the NPWS, Wonnarua T.C. and Mindarriba LALC by the consultant Archeaologists.

4.0 The nature of the Development Project.

From the A4 plan of development given to the consultant by M Daly and Associates, the development area is quite extensive and will involve a considerable amount of surface disturbance.
With several dams present and additional dams going in, the location of the buildings and earth works will have considerable impact on any sites that would be located within the project area.
It would be recommened that in the interest of the Aboriginal community, the Developer and the requirements to be met for the NPWS, that a total area survey be required with some sub surface testing. The methodology of the consultancy would therefore have to be altered from the original design (September 20th) involving more time for field work and analysis of any cultural material.

Preliminary Field Survey
Friday October 3rd 1997

Present: Wayne Brennan consultant archaeologist, Emily Coleing field assistent, Victor Perry, Wonarua Trible Council (WTC) and John Miller (WTC).

The day spent in field was to help establish:
1. The potential for finding Aboriginal sites within the project area.
2. The methodology and research design to be used for the consultancy to establish and locate Aboriginal sites and the significance of these sites within a regional context.
3. The importance of these sites to Aboriginal people of the area.
4. Time frames and logistics of the survey.

Discussion took place about the potential for finding sites within the project area and the methodology used for the consultancy.
Victor Perry and myself agreed that there was high potential for sites being found in the area and that there was some concern about weather a partial or random survey method would be appropraite for the project.
It was decided that we would walk the boundries and examine the areas along the creek lines where erosion scars existed and to target roads tracks and any disturbed areas for cultural material.
Ground visibilty (apart from erosion scars) was 0% to 5 % and introduced grass species covered nearly all of the project area. There

were several dams put in and these area were also observed for evidence of cultural material within the dam tailings or erosion areas.
As we continued the preliminary field survey artefacts were sighted in some of the erosion scars observed and in more particular areas such as the tailings from existing dam sites. Most of these artefacts were flakes of: silcrete, red mudstone and some cherts with some silcrete cores also present. Artefact densities vaied from 2 per 10x10 quadrant to 10 per 10x10 quadrant. Further field work is nessary to discuss the material in relationsbip to site locations and site densities.
A grinding stone was also located near a dam approx 150 metres south east of the existing homestead.There have not been many grindstones found within the Hunter Valley Region.
To place these finds into an archaeological context there would have to be taphonomic considerations to be examined and discussed, as well as a review of the literature from the area. This being other consultancy reports, ethnnography, oral histories and research undertaken by both the NPWS and the University of New England Armidale.

5.0 Conclusions

1. That a total area survey should be completed on the project area.
It is important for this to occur as both the Land Council and Tribal Council have requested the area to be completely surface surveyed. It will also be a requirement in the research design and permit application for the NPWS.

2. Permits for subsurface testing may be necessary
A research design will have to be submitted to NPWS for approval.

3. A new time frame and costs will have to be finalised by next week.
This will include fees from the Wonnarua Tribal Council and the Mindarriba LALC as additional time will be needed in the field.

4. Permits for collection of artefacts and or/consents to destroy may have to be applied for to the NPWS.

5. A meeting should be arranged between the developer and the Archaeologists (Burramoko Archaeological Services)
This would be to clarify the process-of the survey and to discuss some of the issues that may be involved with the development and to gain clarity on the impacts of the development on Aboriginal sites and the Aboriginal community.

BURRAMOKO ARCHAEOLOGICAL SERVICES

Grace Hill, 108 Narrowneck Road, Katoomba NSW 2780
Tel : (02) 4782 5495
Fax (02) 4787 8514
e-mail:
Wayne.Brennan@NPWS.NSW.Gov.au

New Horizon International Pty Ltd
304 Kent ST
Sydney NSW 2000

30th October 1997

Re: Archaeological Investigations - Proposed Rothbury Country Resort
Project Number 953

Dear Mr Alex P. Goh,

We have pleasure in submitting a tender for preliminary archaeological work in the Proposed Rothbury Country Resort Project N° 953. In accordance with your fax dated 17/10/97, enclosed is a proposal for the archaeological component of the above project.

In the absence of any detailed tender requirements having been provided by you, we have formulated the following as the main aims of the project:

- inspection of the proposed development area in order to locate and identify any archaeological sites.
- compliance with the requirements and constraints of the NSW National Parks and Wildlife Service (NPWS), the Mindarriba Local Aboriginal Land Council (LALC), the Wonnarua Tribal Council and New Horizon International Pty Ltd.
- evaluation of the archaeological and cultural significance and conservation value of any Aboriginal sites located within the proposed development area.

We also note that the submission date for the completed report is yet to be supplied by New Horizon International Pty Ltd.

Rule 7 of the Code of Ethics of the Australian Archaeological Association requires members to involve Aboriginal people at all stages of their projects. Initial discussions with the local Aboriginal community have already been undertaken to allow their input to the methodology for investigation of the development area.

With the principal aims as outlined above and the outcomes of discussions with the local Aboriginal community in mind, we offer the following:

SURVEY STRATEGY

The archaeological assessment of the development area will be designed to locate sites and record a set of quantitative and qualitative variables. Local Aboriginal knowledge will be used to define any known sites of cultural significance in the area.

The investigation will include a search of the NPWS Site Register and relevant reports, of relevant ethnographic literature, and of research articles and publications. It will include consultation with NPWS personnel and representatives of the local Aboriginal community.

NPWS will review the work to assess the sample adequacy. It must be stressed that if surface conditions are such that lack of visibility precludes discovery or assessment of the archaeological resource, it is usual practice for NPWS to require a second phase of work involving sub-surface investigation. We have already advised you that we would expect this to be the case for the proposed Rothbury Country Resort development area.

We will carry out a broad survey to locate surface evidence of Aboriginal sites along all creeklines, tributaries, existing and proposed dams or other water courses within the study area and use transects (approximately 60 metres in width) to investigate the total area away from water courses.

Surveys will be conducted on foot or by vehicle as appropriate. It is anticipated that in most places, the degree of ground cover will obscure material evidence of Aboriginal occupation and mask any surface sites. In order to address this problem, during this first survey phase, particular attention will be paid to bare sections and any areas of 'disturbance' with minimal ground cover (such as vehicle tracks, animal pads, pathways, fencelines, junctions of tributaries and main channels, waterwash, dam tailings and eroded slopes, banks or gullies) where it is more likely for archaeological artefacts to be exposed. Attention will also be paid to large trees for scars, bedrock exposures for grinding grooves, and natural rock outcrops which may have provided sources of raw material for stone artefact manufacture, although all of these are less likely to be found within the development area.

NPWS Guidelines for Minimum Requirements for Survey and Significance Assessment of Aboriginal Archaeological Heritage (p11) state that the "...minimum information to be presented in any assessment is the known (observed) Aboriginal heritage, and the potential (unknown/unobserved) heritage (ie the coverage results should be interpreted as to whether there are some parts of the survey which may be associated with buried archaeological evidence)." NPWS (p14) further require any locations with artefacts should be recorded in terms of the landform unit and surrounding environmental context (including associated vegetation and specific geomorphic processes). To address these requirements, allowance has also been made for a geomorphologist to inspect the area in order to identify processes of sedimentation and stream channel formation, geomorphic processes which have contributed to the formation of the site structure, the potential for subsurface archaeology, as well as some indication of the degree of disturbance present at sites. This information is pertinent to any assessment of archaeological potential and scientific value. Open sites in all environments occur on and within a natural soil mantle and present a number of problems of identification and interpretation, which are related to the genesis of the soil. As a result, as the NPWS Guidelines (p34) point out, "... interpretation of open sites is extremely difficult and requires the assistance of a geomorphologist or pedologist."

All observed locations with artefacts will be marked on a 1:25,000 topographic map. Salient features of the geomorphic/land units will be noted, as will artefact density and location. Artefacts will be described using technological descriptors. NPWS also requires that the routes/locations of surveys in relation to method of inspection (ie foot, vehicle etc) be clearly mapped (Guidelines p4, p10) so survey coverage will also be recorded on a 1:25,000 topographic map.

ANALYSIS

Analysis will include description and summary statistics of quantitative and qualitative variables recorded for artefacts during fieldwork, as appropriate. If sufficient stone artefacts are recovered, technological analysis will be carried out and the results interpreted within a regional context. Geomorhological analysis of any soil samples will be carried out by the geomorphologist who will produce a report on his findings and their relevance for the archaeology of the development area.

PERSONNEL

The field survey will be conducted by Wayne Brennan and Rosalind James as Archaeologists, with the help of a field assistant and four local Aboriginal persons (two field workers from the Wonnarua Tribal Council and two from the Mindarriba LALC). Provision has also been made for both Aboriginal groups to provide reports to be incorporated into the final survey report. Rosalind James and Wayne Brennan will carry out final report preparation. Geomorphological investigations will be done by Dr Bob Haworth (UNE) who has extensive experience in the Hunter Valley region. Brief biographical details of the archaeological personnel are contained in Attachment 1.

DOCUMENTATION OF RESULTS

Full documentation of results of the survey will be included in the written reports in the usual way. The wishes of Aboriginal people will be respected in this matter whilst meeting legislative requirements. This allows for a statement of restriction of access to information as necessary.

Copies of the reports will be lodged in the usual places. We note that Rule 4 of the Code of Ethics of the Australian Archaeological Society requires copies of all reports, theses and published materials resulting from archaeological work to be presented to the relevant Aboriginal people. In this case a copy would be given to the Wonnarua Tribal Council and from the Mindarriba Local Aboriginal Land Council and to all personnel involved in the work. Copies of the report will also be furnished to NPWS (3 copies) and New Horizon International Pty Ltd.

In accordance with NPWS requirements, the final report will include:

- a review of previous archaeological research and surveys in the Hunter Valley to demonstrate the character and density of artefactual remains found in the nearby catchments, to determine the scientific and cultural significance attributed to other sites and assemblages in the area.
- outline of Aboriginal values and the consultation process.
- description of the methodology and survey strategy employed.
- description and analysis of the environmental context.
- description and technological analysis of artefacts, if possible.

- full description of the development and its potential impact on the landscape and heritage resource as well as a summary of previous impacts on the area. This description must include how the proposed development is to be implemented, flexibility of the project design, timing and staging of the proposal and identification of direct and indirect impacts (both short and long term) (NPWS Guidelines p6).
- survey results presented in detail providing contextual information as appropriate, such as geomorphic context, substrate, area of exposure, aspect, incline, groundcover, erosion status, and archaeological information such as number of artefacts, density, raw materials and technological description.
- comparison of the overall results of this survey with others from nearby catchments of the Hunter Valley.
- assessment of the cultural and scientific significance of the archaeological material, including significance in a regional context, and recommendations for additional investigations (including subsurface testing, if necessary), salvage or protection required and long term management of archaeological resources in the development area.
- any other relevant or useful information.

POSSIBLE CONTINGENCIES AFFECTING COMPLETION

Climatic conditions may affect the completion time of the survey.

It will be necessary for us to arrange a meeting with you (or the relevant persons) to ascertain details about the exact nature of the impact of the project in various parts of the development area. As explained above, NPWS expect such information to be incorporated into the report and taken into account in the formulation of recommendations.

PROJECT COSTS AND SCHEDULE

The maximum total cost of preliminary archaeological investigations by Burramoko Archaeological Services for the project will be [redacted] A breakdown of this figure is outlined in Attachment 2. Although it will be necessary for you to deal directly with the Mindarriba LALC and the Wonnarua Tribal Council regarding their employment during these preliminary investigations, in Attachment 3 we have outlined the projected costs of their involvement in the fieldwork. These projections are based on information provided to us by them during telephone conversations, however, they do not include their charges for report production. You will need to negotiate report production costs with the Mindarriba LALC and the Wonnarua Tribal Council. We have provided contact information for both groups below.

Any queries regarding this costing or proposal may be directed to me on the above telephone number. We look forward to hearing from you.

Yours sincerely,

R James

Rosalind James
for Wayne Brennan

W BRENNAN BURRAMOKO 02 478225670 08-03-98 18:18 P.02
Fax sent by : 02 65721989 A4->A4 05/03/98 15:52 Pg: 2

Wonnarua Tribal Council Inc.

Po Box 184
14 Kent St
Singleton NSW 2330

Telephone Mobile 017 875571 / 018 174946
Phone 02 6572 1889 Fax 02 6572 1989

Ros James & Wayne Brennan
Burramoko Archaeological Services
108 Narrowneck Road
Katoomba NSW 2780

16th February 1998

RE; Proposed Rothbury Country Resort Development.

Dear Ros
The Wonnarua Tribal Council act on behalf of the Traditional land Owners of this part of the Hunter Valley, do tender their response in regards to the overall project.

Firstly the Wonnarua Tribal Council is very concerned by the way in which the Project Manager has approached the issues in regards to Aboriginal Consultations and Site Management.

There seems to be some confusion as to which Aboriginal Organization should be contacted in relation to who or which Aboriginal Group has the Right to have a say in what happens to the Aboriginal sites in the Cessnock area.

The members of the Wonnarua Tribal Council are the Descendants of the Wonnarua Koori people who still inhabit their Traditional Lands which includes the present development currently under the Cessnock Shire Council area.

The Wonnarua Tribal Council is involved in current Native Title Land Claims in the Cessnock area and the Tribal Council will be making further Native Title Claims within this boundary at a future date.

Our Tribal Council is also very concerned with the current development and the involvement of other Aboriginal Parties who do not have an Historical Connection to the Land ear marked by this development.

The Wonnarua Tribal Council is mainly concerned with the National Parks and Wildlife Service ACT, and do wish to have this matter settled as to which Aboriginal Group has the final say in regards to what happens to the Wonnarua Heritage Sites found within our Traditional Homelands.

W BRENNAN BURRAMOKO 02 478225670 08-03-98 18:19 P.03

Fax sent by : 02 65721889 A4->A4 05/03/98 15:52 Pg: 3

Wonnarua Tribal Council Inc.

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Singleton NSW 2330

Telephone Mobile 017 025521 / 010 174940
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The Wonnarua Tribal Council do not wish to upset any Aboriginal Community in regards to this issue, but this question will need to be answered by the Minister for NPWS either now or in the very near future.

As this is an issue that can be answered outside of this process in regards to this project the Wonnarua Tribal Council would through this letter make everyone aware that the Traditional Owners are seeking an answer to the question about Aboriginal Rights under the NPWS Legislation.

In relation to the report prepared by the Consulting Archaeologists, Ros James and Wayne Brennan, and having read their Recommendations in regards to this project the Wonnarua Tribal Council have the opinion that the Archaeological Report and Recommendations, are interesting and there has been a large number of Tool Making areas identified in the Survey Area, which comes as no surprise to the Tribal Council as our Ancestors moved across the Land, Hunting and Gathering quite regularly in this area, in which these Sites testify too, and are a part of the Cultural evidence of our past Wonnarua Koori Heritage.

At this point there is only one Recommendation as put by the Archaeologists in their Report that the Wonnarua Tribal Council would consider supporting, which would be Point 10, which reads *"A more detailed Research of the Ethnographic Historical Records and previous Archaeological work in the Region should be carried out"* before the Wonnarua tribal Council makes any further comment.

If you wish to discuss further our Recommendations, please contact on the above numbers and address.

Yours Thankfully

Victor Perry
Cultural Heritage Officer
Wonnarua Tribal Council Inc

APPENDIX C: PHOTOGRAPHIC PLATES

Plate C.1: Looking west across development site to the 600 m high ridges of the northern spur of Broken Back Range which are the source of Rothbury Creek. Rothbury Creek joins Black Creek at the northwestern tip of the development site and probably checks Black Creek's flood flow, resulting in the extensive deposition which has built up the complex terrace sequence on the development site.

Plate C.2: Looking west over the Black Creek floodplain towards Broken Back Range from the base of the Molly Morgan Range Escarpment.

Plate C.3: Cobbles in the banks of Kangaroo Gully near the abandoned "Rose Mount" homestead site in the central/north sector of the development site.

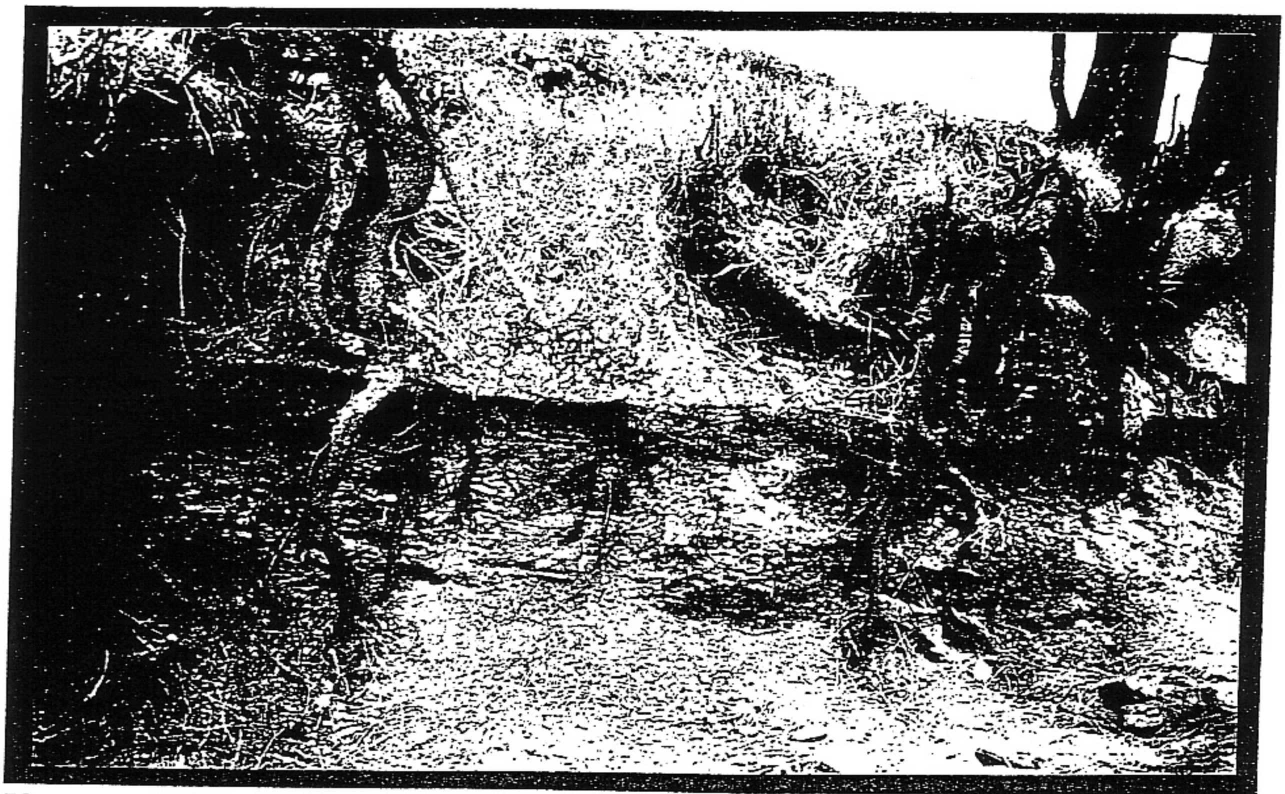

Plate C.4: Exposure of basement rock in Kangaroo Gully near the abandoned "Rose Mount" homestead site in the central/north sector of the development site.

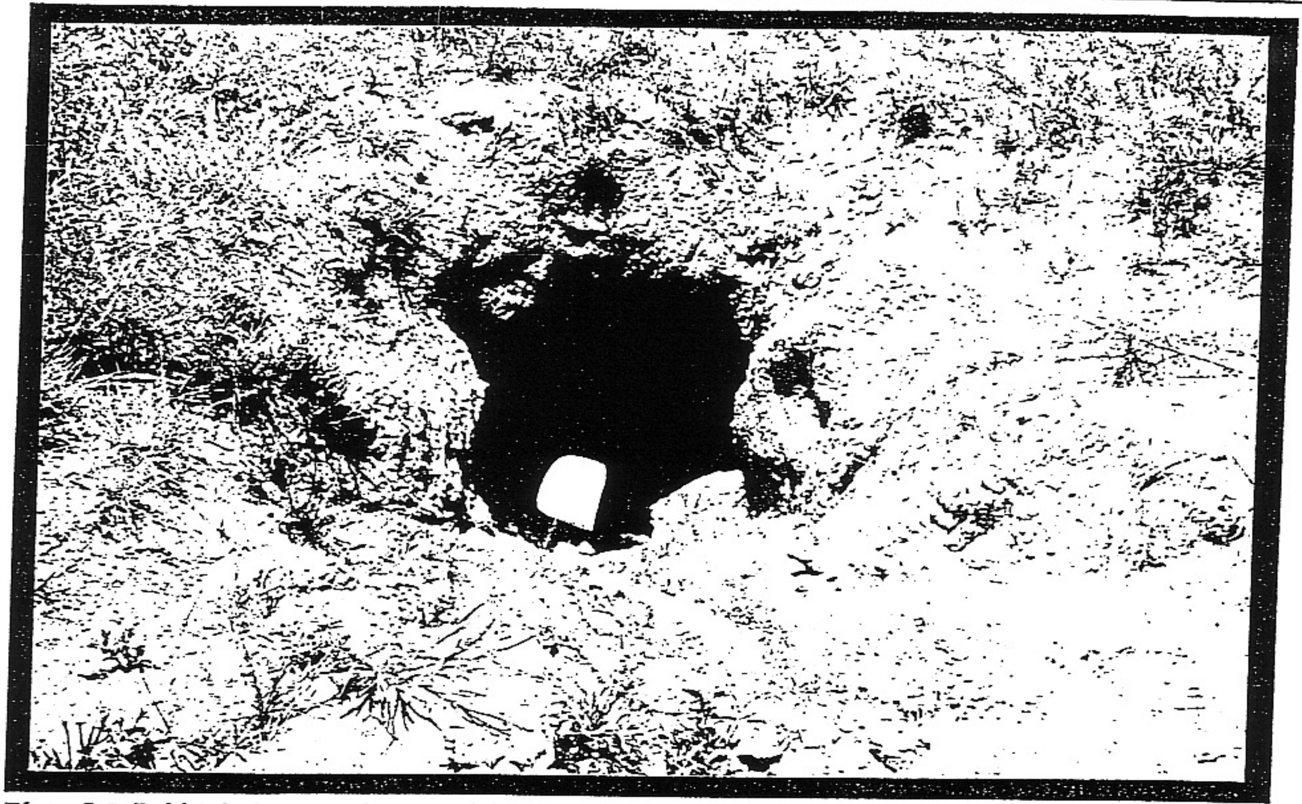

Plate C.5: Rabbit hole on aeolian sand fields in the southeastern sector of development site: note denuded ground cover.

Plate C.6: Looking northeast over the primary terrace across a backswamp (darker brown vegetation zone) and aeolian sand field (denuded ground cover) from the top of the bank demarcating the middle (secondary) terrrace from the lower terrace, in the southeastern sector of the development site. The Molly Morgan Escarpment is in the background.

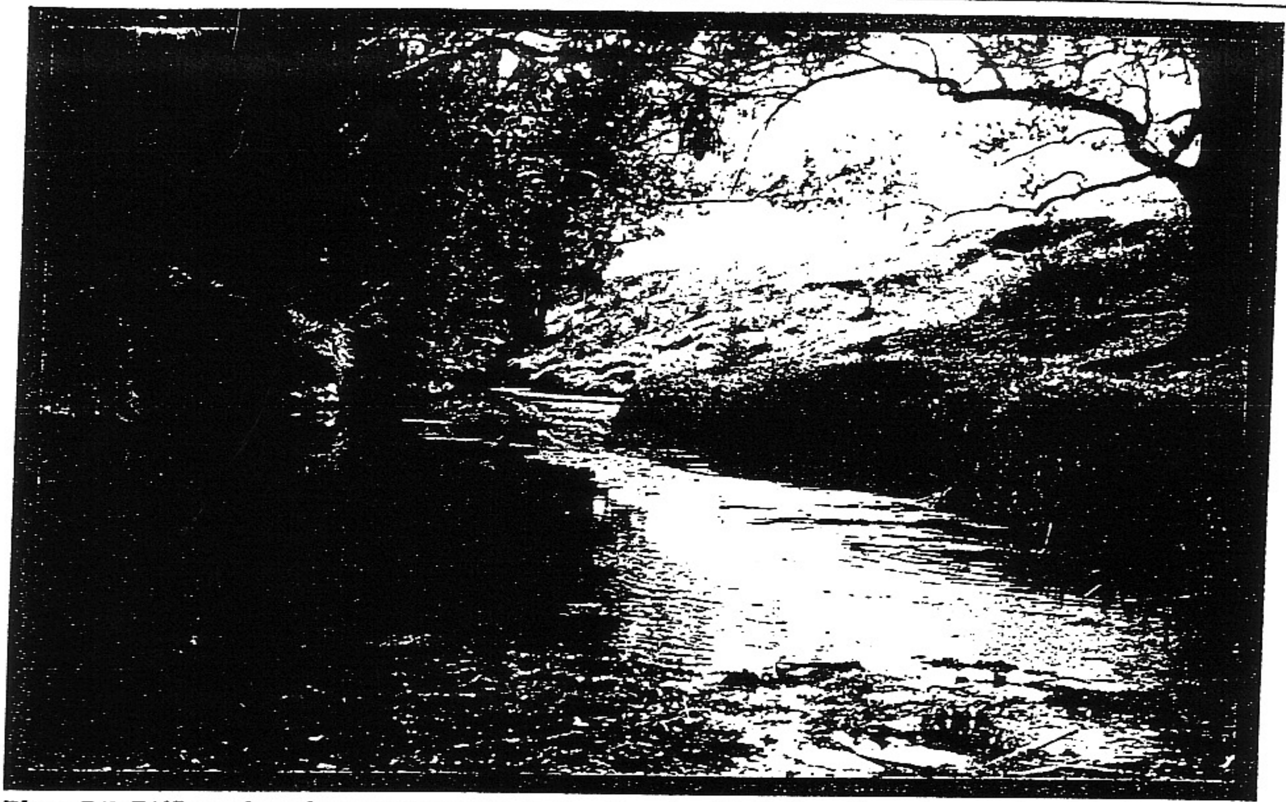

Plate C.7: Riffle and pool sequence in Black Creek and cattle-induced erosion on the right (eastern) bank.

Plate C.8: Discontinuous gully erosion below Dam 3 on Grinding Stone Gully in the northwestern sector of the development site.

Plate C.9: Kangaroo Gully behind the abandoned "Rose Mount" homestead site in the central/north sector of the development site.

Plate C.10: Top of Kangaroo Gully near the southern boundary of the development site. This is possibly an artificial channel.

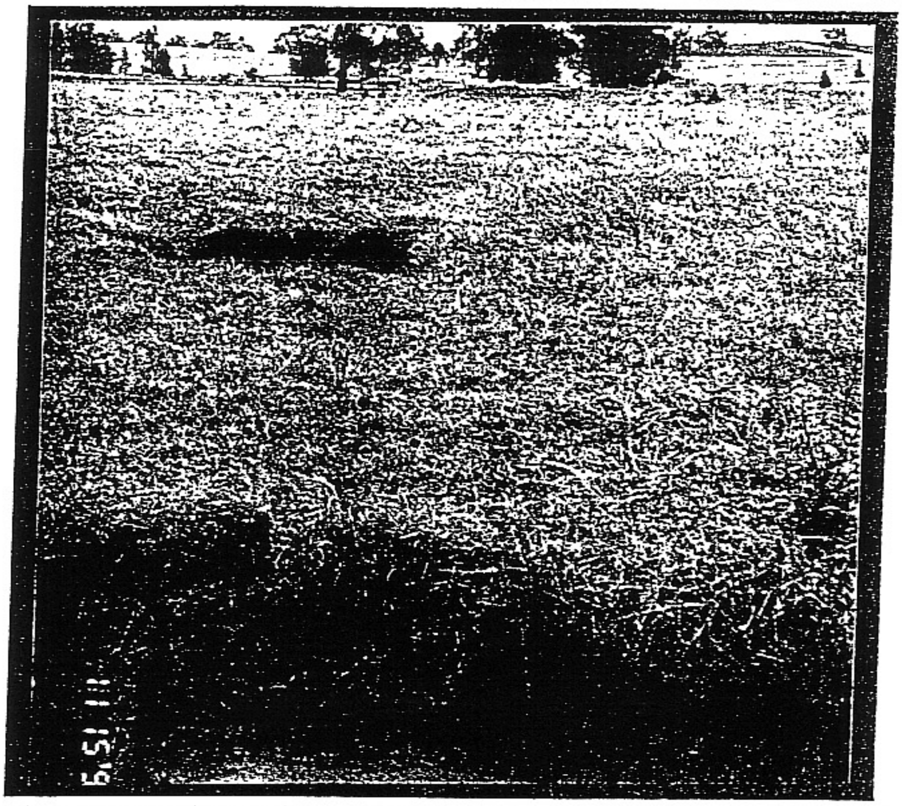

Plate C.11: In the south of the northwestern sector of the development site, at the actively eroding head of Grinding Stone Gully, showing doline collapse (headward erosion by sapping) creating a discontinuous gully. Earthworks directing overland sheet flow in the background.

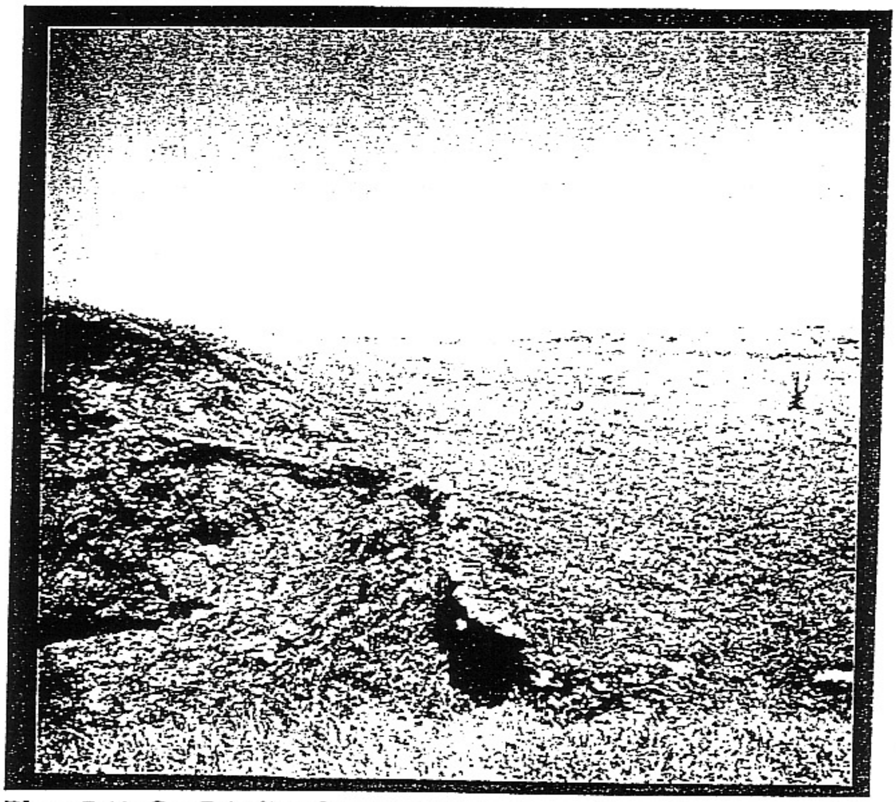

Plate C.12: On Grinding Stone Gully, in the northwestern sector of the development site, showing headward erosion into the undifferentiated sediments of the primary terrace with the scarp of the secondary terrace behind. Relatively recent deposition is suggested by lack of soil formation in the sediments of the primary terrace.

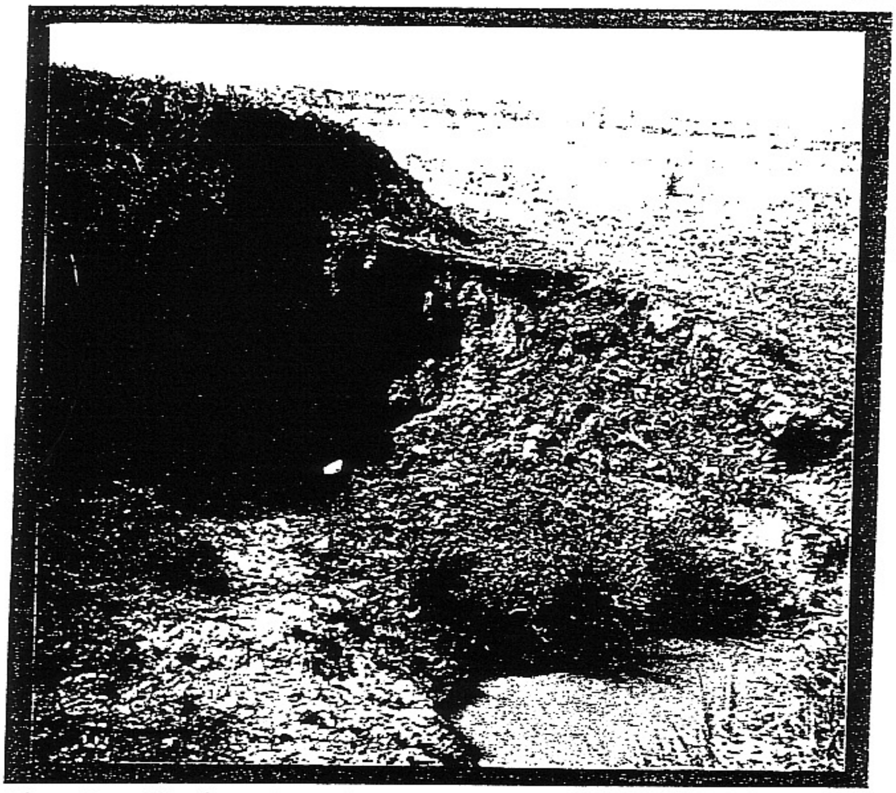

Plate C.13: Headward erosion on Grinding Stone Gully in the northwestern sector of the development site, with the secondary terrace in the distance. This shows undifferentiated sediments, possibly an old clay plug, at the entrance to an abandoned billabong marking the edge of the lower, primary terrace.

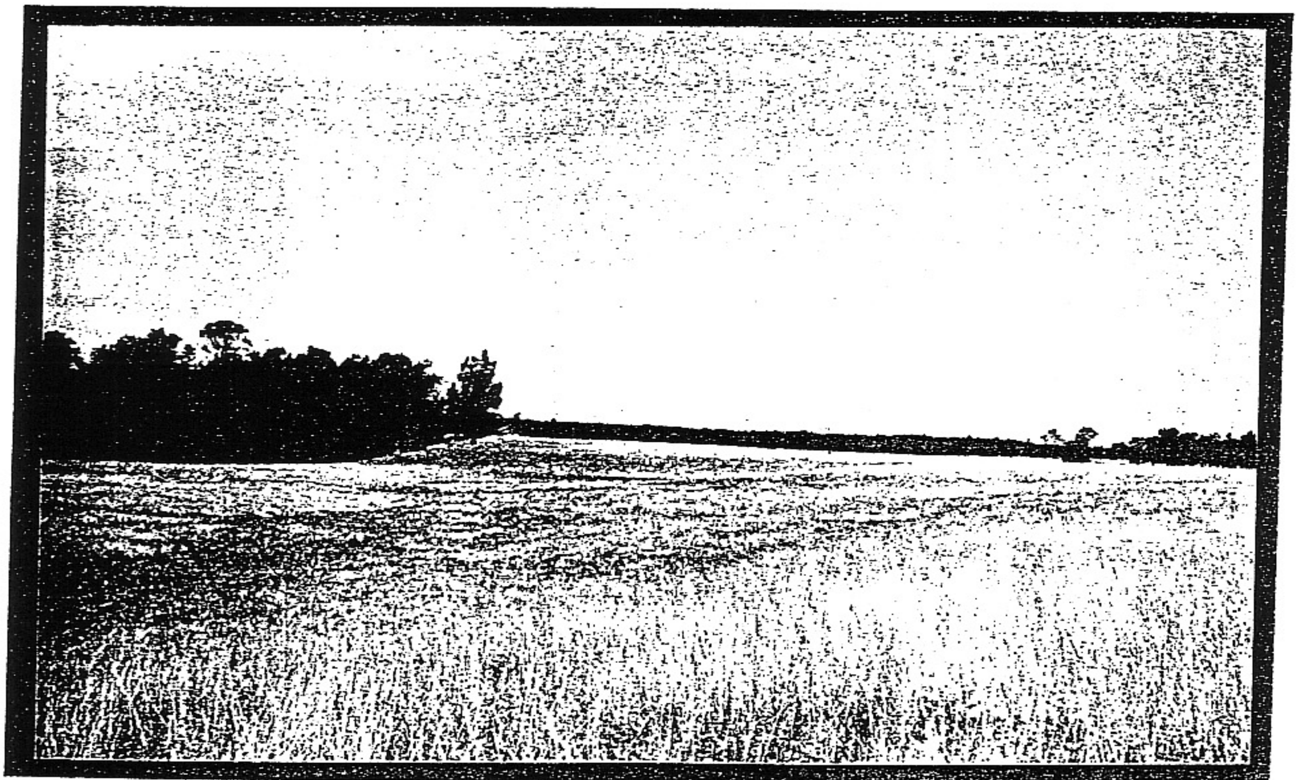

Plate C.14: The photograph is taken from the top of the bank of the middle terrace in the southeastern sector, looking south over a relic billabong on the lower terrace, with the bank of the middle (secondary) terrace swinging round to the left to serve as the bank of the present Black Creek (marked by dense trees on the far left). The secondary terrace can be seen sloping gently away towards its backswamp on the far right, marked by a cluster of Melaleuca (Tea Tree).

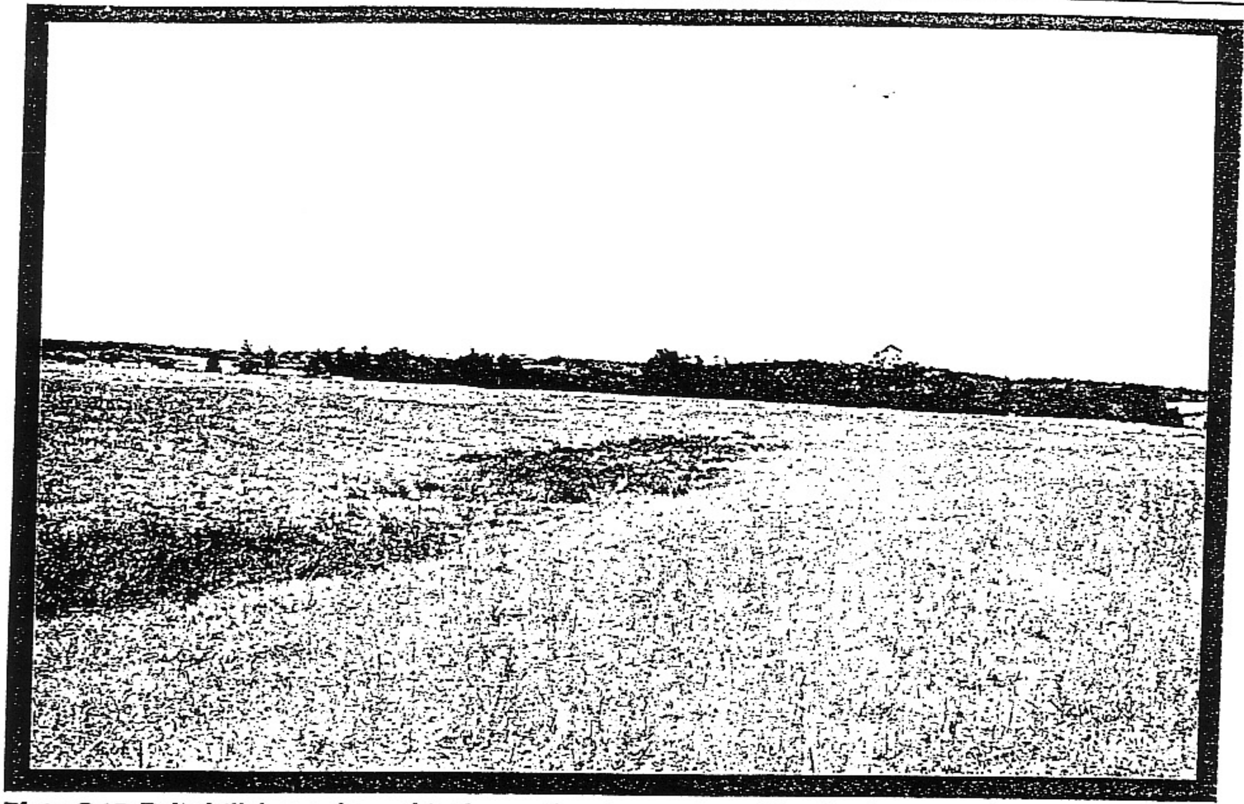

Plate C.15: Relic billabong channel in the southeastern sector of the development site.

Plate C.16: Relic billabong channel in the southeastern sector of the development site.

Plate C.17: Looking northwest towards the abandoned homestead site of "Rose Mount" from the top of the secondary terrace, across a primary backswamp/abandoned billabong, in the southeastern sector of the development site.

Plate C.18: In the southeastern sector of the development site, looking northwest to "Rose Mount" over a 'depression' (a backswamp/abandoned billabong) between the lower primary terrace and the secondary terrace.

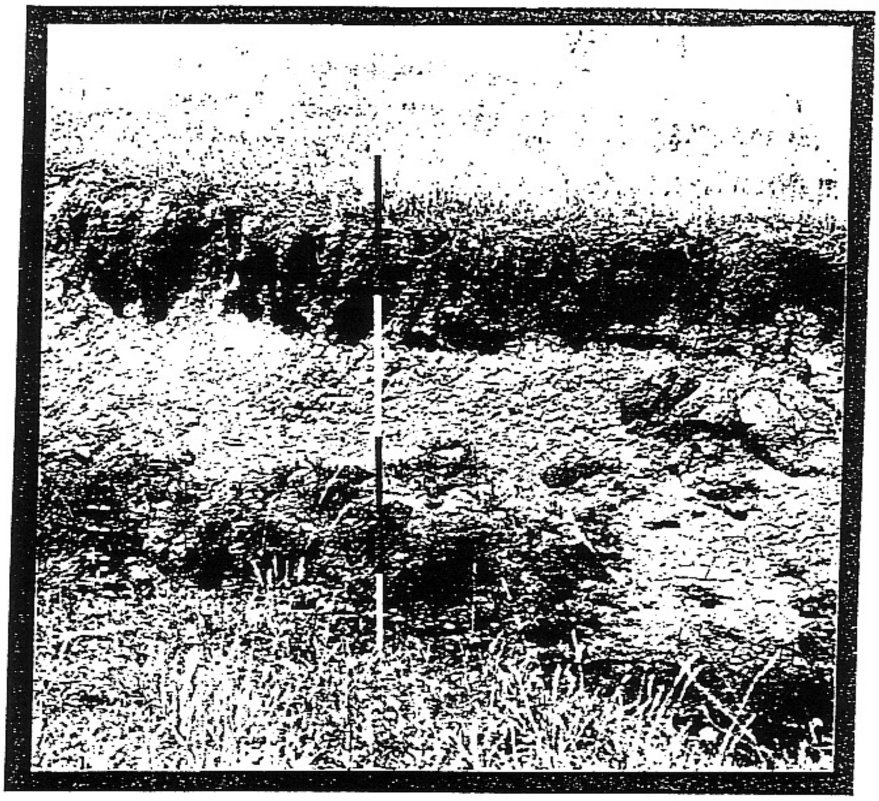

Plate C.19: Duplex soils of the secondary terrace near Dam 3 on Grinding Stone Gully in the northwestern sector of the development site.

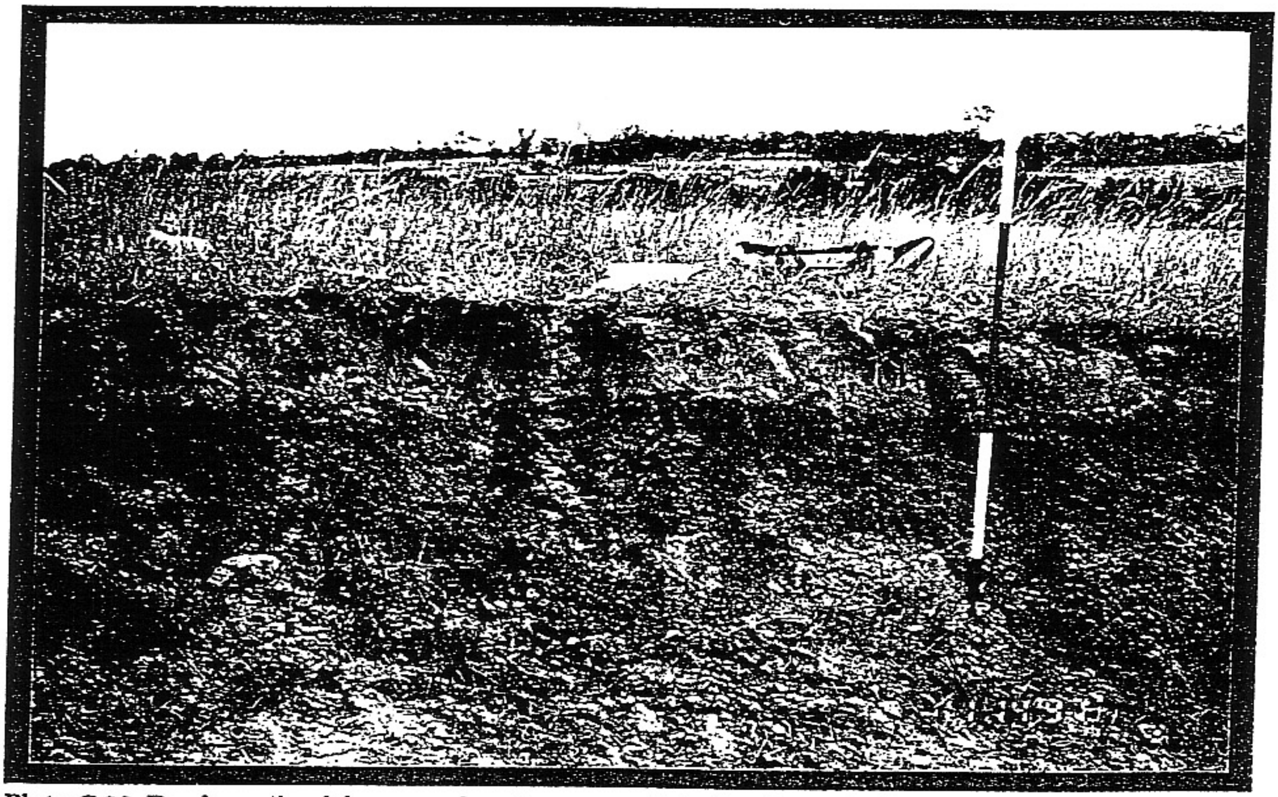

Plate C.20: Duplex soils of the secondary terrace on Grinding Stone Gully in the northwestern sector of the development site.

Plate C.21: Abandoned "Rose Mount" homestead site with flowering silky oaks, in the central/north sector of the development site.

Plate C.22: Simple slope in the central/southwest sector of the development area near Allandale Road.

Plate C.23: Pebbles and cobbles present in great numbers on southwestern corner of Dam 6, on the interface of the tertiary (upper) terrace and simple slope in the central/southwest sector of the development site.

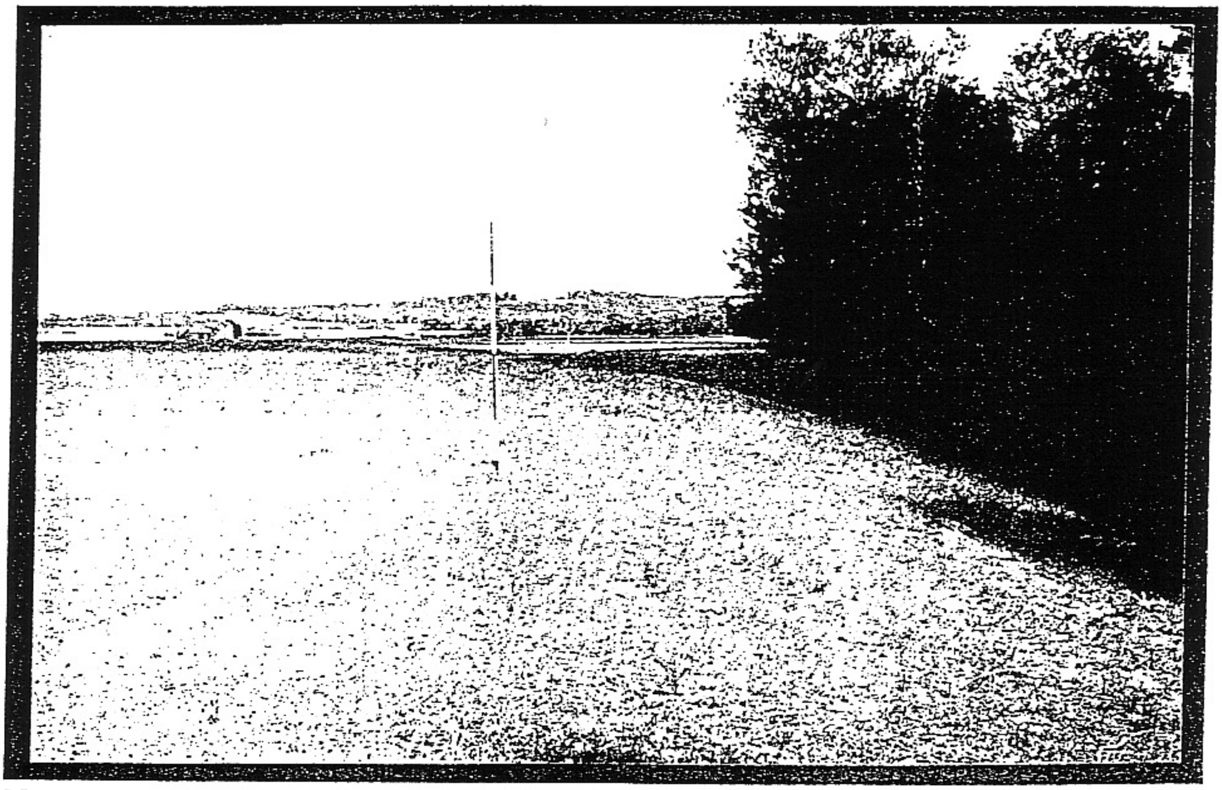

Plate C.24: Looking northwest across artefact scatter BC1 on the secondary terrace above Black Creek (to left) in the central/north sector of the development site. Note lower (primary) terrace below second range-pole.

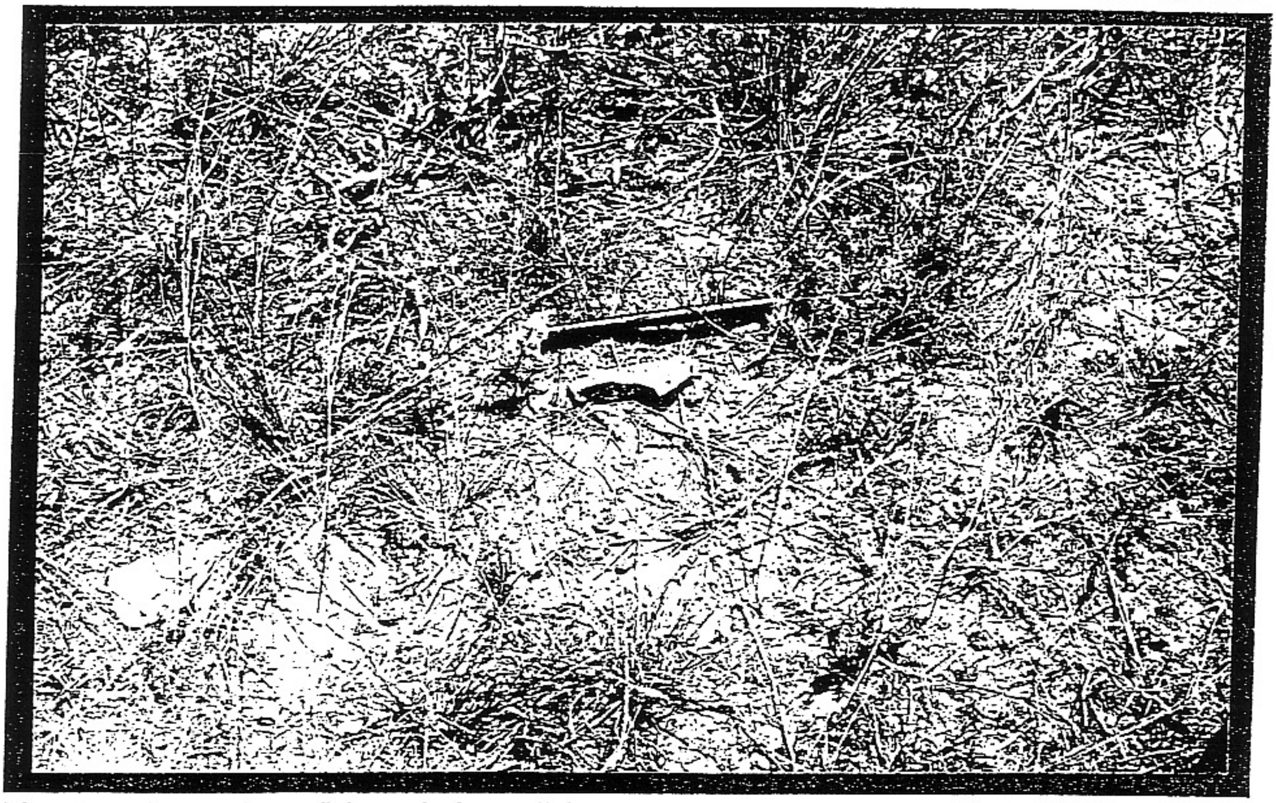

Plate C.25: Large silcrete flake and silcrete flake with tranchet retouch at artefact scatter BC1 on Black Creek in the central/north sector of the development site.

Plate C.26: Artefact scatter D3 on Grinding Stone Gully in the northwestern sector of the development site.

Plate C.27: Artefact scatter D3 on Grinding Stone Gully in the northwestern sector of the development site, looking east to Black Creek.

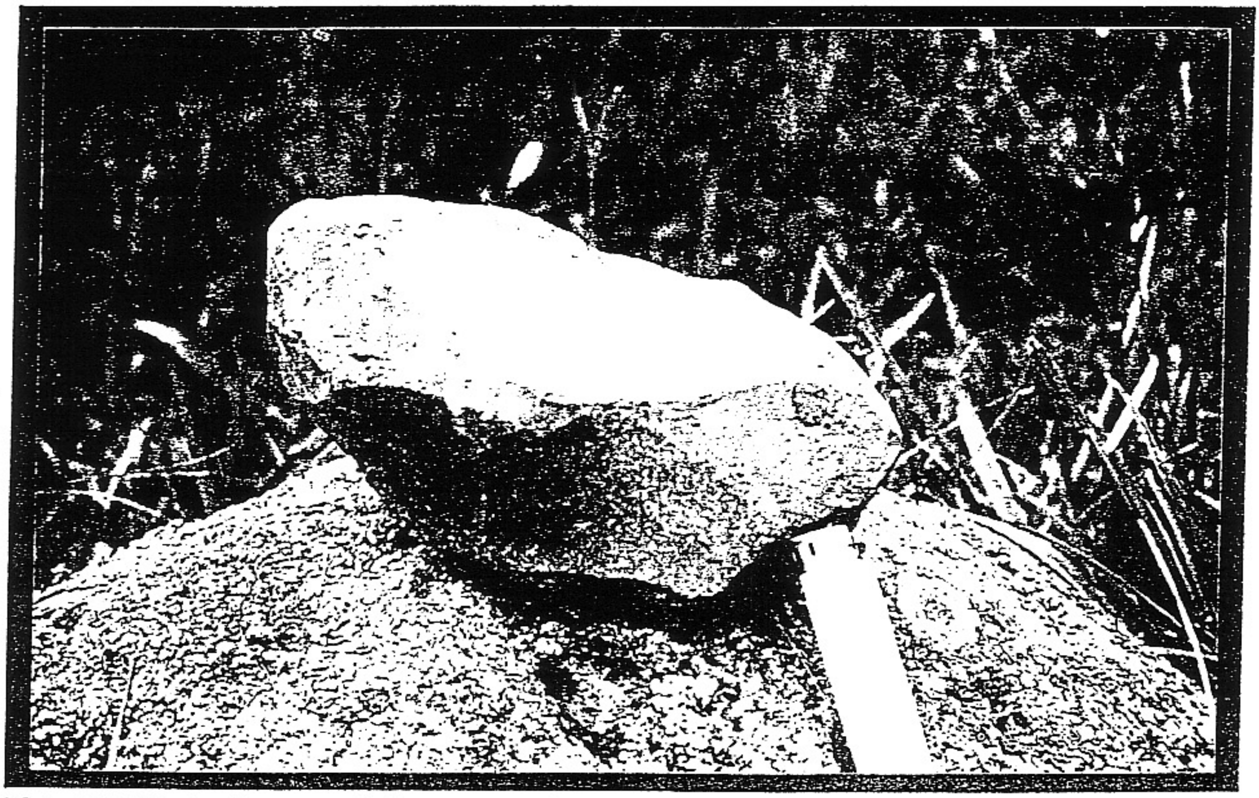

Plate C.28: Broken bottom grindstone at artefact scatter D3 on Grinding Stone Gully in the northwestern sector of the development site.

Plate C.29: Artefact scatter D8 in the central/north sector of the development site on backswamp of secondary terrace, looking north/northwest across the secondary terrace to homestead and silos. Black Creek swings left at base of ridge to pass through narrow defile on extreme left of picture.

Plate C.30: Earthworks at the top of Grinding Stone Gully near Allandale Road in the south of the northwestern sector of the development site.

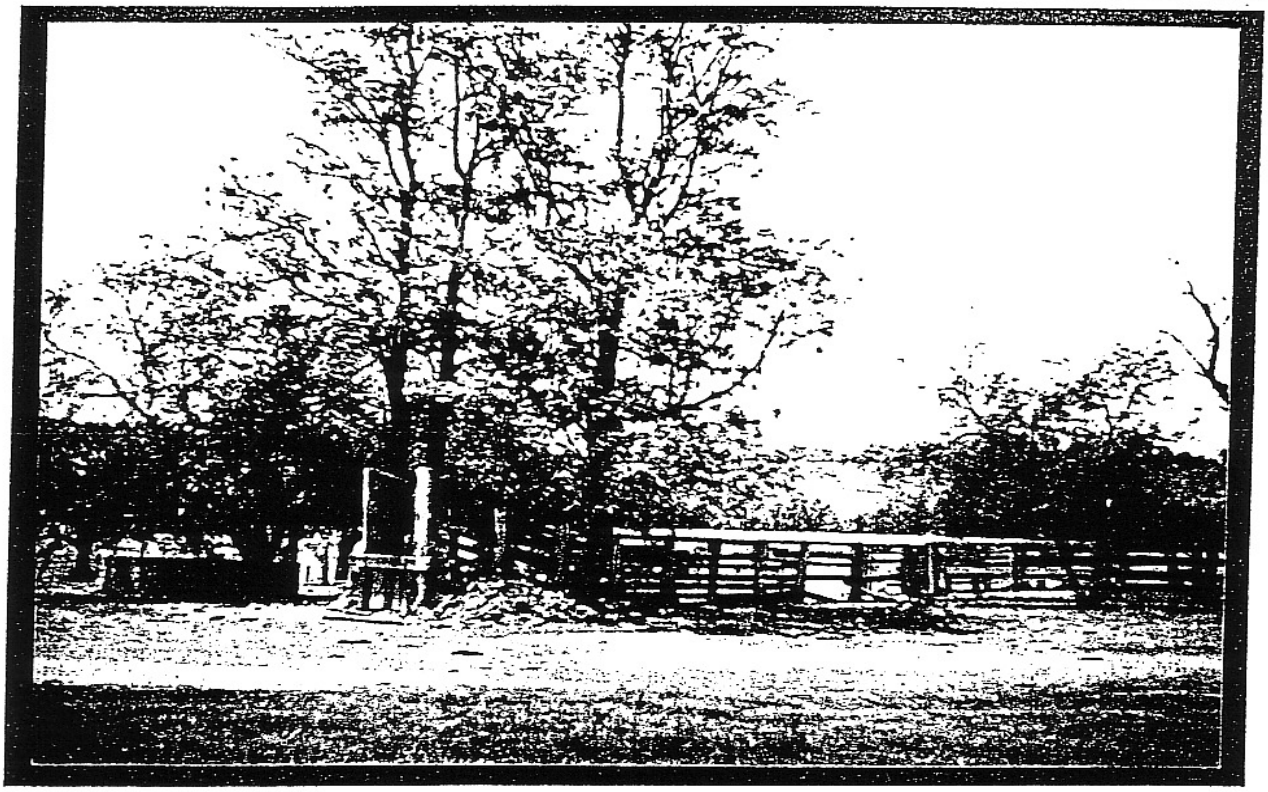

Plate C.31: Artefact scatter HS1 located in the disturbed area around the cattleyards and sheds near the new house on the access driveway in the northwestern sector of the development area.

Plate C.32: Looking southeast over a backswamp/abandoned billabong to artefact scatter WT1, near the cement watertrough on the sand field in the southeastern sector of the development site.

APPENDIX D: DESCRIPTIONS OF SURVEY TRANSECTS