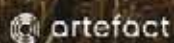


Energy from Waste Facility, Eastern Creek

Aboriginal Cultural Heritage
Assessment Report

Report to Urbis
March 2015



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EXECUTIVE SUMMARY

The Next Generation NSW (the Proponent), propose to develop an Energy from Waste (EFW) facility at Eastern Creek. The proposed EFW works will include the construction of an Electricity Generation Plant; with ancillary works related to the preparation and subsequent operation of the EFW. The works will be located within Lots 1 to 2 of DP1145808, in the Blacktown City Council Local Government Area (LGA). The subject site is bounded by the M4 Western Motorway, the Hanson Wallgrove Quarry, transmission line easement and Archbold Road (Figure 1)

An Aboriginal Archaeological Technical Report (ATR) and Aboriginal Cultural Heritage Assessment Report (ACHAR) was prepared by Godden Mackay Logan (GML) in 2014 for the Eastern Creek EFW Facility Environmental Impact Statement (EIS). A copy of the ATR is provided in Appendix A and the ACHAR in Appendix B. GML identified one area of moderate archaeological potential and two areas of high archaeological potential (2014a:40). However, only one of these areas of archaeological potential will be directly impacted by the proposed works. The area is known as EFW South (AHIMS 45-5-4491), and is located on an elevated area at the confluence of three waterlines in the southeast corner of the subject site (Figure 4). Therefore GML recommended that an archaeological test excavation was required to assess the nature, extent, condition and integrity of the site (2014a:49).

Following the preparation of test excavation methodology (Artefact 2014) for EFW South, archaeological test excavation was conducted over a period of four days at the proposed EFW Facility. Test excavation of PAD site EFW South (AHIMS 45-5-4491) retrieved an assemblage of fourteen artefacts from nine of the thirty-seven 500x500 mm excavation units. The Archaeological Test Excavation Report is included as Appendix C.

Artefact Heritage has been engaged by Urbis to prepare an updated addendum to 2014 ACHAR prepared by GML, to incorporate the additional Aboriginal consultation and results of test excavation.

Overview of findings

The following recommendations were based on consideration of:

- Statutory requirements under the EP&A Act 1979.
- The requirements of the DGRs.
- The results of background research, archaeological test excavation and assessment.
- The likely impacts of the proposed development.
- The interests of Aboriginal stakeholders.

It was found that:

- EFW South (45-5-4491) will be partially impacted by the proposed works. Based on the ATR (GML 2014a) and the results of test excavation, this site has been assessed as having low archaeological significance. Impacts would result in partial loss of value.
- The intrinsic values of Archbold Road 1 (45-5-4492) and Archbold Road 2 (45-5-4493) will be indirectly impacted by the modification of the study area. However there will be no ground surface impact within these areas as part of the proposed development.

It is therefore recommended that:

- No further archaeological investigation of EFW South (45-5-4491) is required prior to impacts.
- Archbold Road 1 (45-5-4492) and Archbold Road 2 (45-5-4493) are located outside of the development footprint and will be retained. Impact to this area should be avoided during proposed works, by designating these areas conservation zones. All contractors working in the area should be made aware of its location to avoid unintentional impacts.
- If Aboriginal skeletal material is uncovered during construction the requirements of Section 3.6 of the OEH code of practice would be followed.
- The retrieved test excavation artefact assemblage will be reburied at a nearby location that will not be impacted by any future development works. The area selected as a location for reburial is the portion of EFW South (45-5-4491) that falls within the Riparian Setback (Figure 6); as it will be retained as part of the proposed development.
- When the artefact assemblage is reburied, a site recording form should be submitted to the OEH AHIMS site register within details of the location of the assemblage.
- A draft version of this ACHAR was forwarded to registered Aboriginal stakeholders on 26 February 2015 for review and comment.

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APPENDIX A:	GML 2014 - Aboriginal Archaeological Technical Report
APPENDIX B:	GML 2014 - Aboriginal Cultural Heritage Assessment Report
APPENDIX C:	Artefact 2014 - Archaeological Test Excavation Report
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1.0 INTRODUCTION AND BACKGROUND

1.1 Introduction

The Next Generation NSW (the Proponent), propose to develop an Energy from Waste (EFW) facility at Eastern Creek. The proposed EFW works will include the construction of an Electricity Generation Plant; with ancillary works related to the preparation and subsequent operation of the EFW. The works will be located within Lots 1 to 2 of DP1145808, in the Blacktown City Council Local Government Area (LGA). The subject site is bounded by the M4 Western Motorway, the Hanson Wallgrove Quarry, transmission line easement and Archbold Road (Figure 1).

An Aboriginal Archaeological Technical Report (ATR) and Aboriginal Cultural Heritage Assessment Report (ACHAR) were prepared by Godden Mackay Logan (GML) in 2014 for the Eastern Creek EFW Facility Environmental Impact Statement (EIS). A copy of the ATR is provided in Appendix A and the ACHAR in Appendix B. GML identified one area of moderate archaeological potential and two areas of high archaeological potential (2014a:40). However, only one of these areas of archaeological potential will be directly impacted by the proposed works. The area is known as EFW South (AHIMS 45-5-4491), and is located on an elevated area at the confluence of three waterlines in the southeast corner of the subject site (Figure 4). Therefore GML recommended that an archaeological test excavation was required to assess the nature, extent, condition and integrity of the site (2014a:49).

Following the preparation of a test excavation methodology (Artefact 2014) for EFW South, archaeological test excavation was conducted over a period of four days at the proposed EFW Facility. Test excavation of PAD site EFW South (AHIMS 45-5-4491) retrieved an assemblage of fourteen artefacts from nine of the thirty-seven 500x500 mm excavation units. The Archaeological Test Excavation Report is included as Appendix C.

Artefact Heritage has been engaged by Urbis to prepare an updated addendum to 2014 ACHAR prepared by GML, to incorporate the additional Aboriginal consultation and results of test excavation.

1.2 Objectives of this ACHAR

The Director-General's Environmental Assessment Requirements (DGRs) for the Eastern Creek EFW facility required an Aboriginal Heritage Assessment as part of the EIS. An Aboriginal Archaeological Technical Report (ATR) and Aboriginal Cultural Heritage Assessment Report (ACHAR) was prepared by Godden Mackay Logan (GML) in 2014, which recommended archaeological test excavation. The main objective of this addendum ACHAR is provide the results of the archaeological test excavation and additional stakeholder consultation, to meet the requirements of the DGRs.

This addendum report includes:

- An updated description of the Aboriginal community involvement and Aboriginal consultation
- Details of archaeological test excavation results
- A significance assessment of the study area including cultural and archaeological values
- An impact assessment to the significance of Aboriginal heritage values of all identified Aboriginal sites within the study area.
- Provision of recommendations for management and mitigation measures for Aboriginal heritage values

This addendum ACHAR does not include background information including: archaeological survey, environmental background, ethnohistory or review of the archaeological background. For full details, please see the original ACHAR, prepared by GML (2014b).

1.3 Proposed Development

The proposed development involves the construction and operation of an Electricity Generation Plant. The proposal will result in an Energy from Waste Plant using as fuel, residual waste which would otherwise be land filled, to allow for a 'green' electricity generation facility. The plant, powered by burning non-recyclable combustible waste material, will have a capacity for up to 1.35 million tonnes of waste material.

Further to the EFW Facility, the proposal includes the adoption of a plan of subdivision (Figure 2) and the following ancillary works:

- Earthworks associated with the balance of the site
- Internal roadways
- Provision of a direct underpass connection (Precast Arch and Conveyor Culvert) between TNG Facility and the Genesis Xero Waste Facility
- Staff amenities and ablutions
- Staff car parking facilities
- Water detention and treatment basins
- Services (Sewerage, Water Supply, Communications, Power Supply).

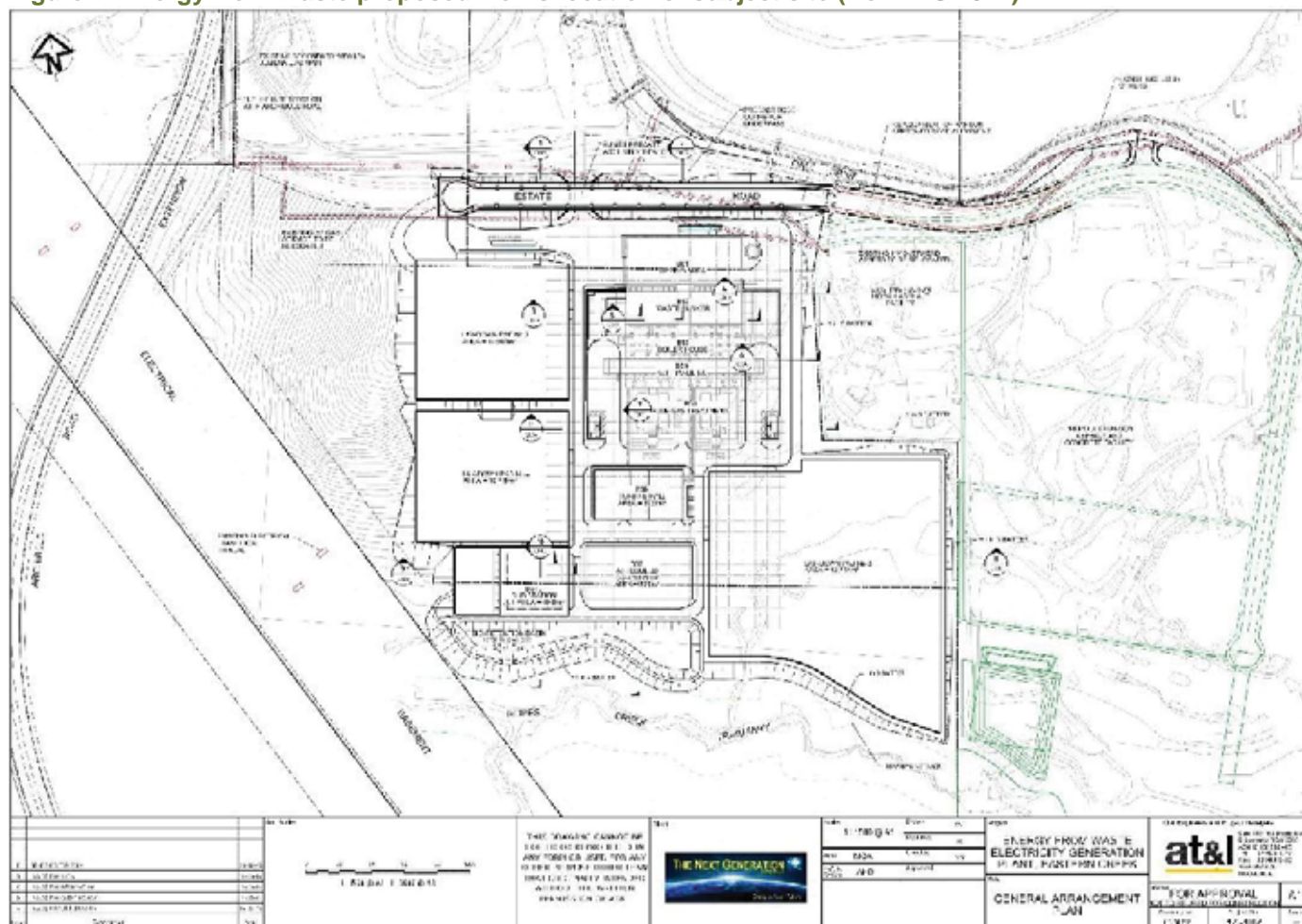
1.4 Investigators and Contributors

Alexander Timms, Archaeologist at Artefact Heritage, prepared this report with management input from Principal Archaeologist Dr Sandra Wallace.

Figure 1: General location of study area



Figure 2: Energy from Waste proposed works location of subject site (from EIS 2014)



1.5 Statutory Requirements

National Parks and Wildlife Act (1974) (NPW Act)

The NPW Act, 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 NPW 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 increased.

As this project is being assessed under Part 4 Division 4.1 of the EP&A Act 1979 permits issued under the NPW Act 1974 are not required.

Environmental Planning & Assessment Act (1979) (EP&A Act)

The proposal will be assessed under Part 4, Division 4.1 of the EP&A Act, which establishes an assessment and approval regime for State Significant Development (SSD). Part 4, Division 4.1 applies to development that is declared to be SSD by a State Environmental Planning Policy (SEPP). Section 89J of the EP&A Act specifies that approvals or permits under section 90 of the NPW Act 1974 are not required for approved SSD.

2.0 DESCRIPTION OF THE AREA

2.1 Location of the Study Area

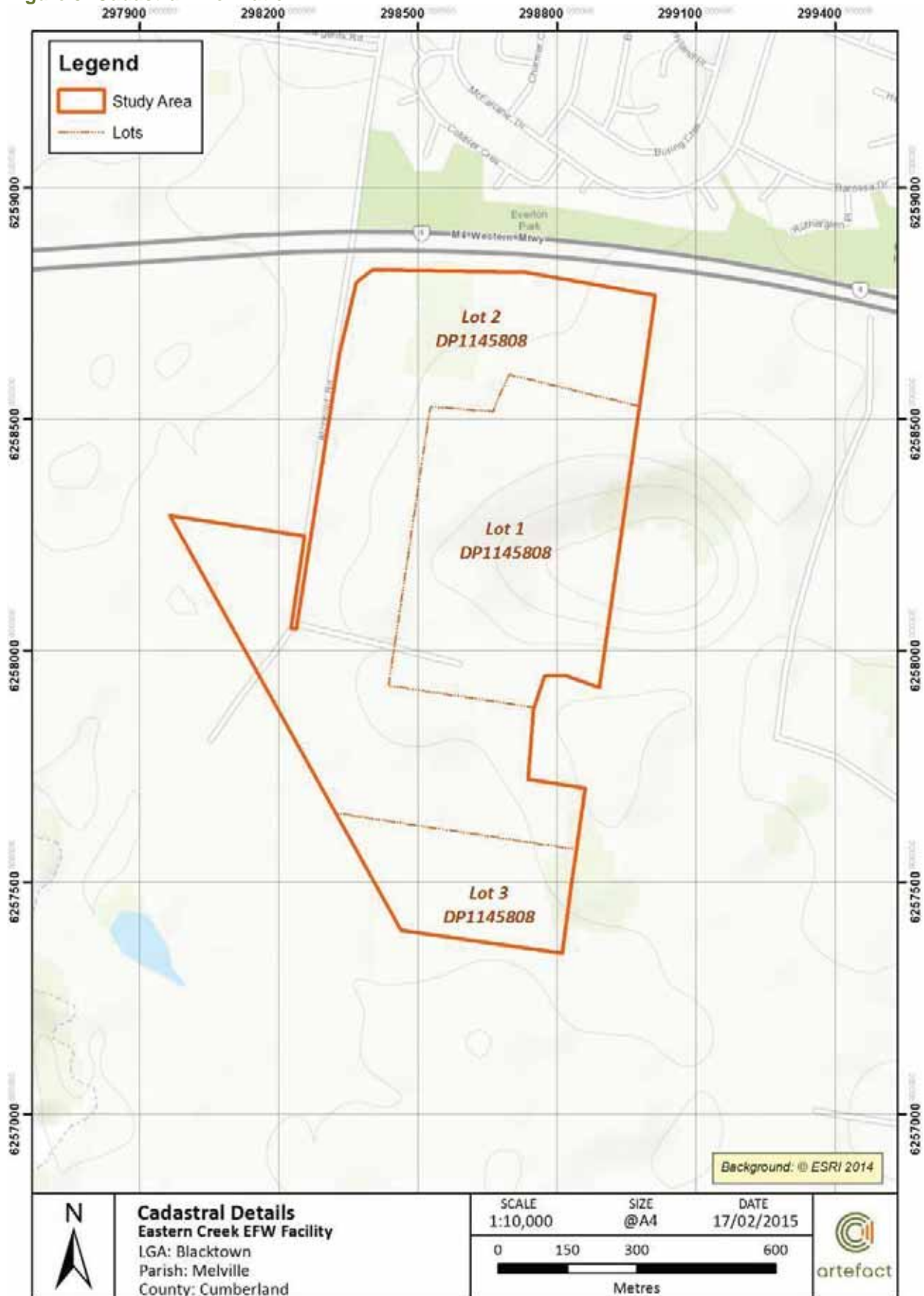
The study area is located within the Blacktown City Council Local Government Area in the County of Cumberland, Melville Parish (Figure 3).

2.2 Environmental Context

The study area is located on the undulating floodplain between Ropes Creek (450 metres to the west) and Eastern Creek (2.7 kilometres to the east). The study area is made up of low elevation undulating land, with a slight ridge in the running north-south through the southeast portion of the study area. There are also a number of gentle slopes in the northwest and north portions of the study area, associated with low hills outside of the study area. To the west the terrain flattens out towards the floodplain. Overall, the landform units within the study area range from alluvial flats, to gentle ridges, slopes and gullies.

The underlying geology of the study area consists of late Triassic period Bringelly shale deposits; which consists of shale, claystone, laminate, lithic sandstone, rare coal and tuff (Clark and Jones 1991). The study area is within the Blacktown soil landscape; which generally consists of shallow duplex soils over a clay base.

Figure 3: Cadastral information



2.3 Identified Aboriginal Objects

Three sites are located within the study area, which were identified by GML during an archaeological survey (GML 2014a). A summary of each site is provided below.

2.3.1 Archbold Road 1 (45-5-4492)

Archbold Road 1 is located in the north portion of the study area. The site area combines three previously recorded sites that had not been registered with AHIMS (Brayshaw and Haglund 1996, JMcD 2002). During the survey GML identified two surface artefacts (one silcrete and one quartz) and large PAD with a high archaeological potential (2014a:35). The location of this site is shown in Figure 4.

2.3.2 Archbold Road 2 (45-5-4493)

Archbold Road 2 is located in the northwest portion of the study area. During the survey GML identified three surface artefacts and a large PAD with a moderate archaeological potential (2014a:36). The location of this site is shown in Figure 4.

2.3.3 EFW South (45-5-4491)

EFW South, was located in the southeast portion of the study area. The area had previously been identified as being an area of high archaeological potential (JMcD 2002 and JMcD 2005). During the survey two surface artefacts were identified, and the area was assessed as a large PAD with a high archaeological potential (2014a:36-37). Artefact Heritage completed an archaeological test excavation of this site (2014). A total of 14 silcrete flaked pieces were recovered during subsurface test excavation. The location of this site is shown in Figure 4.

2.4 Aboriginal land use

The exact nature of Aboriginal land use patterns in the vicinity of the study area before colonisation is unknown. Assumptions about land use patterns are made on the basis of archaeological information gained from the local area, from observations made by the Europeans after settlement of the area, and from information known about available natural resources.

As Aboriginal people were mobile hunter-gatherers, it is likely that they moved across the landscape between resources. It is also likely that movement was related to socio/cultural factors such as gatherings and ceremonial obligations. Campsites would have provided temporary residences for the transitory lifestyle. 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 is likely that knapping would have occurred at a campsite, it is also 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 are found across the landscape in varying densities. High density artefact scatters are adjacent major waterlines in the area (Ropes Creek and Eastern Creek); with a drop in artefact density in the transitional land between them.

Figure 4: Location of recorded Aboriginal sites within the study area



3.0 CONSULTATION PROCESS

Aboriginal stakeholder consultation for the Eastern Creek EFW facility project was commenced by GML on behalf of The Next Generation NSW (the proponent). As a SSD project, under Part 4, Division 4.1 of the EPA Act, consultation can be undertaken in accordance with the Department of Environment and Conservation (now OEH) *Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation 2005*. However the *Aboriginal cultural heritage consultation requirements for proponents 2010* was used as a guideline for best practice. Twelve Aboriginal stakeholders have registered for consultation throughout the project, including:

- Darug Land Observations (DLO)
- Tocomwall
- Darug Aboriginal Cultural Heritage Assessments (DACHA)
- Koomurri Ngunawal Aboriginal Corporation (KNAC)
- HSB Heritage Consultants (HHC)
- Wurrumay Consultants
- Darug Aboriginal Landcare (DALC)
- Darug Tribal Aboriginal Corporation (DTAC)
- Deerubbin Local Aboriginal Land Council (DLALC)
- Kamilaroi-Yankuntjatjara Working Group (KYWC)
- Gunjeewong Cultural Heritage Aboriginal Corporation (GCHAC)
- Darug Custodian Aboriginal Corporation (DCAC)

A consultation log was maintained detailing correspondence with the Aboriginal stakeholder groups. For the full consultation log maintained by GML see the ACHAR (GML 2014b). A copy of the ATR and ACHAR completed by GML in 2014 are attached as Appendix A and Appendix B.

The Test Excavation Methodology was sent by Artefact Heritage to all registered Aboriginal stakeholders for comment on 8 October 2014. Glen Freeman indicated that KNAC had no issues with the methodology. Des Dyer indicated that DALC agreed with the recommendations and methodology and would like to see a plan of management put in place to rebury artefacts somewhere close by, once the development is completed.

Test excavation was conducted over four days from Monday 3 November to Thursday 6 November 2014. The Archaeological Test Excavation Report is included as Appendix C.

A draft version of this ACHAR was forwarded to registered Aboriginal stakeholders on 26 February 2015 for review and comment. The comments indicated that the sites were highly significant to the Darug people. The sites are considered to be closely associated with the wider landscape and land use practices of Aboriginal people. The responses agreed with the findings and recommendations of this report and requested that the artefact assemblage be reburied somewhere close to the site. This included a comment from DACHA supporting reburial of the retrieved artefacts within a conserved and protected area close to where the artefacts were retrieved from.

The consultation log is provided in Appendix D and copies of relevant correspondence are provided in Appendix E.

4.0 SUMMARY AND ANALYSIS OF BACKGROUND INFORMATION

This addendum ACHAR does not include background information including: archaeological survey, environmental background, ethnohistory or review of the archaeological background. For full details, please see the original ACHAR, prepared by GML (2014b).

4.1 Results of Archaeological Test Excavation

The ATR and ACHAR investigations prepared by GML (2014a, 2014b) recommended further archaeological investigation should take place at Aboriginal site EFW South; which consisted of two surface artefacts with an associated PAD; which will be directly impacted by the concept design and placement of ancillary facilities:

Test excavation should be undertaken across any areas of PAD that cannot be avoided by the direct impacts from the EFW – this is understood to mean the stone artefact site with PAD 'EFW South'. Test excavation should be used to confirm the condition and extent of the archaeological deposit and allow for a complete scientific investigation of the site. Test excavations should follow the requirements of the OEH's Code of Practice.

GML assessed that Archbold Road 1 and Archbold Road 2 will not be directly impacted by the proposed design. Therefore these sites do not require archaeological test excavation, as per the recommendations of the ATR (GML 2014a:49).

The ATR report completed by GML (2014a) recommended that the test excavation should be completed according to the OEH *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (Code of Practice). As the project has been declared to be SSD use of the Code of Practice is not required. However the test excavation methodology was completed in accordance with the Code of Practice, as per the recommendations of GML (2014a). The Code of Practice is an applicable framework to use for comparative analysis of archaeological findings within the current test excavation and past excavations within the wider region.

The subsequent test excavations identified a low density, sub-surface artefact scatter EFW South (45-5-4491). The results of the archaeological test excavation within EFW South are detailed below.

4.1.1 Stone artefact distribution and density

Test excavation of PAD site EFW South retrieved an assemblage of fourteen artefacts from nine of the thirty-seven 500x500 mm excavation units (Figure 5). The total area excavated 18.5m²; with an artefact density of 0.76 artefacts/m².

The location of artefacts indicates a sparse scatter across the majority of the site area, with a concentration of ten artefacts within the north central portion of Area 3 (TP16-A, TP16-B, TP16-C, TP18 and TP19). The highest number of artefacts were found in TP16-A; therefore the excavation unit was extended into a 1x1 m test pit, using three more 500x500 mm test pits (TP16-B, TP16-C, TP16-C (Figure 5). However the artefact numbers decreased in the additional test pits. Additional artefacts identified in TP18 and TP19 showed that there was a concentration in the area.

An additional transect was excavated to the east of these artefact bearing excavation units to investigate the potential continuance of the concentration (TP21 to TP24).

However, no artefacts were identified in the additional pits; which successfully established an extent for the artefact concentration.

One more artefact was identified in the south portion of Area 2 (TP27) and a further three artefacts in Area 3 (TP30 and TP34), demonstrating that the pattern of artefact distribution across this portion of the site reflected isolated scatters /isolated artefacts rather than a continuous scatter. However as all artefacts were identified on slightly raised areas adjacent ephemeral waterlines, they are considered to part of the same site (EFW South).

4.1.2 Raw material and artefact characteristics

The artefact assemblage was made up of stone artefacts composed entirely of silcrete (n=14, 100%); which ranged from orange to red in colour.

Technological categories represented in the assemblage included: angular fragments (n=7, 50%), distal flakes (n=4, 29%), complete flakes (n=2, 14%) and a proximal flake (n=1, 7%).

No tools, retouched artefacts or cores were noted in the assemblage. The assemblage is indicative of general stone reduction and casual discard.

4.1.3 Artefact depth

The majority of the artefacts were recovered from 0 – 100 millimetres depth, broadly corresponding to the A horizon.

No artefacts were retrieved from the underlying B horizon.

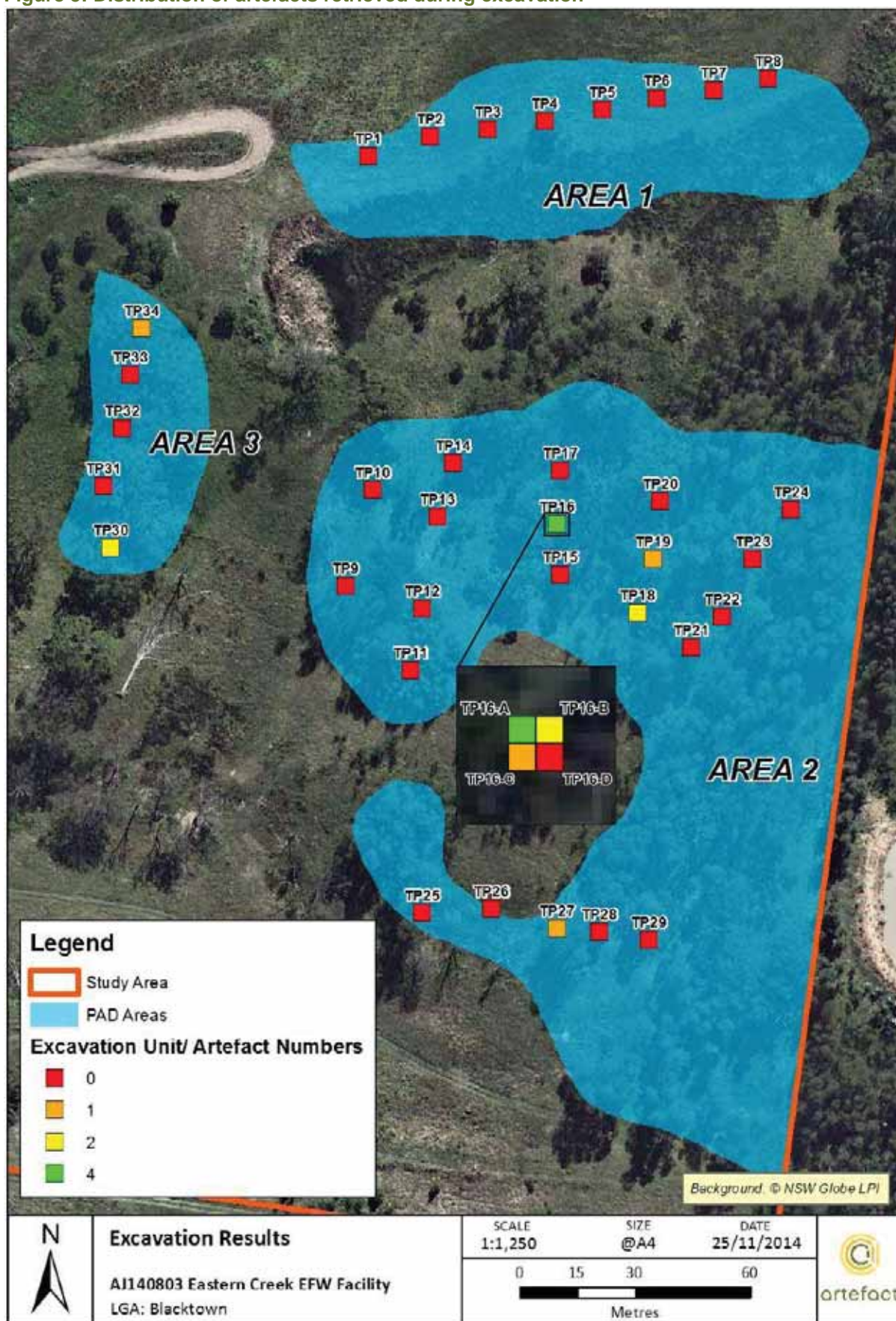
4.1.4 The artefact assemblage

Artefact density was low across the site (0.76 artefacts/m² on average). There is a slight concentration of artefacts within the north central portion of Area 2; however artefacts are diffuse overall and no meaningful patterns between location and landform were identified (Figure 5). The small size of the assemblage means that patterns of intra-site artefact distribution cannot be reliably (statistically) established.

The low artefact density at EFW South conforms to the wider pattern of variable artefact densities recorded during sub-surface investigations in the region. Previous archaeological investigations in the area identified high concentrations of artefacts adjacent to major waterlines in the area (Ropes Creek and Eastern Creek); with a drop in artefact density in the transitional land between them. Site EFW South (45-5-4491) is located within the lower lying, transitional land, between the two major creeks; and therefore conforms to site patterning of the region.

The artefacts recovered comprise small to medium sized angular fragments, distal flakes, complete flakes and a proximal flake. Silcrete was the only raw material type identified; studies have shown that silcrete is ubiquitous across the Eastern Creek area and wider Cumberland Plain region.

Figure 5: Distribution of artefacts retrieved during excavation



4.1.5 Aboriginal settlement history

The archaeological investigations undertaken at EFW South uncovered a low density assemblage of small to medium size flakes and angular fragments with no evidence of usewear. The raw material used is common in the region. No evidence of intensive occupation of the site or the manufacture of stone tools was discovered. The assemblage is likely to reflect general stone reduction and discard rather than intensive occupation or site use. The overall results are reflective of background scatter or transient campsites related to the movement of Aboriginal people across the landscape. The type of low-density site represented by EFW South (45-5-4491) is common in the Eastern Creek area and wider Cumberland Plain region.

5.0 CULTURAL HERITAGE VALUES

5.1 What are cultural heritage values?

This significance assessment has been undertaken in accordance with the OEH *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in New South Wales 2011*.

Cultural heritage consists of places, or objects, that are of significance to Aboriginal people. Cultural heritage values are the attributes of these places or objects that allow the assessment of levels of cultural significance.

5.2 What is cultural significance?

Assessing the cultural significance of a place or object means defining why a place or object is culturally important. It is only when these reasons are defined that measures can be taken to appropriately manage possible impacts on this significance. Assessing cultural significance involves two main steps, identifying the range of values present across the study area and assessing why they are important.

5.3 Social/cultural heritage values and significance

Social/cultural heritage significance should be addressed by the Aboriginal people who have a connection to, or interest in, the area. As part of the consultation process the registered Aboriginal stakeholder groups will be asked to provide appropriate information on the cultural significance of the study area.

The ACHAR completed by GML indicated that the registered stakeholders considered the study area to be part of a complex of sites within the region; and represented a component of the wider Darug landscape (2014b:23). Leanne Watson (DCAC) commented that the all previous studies and oral histories revealed that the Darug people had lived in the area for thousands of years, and are still present (GML 2014b:23).

The correspondence received from the updated ACHAR confirmed the cultural importance of the sites within the Darug region. The Aboriginal stakeholders indicated a deep connection to the area and associated cultural material.

5.4 Historic values and significance

Historic values refer to the association of the place with aspects of Aboriginal history. Historic values are not necessarily reflected in physical objects, but may be intangible and relate to memories, stories or experiences.

No comments about the historic values of the area were forthcoming from any of the registered stakeholders. There are no known historic values associated with the study area. No evidence of historic interactions, such as flaked glass or ceramic, were identified during test excavations at EFW South. The study area as a whole has been assessed as demonstrating low historic values and significance.

5.5 Archaeological significance assessment

Archaeological significance refers to the archaeological or scientific importance of a landscape or area. This is characterised by 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?

A summary of the significance values of the recorded site within the study area is outlined in Table 1 discussed below.

Table 1: Summary of archaeological significance values of sites within the study area

AHIMS #	Site name	Research potential	Scientific/ archaeological potential	Representative value	Rarity value	Overall significance
45-5-4491	EFW South	Low	Low	Low	Low	Low

Aboriginal site EFW South (45-5-4491) has been assessed as having low archaeological significance.

The ATR previously assessed EFW South (45-5-4491) as having high archaeological potential (GML 2014a:50). However, test excavation identified a low density artefact scatter, with minimal lithic or technological diversity. EFW South (45-5-4491) presents low potential for further research and low rarity and representativeness within the local landscape. As such, EFW South (45-5-4491) has been assessed as having low archaeological significance.

The ATR previously assessed Archbold Road 1 (45-5-4492) as having high archaeological potential (GML 2014a:50). The significance assessment within the ACHAR indicated that the site had moderate research potential, as any artefacts recovered could further the understanding of the Darug cultural landscape (GML 2014a:50 and 2014b:24). The site was considered rare within a local context, as similar sites have been impacted by development. Similarly the ATR had assessed Archbold Road 2 (45-5-4493) as having moderate archaeological potential; with moderate research and rarity ratings (GML 2014a:50 and 2014b:24). The archaeological significance of Aboriginal sites Archbold Road 1 (45-5-4492) and Archbold Road 2 (45-5-4493) can't be assessed without further archaeological investigation. However these areas will not be impacted by the proposed development.

5.6 Aesthetic values and significance

Aesthetic values refer to the sensory, scenic, architectural and creative aspects of the place. These values may be related to the landscape and are often closely associated with social/cultural values.

A large portion of the study area has been modified; however it still retains areas of aesthetic values. The natural features of the landscape, including vistas of the surrounding area and the gentle slope down to Ropes Creek tributary can still be seen. However, the visual features of the landscape have been modified and altered by quarrying activities and landform modification.

Examples of woodland that once covered the study area are still extant within EFW South (45-5-4491) and Archbold Road 1 (45-5-4492); however these are located on the edges of the existing waste facility and quarry in the centre of the study area. The study area as a whole has been assessed as demonstrating moderate aesthetic significance.

5.7 Statement of significance

Archaeological significance has been established for EFW South (45-5-4491), based on the results of archaeological test excavation. The area is considered to have high cultural values to the Darug landscape, based on the Aboriginal stakeholder comments. However, due to the limited lithic and technical diversity within the artefact assemblage; the site presents low potential for further research and low rarity and representativeness within the local landscape. Therefore the overall significance of EFW South (45-5-4491) is considered low.

The archaeological significance of Aboriginal sites Archbold Road 1 (45-5-4492) and Archbold Road 2 (45-5-4493) can't be assessed without further archaeological investigation. However these areas will not be impacted by the proposed development.

6.0 AVOIDING AND MINIMISING HARM

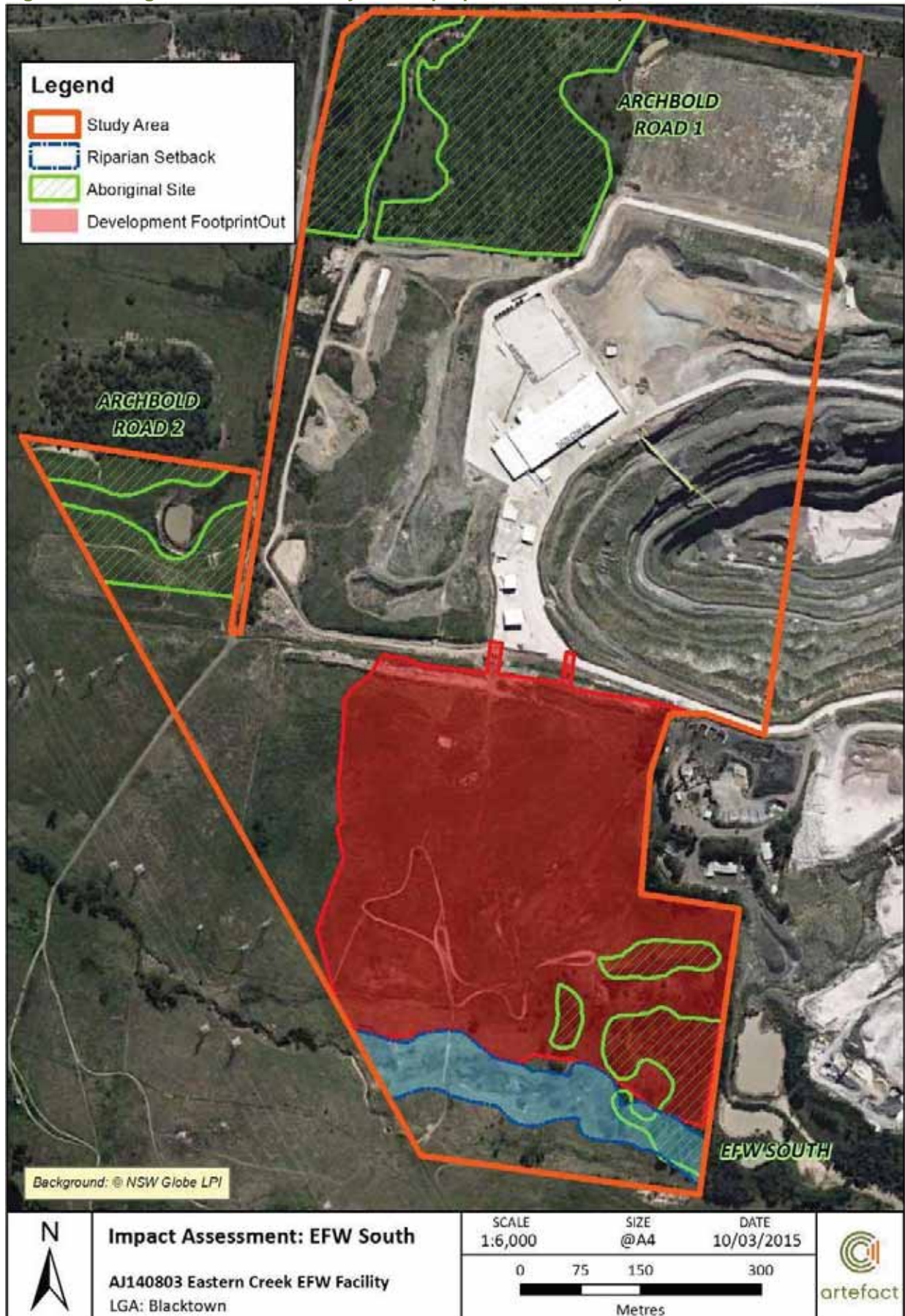
AHIMS site EFW South (45-5-4491) would be directly impacted by the proposal (Figure 6). The proposed development would involve the construction and operation of an Electricity Generation Plant. Other works associated with the development would include earthworks to balance the site, construction of internal roadways/carparks, construction of a direct underpass connection (Precast Arch and Conveyor Culvert) between TNG Facility and the Genesis Xero Waste Facility, water detention/treatment basins and installation of services (Sewerage, Water Supply, Communications, Power Supply). A majority of EFW South (45-5-4491) is located within the development footprint, with a small portion of the site running into the Riparian setback to the south, associated with Ropes Creek tributary (Figure 6). Therefore a majority of the site will be impacted, with the remaining portion of the site preserved within Riparian setback (Table 2).

Aboriginal sites Archbold Road 1 (45-5-4492) and Archbold Road 2 (45-5-4493) will not be directly harmed by the proposed development, as they are outside of the development footprint (Figure 6). However the indirect harm could be caused through the partial loss of intangible heritage values, including cultural and aesthetic (GML 2014b). As the landscape within the study area will be modified, the value of the sites as part of the cultural landscape will be partially affected (Table 2).

Table 2: Impact assessment

Site Name	Type of harm	Degree of harm	Consequence of harm
EFW South (45-5-4491)	Direct	Partial	Partial loss of value
Archbold Road 1 (45-5-4492)	Indirect (No physical impacts)	Partial	Partial loss of [intrinsic] value
Archbold Road 2 (45-5-4493)	Indirect (No physical impacts)	Partial	Partial loss of [intrinsic] value

Figure 6: Aboriginal site areas overlaid with proposed area of impact



6.1 Consideration of alternatives and justification of impacts

The proposed Eastern Creek EFW allows waste material from Genesis Xero Material Processing Centre (MPC) and Waste Transfer Station (WTS) to generate electrical power. The EFW facility will ensure a safe, clean and reliable form of energy generation for Metropolitan Sydney now and in the future, while providing a means of waste management through the operation of the facility in concurrence with the Genesis Resource Recovery Facility to reduce or even eradicate the need for landfill in the future. The Facility provides a sustainable solution to Sydney's growing waste generation. The proposal will result in a net positive Greenhouse Gas effect, eliminating some 1 million tonnes of CO₂ per annum.

Aboriginal heritage values within the study area have been taken into consideration during the development of the concept design. However, the design requires a certain layout for efficient operation of the proposed EFW facility; located adjacent the existing Genesis Xero MPC and WTS. This is necessary for the transfer of waste material to the Eastern Creek EFW facility for processing.

EFW South (45-5-4491) demonstrates low research potential and low representativeness, rarity and education values; resulting in an overall low scientific significance. There is no alternative layout that will allow for the retention of the site and still meet the necessary requirements for the EFW facility design. The design has also avoided direct impact to the two remaining sites, Archbold Road 1 (45-5-4492) and Archbold Road 2 (45-5-4493).

6.2 Ecological Sustainable Development (ESD) Principles

ESD principles are relevant to this ACHAR as the OEH *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* specifies that ESD principles must be considered when assessing harm and recommending mitigation measures in relation to Aboriginal objects.

The following relevant ESD principles are outlined in Section 3A of the *Environment Protection and Diversity Act 1999*:

- Decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations (the 'integration principle').
- If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation (the 'precautionary principle').
- The principle of inter-generational equity – that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations (the 'intergenerational principle').

The proposal would adhere to the following ESD principles.

The Integration Principle

The proposal would comply with the Integration Principle in regard to Aboriginal heritage. The Aboriginal heritage values of the study area have been considered as part of the planning process for the EFW facility. Archaeological test excavation was conducted at EFW South (45-5-4491) to investigate the extent and nature of the site. The investigation identified that the proposed works will not impact on any areas of high archaeological and/or cultural significance.

Furthermore, Archbold Road 1 (45-5-4492) and Archbold Road 2 (45-5-4493) have been recorded as Aboriginal sites and areas of archaeological potential, which will be retained as conservation areas, based on their cultural merit.

The Precautionary Principle

The proposal would be unlikely to effect the overall significance of identified Aboriginal cultural heritage values within the Precinct. There is no considerable scientific uncertainty as to the impacts of the project on heritage values. Predictive models have been used to assess the probable nature of the archaeological record within the study area, based on other studies in the locality.

The precautionary principle would nevertheless be adhered to in the implementation of conservation areas at Archbold Road 1 (45-5-4492) and Archbold Road 2 (45-5-4493).

The Principle of Intergenerational Equity

The proposal was considered to adhere to this principle in regard to Aboriginal heritage as archaeological test excavation was used to identify the nature and significance sub-surface archaeological deposits within the study area and provided further information on requirements for impact avoidance and/or further archaeological mitigation measures if required. The archaeological investigation assessed EFW South (45-5-4491) as having low scientific significance.

Furthermore, the cultural environment will be preserved for the benefit of future generations, with the retention of Archbold Road 1 (45-5-4492) and Archbold Road 2 (45-5-4493).

6.3 Management and Mitigation Measures

Mitigation measures vary depending on the assessment of archaeological significance of a particular Aboriginal site and are based on its research potential, rarity, representativeness and educational value. In general, the significance of a site would involve the following mitigation measures:

In general, the significance of a site would involve the following mitigation measures:

- Low archaeological significance – No further investigation required.
- Moderate archaeological significance – Conservation where possible. If conservation was not practicable, further archaeological investigation would be required such as salvage excavations or surface collection.
- High archaeological significance – Conservation as a priority.

The proposed plans for the EFW facility development would impact on a portion of EFW South (45-5-4491). The archaeological significance of EFW South (45-5-4491) is considered to be low. The test excavation of the site (Artefact 2015) has provided sufficient information on the site. Further archaeological investigation would not be able to provide any meaningful information on the nature of the site.

The archaeological significance of Aboriginal sites Archbold Road 1 (45-5-4492) and Archbold Road 2 (45-5-4493) can't be assessed without further archaeological investigation. However these sites will be conserved, which meets the mitigation measures.

Table 3: Impacts and mitigation measures for Aboriginal heritage values within the study area.

Site Name	Site type	Significance	Type of harm	Degree of harm	Mitigation measures	Management measures
EFW South (45-5-4491)	Artefact Scatter	Low	Direct	Partial	Test excavation	None
Archbold Road 1 (45-5-4492)	Artefact Scatter, PAD	Moderate	Indirect (no physical impacts)	Partial	None	Conservation
Archbold Road 2 (45-5-4493)	Artefact Scatter, PAD	Moderate	Indirect (no physical impacts)	Partial	None	Conservation

6.3.1 Management outcomes

Archaeological information from EFW South (45-5-4491) has been retrieved and assessed. No further mitigation measures are recommended for the site.

Archbold Road 1 (45-5-4492) and Archbold Road 2 (45-5-4493) should be designated as conservation zones and be avoided by future development impacts.

6.4 Proposed management policy for Aboriginal Heritage

6.4.1 Conservation Areas

The area that makes up Archbold Road 1 (45-5-4492) and Archbold Road 2 (45-5-4493) has been recommended as conservation zones by previous work in the area. Jo McDonald Cultural Heritage completed a Heritage Conservation Strategy for the SEPP59 Eastern Creek Business Park Precinct (2005); which covered the current study area. The findings of the Heritage Conservation Strategy were based on a wider Strategic Management Model for heritage (JMcD 2002). The report identified requirements of Aboriginal cultural heritage impact mitigation and ongoing management requirements. The report recommended two conservation areas, one in the north and another in the south of the current study area.

The southern conservation identified by Jo MacDonald (2005) was registered as EFW South (45-5-4491) and the northern conservation area was registered as Archbold Road 1 (45-5-4492). The ATR (GML 2014a) for the proposed Eastern Creek EFT Facility identified Archbold Road 2 (45-5-4493) within the northwest portion of the study area. The ACHAR recommended that Archbold Road 1 (45-5-4492) and Archbold Road 2 (45-5-4493) be conserved as part of the proposed development (GML 2014b:27)

Due to the archaeological potential and relationship to the cultural landscape Archbold Road 1 (45-5-4492) and Archbold Road 2 (45-5-4493) will be designated conservation areas. All contractors working in the area should be made aware of its location to avoid unintentional impacts. The archaeological value of these areas should be taken account in any future planning for the area. These mitigation measures should be outlined in the Construction Environmental Management Plan (CEMP); including detailed maps of the conservation area locations.

6.4.2 Discovery of human remains

If suspected human skeletal remains are uncovered at any time throughout archaeological test excavation program, procedures outlined in Part 3.6 of the OEH Code of Practice would be followed.

6.4.3 Changes of development design

This ACHAR was based upon the development design made available to Artefact as of the date of preparation of this report. Any changes that may impact on known Aboriginal sites or may impact areas that have not been assessed during the current study should be assessed by an archaeologist in consultation with the registered Aboriginal stakeholder groups.

6.4.4 Ongoing consultation with Aboriginal stakeholder groups

This project is ongoing and consultation with registered Aboriginal stakeholders should continue throughout the life of the project. Ongoing consultation with registered Aboriginal stakeholders will take place throughout the preparation of this final version of the ACHAR and reburial of retrieved artefacts.

It should be noted that if there has been a gap of greater than six months in consultation for a project, the consultation process would restart with the compilation of a new registered stakeholder list.

6.4.5 Reburial of artefacts

The retrieved test excavation artefact assemblage from EFW South (45-5-4491) will be reburied at a location that will not be impacted by any future development works. The selected location for reburial is the portion EFW South (45-5-4491) which is within the Riparian setback (located to the south of the development footprint) and will not be impacted (Figure 6).

7.0 RECOMMENDATIONS

The following recommendations were based on consideration of:

- Statutory requirements under the EP&A Act 1979.
- The requirements of the DGRs.
- The results of background research, archaeological test excavation and assessment.
- The likely impacts of the proposed development.
- The interests of Aboriginal stakeholders.

It was found that:

- EFW South (45-5-4491) will be partially impacted by the proposed works. Based on the ATR (GML 2014a) and the results of test excavation, this site has been assessed as having low archaeological significance. Impacts would result in partial loss of value.
- The intrinsic values of Archbold Road 1 (45-5-4492) and Archbold Road 2 (45-5-4493) will be indirectly impacted by the modification of the study area. However there will be no ground surface impact within these areas as part of the proposed development.

It is therefore recommended that:

- No further archaeological investigation of EFW South (45-5-4491) is required prior to impacts.
- Archbold Road 1 (45-5-4492) and Archbold Road 2 (45-5-4493) are located outside of the development footprint and will be retained. Impact to this area should be avoided during proposed works, by designating these areas conservation zones. All contractors working in the area should be made aware of its location to avoid unintentional impacts.
- If Aboriginal skeletal material is uncovered during construction the requirements of Section 3.6 of the OEH code of practice would be followed.
- The retrieved test excavation artefact assemblage will be reburied at a nearby location that will not be impacted by any future development works. The area selected as a location for reburial is the portion of EFW South (45-5-4491) that falls within the Riparian Setback (Figure 6); as it will be retained as part of the proposed development.
- When the artefact assemblage is reburied, a site recording form should be submitted to the OEH AHIMS site register within details of the location of the assemblage.
- A draft version of this ACHAR was forwarded to registered Aboriginal stakeholders on 26 February 2015 for review and comment.

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APPENDIX A

GML 2014 - ABORIGINAL ARCHAEOLOGICAL TECHNICAL REPORT

Energy From Waste (EFW) Plant, Eastern Creek

Aboriginal Archaeological Technical Report

Report prepared for Urbis on behalf of The Next Generation (TNG)

September 2014



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Report Register



The following report register documents the development and issue of the report entitled Energy From Waste (EFW) Plant, Eastern Creek—Aboriginal Archaeological Technical Report, undertaken by GML Heritage Pty Ltd in accordance with its quality management system.

Job No.	Issue No.	Notes/Description	Issue Date
13-0493	1	Final Report	22 September 2014

Quality Assurance

GML Heritage Pty Ltd operates under a quality management system which has been certified as complying with the Australian/New Zealand Standard for quality management systems AS/NZS ISO 9001:2008.

The report has been reviewed and approved for issue in accordance with the GML quality assurance policy and procedures.

Project Manager:	Tyler Beebe	Project Director & Reviewer:	Tim Owen
Issue No.	1	Issue No.	1
Signature		Signature	
Position:	Consultant	Position:	Associate
Date:	22 September 2014	Date:	22 September 2014

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1.0 Introduction

GML Heritage (GML) Pty Ltd was engaged by Urbis, on behalf of The Next Generation NSW Pty Ltd (TNG) to prepare an Aboriginal Cultural Heritage Assessment Report (ACHAR) and an Aboriginal Archaeological Technical Report (ATR) for the proposed Energy from Waste (EFW) facility at Eastern Creek project (Figure 1.1).

The purpose of this report is to identify whether the study area possesses or has the potential to possess Aboriginal heritage archaeological sites, places, objects, landscapes and/or values, in accordance with the NSW Office of Environment and Heritage (OEH) guidelines for Aboriginal heritage assessment (listed below). This report details the results of archaeological field survey carried at the study area, in accordance with OEH's *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (Code of Practice).

GML's involvement in the project ended following the field survey, prior to archaeological test excavation. As such, this report provides a preliminary significance assessment of the identified archaeological Aboriginal sites, places, landscapes and/or other values. As archaeological test excavation was required to characterise the nature and extent of the archaeological deposit, and allow an assessment of its archaeological value, the impact assessment and recommendations for future archaeological investigation and management strategies provided reflect the need for further work in relation to understanding the archaeological resource—rather than a formal assessment of the proposed EFW facility.

1.1 Project Brief and Study Area

The Energy from Waste (EFW), Eastern Creek project area (the study area), is located at Eastern Creek, Lots 2 and 3 in DP 1145808, within the Blacktown Local Government Area (LGA), south of the M4, east of Ropes Creek, west of the former Pioneer Quarry, and bounded to the west by Archbold Road (Figures 1.1 and 1.2).

TNG proposes to construct an EFW electricity generation plant at the southern end of the study area. The proposed development involves the construction of the EFW energy generation plant, as well as internal roadways, amenities and ablutions, parking facilities, and water detention basins. Any action that disturbs the ground surface has the potential to impact soils that may contain an Aboriginal archaeological deposit. Therefore this assessment has been undertaken in order to determine if there is the potential for Aboriginal objects within the study area, and if so, to what extent they may be impacted through the development proposal. This will allow development of relevant and appropriate Aboriginal cultural heritage management strategies as necessary and appropriate to the study area.

Figure 1.3 depicts the proposed location of the proposed plant. Details of the proposed development impact and location are presented in the Impact Assessment, Section 5.0 of this report. The EFW project will be assessed under the Environmental Planning and Assessment Act (EPA Act) as a State Significant Development (SSD) Project. This report will be used to support a DA for the EFW plant and associated works within the study area.

1.2 Objectives for the Assessment

The objectives of this assessment were:

- to understand the number, extent, type, condition, integrity and archaeological potential of Aboriginal heritage sites and places within the study area;
- to determine whether the identified Aboriginal sites and places are a component of a wider Aboriginal cultural landscape;
- to understand how the physical Aboriginal sites relates to Aboriginal tradition within the wider area;
- to prepare a scientific cultural values assessment for all identified aspects of Aboriginal cultural heritage, as identified within this report;
- to determine how the proposed project may impact the identified Aboriginal cultural heritage;
- to aim to minimise impacts to Aboriginal cultural heritage through sensible and pragmatic site and land management;
- to determine where impacts are unavoidable and develop a series of impact mitigation strategies that benefit Aboriginal cultural heritage and the proponent; and
- to provide clear recommendations for the conservation of archaeological values and mitigation of impacts to these values.

1.3 Statutory Context

In NSW Aboriginal heritage is principally protected under two Acts:

- the *National Parks and Wildlife Act 1974* (NPW Act 1974); and
- the *Environmental Planning and Assessment Act 1979* (EP&A Act 1979).

1.3.1 NPW Act 1974

The NPW Act provides statutory protection for all Aboriginal ‘objects’ (consisting of any material evidence of the Indigenous occupation of New South Wales) under Section 90 of the NPW Act, and ‘Aboriginal places’ (areas of cultural significance to the Aboriginal community) under Section 84 of the NPW Act. Aboriginal objects and places are afforded automatic statutory protection in New South Wales whereby it is an offence (without the Minister’s consent) to harm an Aboriginal object or declared Aboriginal Place.

The NPW Act defines an Aboriginal object as:

any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises New South Wales, being habitation before or concurrent with (or both) the occupation of that area by persons of non-Aboriginal extraction, and includes Aboriginal remains.

The protection provided to Aboriginal objects and places applies irrespective of the level of their significance or issues of land tenure. Sites of traditional significance that do not necessarily contain material remains may be gazetted as ‘Aboriginal Places’ and thereby protected under the NPW Act.

However, areas are only gazetted if the Minister is satisfied that sufficient evidence exists to demonstrate that the location was and/or is of special significance to Aboriginal culture.

On 1 October 2010, the mechanisms for the protection and management of Aboriginal heritage places and objects changed with the adoption of the *NPW Amendment (Aboriginal Objects and Places) Regulation 2010*.

New offences relating to the harm to, or desecration of, an Aboriginal object or declared Aboriginal Place were introduced. The definition of 'harm' now includes to destroy, deface, damage or move an Aboriginal object or declared Aboriginal Place. The former Department of Environment, Climate Change and Water (DECCW—now the OEH) stated:

The most significant change is the introduction of tiered offences and penalties. Offences committed with knowledge, in aggravating circumstances or in relation to an Aboriginal Place will attract higher penalties than previously. There is a new strict liability offence of harming Aboriginal objects and of harming or desecrating Aboriginal Places. (DECCW 2010b)

The strict liability offence of harming Aboriginal objects has a number of defences. The two defences relevant to the proposed development include the statutory defence of due diligence through complying with an adopted industry code or compliance with the conditions of an AHIP.

The potential for Aboriginal objects, sites, places and/or values within the study area and whether the proposed development may impact on such objects has been assessed and the results presented in this report.

1.3.2 EPA Act 1979

The *Environmental Planning and Assessment Act 1979* (NSW) (EPA Act) provides a statutory framework for the determination of development proposals. It provides for the identification, protection and management of heritage items through inclusion in schedules to planning instruments such as Local Environmental Plans (LEPs) or Regional Environmental Plans (REPs). Heritage items in planning instruments are usually historic sites but can include Aboriginal objects and places. The EPA Act requires that appropriate measures be taken for the management of the potential archaeological resource by means consistent with practices and standards adopted in meeting the requirements of the NPW Act.

The EFW Plant Development will be assessed as a State Significant Development (SSD) in accordance with Part 3 of the EPA Act. Therefore the requirement for an Aboriginal Heritage Impact Permit (AHIP) in accordance with Section 90 the NPW Act may not apply to this development.

1.3.3 Approach to Aboriginal Heritage Management

In order to administer the NPW Act 1974 and EP&A Act 1979, the OEH has issued a series of best practice guidelines and policies. The applicability of these depends upon the approval mechanism for a project. The current project will be assessed and granted approval under Part 3 (State Significant Development) of the EP&A Act 1979. Therefore the approach to the preparation of this document was based on the following current best practice guidelines:

- DECC Operational Policy: *Protecting Aboriginal Cultural Heritage* (February 2009);
- DECCW *Aboriginal cultural heritage consultation requirements for proponents 2010. Part 6 National Parks and Wildlife Act 1974* (April 2010);

- DECCW *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* (13 September 2010);
- DECCW *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (24 September 2010);
- OEH *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (April 2011); and
- The *Australia ICOMOS Burra Charter* 1999 (Burra Charter).

1.3.4 Due Diligence Approach

The OEH adheres to a code of practice guideline that defines a 'due diligence' approach to Aboriginal heritage: DECCW *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* (13 September 2010). This guideline is designed to assist individuals and organisations to exercise due diligence when carrying out activities that may harm Aboriginal objects, and/or Aboriginal Places, and to determine whether they should apply for consent in the form of an AHIP.

The *Due Diligence Code of Practice* sets out the reasonable and practicable steps which individuals and organisations need to take in order to:

- identify whether or not Aboriginal objects are, or are likely to be, present in an area;
- determine whether or not their activities are likely to harm Aboriginal objects (if present); and
- determine whether an AHIP application is required.

The OEH has defined due diligence thus:

Due diligence is a legal concept describing a standard of care. Exercising due diligence means turning your mind to the likely risks of your proposed course of action. It is not enough to perform activities carefully. Due diligence requires consideration of your obligations under, in this case, the NPW Act, and the consideration and adoption of a course of action that is directed towards preventing a breach of the Act.

In the context of protecting Aboriginal cultural heritage, due diligence involves taking reasonable and practicable measures to determine whether your actions will harm an Aboriginal object and if so avoiding that harm.¹

The steps that are required to follow the due diligence process are:

- searching the Aboriginal Heritage Information Management System (AHIMS);
- checking for landscape features which may indicate the presence of Aboriginal objects;
- strategies to avoid harming Aboriginal objects; and
- desktop assessment and visual inspection to confirm the presence of Aboriginal objects.²

In preparing this report, GML complied with the guidelines set out in OEH *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (13 September 2010). The extent of land covered by the due diligence process is described as the study area, see below.

1.3.5 Reporting Approach

This Aboriginal Archaeological Technical Report (ATR) is an appendix to the ACHAR. This ATR is a standalone technical report which provides evidence about the material traces of Aboriginal land use that is integrated with the other findings from the assessment of Aboriginal heritage to support the conclusions and management recommendations in the ACHAR.

This report has been prepared following the requirements for reporting as established in DECCW *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales (24 September 2010)*.

These two reports should be used by TNG to demonstrate compliance with the initial stages of the Aboriginal assessment, to the completion of the field survey. Future reporting, archaeological test excavation and further Aboriginal consultation would be required to complete the assessment. These tasks were beyond GML's commissioned scope.

1.4 Investigators and Contributors

This project has undertaken by the following personnel; each person's role, qualification and affiliations are detailed in the table below.

Table 1.1 Investigators and Contributors

Person (Qualification)	Affiliation	Role
Sam Cooling (M. Arch. Science, BA.)	GML	Project Manager, Author
Dr Tim Owen (PhD Aboriginal archaeology, BSc [Hons] International Archaeology)	GML	Project Director, Report Reviewer
Natalie Vinton	GML	Senior Advice
Jane McMahon (BA)	GML	Author
Tyler Beebe (BA)	GML	Project Manager, Author
Gordon Workman	DLO	
Paul Goddard	DLO	
Des Dyer	DALC	
John Reilly	DTAC	
Gordon Morton	DACHA	
Tylan Blunden	DCAC	
Philip Khan	KYWG	
Jen Norfolk	Tocomwall	



Figure 1.1 Regional Study area location. (Source: Nearmaps with GML Additions 2014).



Figure 1.2 Study area. (Source: Nearmaps with GML Additions)

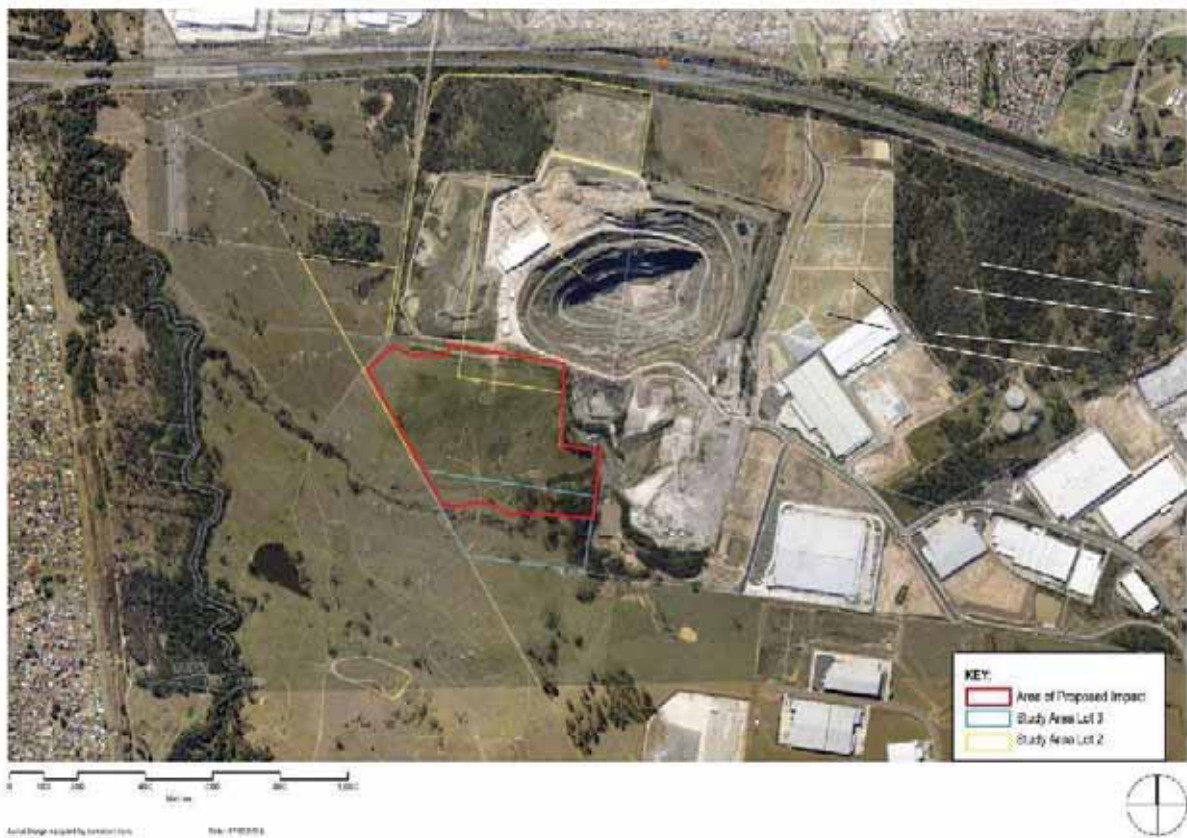


Figure 1.3 Approximate location of proposed EFW plant. (Source: Nearmaps with GML additions)

1.5 Endnotes

- ¹ DECCW, 24 April 2009. *Due diligence guidelines for protection of Aboriginal objects in NSW*. Accessed Online.
- ² DECCW 2010. NPWS Act 1974. *Fact sheet 2*. September 2010.

2.0 Archaeological Context

In line with OEH reporting requirements¹, this section provides a review of previous archaeological work, the landscape context, regional character and an Aboriginal heritage predictive model.

2.1 Previous Archaeological Work

The purpose of this section is to synthesise available information from previous archaeological and ethno–historical studies to provide a context and baseline for what is known about Aboriginal cultural heritage in the subject area.

2.1.1 Previous Archaeological Reports

A literature review of the NSW OEH library (and additional reports held by GML) was undertaken to understand the broader region's archaeological patterning. This review was targeted to those reports relevant to the study area. Key word searches were used to find reports for the locality in AHIMS. A review of key reports is provided, in chronological order, below..

Kohen 1986²

An archaeological survey by Jim Kohen in 1986 covered the current study area, as well as some of the surrounding land. Through the course of this survey, a total of 13 sites were located and registered (BTSW/1 to BTSW/13). Visibility during this survey was described as poor and survey concentrated on exposures such as creek lines, dams and tracks³. No sites were identified within the current study area through the course of this survey however this could have been due to low visibility and exposure in the area. This is one of only two archaeological surveys (the other being JMcDCHM 2002, detailed below) that have previously covered the area of the proposed EFW Plant.

Brayshaw and Haglund 1996⁴

Brayshaw and Haglund undertook archaeological survey in 1996 of the lands to the north of the current study area in relation to the proposed widening of the M4 motorway. Of the sites recorded during this survey, one ('Chatsworth Road') was recorded on the boundary of, or immediately to the north of, the northern boundary of the current study area (to the south of the M4). This site consisted of three silcrete flakes over a distance of 270m (across three locations). This site is referred to in subsequent reports as both 'Chatsworth Road', and 'M4U4'. The site was not registered with AHIMS at the time, and was assessed further in JMcDCHM 2002 and 2005 (see below).

JMcDCHM 2002⁵

In 2002, JMcDCHM undertook archaeological assessment of lands which were gazetted under the State Environment Planning Policy (SEPP 59)—Central Western Area Economic and Employment Area. This included the entirety of the current study area, as well as surrounding lands. Through this study, the current study area was surveyed as a part of the investigation of the wider SEPP 59 lands. At the time of the 2002 report, the lands subject to SEPP 59 were owned by several different landowners, and therefore the current study area was referred to throughout this report as included within the 'Fitzpatrick' land. Archaeological survey across the 'Fitzpatrick' land in 2002 recorded two new artefacts (RF/ISF1 and RF/ISF2), both located on a graded track in the north of the study area. As these two Isolated Finds were in close proximity (ie within 100m of each other) to each other, as well as the site originally recorded by Brayshaw and Haglund in 1996 (ie Chatsworth Road/M4U4), and in consideration of the fact that none of the three sites had yet been registered, JMcDCHM decided

that these three sites should all be registered as one. This site was renamed 'Archbold Road', and an AHIMS site card prepared and attached to the 2002 report in Appendix 5. However, somehow still this site has not been registered with AHIMS.

In addition, two artefact sites were recorded in the land immediately adjacent to the current study area (referred to as 'Sargents' land). These two sites (Sargents 1 and Sargents 2), both also had site cards prepared for registration at the time of recording, and included in Appendix 5 of the report, however neither seem to be registered with AHIMS.

A Strategic Management Model (SMM) was developed for the SEPP 59 lands in order to manage development of lands on the basis of their conservation potential. Management zones were allocated across the whole of the SEPP59 lands based on a combination of their archaeological potential, landscape type and levels of disturbance. The majority of the (then) 'Fitzpatrick' land, outside of the area of the Quarry (ie the current study area) was assigned as Zone 2 (moderate archaeological potential), with treed areas in the north and south assigned as Zone 1 (high archaeological potential and a Core Conservation Zone candidate). This report proposed that no archaeological investigation, or development, should take place within designated Core Conservation Zone (CCZ) areas, while any land outside the CCZ would be deemed developable. This report provided recommendations for the direction of further management decisions to be made for the SEPP 59 lands regarding Aboriginal heritage.

JMcDCHM 2005⁶

In 2005, JMcDCHM undertook prepared a Heritage Conservation Strategy regarding Aboriginal cultural heritage management outcomes for part of the SEPP59 Eastern Creek Business Park (Stage 3) Precinct; the lands referred to as 'Sargents' land, and the 'Valad' land (previously known as 'Fitzpatrick' land, and including the current study area). Following on from the assessment of the entire SEPP59 lands in 2002, this report focused on identifying requirements for mitigation of Aboriginal cultural heritage impacts, as well as ongoing management requirements for lands proposed for conservation within the Stage 3 Precinct area.

This report followed the SMM set out in the JMcDCHM 2002 report (as above), and recommended the conservation of two areas (one in the north and one in the south), selection of a sample for archaeological sub-surface investigation within Zone 2 lands to mitigate the impact to Aboriginal heritage through development of the area, and the preparation of a Plan of Management as part of the conservation management strategy.

ERM 2005⁷

In 2005, ERM undertook a heritage study (including both Aboriginal and historical heritage), including background research and a field survey, at Eastern Creek, Blacktown. The ERM study area was located immediately adjacent (to the west) of the study area for the current project. The eastern boundary of the ERM study area was governed by the location of the main power lines, which form the south west border of the current study area.

The survey for this project identified 14 Aboriginal sites and 2 PADs across the area. ERM recommended that a 'heritage preservation zone' be established in order to protect the main concentration of Aboriginal heritage sites. Aboriginal objects were generally found during survey wherever good exposures for the detection of archaeological materials were present. ERM concluded that Aboriginal objects were likely to be found across low-lying areas of the site in varying concentrations, with higher densities likely to be found closer to creek banks.

JMcDCHM 2006⁸

In 2006 JMcDCHM undertook archaeological salvage excavation in accordance with a Section 90 permit within an area known as the Wonderland Surplus (approximately 1.3km to the east of the study area). Throughout this project, two areas of PAD (EC3/1 and EC3/2) were investigated and subject to salvage excavation due to having previously been assessed as having good potential for an intact archaeological deposit. The excavation of EC3/1 sampled a hill slope and drainage gully, while EC3/2 sampled the adjacent low ridgetop. Lithic density was similar in each landscape, with average densities of 0.8 artefacts/m² and 0.9 artefacts/m² respectively.

A total of 1550 lithics were recovered from the salvage excavation of the two PADs. Although the relatively low lithic densities recovered made the determination of site use difficult, the excavation demonstrated clear use of the area by Aboriginal people.

Navin Officer 2007⁹

In 2007 Navin Officer was engaged by FDC Building Services Pty Ltd to undertake a subsurface test excavation program at the previously surveyed Erskine Park Employment Area. The aim of the test excavation was to identify the nature and extent of the three previously identified Aboriginal sites (EP1, EP 2 and EP PAD 1). This test excavation area was located approximately 1.7km south west of the current study area (Figure 2.1).

The excavation was undertaken by backhoe and mechanical excavation equipment while monitored by archaeologists and Aboriginal stakeholder representatives. The study area was divided into four areas and a total of 112 test units were excavated with a total of 310 stone artefacts identified within 70 of the 112 test units.

It was concluded that average densities were 5.7 artefacts per square metre. The dominating raw material types identified during the excavation were silcrete (70%) and tuff (21.3%). Area 2, a spurline crest along Ropes Creek had the highest densities. Area 3, a valley floor, had the second highest densities while Area 4 and Area 1, adjacent to a first order drainage line, were identified as low potential landforms.

JMcDCHM 2009¹⁰

An Aboriginal Heritage Management Plan (AHMP) was prepared by JMcDCHM in 2009 for the development of 'The Light Horse Business Centre' within the lands known as 'Dial A Dump' Industries (DADI) lands, including the 'Valad' lands as assessed in JMcDCHM 2005, as well as the current study area. This AHMP built on the archaeological assessment reports prepared by JMcDCHM in 2002 and 2005 for wider land holdings in the area. The AHMP identified two designated conservation areas within the subject land, and was prepared in order to ensure the protection of Aboriginal sites and landscapes within these conservation areas.

The 2009 reports notes that at some time between the preparation of the JMcDCHM 2005 assessment of the land, and the 2009 assessment, part of the area designated as archaeologically sensitive (Zone 1- High Archaeological Potential), had been subject to earthworks. A trench cut and subsequent infill seriously impacted a portion (c. 1ha in size) of the Zone 1 area located in the south of the study area (within, and to the south of the second order stream in the south of the current study area). Therefore the 2009 report reassigned the zoning of archaeological sensitivity of the area accordingly in order to mitigate against this impact (Figure 2.1). This disturbance is further detailed in Section 2.2.5 below.

The conservation of the south and north Zone 1 areas was deemed to represent an appropriate conservation outcome, and thus a meaningful management outcome was anticipated for the subject land in conjunction with the appropriate management of the two conservation areas.

While the majority of the 2009 development was located within archaeological sensitivity Zone 3, small amounts of ground disturbance were required within Zone 2 lands (ie three detention basins and an area of fill). The report determined that the proposed development impacts from the DADI Light Horse Business Centre were not considered major enough to warrant further archaeological investigation in those areas, the report states that:

Should more extensive development proposals in the future be located in these Zone 2 areas then these would require further assessment at the time to determine whether subsurface investigation was warranted. (JMcDCHM 2009: 10).

The final recommendations of the AHMP included: access to conservation areas be limited (ie fenced) and managed appropriately; no construction activities or any future works that impact on soil should take place in the conservation areas; and that any management decisions made in relation to Aboriginal heritage must involve consultation with representatives of the Aboriginal community. The Aboriginal community provided written response regarding the AHMP, stating their support for the implementation and adherence to the recommendations and management strategies of the AHMP.

GML 2013¹¹²

Throughout the course of 2013, GML undertook an Aboriginal archaeological assessment, including test and salvage excavation, of the development area known as Oakdale Central Precinct, on behalf of Goodman Property Services. The Oakdale Central Precinct is located approximately 2km south west of the current study area (Figure 2.1).

This assessment included field survey, Aboriginal community consultation, test excavation, and salvage excavation. Final post-excavation reporting is currently being undertaken, and therefore the results as presented here are preliminary.

The archaeological excavation of the Oakdale Central Precinct demonstrated that there are discrete artefact deposits of moderate densities within 150m of Ropes Creek, generally located on alluvial as opposed to residual soils (ie in association with the flood plain of Ropes Creek, a third order stream). Archaeological salvage excavation within the Oakdale Central Precinct also recovered the presence of Aboriginal cultural features other than stone objects, such as Aboriginal earth ovens within the site. Therefore, the post-excavation reporting of this site is also investigating the location and presence of domestic activities undertaken by Aboriginal people within this landscape. This has important implications for Aboriginal use of landscape, as well as the investigation of archaeological evidence other than stone objects (ie hearths and ovens), which have not previously been often sought, or focused on through archaeological investigations on the Cumberland Plain.

2.1.2 Aboriginal Heritage Information Management System (AHIMS) search

A search of the OEH AHIMS database of an area approximately 1km surrounding the study area was undertaken on 11 March 2014. The results of the search are shown in Figure 2.3. The search identified 63 recorded Aboriginal sites, which comprised: artefact concentrations (open camp sites), Potential Archaeological Deposits (PADs), and Artefact Sites with PADs. This search indicated that artefact concentrations constitute the predominant remnants recorded in this area. An overview of the AHIMS results are shown in Table 2.1. The complete results of the AHIMS search are provided in Appendix A.

Table 2.1 Results of the AHIMS search

Site Feature	Frequency	Percentage (%)
Artefact Concentrations (Open Camp Sites)	59	94
Artefact Site + PAD	2	3
PAD	2	3
Total	63	100

General patterning indicates that artefact sites dominate the archaeological record. These can be found in any location, on any landform; however recorded sites appear to become denser towards the margins of smaller creek lines and near the confluences of the water courses. However, this is also likely to be influenced by the locations of previous intensive archaeological surveys, with sites tending to decrease in number within areas that have been subject to less intensive archaeological survey (ie within the proposed EFW Plant location; the current study area).

Unregistered Aboriginal Sites

The assessment of prior reports indicated that there were also three recorded, but unregistered Aboriginal sites located within, or in close proximity to, the study area. Details of sites reported on, but not previously AHIMS registered, are provided below. All three of these sites have now been registered with the AHIMS registrar through the course of this project. However, only one of these unregistered sites is located within the current study area.

Table 2.2 Summary of Aboriginal sites (AHIMS Search area)

Sites	Number
AHIMS Registered Sites	63
Unregistered Sites	3
Total	69

Archbold Road 1

This site is comprised of three recorded sites; M4U4, RF/ISF1 and RF/ISF2. M4U4 was first recorded by Brayshaw and Haglund¹³ (see Brayshaw and Haglund 1996 in Section 2.1.1 above), and consisted of three artefacts located over a distance of 270m on a fire trail just on the border of/slightly outside the current study area boundary. These artefacts were recorded on areas of exposure adjacent to intact vegetation, which was designated as an area of associated PAD.

During the JMcDCHM survey in 2002 (see JMcDCHM 2002 in Section 2.1.1 above), two new surface sites were recorded: RF/ISF1 and RF/ISF2. These two sites both consisted of an isolated artefact on a track within 100m of each other.

Due to the proximity of these three sites to each other, and that none of them had been registered with AHIMS, in 2002 JMcDCHM prepared a site card to register all three sites as a single site. However, this site had not previously been registered with AHIMS.

Sargents 1 and 2

Through the survey undertaken by JMcDCHM 2002 of the study area, two artefact sites were recorded in the land immediately adjacent to the current study area (referred to in the 2002 report as ‘Sargents’ land). Sargents 1 consisted of two artefacts in an area of various dirt vehicle tracks, in association with an area of extensive dumping of building and household rubbish, where severe sheet wash erosion had cut through the soil. Sargents 2 was located to the west of Sargents 1, and consisted of two artefacts on dirt vehicle/bike tracks. Site cards were prepared for both sites at the time of recording in 2002, and included in Appendix 5 of the JMcDCHM 2002 report, however neither was registered with AHIMS at the time.

While neither Sargents 1 or 2 are located within the current study area, they have been registered through the course of this project as they contribute to the wider Aboriginal site location patterning in the regional context of the study area.

2.1.3 Synopsis of Known Aboriginal Sites and Previous Work

A number of archaeological surveys have been undertaken surrounding and including portions of the study area. The intensity of archaeological survey has resulted in the recording of numerous Aboriginal sites and the patterning observed in the AHIMS data. In addition, a number archaeological excavations have been undertaken, all of which have recovered sub-surface material from associated deposits.

Artefact sites dominant the record for the study area and surrounding land, particularly in association with areas of exposure and erosion. Sub surface excavations have demonstrated the ability for areas of moderate to low disturbance to possess intact archaeological deposits with low, moderate and high artefact counts, and in some cases, stratigraphic integrity of alluvial soils (ie Oakdale Central), and evidence for Aboriginal occupation of the region other than stone objects (ie hearths and earth ovens at Oakdale Central).

A total of 69 sites (63 on AHIMS, 3 previously unregistered) are located within, and in close proximity to the study area. Of these sites however, only one is registered within the study area itself. However, previous research, as well as the number of Aboriginal sites registered in the study area surroundings demonstrates that this single site is not an accurate reflection of the presence of Aboriginal archaeological deposits within the study area. Previous research demonstrates that the study area is likely to possess Aboriginal stone objects and archaeological deposits in all areas that have not previously been subject to high levels of historical ground disturbance.



Figure 2.1 JMcDCHM 2009: Archaeological Sensitivity Zoning.



Figure 2.2 AHIMS results. (Source: OEH AHIMS, Near Maps with GML additions 2014).

2.2 Landscape Context

The purpose of this section is to provide contextual information for use in developing a predictive model relating to the remains for evidence of Aboriginal occupation and use of the study area. Interactions between people and their surroundings are of integral importance in both the initial formation and the subsequent preservation of the archaeological record. The nature and availability of resources including water, flora and fauna and suitable raw materials for the manufacture of stone tools and other items had (and continues to have) a significant influence over the way in which people utilise the landscape.

Alterations to the natural environment also impact upon the preservation and integrity of any cultural materials that may have been deposited whilst current vegetation and erosional regimes affect the visibility and detectability of Aboriginal sites and objects. For these reasons, it is essential to consider the environmental context as a component of any heritage assessment.

2.2.1 Geology

The study area is located within a primary geology of a Triassic Wianamatta Group and is a part of the Liverpool sub-group with a structure of Bringelly shale overlaying both Minchinbury Sandstone and the Ashfield shale sequences. The Bringelly shale formation comprises well-bedded shales, carbonaceous and non-carbonaceous claystone, laminates, quartz and occasional beds of fine to medium lithic sandstones.¹⁴

The natural landscape of the study area is characterised by its location within the Cumberland Plain and its proximity to, and association with Ropes Creek, a third order permanent water source.

The natural topography of the broader landscape is characterised by the gently undulating rises of the Wianamatta Group shales.

2.2.2 Geomorphology and Soils

Landforms across the study area are comprised of relatively flat undulating grass surface terrain containing hillslopes and ridgelines with gently inclining slopes of 5 to 10 degrees. Surrounding local relief is 10 to 30 metres and a modal terrain slope of approximately 3% exists within the study area.¹⁵ In general, the Cumberland Plain is an aggrading landscape that results in artefact scatters and Aboriginal sites being buried over time.

The geology of the study area is overlain by the Blacktown soil landscape¹⁶. The soils of the Blacktown soil landscape range in depth from shallow to moderately deep (less than 100cm) and consist of red and yellow podzolic soils on crests, grading to yellow podzolic soils on lower slopes and on drainage lines. Minor sheet and gully erosion can often occur within this soil landscape where surface vegetation is not maintained. The South Creek soil landscape can often occur within the Blacktown soil landscape along drainage depressions.

2.2.3 Hydrology

The availability of water has significant implications for the range of resources available and the suitability of an area for human occupation, both past and present. The study area is located approximately 500–700m to the east of Ropes Creek (a third order stream in this location), and therefore has a number of locations where water would have been available. The study area contains one second order tributary of Ropes Creek (including a first order stream node) in the south of the study area (within the area proposed as the location for the Energy Plant). A first order stream drains out of the study area from the eastern boundary approximately in the centre of the site, with the headwaters of another first order stream entering the study area just to the north of the first (Figure 2.3).

The presence of fresh water within the study area, as well as its close proximity to a permanent water source (ie Ropes Creek) means that a source of fresh water should have been accessible all year round from the landforms present within the study area. Eastern Creek is located approximately 3km to the east of the current study area.

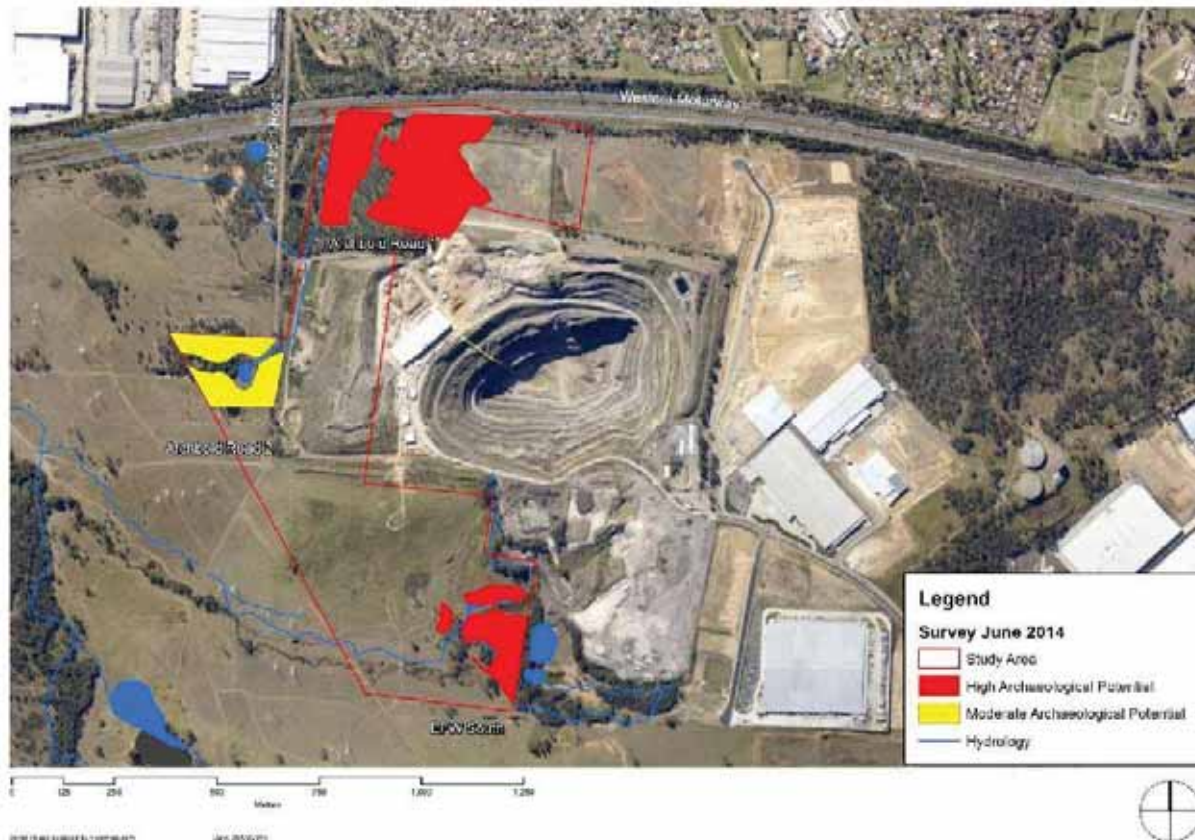


Figure 2.3 Hydrology of the study area with zones of archaeological potential. (Source: Near Maps with GML additions)

2.2.4 Vegetation

The Cumberland Plain originally contained a complex of woodland and forest adapted to mostly clayey soils.¹⁷ The vegetation community surrounding the study area includes trees such as the Grey Box (*E. moluccana*), and the Forest red gum (*E. tereticornis*). Ironbarks (mainly Red Ironbark or Mugga—*E. sideroxylon*) also survive in stands or in isolation. Blackthorn (*Bursaria spinosa*) and paperbark (*Melaleuca spp*) are also representative of the woodland in the area. Species such as swamp oak (*Casuarina glauca*) continue to dominate the closed woodlands along creek lines.

The variability of soils across the site and the wider region would have provided a resource rich interface with species adapted to the sandstone and shale soils. The study area would have originally comprised of open eucalypt woodland (eg Forest red gum) in which trees were widely spaced and the ground cover was dominated by grassed understoreys. Closed woodland of paperbark and swamp oak, for example, would have been present along the creek margins.¹⁸

Most of the original vegetation across the study area has now been cleared and is now dominated by introduced pasture grasses. Eucalypts intermingled with pockets of River oaks, along with patchy occurrences of regrowth, shrubs, bushes and weeds occur along the margins of the second and first order tributaries of Ropes Creek present in the south of the study area. A wooded area is present in the north of the study area, bounded by the M4 to the north, and the south/south east by the Hanson Wallgrove Quarry.

2.2.5 Land Use History and Disturbance

A Heritage Impact Statement (HIS) was prepared at the same time as this report, which included historical research into the land use history of the study area. The findings of this historical research is summarised below with regards to associated ground disturbance across the study area. For full details regarding historic land use including land titles and background, see full GML HIS report¹⁹.

Between 1818 and 1920, the area between Prospect and South Creek along the Western Highway was granted to free settlers and ex-convicts. The study area is located across a number of these grants, however the majority falls within John Thomas Campbell's 1100 acre grant, bounded by Ropes Creek to the west, while the northern section of the study area falls within sections of the 800 acres of land granted to William Cox Junior²⁰ (Figure 2.4).

From documentary sources, it is known that the Chatsworth estate, located to the west of the current study area, was developed with a farm and some outbuildings, close to Ropes Creek. Many of the structures associated with the farm remain standing or are evident in the landscape in this area. During the early period of European settlement, no recorded development took place within the portions of the grants which now encompass the study area. Some agricultural uses may have taken place, particularly in the southern portions of the lot which were later owned by the Shepherd brothers as they were likely to have been part of their nursery. The road running through the study area and connecting the Chatsworth homestead with Archbold Road was likely created during the mid-1800s to provide access to the farm.

During the mid-twentieth century, a portion of land across the Campbell and Cox estate was affected by the easement of a transmission line to the Sydney West substation in the south. This caused the division of the estates into the irregular lots they currently form. Archbold Road (then Chatsworth Road) was in place by this time. However, the road to the Chatsworth homestead remained unsealed (Figure 2.5). The construction of the M4 Motorway in the 1970s also alienated portions of the Cox estate.

Since the 1950s, a number of these lots which had been subdivided from the larger grants were purchased by Ray Fitzpatrick Pty Ltd²¹, later known as Ray Fitzpatrick Quarries. Major development by this company commenced before 1956 in the form of excavation of a large open cut mine to the immediate east of the study area. The progressive expansion of the quarrying activity led to the excavation of a portion in the centre of the study area (within Lot 2 DP 1145808) and land use associated with this facility across the site.

Analysis of aerial photography from 1947 (Figure 2.6), 1956 (Figure 2.7), 1978 (Figure 2.8) and 1986 (Figure 2.9) provides some indication of land use during the latter half of the twentieth century. Changes to the landscape during this period include:

- A small dam in the northwest corner, visible in 1947, expanded progressively with increased vegetation in that area since 1986.
- The unnamed road off Archbold Road became more defined and regular after 1956.
- A new dam in the far west corner was created by 1978.
- Quarrying activity was expanded into the study area in 1978, and again in 1986.

At some stage before the end of 2007, a diversion trench was cut across the south of Lot 2, DP262213 (in the south of the study area), in order to provide temporary diversion of dam overflow from the

adjoining property to a minor creek line to allow remediation works to occur in the intervening creek area²². The disturbance created by this diversion is presented in Figure 2.10 and discussed in JMcDCHM 2009 (Section 2.1.1 above).

Therefore, previous land use history and ground disturbance within the current study area can be summarised as follows:

- Limited historic ground disturbance was undertaken across the study area from 1818 to 1956;
- High levels of ground disturbance were undertaken in the centre of the study area in association with the excavation and quarrying activities and development of associated facilities from 1956;
- Excavation for a diversion trench in the south of the study area that took place sometime between 2005 and 2007 resulted in high levels of soil disturbance in the south of the study area, in association with a creek line; and
- Other than vehicle tracks across the grassed section of the study area (ie south of the quarry and associated facilities, and north of the creekline in the south), this part of the study area appears to have been subject to limited historical ground disturbance.

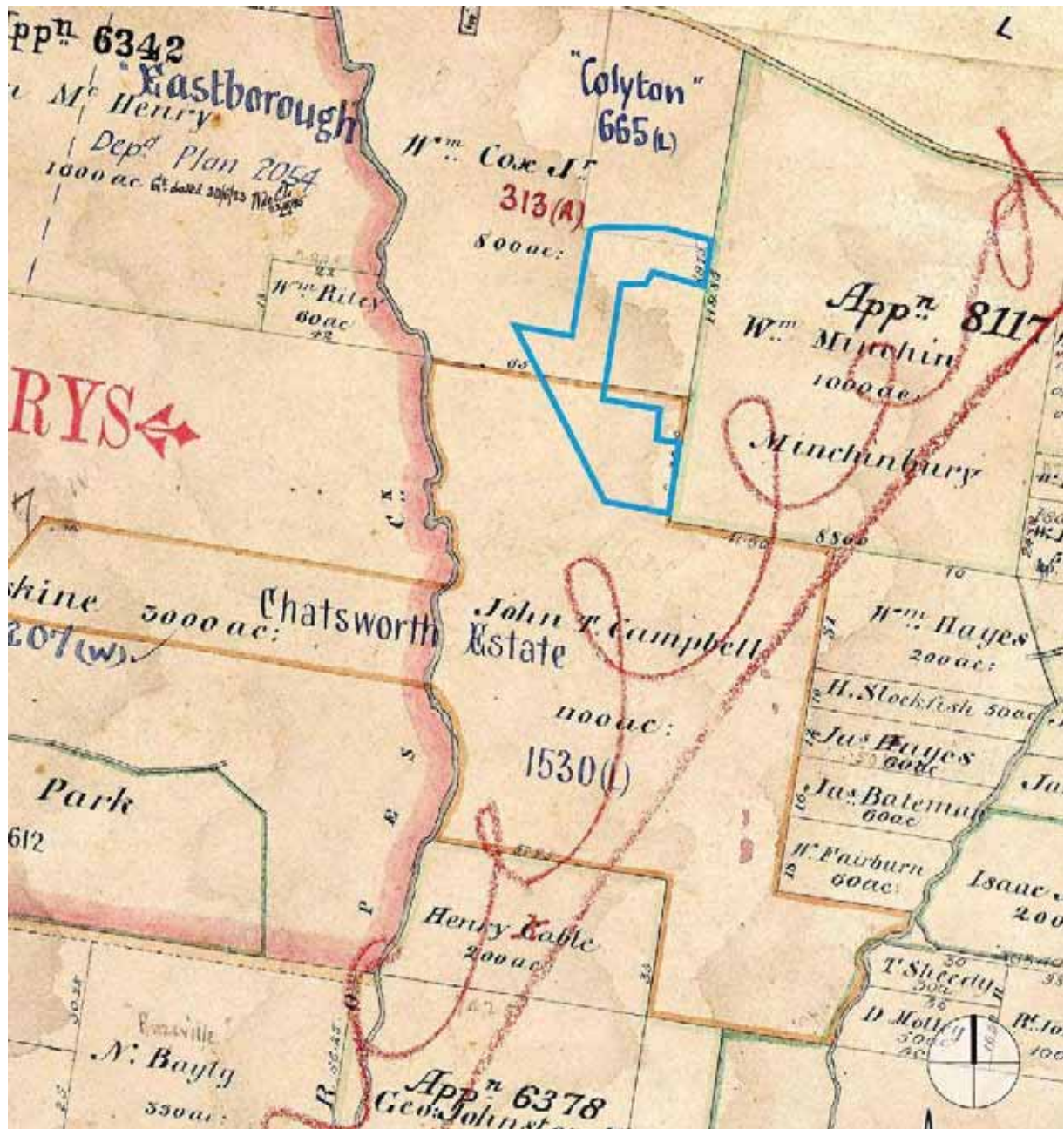


Figure 2.4 1898 Melville Parish Map showing the location of the study area in relation to the first land grants in the area. (Source: Department of Land and Property Information)



Figure 2.5 1938 Melville Parish Map showing the location of the study area in relation to later easements and developments. (Source: Department of Land and Property Information)



Figure 2.6 Aerial photograph of the study area in 1947. (Source: Department of Land and Property Information)



Figure 2.7 Aerial photograph of the study area in 1956. (Source: Department of Land and Property Information)

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Figure 2.9 Aerial photograph of the study area in 1986. (Source: Department of Land and Property Information)



Figure 2.10 Aerial photograph of the study area in 2007. (Note the disturbance in the south of the study area around the creek).
Source: GoogleEarth with GML Additions)

2.3 Regional Character and Aboriginal Heritage Predictive Model

This section considers the evidence for Aboriginal landscape (regional) use of the broader study area, as presented in Sections 2.1 and 2.2. The aim is to highlight the main issues and regional character of Aboriginal land use and the material traces it has produced along the Cumberland Plain.

2.3.1 Aboriginal Chronology in the Sydney Area

Thousands of occupation sites have been documented for the Sydney region and the available radiocarbon ages are thus only indicative of the rates of occupation for each millennium. Most of the determinations date to the second millennium (1ka–2ka BP) with around 50% of the dates falling within the last 2000 years. Recent archaeological excavations have revealed a number of older open site deposits in the region with Pre-Bondaian assemblages, but not all of these have been dated. It is likely, therefore, that the available determinations underestimate the number of assemblages more than 5000 years old.

The Eastern Regional Sequence (ERS) is a framework for chronologically understanding changes in lithic technologies in southeastern Australia, particularly in the Sydney region. Our understanding of temporal change and characteristics of lithic technologies within the Bondaian phases of ERS for the Sydney region is presented in Table 2.3.

Table 2.3 Eastern Regional Sequence.

Period	Age	Description
Pre-Bondaian	c30,000–8000BP	Preferential use of silicified tuff in assemblages. Cores and tools vary widely in size. No backed artefacts, elouera or ground stone. Predominant technique is unifacial flaking. Bipolar flakes are rare.
Early Bondaian	c8000–3000BP	Decline in use of silicified tuff. Shift in rare material usage. Appearance of backed artefacts. Wide use of bipolar flaking.
Middle Bondaian	c3000–1000BP	Main phase of backed artefacts. Introduction of asymmetric alternating flaking. Smaller tools and cores. Increase in bipolar flaking.
Late Bondaian	c1000BP–European Contact	Backed artefacts become rare or absent from most sites.

Pleistocene Deposits—Parramatta Sand Body

Multiple phases of prehistoric Aboriginal occupation, from late Pleistocene (c25–30ka) to mid-Bondaian (c3–5ka) were dated from among the lithic assemblages retrieved from this sandy river terrace deposit (JMcDCHM 2005c).

The radiocarbon determinations from RTA-G1 in Parramatta demonstrate multiple occupation events over a considerable time period. The date of $30,735 \pm 407$ BP is the earliest date for human occupation along the eastern coast of Australia. The RTA-G1 determinations indicated that a transition from preferential use of silicified tuff to substantial use of silcrete was made between c6000 and 8000 years ago. A significant amount of occupation evidence from RTA-G1 predates this transition.

Prior to this suite of determinations, we lacked a firm indication of age for silicified tuff assemblages across the Cumberland Plain (and the broader Sydney region) which underlay silcrete dominant assemblages.

Pleistocene Deposits—Discovery Point, Tempe

A date of 9376 ± 61 BP (Wk-16167), calibrated to 10,700 BP (95.4% probability) was recovered for a small weathered silicified tuff assemblage at the former Tempe House, the earliest date for an occupation site in the eastern coastal strip of the Sydney Basin (JMcDCHM 2005b). This date provided contextualization of an earlier phase of stone tool production that has now been identified in a number of open stratified sand bodies around the region (at Richmond, Rouse Hill, and Parramatta) (JMcDCHM 1997c, 2001 and 2005d). This date likely referred to an earlier silicified tuff assemblage (characterised by relatively sparse deposition rates, non-blade technology and stone rationing behaviour).

The use of silicified tuff as a Pre-Bondaian signature was also encountered through the increased use of silicified tuff at the base of the Darling Mills State Forest—two rock shelters with dates of 6740 ± 120 BP (Wk-2963) and $10,150 \pm 130$ BP (Wk-2511) (Corkill 1999). These radiocarbon determinations also indicate that use of glossy silcrete (ie heat-treated silcrete)—which dominates most silcrete assemblages on the Cumberland Plain—may have been adopted as early as c6700 and 5050 Cal BP. This is significantly earlier than had been suggested by previous studies of heat treatment in the region (McDonald and Rich 1993).

2.3.2 Cumberland Plain Predictive Model

The Cumberland Plain is one of Australia's most archaeologically excavated landscapes, where the past 20 years has seen hundreds of excavations across many locations and landforms. A number of key Aboriginal heritage archaeological excavations have been undertaken that have informed the archaeological record and provided the basis for predictive modelling on the Cumberland Plain (JMcDCHM 1999, 2002b, 2005b and 2005c; McDonald and Rich 1993; White and McDonald 2010).

On this research basis, a predictive model has been developed that suggests how the likely nature of Aboriginal sites across the Cumberland Plain can vary in terms of landforms and landscape. Stream order is the basis for the Cumberland Plain predictive model of Aboriginal site location (McDonald and Mitchell 1994²³; White and McDonald 2010²⁴), and assumes that Aboriginal people would preferentially select places where the water supply is more permanent and predictable for their usual camping locations. The smallest tributary streams are first order streams and the classification continues stepwise downstream. Two first order streams join at a first order node to form a second order stream; two second order streams join at a second order node to form a third order stream, and so on.

It is predicted that the size (density and complexity) and nature of archaeological features will vary according to the permanence of water (ie ascending stream order), landscape unit and proximity to lithic resources in the following ways:

- in any landscape location across the Cumberland Plain, there is a chance that a 'background scatter' of Aboriginal objects exists—that is, objects deposited as a consequence of one-off manufacture and/or use, where no correlation would be associated with a landform or a more permanent activity area. Such areas are unlikely to contain a subsurface archaeological deposit;
- assessment of archaeological subsurface potential solely through surface manifestation of artefacts during surface survey is inadequate to accurately identify and assess the presence of subsurface deposits as soils are largely aggrading across the Cumberland Plain, and therefore most artefacts are buried;
- in the headwaters of upper tributaries (ie first order creeks), archaeological evidence will be sparse and represent little more than a background scatter; and where distant from stone sources, it would demonstrate the use of stone rationing strategies;
- in the middle reaches of minor tributaries (second order creeks) there will be archaeological evidence for sparse but focused activity (eg one-off camp locations, single episode knapping floors);
- in the lower reaches of tributary creeks (third order creeks) there will be archaeological evidence for more frequent occupation. This will include repeated occupation by small groups, knapping floors (perhaps used and reused), and evidence of more concentrated activities;
- on major creek lines (fourth order) there will be archaeological evidence for more permanent or repeated occupation. Sites will be complex and may even be stratified. Artefacts will show less use of rationing strategies as people may have been less mobile during their use of tools, and remained in the same location for several days, or even weeks;
- creek junctions may provide foci for site activity; the size of the confluence (in terms of stream ranking nodes) could be expected to influence the size of the site;

- ridge top locations between drainage lines will usually contain limited archaeological evidence although isolated knapping floors or other forms of one-off occupation may be in evidence in such a location;
- elevated terraces and flats, overlooking higher order watercourses may contain archaeological evidence for more permanent or repeated occupation; and
- naturally outcropping silcrete will have been exploited and evidence for extraction activities (decortication, testing and limited knapping) would be found in such locations.

It has also been hypothesized that stone artefact based sites in close proximity to an identified stone source would cover a range of size and cortex characteristics. With distance away from the resource, the general size of artefacts in the assemblage should decrease, as should the percentage of cortex and rate of artefact discard (distance–decay model). The increasing number of new silcrete sources has made the testing of the distance decay model (Dallas & Witter 1983) more difficult, and suggests that this model is a risky mechanism for explaining raw material preferences around the Cumberland Plain.

2.3.3 Strategic Management Model

As briefly summarised in Section 2.1.1 above (JMcDCHM 2002), a Strategic Management Model (SMM) was developed for the lands previously covered by SEPP 59, within which the current study area is located. This SMM was modelled on a similar approach to wider landscape based archaeological modelling, as utilised at the St Marys Development Site (SMDS) (former ADI St Marys).²⁵ The SMM was based on a combination of both scientific and cultural (social) values, and identified the range of representative landscapes with the best conservation potential in combination with identified areas of Aboriginal significance. The main aim of this strategy is to preserve a representative sample of intact landscapes where possible, in order to ‘ensure that a range of human responses, as represented by the archaeology, can be protected’.²⁶ The SMM identified three zones across the former SEPP 59 lands. All archaeological assessment that has been undertaken since the JMcDCHM 2002 report, including the study area, has been predicated on the use of this model to mitigate against impact to Aboriginal cultural heritage values.

Table 2.4 Archaeological management zones across SEPP 59 lands, after the SMM. (Source: JMcDCHM 2002)

Management Zone	Archaeological Potential	Management Outcome
Zone 1	High potential for intact archaeological evidence.	Conservation Zone to be selected from this zone. Remainder to be developed.
Zone 2	Moderate potential for intact archaeological evidence.	Developable land. Some landscapes may require further work before clearance given.
Zone 3	Low to no potential for intact archaeological evidence.	Developable land with no constraints—no further archaeological work required

2.3.4 Current Study Area Predictions

The current study area is located to the east of Ropes Creek, and contains one second order stream (in the south), as well as one first order stream, and the headwaters of another first order stream in the north. Archaeological material associated with the second order tributary is anticipated to be sparse and likely to represent background densities associated with people moving across the landscape.

Deeper alluvial soils, such with the possibility to yield stratigraphic evidence, are unlikely to be present within the study area. The following predictive statements can be made about the study area, however would likely require validation through archaeological test excavation.

Based upon an understanding of the landforms and disturbances associated with the study area, it can be stated that:

- Aboriginal sites are most likely to be evidenced by the presence of stone artefacts. Other types of Aboriginal sites are unlikely to occur within the study area;
- most landforms within the study area that contain residual soil horizons; even those with sparse or no surface manifestations of Aboriginal objects may contain subsurface archaeological deposits, albeit in low densities $>1/m^2$;
- most sites will be of middle to late Holocene age (4000 years before present to c1850). Suitable geomorphic conditions for the preservation of Pleistocene aged assemblages do not occur within the study area;
- the density and diversity of implements and debitage are likely to be conditioned by permanence of water (stream order) and landscape unit;
- distance to known silcrete sources seems to have little influence on artefact discard generally, although many silcrete sources are perhaps still to be identified. Proximity to known sources does influence the proportion of flaked to blocky silcrete material on sites; and
- landforms that overlook creek systems may have also been used for Aboriginal activities. Such landforms include the hilltops, hill slopes and low flat elevations with a creek facing aspect. .

2.4 Endnotes

- ¹ DECCW *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (24 September 2010). Pages 20-21.
- ² Kohen 1986, An archaeological survey of the Aboriginal sites in the City of Blacktown, in JMcDCHM 2002 Archaeological assessment of Aboriginal sites: Eastern Creek Strategic Land Use Study, SEPP59.
- ³ *ibid*, p. 20
- ⁴ Brayshaw and Haglund 1996, M4 Upgrade Archaeological Survey for Aboriginal Sites for proposal to upgrade the M4 Motorway from Church St, Parramatta, to Coleman St, St Marys, and Prospect to Emu Plains.
- ⁵ JMcDCHM 2002 Archaeological assessment of Aboriginal sites: Eastern Creek Strategic Land Use Study, SEPP59
- ⁶ JMcDCHM 2005 Heritage Conservation Strategy for Aboriginal sites in lands owned by Valad and Sargents, Eastern Creek Business Park (Stage 3) Precinct Plan.
- ⁷ ERM 2005, Historical and Aboriginal Heritage Assessment of Lot 4 DP 262213, Eastern Creek
- ⁸ JMcDCHM 2006 Archaeological Subsurface investigations at SEPP59 EC3/1 (#45-5-3201) and EC3/2 (#45-5-3202), Wonderland Surplus, Old Wallgrove Road, Eastern Creek. Report to Australand Holdings Pty Ltd.
- ⁹ Navin Officer 2007 *Erskine Park Employment Area, Ropes Creek NSW, Archaeological Subsurface Testing Program*.
- ¹⁰ JMcDCHM 2009 'Dial A Dump' Industries Holdings Eastern Creek, The Light Horse Business Centre, Aboriginal Heritage Management Plan, prepared for 'Dial a Dump' Industries.
- ¹¹ GML 2013 Oakdale Central Archaeological Technical Report
- ¹² GML 2014, in preparation, Oakdale Central Aboriginal Salvage Excavation Report.
- ¹³ Brayshaw and Haglund 1996
- ¹⁴ Bannerman, SM & PA Hazelton. 'Soil Landscapes of the Penrith 1:100,000 Sheet'. Soil Conservation of NSW. Sydney.
- ¹⁵ Speight, JG 1990 Landforms. In Australian Soil and Land Survey Field Handbook. McDonald, RC et al. Inkata Press.
- ¹⁶ *ibid*.

- ¹⁷ Benson, D & Howell, J 1990 Taken for Granted: The bushland of Sydney and its suburbs. Kangaroo Press (in association) with the Royal Botanic Gardens, Sydney.
- ¹⁸ See for example Denson, D & J Howell 1990, 'Taken for Granted: the bushland of Sydney and its suburbs', Kangaroo Press Pty Ltd, NSW.
- ¹⁹ GML Heritage 2014, Energy From Waste (EFW) Plant, Eastern Creek, Heritage Impact Statement, prepared for Urbis on behalf of The Next Generation (TNG).
- ²⁰ *ibid*, p4.
- ²¹ Certificate of Title Vol.13544 Fol.125, Vol.13548 Fol.70, Vol.13507 Fol.223.
- ²² Ian Grey Groundwater Consulting Pty Ltd 2007, Results of Water Quality and Soil Sampling and Analysis, Lot 2, DP262213, Old Wallgrove Road, Eastern Creek, Letter report to Minter Ellison Lawyers.
- ²³ McDonald, J and Mitchell, P 1994. An assessment of the archaeological context, landuse history and management requirements for Aboriginal Archaeology in the Australian Defence Industries Site, St. Marys, NSW. JMcDCHM Pty Ltd Report to ADI Ltd, NSW Property Group.
- ²⁴ White, E and McDonald, J 2010. Lithic Artefact Distribution in the Rouse Hill Development Area, Cumberland Plain, New South Wales. *Australian Archaeology*. p 70.
- ²⁵ GML + JMcDCHM 2013 SMDS Central Precinct
- ²⁶ JMcDCHM 2002 p. 43

3.0 Archaeological Field Survey

The first aim of an archaeological survey is to identify all visible evidence of past Aboriginal occupation within the study area. The second aim is to determine zones that have the potential for buried subsurface archaeological deposits. Combining these two together will allow the creation of an Archaeological Zoning Plan (AZP) that defines where Aboriginal evidence is (and will be) across the study area. In addition consideration should be given to locations within the study area that do not contain physical evidence from Aboriginal occupation, but would have been significant to Aboriginal use of the landscape, eg walking tracks, ceremonial areas, Dreaming trails etc. These should also be recorded, mapped and considered within the framework of assessment and management for Aboriginal heritage.

It must be noted that practically all archaeological survey is limited by a number of factors such as ground surface visibility, access restrictions and tempered by environmental factors during the period of survey. These influences will affect the outcome of any survey, and possibly introduce biases into the results.

3.1 Survey Methodology and Survey Sampling Strategy

An archaeological survey was undertaken by GML Archaeologists (Sam Cooling and Jane McMahon) and representatives from seven RAPs on Friday 13 June 2014. A linear pedestrian survey aimed to assess the whole study area, inspecting all soil exposures and zones with low vegetation that contained tracks and paths. Sampling included all landforms that will potentially be impacted by the proposed project. As archaeological survey had previously been undertaken across the study area (JMcDCHM 2002, 2005, 2009), the current survey aimed to ground truth the current state of the study area (as compared with previous surveys), as well as to attempt to relocate previously identified artefact locations and identify Potential Archaeological Deposits (PADs).

The archaeological survey was undertaken in accordance with the OEH *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales 2010* and the results recorded in this section of the report.

The study area was systematically surveyed with parallel transects, where possible, and opportunistic inspection of areas and features which were identified as having potential to be associated with Aboriginal cultural heritage, or identified as requiring archaeological test excavation. Survey units were accurately defined and the beginning, length and end point of transects or survey unit boundaries were recorded using a GPS.

Newly identified sites had their location recorded using a GPS, their surface visible content described, their visible extent mapped on the aerial and were digitally photographed. Notes were also made of soil conditions and evidence of disturbance. AHIMS cards will be completed for each site, which will be submitted to the OEH. An attempt was made to relocate previously recorded sites to confirm their condition.

The landscape of the study area was characterised and areas suitable for test excavation were designated in collaboration with the RAPs.

3.1.1 Field Methods

OEH Definitions

In accordance with the OEH guidelines¹, the description of survey coverage includes landform units, the total area surveyed within that landform unit and a quantification of the level of exposure and visibility. OEH have defined exposure and visibility thus:

Visibility is the amount of bare ground (or visibility) on the exposures which might reveal artefacts or other archaeological materials. It is important to note that visibility, on its own, is not a reliable indicator of the detectability of buried archaeological material. Things like vegetation, plant or leaf litter, loose sand, stony ground or introduced materials will affect the visibility. Put another way, visibility refers to 'what conceals'.

Exposure is different to visibility because it estimates the area with a likelihood of revealing buried artefacts or deposits rather than just being an observation of the amount of bare ground. It is the percentage of land for which erosion and exposure was sufficient to reveal archaeological evidence on the surface of the ground. Put another way, exposure refers to 'what reveals'.²

The calculation of effective coverage provides a means with which to describe the proportion of the study area in which it is possible to assess the presence or absence of archaeological material. This measure is expressed as a percentage and can be calculated using a number of different techniques. For this study, effective coverage was calculated by multiplying the area surveyed by the percentage of exposure and visibility within the survey unit. The area of effective coverage was then expressed as a percentage of the whole survey unit.

3.1.2 Archaeological Potential

Archaeological site formation is a complex combination of scientific factors, such as bioturbation; and environmental factors, such as erosion or burial through soil movement. Once discarded on the ground surface, artefacts are often readily incorporated into the topsoil horizons through the process of bioturbation. Most commonly, dense artefact deposits exist hidden beneath the upper surface, unobservable by the casual observer (cf Wandsnider and Camilli 1992³; Fanning and Holdaway 2001⁴). Archaeological assessments that do not employ appropriate methods of subsurface detection or prediction cannot reliably define an area's archaeological content. Most frequently, the eroded component of a larger subsurface deposit is detected and recorded at a site. Where soils are sandy, artefacts can occur at greater depths and erosion may frequently expose artefacts. Therefore, it is crucial that soils, sands and the geomorphology of an area are defined in an archaeological assessment and the archaeological implications defined. An understanding of these factors, linked further to the notions of site integrity and condition, yield an understanding of an area or site's archaeological potential.

It is important to note that the level of archaeological potential relates to the likelihood of discovering an Aboriginal object within a location. Further description should then be made as to the potential condition and integrity of the soil matrix and potential site itself. Only once all these factors have been considered can scientific value start to be assessed for an area with potential. Therefore, while scientific value and potential are linked, it must be noted that these values and potentials are not the same and can differ substantially for any single site or area with potential.

Areas with archaeological potential were identified according to the definitions in Table 3.1.

Table 3.1 Definitions of Archaeological Potential.

Rank	Definition	Example
No potential	Artefacts and other evidence cannot occur in situ.	Eroded landforms, reconstructed landscapes, hazardous landscape, developed areas.
Low potential	Artefacts (or other evidence) are not normally found in comparable contexts but could occur in low densities making detection unlikely.	Landforms with no specific focus for use, that is, with water sources or undifferentiated slopes.
Moderate potential	Artefacts (or other evidence) are known to occur in comparable landforms in detectable densities (~1 artefact/m ²) and there is an unknown possibility for detection.	Landforms with an environmental focus which may have seen seasonal visitation.
High potential	Artefacts (or other evidence) are consistently found in comparable landforms or similar environmental contexts and thus will certainly be found in any ground breaking works.	Landforms with known environmental focus encouraging repeat visitation to specific locale, that is, margins of swamp or near high order creeks.

3.2 Survey Results—Survey Units & Landforms

In accordance with OEH recording requirements the study area was surveyed according to survey units, landforms and landscapes. All survey units are described in Table 3.2 and shown in Figure 3.1. Details with respect to landform coverage are provided in Table 3.3.

Whilst the whole study area was walked and inspected for Aboriginal objects, only transects associated with the zones of potential are described in the following table and figures.

Table 3.2 Survey Coverage

Survey Unit (SU)	Landform	Survey unit area (SUA) (sq m)	Visibility (V) %	Exposure (E) %	Effective coverage area (ECA) (sq m) (=SUA* V%*E%)	Effective coverage % (=ECA/SUA *100)
1	slope	120	10%	20%	2.4	2%
2	hilltop	90	0	0	0	0
3	slope	560	5%	20%	5.6	1%
4	slope	310	5%	5%	0.78	0.25%
5	slope	500	5%	5%	1.25	0.25%
6	slope	370	100%	100%	370	100%
7	slope	170	0%	0%	0	0%
8	slope	454	5%	20%	4.5	1%
9	Slope	240	100%	100%	240	100%
10	Slope	360	10%	5%	1.8	0.5%
11	Ridge	400	5%	5%	1	0.25%
12	Slope	290	1%	0	0	0

13	slope	420	100%	100%	420	100%
14	slope	250	50%	20%	25	10%
15	slope	300	50%	50%	75	25%
16	slope	260	80%	80%	166	64%
17	slope	250	90%	90%	203	81%
18	Slope	360	10%	5%	1.8	0.5%

Table 3.3 Landform summary—sampled areas

Landform	Landform area (LA) (sq m)	ECA	% landform effectively surveyed (=ECA/LA *100)	Number of Aboriginal sites	Number of artefacts or features
Slope	5214	1517.13	29%	7	14
Ridge	400	1	<1%	1	1
Hill top	90	0	0	0	0

3.3 Survey Results—Aboriginal Sites/Places and Landscapes

The archaeological survey identified a previously recorded site (Archbold Road 1) and two additional previously unrecorded Aboriginal sites. An overview of these sites and areas of PAD are provided in Table 3.4. The locations of all recorded sites and PADs are shown in Figure 3.5.

3.3.1 Archbold Road 1

The area of Archbold 1 was previously assessed by JMcDCHM in 2002 as being an area of high archaeological potential. GML is in agreement with this assessment. Eight pedestrian survey transects (1–8) were used to cover the area (Figure 3.4). There is a hill top in the south east area of the site that slopes down to the western and northern study area boundaries. Ground visibility was hampered by dense vegetation and scrub brush. Soil exposure was limited to transect 6 which followed a vehicle track. Exposed soils were a red clay B horizon. It was along this track where two stone objects were observed, a small silcrete piece (<2cm) and quartz (<2cm). Archbold 1 is comprised of three previously recorded sites (M4U4, RF/ISF1 and RF/ISF2), in addition to the stone objects observed during this survey.



Figure 3.1 Archbold Road 1. (Source: GML 2014)

3.3.2 Archbold Road 2

JMcDCHM (2002) previously assessed this area as having moderate archaeological potential. GML is in agreement with this assessment. Five pedestrian survey transects (14–18) were used to cover the area (Figure 3.4). The site is on a gentle slope covered in dense grass. An east west running unnamed ephemeral creek crosses the area. There is a dam that first appears on the 1947 aerial, at the creek location. Soil exposure and visibility was limited to a dirt vehicle track that crosses the area. Exposed soil profiles consisted of brown silty loam topsoil over brownish red clay. It was along this track where three isolated stone objects were observed, a low density scatter (3 objects) was located further along.



Figure 3.2 Archbold Road 2. (Source: GML 2014)

3.3.3 EFW South

The EFW South site is in the southern portion of the study area that was assessed as being of high archaeological potential. Five pedestrian survey transects (9-13) were placed in the area of the site

(Figure 3.4). An unnamed tributary of Ropes Creek runs across the southern portion of the site, with an unnamed ephemeral creek branching off of it and crossing the site north-south. There is a slightly raised flat area among the trees where these two creeks meet that was determined to be an area of potential archaeological deposit. One stone object (silcrete) was observed on a dirt track adjacent to this area. A second stone object was located along a slight ridge line to the immediate north east of the PAD.



Figure 3.3 EFW South, showing area of PAD in background amongst the trees. (source: GML)

All specific details relating to each individual archaeological site are recorded on the AHIMS site cards. These are attached as Appendix B of this report.

Table 3.4 Recorded Aboriginal heritage sites and places

Site Name	Features	SU	Landform
Archbold Road 1	Lithic scatter, isolated finds	6	Slope
Archbold Road 2	Lithic scatter, isolated finds	14, 15, 16, 17, 18	Slope
EFW South	Isolated finds	11, 9	Ridge, slope

3.4 Analysis and Discussion

3.4.1 Observed Landform and Aspect

Gently inclined slopes were the dominate landform in the study area. Seven of the identified stone object expressions were associated with this landform. There is a slight ridge running north south in the south eastern portion of the study area. It was along this ridge that a stone object was observed at the base of a large tree (EFW South).

In general the PAD's associated with the identified stone object sites were located near ephemeral and second order creek lines. One area of PAD was associated with the Archibold Road 1 site located towards the base of a slight hill in the northern section of the study area.

The Cumberland Plain predictive model and assessment of the environmental context within which the study area is located, suggested landforms across the study area have a moderate potential to contain Aboriginal objects. The model predicts that there will be sparse but focused Aboriginal activity associated with second order creeks and that creek junction may also provide foci for site activity.

3.4.2 Soil Conditions (Integrity and Condition)

Pedestrian survey and examination of historic aerials reveal that much of the study area has been disturbed to varying degrees by both agriculture and industrial activities, although some portions of the study area, primarily in the north and south, have remained largely undisturbed. Along the undisturbed areas, the areas of agricultural disturbance still retain the potential for intact archaeological deposits.

The southern two thirds of the study area appear to have been used for agriculture and animal grazing, as evident by the construction and subsequent expansion of a dam in 1947. By 1978 a large commercial quarry had been constructed to the east of the study area. Large portions of the northern third of the study area appear to have been left largely untouched since 1947. Disturbances associated with the quarry in the northern third of the area can be seen in the 1978 aerial. Disturbance to the topsoil on the hill top overlooking the study area were observed during the survey. This disturbance was a result of terracing and other earthworks associated with the quarry. By 2007 documented disturbances also include topsoil stripping in the southern most portion, expansion of disturbances into the central portion associated with the quarry, and the construction and use of sealed and unsealed vehicle tracks over the extent of the study area. The construction in the 1970's of the M4 motorway along the northern margin of the study area may also have had some impact.

Erosion has generally been restricted to areas immediately associated with the creeks, dam, and vehicle tracks. In general the majority of the study area retains a good level of soil integrity. However areas that have been used for agriculture and grazing may have had an impact on the soils condition. Areas where soil has been removed have a definite impact on both the integrity and condition of said soils.

3.4.3 Environmental Focus

Following the field survey, it would appear that the ephemeral and second order creek systems within the study area may have been the preferred locations for Aboriginal activity. Should sufficient archaeological material be present, then it may be possible to describe this area as an Aboriginal landscape.

3.4.4 Observed Aboriginal sites

The location of the Aboriginal sites identified during the survey is shown in Figure 3.6. No scarred trees or other site features were observed. The most common stone material was red silcrete. This is not surprising considering the abundance of silcrete across the Cumberland Plain. Quartz and tuff were the other material observed during the survey. Stone material was only observed within the zones of archaeological potential associated with the three identified Aboriginal sites.

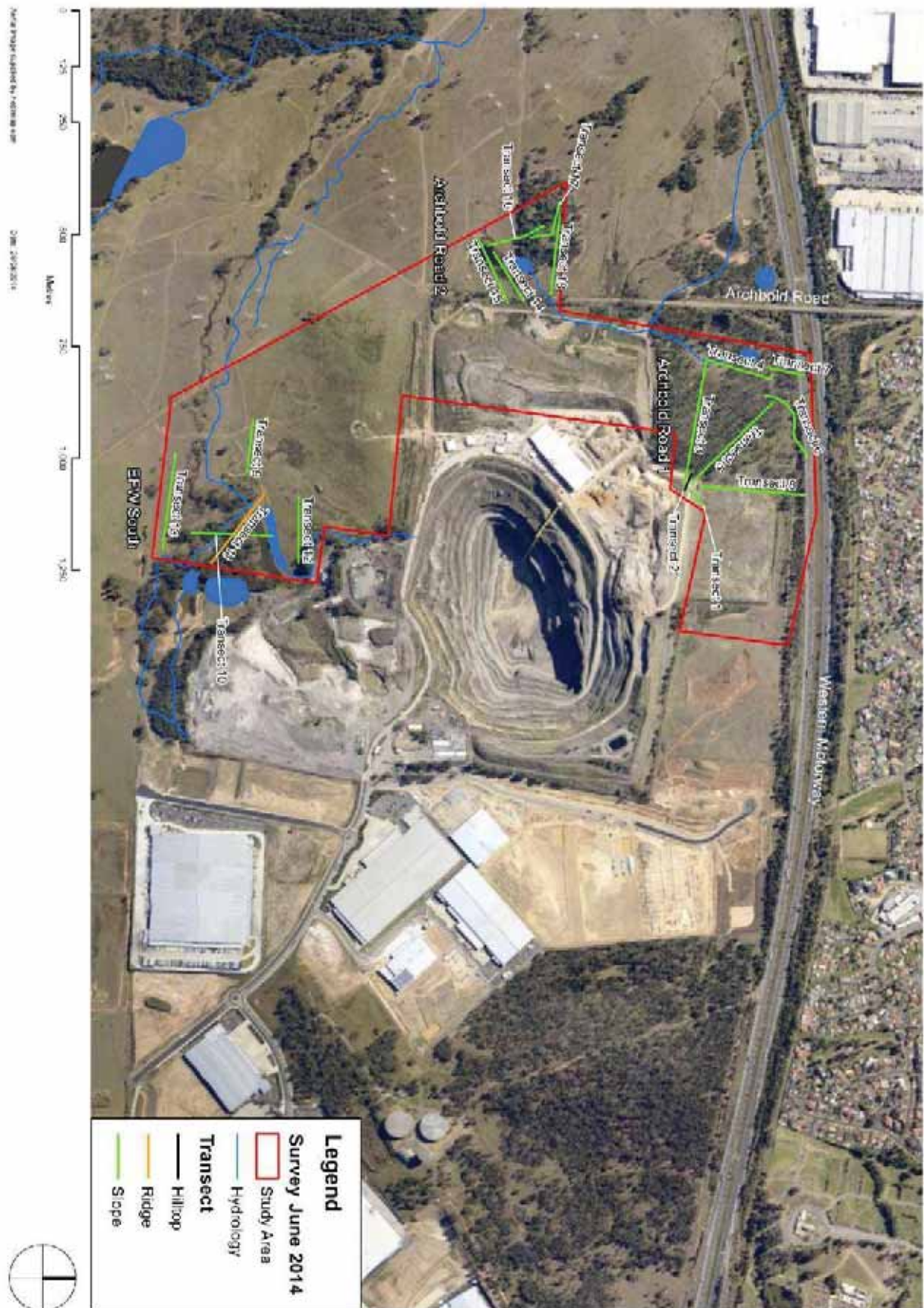


Figure 3.4 Survey transects and the hydrology of the study area. (Source: Near Maps with GML additions)

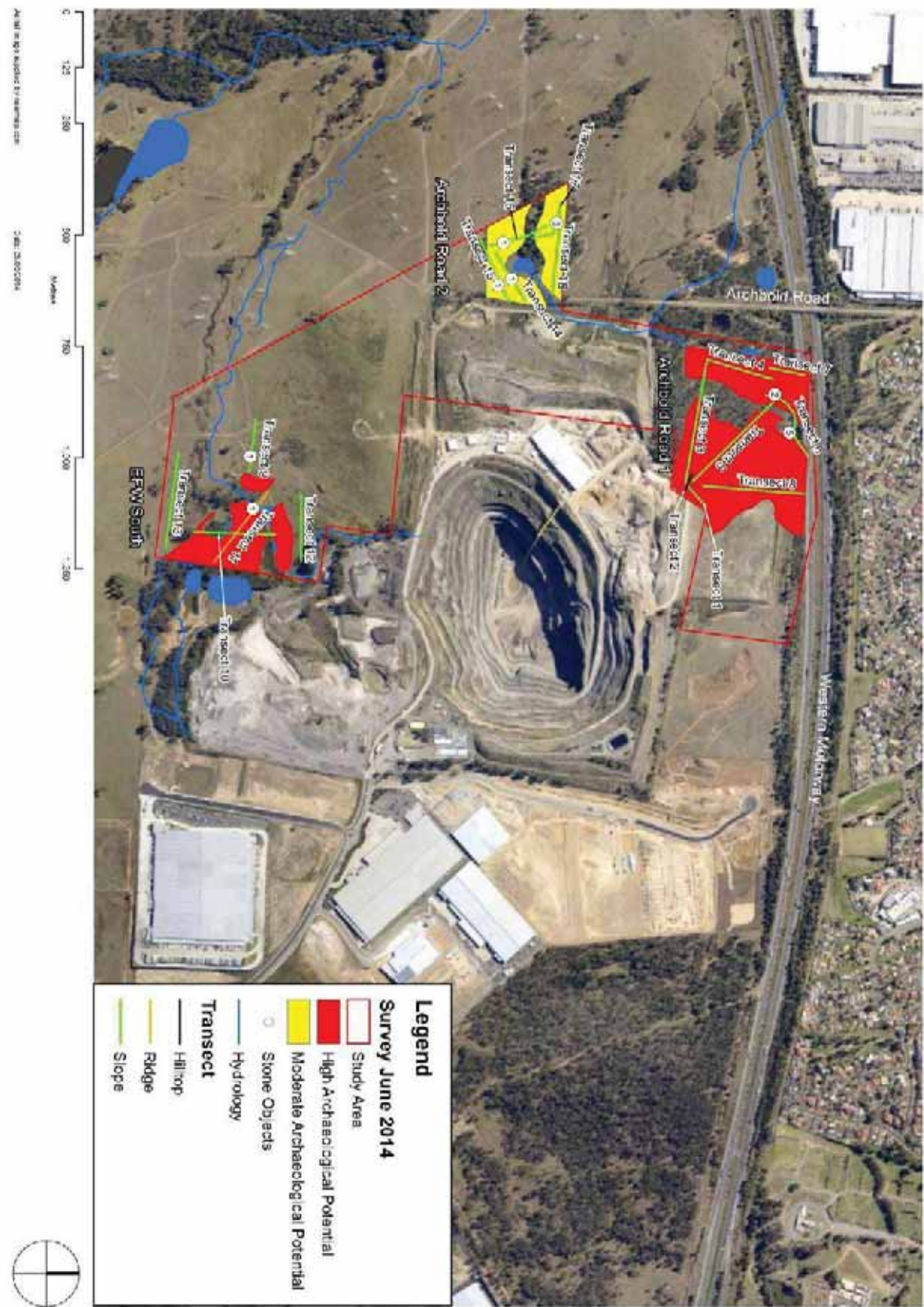


Figure 3.5 Survey transects, the identified Aboriginal sites with their connected zones of archaeological potential and observed stone object densities. (Source: Near Maps with GML additions)