SYDNEY SCIENCE PARK PLANNING PROPOSAL

Aboriginal Heritage Assessment

Prepared for APP Corporation Pty Ltd

Penrith Local Government Area

Draft Report
December 2013

Ref. 1301

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1 Introduction

1.1 Project background

APP Corporation Pty Limited (APP) was engaged to prepare a planning proposal for rezoning lands near Luddenham, western Sydney, for future development purposes. The rezoning proposal will be submitted to Penrith City Council.

The subject land, hereafter referred to as the study area, comprised Lot 201 and part Lot 202 DP 1152191 and was approximately 288 hectares in size (Figure 1). The study area was bounded generally by Luddenham Road in the east, the Warragamba-Prospect water pipeline easement to the north and private property boundaries in the west and south. Surrounding land use was mixed semi-rural development on all sides.

To inform the rezoning proposal, Kelleher Nightingale Consulting Pty Ltd (KNC) was engaged to carry out an Aboriginal heritage archaeological assessment of the land. The assessment included background research and an archaeological field survey conducted in accordance with Office of Environment and Heritage (OEH) requirements including:

Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales

Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales

1.2 Summary of findings

Four Aboriginal archaeological sites were identified in the study area:

RPS LTPAS01 (AHIMS Site ID 45-5-4189)

Sydney Science Park 1 (SSP 1)

Sydney Science Park 3 (SSP 3)

Sydney Science Park 4 (SSP 4)

Archaeological sites RPS LTPAS01 and SSP 3 were open artefact scatters. Archaeological sites SSP 1 and SSP 4 consisted of isolated finds.

Three of the identified sites (RPS LTPAS01, SSP 1, SSP 4) within the study area were isolated or low density artefact scatters, of low archaeological significance. One identified site (SSP 3) exhibited moderate significance based on the integrity of the soil deposit.

None of the identified sites warrant conservation, however, conservation of heritage is a positive outcome if it can be achieved within the future development layout. The master plan developed for the planning proposal will at least partially affect all identified archaeological sites within the study area, although some portions of identified sites will be retained in areas identified as open space, incorporating riparian corridors, active and passive recreation and water management features such as wetlands and lakes and detention basins.

Sites RPS LTPAS01 and SSP 1, 3 and 4 do not pose a constraint to development but will require a process of further assessment, consultation and mitigation to comply with relevant legislation and associated requirements.

1.3 Investigators and contributors

A list of investigators and contributors to the study is included in Table 1 below.

Table 1. Investigators and contributors

Investigator/Contributor	Affiliation	Role
Alison Nightingale	KNC	Advisor, reporting and review
Matthew Kelleher	KNC	Site inspection, advisor, reporting and review
Cristany Milicich	KNC	Survey, reporting
Kylie McDonald	KNC	Survey
Ben Anderson	KNC	GIS mapping
Steve Randall	DLALC	Cultural Heritage Advisor
Kayne Moreton	DLALC	Survey, Cultural Heritage Advisor
Shane Yule	DLALC	Survey, Cultural Heritage Advisor

Figure 1. Study area location

2 Description of Development Proposal

A Planning Proposal is being submitted to Penrith City Council (Council), on behalf of E.J. Cooper & Son Pty Limited (EJC), in support of an amendment to the Penrith Local Environmental Plan (LEP) 2010. The proposal is to rezone a 288 hectare parcel of land at 565-609 Luddenham Road, Luddenham to accommodate a new integrated mixed use research and development, employment, education, retail and residential specialised centre.

The Planning Proposal is supported by a Master Plan, which represents the overall planning framework and preferred outcome for Sydney Science Park. The Master Plan includes:

- approximately 340,000m^2 of research and development floor space;
- approximately 100,000m^2 of education floor space;
- a Town Centre including a 30,000m^2 mix of retail floor space and residential apartments;
- 3,400 dwellings including student housing;
- a primary school;
- new roads and infrastructure; and
- sporting fields and parks.

The planning proposal addresses site servicing and environmental conditions. It is also accompanied by an offer to enter into Voluntary Planning Agreements with State Government and Penrith City Council for the delivery of infrastructure and community facilities that are required to meet the future demands of Sydney Science Park. This includes road network improvements, district and local open space and a community facility.

A number of technical and environmental studies were undertaken to assess potential impacts of future development and to inform the future development layout of the study area. These included:

- contamination;
- ecology;
- Aboriginal heritage;
- hydrology, flood, creeklines and riparian;
- landscape;
- topography;
- servicing – power, water and sewer;
- urban design and land use;
- transport;
- economic analysis; and
- socio economic and support services.

The Master Plan was prepared in consideration of the findings of these studies. The Master Plan is shown on Figure 2.

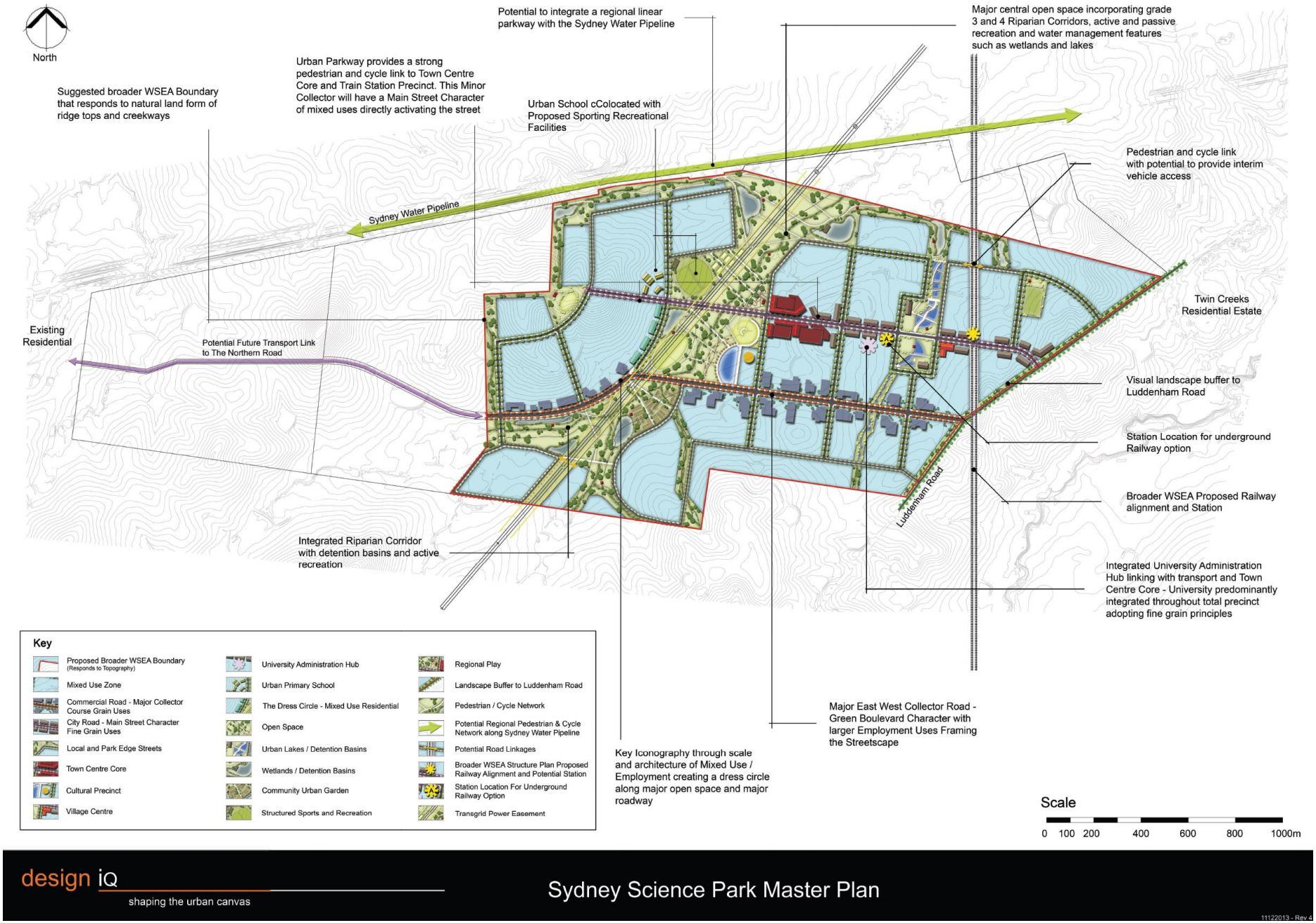

Figure 2. Sydney Science Park Master Plan (source: APP, prepared by design iQ, dated 11 December 2013, Rev 4)

3 Aboriginal Community Involvement

According to the Code of Practice, consultation with the Aboriginal community is not a formal requirement of the due diligence process. However, the proponent considered consultation with the local Aboriginal community at the planning stage would assist in the decision-making process. The proponent sought to undertake the due diligence assessment in consultation with the relevant Local Aboriginal Land Council to identify any sites or issues of cultural significance.

The assessment was undertaken in consultation with Deerubbin Local Aboriginal Land Council (DLALC) whose boundaries covered the study area. DLALC was contacted at the commencement of the project to discuss the planning proposal and invited to participate in site investigations. Land Council representatives Kayne Moreton and Shane Yule participated in a site inspection on Thursday 22 August 2013.

DLALC provided a cultural assessment report on the study area (Appendix A). The report noted that in spite of poor ground surface visibility, Aboriginal cultural material in the form of stone artefacts was found in the study area. The Land Council therefore recommended further detailed investigation prior to development of the lands.

4 Previous Archaeological Work

4.1 Database search (AHIMS) and known information sources

4.1.1 AHIMS web services

The Aboriginal Heritage Information Management System (AHIMS) is a database operated by the Office of Environment and Heritage (OEH) and regulated under section 90Q of the *National Parks and Wildlife Act 1974*. AHIMS contains information and records related to registered Aboriginal archaeological sites (Aboriginal objects, as defined under the Act) and declared Aboriginal places (as defined under the Act) in NSW.

A search of AHIMS was conducted on 29 July 2013 to identify registered (known) Aboriginal sites or declared Aboriginal places within or adjacent to the study area (AHIMS Client Service ID: 107236). Search results are attached as Appendix B.

The AHIMS Web Service database search was conducted with the following coordinates (GDA, Zone 56):

Eastings: 0286000 to 0293000
Northings: 6251500 to 6255000
Buffer: 0 metres (search coordinates included a substantial buffer around the study area)

The AHIMS search results showed:

20	**Aboriginal sites are recorded in or near the above location**
0	**Aboriginal places have been declared in or near the above location**

All previously recorded Aboriginal sites within the AHIMS search area were open artefact scatters (Table 2). Site locations are shown in Figure 3.

Table 2. Frequency of site types from OEH AHIMS database search

Site Context	Site Features	Number	%
Open Site	Artefact (AFT)	20	*100*

4.1.2 Other heritage registers and databases

Other sources of information including heritage registers and lists were also searched for known Aboriginal heritage in the vicinity of the study area. These included:

- Penrith Local Environment Plan 2010
- Sydney Water Heritage Register
- State Heritage Register and State Heritage Inventory
- Commonwealth Heritage List
- National Heritage List
- Australian Heritage Places Inventory and
- Historic Heritage Information Management System (HHIMS).

No items of Aboriginal heritage were listed on these databases within the study area.

4.2 Discussion of AHIMS search results

As well as determining if there are any registered (known) sites within a given area, an AHIMS search also helps to characterise local archaeology by illustrating the distribution of known sites within the local landscape. This can aid in the development of predictive models used at the desktop stage of archaeological investigation and is integrated with known regional trends to help identify where archaeology may be present within a given area.

Archaeological sites listed on the AHIMS database often represent a record of archaeological survey effort, rather than a comprehensive or complete depiction of an area's archaeology, but provide a useful starting point for further investigation. Search results for the current study area indicated the predominance of open sites with artefacts (open camp sites) around the study area. The open camp site is a common site type in the Cumberland Plain. Artefacts may be identified in isolation ('isolated finds') or in association with others in an artefact scatter. According to the data retrieved from AHIMS, these are the most common manifestations of archaeological material in the local area.

Many of the open camp sites registered within the AHIMS search area were located close to Cosgroves Creek, South Creek and Badgerys Creek, east of the study area. Other recorded sites to the southwest were located in association with an unnamed tributary of South Creek which flows through the centre of the study area. One site, AHIMS number 45-5-4189 (RPS LTPAS01), was located within the study area, immediately west of a large dam formed along the line of this unnamed tributary. RPS LTPAS01 was an open site measuring approximately 40m x 25m with 16 artefacts recorded. Raw materials identified were silcrete and quartz.

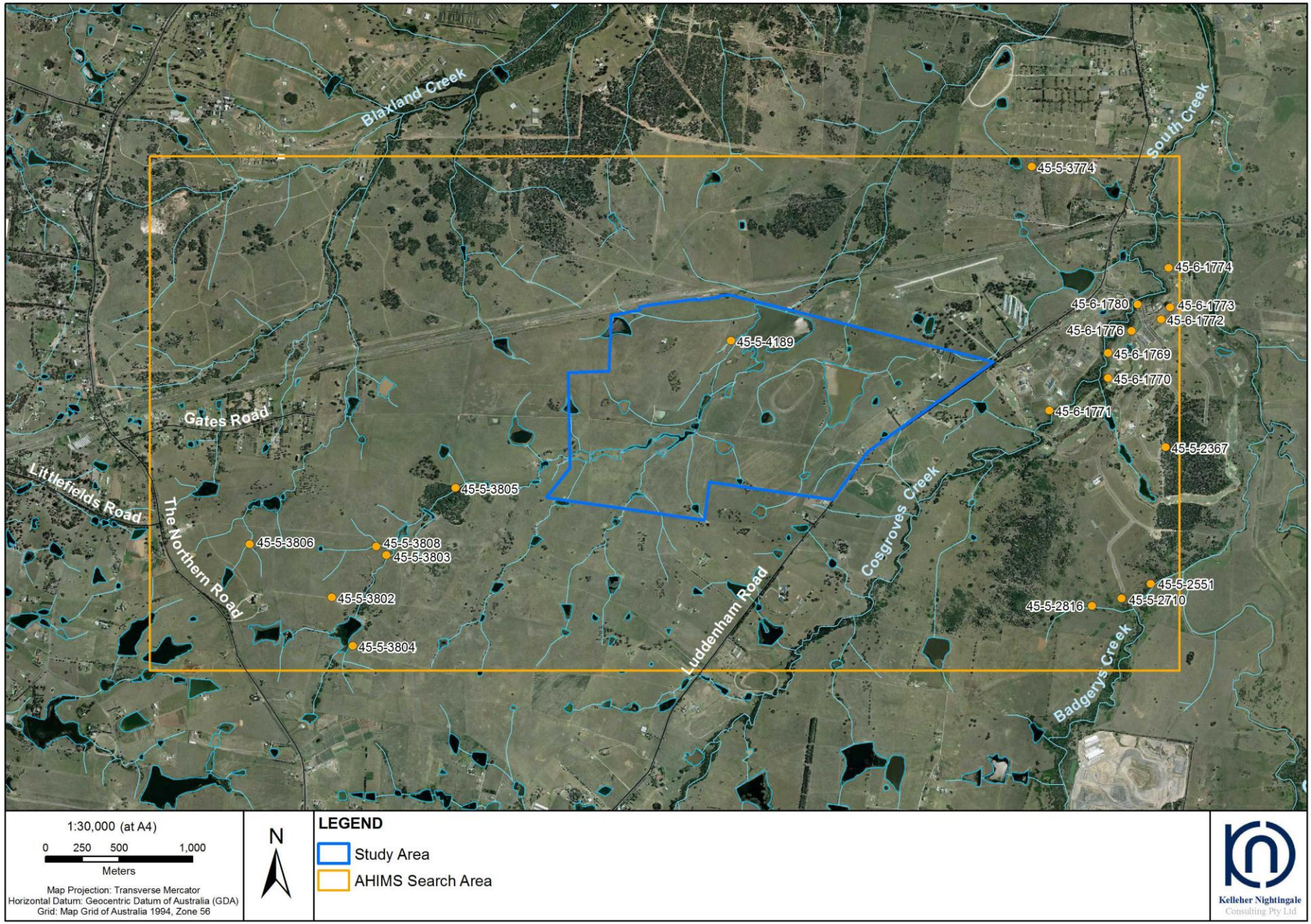

Figure 3. Previously recorded Aboriginal sites

The presence of recorded sites in the vicinity of the study area demonstrates that the local landscape was used by Aboriginal people in the past and that material traces of this landscape use have survived in the form of Aboriginal objects.

4.3 Previous archaeological investigations and recorded sites

Several archaeological surveys and test excavation programs have been carried out across the local landscape surrounding the study area. This section summarises what is known from existing and available data.

The majority of archaeological investigation in the vicinity has taken place to the east of the study area, associated with the planning and construction of Twin Creeks residential and leisure development. Twin Creeks comprised approximately 354 hectares between Luddenham and Mamre Roads which was subject to archaeological survey and subsequent test and salvage excavations (Dallas 1988; Dallas & Smith 1988; Steele 1999, 2001, 2004, 2007). The study area included stretches of Cosgroves Creek, Badgerys Creek and South Creek and was bounded in the east by the margins of a large dam at the confluence of the latter two watercourses. The majority of the land was low lying flood prone pasture, with a ridgeline separating Cosgroves and Badgerys Creeks.

Field survey identified 12 archaeological sites, in two series associated with the watercourses of Cosgroves Creek and South Creek. Eight were identified along Cosgroves Creek and its flood prone creek flats: LEC 1 – LEC 8 (AHIMS 45-6-1769-1774, 1776, 1780). These sites consisted of open artefact scatters ranging from three to 34 artefacts, with the most common raw material being red, grey and yellow silcrete. Occasional artefacts of chert, quartz and quartzite were also noted. Based on observed frequencies of artefact types, it was established that there was a slightly higher proportion of cores among the assemblages from LEC1-8 in comparison to other nearby sites (Dallas 1988:23), possibly related to the occurrence of silcrete nodules along the creek line (i.e. an adjacent source of raw material). Overall, sites along Cosgroves Creek were considered moderately to highly disturbed by flooding/erosional processes, stock movement and construction of a golf course. Sites were widely dispersed, with low apparent artefact densities. It was concluded that further archaeological material may exist along the creek line, but if present were "unlikely to be substantial, significant, or undisturbed" (Dallas 1988:23).

Sites LEC 9 - -LEC 12 (AHIMS 45-5-45-6-1775, 1777-1779) were located in association with South Creek and a series of confluences with its tributaries, Badgerys Creek and Kemps Creek. LEC 9, 10 and 12 were located on relatively flat higher ground on the eastern faces of a north-south tending ridgeline, while LEC 11 was located on churned and disturbed ground adjacent to the creek. Similarly, all sites were open artefact scatters. LEC 9, 10 and 11 displayed low numbers (20, 7 and 7 respectively) of mostly silcrete artefacts, with single instances of chert and quartz at LEC 11. Artefacts included multiplatform and bipolar cores, flakes, bipolar flakes and broken debitage, in many cases displaying signs of retouch or usewear on the margins. LEC 12 was identified in cuttings and exposures related to extraction of soil for dam wall material. The site contained 567 artefacts of predominantly silcrete with occasional chert, quartz and volcanic materials. The sample artefacts recorded included cores, a ground edge fragment, thumbnail scrapers, flakes and broken debitage. Unmodified cobbles and nodules of silcrete were also observed.

It was concluded that LEC 1-8 and 11 were of low archaeological significance due to low densities, disturbance and no further archaeological potential. It was recommended that no further investigation was required at these sites. LEC 12 was considered highly significant, due to the number and density of artefacts at the site and the high likelihood of further intact archaeological deposit. LEC 9 and 10 and their spatial relationship with LEC 12 were also considered worthy of further archaeological investigation.

Subsequent further investigation was undertaken at LEC 9 and 12 in the form of subsurface test excavation, to determine the nature and extent of the sites (Dallas & Smith 1988). A series of 13 shovel probes were excavated across the ridge spurs south of LEC 12. Results indicated that archaeological deposit was relatively undisturbed and of substantial depth, associated with colluvial deposits above the gravel and silcrete-rich clay. Presence of archaeological deposit within this colluvium was affected by disturbance and steepness of slope, with the deepest deposits and highest artefact densities present on the relatively flat areas of LEC 9 and 12. Both sites were considered to display high significance both locally and regionally and it was recommended that these sites be preserved and protected from future development impact (Dallas & Smith 1988:24).

An additional archaeological survey of the same study area was undertaken in 1999 (Steele 1999). In the intervening years between the Dallas (1988) investigation and this additional survey, the large dam at the confluence of Badgerys and South Creeks had been drained, substantially altering the character of the eastern part of the study area. Five of the original 12 sites (LEC 1 – 12) were relocated and an additional seven sites were identified. Five of these (CGD 1, 2, 4, 5 and 6) consisted of artefact scatters comprised mostly of silcrete, with instances of chert, indurated mudstone/tuff, quartz and quartzite. CGD 4 was described as an open artefact scatter/silcrete source, with over 300 unworked silcrete cobbles and pebbles noted on the surface and eroding out of the subsurface clays. The location of CGD 1 and CGD 4 had previously been submerged under the South Creek/Badgerys Creek confluence dam. Other

identified sites included IF 1, an isolated find of a broken edge-ground axe/hatchet of an unidentified volcanic material and CGD 3, a possible scarred tree.

Based on an impact assessment completed in 2001, it was recommended that three sites (LEC 6, 8 and 10) be subject to an archaeological testing program ahead of development, to determine the nature and extent of the archaeological resource that would be impacted by the proposed development (Steele 2001). Results of the test program were characterised by low density artefact distributions comprising mostly silcrete debitage with very few formal tool types identified. No undisturbed or significant archaeological deposit was identified at these sites. This was interpreted as evidence for casual and transitory Aboriginal use of the local landscape, with no indications of camping or activity areas. It was considered that the focus of past Aboriginal occupation and landscape use was the area at the confluence of Kemps, South and Badgerys Creeks and the slopes and spurs near these larger watercourses. An Aboriginal Heritage Conservation Action Plan prepared for the Bushland Conservation Zone of the Twin Creeks development determined that some areas adjoining LEC 12 would be affected by residential development and recommended a program of salvage excavation in these localities (Steele 2004), as well as surface collection of artefacts from other areas in partnership with Aboriginal community groups.

Subsequent salvage excavation of the areas designated Zones F and G adjacent to LEC 12 demonstrated shallow soils and low artefact density across this locale (Steele 2007). 120 artefacts were recovered from a total excavation area of 16m^2, giving a mean artefact density of 7.5/m^2. Silcrete accounted for 90% (n=108) of all artefacts recovered, with small frequencies of silicified tuff (n=8), petrified wood (n=2) and single instances of quartzite and indurated mudstone. The majority of artefacts were debitage, with only one formal tool type (a scraper of indurated mudstone) identified. It was concluded that these areas were similar in nature to those investigated in 2001 and represented sporadic or casual landscape use, away from the nearby activity focus of LEC 12.

Southwest of the current study area, a number of archaeological sites have been recorded in association with the upper reaches of the unnamed watercourse that traverses the study area. These consist of three open artefact scatters (45-5-3805, 45-5-3806 and 45-5-3808) and three isolated artefacts (45-5-3802, 45-5-3803 and 45-5-3804). These sites appear to have been recorded during an archaeological field survey for an unknown project. Artefacts recorded were flakes, flaked pieces, a blade core and a flake with retouch, with the most common raw material being silcrete of varying colours, followed by chert and tuff. All identified sites were considered to be in poor condition, with one (45-5-3806) described as 'totally destroyed'. Sites were recorded in a variety of landscape contexts, including creek flats, gentle slopes above the creek and elevated knolls. Site records noted the low visibility of the area, with visibility largely limited to erosion scars and patches of upcast spoil along levees and dams. In most cases it was considered that the areas around the identified sites displayed low likelihood of retaining archaeological deposit, due to factors including historical disturbance and the location of the sites along a watercourse that would have been regularly waterlogged and retained standing water for long periods of time. The sites located on the more elevated knolls near the watercourse were considered to retain slightly better archaeological potential.

4.4 Implications for the study area

These previous archaeological investigations described above have been undertaken in landscapes comparable to that of the study area. Archaeological sites in the vicinity of the study area are located in proximity to the numerous watercourses that traverse this part of the Cumberland Plain. The sites identified close to South Creek, a major watercourse, appear to represent more frequent or long term occupation by Aboriginal people. Sites located in other parts of the landscape have been interpreted as representing more casual or sporadic use of these areas.

Archaeological potential in the local area has been affected by various factors, chiefly the extent of historical disturbances to the land surface, degree of slope and the effect that natural fluvial and erosional processes have on sites located on the low lying creek flats that are periodically affected by flooding. Elevated landforms are considered more likely to retain archaeological potential. The complex network of drainage channels and the likely presence of a near-permanent water source and/or swampy flats in the study area suggest that the environmental resources offered in the past may have encouraged Aboriginal landscape use.

Investigations at identified sites away from the major watercourse of South Creek have established generally low to moderate artefact densities and few clearly identified activity areas. Nonetheless, archaeological evidence of past Aboriginal people's landscape use does survive. Based on the outcomes of previous archaeological assessments in the local area, it was considered likely that the study area contained further Aboriginal sites than the one previously recorded site. These will have been variably affected by the factors outlined above. Similarly, the archaeological potential of the study area was likely to be variable.

5 Landscape Context

The study area is located in the west of the Cumberland Plain, a physiographic region of the western Sydney Basin characterised by low lying, gently undulating low hills, wide valleys and plains atop the Wianamatta Group of sedimentary shales. The topography of the study area is characterised by rolling low hills, gentle to moderately inclined hillslopes and a broad, shallow drainage channel encompassing the unnamed watercourse that flows through the centre of the study area. A network of numerous small drainage channels runs down the slopes to meet this watercourse, which flows towards a confluence with South Creek approximately 4km northeast of the study area. South Creek itself passes within 2km of the study area to the east, while the Nepean River is approximately 10km to the west. Numerous other permanent waterways such as Cosgroves Creek, Badgerys Creek and Blaxland Creek are also in close proximity. A number of dams have been constructed within the study area, which has somewhat altered the natural hydrology of the terrain. A local high point/hill crest is situated to the west of the study area. The landscape is undulating, with low ridges and crests and associated slopes. Flat areas are located closer to the watercourses and at lower elevations. Hillslopes within the study area vary from gentle to steep gradients (Figure 4).

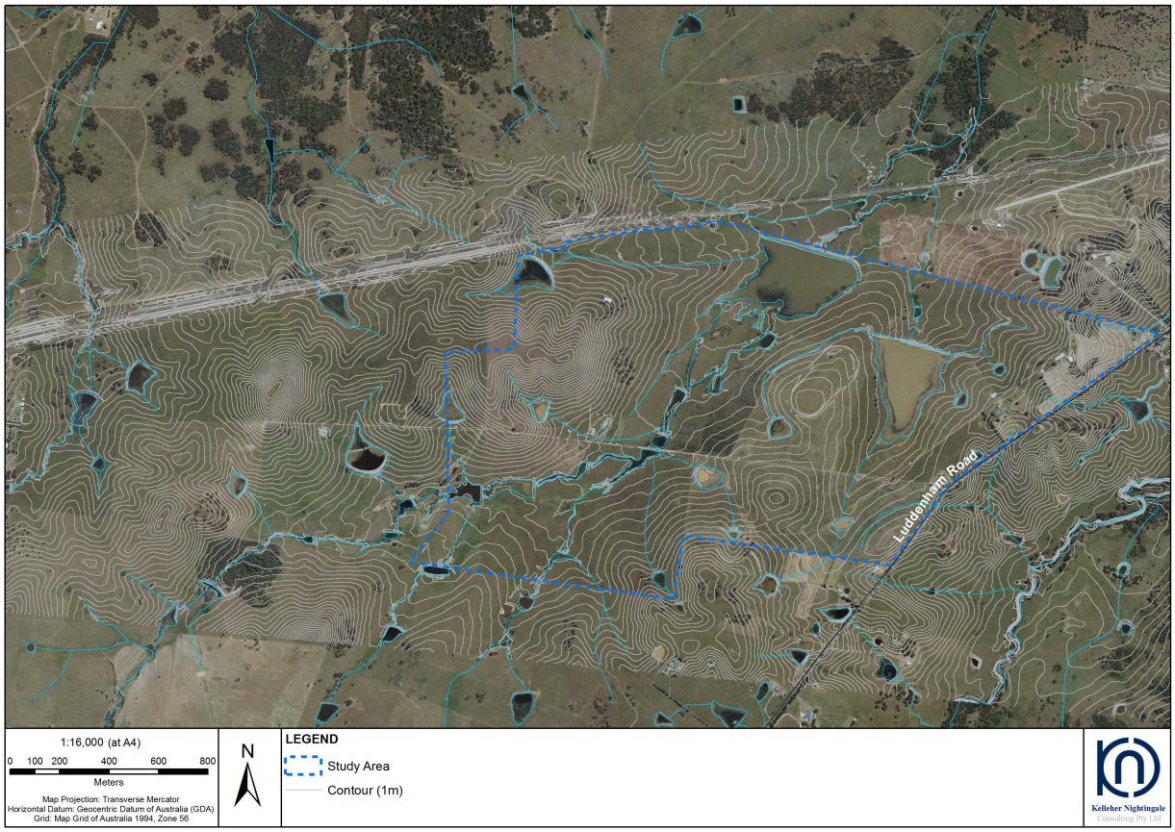

Figure 4. Study area topography

Geology within the study area was comprised of two chief units (Figure 5). For the most part, the study area is underlain by Bringelly Shale, a complex formation of different lithologies forming the upper unit of the Wianamatta group of Triassic Period sedimentary shales (Clark & Jones 1991). The Wianamatta group was deposited during the subsidence of an alluvial plain and represents the continuous supply of sediment filling the Sydney Basin and pushing the original shoreline out. The group grades upwards from shallow marine deposits through a shoreline sand and the uppermost unit represents the increasingly terrestrial alluvial deposits. This uppermost unit is the Bringelly Shale, consisting of claystone/siltstone, shale, carbonaceous claystone, laminate, fine to medium-grained lithic sandstone, rare coal and occasional tuff.

The second geological unit in the study area is Quaternary alluvium, present in the centre of the study area associated with a small watercourse which flows northeast to South Creek. Quaternary alluvium is the substance of extensive alluvial plains deposited on terraces along the Nepean River and along the floodplains and terraces of the South Creek and Eastern Creek hydrological systems, most probably during the Pleistocene (Clark & Jones 1991). The sediments consist of fine grained sand, reddish brown silt and clay, derived from the Wianamatta Group shales and Hawkesbury sandstone.

Soils within the study area are primarily of the Blacktown soil landscape, with the South Creek soil landscape occurring in association with the drainage channel of the unnamed watercourse (Figure 6). A large area of the Luddenham soil landscape is also mapped immediately south of the southern study area boundary and may extend onto the slopes in this part of the study area.

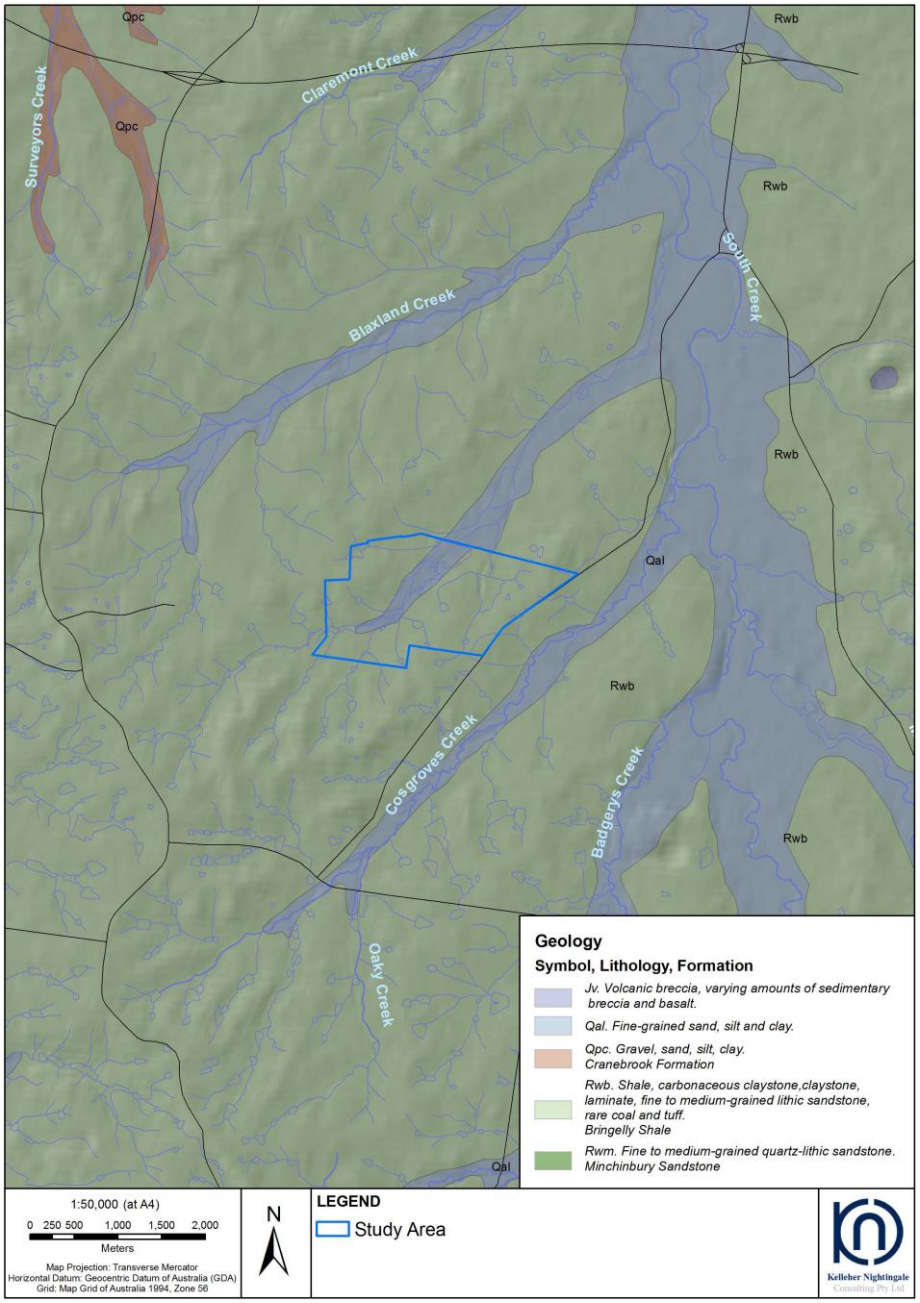

Figure 5. Geology of the study area

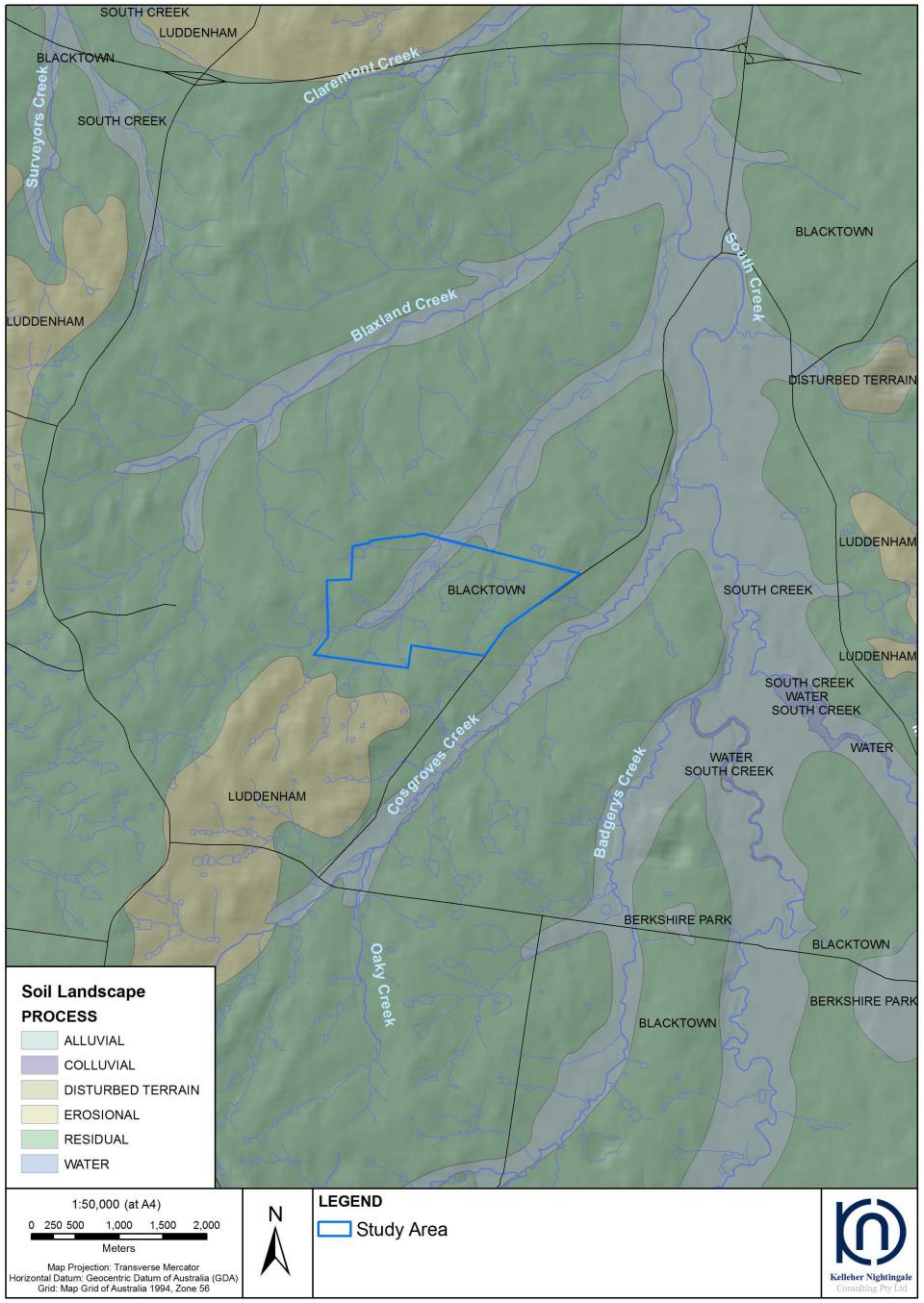

Figure 6. Soil landscapes of the study area

Residual soils of the Blacktown soil landscape, developed in situ from the underlying Bringelly Shale, are present on the broad rounded crests and ridges and gently inclined slopes found in the majority of the study area. The residual Blacktown soil landscape consists of shallow to moderately deep hard setting red, brown and yellow podzolic soils. Soil fertility and soil drainage are low. Erosional susceptibility of this soil landscape is relatively low, but is increased where surface vegetation is not maintained (Bannerman, Hazleton and Tille 1990). Archaeologically, these soils may retain intact archaeological deposit where disturbance levels are low but these are likely to retain only horizontal integrity.

The fluvial South Creek soil landscape is associated with active floodplains of the rivers and stream networks of the Cumberland Plain. In the study area, it is present alongside the unnamed watercourse which bisects the study area. South Creek soils are often very deep layered sediments over relict soils or bedrock (Bannerman, Hazleton and Tille 1990). This soil landscape, being present on active floodplains, is constantly subject to processes of erosion and deposition. Both streambank erosion and sheet erosion are common and sedimentation of watercourses during phases of deposition contributes to a constant fluvial reworking of the floodplain.

Archaeologically, South Creek soils have the potential to retain Aboriginal objects but the stratigraphic and positional integrity of these are likely to have been affected by fluvial processes. Terraces and higher areas of ground near watercourses are more likely to retain objects in situ, while those present on the floodplain itself may have originated elsewhere and been deposited during flood events.

The Luddenham soil landscape is mapped immediately south of the study area (at 1:100,000 scale) and may extend to the fringes of the hillslopes in this part of the study area. Luddenham soils consist of shallow dark podzolic soils and earthy clays on crests, with moderately deep red and yellow podzolics on slopes and thick topsoil prairie soils on lower slopes and in drainage lines. Soils have moderate to high erodibility, with sheet erosion particularly prevalent where pasture has been overgrazed.

Sources of lithic raw materials suitable for artefact manufacture occur close to the study area. The Tertiary alluvial deposits known as the Rickabys Creek Gravels are widely distributed across the western Cumberland Plain, offering a raw material source of quartzite, quartz, granite, chert, silicified tuff, silcrete and others.

Silcrete cobbles have been observed during archaeological survey and excavation to the east of the study area, exposed along the confluence of South and Badgerys Creeks and are known to occur in the Berkshire Park soils between these watercourses and Kemps Creek further east. Gravels from the Cranebrook Formation along Mulgoa Creek and Surveyors Creek to the west and north would have contained quartz, quartzite, chert, hornfels, sandstone, silcrete, granite and various other igneous materials. Raw material sources (especially of silcrete) have also been documented at St Marys (approximately 9km to the northeast) and Plumpton Ridge (approximately 16km to the northeast).

Vegetation is limited in the study area, with the majority of the landscape having been cleared for pasture or historical cultivation. Original vegetation communities would have included species typical of the shale hills and shale plains Cumberland Plain woodland group, with various dry sclerophyll species and eucalypt species including ironbark, stringybark, grey box and cabbage gum, as well as lightwood, spotted gum and broad-leaved apple. Along the creekline, alluvial woodland of the Sydney Coastal River-flat Forest group would have included Parramatta wattle, river oak (*Casuarina* spp.), paperbarks (*Melaleuca* spp.) and various herbs and grasses.

The periphery of the small dams constructed along the central watercourse are vegetated with rushes (particularly *Juncus acutus*) and isolated clumps of *Casuarina* spp. Introduced pasture grasses, scrub and occasional regrowth natives currently cover the majority study area.

6 Regional Character

Previous archaeological field surveys and excavations across the western Cumberland Plain have provided data on artefact distribution, site typology and lithic raw material use that aid in assessing the archaeological character of the wider region.

Investigations in the western Cumberland Plain have revealed a rich settlement history. The archaeological signature of this settlement history is varied and numerous studies have demonstrated that surface artefact distribution is not always a reliable indicator of the density or composition of subsurface archaeological deposits. Site frequency and density can be related to key landscape factors and assessing the combination of these present in a particular area, based on what is known for the region, allows for an assessment of the likely archaeology in a given area. For the Cumberland Plain, the chief landscape factors include distance to water, landform, aspect, degree of slope and proximity to environmental resources. Additionally, historical land use practices and disturbance must be taken into account.

Archaeological sites in the region generally occur as open camp sites or surface scatters and as isolated finds on the underlying Bringelly shale and Quaternary alluvium geologies. Open sites predominate as the underlying geology of the region is not conducive to the formation of rock shelters. Rock shelters and grinding grooves are present but at the margins of the Plain, in the interface zone between the underlying shale and sandstone geologies. In the Plain proper, relatively elevated landforms along the margins of creeks, especially those offering permanent water and associated environmental resources, would have been favourable for occupation by Aboriginal people. This is reflected in the archaeological record by higher artefact densities recorded at these sites, especially along the major creeklines, potentially reflecting repeated or more intensive use of these locations. Elevated locations on hilltops and ridge crests tend to display a different archaeological signature, chiefly a sparser artefact distribution and less evidence for 'everyday' or utilitarian activities, suggesting that these areas were often used differently. Stratification of open sites is rare but has been documented and appears to be strongly linked to the presence of alluvial soils conducive to layering and/or the presence of a substantial raw material source (e.g. Second Ponds Creek, Regentville, Power Street Bridge and Plumpton Ridge).

Numerous raw material sources have been documented in the wider region and are known to have been utilised by Aboriginal people in the past. The prevalence of silcrete, chert, quartz and tuff in regional artefact assemblages is related to the availability of these raw materials in regional geologies and their wide distribution across the Cumberland Plain. Silcrete in particular dominates regional artefact assemblages and there is evidence for intensive silcrete reduction activities taking place at both St Marys and at Plumpton Ridge, as well as widespread opportunistic use of silcrete outcroppings and cobbles across the broader landscape.

Regional archaeology has been variably impacted by historical and current land use practices as well as by natural processes. Preservation of archaeological sites in open contexts is difficult because of the adverse effects of erosion, flooding and disturbance from various human activities. Conversely, ground surface visibility is often increased by these processes, leading to increased identification of artefacts in these areas. Previous studies have underscored the relationship between particular landforms and ground disturbance as key factors in the location of archaeological sites.

7 Predictions

The information outlined in previous sections allows several predictions to be made about the nature of the archaeology that may be expected in the study area:

- Archaeological sites are likely to consist of open artefact scatters and/or isolated finds on the undulating hills associated with the Bringelly shale landscape.
- It can be expected that silcrete will be the most commonly encountered artefact raw material, with occasional occurrences of quartz, chert and siliceous tuff/mudstone.
- Clearance of the majority of original vegetation lessens the likelihood of identifying culturally modified trees, but old growth trees may be present in the study area and have the potential to display scars of Aboriginal origin.
- Archaeological sites are more likely to be identified in areas that have been subject to less intensive disturbance.
- The identification of archaeological sites is likely to be affected by differential visibility of the ground surface, but successful assessment of areas of potential archaeological deposit can be made based on landform and other environmental factors such as aspect and distance to water.

8 Methods and Survey Coverage

8.1 Sampling strategy

The aim of the survey was to conduct an archaeological inspection of the study area and identify any Aboriginal archaeological sites. A brief visual inspection of the area was undertaken the week prior, with the aim of identifying areas to be targeted during the field survey and establishing the general condition of the property. The study area was to be subject to a targeted pedestrian survey.

Due to the majority of the study area being covered in thick grasses, field assessment focused on areas of surface exposure, where there was a greater chance of identifying artefactual material due to better visibility. The very poor visibility of the remainder of the study area led to an increased focus on landform and topography.

Based on the archaeological background and landform context of the local area, several areas were targeted for close inspection. In particular, relatively elevated ground and lower toe slopes in proximity to the principal drainage line running through the study area were closely inspected for areas of exposure. Prominent hill crests and ridgelines were also inspected. The recorded location of archaeological site RPS LTPAS01 was inspected with the aim of relocating and reassessing the site. Any potential old growth trees were also examined for evidence of cultural modification.

Assessment of archaeological potential was also carried out, focusing on a combination of factors such as landform and topography, aspect, distance to water and relation to identified Aboriginal sites. The level of soil disturbance was also assessed, as this has the potential to impact upon any subsurface archaeology that may be present.

8.2 Field methods

Field survey of the study area was carried out on 7th, 8th and 22nd August 2013 by KNC archaeologists Dr Matthew Kelleher, Cristany Milicich and Kylie McDonald and Deerubbin Local Aboriginal Land Council representatives Steve Randall, Kayne Moreton and Shane Yule.

A desktop review of AHIMS registered Aboriginal sites found that site types in the vicinity of the study area were predominantly isolated finds and open artefact scatters, often identified in exposures along the margins of minor order creeks and on defined ridge and crest landforms. For this reason, areas of high surface visibility were targeted for close inspection, including exposures such as vehicle tracks, driveways, stock tracks, sheet wash erosion scours, dam edges and creek banks, particularly on those landforms mentioned above but also wherever they were present. Large mature or dead trees, including those apparently felled some time ago, were also inspected for the possibility of being a culturally modified tree.

The study area was divided into four survey units, for ease of reference, and landforms (Figure 7). Survey unit boundaries were defined by a combination of landform boundaries and paddock fencing. The current study area included survey units 2-5. Survey unit 2 occupied the northwestern portion of the study area. Survey unit 2 included the eastern portion of a long, gentle ridge crest and spurs, moderate to gentle gradient hill slopes and a dam and associated modified drainage line in the north of the survey unit.

Survey unit 3 comprised the central survey unit, including the main drainage channel running through the study area and related floodplain, flats, lower slopes and toe slopes. This survey unit included two large dams in the northern half of the study area and several smaller online dams in the centre and south. Survey unit 4 comprised a gentle ridge crest and spurs, with moderate to gentle slopes and minor drainage channels leading down to the main drainage line and associated flats. Survey unit 5 comprised the ridgeline and upper slopes in the easternmost portion of the study area, where most of the farm buildings, outhouses and residential houses were located.

The study area was traversed by pedestrian survey in a series of transects. High resolution colour aerial photographs, topographic maps and geological maps were used for reference in the field. Site locations were plotted using handheld GPS units, mapped and photographed, including landform context and site contents. Site recording forms were completed for each site, listing details of artefacts observed, site extent and field sketches. Notes were taken during the survey of landform, exposures, nearest water, vegetation, current land use, aspect, previous ground disturbance and areas of potential for intact subsurface archaeological deposit or PAD.

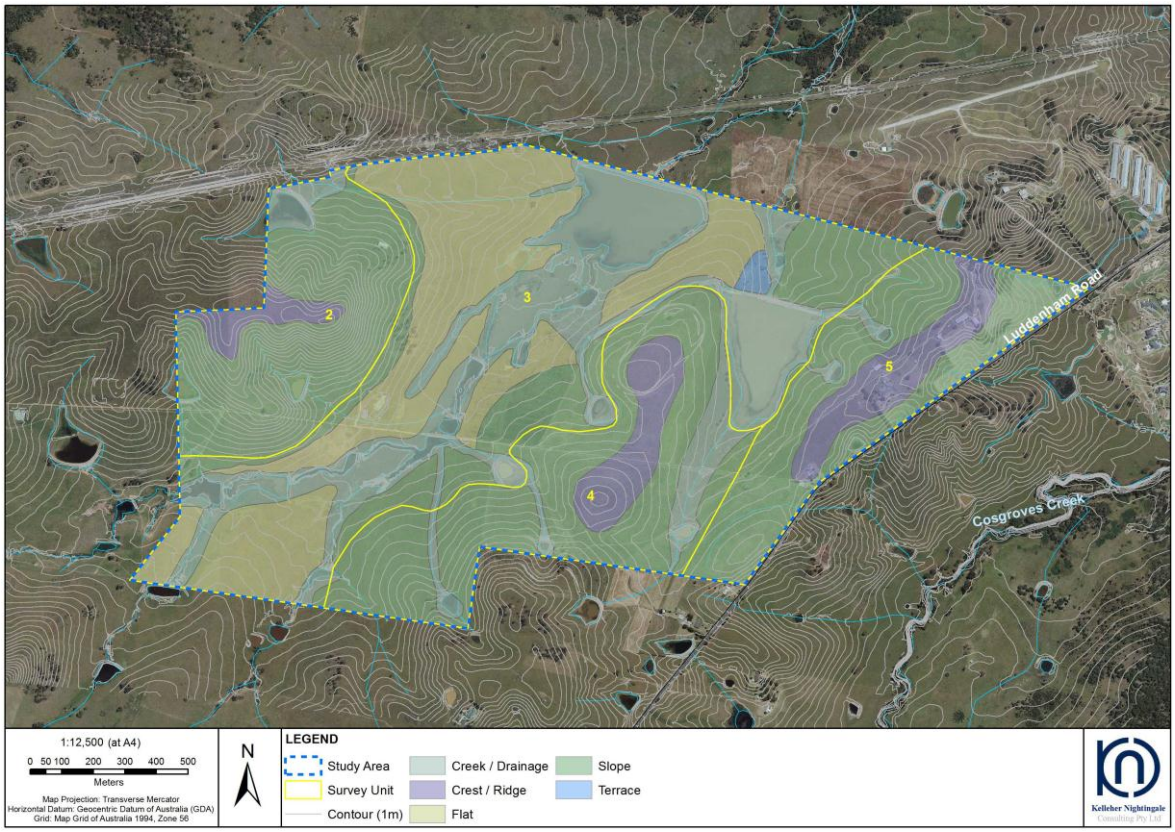

Figure 7. Landforms and survey units of the study area

8.3 Survey coverage

Field survey commenced in the western portion of the study area, in survey unit 2.The survey team moved from west to east along the central access track through the centre of the study. Thick grasses covered the majority of this survey unit, with exposures limited to occasional patches of bare earth along fence lines, patches of dead grass, stock tracks and along the central access track. This central access track had exposure varying between 20-40% along its length, limited by cattle trampling, pasture weeds, grasses and occasional rubbish in the form of broken glass, ceramics and blue metal. The margins of dams in this survey unit were inspected for areas of exposure but again, visibility was hampered by vegetation.

Survey unit 3 was the next to be inspected, consisting of a wide, shallow drainage channel and associated flats in the central part of the study area. Survey began near the southern study area boundary and focused on a series of exposures along the margins of the drainage line, where erosion at the toe of the gentle slope rising to the north west had exposed the soils. The mudflats along the channel itself were also examined. Visibility was variable in this area, with rushes and pond weeds intermittent with raised, grassy patches of ground. Exposure was generally good, approaching 30% along the toe of slope and mudflats, with visibility in eroded patches ranging from 30-60%, lessened by extensive cattle trampling and pools of water. Most of the gentle lower slopes and flats along the main drainage channel to the north were heavily grassed paddocks with zero exposure and visibility, apart from along the margins of the larger dams and the edges of the terrace in the northeast of this survey unit, where sheet eroded and bare patches offered up to 70% visibility with a background of weeds and gravels.

Survey unit 4 was examined from south to north, beginning at the southern study area boundary along the gentle slope and toe of slope east of a minor drainage line. Aerial photographs suggested this area may have offered exposure along the margins of the drainage line but in the field these were found to be vegetated and/or under shallow surface water. Some disturbance was evident in the south east of this paddock, with piles of burnt rubbish and plastics. To the north east was a broad crest landform, heavily grassed and offering zero visibility. The northernmost part of this crest appeared to have had a trotting track or other circular construction installed at some point, with a large oval ring of bare earth cutting into a circular grassed bank at the top of the slope. Visibility on the track and bank was generally high, approaching 80%, but was obscured in parts by cattle trampling, dung and dead grass. The remainder of this survey unit displayed low to zero visibility.

Survey unit 5 was located along the ridgeline and upper slopes in the easternmost portion of the study area. This survey unit had been subject to the most obvious historical disturbance, with construction of houses and farm buildings as well as numerous vehicle tracks in this part of the landscape. Exposures in this survey unit were limited to the margins of the central access track and occasional patches of bare earth around farm outbuildings, but in both cases visibility was moderate to low due to gravel cover on the track and various surface disturbances around the outbuildings.

Overall, surface exposures were infrequent in the study area, limited to flats and erosion scours bordering drainage lines, stock and vehicle tracks, occasional patches of bare earth where vegetation had died off and eroded banks on the edges of slopes and terraces. Surface visibility was likewise low, with exposures generally in poor condition due to stock trampling, weed and grass growth and pools of water. Small areas offered good visibility. The majority of the property appeared not to have been subject to cultivation for a considerable amount of time and had turned to under-grazed pasture, with thick knee to waist high grasses in paddocks not currently containing stock. The numerous small drainage lines crossing the study area have encouraged the proliferation of rushes and other marsh grasses, meaning the margins of dams and watercourses (frequently areas of good archaeological exposure) were often obscured. A tabulated summary of survey coverage by survey unit and landform is presented in Tables 3 and 4.

Table 3. Survey coverage

Survey Unit	Landform	Survey Unit Area (sq m)	Visibility %	Exposure %	Effective Coverage Area	Effective Coverage %
2	Crest / Ridgeline	47,000	30	5	705	1.5
2	Slope	369,100	40	5	7,382	2
2	Creek / Drainage	27,150	40	15	1,629	6
3	Slope	262,300	50	5	6,557.5	2.5
3	Terrace	10,000	70	15	1,050	10.5
3	Flat	586,500	45	20	52,785	9
3	Creek / Drainage	542,000	30	10	16,260	3
4	Crest / Ridgeline	90,000	75	5	3,375	3.75
4	Slope	434,000	10	5	2170	0.5
4	Creek / Drainage	87,000	10	5	435	0.5
5	Crest / Ridgeline	112,000	40	5	2240	2
5	Slope	313,000	10	5	1565	0.5
5	Creek / Drainage	12,000	15	20	360	3

The survey coverage table above demonstrates the limitations imposed on the effectiveness of the survey by infrequent exposures and generally poor visibility of the ground surface. The majority of the area was heavily grassed, with exposures mostly limited to occasional stock tracks, dam and drainage margins, erosion scours and the mudflats along the main drainage line. The flats and gentle lower slopes bordering the main drainage line in survey unit 3 provided the most effective coverage in the study area, as did the small terrace located in this survey unit. Generally, the lowest effective coverage was on the slopes and creek/drainage lines due to thick, ungrazed pasture grasses and vegetation obscuring the creek and dam margins. A summary of effective coverage and results by landform is presented in Table 4.

Table 4. Landform summary

Landform	Landform Area (sqm)	Area Effectively Surveyed	% of landform effectively surveyed	Number of sites	Number of artefacts or features
Crest / Ridgeline	249,000	6,320	2.5	nil	nil
Slope	1,378,400	17,674.5	1.3	1	1
Terrace	10,000	1,050	10.5	1	3
Flat	586,500	52,785	9	2	17
Creek / Drainage	668,150	18,684	2.8	nil	nil

9 Results

Field inspection identified four Aboriginal archaeological site locations within the study area. The archaeological sites comprised two open artefact scatters and two isolated finds.

One previously recorded site, RPS LTPAS01 (AHIMS Site ID 45-5-4189) was relocated and reassessed. Newly identified sites within the study area were given the identifier "Sydney Science Park" or SSP 1, 3 and 4.

A summary of Aboriginal archaeological sites identified in the study area is presented in Table 5 and described following. Site locations in the study area are shown on Figure 8.

Table 5. Summary of identified archaeological features in the study area

Site ID	Feature	Survey Unit	Landform
RPS LTPAS01 (AHIMS # 45-5-4189)	Open artefact scatter	3	Flat
SSP 1	Isolated Find	3	Flat
SSP 3	Open artefact scatter	3	Terrace
SSP 4	Isolated Find	3	Slope

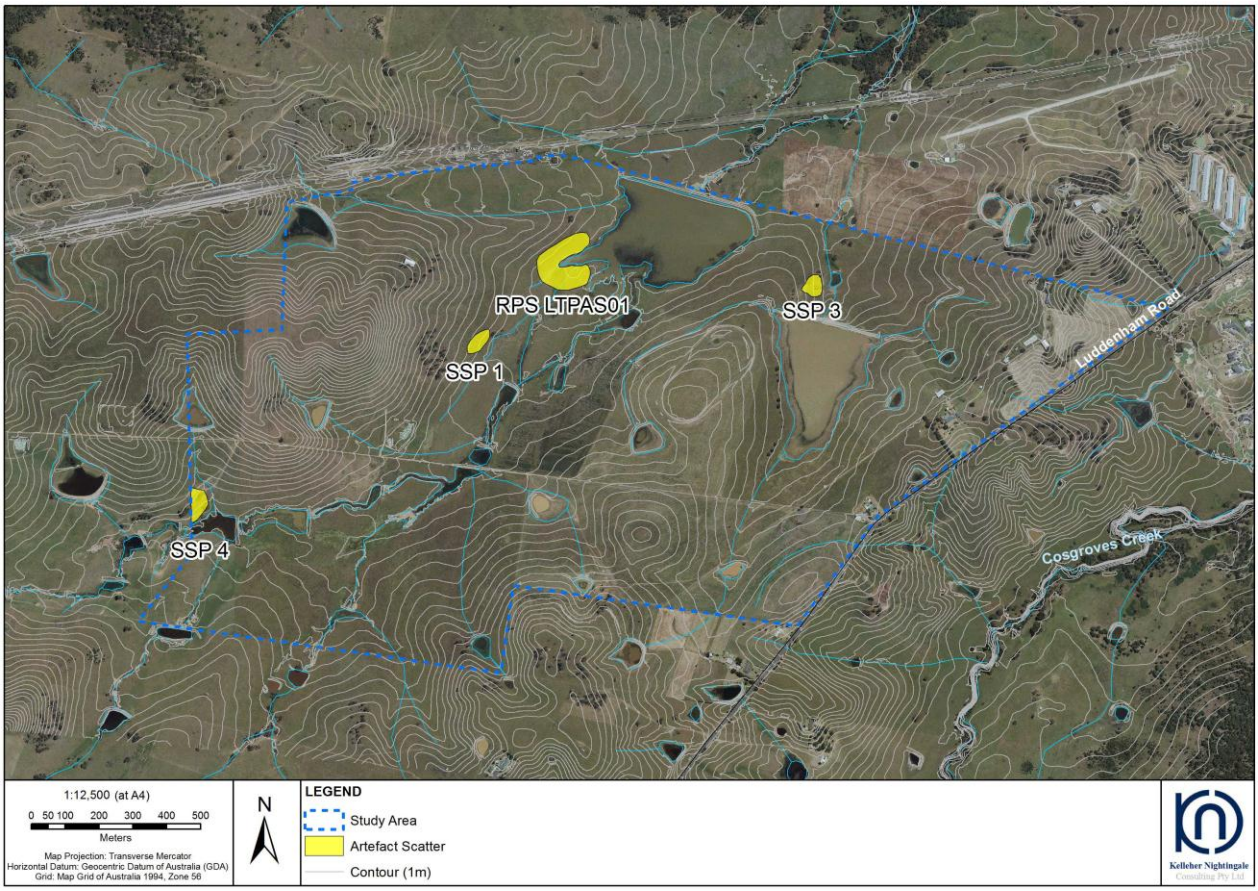

Figure 8. Aboriginal archaeological sites in the study area

9.1 RPS LTPAS01 (AHIMS # 45-5-4189)

This site was first identified in November 2012 and was described as an artefact scatter of approximately 40m x 25m, with at least 16 artefacts of silcrete and quartz noted, located on the stream bank and flats immediately adjacent to the chief drainage line. This site was relocated during the current survey and found to cover a larger area than originally described.

RPS LTPAS01 was located on the north, west and south margins of a projection of the large online dam abutting the northern boundary of the study area. The site was present on the flats immediately surrounding the dam, which would have originally bordered the watercourse. The site was located approximately 200m north east of site SPP 1 (see section 9.2), at the point where the drainage line passing by SPP 1 joins the main creekline. RPS LTPAS01 was located approximately 300m south of the northern study area boundary. The general area has been cleared for grazing and had a cover of pasture grasses and clumps of swamp tussock on the margins of the dam.

The site was estimated to extend approximately 80m north, west and south from the edge of the dam. Exposure was moderate, with the dam edges generally free of vegetation apart from occasional clumps of swamp tussock. Visibility on the exposure was moderate, with cattle trampling, scattered grasses and pools of water. Sediment background was a dark silty humic soil, probably partially derived from neighbouring slopes. Site condition was moderately poor, with areas closest to the dam affected by stock tracks. Sediments towards the outer margins of the site were likely to have been less affected and retain slightly better integrity. Details for a sample of artefacts observed at RPS LTPAS01 are presented in Table 6.

Table 6. Sample of artefacts at RPS LTPAS01

Artefact type	Raw material	Length (mm)	Width (mm)	Thickness (mm)	Notes
Flake	Silcrete	21	13	4	Red silcrete flake, 0% cortex, flake shape L>W, plain platform, edge damage on lateral margins
Flake	Silcrete	16	9	4	Red/pink silcrete flake, 0% cortex, flake shape L>W, plain platform, 5? partial dorsal scars
Flaked piece	Silcrete	12	9	2	Red/pink silcrete flaked piece, no diagnostic features

Plate 1. RPS LTPAS01 looking southwest towards SSP1

Plate 2. RPS LTPAS01 looking northeast across edge of dam

Plate 3. Sample of artefacts from RPS LTPAS01

Plate 4. Soils and exposure at RPS LTPAS01

9.2 SSP 1

SSP 1 comprised an isolated find of a red silcrete flaked piece. The site was located on the border of the creek flats surrounding the chief drainage line in the study area, to the west of the main drainage channel. The artefact was observed in an exposure within a minor drainage line. The site was located approximately 20m east of a small stand of regrowth trees and approximately 400m north of the access track that currently runs the length of the property from east to west. A large dam was located approximately 300m to the north east. The site was located beneath the overhead lines of an electricity transmission easement.

Visibility across the surface of the exposure was moderate, with swamp tussocks and pasture grasses thickly bordering the area and cattle trampling and dung obscuring some parts of the surface. Site condition was generally poor, with the area affected by stock movement and continued minor sheet erosion from fluvial movement along the drainage line. Sediment observed both in and along the margins of the exposure consisted of a very dark humic soil, likely deriving from neighbouring gentle slopes and/or deposited by flood events and water movement through the drainage line. A single silcrete artefact was observed at the western edge of the exposure. Artefact details for SSP 1 are presented in the table below.

Table 7. Artefact at SSP 1

Artefact type	Raw material	Length (mm)	Width (mm)	Thickness (mm)	Notes
Flaked piece	Silcrete	12	10	2	Red/yellow silcrete flaked piece, poor quality, no diagnostic features, concretions on dorsal surface

Plate 5. SSP 1 looking west. Exposure where artefact was identified in foreground

Plate 6. Artefact identified at SSP 1

Plate 7. SSP 1 looking south along transmission line. Exposure in foreground

9.3 SSP 3

Site SSP 3 was an open artefact scatter located on the margins of a terrace landform above a minor drainage channel and small dam. The site was located approximately 60m north of the second largest dam on the property and 50m south west of a smaller online dam. SSP 3 was located approximately 200m south of the northern study area boundary. Visibility across the majority of the terrace was low, being impeded by thick pasture grass. Small copses of regrowth trees were also present. Exposures were identified along the margins of the drainage line and just north of the northern large dam wall.

Visibility on exposures was moderate, with stock trampling the main factor affecting visibility. Exposures had a background of small degraded shale gravels and occasional leaf litter. Pasture grasses on the terrace proper made visibility close to zero on this landform. Sediment background was a relatively stable soil mass of Blacktown yellow podzolic soils, with no appreciable disturbance evident on the terrace at SSP 3. The terrace itself did not appear to have an overburden of the very dark humic soils present in the main drainage channel.

Site boundaries were defined according to landform boundary. The terrace was demarcated in the south by the large dam, to the east and north east by the drainage channel and to the west and north west by the start of gentle slopes leading up to a low hill crest. The presence of artefacts on the terrace margins suggested they derived from this landform and the landform was considered likely to retain further intact subsurface archaeological deposit. Artefacts observed at SSP 3 are detailed in Table 8 below.

Table 8. Artefacts at SSP 3

Artefact Type	Raw Material	Length (mm)	Width (mm)	Thickness (mm)	Notes
Flake	Silcrete	24	36	8	Red silcrete, glossy, plain platform, flake shape W>L, feather termination, eraillure scarring on bulb
Broken Flake	Silicified tuff	27	14	5	Orange tuff, 0% cortex, possible transverse snap of distal flake fragment, no other diagnostic features
Broken flake	Silcrete	15	20	4	Red/yellow silcrete, relatively coarse-grained, 0% cortex, missing platform, partial feather termination

Plate 8. Looking north across terrace

Plate 9. Artefacts at SSP 3

Plate 10. Artefact at SSP 3

Plate 11. View to north east. Eastern margin of raised terrace visible at left, with exposure visible in foreground

9.4 SSP 4

SSP 4 was an isolated find of a silcrete flaked piece. The site was located on the gentle lower slope immediately above the creek flats and main drainage channel where it meets the western boundary of the study area. The artefact was observed in a patchy exposure in a paddock north of the drainage channel. The site was located approximately 30m north east of a stand of regrowth trees, with another stand of regrowth trees 80m to the south west. It was approximately 50m north of the drainage channel itself. The central property access track was an additional 200m to the north.

Visibility at the site was low, with the area generally heavily grassed with both tussock and pasture grasses. Small, infrequent exposures had a background of gravels and groundcover weeds. Average visibility across the site was approximately 5%, with exposures limited to bare patches around the base of trees, stock tracks leading to the creek line and occasional areas of dead grass. Visibility on exposures was also generally low, around 30%, due to vegetation and cattle trampling. Overall, the slightly elevated, low gradient base of this slope appears to have suffered little obvious subsurface disturbance. Details for the single artefact observed at SSP 4 are presented in the table below.

Table 9. Artefact at SSP 4

Artefact type	Raw material	Length (mm)	Width (mm)	Thickness (mm)	Notes
Flaked piece	Silcrete	28	18	7	Red/yellow silcrete, 0% cortex, edge damage on lateral margins, coarse-grained material, no diagnostic features

Plate 12. SSP 4 artefact location (at bag), looking south

Plate 13. Artefact identified at SSP 4 *in situ*

Plate 14. .Detail of artefact identified at SSP 4

Plate 15. Looking south west from find spot at SSP 4

10 Discussion

Field survey of the study area identified four Aboriginal archaeological sites: two open artefact scatters and two isolated finds. These findings were consistent with the known archaeology of the local and regional area, namely, low density artefact scatters of silcrete and occasional quartz and tuff artefacts, located on flats and lower slopes adjacent to watercourses. All four identified sites were located on the lower slopes, flats and terraces along the main drainage line in the study area.

Site locations within the drainage channel have been affected by various erosional and depositional processes. In the case of RPS LTPAS01 and SSP 1, artefacts observed at these sites may have derived from further up the drainage catchment and been transported to these locations by flood events or downslope movement of sediments.

Sites SSP 3 and SSP 4 were located on more stable landforms. Artefacts observed at these locations are more likely to have derived from the immediate area, offering greater archaeological integrity.

11 Scientific Values and Significance Assessment

11.1 Assessment criteria

One of the primary steps in the process of cultural heritage management is the assessment of significance. Not all sites are equally significant and not all are worthy of equal consideration and management (Sullivan and Bowdler 1984; Pearson and Sullivan 1995:7). The determination of significance can be a difficult process as the social and scientific context within which these decisions are made is subject to change (Sullivan and Bowdler 1984). This does not lessen the value of the heritage approach, but enriches both the process and the long term outcomes for future generations as the nature of what is conserved and why, also changes over time.

The assessment of significance is a key step in the process of impact assessment for a proposed activity as the significance or value of an object, site or place will be reflected in resultant recommendations for conservation, management or mitigation.

The *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (OEH 2010) requires significance assessment according to criteria established in the *Australia ICOMOS Burra Charter, 1999* (Australia ICOMOS 1999). The *Burra Charter* and its accompanying guidelines are considered best practice standard for cultural heritage management, specifically conservation, in Australia. Guidelines to the *Burra Charter* set out four criteria for the assessment of cultural significance:

- Aesthetic value - relates to the sense of the beauty of a place, object, site or item;
- Historic value - relates to the association of a place, object, site or item with historical events, people, activities or periods;
- Scientific value - scientific (or research) value relates to the importance of the data available for a place, object, site or item, based on its rarity, quality or representativeness, as well as on the degree to which the place (object, site or item) may contribute further substantial information; and
- Social value - relates to the qualities for which a place, object, site or item has become a focus of spiritual, political, national or other cultural sentiment to a group of people. In accordance with the OEH *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW*, the social or cultural value of a place (object, site or item) may be related to spiritual, traditional, historical or contemporary associations. "Social or cultural value can only be identified though consultation with Aboriginal people" (OEH 2011:8).

The assessment of these values are brought together to form a comprehensive assessment of significance.

11.2 Statement of significance

Four Aboriginal archaeological sites are located within the study area: isolated finds SSP 1 and SSP 4 and open artefact scatter sites RPS LTPAS01 and SSP 3. The type of sites identified was consistent with known Aboriginal heritage across the western Cumberland Plain, specifically within the South Creek area and with predictions made for the study area.

Sites SSP 3 and SSP 4 were spatially defined by landform, being located across a low gradient lower slope and terrace adjacent to drainage features. These relatively stable landform contexts are common locations for the identification of Aboriginal sites in the region. SSP 3 exhibited a moderate level of archaeological value based on its depositional integrity. SSP 4 exhibited a stable landform but low localised depositional integrity resulting in a low level of archaeological value.

Sites RPS LTPAS01 and SSP 1 were located in less defined landform contexts, associated with colluvial and alluvial material and demonstrating less archaeological integrity than SSP 3 and SSP 4.

Three sites identified within the study area exhibited low archaeological significance, while one site exhibited moderate significance. All identified Aboriginal heritage features are consistent with the known archaeological record for the locality. They are not considered to be rare or unique, however, they can be seen to be representative of the types of sites in the area.

Significance of archaeology sites/objects within the study area

- Low significance RPS LTPAS01 (AHIMS 45-5-4189)
- Low significance SSP 1
- Moderate significance SSP 3
- Low significance SSP 4

The sites do hold value to the local Aboriginal community. The Deerubbin Local Aboriginal Land Council cultural assessment report on the study area concluded that the Aboriginal objects, sites and potential archaeological deposits contained within the study area warranted further detailed investigation prior to development of the lands.

12 Impact Assessment

A master plan has been prepared for the study area, which includes the majority of the land being developed. Based on this layout, an impact assessment can be made for the identified Aboriginal archaeological features in Sydney Science Park (Figure 9).

All identified archaeological sites will be impacted to some degree by the proposed development. Based on the master plan, Aboriginal archaeological features will be impacted by the following proposed land uses:

- RPS LTPAS01 (AHIMS 45-5-4189) is located within an area planned as major central open space associated with the main drainage line through the property, incorporating riparian corridors, active and passive recreation and water management features such as wetland and detention basins. Part of the site exists within an area proposed as mixed use zone and local roads to the west of the site. It also borders a proposed recreational sports field. The transmission line easement also crosses the site.

  The site was assessed as being of low archaeological significance, based on its location in a less defined landform context, association with colluvial and alluvial material and low archaeological integrity.

  RPS LTPAS01 will be at least partially impacted by the proposed future development layout, although it is likely that adjacent development, sports field and roads, as well as construction of water management features within the open space corridor will impact on the site, meaning that only small pockets, if any, of the site may remain within the proposed open space corridor. The site context has been partially disturbed by flooding and colluvial movement so that the archaeological integrity of the site has already been diminished. As a result, while the site will be impacted, it is not considered to be a significant impact in terms of archaeological value. The site holds cultural value and a cultural salvage (collection) of Aboriginal objects at this location may be an appropriate mitigation measure for this site.

- SSP 1 is also generally located within the planned central open space corridor, although will be predominantly impacted by the sports field and proposed main collector road, which would bisect the site. These direct and adjacent impacts effectively impact the majority of the site area, with the potential for only small pockets, if any, to remain within the proposed open space corridor. Similarly to RPS LTPAS01, the site was assessed as being of low archaeological significance, being in a similar environmental context. The overall impact would be similar to RPS LTPAS01 and consistent mitigation measures would be appropriate.

- SSP 3 is located wholly within a planned mixed use zone and local road. The site was considered to have potential for further intact subsurface archaeological deposit, being situated on a terrace landform adjacent to a drainage line, albeit as a moderate to low density archaeological deposit.

  Aboriginal sites contained within the study have been identified as being important to Aboriginal people. The Land Council recommended further detailed investigation prior to development. Mitigation requirements for SSP 3 should be determined following rezoning.

- SSP 4 was an isolated artefact on a gentle lower slope immediately above the creek flats and main drainage channel where it meets the western boundary of the study area. Due to the site context and stability of the landform, the site was considered to have potential for further intact subsurface archaeological deposit, albeit as a low density archaeological deposit. The master plan shows most of the site would be impacted by the major collector road. Mitigation requirements for SSP 4 may include a cultural salvage (collection).

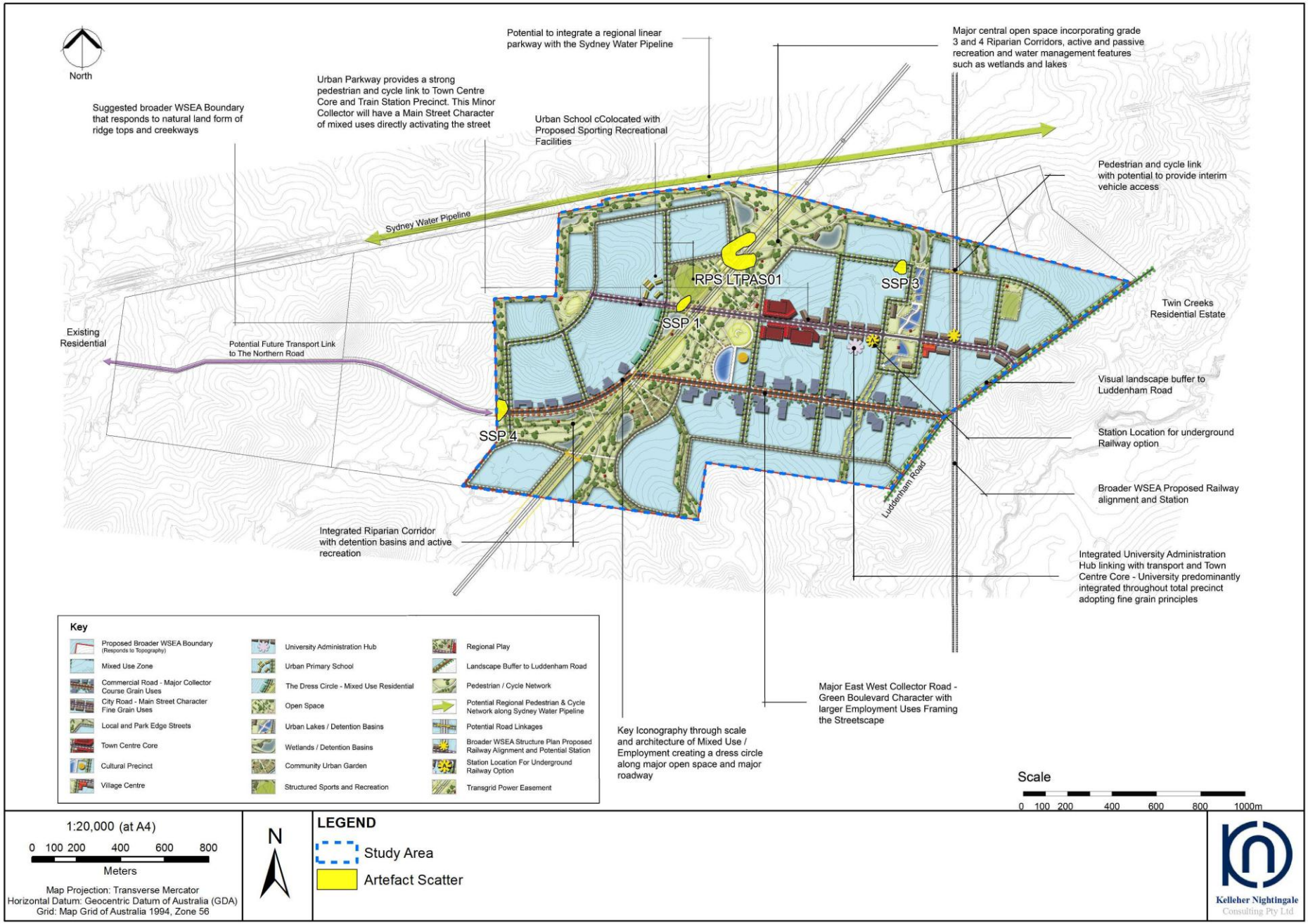

Figure 9. Master Plan and identified Aboriginal heritage

13 Legislative Considerations

The *National Parks and Wildlife Act 1974* is the primary statutory control for the protection and regulation of Aboriginal heritage in New South Wales.

Aboriginal objects and declared Aboriginal places are protected under section 86 of the Act. It is an offence to harm or desecrate an Aboriginal object, either knowingly [section 86 (1)] or unknowingly [section 86 (2)]. Harm includes to destroy, deface, damage or move.

An "Aboriginal object" is defined under the Act as "any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises New South Wales, being habitation before or concurrent with (or both) the occupation of that area by persons of non-Aboriginal extraction and includes Aboriginal remains". As such, Aboriginal objects are confined to physical evidence and are commonly referred to as Aboriginal sites.

Under section 87 (1) it is a defence to a prosecution for an offence under section 86 (1), (2) or (4) if "(a) the harm or desecration concerned was authorised by an Aboriginal heritage impact permit and (b) the conditions to which that Aboriginal heritage impact permit was subject were not contravened".

Section 87 (2) of the Act provides a defence against prosecution under section 86 (2) if "the defendant exercised due diligence to determine whether the act or omission constituting the alleged offence would harm an Aboriginal object and reasonably determined that no Aboriginal object would be harmed". This defence appears to specifically relate to Aboriginal objects.

Section 89A of the Act relates to the notification of sites of Aboriginal objects, under which it is an offence if the location of an Aboriginal object is not notified to the Director-General in the prescribed manner within a reasonable time.

Under section 90 (1) of the Act "the Director-General may issue an Aboriginal heritage impact permit". The regulation of Aboriginal heritage impact permits is provided in Part 6 Division 2 of the Act (sections 90 to 90R).

An Aboriginal heritage impact permit (AHIP) is required for any activity which will harm an Aboriginal object or Aboriginal place.

14 Conclusions and Recommendations

Four Aboriginal archaeological sites were identified in the study area:

RPS LTPAS01 – AHIMS # 45-5-4189

Sydney Science Park 1 (SSP 1)

Sydney Science Park 3 (SSP 3)

Sydney Science Park 4 (SSP 4)

Sites consisted of two open artefact scatters (RPS LTPAS01 and SSP 3) and two isolated find (SSP 1 and SSP 4).

Identified archaeological sites were representative of expected results for isolated or low density artefact scatters. The findings were consistent with the existing archaeological record for the locality and the sites were assessed to be of low or moderate archaeological value.

The four identified sites within the study area do not pose a constraint to the future development of the land but will require a process of further assessment, consultation and mitigation to comply with relevant legislation and associated requirements.

Rezoning will not affect identified Aboriginal heritage items, however an Aboriginal heritage impact permit (AHIP) will be required prior to any activities which may harm Aboriginal objects. It is recommended the AHIP application be made for the entire study area to allow for impacts (harm) to identified and potential Aboriginal objects on site.

The next step in obtaining an AHIP would be the preparation of a Cultural Heritage Assessment Report (CHAR) and associated Aboriginal stakeholder consultation. An AHIP application can be lodged following completion of the CHAR and associated development application. Recommendation is for a bulk earthworks DA to accompany the AHIP application.

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Appendix A Deerubbin Local Aboriginal Land Council Report

Deerubbin Local Aboriginal Land Council

Level 2, 9 Tindale Street
PENRITH NSW 2750

PO Box 40
Penrith BC
NSW 2751 AUSTRALIA

T: (02) 4724 5600
F: (02) 4722 9713
E: Staff@deerubbin.org.au
W: http://www.deerubbin.org.au

APP Corporation Pty Limited
Level 7, 116 Miller Street
NORTH SYDNEY NSW 2060

Our Ref: 2365

19 September 2013

SUBJECT: PROTECTION OF ABORIGINAL CULTURAL HERITAGE

Attention: Clair Baxter, Project Manager

Representatives of the Deerubbin Local Aboriginal Land Council inspected the properties known as Bangaroo Farm on 565a Luddenham Road, Luddenham on Thursday, 22 August 2013. An Aboriginal cultural heritage assessment was undertaken to evaluate the likely impact the development has on the cultural heritage of the land. Consulting archaeologist from Kelleher Nightingale Consulting Pty Ltd carried out a scientific survey at the same time.

Our representatives report that, although ground surface visibility was poor because of the grass cover, Aboriginal cultural material (in the form of stone artefacts, for example) was found.

Deerubbin Local Aboriginal Land Council therefore, recommends that further investigation be undertaken before any development.

Yours Faithfully,

S Randall

(Steven Randall
Senior Cultural Heritage Officer)

C.c. Miranda Morton – Office of Environment & Heritage

C.c. Critany Milicich – Kelleher Nightingale Consulting Pty Ltd

Appendix B AHIMS Search Results

AHIMS Web Services (AWS)
Search Result

Your Ref Number : 1301

Client Service ID : 107236

Kelleher Nightingale Consulting Pty Ltd

suite 911-912 155 King Street
Sydney New South Wales 2000

Attention: Benjamin Anderson

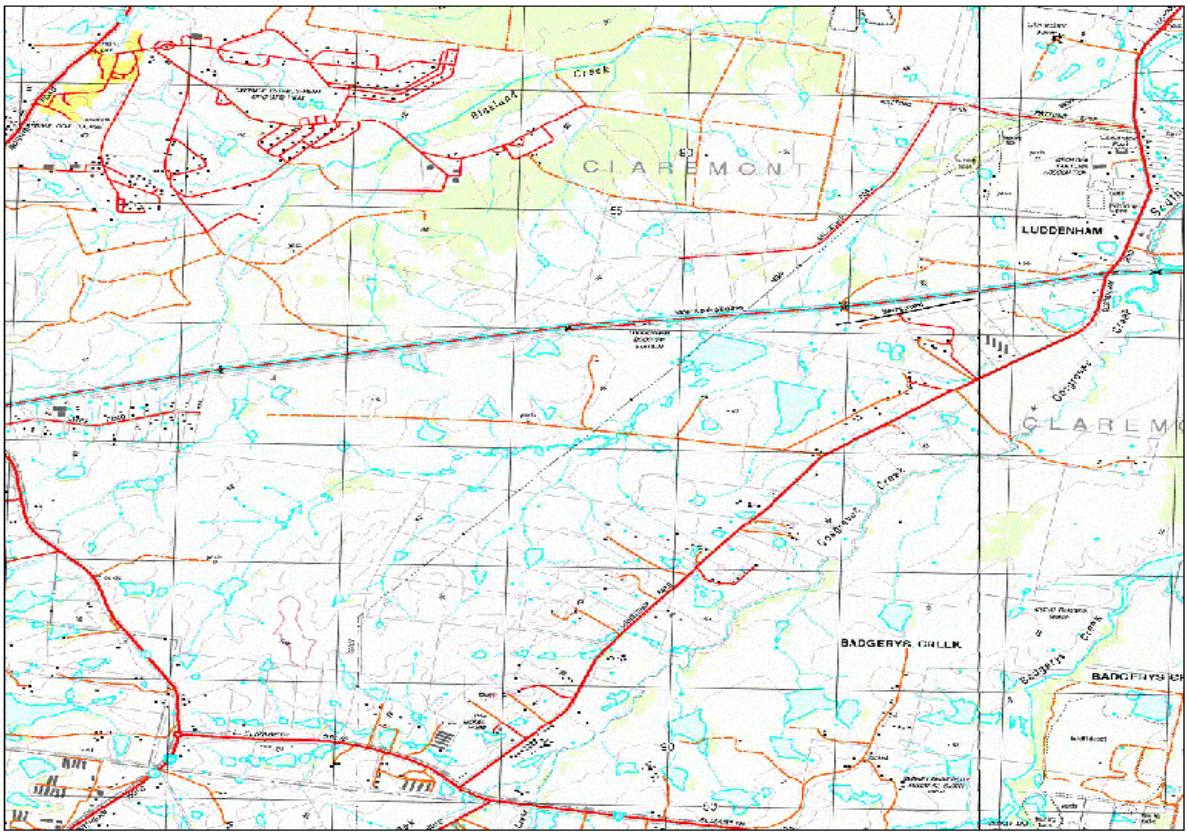
Email: ben.anderson@knconsult.com.au

Date: 29 July 2013

Dear Sir or Madam:

AHIMS Web Service search for the following area at Datum :GDA, Zone : 56, Eastings : 286000 - 293000, Northings : 6251500 - 6255000 with a Buffer of 0 meters, conducted by Benjamin Anderson on 29 July 2013.

The context area of your search is shown in the map below. Please note that the map does not accurately display the exact boundaries of the search as defined in the paragraph above. The map is to be used for general reference purposes only.



A search of the Office of the Environment and Heritage AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

20	Aboriginal sites are recorded in or near the above location.
0	Aboriginal places have been declared in or near the above location. *

If your search shows Aboriginal sites or places what should you do?

- You must do an extensive search if AHIMS has shown that there are Aboriginal sites or places recorded in the search area.
- If you are checking AHIMS as a part of your due diligence, refer to the next steps of the Due Diligence Code of practice.
- You can get further information about Aboriginal places by looking at the gazettal notice that declared it. Aboriginal places gazetted after 2001 are available on the NSW Government Gazette (http://www.nsw.gov.au/gazette) website. Gazettal notices published prior to 2001 can be obtained from Office of Environment and Heritage's Aboriginal Heritage Information Unit upon request

Important information about your AHIMS search

- The information derived from the AHIMS search is only to be used for the purpose for which it was requested. It is not be made available to the public.
- AHIMS records information about Aboriginal sites that have been provided to Office of Environment and Heritage and Aboriginal places that have been declared by the Minister;
- Information recorded on AHIMS may vary in its accuracy and may not be up to date .Location details are recorded as grid references and it is important to note that there may be errors or omissions in these recordings,
- Some parts of New South Wales have not been investigated in detail and there may be fewer records of Aboriginal sites in those areas. These areas may contain Aboriginal sites which are not recorded on AHIMS.
- Aboriginal objects are protected under the National Parks and Wildlife Act 1974 even if they are not recorded as a site on AHIMS.
- This search can form part of your due diligence and remains valid for 12 months.

PO BOX 1967 Hurstville NSW 2220
43 Bridge Street HURSTVILLE NSW 2220
Tel: (02)9585 6345 (02)9585 6471 Fax: (02)9585 6094

ABN 30 841 387 271
Email: ahims@environment.nsw.gov.au
Web: www.environment.nsw.gov.au

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref Number : 1301

Client Service ID : 107236

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
45-5-2551	CGD6	AGD	56	292700	6251900	Open site	Valid	Artefact : -	Open Camp Site	
	Contact	**Recorders**	Dominic Steele Archaeological Consulting					**Permits**		
45-6-1769	Lec 3;	AGD	56	292410	6253470	Open site	Valid	Artefact : -	Open Camp Site	1345
	Contact	**Recorders**	Mary Dallas Consulting Archaeologists					**Permits**		
45-6-1770	Lec 4;	AGD	56	292410	6253300	Open site	Valid	Artefact : -	Open Camp Site	1345
	Contact	**Recorders**	Mary Dallas Consulting Archaeologists					**Permits**		
45-6-1771	Lec 5;	AGD	56	292010	6253080	Open site	Valid	Artefact : -	Open Camp Site	1345
	Contact	**Recorders**	Mary Dallas Consulting Archaeologists					**Permits**		
45-6-1772	Lec 6;	AGD	56	292770	6253700	Open site	Valid	Artefact : -	Open Camp Site	1345,97496
	Contact	**Recorders**	Mary Dallas Consulting Archaeologists					**Permits**	1586	
45-6-1773	Lec 7;	AGD	56	292830	6253780	Open site	Valid	Artefact : -	Open Camp Site	1345
	Contact	**Recorders**	Mary Dallas Consulting Archaeologists					**Permits**		
45-6-1774	Lec 8;	AGD	56	292820	6254050	Open site	Valid	Artefact : -	Open Camp Site	1345,97496
	Contact	**Recorders**	Mary Dallas Consulting Archaeologists					**Permits**	1586	
45-6-1776	Lec 2;	AGD	56	292570	6253620	Open site	Valid	Artefact : -	Open Camp Site	1345
	Contact	**Recorders**	Mary Dallas Consulting Archaeologists					**Permits**		
45-6-1780	Lec 1;	AGD	56	292610	6253800	Open site	Valid	Artefact : -	Open Camp Site	1345
	Contact	**Recorders**	Mary Dallas Consulting Archaeologists					**Permits**		
45-5-2710	DUKE 9	AGD	56	292500	6251800	Open site	Valid	Artefact : -		1345,1539,4737
	Contact	**Recorders**	Dominic Steele Archaeological Consulting					**Permits**		
45-5-2816	IF/1	AGD	56	292300	6251750	Open site	Valid	Artefact : -		4737
	Contact	**Recorders**	Dominic Steele Archaeological Consulting					**Permits**		
45-5-2367	Kemps creek 1 (CK/1);	AGD	56	292800	6252830	Open site	Valid	Artefact : -	Open Camp Site	
	Contact	**Recorders**	Jim Kohen					**Permits**		
45-5-3802	Isolated Artefact 1 (Penrith)	GDA	56	287238	6252000	Open site	Valid	Artefact : 1		
	Contact	**Recorders**	Ms.Mary Dallas					**Permits**		
45-5-3803	Isolated Artefact 2 (Penrith)	AGD	56	287504	6252095	Open site	Valid	Artefact : 1		
	Contact	**Recorders**	Ms.Mary Dallas					**Permits**		
45-5-3804	Isolated Artefact 4 (Penrith)	AGD	56	287276	6251479	Open site	Valid	Artefact : 1		
	Contact	**Recorders**	Ms.Mary Dallas					**Permits**		
45-5-3805	OS 1	AGD	56	287973	6252553	Open site	Valid	Artefact : 3		
	Contact	**Recorders**	Ms.Mary Dallas					**Permits**		
45-5-3806	OS 2	AGD	56	286575	6252169	Open site	Valid	Artefact : 2		
	Contact	**Recorders**	Ms.Mary Dallas					**Permits**		

Report generated by AHIMS Web Service on 29/07/2013 for Benjamin Anderson for the following area at Datum :GDA, Zone : 56, Eastings : 286000 - 293000, Northings : 6251500 - 6255000 with a Buffer of 0 meters. Additional Info : Archaeological Assessment. Number of Aboriginal sites and Aboriginal objects found is 20

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref Number : 1301

Client Service ID : 107236

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
45-5-3774	Luddenham Road 2	GDA	56	291997	6254930	Open site	Valid	Artefact : 100		
	Contact Deerubbin LALC	**Recorders**	Mr.Lyndon Patterson					**Permits**		
45-5-3808	OS 3	AGD	56	287435	6252155	Open site	Valid	Artefact : 4		
	Contact	**Recorders**	Navin Officer Heritage Consultants Pty Ltd					**Permits**		
45-5-4189	RPS LTPAS01	GDA	56	289952	6253747	Open site	Valid	Artefact : 1		
	Contact	**Recorders**	RPS					**Permits**		

Report generated by AHIMS Web Service on 29/07/2013 for Benjamin Anderson for the following area at Datum :GDA, Zone : 56, Eastings : 286000 - 293000, Northings : 6251500 - 6255000 with a Buffer of 0 meters. Additional Info : Archaeological Assessment. Number of Aboriginal sites and Aboriginal objects found is 20