

1.2 Appendix C: PACHCI Stage 2 ASR

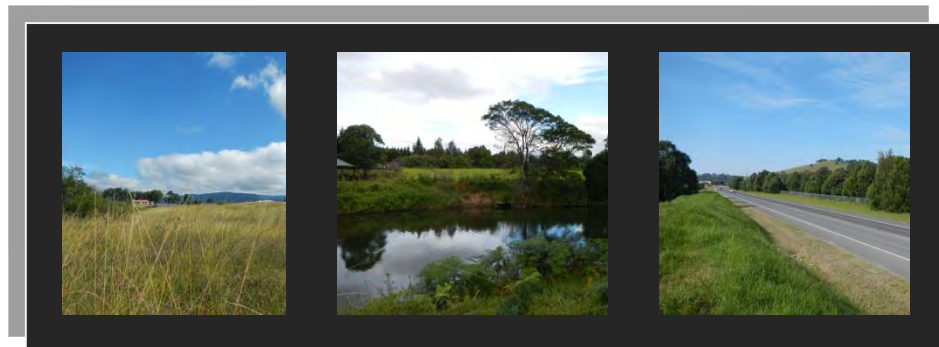
Yallah to Oak Flats Road Upgrade

Stage 2 PACHCI Aboriginal Archaeological Survey Report

Wollongong and Shellharbour Local Government Areas

Report to Roads and Maritime Services (RMS)

June 2013



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**Document history and status**

Revision	Date issued	Reviewed by	Approved by	Date approved	Revision type
A	13 May 2013	SW	SW	13 May 2013	Internal review
B	12 June 2013	SW	SW	13 June 2013	Amendments to draft report in response to RMS comments
C	17 June 2013	SW	SW	17 June 2013	Amendment to Figure 4

Printed:**Last saved:**

13 October 2015 03:53 PM

File name:

Yallah to Oak Flats Road Upgrade Aboriginal Archaeological Survey Report

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Name of project:

Yallah to Oak Flats Road upgrade

Name of document:

Aboriginal Archaeological Survey Report

Document version:

Final report

Executive summary

Roads and Maritime Services (RMS) is currently examining whether a proposed road corridor between Yallah and Oak Flats is suitable to provide a long term solution for an upgrade of the Princes Highway. Artefact Heritage has been engaged by RMS to conduct an Aboriginal archaeological survey and assessment for the study area in accordance with Stage 2 of the RMS *Procedure for Aboriginal Cultural Heritage Consultation and Investigation 2011* (PACHCI). The resulting Archaeological Survey Report (ASR) will be used to guide the future planning of an upgrade of the Princes Highway between Yallah and Oak Flats.

The aims of the study were to accurately locate previously registered Aboriginal sites and identify new sites within the study area, and to assess their archaeological significance. Preliminary recommendations have been made regarding further assessment or management measures for Aboriginal sites and areas of potential archaeological deposit (PAD). These would be confirmed once a concept design has been developed and potential impacts are more definitively known.

Two Aboriginal sites (52-5-0484/52-5-0512 and 52-5-0227) were previously recorded within the current study area and one area of PAD (YTOF PAD 1) was identified during this assessment.

Site 52-5-0484/52-5-0512 has been assessed as having a moderate archaeological potential and an unknown archaeological significance. YTOF PAD 1 has been assessed as having a high archaeological potential and an unknown archaeological significance. Prior to works being undertaken that may result in impacts to site 52-5-0484/52-5-0512 or YTOF PAD 1, archaeological test excavations under the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales 2010* (referred to as the Code of Practice) would be conducted in both areas. Test excavations would be required to inform an assessment of archaeological significance and recommendations regarding management and mitigation if required.

Site 52-5-0227 has been assessed as having low archaeological significance. No further archaeological investigation of this site is necessary. An Aboriginal Heritage Impact Permit (AHIP) would be required prior to impacts occurring at this site.

This ASR complies with the requirements of Stage 2 of the RMS PACHCI. RMS and Artefact consulted with the Illawarra Local Aboriginal Land Council (ILALC) during Stage 2. Representatives from ILALC participated in the field survey.

If Aboriginal objects or areas of PAD were to be impacted by the proposal, Stage 3 of the PACHCI would be initiated by RMS. Stage 3 requires comprehensive stakeholder consultation to be undertaken in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (referred to as the Consultation Requirements). This would be undertaken by RMS and would involve a process of formal notification of the project proposal and Aboriginal stakeholder registration. As part of Stage 3 the cultural significance of the study area would be addressed during



consultation with the registered Aboriginal stakeholder groups. If test excavation were recommended a methodology would also be prepared in consultation with the Aboriginal stakeholder groups at an Aboriginal Focus Group (AFG) meeting. In accordance with Stage 3 PACHCI a Cultural Heritage Assessment Report (CHAR) would be prepared to accompany the future AHIP application.

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1.0 Introduction and background

1.1 Description of the proposal

RMS is currently examining whether a proposed road corridor between Yallah and Oak Flats is suitable to provide a long term solution for an upgrade of the Princes Highway (Figure 1). Artefact Heritage has been engaged by RMS to conduct an Aboriginal archaeological survey and assessment for the proposal in accordance with Stage 2 of the RMS PACHCI. The resulting ASR will be used to guide the future planning of an upgrade of the Princes Highway between Yallah and Oak Flats.

1.2 Scope of the study

This study would form part of an initial constraints analysis for the proposed upgrade of the Princes Highway from Yallah to Oak Flats. This ASR complies with Stage 2 of the RMS PACHCI. If Aboriginal sites or archaeological deposits were to be impacted by the proposal, Stage 3 PACHCI would be initiated by RMS. The study area is the road corridor as shown in Figure 1.

1.3 Objectives of the study

The objectives of this study are to comply with the RMS PACHCI, and the Office of Environment and Heritage (OEH) regulations, including the Code of Practice and the Consultation Requirements. The main objectives of this study include providing:

- A description of the proposal and the extent of the study area.
- A description of Aboriginal community involvement and Aboriginal consultation.
- Discussion of the environmental context of the study area.
- Discussion of the Aboriginal historical context of the study area.
- A summary of the archaeological context of the study area including a discussion of previous archaeological work in the area.
- Development of an archaeological predictive model.
- Description of Aboriginal sites and areas of PAD within the study area.
- Development of a significance assessment for these sites addressing archaeological values.
- Recommendations for management and mitigation measures for Aboriginal sites and PADs.

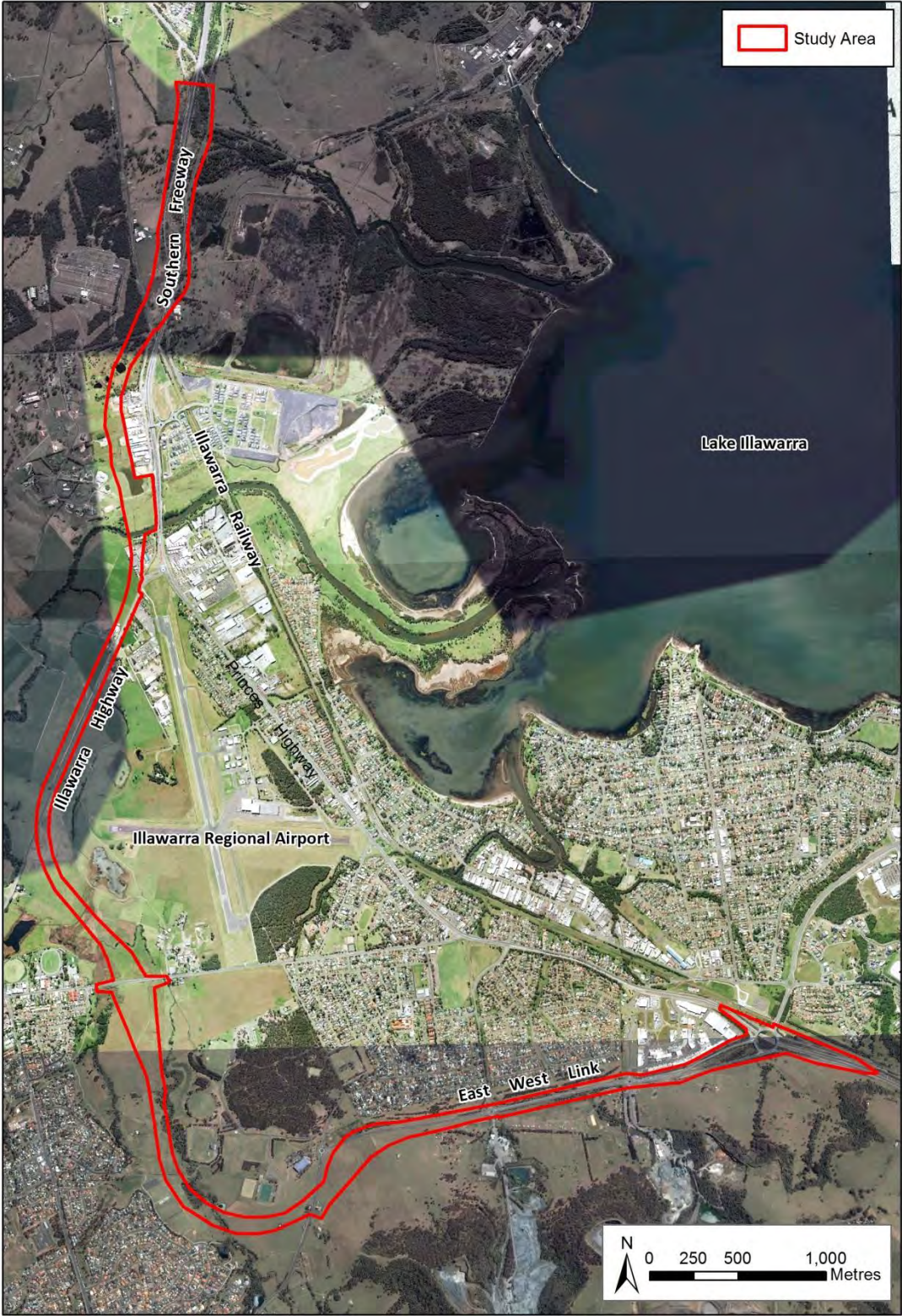


Figure 1: The study area. Background image source Google© 2013 and Land and Property Information NSW.

1.4 Development context

The study area is within a locality that is undergoing rapid development. The study area is partly within the West Dapto Release Area (WDRA). Development projects that are associated with this area include water and wastewater infrastructure provision by the Sydney Water Corporation.

1.5 Investigator and contributions

Josh Symons, Senior Archaeologist at Artefact Heritage, undertook this study along with Archaeologist Samantha Gibbins. Samantha Gibbins prepared this report with management input from Josh Symons. Principal Archaeologist Dr Sandra Wallace provided management input and reviewed the report. Josh Symons and Samantha Gibbins attended the site survey.

1.6 Aboriginal community involvement

Aboriginal consultation has been conducted in accordance with Stage 2 of the RMS PACHCI. A Native Title search was requested on the 23 April 2013 by Artefact. The results indicated that there were no Native Title claims granted or registered for consideration within the study area. The study area is within the boundary of Illawarra Local Aboriginal Land Council (ILALC). Pam Glover, Neville Maher, William Butler and Jon Kirby represented ILALC throughout the survey.

2.0 Environmental context

2.1 Landform units

Much of the study area crosses through the floodplain associated with Duck Creek and Macquarie Rivulet. The land at the very northern end of the study area rises up moderately into the hill slopes of Mount Brown. South of this, the terrain flattens out towards the floodplain. The area immediately to the north and west of where the study area crosses Macquarie Rivulet is gently undulating. The east-west stretch of the study area runs along the northern basal slopes of Wentworth Hills and Signal Hill, which are drained by Horsley Inlet and its tributaries. Overall, the landform units within the study area range from alluvial flats and creek terraces, to gentle and moderate hill slopes and gullies. The study area presents an opportunity to investigate a variety of landform units across a large area.

2.2 Geomorphology

The underlying geology of the study area primarily consists of sedimentary rock of the Berry Siltstone formation, part of the Permian-aged sediments of the Shoalhaven Group. The Berry Siltstone geological unit consists of dark-grey siltstone and very fine felspathic litharenite. The matrix includes pebbles of quartzite, reef quartz and basic igneous materials that are up to 20 millimetres in diameter. The Berry siltstone formation is found exposed in low-lying parts of the study area, along drainage channels. This is overlain by Quaternary Alluvium - material that has been eroded from the local geological units and transported and deposited by water. It comprises gravel, swamp deposits, peat, silt, beach sand and dune sand. The east-west stretch of the study area is underlain in places by Late Permian Gerringong volcanics, which include laterite (Rose 1966; AMBS 2006a: 16-18).

As shown in Figure 2, the study area passes through three main soil landscapes (Hazelton 1992; Hazelton and Tille 1990). Fairy Meadow is the most predominant and is widely present in the alluvial plains, floodplains, valley flats and terraces below the Illawarra Escarpment. Topography of this soil landscape is relatively flat, generally consisting of slopes less than 10 metres in height and inclined less than 5 percent. Soils on terraces are moderately deep (50 to 100 centimetres) Alluvial Loams and Siliceous Sands. Drainage plains include Prairie Soils and Yellow Podzolic Soils. The Fairy Meadow soil landscape is characterised by flood hazard, low wet bearing strength, topsoils that are highly permeable, and high water tables (Hazelton 1992: 97).

A small part of the northern sector of the study area, and the entire east-west stretch of the study area, passes through the Albion Park soil landscape. The very northern and eastern ends of the study area cross the Shellharbour soil landscape. Both soil landscapes are subject to localised mass movement and are characterised by eroding soils. The Albion Park soil landscape is subject to seasonal waterlogging,

whilst the Shellharbour soil landscape is subject to localised water erosion hazard. Soil depths range from shallow, at less than 50 centimetres, to deep, at over 150 centimetres (AMBS 2006a: 23).

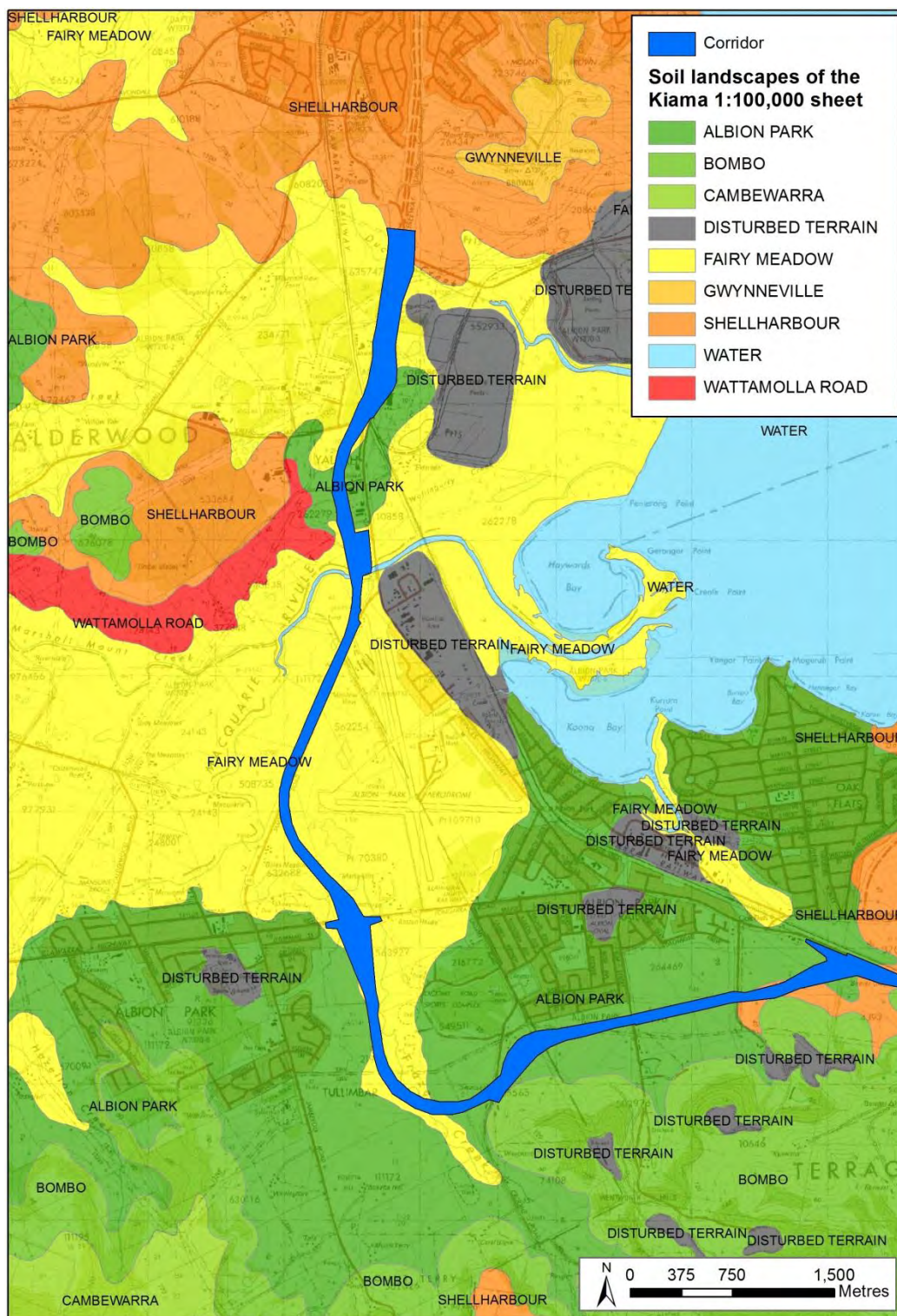


Figure 2: Soil Landscape Map (study area marked in blue).

2.3 Hydrology

The study area mostly falls within the Macquarie Rivulet Catchment, which covers an area of approximately 110 square kilometres from the Illawarra escarpment in the west to Lake Illawarra in the east. The study area crosses over a number of water courses that transect the landscape. These watercourses generally flow eastwards from the Illawarra Escarpment, and northwards from the southern elevated regions, towards Lake Illawarra. From north to south, the water courses crossed by the study area include Duck Creek and its tributaries; Macquarie Rivulet; and Frazers Creek – a tributary to Macquarie Rivulet that drains the southern portion of the Macquarie Rivulet Catchment. At the southern end, the study area turns eastwards and crosses over the northwards flowing Frazers Creek, and the north-westwards flowing Horsley Inlet and its tributaries. The study area is mostly within a distance of 2.5 kilometres to the west and south of Lake Illawarra. These water courses provide semi-permanent and permanent water sources.

2.4 Natural resources

Much of the study area has been cleared as a result of European land use practices. The area would have featured a diverse range of flora and fauna resources prior to clearance. Ecological communities that have been identified across low-lying swamp landscapes within the wider region include Alluvial Swamp Mahogany Forest, comprising *Eucalyptus robusta*, *E. botroides* and *Casuarina glauca* (NSW NPWS 2003: 42). More specifically, the floodplains of the Duck Creek and Macquarie Rivulet Catchments feature “highly degraded freshwater wetlands.” The floristic composition of these wetlands is apparently inconsistent, dependent on water levels and the degree of disturbance (NSW NPWS 2003: 41).

Macquarie Rivulet supports an apparently unique riparian vegetation community that is not found further north. This features Tall River Oak (*C. cunninghamiana*) that grows along the banks of the drainage lines in narrow bands. Closer to Lake Illawarra, in areas affected by tidal waters, Tall River Oak is replaced by *C. glauca* and *Melaleuca species* (NSW NPWS 2003: 42).

Other vegetation communities identified across the floodplain landforms within the wider region include Coastal Grassy Red Gum Forest and Lowland Woollybutt-Melaleuca Forest. The Coastal Grassy Red Gum Forest is dominated by Red Gums (*E. tereticornis*, *E. amplifolia*). These may occur with Stringybarks (*E. eugenioides*), *Melaleuca styphelioides* and *E. bosistoana*. The Lowland Woollybutt-Melaleuca Forest consists of *E. longifolia*, *M. decora* and *E. pilularis*, with Red Gum less dominant. This community occurs towards the margins and on the bordering slopes of the alluvial floodplains (NSW NPWS 2003: 42).

The original vegetation of the study area would have supported a diverse range of mammals, reptiles, insects and birdlife, all of which would have been utilised by Aboriginal hunter-gatherers. Plants were also an important resource, being used for food or as sources of raw material for manufacture (Attenbrow

2010: 41). The presence of nearby fresh water sources would have attracted Aboriginal people to the area. These water sources would also have provided Aboriginal people with fish and shellfish resources.

No specific sources of stone for artefact manufacture are known within the study area. AMBS (2010: 27) note that the underlying geology to the north of Lake Illawarra comprises Late Permian Gerringong volcanics. These include laterite, trachytes tuff with pebbly sandstone bands, siltstone and conglomerate. Some types of tuff are used in stone tool production and the area may therefore have been exploited by Aboriginal people in the region. The Illawarra escarpment edge to the west of the study area is made up of the Illawarra coal measures. Rock types include chert and mudstone, which are sometimes used in stone tool production and may therefore have been exploited by local Aboriginal people (AMBS 2010: 27).

In an earlier study that incorporates a small section of the current study area, AMBS (2006: 250) determined that the diversity and varying quality of the raw materials used in stone tool manufacture is suggestive of local sourcing. It is thought likely that the materials were sourced from the conglomerate gravels of the underlying sandstone and siltstone bedrock, particularly quartz and quartzite. Other possible local raw material sources are the pebbles and cobbles identified from a paleo-channel adjacent to the existing alignment of Robins Creek to the west of Horsley.

It is therefore likely that the local geology, which provided a variety of stone resources, was an influencing factor on Aboriginal occupation of the area.

2.5 Land use history

The Macquarie Rivulet Catchment area has been subject to a diverse range of land uses, including rural practices; low/medium density residential areas; industrial development; and regionally significant developments such as the Illawarra Regional Airport.¹ Much of the study area incorporates existing roads/corridors (e.g. Princes Highway and Motorway; Illawarra Highway; Tongarra Road; East-West Link). A small portion of the study area crosses over the Illawarra Railway, near where it meets Yallah Road. For the most part, the roads and road reserve that are encompassed by the study area pass through land that is used for agricultural purposes. Small sections also pass through, or run adjacent to, areas of industrial and residential development.

2.6 Archaeological implications for the study area

The study area would have provided a wide range of food and manufacturing resources for the local Aboriginal population. It is also located within close proximity to perennial fresh water. As noted by Dallas and Sullivan (1995: 14, 19) the largest areas of alluvial deposit in the region are located between the

¹ Shellharbour City Council website (<http://www.shellharbour.nsw.gov.au/default.aspx?WebPage=165>) viewed 24 April 2013.



foothills and Lake Illawarra, and are associated with, amongst others, the Duck Creek system and the Marshall Mount/Macquarie Rivulet creek system. It has been observed that depositional and swamp landscapes are characterised by the retention of parent soil, along with the deposition of transported soil, therefore making them more likely to retain archaeological materials (AMBS 2006a: 24). These factors combined imply that Aboriginal objects are likely to be present in certain parts of the study area. The steeper slopes within the study area are not likely to have been sites of frequent or repeated Aboriginal activity, nor are they likely to retain intact Aboriginal deposit.

3.0 Aboriginal historical and archaeological context

3.1 Aboriginal material culture

The oldest dated sites for Aboriginal occupation in the Sydney Basin are from the late Pleistocene period, with a securely dated site at the base of the Blue Mountains of 14,700 years before present (yBP), and two coastal sites south of Wollongong at Bass Point and Burrill Lake in the Shoalhaven both dated to around 20,000 yBP (Lampert 1971; Nanson *et al* 1987). Evidence of Aboriginal occupation has been found dated to 50-60,000 yBP at Lake Mungo in NSW, so it would be likely that Aboriginal people have lived in the Illawarra region for even longer than indicated by the oldest recorded dates available at present. The archaeological material record provides evidence of this long occupation, but also provides evidence of a dynamic culture that has changed through time.

The existing archaeological record is limited to certain materials and objects that were able to withstand degradation and decay. As a result, the most common type of Aboriginal objects remaining in the archaeological record are stone artefacts. Archaeological analyses of these artefacts in their contexts have provided the basis for the interpretation of change in material culture over time. Technologies used for making tools changed, along with preference of raw material. Different types of tools appeared at certain times, for example ground stone hatchets are first observed in the archaeological record around 4,000 yBP in the Sydney region (Attenbrow 2010: 102). It is argued that these changes in material culture were an indication of changes in social organisation and behaviour.

The Eastern Regional Sequence was first developed by McCarthy in 1948 to explain the typological differences he was seeing in stone tool technology in different stratigraphic levels during excavations such as Lapstone Creek near the foot of the Blue Mountains (McCarthy *et al* 1948). The sequence had three phases that corresponded to different technologies and tool types (the Capertian, Bondaian and Eloueran). The categories have been refined through the interpretation of further excavation data and radiocarbon dates (Hiscock & Attenbrow 2005; JMcD CHM 2005). It is now thought that prior to 8,500 yBP tool technology remained fairly static with a preference for silicified tuff, quartz and some unheated silcrete. Bipolar flaking was rare with unifacial flaking predominant. No backed artefacts have been found of this antiquity. After 8,500 yBP silcrete was more dominant as a raw material, and bifacial flaking became the most common technique for tool manufacture. From about 4,000 yBP to 1,000 yBP backed artefacts appear more frequently. Tool manufacture techniques become more complex and bipolar flaking increases (JMcD CHM 2006). It has been argued that from 1,400 to 1,000 years before contact there is evidence of a decline in tool manufacture. This reduction may be the result of decreased tool making, an increase in the use of organic materials, changes in the way tools were made, or changes in what types of tools were preferred (Attenbrow 2010: 102). The reduction in evidence coincides with the reduction in frequency of backed blades as a percentage of the assemblage.

3.2 Aboriginal histories of the locality

Aboriginal people traditionally lived in small family or clan groups that were associated with particular territories or places. The study area is located within the Dharawal language group area (Attenbrow 2010: 34). The Dharawal language group was largely coastal and is thought to have extended from the Shoalhaven River in the south, to Botany Bay in the north and then inland to Camden (Attenbrow 2010: 34). The Dharawal language group was bordered to the north in the Botany Bay – southern Sydney region by the Darug and to the west in the Mittagong – Moss Vale region by the Gundungurra. The study area falls within the territory of the Dharawal-speaking Wodi Wodi people. Tindale (1974) described the territory of the Wodi Wodi as extending from north of the Shoalhaven River at Nowra to Wollongong and inland to Moss Vale.

The area covered by the Dharawal language included a variety of landscape and resource types, including coastal and estuarine environments, rolling hills and creeks bordering the coastal environment, and the large sandstone escarpment and plateau. Sullivan (cited in Rich 1988: 23) suggested that the boundary between the Gundungurra and the Dharawal was the divide between the coastal and inland river systems, which runs on an approximate south-west to north-east line east of Wingello, Bundanoon, Robertson and Mittagong. Movement across these different terrain types and resource areas may have been dictated by the season or purpose (DEC 2005: 8). Additionally, exchange with people from surrounding language groups included Gundungarra and Wiradjuri people travelling to the coast to exchange foods and raw materials, whilst the Dharawal and Awabakal (Central Coast region) shared ceremonies (DEC 2005: 8).

Long-term areas of interaction and ‘travel corridors’ for movement between different language groups may have existed where there were shared boundaries. Laila Haglund has suggested that the Campbelltown area in south-west Sydney may have represented the intersection between the boundaries of the Dharawal, Darug and Gundungurra, and that the Narrelan Valley may have been part of a ‘travel corridor’ facilitating movement between the north-western Sydney and the Illawarra (JMcD CHM 2007: 21 after Haglund 1989).

Early interaction between the Dharawal and the British was intermittent and brief. The earliest sighting of British people by the Dharawal would most likely have been when they saw sailing ships along the coast. The records of Captain Cook and several of his crew document seeing numerous fires and occasional Aboriginal people on the coastline in the Illawarra region (Organ 1993: 46). Organ (1993: 49) documents an anonymous exploration journal attributed to surveyor George William Evans, which recorded an overland expedition north from Jervis Bay via Wollongong in 1812. The exploration party encountered several groups of Aboriginal people, and at one point exchanged some of their possessions with one of the groups for oysters (Organ 1993: 49).

Several of the early British settlers in the Illawarra documented large gatherings of Aboriginal people, including a reference by Navin (1994: 8) that Robert James, a local resident of the area, recorded a camp of around 100 Aboriginal people on the banks of American Creek at Mount Kembla. In 1836 a group of around 200 Aboriginal people were observed in the Illawarra area as they were preparing to travel to Cowpastures in south-west Sydney (Griffin 1986: 6 cited in AMBS 2010: 33).

A variety of flora and fauna resources were utilised in the Illawarra region for subsistence, personal ornament and tool requirements. The variety of subsistence resources in the Illawarra included marine, estuarine, freshwater and hinterland flora and fauna. Early British records documented torchlight spearing of bream and consumption of whale meat (Organ 1993: 262). The consumption of whale was documented as an important event linked to the spirits of their ancestors (Organ 1993: 262). Cabbage trees were used for various purposes, including utilisation of the fibre (Organ 1993: 155), used to make bridges over creeks and for food (AMBS 2010: 35). Other plant species utilised for food and tools included bats-wing tree, grass tree, Gynea lily, various Eucalypt *sp.*, mat-rush, sticky hop bush, Melaleuca and black wattle (AMBS 2010: 35).

3.3 Registered Aboriginal sites in the local area – AHIMS search

An extensive search of the Aboriginal Heritage Information System (AHIMS) database was undertaken on the 23 April 2013 for sites registered within the following coordinates:



Buffer	50 m
Number of sites	102
AHIMS Search ID	98600

The distribution of recorded sites within the AHIMS search area is shown in Figure 3. The location of Aboriginal sites is considered culturally sensitive information. It is advised that this information, including the AHIMS data appearing on the heritage map for the proposal be removed from this report if it is to enter the public domain.

The frequency of recorded site types is summarised in Table 1. Of the 102 sites previously recorded in the 10.5 x 8.7 kilometre search area, Artefact sites are predominant (n=72). The remaining site types include Shell with Artefact (n=14); Potential Archaeological Deposit (PAD) (n=7); Shell (n=6); Modified Tree (n=2); and Modified Tree with Artefact (n=1). It can be seen in Figure 3 that the majority of sites are located within 200 m of water sources such as Duck Creek, Macquarie Rivulet, Marshall Mount Creek and their tributaries, or close to the shores of Lake Illawarra. The site distribution is also a reflection of the pattern of archaeological assessments undertaken in relation to development activities.

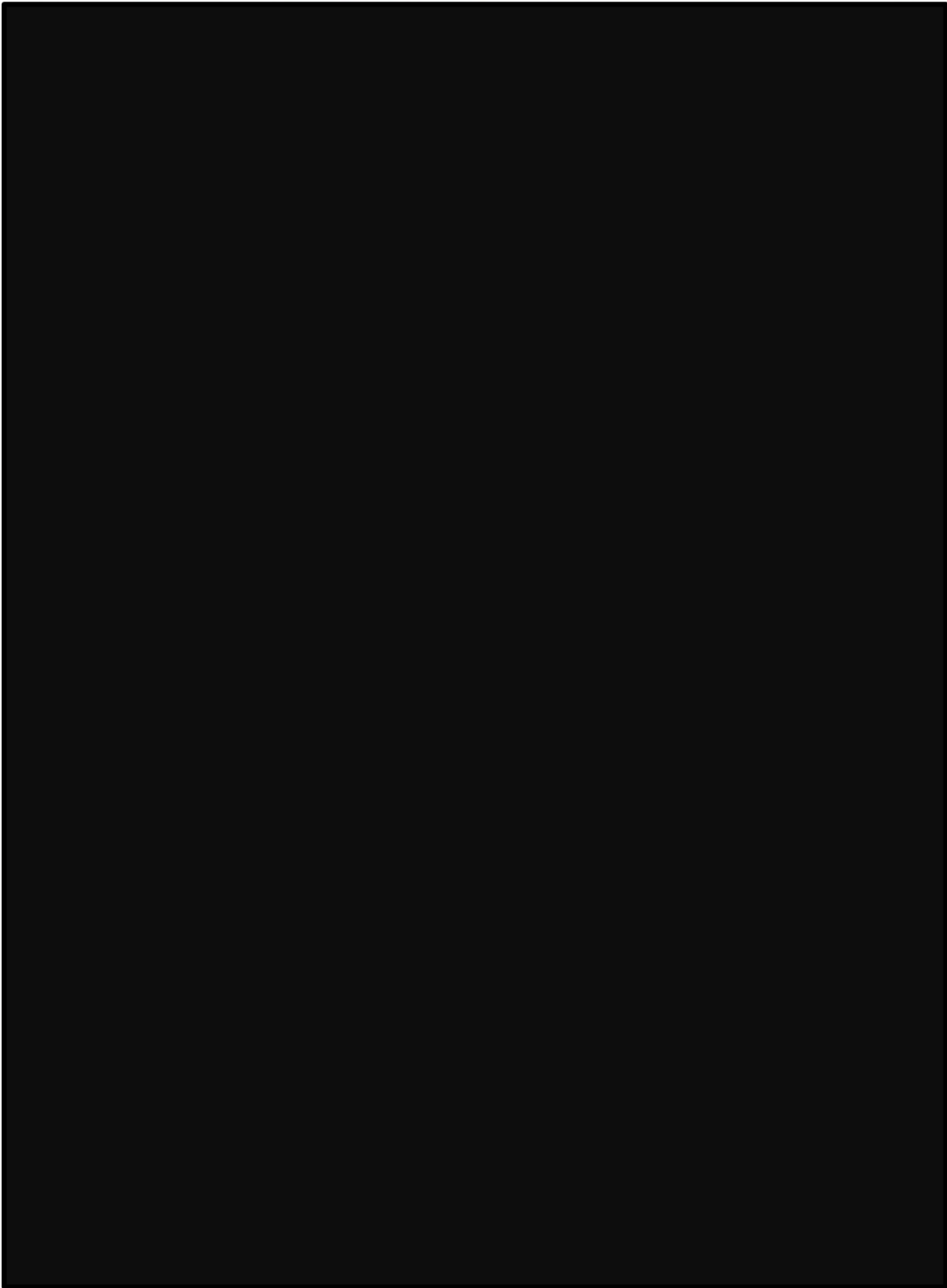


Figure 3: AHIMS results within/near the study area. Background image sourced from Land and Property Information NSW.

Two previously recorded sites are located within the current study area (Figure 12). A substantial artefact scatter was recorded during survey work undertaken by AMBS (2006a) within the West Dapto Release Area (AHIMS site 52-5-0484) at approximately 420 metres to the south of Yallah Road. This site is duplicated within the AHIMS database as site 52-5-0512. Another artefact scatter was recorded by Navin, Officer and McIntyre as part of research for a Bachelor of Arts Honours thesis (Navin 1987) near the southern bank of Macquarie Rivulet (AHIMS site 52-5-0227). Description of these sites is provided below.

AHIMS site 52-5-0484/52-5-0512 (WDRA_AS_09) comprises 89 artefacts located on the Marshall Mount spur crest in an exposed area of 180 square metres of ungraded access road. The assemblage consists of flakes, broken flakes, cores and flaked pieces. Raw materials include silcrete, chert, quartz, chalcedony, fine-grained siliceous and fine-grained volcanic. It is noted that A1 and A2 soils were exposed at the surface in the area. According to AMBS (2006a: Table 37) this site has high archaeological potential. The surface scatter had the highest density of those recorded within the West Dapto Release Area. The potential to contain additional surface/subsurface deposit was identified. Some impacts from vehicle use in the known site area were noted.

AHIMS site 52-5-0227 (Macquarie Rivulet 1) is an artefact scatter located on a terrace approximately 20 metres to the south of Macquarie Rivulet, within [REDACTED]. The site is described on the site card as a midden/artefact scatter, with artefacts scattered over the park. Artefacts include beach pebble flakes. Other artefact raw materials include chert, silcrete, fossilised wood and mudstone. Shell fragments of *Anadara trapezia* were noted to be scattered sparsely throughout the area. The recorders determined that possible surface disturbance may have occurred when the park was established; however, it is possible that undisturbed sub-surface material is present.

Three other sites, all clustered together, have been previously recorded outside the study area, but within close proximity (100 metres) to the western boundary (Figure 3). Site 52-5-0483 (WDRA_AS_10) is duplicated on the AHIMS database as site 52-5-0513. This site was recorded by AMBS (2006a) during survey of the West Dapto Release Area. It consists of an isolated fine-grained volcanic flake located on an exposure under a large fig tree on a hill crest. The site is positioned approximately 40 metres west of the western boundary of the current study area, and around 200 metres to the north of Macquarie Rivulet.

Sites 52-5-0480 (Larkins Lane Site 10 [LLS10]) and 52-5-0481 (Larkins Lane Site 8 [LLS8]) were both recorded by AMBS (2006b) as part of an Aboriginal Cultural Heritage Assessment undertaken for the Larkins Lane subdivision, Yallah. Site 52-5-480 is an isolated chert flake measuring 36.2 x 22 millimetres. It is positioned on a northeast facing slope, approximately 20 metres west of the western boundary of the current study area, and roughly 300 metres to the north of Macquarie Rivulet. Site 52-5-0481 comprises the isolated find (site 52-5-0513) previously recorded by AMBS (2006a) beneath a fig tree and 4-6 small shell fragments. The shell is noted to be highly fragmented and disbursed, with oyster and possible turbo present.

Table 1: Frequency of site features from AHIMS data

Site Feature	Frequency	Percentage
Artefact	72	70.5
Shell; Artefact	14	13.7
PAD	7	6.9
Shell	6	5.9
Modified Tree	2	2
Modified Tree; Artefact	1	1

3.4 Site types

Material traces of Aboriginal occupation exist throughout the landscape and are known as Aboriginal sites. The primary site types that are found in the region are as follows:

- **Stone artefacts** – Flaked and ground stone artefacts are the most common trace of Aboriginal occupation in the Sydney region. Aboriginal people used particular techniques to flake stone and these changed over time. The approximate age of a tool can often be diagnosed by the way that it was made. Stone artefacts are most often found in scatters that may indicate an Aboriginal campsite was once present. Stone artefacts may also be found as isolated finds. Stone tools in the Sydney region are most often made from raw materials known as silcrete, tuff and quartz. These are all easily flaked and form sharp edges, which can be used for cutting or barbing spears. Two artefact sites have previously been recorded within the study area. It is possible that further unrecorded stone artefacts, either on the surface, or buried, exist within the study area.
- **Rock shelters with deposit** – Rock shelters were used by Aboriginal people for habitation, rest places and as art or ceremonial sites. Deposits can build up on the floor of these shelters over time and bury traces of Aboriginal occupation. If these deposits are not disturbed, rock shelters can provide an intact stratigraphy that can tell us about the way Aboriginal occupation changed through time. It is unlikely that rock shelters will be present within the study area due to the lack of suitable topographical features.
- **Shell middens** – Shell middens are remains of campsites in which the primary traces are shell and/or bones of fish. Shell middens are often found close to rivers or streams and are either along banks or within enclosed shelters. A surface scatter of shell has been previously recorded near the southern bank of Macquarie Rivulet.
- **Rock engravings/Rock art** – Rock engravings are often found in Hawkesbury geologies on flat sandstone platforms. Shapes of animals, ancestor figures or other symbols were carved into the sandstone. Weathering has affected the visibility of many rock engravings. Other rock art of various

forms has also been recorded in the Sydney basin. Stencils, charcoal drawings and paintings are examples of the techniques used by Aboriginal people. Rock art is relatively rare, but is most common on sandstone geologies than on the plains of western Sydney. It is unlikely that engravings exist in the study area due to the absence of suitable horizontal sandstone outcrops.

- **Axe grinding grooves** – Axe grinding grooves are created when axe blanks (often basalt cobbles) are shaped by rubbing the stone across an abrasive rock such as sandstone, often using water. Sharpening axes and other tools also forms them. Axe grinding grooves are often found on the banks of streams or rock pools. It is unlikely that axe grinding grooves are present within the study area due to the absence of suitable horizontal sandstone outcrops.
- **Scarred trees** – Aboriginal people practiced tree marking or scarring for a variety of reasons. Large scars are often the result of a tree being debarked for a canoe blank and smaller scars may have been the result of making shields or coolamons (storage vessels). Tree marking may have been the result of ritual practices, or associated with burial. Scarred trees that remain today would be over 150 years old and the scar would retain certain characteristics that enable its identification as cultural.
- **Post-contact sites** – Sites with evidence of early interaction between Aboriginal people and Europeans. Artefacts found may include flaked glass or ceramic. This site type is usually known from historical records or knowledge within the local community. It is considered unlikely that a post-contact site will be present within the study area.
- **Quarries** – Quarries are areas where people procured resources for the manufacture of stone artefacts (Hiscock and Mitchell 1993). Raw materials often occurred in the form of cobbles. Cobbles were reduced on site and made into smaller cores, which could be transported. Tool manufacture may also occur at quarry sites (JMcD CHM 2006). No quarries have been previously recorded in the vicinity of the study area and it is considered unlikely that quarries are present in the study area.
- **Potential Archaeological Deposit (PAD)** – Areas are classified as PADs if there is a likelihood of archaeological material existing below the ground surface, or on the ground surface but obscured from view. An Aboriginal object does not need to be recorded for an area of PAD to be specified.
- **Aboriginal ceremony and dreaming** – Such sites are important and many were recorded in the early years of the NSW Aboriginal Site Register. As more recent recordings are relatively rare, it is unlikely that additional unrecorded Aboriginal ceremony and dreaming sites are present in the local area (AMBS 2010: 41).
- **Burial sites** – Aboriginal burials are found in a variety of landscape types throughout NSW, although most frequently they are found in middens, sand dunes, lunettes and other sandy/soft sedimentary soils. AMBS (2010: 41) note from personal communication with Aboriginal representative Allan Carriage in 2006 that Aboriginal burials are present in the West Dapto Release Area, particularly along Mullet Creek. Aboriginal burials can occur anywhere across the landscape, with acidic soils greatly reducing the likelihood of long-term bone survival.

3.5 Previous archaeological investigations

A number of archaeological investigations have been carried out within and around the study area. These have generally been associated with large land releases and the development of infrastructure to service these precincts. The following discussion takes into account the most recent and relevant studies and aims to provide contextual information for the current study.

West Dapto Release Area

Extensive archaeological assessment and preliminary sub-surface excavation have occurred within the WDRA, located across gently undulating farming land between the Princes Highway and the Illawarra Escarpment (Figure 4). The WDRA covers a planned residential release area, and extends over a large area stretching from Yallah in the south to Kembla Grange in the north. The WDRA has been subject to an archaeological assessment with sample field survey and test excavation (AMBS 2006a); cultural heritage assessment of specific release areas (AMBS 2006b); a preliminary Sydney Water Aboriginal heritage desktop assessment that covered both the WDRA and surrounding area, including the current study area (AMBS 2010); and sub-surface investigation in specific release areas (AHMS 2011). The section of the current study area to the west of the Princes Highway (M1) between Macquarie Rivulet and the area just to the north of Yallah Road (where it meets the Illawarra Railway line) falls within the WDRA.

Australian Museum Business Services (AMBS) 2006a

An inspection of registered sites; a sample survey of WDRA landforms; and a targeted survey of areas of archaeological and social/cultural interest were undertaken as part of the assessment by AMBS (2006a). The sample survey of WDRA landforms covered 104 hectares of the assessment area (approximately 3.5 percent of the WDRA). All landform units were covered, including streams (36), alluvial flats (9), streams and alluvial flats (1), hilltops (27) and spur crests (10). Twenty-four archaeological sites were identified, including those previously recorded. The sites comprised 13 open camp sites, six isolated finds and five scarred tree locations (containing a total of eight scarred trees). Sites were positioned on all landforms.

**artefact**

current study area. Details of both sites are provided in section 3.3.

A total of 136 test pits were excavated across the WDRA by AMBS (2006a), sampling the main landform units within the study area – slope, alluvial flat, drainage channels and crest. The number of artefacts recovered totalled 425, and these were retrieved from just over half of the test pits (n=75). The highest number of artefacts retrieved (n=146) came from a single test pit in a slope landform context. Artefacts were recovered from all creek catchments (AMBS 2010: 38).

The majority of artefacts (n=353) were recovered from the upper 20 cm of deposit. The total assemblage comprised a range of raw materials, with chert being predominant (n=176). Quartz was the next most frequent material (n=100), followed by silicified wood (n=51), quartzite (n=41), silcrete (n=38), silicified tuff (n=13) and fine-grained siliceous (n=6). Broken flakes were the most frequent artefact type (n=209), followed by flakes (n=112), flaked pieces (n=82) and cores (n=22). Twenty-nine artefacts displayed modification or retouching. Usewear was identified on five artefacts, and evidence for both retouch and usewear was identified on one artefact (AMBS 2010: 39). The results of the test excavation program demonstrated that higher frequencies of artefacts were found along certain watercourses and on some ridges (AMBS 2010: 93).

Areas of high archaeological potential were identified based on the available archaeological information, including the results of the test excavation program, and on predictive modeling. Areas considered to be of high archaeological potential include major creek lines of the WDRA; the wetlands of Mullet, Duck and Marshall Mount Creeks; the foothills of the Illawarra Escarpment; high points on ridges through the WDRA; and any sources of stone material for flaking, such as pebbles and cobbles along tributaries (AMBS 2006a: 266). Three areas of high archaeological potential were identified within the current study area. The first is located along the alignment of Duck Creek, in the very north of the current study area; the second is positioned on the slope and crest landform where site 52-5-0484/52-5-0512 is located; and the third is located along the northern side of Macquarie Rivulet (AMBS 2006a: Fig. 25b).

AMBS 2006b

AMBS (2006b) undertook a cultural heritage assessment of the proposed Larkins Lane subdivision at Yallah, within the WDRA. The study area is located immediately to the west of the current study area, between Macquarie Rivulet in the south and Yallah Road in the north. The AMBS study area comprised 35 Lots, covering a continuous land area of approximately 750 x 500 metres of varying topography. The subdivision is bisected through the middle by the Marshall Mount spur crest that runs in a southwest to northeast direction (AMBS 2006b: 3). Aboriginal stakeholders have previously advised AMBS that a ceremonial place was located on Mount Marshall to the west of the WDRA. This supports the assessment of archaeological potential for the Marshall Mount spur crest because the landform would have provided an important access route to the ceremonial place (AMBS 2006b: 10).

One known site (WDRA_AS_10) is located within the subdivision. As discussed in section 3.3 above, this site is located approximately 40 metres to the west of the current study area. Two known sites (WDRA_AS_09) and AHIMS site 52-5-0398 are located immediately adjacent to the eastern and southern boundaries of the subdivision respectively. As discussed in section 3.3 above, site WDRA_AS_09 is located within the current study area. Aboriginal objects were identified on 13 Lots throughout the subdivision, in areas where the ground surface had been disturbed by development activities such as road construction. Eight isolated stone artefacts and ten locations of very low density shell remains (1-12 fragments) were recorded, a large proportion of which were associated with the upper slope of the ridge crest landform in the northern half of the study area. It was determined that due to the very low density of archaeological materials, and to the low archaeological integrity of the landscape resulting from development activities throughout a large proportion of the site, the entire Larkins Lane study area was of low archaeological significance (AMBS 2006b: ii).

AMBS 2010

AMBS (2010) also undertook an Aboriginal and historic heritage desktop assessment for the provision of proposed water and wastewater infrastructure for the WDRA. The current study area falls within the area that was the focus of that study. AMBS determined that 309 registered Aboriginal sites were located in their study area. An assessment of Aboriginal scientific (archaeological) significance was undertaken and it was found that, overall, areas of high potential were focused on certain watercourses and specific ridges. Of the approximately 31 square kilometre area of the study area, approximately 12 percent was assessed to be of high archaeological significance; 74 percent was assessed to be of moderate archaeological significance; and 14 percent was assessed to be of low archaeological significance. It was recommended that all registered Aboriginal sites and areas of high archaeological significance be avoided when planning the pipelines and other assets.

Archaeological & Heritage Management Solutions (AHMS) 2011

AHMS (2011) conducted further archaeological test excavation of a property off Bong Bong Road in the WDRA that had been the subject of limited test excavation by AMBS (2006a). This property is located approximately 4 km to the northwest of the current study area. AMBS (2006a) had retrieved three artefacts from six test pits in the property, with AHMS conducting an extended test excavation program of 47 test pits. The 47 test pits were distributed across transects that sampled each of the landform units within the property, including low-lying open depression, a creek levee and undulating slopes (AHMS 2011: 18). A total of 34 stone artefacts were retrieved from the test excavation program, with an average artefact density of 0.7 per square metre (AHMS 2011: 19). AHMS (2011: 52) suggested that the retrieved lithic assemblage demonstrated activities associated with raw material procurement, knapping and tool utilisation.

Biosis Research 2007

Biosis Research (2007) undertook an archaeological assessment along a proposed gas pipeline route near the Tallawarra Power Station, at Yallah NSW. The survey area crosses from west to east through the northern sector of the current study area, near Duck Creek. Two areas of PAD and surface artefacts were identified to the west of the current study area. No sites or areas of PAD were identified along the pipeline route within, or to the east of, the current study area. The two areas of PAD - Tallawarra Pipeline 1 (AHIMS site 52-5-0471) and Tallawarra Pipeline 2 (AHIMS site 52-5-0472) - were subject to a program of test excavation. Thirty-six 1.0 x 0.5 metre test pits were excavated, totalling an area of 18 square metres. A total of 136 artefacts were recovered – nine from Tallawarra Pipeline 1 (seven percent of the excavated assemblage) and 127 from Tallawarra Pipeline 2 (93 percent of the excavated assemblage). The predominant raw material is silcrete (43 percent), with other common raw materials including chert, quartz and volcanics. Manufacturing debris including flakes, cores and angular fragments comprised 96 percent of the assemblage (Biosis Research 2007: 21-24).

Very few (if any) artefacts were recovered from within many of the test pits, and it is concluded that this distribution represents background scatter. Relatively higher densities were recovered from two areas within Tallawarra Pipeline 2, both associated with locally elevated positions close to the aggraded channel of Duck Creek. It was suggested that these areas were more frequently occupied and utilised than is indicated by the background scatter elsewhere. It was determined that a main function of the area appears to have been stone tool production. The overall low numbers of artefacts possibly indicates that sites were occupied at a low level of intensity, and the area may have been used intermittently to access local wetland sources (Biosis Research 2007: 29-30). It was concluded that the findings are comparable with site predictive models for the Illawarra region, where artefact scatters are the common site types and are usually located on level, well-drained ground, close to water sources and wetlands such as Duck Creek (Biosis Research 2007: 30).

HLA-Envirosciences (HLA) 2007

HLA (2007) conducted an Aboriginal and historical heritage assessment of the proposed Illawarra Regional Business Park. The study area comprised approximately 80 hectares of dairy farmland at 78 Tongarra Road, Albion Park NSW. It incorporates a section of the current study area immediately to the north of Tongarra Road, which could not be accessed during the current survey. It was determined that no previously recorded Aboriginal sites are situated within the study area (HLA 2007: 9). One previously unrecorded Aboriginal site was identified during the survey. This was an isolated silcrete flake of approximately 16 x 20 millimetres, found on the side of an embankment on a bend in Frazers Creek. The 0.5 metre high embankment had been formed through the dredging of Frazers Creek in the recent past (HLA 2007: 13). No other Aboriginal sites or PADs were located in the study area. It was concluded that

the isolated find is likely to have been redeposited and therefore has low scientific value. However, due to low ground surface visibility, recognition must be made of the possibility of further Aboriginal sites within the study area (HLA 2007: 16). The isolated artefact has not been registered on the OEH AHIMS site register and is not located within the current study area. The site is shown as a purple dot on Figure 4.

Godden Mackay Logan (GML) 2012

Test excavation of PAD SUFA 3 at Lot 12 Ashburton Drive, Albion Park, was undertaken by GML (2012). The PAD area is located on a spur between two second order creeks, approximately 1.5 kilometres to the southwest of the current study area. Thirty-five test pits were excavated, each of 0.50 x 0.50 metres. The total excavation area comprised 8.75 square metres (0.044 percent of the PAD). A total of 54 artefacts were recovered across the 35 test pits. Eleven test pits contained no artefacts. The highest number of artefacts recovered from one test pit was nine, while the remaining test pits contained between one and three artefacts (GML 2012: 25-27). The assemblage included three retouched tools; two artefacts with possible usewear; a broken core; a bipolar flake; 11 complete flakes; seven proximal broken flakes; eight cone-split broken flakes; 11 medial and five distal flake fragments; and five flaked pieces (GML 2012: 30). The most common raw material was fine-grained siliceous, followed by chalcedony, petrified wood, chert and silcrete, most of which can be found within the local area. The uneven soil depths and presence of certain stratigraphic layers across the site reflected the erosional hill slope landform the study area is located on (GML 2012: 34-35). It was concluded that the artefacts of the PAD appear to be part of background scatter as opposed to a concentrated camp site. The PAD has low potential for additional scientific information, and low significance based on scientific value (GML 2012: 54-55).

3.6 Previous predictive models

AMBS (2006a: 63-86) provide a comprehensive overview of previous archaeological research undertaken in the local region relevant to the WDRA, and to the current study area. The review includes regional assessments of the Illawarra undertaken by Dallas and Sullivan (1995) and Therin (2003). Both studies note that drinking water is freely available within the Illawarra, so whilst still important, would not be the overriding factor determining landscape use. Instead, the composition and distribution of known archaeological sites throughout the Illawarra is found to be strongly correlated with bedrock geology and landform features, such as sandstone outcrops that are suitable for shelter and axe grinding grooves (AMBS 2006a: 65). It is acknowledged within both studies that the current understanding of Aboriginal heritage of the Illawarra is limited. Investigations have been focused on landforms of the immediate coast and escarpment, with the archaeology of the Coastal Plain and escarpment foothills less well known. Alluvial landforms (streams) have been the focus of test excavation, meaning the potential of higher landforms that offer vantage points and elevated pathways has not been recognised (AMBS 2006a: 94).



AMBS (2006a: 87- 92) also review studies that have contributed to the assessment of archaeological potential of the WDRA, including that undertaken by Sefton (1984) for Stage 1 of the WDRA. Whilst recognising the limited understanding of Aboriginal heritage in the Illawarra, areas of potential within the WDRA are nominated as being archaeologically sensitive based on Sefton's predictive model (AMBS 2006a: 93). Of particular relevance to the current study area is the prediction that all level areas of the Western foothills zone and the Coastal Plain within 100 m of a creek situated on: (a) quaternary deposits (flood plains); (b) Budgong Sandstone; and (c) Berry Siltstone are archaeologically sensitive.

4.0 Predictions

4.1 Aboriginal land use

Assumptions about Aboriginal land use patterns are made on the basis of archaeological information gained from the local area, from observations made by Europeans after settlement of the area, and from information known about available natural resources.

As Aboriginal people were mobile hunter-gatherers, it would be likely that they moved across the landscape between resources. It would also be likely that movement was related to socio/cultural factors such as gatherings and ceremonial obligations. Campsites would have provided temporary residences such as bark structures. It is difficult to ascertain whether a campsite existed at a given location, but correlations between stone artefact density and campsites are often assumed. While it would be likely that knapping would have occurred at a campsite, it would also be likely that knapping would have occurred during movement across the landscape, as tools were prepared or repaired during hunting and gathering activities.

Archaeological data gathered in the locality suggests that artefacts would be found across the landscape in varying densities, with higher densities expected in close proximity to water sources. The main limitations to the survivability of archaeological material in the study area include impacts of soil erosion, flooding, and infrastructure development.

4.2 Predictive model

The predictive model used in the current study comprises a series of statements about the nature and distribution of evidence of Aboriginal land use that is expected in the study area. These statements were based on the information gathered regarding:

- Landscape context and landform units.
- Ethno-historical evidence of Aboriginal land use.
- Distribution of natural resources.
- Results of previous archaeological work in the vicinity of the study area.
- Predictive modeling proposed in previous investigations.

Predictive statements for the study area are as follows:

- Stone artefacts/artefact scatters will be the most likely Aboriginal site type.
- Artefact densities will be low.
- Stone artefacts will be less likely to be identified on steep slopes.
- *In situ* artefacts will be located in areas of least ground disturbance.



It is probable that the only material traces of Aboriginal occupation remaining will be stone artefacts. The potential for shelter sites, rock engravings and axe grinding grooves is limited by the nature of the underlying geology. There is some potential for shell middens and burials to exist along/near the banks of the major waterways within the study area (e.g. Duck Creek, Macquarie Rivulet and Frazers Creek). Scarred tree sites would be rare in areas that have been extensively cleared following European colonisation such as the Illawarra coastal plain, suggesting that there is limited potential for suitable old growth trees to occur within the study area.

Areas of PAD would be dependent on landform and levels of disturbance. Areas of PAD would not be identified across steep slopes, in areas of flooding, or in areas of high disturbance.

5.0 Field methods

5.1 Site definition

An Aboriginal site is generally defined as an Aboriginal object or place. An Aboriginal object is the material evidence of Aboriginal land use, such as stone tools, scarred trees or rock art. Some sites, or Aboriginal places can also be intangible and although they might not be visible, these places have cultural significance to Aboriginal people.

OEH guidelines state in regard to site definition that one or more of the following criteria must be used when recording material traces of Aboriginal land use:

- The spatial extent of the visible objects, or direct evidence of their location.
- Obvious physical boundaries where present, e.g. mound site and middens (if visibility is good), a ceremonial ground.
- Identification by the Aboriginal community on the basis of cultural information.

For the purposes of this study an Aboriginal site was defined by recording the spatial extent of visible traces or the direct evidence of their location.

PADs are areas where sub-surface stone artefacts and/or other cultural materials are likely to occur (DECCW 2010: 38). These areas may be associated with recorded sites but are often greater in extent, taking in areas around the visible artefacts where there is a potential for further buried artefacts to exist. PADs may also be present where no visible artefacts are located. This may be the case when there is no ground surface visibility, but the area is seen to have a high likelihood of containing artefacts.

5.2 Survey methodology

The survey was conducted on foot over two days (30 April to 1 May 2013). The survey was undertaken by Josh Symons and Samantha Gibbins (Artefact Heritage). Pam Glover, Neville Maher, William Butler and Jon Kirby represented ILALC throughout the survey.

The study area is a long, linear strip of land that crosses multiple landform units. The study area was divided into six survey units, each containing several landform units (Figure 5). A sample survey of Survey Unit 1 was undertaken (see below). Full survey coverage of all other survey units was undertaken, apart from the areas where property access had not been granted.

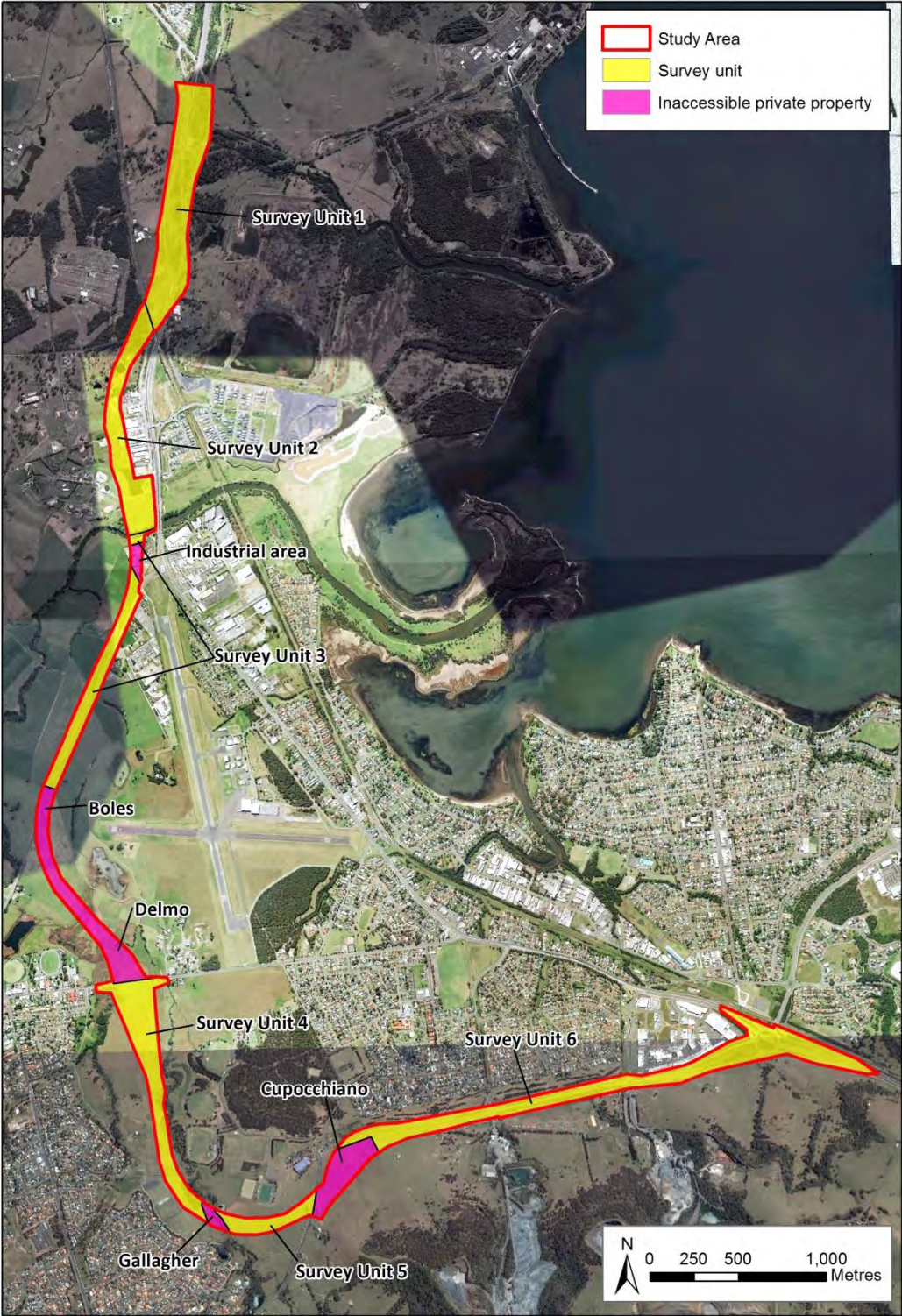


Figure 5: Overview of Survey Units. Background image source Google© 2013 and Land and Property Information NSW.

The survey was undertaken in accordance with relevant OEH standards and guidelines, as part of Stage 2 of the RMS PACHCI. A handheld Global Positioning System (GPS) was used to track the path of the surveyors, and to record the co-ordinates of sites, features and location of landform units within the study area. An aerial map of the study area was also carried by members of the survey team in the field. GDA94 coordinates for sites and PADs were taken with a handheld GPS.

All ground exposures were examined for stone artefacts, shell, or other traces of Aboriginal occupation. Old growth trees were examined for signs of cultural scarring or marking.

A photographic record was kept of all sections of the study area that were accessible. Photographs were taken to record different aspects of the landform units within the study area, vegetation, levels of disturbance, Aboriginal sites and PADs. Scales were used for photographs where appropriate.

Survey Unit 1 Sample Survey

A sample survey is acceptable under the OEH Code of Practice with justification. A sample survey of Survey Unit 1 was conducted primarily because parts of the unit were covered in dense, impenetrable vegetation, and also because other sections could not be accessed due to the alignment of the rail corridor, the Princes Highway (M1), F6 Freeway and associated on/off ramps. Dense grass and vegetation cover also reduced ground surface visibility to zero over most of the survey unit. Surface visibility was limited to small portions of exposures along drainage channels, erosion scours and in areas of roadside disturbance.

Properties to which access was not granted

Several properties within the study area could not be surveyed because property access was not granted (Figure 5). These properties are not included in the survey units shown in Figure 5.

6.0 Results

6.1 Effective survey coverage

The study area is a long, linear strip of land that crosses multiple landform units. The study area was divided into six survey units, each containing several landform units (Figure 5). Although mostly cleared of original vegetation, the landforms within the study area (crests, hill slopes, flats and terraces) were covered in dense grass that limited ground surface visibility to zero, except in the odd areas of exposure. The only areas of surface visibility were observed in vehicle tracks, animal tracks, exposures around tree bases, exposures around dams and other areas of disturbance, and odd patches of erosion on the steeper slopes. Standing sections of deposit could be observed in some places along drainage channels. Vegetation was impenetrable or extremely dense in several sections of the study area and these were not surveyed. Parts of the study area could not be surveyed because property access had not been granted. Visibility and exposure levels have been taken into consideration in determining the effective coverage area on this survey (Table 2 and Table 3).

Table 2: Survey Coverage

Survey Unit	Landform	Survey unit area (m ²)	Visibility (%)	Exposure (%)	Effective coverage area (m ²)	Effective coverage (%)
1	Open depression, modified	247,210 (46,869*)	3	2	28	0.06
2	Open depression, modified, crest, slope, flat	153,757	5	3	230	0.15
3	Open depression, terrace, flat	99,536	1	5	50	0.05
4	Open depression, terrace, flat	175,404	2	5	175	0.1
5	Open depression, slope, flat	48,723	5	3	73	0.15
6	Modified, crest, slope	308,263	3	5	462	0.15

* = sample survey area

Table 3: Landform survey coverage

Landform	Landform area (m ²)	Area effectively surveyed (m ²)	% of landform effectively surveyed	Number of sites	Number of artefacts or features
Open depression	70,730	66	0.09	-	-
Modified	272,376	388	0.14		
Crest	37,017	55	0.14	1 site (AHIMS ID 52-5-0484/52-5-0512)	89*
Slope	155,589	233	0.15	1 PAD (YTOF PAD 1)	-
Terrace	91,664	73	0.08	1 site (AHIMS ID 52-5-0227)	-
Flat	211,048	206	0.09	-	-

* 89 artefacts were originally recorded at site 52-5-0484/52-5-0512 by AMBS (2006a).

6.2 Survey observations

Survey Unit 1 (Figure 6)

Survey Unit 1 has been extremely disturbed and modified due to the installation of the Princes Highway (M1), F6 Freeway and associated on/off ramps and bridges (Plate 1). Other disturbances within the survey area include the construction of the Illawarra Railway line, installation of a property access road leading off the Princes Highway, installation of an overhead transmission line and water pipeline, and modifications made to drainage channels such as Duck Creek (Plate 2 and Plate 3).

Ground surface visibility across the survey area was generally nil due to dense grass and vegetation cover. Odd exposures were observed along drainage channels, erosion scours and in areas of roadside disturbance. The main observed landforms include Duck Creek in the north and a swamp/drainage channel in the south, both of which have been heavily modified. Beyond the southern swamp/drainage channel the land sloped up towards the south. As observed from the road, this area appears to have undergone disturbance, with mounds visible along the surface. The remainder of the original landforms within the parts of Survey Unit 1 that were inspected were all heavily modified (e.g. through the construction of embankments along the highway).

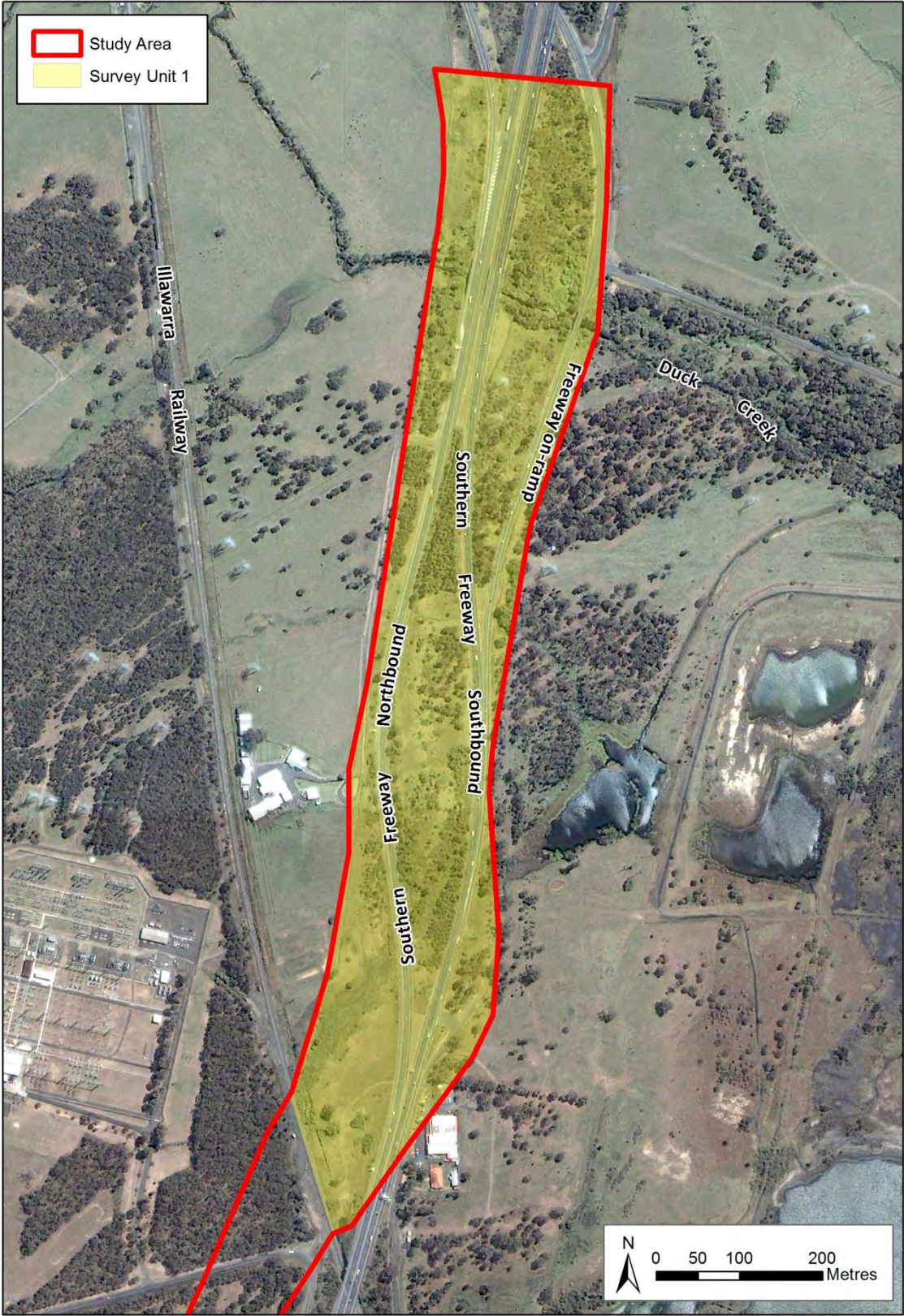


Figure 6: Survey Unit 1. Background image sourced from Land and Property Information NSW.

Plate 1: Survey Unit 1 – disturbance and modification associated with highway, view to N.



Plate 2: Survey Unit 1 – transmission line and embankment associated with highway, view to N.



Plate 3: Survey Unit 1 – modifications made to Duck Creek, view to N.



Plate 4: Survey Unit 1 - impenetrable swamp/drainage channel in south, view to E.



Survey Unit 2 (Figure 7)

Survey Unit 2 incorporates four main landform units – slope, crest, flat and open depression. The area is dominated by a broad crest that runs roughly across the centre. This is part of the Marshall Mount spur crest that runs in a southwest to northeast direction through the region. Previously recorded site 52-5-0484/52-5-0512 (WDRA_AS_09) is located on the crest. The location of the site was inspected, but no artefacts were visible on the surface due to the dense vegetation cover (see discussion in section 6.4). The land to the north of the crest slopes gently to the north and west, towards a drainage channel that runs from southwest to northeast through the area. The drainage channel has been heavily modified and dams have been installed along the drainage depression. The land to the north and west of the drainage channel slopes gently eastwards towards the channel.



Figure 7: Survey Unit 2. Background image sourced from Land and Property Information NSW.

To the south of the crest, the land slopes down moderately and then more gently towards a drainage channel and flat above Macquarie Rivulet in the south (Plate 5). This land is used mostly for pastoral purposes. The drainage channel has been modified and a large dam has been constructed along the flat. The land to the west of the dam rises up moderately towards a crest where several sites have previously been recorded outside of the study area (AHIMS sites 52-5-0483/52-5-0513, 52-5-0480 and 52-5-0481). The flat is dissected by artificial drainage channels in several places.

Ground surface visibility across Survey Unit 2 was generally nil due to the dense grass cover. Some infrequent exposures were present in areas of disturbance, such as dam walls, animal and vehicle tracks, erosion scours and areas that had been leveled by previous development. Overall, Survey Unit 2 has been subject to significant disturbance, including the installation of Yallah Road and the Illawarra Railway line in the north and substantial industrial development along much of the eastern edge, which has encroached particularly upon the crest landform (Plate 6 and Plate 7). In spite of this, the crest landform appears to be relatively intact, however, previously recorded site 52-5-0484/52-5-0512 (WDRA_AS_09) was not visible and it was evident that the area had been subject to some disturbance since the site was recorded (Plate 8).

All drainage channels in Survey Unit 2 have been modified or constructed, and the installation of dams has led to further ground disturbance in the area. Evidence of frequent flooding along the flat near Macquarie Rivulet was found in the deep homogenous deposits observed in an exposed section of one of the drainage channels.

Plate 5: Survey Unit 2 – slope and flat towards Macquarie Rivulet (note dam in centre), view to SE.



Plate 6: Survey Unit 2 – railway embankment and drainage channel/drain in the north, view to SE.



Plate 7: Survey Unit 2 – industrial development on crest landform, view to S.



Plate 8: Survey Unit 2 – location of site 52-5-0484, view to W.



Survey Unit 3 (Figure 8)

Survey Unit 3 incorporates three main landform units – flat, terrace and drainage channel. Survey Unit 3 included the disturbed road corridor along the eastern and western edges of the Illawarra Highway. This is a major disturbance throughout the survey unit. The road easement to the property boundaries along the eastern edge of the highway was covered during the survey.

The land to the south of the industrial development is a broad, flat terrace, which slopes down gently to the west (beyond the study area). Ground surface visibility along the terrace was generally nil due to the dense grass cover. Some exposures were evident along vehicle tracks and areas of cattle mustering. The southern portion of the terrace has been heavily disturbed by the construction of a dairy complex, which is currently functioning, and an associated residence (Plate 10). South of the residence, the land slopes gently southwards into an extensive flat, which extends through the remainder of Survey Unit 3 (Plate 11). The flat is dissected by Frazers Creek, which is modified in this area, passing beneath the Illawarra Highway. The flat is used for pastoral purposes and was covered in dense grass, leading to nil visibility. The installation of property fences has resulted in minor localised disturbance in the area. Conversation with a property owner during the survey confirmed that the flat is frequently inundated (Plate 12).

The land immediately to the south of Macquarie Rivulet is relatively flat for a distance of approximately 20 metres. It then rises up gently to the south to form an elevated terrace overlooking the Rivulet. Previously recorded site 52-5-0227 (Macquarie Rivulet 1) is located on this terrace. The location of the site was inspected, but no artefacts were visible on the surface due to the dense grass cover (see discussion in section 6.4). The terrace and flat have been heavily disturbed by landscaping and by the installation of a roadway, parking and picnic facilities associated with [REDACTED]. Immediately to the south of the terrace is an industrial development, where the land has been heavily disturbed and modified. Construction of this would also have impacted on the terrace landform.

Plate 9: Survey Unit 3 – modified flat and terrace (Darcy Dunster Park), view to NE.



Plate 10: Survey Unit 3 – dairy complex on southern portion of terrace, view to S.



Plate 11: Survey Unit 3 – terrace slope and flat (Illawarra Road to left), view to S.



Plate 12: Survey Unit 3 – flat that is subject to frequent inundation, view to S.



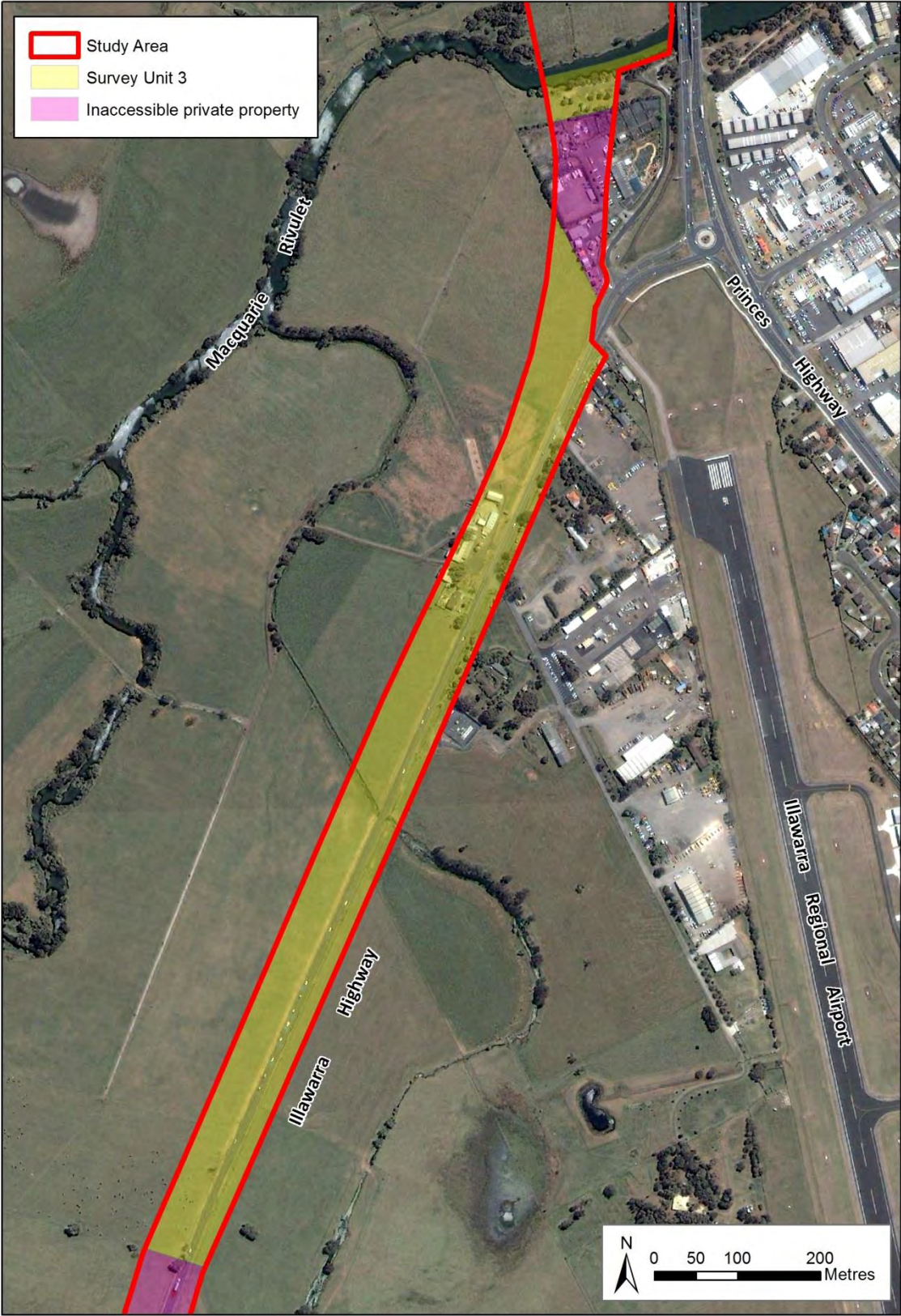


Figure 8: Survey Unit 3. Background image sourced from Land and Property Information NSW.

Survey Unit 4 (Figure 9)

Survey Unit 4 incorporates three main landform units – flat, terrace and drainage channel. The northern end of Survey Unit 4 is marked by Tongarra Road, which has resulted in major disturbance in this section (Plate 13). Frazers Creek generally runs along the eastern edge of the survey unit, but meanders into it in several places. The land to the south of Tongarra Road is relatively flat, with undulations possibly representing remnant terraces, particularly in the northern half of the survey area (RMS land). This northern area is currently used for pastoral purposes. Disturbances appear to be relatively localised, including mounding of earth, fencing, animal tracks and vehicle tracks. An underground gas pipeline runs from north to south through the area.

The flat landform with undulating terraces continues southwards into the land currently occupied by the pony club (Plate 14). This area has been levelled and landscaped, resulting in significant disturbance to the ground surface (Plate 15). The underground gas pipeline also continues into this area. Further south, the land has been levelled to accommodate sports grounds, again resulting in major ground surface disturbance (Plate 16). Where Frazers Creek enters Survey Unit 4, it appears to have been heavily modified, with built up embankments and fencing evident in places (Plate 16).

Overall, visibility throughout Survey Unit 4 was restricted by dense grass cover. Odd patches of exposure were evident along animal tracks in the northern sector, revealing silty alluvial deposit. Exposures in the southern, more disturbed section of Survey Unit 4 were limited to odd water erosion scours and vehicle tracks. Clay was noted to be present in the basal layers of the creek section in this area.

Plate 13: Survey Unit 4 – Tongarra Road at northern end of unit, view to E.



Plate 14: Survey Unit 4 – undulating terrace landform, view to S.



Plate 15: Survey Unit 4 – levelling and landscaping in pony club area, view to S.



Plate 16: Survey Unit 4 – levelled sports ground and modified Frazers Creek, view to E.



Survey Unit 5 (Figure 10)

Survey Unit 5 incorporates three main landform units – flat, slope and drainage channel. The survey unit includes the road corridor of Croome Road, which is a major disturbance at the eastern end of the unit. Frazers Creek runs from south to north through the western end of the survey unit. A dam has been installed nearby and the creek appears to be heavily modified in this area, with built up embankments evident. The land to the east of Frazers Creek is relatively flat. The slope rises gradually from the flat towards the east, culminating in a spur crest near Croome Road where a residential property is present (Plate 17). The lower and mid slopes are relatively gentle, with the upper slope becoming moderately inclined towards the crest. A dam has been installed along the mid slope and falls partially within the study area. Dense grass cover across the survey unit resulted in mostly nil visibility, however, exposures were evident along animal and vehicle tracks. The land is currently used for horse agistment, and property fences divide the area. Overall, the gentle slope landform appears to be relatively intact, with localised disturbances only, such as the dam, tracks and fences (Plate 18).

Plate 17: Survey Unit 5 – slope landform above flat, view to E.



Plate 18: Survey Unit 5 – slope landform viewed from crest (note dam and fencing to left), view to W.



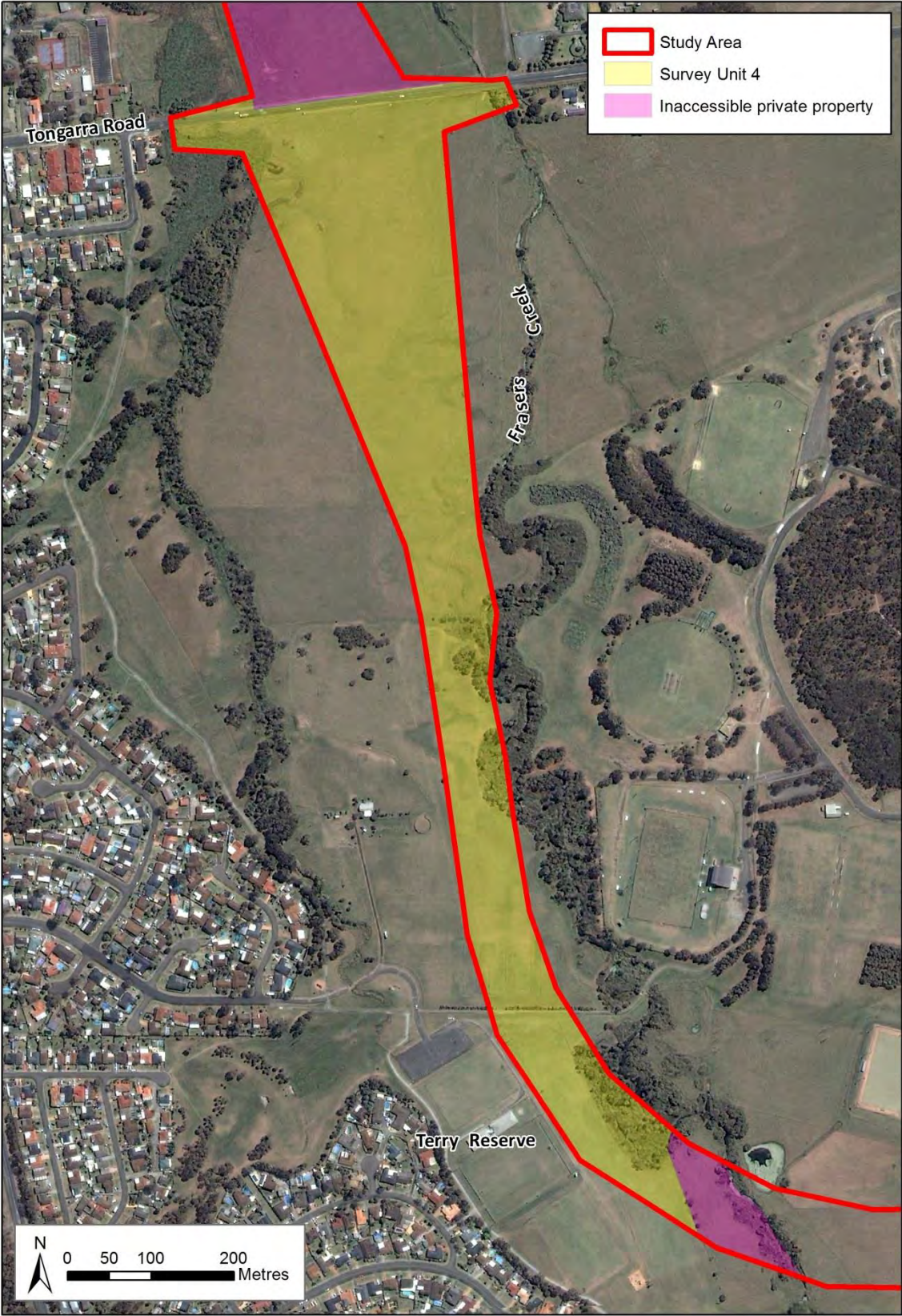


Figure 9: Survey Unit 4. Background image sourced from Land and Property Information NSW.

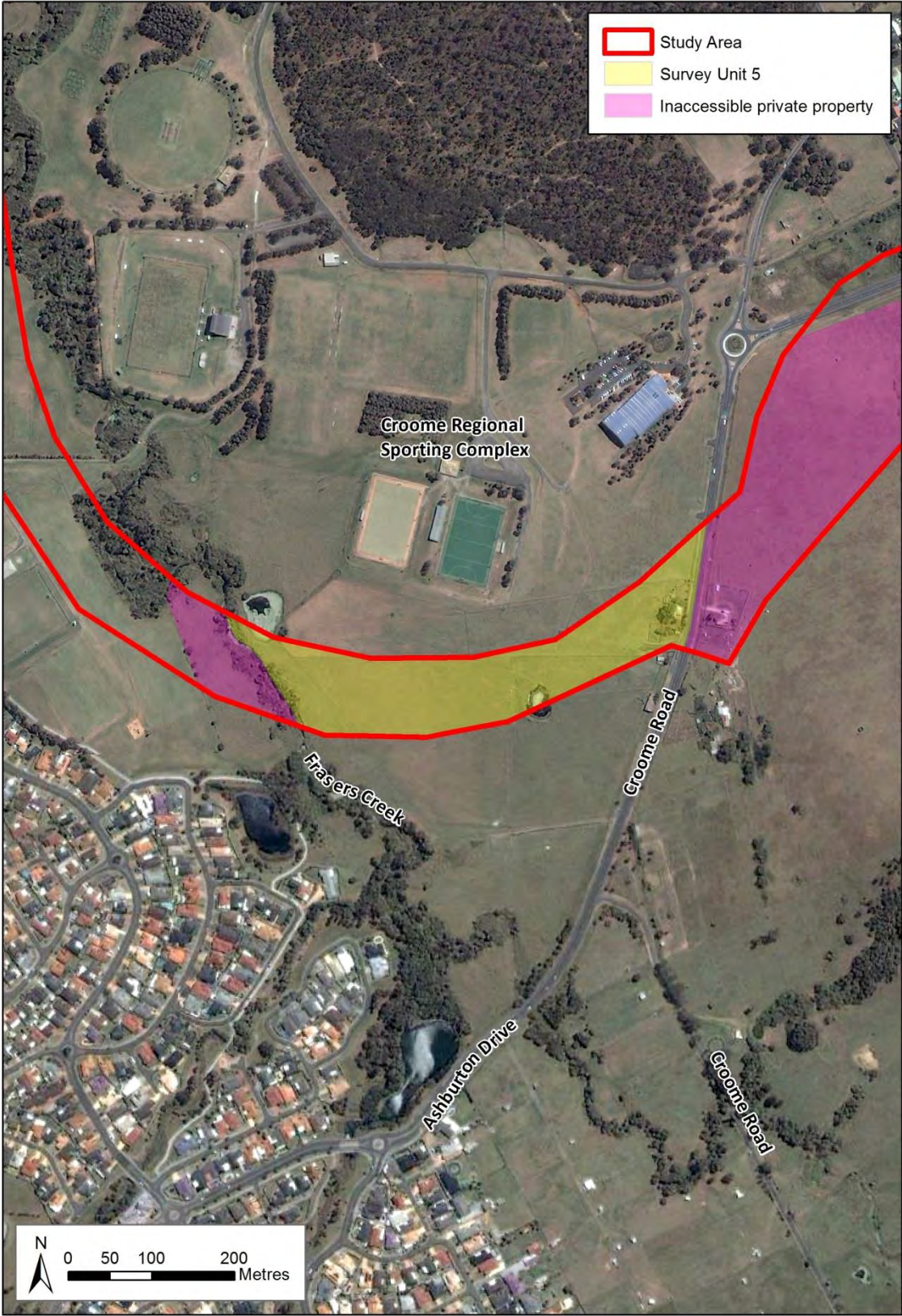


Figure 10: Survey Unit 5. Background image sourced from Land and Property Information NSW.

Survey Unit 6 (Figure 11)

Survey Unit 6 includes four main intact landform units – slope, crest, flat and drainage channel. The survey unit includes the disturbed road corridor of the East West Link; associated roundabouts (Woollybutt Drive and Durgadin Drive); the truck stop; the major roundabout and on/off ramps at the intersection of the East West Link, Princes Highway and New Lake Entrance Road; and short stretches of the Princes Highway on each side of the roundabout. The majority of Survey Unit 6 has been heavily disturbed and modified as a result of the road construction. The road easement to the property boundaries along the northern edge of the East West Link was covered during the survey.

Visibility throughout the survey unit was generally nil due to the dense grass cover across most of the area. Areas of exposure were evident along vehicle tracks and in odd erosion scours. The section of the survey unit to the north of the East West Link was dominated by a large artificial embankment with intermittent road bunds (Plate 19). This entire area was highly disturbed. South of the East West Link, between Woollybutt Drive and Durgadin Drive, the land is currently being used for horse agistment. This area has been heavily modified through the installation of an artificial drainage channel and the construction of a levelled retention basin immediately to the south (Plate 20). Landscaping and tree plantings have also been undertaken in this area.

South of the East West Link, west of Woollybutt Drive, the original landform is intact but ground surface disturbance is evident. The area runs along the basal slopes of a hill that rises up to the south. The land within the study area rises gently from west to east, towards a crest. Beyond the crest, the land slopes gently eastwards towards a drainage channel (Plate 21). Disturbances to the area were evident, including earthen mounds, blue metal around the trees on the crest, a road bund, drainage installations, and an overhead transmission line. Patches of exposure near the crest revealed sandstone bedrock very close to the surface, indicative of the shallow depth of remnant deposit.

South of the East West Link, east of Durgadin Drive, a slope and crest formation is intact, but again has been highly disturbed (cut through during the road construction [Plate 22]). Erosion scours along the crest revealed bedrock very close to the surface, suggesting that any remnant deposit would be very shallow (Plate 23). Further evidence of major disturbance was detected within the island in between the two branches of the East West Link, leading on to and off of the major roundabout (Plate 24). A massive earthen mound was present in this area, and it was noted that the original topsoil had been stripped down to bedrock, presumably during road construction.

Plate 19: Survey Unit 6 – massive embankment and road bund along northern edge of East West Link, view to W.



Plate 20: Survey Unit 6 – retention basin (left), drainage channel and embankment to south of East West Link, view to W.



Plate 21: Survey Unit 6 – slope and crest landform to south of East West Link, view to W.



Plate 22: Survey Unit 6 – cutting through slope and crest landform to south of East West Link, view to E.



Plate 23: Survey Unit 6 – exposed/disturbed bedrock along crest landform to south of East West Link.



Plate 24: Survey Unit 6 – disturbed island between the branches of the East West Link, view to NE.



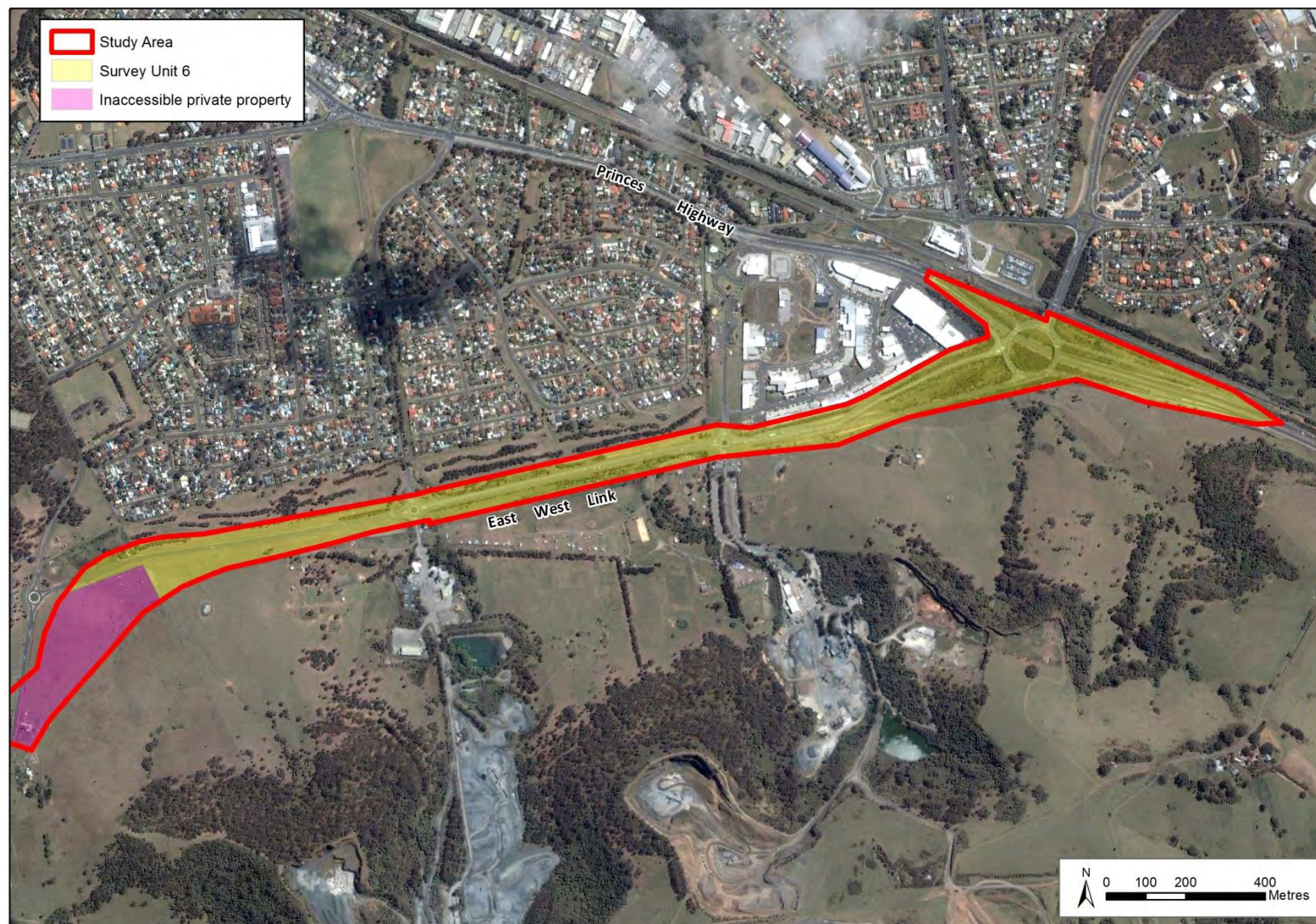


Figure 11: Survey Unit 6. Background image sourced from Land and Property Information NSW.

Properties to which access was not granted

The section of the study area between Tongarra Road in the south and to the Illawarra Highway in the north (between Survey Units 3 and 4) could not be surveyed because property access was not granted. It is to be noted that HLA (2007) undertook an assessment of an area that incorporates a small section of the current study area immediately to the north of Tongarra Road. One isolated artefact was found on the side of an embankment on a bend in Frazers Creek (not within the current study area). This is thought to have possibly been redeposited during dredging of the creek in the recent past, and indicates that the creek has been heavily modified in this area. No other sites or PADs were identified during the assessment.

The industrial estate immediately to the south of Darcy Dunster Park could not be surveyed because property access was not granted. A portion of the study area to the east of Croome Road (between Survey Units 5 and 6) could not be surveyed because property access was not granted. A small section of the study area immediately to the west of Frazers Creek (between Survey Units 4 and 5) also could not be surveyed because property access was not granted.

6.3 Summary of results

Two previously recorded Aboriginal sites were located within the study area (AHIMS sites 52-5-0484/52-5-0512 [WDRA_AS_09] and 52-5-0227 [Macquarie Rivulet 1]). Descriptions of these sites as recorded are provided in section 3.3 and the locations are shown on Figures 12-14. Both sites were located during the field survey using GPS coordinates and photographs. No artefacts were visible on the surface at either site. No previously unrecorded Aboriginal sites were detected during the field survey. One area of PAD was identified during the field survey (see Figure 12 and Figure 15). A summary of the recorded sites and PAD is included in Table 4.

Table 4: Summary of survey findings

AHIMS number	Site name	Feature(s)	Survey Unit	Landform
52-5-0484/ 52-5-0512	WDRA_AS_09	Artefact scatter	2	Crest
52-5-0227	Macquarie Rivulet 1	Artefact scatter	3	Terrace
-	YTOF PAD1	PAD	5	Lower slope

A detailed description of each site and the PAD is included below.

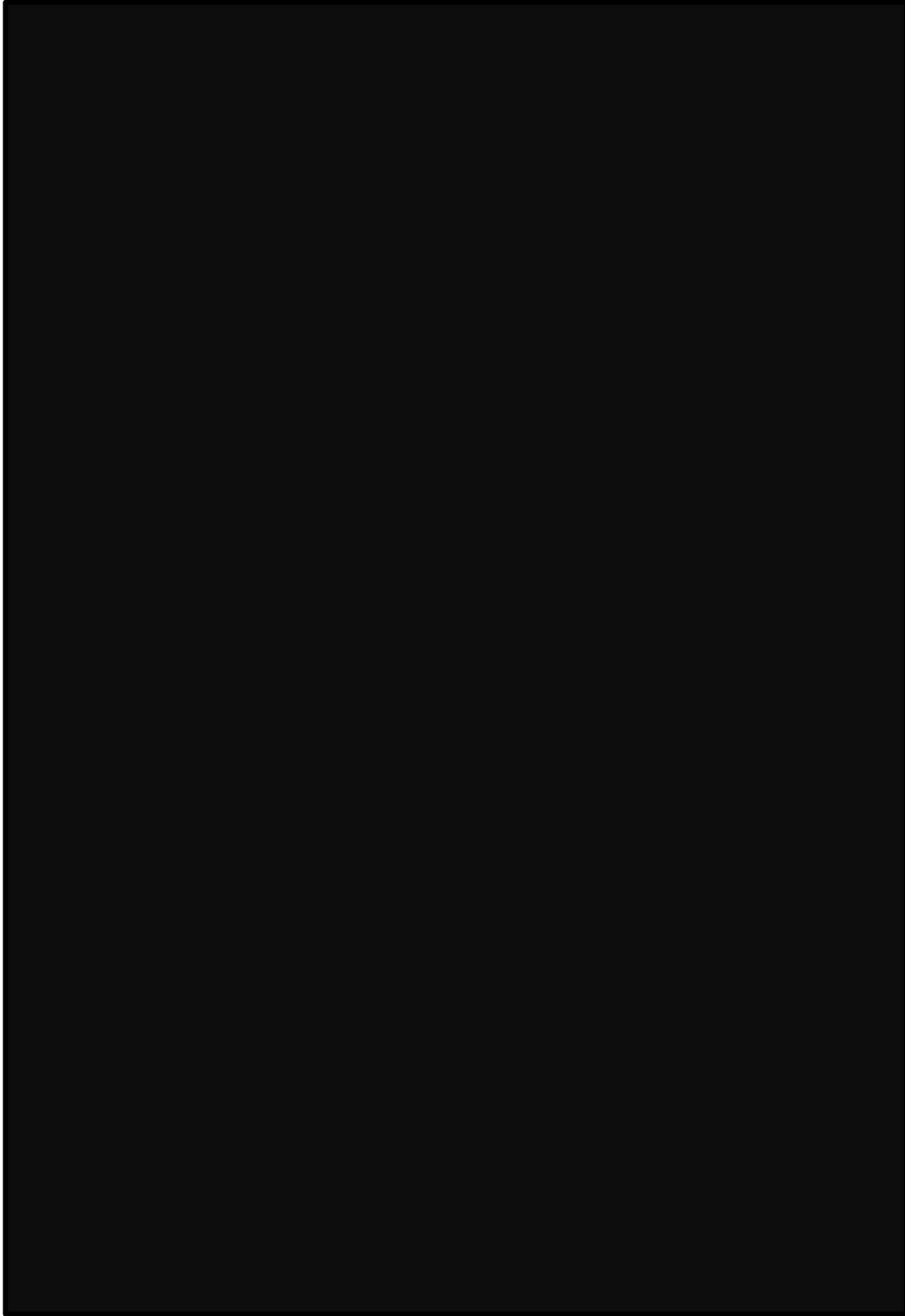


Figure 12: Overview of sites and PAD located within the study area. Background image source Google© 2013 and Land and Property Information NSW.

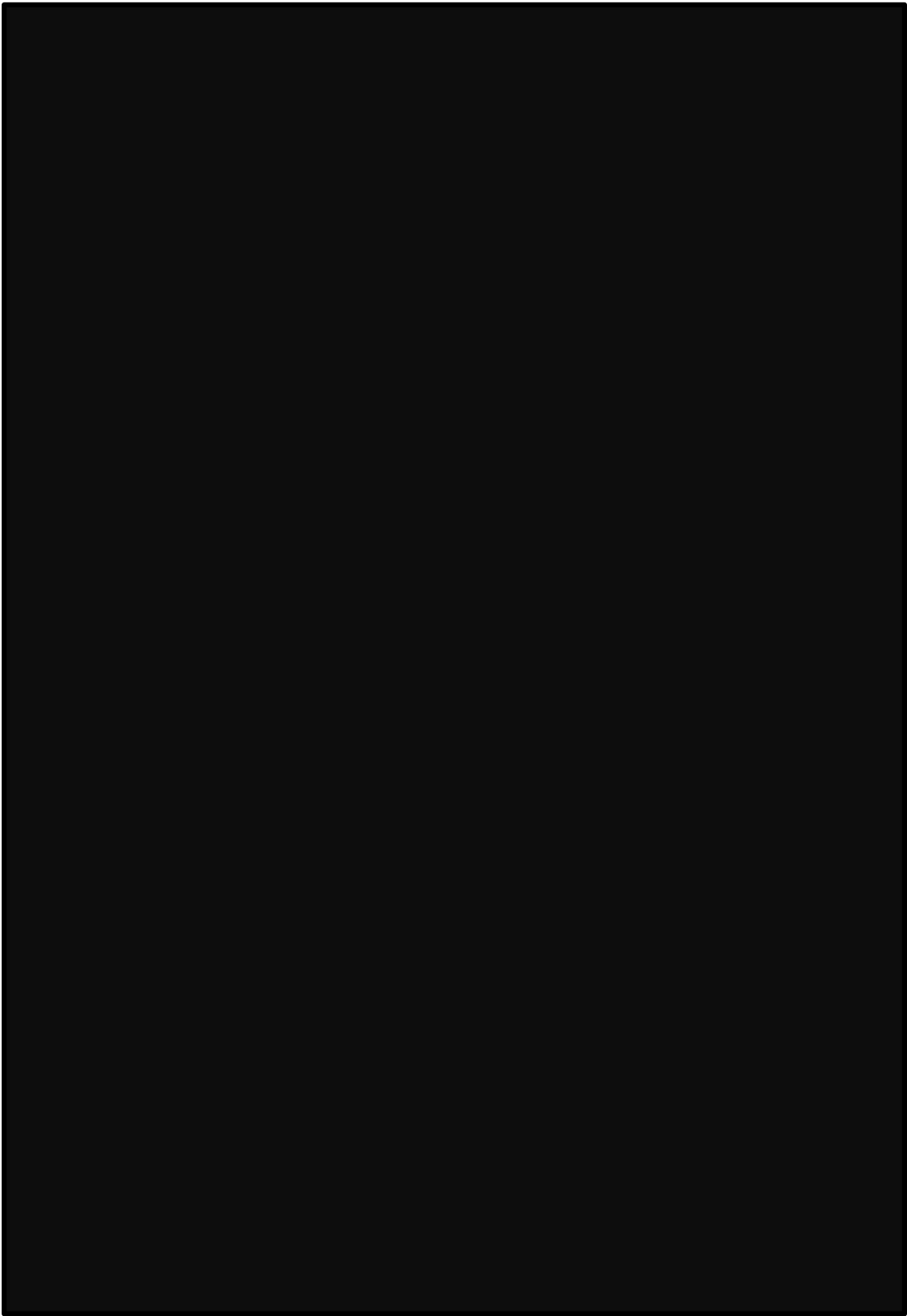


Figure 13: Location and extent of site 52-5-0484/52-5-0512. Background image sourced from Land and Property Information NSW.

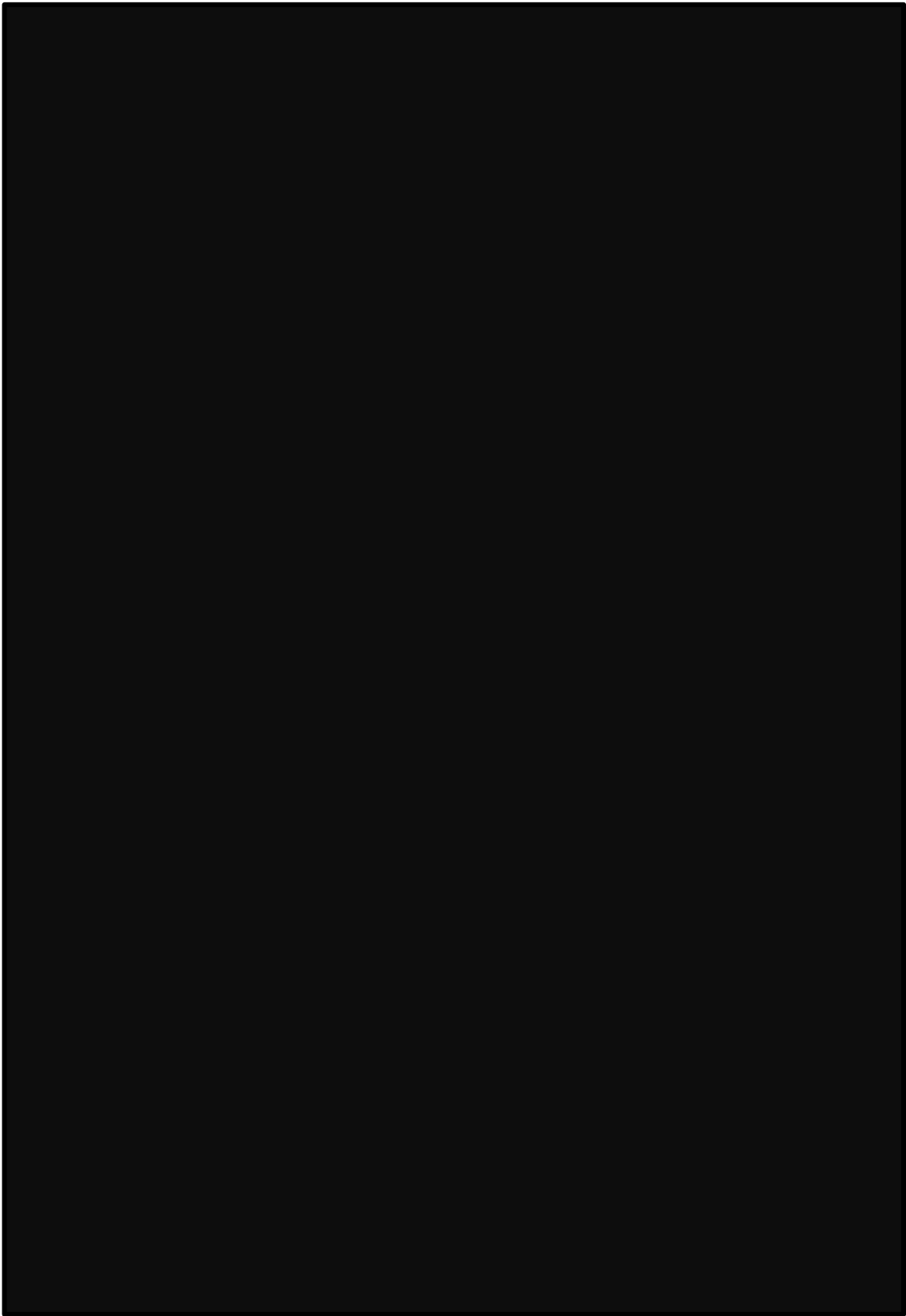


Figure 14: Location of site 52-5-0227. Background image sourced from Land and Property Information NSW.

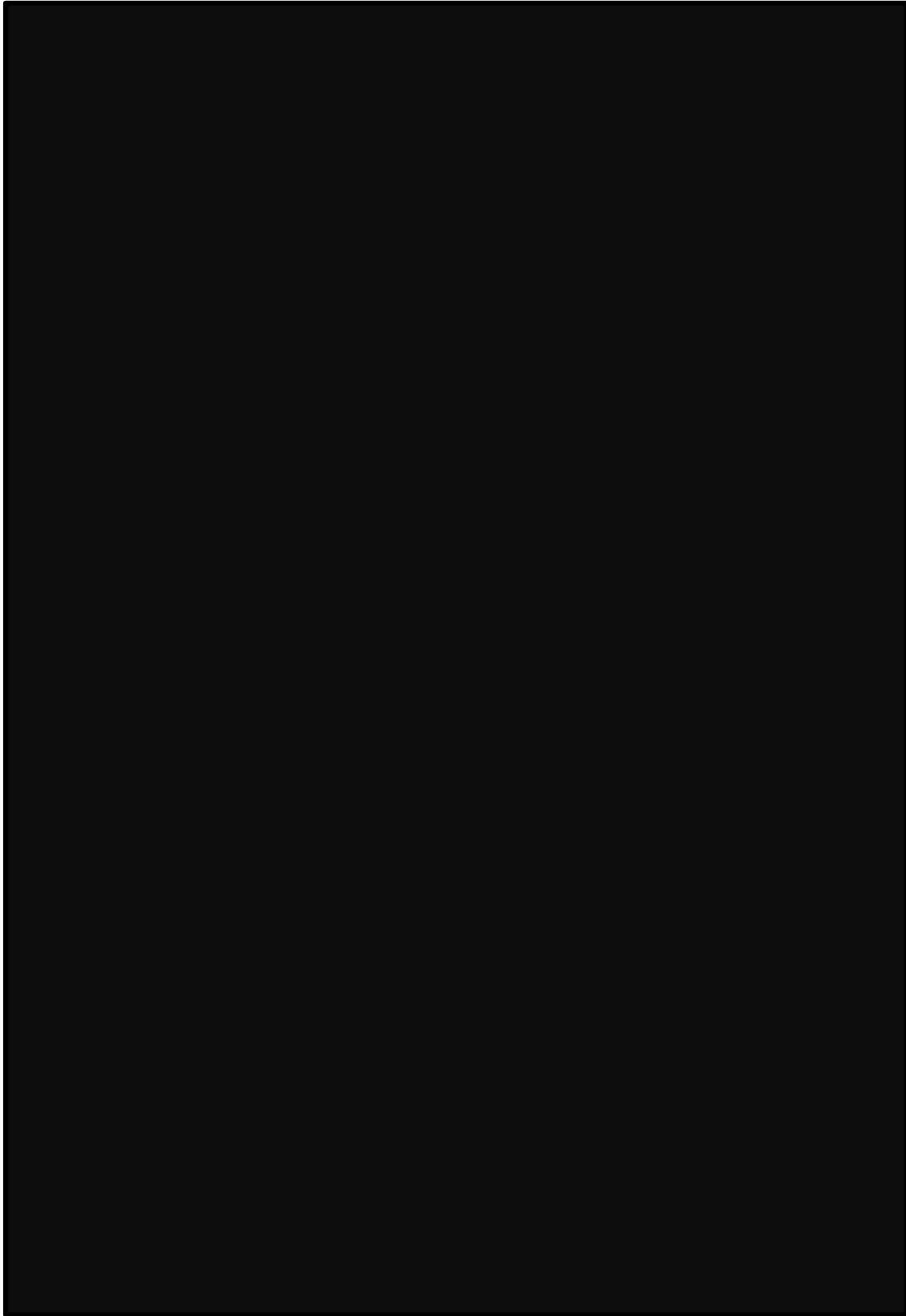


Figure 15: Location and extent of YTOF PAD 1. Background image sourced from Land and Property Information NSW.

6.4 Previously recorded Aboriginal sites

AHIMS site 52-5-0484/52-5-0512 (WDRA_AS_09)

Landform:	Crest
Coordinates:	
Site type:	Open artefact scatter
Site Area:	180 square metres

AHIMS site 52-5-0484/52-5-0512 comprises 89 artefacts scattered across an exposed area of 180 square metres. The assemblage consists of flakes, broken flakes, cores and flaked pieces. Raw materials include silcrete, chert, quartz, chalcedony, fine-grained siliceous and fine-grained volcanic. A1 and A2 soils were exposed at the surface in the area. According to AMBS (2006a: Table 37) this site has high archaeological potential. The potential to contain additional surface/subsurface deposit was identified. Some impacts from vehicle use in the known site area were noted at the time.

Site 52-5-0484/52-5-0512 was located during the current field survey using GPS coordinates and photographs. No artefacts were visible on the ground surface due to dense grass and vegetation cover. The presence of mounds across the site area indicates that some disturbance (e.g. dumping of rubbish and spoil) has occurred since the site was recorded.

Plate 25: View eastwards across site 52-5-0484/52-5-0512.



Plate 26: View north to crest on which site 52-5-0484/52-5-0512 is located.



AHIMS site 52-5-0227 (Macquarie Rivulet 1)

Landform:	Terrace
Coordinates:	
Site type:	Open artefact scatter
Site Area (original):	Unknown (site card states “artefacts scattered over park”)

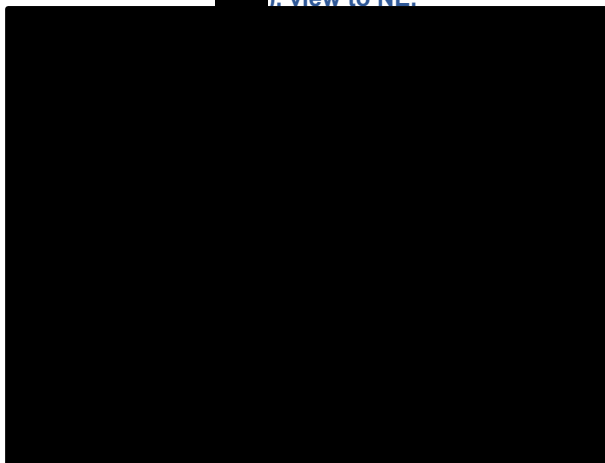
AHIMS site 52-5-0227 is an artefact scatter located on a terrace approximately 20 metres to the south of Macquarie Rivulet, within [REDACTED]. The site is described on the site card as a midden/artefact scatter, with artefacts scattered over the park. Artefacts include beach pebble flakes. Other artefact raw materials include chert, silcrete, fossilised wood and mudstone. Shell fragments of *Anadara trapezia* were noted to be scattered sparsely throughout the area. The recorders determined that possible surface disturbance may have occurred when the park was established; however, it is possible that undisturbed sub-surface material is present.

Site 52-5-0227 was located during the current field survey using GPS coordinates. No artefacts were visible on the ground surface. The terrace and creek flat have been heavily disturbed by landscaping and by the installation of a roadway, parking and picnic facilities associated with [REDACTED]. Immediately to the south of the terrace is an industrial development, where the land has been heavily disturbed and modified. Construction would also have impacted on the terrace landform. Although sub-surface artefacts may be present in the area, the high level of disturbance and the alluvial context mean that they are likely to have been redeposited.

Plate 27: View SW to approximate GPS coordinate location of site 52-5-0227.



Plate 28: Location of site 52-5-0227 ([REDACTED]), view to NE.



6.5 Newly recorded PAD

YTOF PAD 1

Landform:	Lower slope
Coordinates:	[REDACTED]
Site type:	PAD
Site Length:	85 metres (north-south)
Site Width:	70 metres (east-west)
Site Area:	6050 square metres

PAD 1 is positioned on a very gentle southwest-facing slope above a flat that extends to Frazers Creek. The PAD is located less than 200 metres to the east of the creek. The PAD area was densely grassed, leading to nil ground surface visibility. A dam is located approximately 50 metres to the east of the eastern edge of the PAD. The construction of this dam does not appear to have impacted on the PAD area. Other disturbances within the vicinity of the PAD are minimal, related to the installation of property fences and the use of the land for pastoral purposes. AMBS (2006a) found that eight of 24 archaeological sites identified within the WDRA were located on hill slopes. During test excavations within the WDRA it was determined that the highest number of artefacts was retrieved from a single test pit in a slope landform context. There is, therefore, potential for sub-surface artefacts to be present within the hill slope landform of PAD 1, particularly given the close proximity to Frazers Creek.

Plate 29: View east across PAD 1.



Plate 30: View west across PAD 1.



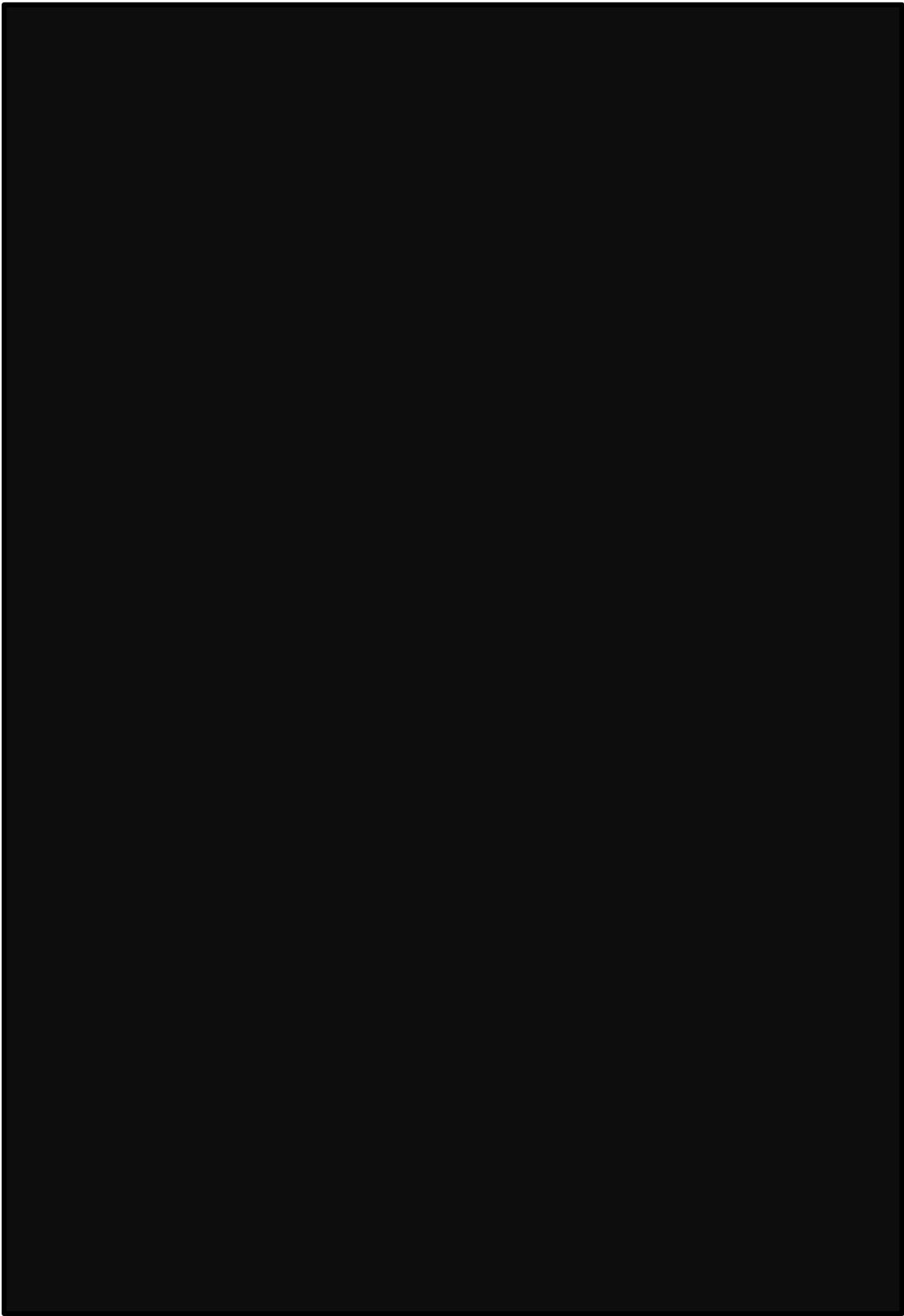


Figure 16: Sites and PAD within the study area. Background image source Google© 2013 and Land and Property Information NSW.

7.0 Analysis and discussion

7.1 Disturbance levels

Overall the study area has high levels of ground disturbance. The construction of roads and the railway, and associated ground modification, has resulted in disturbance along most of the study area. The northern sector (Survey Unit 1) has been extremely disturbed and modified due to the installation of the Princes Highway (M1), F6 Freeway and associated on/off ramps and bridges. The construction of the Illawarra Highway and Yallah Road has led to localised disturbance within Survey Units 1 and 2. Survey Unit 3 incorporates the highly disturbed road corridor along the eastern and western edges of the Illawarra Highway. The area at northern end of Survey Unit 4 has been subject to localised disturbance associated with the construction of Tongarra Road. Survey Units 5 and 6 in the eastern sector of the study area have been heavily impacted by Croome Road; the East West Link; associated roundabouts (Woollybutt Drive and Durgadin Drive); the truck stop; the major roundabout and on/off ramps at the intersection of the East West Link, Princes Highway and New Lake Entrance Road; and short stretches of the Princes Highway on each side of the roundabout.

All drainage channels within the study area, including Duck Creek, Macquarie Rivulet and Frazers Creek, have been heavily modified. Some modifications are associated with the construction of roads (e.g. the Princes Highway crossing over Duck Creek and Macquarie Rivulet; and the Illawarra Highway crossing over Frazers Creek). Other modifications are associated with dredging and the installation of dams (e.g. Frazers Creek). A section of Frazers Creek within the vicinity of the current study area has been noted by a previous study to have been dredged, resulting in the formation of an embankment (HLA 2007: 13). The flat and terrace immediately to the south of Macquarie Rivulet has been subject to extensive disturbance through landscaping and the installation of a roadway, parking and picnic facilities associated with Darcy Dunster Park. The construction of an industrial development immediately to the south of the terrace has also impacted on this area.

Substantial industrial development along much of the eastern edge of Survey Unit 2 has resulted in major disturbance to the area, including to part of the crest landform on which site 52-5-0484/52-5-0512 is located, although the site itself does not appear to have been impacted. A dairy complex and residence has caused localised disturbance within Survey Unit 3. Similarly, a residence and associated infrastructure has resulted in localised disturbance within Survey Unit 5. Landscaping and levelling within the pony club and sports ground areas in Survey Unit 4 have caused significant disturbance to the ground surface. The section of Survey Unit 6, south of the East West Link, between Woollybutt Drive and Durgadin Drive has been heavily modified through the installation of an artificial drainage channel and the construction of a levelled retention basin immediately to the south. Other localised disturbances within the study area have resulted from the installation of utilities such as an underground gas pipeline and

overhead transmission lines. Localised dumping of rubbish and mounding of earth was noted intermittently throughout the study area (e.g. in the area of site 52-5-0484/52-5-0512).

The study area to the south of Macquarie Rivulet is mostly located along an alluvial floodplain, which is subject to frequent inundation. Flat areas adjacent to drainage channels within the study area would also be subject to frequent flooding.

7.2 Archaeological potential

Archaeological potential is closely related to the levels of ground disturbance in the area. Other factors are also taken into account when assessing archaeological potential, such as whether artefacts were located on the surface, and whether the area is within a sensitive landform unit according to the predictive statements for the area.

Two Aboriginal sites were previously recorded within the study area. No new Aboriginal sites were located during the survey. One area of PAD (YTOF PAD 1) was identified during the survey.

Site 52-5-0484/52-5-0512 (WDRA_AS_09) was located during the current field survey using GPS coordinates and photographs. No artefacts were visible on the ground surface due to dense grass and vegetation cover. AMBS (2006a) originally assessed this site as demonstrating high archaeological potential. However, the presence of mounds across the site area observed during the current assessment indicates that extensive rubbish/spoil deposition and possible sub-surface impacts have occurred since the original recording. Due to the undulating nature of the deposits, the level of disturbance to the original ground surface is unknown. The remainder of the crest landform to the south of the site location appeared to be more intact. Based on the observed changes to the site area and possible surface impact since the original recording, the site area has been reassessed as demonstrating moderate archaeological potential.

Site 52-5-0227 (Macquarie Rivulet) was located during the current field survey using GPS coordinates. No artefacts were visible on the ground surface. The terrace and creek flat have been heavily disturbed by landscaping and by the installation of a roadway, parking and picnic facilities associated with [REDACTED]. Immediately to the south of the terrace is an industrial development, where the land has been heavily disturbed and modified. Construction of this would also have impacted on the terrace landform. Although sub-surface artefacts may be present in the area, the high level of disturbance and the alluvial context mean that they are likely to have been redeposited. Kelleher Nightingale Consulting (KNC) recently undertook an assessment of Aboriginal cultural heritage along the banks of the Hawkesbury River for the Windsor Bridge Replacement project. It was determined that collections of artefacts in active floodplain environments are likely to become archaeologically dilute due to aggrading processes (increased deposition of sediment) and/or displacement by flood events. This means that the integrity of single artefacts can never be certain and such environments therefore offer low levels of

archaeological significance (KNC 2012: 12). This finding supports our re-assessment of the archaeological potential of site 52-5-0227 as low.

As RMS requires management measures regarding archaeological potential to be based on the definition of PAD, areas of archaeological potential within the study area are described in terms of PAD instead of in terms of a gradient from low to high archaeological potential or sensitivity. One area of PAD was identified during this study (YTOF PAD 1). Because of the sensitivity of the locality (very gentle slope less than 200 metres from Frazers Creek) and low level of ground disturbance, there is potential for sub-surface artefacts to be present within PAD 1. This assessment is supported by the findings of AMBS (2006a) that eight of 24 archaeological sites identified within the WDRA were located on hill slopes. Further, during test excavations within the WDRA it was determined that the highest number of artefacts was retrieved from a single test pit in a slope landform context. YTOF PAD 1 was assessed as having a high archaeological potential.

Several other intact landforms were identified within the study area, but these were determined to be of low archaeological potential. The hill slopes to the south of the crest in Survey Unit 2 were moderately steep and would not have been suited to Aboriginal occupation. The crest and slope formations within Survey Unit 6 have been heavily disturbed during road construction and remnant topsoils were very shallow. These areas are therefore assessed as having a low archaeological potential. The alluvial floodplain and creek flats would not have been suited to occupation due to frequent inundation, and therefore have a low archaeological potential. The remainder of the study area has low archaeological potential due to the high levels of ground disturbance.

No shell midden or scarred tree Aboriginal sites were observed during the field survey. No specific areas for burials were identified during the field survey. As burials have the potential to occur across the landscape, further stakeholder consultation during Stage 3 of the PACHCI should include a request for cultural information relating to the study area, including any knowledge of potential burial locations.

Archaeological potential of areas not surveyed

A field investigation of the properties not accessible for the current investigation would be required to verify the archaeological potential of those areas.

A preliminary assessment of archaeological potential within those inaccessible properties is outlined below based on background research and observations made of similar landforms during the field survey.

Industrial area between the Illawarra Highway and the Princes Highway

The industrial estate, which included a nursery and other businesses, was located across a terrace landform between two portions of Survey Unit 3. The industrial area appeared highly disturbed with

building construction, landscaping, and extensive areas of excavation associated with the nursery. The preliminary assessment of archaeological potential within the industrial area is low.

Boles, Delmo and Gallagher properties

The Boles, Delmo and Gallagher properties demonstrate a continuation of the flat, terrace and drainage channel landforms assessed in Survey Units 3 and 4. No areas of archaeological potential were identified in either Survey Units 3 or 4. The low-lying portions of both properties would likely be inundated during high water events.

Site integrity in low-lying areas subject to frequent inundation is likely to be low. Frequent inundation and movement / deposition of sediments are likely to have resulted in the dilution of any sub-surface Aboriginal objects in a deep homogenous deposit. Portions of the surveyed properties had been affected by historical period landform modification, including creek dredging and re-alignment.

An Aboriginal heritage assessment was conducted within the Delmo property by HLA-Envirosciences in 2007. This includes the portion of that property within the Yallah to Oak Flats corridor. HLA identified on isolated Aboriginal object on the bank of Frazers Creek and approximately 85 metres east of the current study area. HLA concluded that the artefact was likely to have been disturbed by dredging activities and suggested that the property was likely to have been heavily modified by flooding events and historical period landform modifications.

Based on observations during the field survey within Survey Units 3 and 4, and the results of field investigation by HLA, the preliminary assessment of archaeological potential within the Boles, Delmo and Gallagher properties is low

Cupocchiano Property

The Cupocchiano property is a cleared area with limited built infrastructure. The property is situated on a gently sloping crest landform at the base of a steep incline and local high point of approximately 120 metres AHD 300 metres to the south of the Yallah to Oak Flats corridor. One ephemeral drainage channel flows north through the portion of the property within the road corridor.

A disturbed area associated with several built structures and landform modification was located in the northeast corner of the property. The remainder of the property within the road corridor is potentially more intact.

The distance of the corridor within the Cupocchiano property from reliable water supply indicates that occupation of this area is unlikely to have resulted in a high density sub-surface archaeological deposit. The closest reliable water source was Frazers Creek approximately 700 metres away. However, there is potential for any deposited Aboriginal objects to have remained relatively *in situ* within the sandy loam



soils across the relatively undisturbed portion of the property. The preliminary assessment of archaeological potential within the Cuppocchiano property is low-moderate.

8.0 Statutory requirements

This study has been undertaken in the context of several items of legislation that relate to Aboriginal heritage and its protection in New South Wales.

National Parks and Wildlife Act (1974)

The *National Parks & Wildlife Act 1974*, administered by the OEH provides statutory protection for all Aboriginal 'objects' (consisting of any material evidence of the Aboriginal occupation of NSW) under Section 90 of the Act, and for 'Aboriginal Places' (areas of cultural significance to the Aboriginal community) under Section 84.

The protection provided to Aboriginal objects applies irrespective of the level of their significance or issues of land tenure. However, areas are only gazetted as Aboriginal Places if the Minister is satisfied that sufficient evidence exists to demonstrate that the location was and/or is, of special significance to Aboriginal culture.

The Act was amended in 2010 and, as a result, the legislative structure for seeking permission to impact on heritage items has changed. A section 90 permit is now the only Aboriginal Heritage Impact Permit (AHIP) available and is granted by the OEH. Various factors are considered by OEH in the AHIP application process, such as site significance, Aboriginal consultation requirements, ESD principles, project justification and consideration of alternatives. The penalties and fines for damaging or defacing an Aboriginal object have also recently been increased.

As part of the administration of Part 6 of the Act OEH regulatory guidelines on Aboriginal consultation are in place, which are outlined in the Consultation Requirements. Guidelines are also in place for the processes of due diligence - *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* (2010), and for investigation of Aboriginal objects – the Code of Practice in accordance with the 2010 amendment to the Act.

There are no gazetted Aboriginal Places within the study area. There are two registered Aboriginal sites within the study area which are subject to the provisions of the National Parks and Wildlife Act 1974. All Aboriginal objects, whether recorded or not are protected under the Act.

Heritage Act (1977)

The *Heritage Act 1977* is administered by the Department of Premier and Cabinet and protects the natural and cultural heritage of NSW. Generally this Act only pertains to Aboriginal Heritage if it is listed on the State Heritage Register, or subject to an interim heritage order.



There are no Aboriginal heritage items listed on the State Heritage Register within the study area.

Aboriginal Land Rights Act (1983)

The Aboriginal Land Rights Act 1983 is administered by the NSW Department of Human Services - Aboriginal Affairs. This Act established Aboriginal Land Councils (at State and Local levels). These bodies have a statutory obligation under the Act to; (a) take action to protect the culture and heritage of Aboriginal persons in the council's area, subject to any other law, and (b) promote awareness in the community of the culture and heritage of Aboriginal persons in the council's area.

There are no lands held, or currently claimed, by the Local Aboriginal Land Council under the Aboriginal Land Rights Act 1983 within the study area.

Native Title Act (1994)

The Native Title Act 1994 was introduced to work in conjunction with the Commonwealth Native Title Act. Native Title claims, registers and Indigenous Land Use Agreements are administered under the Act.

There are no Native Title claims registered within the study area.

9.0 Significance assessment

9.1 Assessment criteria

Archaeological significance refers to the archaeological or scientific importance of a landscape, site or area. This is characterised using archaeological criteria such as archaeological research potential, representativeness and rarity of the archaeological resource and potential for educational values. These are outlined below:

- Research potential: does the evidence suggest any potential to contribute to an understanding of the area and/or region and/or state's natural and cultural history?
- Representativeness: how much variability (outside and/or inside the subject area) exists, what is already conserved, how much connectivity is there?
- Rarity: is the subject area important in demonstrating a distinctive way of life, custom, process, land-use, function or design no longer practised? Is it in danger of being lost or of exceptional interest?
- Education potential: does the subject area contain teaching sites or sites that might have teaching potential?

Cultural values and significance would be discussed by the Aboriginal groups during ongoing Aboriginal consultation for the project and would be detailed in the Cultural Heritage Assessment Report during Stage 3 of the RMS PACHCI.

9.2 Archaeological significance assessment

The archaeological significance of site 52-5-0227 has been determined based on the findings of the previous recorders, observations made during the current field survey, and on the type and distribution of other previously recorded Aboriginal sites in the local context. This artefact scatter was found to be located in a disturbed context on a floodplain and was therefore assessed as having a low archaeological significance.

The significance of site 52-5-0484/52-5-0512 (WDRA_AS_09) could not be accurately assessed based on observations in the field. The archaeological potential of the site was assessed to be moderate. The current levels of sub-surface disturbance are unknown and therefore further archaeological investigations would be required prior to assessments of representative, rarity, educational and archaeological values can be known. The archaeological significance of the site is therefore unknown.

As the identification of the PAD (YTOF PAD 1) was based on the research potential of the designated area, the archaeological significance of the PAD cannot be determined until the results of further archaeological investigations are known. The PAD was assessed as having a high archaeological potential.

A summary of the significance values of each recorded site and PAD within the study area is outlined in Table 5, and discussed below.

Table 5: Summary of significance values

Site name	Research Potential	Scientific / Archaeological Value	Representative Value	Rarity Value	Overall Significance
52-5-0484/ 52-5-0512 (WDRA_AS_09)	Moderate	Unknown	Unknown	Unknown	Unknown
52-5-0227 (Macquarie Rivulet 1)	Low	Low	Low	Low	Low
YTOF PAD 1	High	Unknown	Unknown	Unknown	Unknown

52-5-0484/52-5-0512 (WDRA_AS_09)

The surface artefact scatter as originally recorded indicates a relatively extensive site on a crest landform context. The site was originally assessed by AMBS (2006a) as having high archaeological potential. However, ground surface visibility was very low during the current survey and no artefacts were visible on the surface. Mounds were observed across the site area, indicating that extensive rubbish/spoil deposition and possible sub-surface impacts have occurred since the original recording. Due to the undulating nature of the deposits, the level of disturbance to the original ground surface is unknown. The remainder of the crest landform to the south of the site location appeared to be more intact. Based on the changes to the site area and possible sub-surface impact since the original recording, the site area has been reassessed as demonstrating moderate archaeological potential. Further archaeological investigation would collect additional information on the archaeological, representative and rarity values of the site and therefor to assess archaeological significance. The site has potential to provide information on the nature of Aboriginal occupation/utilisation of elevated crest landforms.

52-5-0227 (Macquarie Rivulet 1)

Artefact scatter 52-5-0227 has been assessed as demonstrating low archaeological significance. The terrace on which the site is located has been heavily disturbed by landscaping and by the installation of a roadway, parking and picnic facilities associated with [REDACTED]. Construction of the industrial development to the south of the terrace would also have impacted on the area. Although sub-surface artefacts may be present in the area, the high level of disturbance and the alluvial context mean that their integrity cannot be assured. As previously discussed, active floodplain environments offer low levels of archaeological significance. This factor, combined with the high level of disturbance observed in the area, has led to archaeological significance of site 52-5-0227 being assessed as low.

PAD

The identified PAD (YTOF PAD 1) has been assessed as demonstrating high research potential. The PAD area has the potential to provide information on the nature of occupation in the area and enable a comparative analysis with other sites in the vicinity. The archaeological values, representative and rarity values cannot be accurately determined until the results of further archaeological investigation are known.

Remainder of the study area

The remainder of the survey area was generally disturbed or included areas of low archaeological potential and low rarity and representative values. The remainder of the survey area was assessed as demonstrating low archaeological significance.

10.0 Impact assessment

10.1 Impact assessment

An impact assessment cannot yet be made as there are no development plans available. Once a concept design has been developed an updated impact assessment would be added to this report.

11.0 Management and Mitigation Measures

11.1 Guiding principles

The overall guiding principle for cultural heritage management is that where possible Aboriginal sites would be conserved. If conservation is not practical, measures would be taken to mitigate against impacts to Aboriginal sites.

The nature of the mitigation measures recommended is primarily based on an assessment of archaeological significance. The final recommendations would also be informed by cultural significance to be discussed by the Aboriginal stakeholder groups during RMS PACHCI Stage 3 consultation.

11.2 Mitigation measures

Mitigation measures recommended vary depending on the assessment of archaeological significance of an area, which is based on the research potential, rarity, representativeness and educational value. In general the significance of a site would involve the following mitigation measures:

- Low archaeological significance – No further investigations required. An Aboriginal Heritage Impact Permit (AHIP) would be required to impact the site before works can commence.
- Moderate archaeological significance – Conservation where possible. If conservation was not practicable further archaeological investigation would be required such as salvage excavation or surface collection. An AHIP would be required if Aboriginal objects are present.
- High archaeological significance – Conservation as a priority. An AHIP would be required only if other practical alternatives have been discounted. Conditions of this AHIP would depend on the nature of the site, but may include comprehensive salvage excavations.

Site 52-5-0227 has been assessed as demonstrating low archaeological significance therefore no further archaeological investigations are required. If it is not practicable to avoid site 52-5-0227 an AHIP will be required prior to impacts occurring.

The archaeological significance of site 52-5-0484/52-5-0512 and PAD YTOF PAD 1 is at present unknown. Site 52-5-0484/52-5-0512 has been assessed as having moderate archaeological potential and the PAD (YTOF PAD 1) has been assessed as having high archaeological potential. If impacts to the site or PAD cannot be avoided by the proposed development, test excavation under the OEH Code of Practice would be undertaken in order to determine whether sub-surface Aboriginal objects are present in each area. The purpose of these excavations would be to assess the significance of the PAD and site 52-5-0484/52-5-0512, not to mitigate against impacts.



If the site or PAD area was found to be of a low archaeological significance, there would be no Aboriginal heritage constraints on the proposed development in those areas. However, an AHIP would be required prior to any works commencing.

If the site or PAD area was found to have a moderate archaeological significance it is likely that there would be no constraints on the proposed development in those areas, but that archaeological salvage excavations would be recommended to mitigate against any proposed impacts as a condition of an AHIP. An AHIP would be obtained from OEH prior to works commencing.

If the site or PAD area was found to be of high archaeological significance, this would inform the decisions made during Stage 3 of the RMS PACHCI regarding the future management of the areas, such as conservation where possible. It is therefore important to understand the nature of the buried archaeological deposits within the site and PAD area before further recommendations are made.

12.0 Recommendations

The following recommendations were based on consideration of:

- Statutory requirements under the *National Parks and Wildlife Act 1974* as amended.
- The results of the background research, site survey and assessment.
- The interests of the Aboriginal stakeholder groups.
- The likely impacts of the proposed development.

It was found that:

- Two artefact scatter sites (AHIMS sites 52-5-0484/52-5-0512 and 52-5-0227) were previously recorded within the study area. Site 52-5-0484/52-5-0512 has been assessed as having moderate archaeological potential and an unknown archaeological significance. Site 52-5-0227 has been assessed as having low archaeological significance.
- One area of high archaeological potential (YTOF PAD 1) was located within the study area. The PAD has been assessed as having a high archaeological potential and an unknown archaeological significance.

It is therefore recommended that:

- If site 52-5-0227 was to be impacted by the proposed development an AHIP will be required prior to impacts occurring. No further archaeological investigations would be required at this site.
- If site 52-5-0484/52-5-0512 was to be impacted by the proposed development test excavations under the OEH Code of Practice would be necessary. Test excavations would be required to inform an assessment of archaeological significance. If the test excavations show that the site has low archaeological significance, there would be no constraints on impacts (apart from an AHIP if required). If the site was shown to have a moderate archaeological significance, further mitigation measures such as salvage excavation and an AHIP may be recommended before impacts were to occur. If the site was shown to have high archaeological significance, this would inform the decisions made during Stage 3 of the RMS PACHCI regarding the future management of the site.
- If the PAD area (YTOF PAD 1) were to be impacted, test excavation under the OEH Code of Practice would be necessary. Test excavations would be required to inform an assessment of archaeological significance. If the test excavations show that the PAD has low archaeological significance, there would be no constraints on impacts (apart from an AHIP if required). If the PAD was shown to have a moderate archaeological significance, further mitigation measures such as salvage excavation and an AHIP may be recommended before impacts were to occur. If the PAD was shown to have high



archaeological significance, this would inform the decisions made during Stage 3 of the RMS PACHCI regarding future management of that area.

- If impacts are proposed to the recorded Aboriginal sites and/or PAD area, including test excavations under the OEH Code of Practice, Stage 3 PACHCI, including comprehensive Aboriginal consultation, would be initiated by RMS. A Cultural Heritage Assessment Report (CHAR) would be prepared as part of the Stage 3 PACHCI.
- If Aboriginal objects are located at any stage outside areas where test excavations are being undertaken, or outside areas for which an AHIP is granted, work would stop immediately and the RMS *Unexpected Archaeological Finds Procedure 2011* would be followed. If human remains are located during any works associated with the project within the study area the RMS *Unexpected Archaeological Finds Procedure 2011* would be followed.
- If the project design is changed and areas not surveyed are to be impacted, or other Aboriginal sites not identified are to be impacted, further archaeological assessment would be required.
- Field survey of the inaccessible properties should be conducted to update the preliminary assessment of archaeological potential for those areas outlined in this report.

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