Gunlake Quarry Modification 2

Modification of Project Approval 07-0074
Response to Submissions

Prepared for Gunlake Quarries Pty Limited | 27 January 2015

Planning + Environment + Acoustics

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Final

Report J14119RP1 | Prepared for Gunlake Quarries Pty Limited | 27 January 2015

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1 Introduction

1.1 Purpose of the report

The Response to Submissions report responds to submissions received on the *Gunlake Quarry Project Modification of Project Approval 07-0074 Environmental Assessment* (EA) which was publically exhibited from 23 October to 21 November 2014. Submissions were lodged through the Department of Planning and Environment's (DP&E) website (www.planning.nsw.gov.au) via the web page for the proposed modification, and directly to DP&E from relevant government agencies.

Gunlake acknowledges and thanks all stakeholders for taking the time to review the EA, and to prepare and submit a response.

1.2 Structure of the report

The following chapters provide responses to matters raised in submissions. Chapter 2 provides responses to submissions from government agencies, with matters addressed for each agency. Chapter 3 provides responses to submissions from the public and special interest groups, and are addressed according to the matters raised.

All submissions are available on the DP&E Major Project Assessment website.

2 Government submissions

2.1 Introduction

Government submissions were received from the following agencies:

- NSW Office of Environment and Heritage (OEH);
- Environment Protection Authority (EPA);
- Department of Primary Industries (DPI):
  - NSW Office of Water (NOW);
  - Agriculture NSW;
  - Crown Lands;
  - Division of Resources and Energy (DRE);
- NSW Roads and Maritime Services (RMS); and
- Goulburn Mulwaree Council (the Council).

No agencies objected to the modification.

2.2 Office of Environment and Heritage

The OEH submission considered ecology and Aboriginal cultural heritage. The OEH did not object to the proposed modification.

2.2.1 Ecology

Biosis completed a flora and fauna assessment for the extension in 2014, under the supervision of Stefan Rose, who completed the Ecotone flora and fauna assessment for the original project in 2008. Stefan has provided a response to OEH's comments on the modification, which is included as Appendix D.

In response to OEH's submission, and due to uncertainty over the condition and extent of Box Gum Woodland endangered ecological community (EEC) within the extension areas, EMM completed additional floristic surveys in January 2015. The survey results are presented in Appendix E.

i Avoidance of Box Gum Woodland endangered ecological community (EEC)

OEH raised concerns regarding the lack of project alternatives discussed in the EA to minimise impacts to Box Gum Woodland EEC.

The main EA report (Section 2.18.2) provides the following description of the location of the quarry pit and overburden emplacement bund:

> The location of the extension to the quarry pit and design represents a practical use of the existing pit with minimised heavy quarry vehicle travel distances and visual and acoustic screening. The selected location provides ready access to the hard rock resource while the surrounding topography and vegetation provides screening and buffer zones to the proposed activity.
>
> The extension of the out of quarry overburden emplacement was based on enhancing the acoustic and visual screening already provided to the operations especially the rock processing area.

The modification disturbance area needs to join to the previous disturbance area. The pit extension area needs to be contiguous with the approved pit, so that continuous benches can be developed and allow the maximum hard resource to be extracted for the given surface disturbance footprint. Separate pits require additional areas for pit batters, additional in-pit haul roads and connecting roads outside of the pits. Therefore, extracting the hard rock resource from a separate pit would most likely increase amount of vegetation clearing required.

The pit extension area was selected to extend the approved pit while avoiding mapped vegetation as far as possible (see Figure 2.1). Alternatives considered were to extend the approved pit:

- north – the resource is not economically viable hence the location of the processing area;
- west – this would require the clearing of woodland that forms part of the project's offsets;
- east – the resource is not economically viable hence the location of the overburden emplacement bund; and
- directly south – this would require the clearing of additional woodland.

The pit extension area to the south-east of the current pit was selected to allow 750,000 tpa to be economically extracted while avoiding the majority of the woodland to the north and south of the extension area (see Figure 2.1).

As for the pit, extending the overburden emplacement bund will minimise the bund's footprint compared to developing a separate overburden emplacement. The bund extension will be largely within the previously cleared farmland (with some scattered trees). The bund is elongated north to south to maximise the environmental (primarily acoustic and visual) benefits. There is little or no economic benefit (based on haul distances) of the proposed north-south emplacement configuration compared to a stockpile extending further to the east which would avoid clearing less than about ten scattered trees. This alternative arrangement would not realise the full benefits of the north-south emplacement bund.

ii Impacts to Box Gum Woodland EEC

OEH considers the modification to have a large impact on Box Gum EEC (9.3 ha) given its conservation status. Concerns were also raised regarding the lack of mapping for vegetation surrounding the extension areas.

The extension areas contain disturbed grassland with scattered trees. Biosis (2014) used a 'worse case' scenario for the ecological assessment in accordance with advice received in 2008 from the then Department of Environment and Climate Change (DECC) (now OEH), and mapped the entire extension area as meeting the description of the Box Gum Woodland EEC. However, a further analysis by Biosis based on more realistic assumptions (see Appendix D), found that there is only 0.2 ha of woodland in the extension areas with the remaining areas being highly degraded and cleared grassland. Despite this, Biosis found that some of this cleared grassland could meet the description of the EEC.

It is not possible to determine the quality of the cleared grassland or dominance of native species in the extension areas based on the Biosis Biobanking plots, as these did not include cover abundance data. It is therefore not possible to determine the extent of the EEC based on the Biosis results alone.

An additional field survey was completed in January 2015 by EMM for this Response to Submission report to map the extent and condition of the grassland and woodland across the modification area. The full survey results are provided in Appendix E.

The EMM survey found that the grassland in the overburden emplacement extension area is in low condition or 'cleared' based on the abundance of exotic species present (greater than 50%). However, the grassland in the pit extension area was in better condition as it contains native forbs and grasses.

The survey also found that the majority of the extension areas would have contained a Stringybark-dominated woodland prior to clearing for agriculture, based on remaining vegetation at the site, the position in the landscape (on a higher slope with ignimbrite outcropping visible), geology and the remnant canopy species present. While some characteristic species still occur in parts of the cleared grassland, these areas do not comply with the listed Box Gum Woodland EEC due to the decreasing proportion of characteristic trees, when compared with areas containing the community at the quarry, and the dominance of non-diagnostic tree species (see Appendix E).

Yellow Box and Blakely's Red Gum, which are characteristic species of the EEC, are the dominant remnant trees are in the south-west corner of the pit extension area. These areas are considered to contain remnant Box Gum Woodland EEC (Figure 2.1). The grassland in the same landscape (ie lower slopes and drainage depressions with alluvial and deeper soils) in the surrounding area would have also once supported this vegetation type.

Impacts on the Box Gum Woodland EEC in the Biosis (2014) report have been overstated. Only 7 ha of vegetation in the modification area is considered to represent 'native vegetation' (greater than 50% native species cover). Of this, only 0.2 ha of woodland and 0.4 ha of grassland is considered to meet the description of Box Gum Woodland EEC.

iii Adequacy of offset proposal

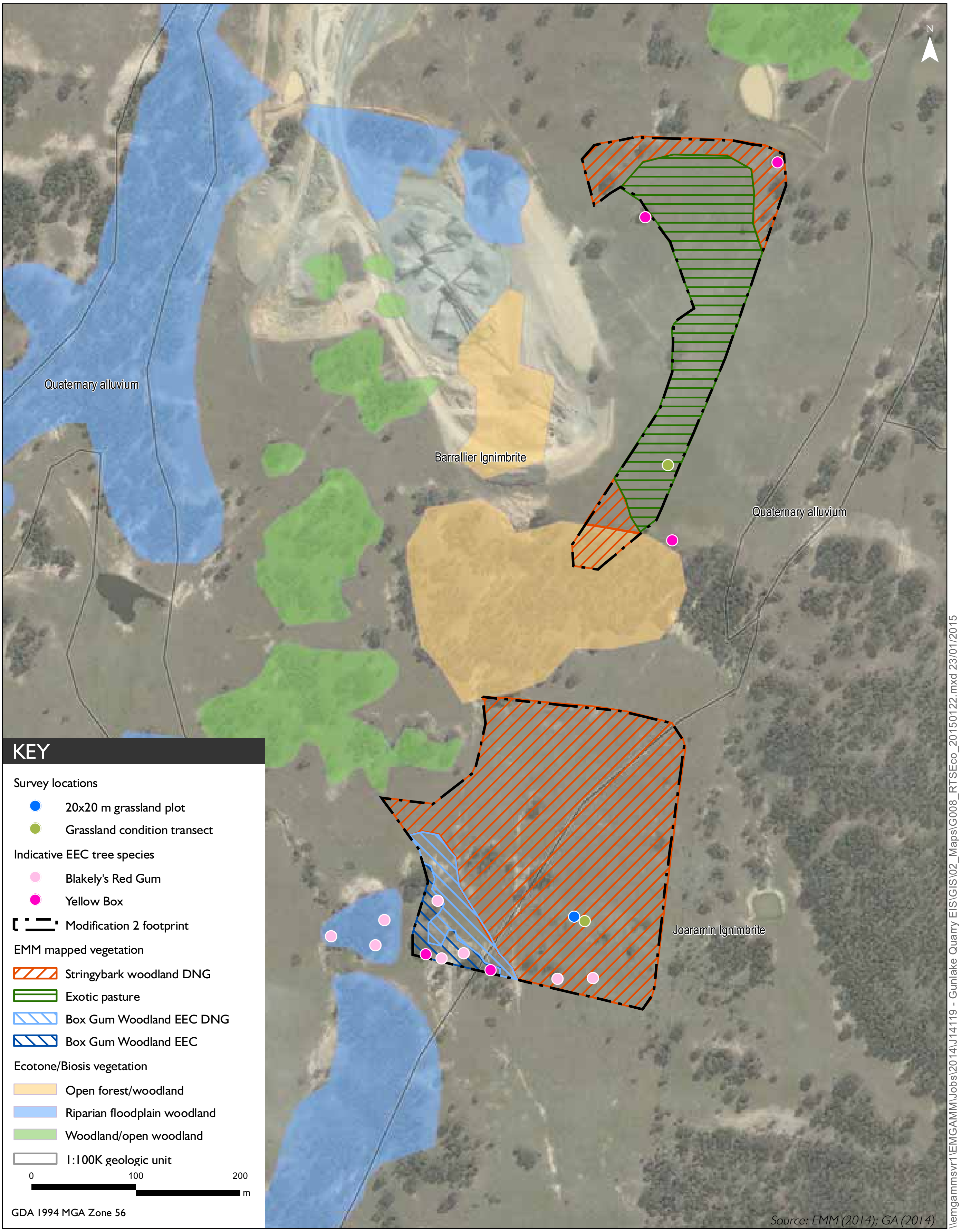
OEH does not support the offset proposal presented in the EA and considers it to be unacceptable. The concerns relate to the original offsets being finalised and therefore not available as offsets for this modification, regardless of the methods used to determine the offset ratios at this time. The offset proposal was not considered to comply with the NSW Biodiversity Offsets Policy for Major Projects, particularly principles 1, 3 and 4 (see Table 2.1).

The offsets proposed to compensate for the loss of vegetation as a result of the approved original proposal are described in the draft Landscape Management Plan (Olsen 2010). This plan modified the proposed offset areas (but not the total area) provided in the Appendix 6 of the Project Approval. The DP&E has not approved or finalised the Landscape Management Plan or the offset areas it describes. Given that this plan will need to be updated to address Modification 2, it is requested that DP&E suspend their review of the draft Landscape Management Plan until Modification 2 has been determined.

The original offset proposal comprised three offset areas totalling 76.5 ha of land (30.4 ha of woodland and 46.1 ha of disturbed grassland to be regenerated). This was an offset ratio of 7:1 for woodland vegetation, which was high for the time when compared to similar projects with impacts on Box Gum Woodland (see Appendix D). It was not based on a standard method for calculating offsets such as the Biobanking method.

Quantitative and objective methods to calculate offset requirements now form part of OEH's offset policies. The offsets that would be required for the original impact area and the extension area have been calculated in accordance with OEH's *NSW Biodiversity Offsets Policy for Major Projects*, using the Biobanking method and calculators (as the *Framework for Biodiversity Assessment* and major projects calculator was not available at the time the assessment was completed). The calculations were based on areas of native grassland and scattered woodland within and adjacent to the modification areas, assuming that these were part of the Box Gum Woodland EEC in moderate-good condition.

The calculated Biobanking offset requirement for areas of Box Gum Woodland EEC in the original (7.8 ha) and modified (9.3 ha) impact areas is equivalent to an offset:impact ratio of 3.8:1 (based on 9 credits generated per hectare of offset). Using this, a total of 65 ha of Box Gum Woodland EEC offsets are required to compensate for the total impacts of the project. The unapproved offset package meets this requirement through a combination of existing woodland and derived grasslands to be regenerated and managed into the future. Further, the offsets would meet the 'like for like' requirements of the Biobanking method.



Revised vegetation in the extension areas
Gunlake Quarry Modification 2 Response to Submissions
Figure 2.1

Based on the EMM vegetation mapping within the modification areas, only half of the Biosis calculated Box Gum Woodland EEC offsets (31.9 ha) would be required (based on the original 7.8 ha and the EMM reclassified Box Gum Woodland EEC (0.2 ha) and EEC derived native grassland (0.4 ha)). Therefore, the modified offset package proposed in the Biosis assessment is considered to be highly conservative and more than compensate for the impacts of the original proposal and modification, in accordance with the OEH's offset policy and calculators. The modified package also meets the Principles that underpin the *NSW Biodiversity Offsets Policy for Major Projects*, as demonstrated in Table 2.1.

Table 2.1 Assessment of the modification against the *NSW Biodiversity Offsets Policy for Major Projects* principles

Offset principle	Compliance
Before offsets are considered, impacts must first be avoided and unavoidable impacts minimised through mitigation measures. Only then should offsets be considered for the remaining impacts:	The proponent (Gunlake Pty Ltd) has considered a number of feasible alternatives to the proposal. The proposed pit extension area has been chosen where the hard rock resource can be most economically extracted while minimising vegetation clearance. The extended overburden emplacement footprint has also been selected to minimise clearing (see Section 2.2.1(i)).
Offset requirements should be based on a reliable and transparent assessment of losses and gains:	The Biobanking method was used to identify offset requirements for the modification and assess the total offset requirements for the original and modified proposal. The credit converter (assuming 9 credits per hectare of offsets) has been used to convert the calculated credits to offset areas for this purpose. The Biobanking method and calculators provide a reliable and transparent assessment of losses and gains.
Offsets must be targeted to the biodiversity values being lost or to higher conservation priorities (like-for-like offsets):	The offset package provides like-for-like outcomes for the vegetation types to be impacted by the proposal. Based on the Biobanking method, 65 ha of land that meets the description of Box Gum Woodland EEC is required for a like-for-like offset (17.1 ha impacted). The offsets provide this area of Box Gum Woodland EEC. Of this, a total of 30.4 ha of Box Gum Woodland EEC in woodland form is required. The offsets provide a like-for-like outcome with 30.4 ha of woodland provided. The remaining offsets suitably compensate for the impacts on the cleared grassland, also providing a like-for-like outcome. Using the revised EMM vegetation mapping of the extension areas, the offsets provide 22 ha more grassland than the calculations require.
Offsets must be additional to other legal requirements:	The original offsets areas have not been finalised. Given recent more objective methods to determine areas and offset ratios required, the existing offsets have been found to more than satisfy the offset requirements of both the existing and proposed extension areas when assessed together. In other words, the offsets would satisfy the current offsetting requirements if approval to clear the total impact area was being sought.
Offsets must be enduring, enforceable and auditable:	When finalised, the offset areas will be protected in perpetuity. Protection and management will be enforced and Gunlake will monitor the performance of offset management and conservation measures completed.
Supplementary measures can be used in lieu of offsets:	Supplementary measures are not part of the proposed offset package.

2.2.2 Aboriginal cultural heritage

The OEH recommended that the Gunlake Aboriginal Heritage Management Plan is updated to reflect the modification footprint and to update the location of some sites of Aboriginal heritage significance. Gunlake will update the plan accordingly.

The OEH also requested that the Modification 2 Aboriginal Cultural Heritage Assessment (ACHA) be revised to include consideration of recent heritage assessments for the Lynwood Quarry area. The updated assessment report is provided in Appendix C. Consideration of the information from the Lynwood Quarry area found (ACHA Section 5.2):

> Despite an extensive and thorough investigation of the two modification areas, no Aboriginal sites were identified and no areas likely to contain potential archaeological deposits were identified. Close inspection of subsurface deposits exposed through mechanical disturbance, animal burrows and earthworks failed to provide any indication of Aboriginal occupation of the area.
>
> These results are in keeping with those of AASC 2007, who's original survey also failed to identify any sites in this area, but slightly contradict the predictive model, which suggests the area has moderate-high archaeological potential and differs dramatically from the findings of Lynwood Quarry to the south. There are several reasons for these differences.
>
> The first is the lack of soil across the area. The entire study area is covered with rocky outcrops with little to no areas with any significant soil depth. The area would have been far too rocky to camp in, making it an unattractive spot for anything but the briefest of visits (see Plates 17 to 21). This is a major point of difference with the Lynwood Quarry to the south, which is located within the same geological zone. At Lynwood, soil depths of between 20-110cm and including 'deep sands' (Umwelt 2009) were recorded, while soil probes immediately adjacent to Gunlake, along Brayton Road, indicate maximum depths of up to 40cm for C horizon soils, with A horizon soils confined to the upper 15-30cm of deposit and intermixed with porphyry bedrock. Further to the east of the study area, towards Chapman's Creek, an increased build up of alluvium is recorded, but falls well outside of the current study area.
>
> A second major area of difference between Lynwood and Gunlake is the presence of water sources. The primary water source in the Gunlake area is Chapman's Creek, which flows intermittently and for the majority of its length through the Gunlake property, it is dry. It is only in the last sections of the creek on the Gunlake property that occasional pools appear, which dry rapidly when rain ceases. Chapman's Creek flows into Joaramin Creek approximately 1.4km downstream of the Gunlake property. Joaramin Creek, which traverses the centre of the Lynwood Quarry flows into the Wollondilly river some 4km further down stream from the junction of Chapman's and Joaramin Creeks. Conversely, the Lynwood Quarry site incorporates the headwaters of Joarimin, Lockersleigh and Marulan Creeks, it has a multitude of ephemeral and semi permanent water sources dispersed across the area. The presence of these headwaters in and near the Lynwood Quarry area would have inevitably been accompanied by additional plant and animal resources for Aboriginal exploitation. The water sources, associated subsistence resources and availability of sandy deposits upon which to camp, makes the Lynwood area a considerably more attractive locality for settlement.

> Consequently, whilst the landforms in the area and proximity to ephemeral water sources offer some utility (though not for permanent occupation as discussed earlier), the harshness of the ground itself would have been a considerable drawback at the Gunlake property. While it is inevitable that Aboriginal people will have traversed and exploited the local area, the study area itself is unattractive as a locality for occupation. The available geology is ill-suited to artefact manufacture, the terrain is unappealing as a camping locality and permanent water sources are at least 1km from the area. The total lack of soil across the area also precludes the possibility of subsurface finds. Aboriginal people would have moved through the area on their way to more suitable campsites to the north and east adjacent to permanent water sources and where level, well drained and rock free ground is available for settlement. The archaeological potential of this area is therefore confirmed as being low.

The additional reports therefore do not have any bearing on the results of the ACHAR and the assessment and management recommendations remain unchanged.

2.3 Environment Protection Authority

The EPA submission considered noise and vibration, blasting, air quality, water use and waste acceptance. The EPA did not object to the proposed modification.

Gunlake will apply to the EPA to vary Environment Protection Licence (EPL) 13012 should the modification be approved.

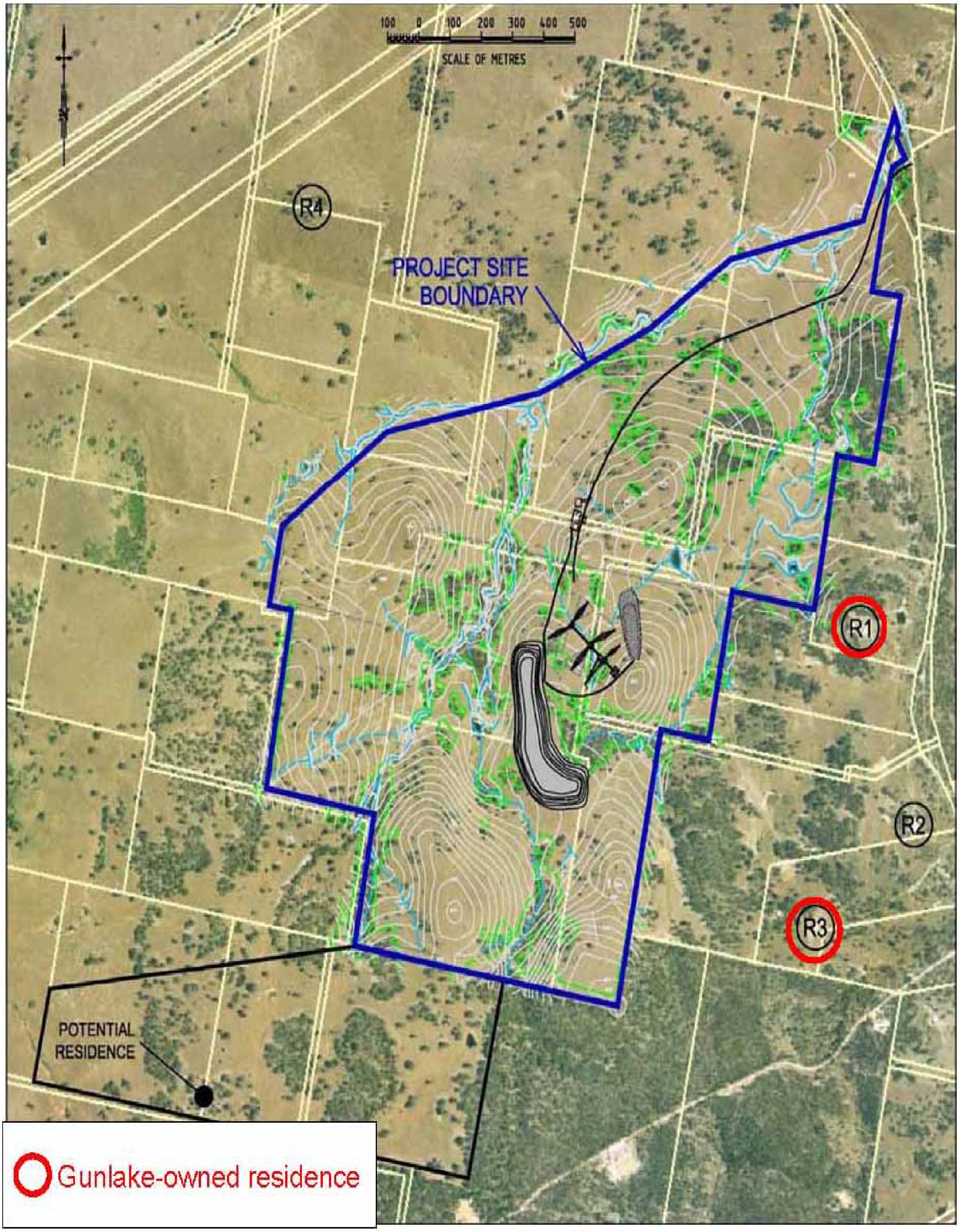
2.3.1 Noise

Gunlake now owns residences R1 and R3 (Figure 2.2).

Project approval conditions for quarries and mines issued by DP&E or the Planning Assessment Commission (PAC) generally apply noise criteria to privately-owned properties, but not to properties owned by the proponent. It is therefore requested that noise criteria for R1 and R3, now owned by the proponent, be removed from the modified conditions should the modification be approved.

As noted in EA Section 5.3.2, it is no longer proposed to build a house at R5 and it is requested that noise criteria for R5 are also removed from the modified conditions. Therefore, R2 and R4 are the only privately owned residences where noise levels could potentially exceed noise criteria.

Noise monitoring will be undertaken at R2 in accordance with Section 3 of the quarry's Noise and Blast Monitoring Program (Heggies 2009). Additional noise monitoring will be conducted at R4 should noise criteria be exceeded at R2.



Receiver locations

Gunlake Quarry Modification 2 Response to Submissions

Figure 2.2

2.3.2 Blasting

Gunlake notes EPA's comments regarding blasting and will continue to implement the existing Quarry Noise and Blast Monitoring Program (Heggies 2009).

2.3.3 Air quality

The EPA notes that an exceedence of the cumulative 24-hour average PM_{10} criterion is predicted at R1, that there is currently no PM_{10} monitoring at the quarry and that Gunlake is corresponding with EPA regarding the installation of a high volume air sampler (HVAS) to monitor PM_{10} concentrations downwind of the quarry. Gunlake has purchased R1 and has installed the HVAS at this location. The HVAS was installed on 4 December 2014. It is proposed to continue monitoring for 12 months.

The average 24-hour PM_{10} concentration for the first three weeks of monitoring in November/December 2014 ranged from 3.3 to 31.3 $\mu g/m^3$.

In consideration of the EPA's comments, Gunlake will:

- take reasonable and feasible avoidance and mitigation measures so that particulate matter generated by the quarry does not cause PM_{10} criteria to be exceed at R1 when it is occupied; and
- undertake regular air quality monitoring at R1 given this is the nearest residence to the quarry.

The EPA requests in its submission that DP&E consider requiring a second HVAS be installed west of the quarry to give an indication of ambient air quality during prevailing winds. However, the EPA does not recommend that this monitor is installed. Gunlake has met with the owners of R4. The owners did not want a HVAS to be located on their property.

Annual average and 24-hour average PM_{10} criteria apply to cumulative concentrations (ie project plus ambient). The average ambient air quality is as described in Section 5 of the *Air Quality Assessment* (EA Appendix 4).

If there are any PM_{10} criteria exceedences recorded by the HVAS downwind of the quarry, records from the three regional EPA PM_{10} monitors can be used to determine if they result from regional events, eg dust storms or bushfires. An investigation of quarry dust sources and dust reduction measures will be implemented at the quarry if PM_{10} criteria are frequently exceeded downwind of the quarry and there are no correlations with regional air quality for the same period. Any required investigation may include the use of a dust monitor (such as a HVAS) to determine local ambient air quality. There would be very little beneficial information provided by a second HVAS, particularly given the cost of installing and maintaining the HVAS. Inclusion of a condition to undertake ambient air quality monitoring at R4 is therefore not justified.

2.3.4 Water use

The EPA recommends that the Soil and Water Management Plan is updated to address increased water use for dust suppression and that it is demonstrated that sufficient water is available.

A water balance for the modified project is presented in the *Gunlake Quarry Marulan Water Assessment* (EA Appendix 5) and summarised in EA Section 5.5.2.

The Erosion and Sediment Control Plan (Appendix 2 of the Gunlake Quarries Water Management Plan (Olsen 2009)) describes measures that are implemented at the quarry to prevent and control runoff. Many of these measures are independent of the total volume of dust suppression water applied. However given the changes to the project, the Water Management Plan including the appended Erosion and Sediment Control Plan will be updated following approval of the modification. The updated plan will be submitted to the Secretary within three months of receiving modification approval to address Schedule 5, Condition 7A of the Project Approval.

2.3.5 Waste acceptance

The EPA's comments regarding the importation, blending and re-use of unused ready-mixed concrete from Gunlake Group Group batching plants are noted. As listed in the Modification Outline on the EA Certification page, Gunlake is seeking approval for these activities. Should approval be granted, Gunlake will apply for the EPL to be modified in accordance with the modified Project Approval.

2.4 NSW Office of Water

The NOW submission considers water demand, groundwater and the Greater Metropolitan Region Groundwater Sources Water Sharing Plan. The NOW did not object to the proposed modification.

2.4.1 Quarry water demand and surface water supplies

Gunlake notes NOW's comments regarding water demand and surface water supplies, including the conclusion that:

> all current and proposed surface waters to be extracted and used for the quarry operation, are appropriately authorised by relevant exemptions under the *Water Management Act 2000*.

Further, Gunlake notes NOW's comment that:

> the reference in section 5.5.3 of the EA that Harvestable Rights do not apply to the site is incorrect. Harvestable rights do apply to the Gunlake property and the total capacity for dams on 1st and 2nd order watercourses must not exceed 18.4 ML.

2.4.2 Groundwater

It was predicted in *Groundwater Impact Assessment* (Cook & Associates 2008), appended to the original EA (Olsen 2008) that the groundwater inflow into the quarry pit will be minimal and the annual inflow will peak at 3.5 ML in Year 30 of the originally approved operation when the pit reaches its maximum depth. The current quarry pit is above the water table and does not experience any inflows. Gunlake will apply for a water licence if measured groundwater inflows to the pit exceed 3 ML annually. The licence will be for the amount of water 'taken' in excess of 3 ML annually.

2.4.3 Greater Metropolitan Region Groundwater Sources Water Sharing Plan

Gunlake notes NOW's comment that:

> [t]he exemptions listed in section 5.5.8.4 of the EA do not apply to incidental groundwater. The exemptions referred to in the EA only apply to Gunlake's surface water supplies.

As describe above, Gunlake understands that a water licence will be required if groundwater inflows to the pit exceed 3 ML annually.

The results of groundwater monitoring will continue to be reported through the Annual Environmental Management Report which will be referred to NOW for review.

2.5 Agriculture NSW

Agriculture NSW did not object to the proposed modification but reiterated previous comments relating to mitigation of impacts on rural landholders. This is noted by Gunlake.

2.6 Crown Lands

The EA states that no Crown land is affected by the modification. However, Crown Lands state that there is a Crown road through Lot 13 DP1123374 (in which the quarry is situated).

Lot 13 DP1123374 was a result of a consolidation of lots 76, 54, 42, 50, 52, 48, 111 in DP750053 in May 2008. These crown roads were for access to these individual lots and were closed as part of the new subdivision.

2.7 Roads and Maritime Services

The RMS submission considered traffic surveys, peak truck movements and the left turn from Red Hills Road onto the Hume Highway. The RMS did not object to the proposed modification.

Responses to these comments prepared by Terry Lawrence, Director, Transport and Urban Planning, are provided in Appendix D.

2.8 Sydney Catchment Authority

The SCA requests Project Approval conditions regarding an investigation of the effluent management system and update of the Soil and Water Management Plan (SWMP). The SCA did not object to the proposed modification.

2.8.1 Effluent management

The SCA requests that a Project Approval condition is included in relation to what SCA regard as a failure in the effluent management area. Gunlake believe that the effluent management system is operating correctly but are investigating further. This issue is not directly related to the activities subject to the proposed modification and it is not appropriate to include the proposed condition in the modified Project Approval should it be granted.

2.8.2 Soil and Water Management Plan

The SCA states that soil and water management is not being undertaken on site in accordance with the approved SWMP but that the practices implemented are ensuring that sediment does not leave the site. Further SCA does not believe that the SWMP presented in EA Figure 2.3 would work and requests that a Project Approval condition be included regarding revision of the Soil and Water Management Plan.

Gunlake will update the SWMP (see Section 2.3.4) in accordance with Schedule 5, Condition 7A of the consolidated Project Approval (October 2014 modification) which requires strategies, plans and programs to be revised within three months of a modification to the satisfaction of the Secretary. This update will include a review by an appropriate expert of the soil and water management layout provided in the EA and the plan will be amended accordingly. The updated plan will also describe the soil and water management measures currently implemented at the quarry.

2.9 Goulburn Mulwaree Council

The Goulburn Mulwaree Council submission considers contributions for the upgrade of Brayton Road. The Council did not object to the proposed modification.

The Council has an agreement with Gunlake regarding the upgrade of Brayton Road and will not be seeking further developer contributions for road upgrade works.

3 Public submissions

3.1 Introduction

This chapter provides a summary and response to the public submissions on the proposed modification. A total of seven submissions were received, including two from special interest groups.

3.2 Ecology

3.2.1 Vegetation clearing

i Submissions

Beattie

The clearing of vegetation was raised with reference to the presence of habitat for threatened fauna species in the area and the removal of habitat for abundant communities of non-threatened native animals. Further, it was raised that habitat destruction contravenes the "Mulwaree Shire LEP [Local Environmental Plan] 1995 (a) vii - promoting, enhancing and conserving localities of significance for nature conservation, including localities with rare plants, wetlands, permanent watercourses and significant wildlife habitat".

ii Response

Some vegetation will be cleared as part of the proposed Modification 2 activities. However, as described in Section 2.2.1, the extensions of the pit and overburden emplacement bund proposed in Modification 2 have been designed to avoid significant vegetation or minimise impacts as far as possible. Compensatory measures (biodiversity offsets) have been provided for the vegetation that cannot be avoided. The biodiversity offsets will ensure that there is significantly more vegetation/habitat protected as a result of the overall project than is cleared in total.

It is noted that Goulburn Mulwaree Local Environmental Plan 2009 has superseded the 1995 LEP and the relevant aims of the LEP are now:

- to protect and conserve the environmental and cultural heritage of Goulburn Mulwaree;
- to allow development only if it occurs in a manner that minimises risks due to environmental hazards, and minimises risks to important elements of the physical environment, including water quality; and
- to protect and enhance watercourses, riparian habitats, wetlands and water quality within the Goulburn Mulwaree and Sydney drinking water catchments so as to enable the achievement of the water quality objectives.

These aims have been considered as part of the project design and the measures taken to met these aims are described in the EA.

3.2.2 Road kill

i Submissions

Beatie

Additional impacts to fauna as a result of increased truck numbers and associated incidence of road kill is raised.

ii Response

Much of the section of Brayton Road between the quarry and Bypass Road is flanked by native vegetation. As this section of road is also used by all Gunlake Quarry trucks, any road kill as a result of quarry trucks is most likely to occur on this section of road. There is an average of 586 daily vehicle movements on this section of road (EA Appendix 2 Figure 4) and there will be an average increase of 32 laden trucks (64 daily truck movements) as a result of the proposed modification. This increase of about 11% in the total number of vehicles using this section of Brayton Road is unlikely to significantly increase road kill.

3.3 Noise and vibration

3.3.1 General noise and blasting impacts on amenity

i Submissions

Pearson; Beattie; Cookbundoon Heritage Preservation Committee; Towrang Community Progress Group; Paschuk-Johnson and Johnson; Curvey; anonymous.

General noise and blasting impacts on amenity were raised. Of particular concern was the modification of quarry operating hours (currently 7 am to 6 pm Monday to Saturday) to 6 am Monday to 6 pm Saturday, for 52 weeks of the year and the noise impact from the site, especially at night. The selection of representative receivers assessed was also questioned.

ii Response

Noise modelling (EA Appendix 3) was undertaken in accordance with the Director-General's Environmental Assessment Requirements (DGRs) issued on 24 July 2014 and contemporary industry standards.

Noise levels as a result of the modification activities were assessed at the closest sensitive receivers (private or quarry-owned) which are all specified in the noise criteria in the Project Approval conditions.

The modelling results show that while noise generated by the quarry will increase under the proposed modification, the quarry will continue to comply with the day, evening and night noise criteria in the Project Approval conditions at all assessed privately-owned residences and therefore also at more distant residences. These criteria are based on the EPA's *Industrial Noise Policy* (INP) (EPA 2000) and *Road Noise Policy* (EPA 2011).

EA Section 5.3.11 includes the following commitments to ensure criteria continue to be met:

- the Noise and Blast Monitoring Plan will be revised to take into account the tertiary crushing activity;
- Gunlake's blasting contractors will continue to design blasts to ensure compliance with the blast limits detailed in the Noise and Blast Monitoring Plan; and
- blast monitoring will continue as per the Noise and Blast Monitoring Program.

However, the following commitments provided in EA Section 5.3.11 are no longer valid as Gunlake now own R3:

- the Blast Management Plan will be revised to take into consideration the reduced separation distance to R3; and
- a modification to the maximum instantaneous charge (MIC) may be required for blasting within 700 m of R3.

3.3.2 Traffic noise impacts

i Submissions

Pearson; Beattie; Cookbundoon Heritage Preservation Committee; Towrang Community Progress Group; Paschuk-Johnson and Johnson; Curvey; anonymous.

It was raised that reducing the speed limit and improving the maintenance of Brayton Road would reduce noise impacts at residences along this road. It is noted that the road noise assessment (EA Appendix 3) measured road noise peaks of up to 80 dB during day and night-time measurements. Concerns regarding the impacts of noise are also raised in reference to *The Health Effects of Environmental Noise Other than Hearing Loss* issued by enHealth Council (Environmental Health) in May 2004.

It was also noted that an increase in traffic noise levels from the Hume Highway was experienced at 394 Brayton Road, Marulan, as a result of the construction of the Bypass Road and vegetation removal along the new road.

ii Response

The road traffic noise assessment (EA Appendix 3 Section 8) considered noise levels at properties along Brayton Road and found that noise generated by trucks from the proposed modification will meet *Road Noise Policy* (EPA 2011) criteria. This policy provides criteria that consider the effects of environmental noise based on a review of a wide range of studies including the enHealth Council (2004) report.

Construction of the Bypass Road is not the subject of the proposed modification and has not been assessed as part of the EA so it is not possible to provide any comment on the veracity of the statements that it has changed the noise levels from Hume Highway traffic at 394 Brayton Road.

The speed limit along Brayton Road is discussed in Section 3.7.1.

3.3.3 Cumulative noise impacts

i Submissions

Pearson; Beattie; Cookbundoon Heritage Preservation Committee; Towrang Community Progress Group; Paschuk-Johnson and Johnson; Curvey; anonymous.

Cumulative noise impacts from the quarry and other operations were raised.

ii Response

As described in EA Section 5.3.7, an assessment of cumulative noise impacts was undertaken in accordance with the INP. The INP criteria were developed to ensure that industrial noise at a receiver location does not exceed either the acceptable or maximum noise level appropriate for the land use. However, this does not necessarily mean that the activity will be inaudible. Generally, noise assessments modify (increase) noise criteria to account for existing industrial noise levels at the receiver location. Given that existing industrial noise levels in the vicinity of the quarry are 6 dB below the accepted noise level during the day, evening and night time periods, no modifications were made to the amenity criteria so the cumulative industrial noise impacts were compared to the lowest recommended criteria.

The noise assessment (EA Appendix 3) found that noise criteria will be met at the four closest residences and therefore will be met at all privately owned residences.

3.4 Air quality

3.4.1 Meteorological data and deposited dust

i Submissions

Beattie; Underdown

The analysis of the prevailing winds in EA Section 5.3.3.2 is questioned, stating that the prevailing winds in the Marulan area are from the west, north and north-west for the majority of the year and that during these times, the wind will deposit dust to properties south and east of the quarry. However, during the summer months, the easterly wind will deposit dust to the west of the pit where several feeder creeks for the Sydney Water Catchment are located. The source of meteorological data is questioned in that it uses information monitored by the NSW EPA at sites 70 to 80 km from the quarry as well as data collected at Holcim Lynwood quarry — which is not operational.

ii Response

Meteorological analyses used a range of local data sources including from quarry's on-site weather station.

The wind regime discussed in EA Section 5.3.3.2 specifically relates to the analysis of 'feature winds' for specific noise analyses. It does not describe the prevailing winds that were used for the air quality assessment.

The annual and seasonal wind roses used for air quality dispersion modelling are presented in EA Appendix 4 Figure 5.1. These are based on data collected from the weather station at the quarry. They show that prevailing winds are from the west (west south-west) over the year but are from east (east to east north-east) during summer. There is little wind from the north or north-west.

Predicted annual dust deposition isopleths are presented in EA Appendix 4 Figure 8.6. These show that annual dust deposition as a result of the project will increase by an average of 0.01 g/m^2/month at the closest residence to the quarry (R1 which is owned by Gunlake). Dust deposition as a result of the activities at the quarry will be negligible further from the quarry.

There will be low levels of deposited dust from the quarry and this deposited dust will be an extremely small fraction of the dust deposited within the total Sydney water catchment.

3.4.2 Impacts to air quality and amenity from general quarry operations and blasting

i Submissions

Pearson; Beattie; Cookbundoon Heritage Preservation Committee; Towrang Community Progress Group; Paschuk-Johnson and Johnson; Curvey; Underdown.

Impacts to air quality and amenity from general quarry operations and blasting were raised.

ii Response

The air quality assessment was undertaken in accordance with the DGRs and contemporary industry standards, including the EPA *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (EPA 2005), 'the Approved Methods', the *National Environment Protection Measure* (NEPM) and associated reports (NEPC 1998a, 1998b and 2003).

The criteria for total suspended particulates (TSP), PM_{10} and deposited dust are specified in the Project Approval based on the Approved Methods and NEPM goals. These air quality criteria were developed to protect general health and amenity of the community. Criteria are applied for all of NSW, irrespective of industry and location.

Air quality dispersion modelling was undertaken (EA Appendix 4) to predict off-site dust concentrations and dust deposition levels from emissions associated with the proposed modification alone (incremental impacts), and with the proposed modification and surrounding operations (cummulative impacts), including Holcim's Johhniefelds and Lynwood quarries. The modelling considered local meteorology and terrain information, using dust emission estimates to predict the incremental and cumulative air quality impacts associated with the worst-case operational scenario.

The assessment predicted that some increases to off-site dust concentrations and dust deposition levels would be detectable due to the modified operations but that incremental and cumulative air quality will continue to meet assessment criteria at the closest residences and therefore will be met at more distant residences (with the exception of at resident R1, which is now owned by Gunlake – see Section 2.3.3). Air quality monitoring at R1 has commenced (see Section 2.3.3).

3.4.3 Health impacts from dust

i Submissions

Beattie; Towrang Community Progress Group.

Health impacts from increased dust emissions as a result of additional operations were raised.

ii Response

As noted in Section 3.4.1, the air quality criteria in the Project Approval are stipulated in the EPA Approved Methods. These criteria provide benchmarks to protect the community against the adverse effects of air pollutants, and generally reflect current Australian community standards for the protection of health and prevention of nuisance dust. Compliance with these criteria indicate that general health and amenity are being protected.

Health effects related to air quality vary depending on the length of exposure and whether those exposed are within a susceptible group (for example the elderly, infants, and persons with chronic cardiopulmonary disease, pneumonia, influenza or asthma).

The majority of particulate emissions from quarrying are dust particles, which originate from rock material. Due to the extreme forces required at the micro level to break down a particle of dust into smaller particles in the fine fraction, techniques used at the quarry generally cannot breakdown rock material into these very fine fractions. As a result, emissions from quarries are predominantly in the coarse size fraction, which would not penetrate as deeply into the lung, or carry additional toxic combustion substances.

Small amounts of respirable crystalline silica (RCS) produced by quarrying presents the greatest potential for health impacts. RCS is the portion of airborne crystalline silica (typically less than 2.5 microns) that is capable of entering the gas-exchange regions of the lungs if inhaled. RCS levels were considered in the air quality assessment. The NSW EPA has not set any impact criteria for RCS. However, as noted in EA Section 5.4.3.1, the air quality assessment considered ambient assessment criterion adopted by the Victorian EPA and cumulative exposure guidelines adopted by the US EPA. The estimated total lifetime cumulative exposure for the proposed modification is considerably lower than these standards and no adverse health impacts are predicted from the proposed modification.

3.4.4 Contamination of drinking water by diesel emissions

i Submissions

Beattie

The contamination of rainwater collected from roofs within 63 m of Brayton Road by diesel emissions is raised.

ii Response

Diesel emissions from trucks are principally gases which are dispersed in the atmosphere rather than depositing locally. The conversion of these gases to aerosols (small particles) is a slow atmospheric process. The eventual deposition of particles from diesel emissions occurs regionally and any property in the region will experience small amounts of pollution from all of the traffic in the region and neighbouring regions. Therefore, the additional trucks from the proposed modification will not impact the water quality in rainwater tanks on properties along Brayton Road.

3.5 Visual

3.5.1 General visual and lighting impacts

i Submissions

Pearson; Beattie; Cookbundoon Heritage Preservation Committee; Towrang Community Progress Group; Paschuk-Johnson and Johnson; Curvey.

General visual and lighting impacts on the rural landscape were raised, including the cumulative impact of multiple quarries.

ii Response

As described in EA Section 5.9, the quarry is generally not visible from Brayton Road and surrounding residences. Distant views (greater than 5 km) of project elements are possible from isolated parts of surrounding private property. However, views of the quarry are generally obscured by topography or distance and therefore the proposed modification will have minimal visual impact.

It is recognised that during certain meteorological conditions (generally dry with little or light wind), dust may be seen above the quarry. However, this is occasional and localised, and is not significantly out of keeping with the highly modified agricultural setting.

Permanent lighting at the quarry allows safe operations, and is positioned away from private residences and public roads to minimise impacts.

Gunlake will continue to manage visual and lighting impacts in accordance with current practice, and is committed to implementing any reasonable additional controls to further reduced impacts, should they be required.

3.6 Water

3.6.1 Water quality

i Submission

Bettie

Impacts to water quality were raised, particularly in reference to drinking water.

ii Response

The potential impact of diesel truck emissions on rainwater tank water quality is discussed in Section 3.4.4.

As described in Section 3.4.1, dust deposition will be low at residences R1 to R4 and negligible at residences further from the quarry. Dust deposition from the quarry will therefore not impact drinking water at residences.

The current pit has not yet reached the depth of the water table. Groundwater investigations (Cook 2008) found the permeability of the fractured rock (porphyry) aquifer to be low. The assessment predicted that the low permeability and structural discontinuities of the geology would restrict the propagation of depressurisation around the pit and concluded that the project would not significantly impact on the local or district water table.

3.6.2 Surface water quality

i Submission

Bettie

The adequacy of sediment control downslope of stockpiles to prevent sediment entering the catchment and impacting the quality of Sydney's water was questioned.

ii Response

As described in EA Section 5.5.6, the volume of water that will need to be discharged from the site has decreased from that predicted for the quarry as described in the original EA. This will result in an improvement in the water quality over that predicted for the approved project.

The Water Management Plan approved by the Director-General of DP&E is implemented at the quarry. A proposed modification to the erosion and sediment controls arrangement is presented in Appendix B of the Water Assessment that forms Appendix 5 of the EA. The Water Management Plan will be updated accordingly.

The Project will have no impact on Sydney's drinking water quality.

3.6.3 Impact of degraded water quality on Jaorimin Creek

i Submissions

Beattie

Concern was raised that nutrients and other pollutants will enter Jaorimin Creek and flow to the Johnniefelds property, which contains a 30 ha lake.

ii Response

Impacts of the modification on surface water quality are discussed in Section 3.6.2.

Gunlake Quarry is not in the catchment of the artificial lake on the Johnniefelds property. Gunlake Quarry is in the headwaters of Chapman Creek which intermittently flows east from the northern end of the Gunlake property and passes downstream of the lake. Therefore, the proposed modification will not impact the lake.

3.7 Traffic and transport

3.7.1 Local roads

i Submission

Pearson; Beattie; Cookbundoon Heritage Preservation Committee; Towrang Community Progress Group; Paschuk-Johnson and Johnson; Curvey.

The safety impacts of the increased truck movements on residential, rural and school bus traffic on local roads was raised along with the inadequacy of line and lane marking on Brayton Road and the cumulative truck traffic from Gunlake Quarry and Johnniefelds Quarry.

The condition of local roads (particularly Brayton Road), the requirement for road upgrades and the adequacy of contributions to road maintenance were also raised.

ii Response

Impacts of the modification of the road network are described in EA Appendix 2 Section 4.3.1. There will be an average of 1.4 additional laden trucks (plus return trips) per hour on the section of Brayton Road south of the quarry. Given the low volume of existing traffic and allowing for some bunching of quarry trucks, the modification will only have a small impact on level of service and/or delay on local roads.

As noted in EA Section 5.2.3.6, school buses currently use Brayton Road in the morning and afternoon periods on school days. Given the small increase in the number of product trucks using the road, school buses will not be impacted by the proposed modification.

Brayton Road between the quarry and Bypass Road is a two lane rural road. The section between the Gunlake Quarry entrance and the Johnniefelds Quarry entrance (2.2 km) has been recently upgraded as part of Gunlake's conditions of consent to comply with Goulburn Mulwaree Development Control Plan (DCP).

The increased truck movements as a result of the modification will increase road maintenance requirements. The road maintenance regime is the responsibility of Goulburn Mulwaree Council and Gunlake has agreed to make contributions to the Council accordingly as described in Section 2.9.

In conjunction with Gunlake, the Council has committed to upgrading the section of Brayton Road between Johniefelds Quarry entrance and Maclura Drive on the outskirts of Marulan township.

The original EA for the quarry (Olsen 2008) stated in Section 4B.1.4 (Traffic Impacts) that “[s]ubject to RTA [Road Traffic Authority] agreement, all haul roads will be signposted with an 80km/hr speed limit, for trucks and buses”. This was not agreed by RTA. The Modification 2 traffic assessment (Transport & Urban Planning 2014) was based on the existing 100 km/h speed limit on Brayton Road. This assessment found that “[t]he increase [in truck movements] would have very minor impacts in terms of road capacity, Level of Service and vehicle delay.” However given community concerns, Gunlake continue to remain amenable RMS reducing the speed limit along the sections of Brayton Road used by quarry trucks.

3.7.2 Rail

i Submission

Pearson; Beattie; Cookbundoon Heritage Preservation Committee; Paschuk-Johnson and Johnson; Curvey.

It was suggested that Gunlake be required to construct a rail connection to the Main Southern Railway and transport product by rail in the same manner as Lynwood and Marulan South quarries.

ii Response

Both the Lynwood Quarry (Holcim) and Marulan South Quarry (Boral) have direct access to the Main Southern Railway, are approved to transport hard rock products by rail and have rail redistribution facilities in Sydney. Gunlake does not have direct access to the Main Southern Railway and does not have rail redistribution facilities that would allow products transported to Sydney by rail to be transferred to trucks for delivery within Sydney. It is therefore not possible for Gunlake to transport quarry products by rail.

3.8 Social

3.8.1 Lifestyle impacts

i Submissions

Pearson; Beattie; Cookbundoon Heritage Preservation Committee; Towrang Community Progress Group; Paschuk-Johnson and Johnson; Curvey; anonymous.

A reduced quality of life as a result of amenity impacts was raised.

ii Response

Impacts on amenity from noise, blasting, dust and visual amenity are addressed in EA Sections 5.3, 5.4 and 5.9. Predictive modelling demonstrates that the proposed modification will continue to comply with relevant amenity criteria for noise, blasting and dust. This does not mean that the quarry will be undetectable in the surrounds. For example, dust may be seen rising above the quarry at times or vibrations from blasts may be felt when close to the quarry. However, compliance with assessment criteria will provide protection against impacts from the quarry.

With the implementation of the proposed management measures, the modification would not significantly impact the amenity of the surrounding community.

3.8.2 Community engagement

i Submission

Pearson; Beattie; Cookbundoon Heritage Preservation Committee; Towrang Community Progress Group; Paschuk-Johnson and Johnson; Curvey.

Concerns were raised that the Gunlake Community Consultative Committee (CCC) propose to only meet twice a year and membership is limited to those who take a supportive view of Gunlake's operations. The need for community groups to attend the CCC meetings was raised.

ii Response

As part of meeting Project Approval Schedule 5, Condition 8, Gunlake placed three half page advertisements in the Goulburn Post outlining the proposed CCC and sent letters to the quarry's four closest neighbors. An additional 15 letters were sent to individuals and groups that made submissions on the original project application. No responses were received. At which point Gunlake, approached two near neighbors directly, who agreed to join the CCC. This level of consultation is considered appropriate given the level of operations at the quarry.

Gunlake have responded positively to queries to meet to discuss the modification, in particular Ed O'Neil, the Managing Director, met with Colin and Cathy Beattie on 11 November 2014 to discuss issues that they have with the operation of the quarry including truck noise, dust, drinking water quality and monitoring.

3.9 Other matters

3.9.1 Compliance with conditions

i Submission

Beattie

It was stated that Gunlake have a history of non-compliance although no specific examples were provided.

ii Response

It is acknowledged that there have been some minor non-compliances with the quarry's extensive Project Approval conditions. Gunlake continues to address all non-compliances through modifying site operations (eg ensuring operating hours are as approved), implementing the environmental management measures described in the quarry's environmental management system, modifying environmental management measures where required and by applying to modify conditions where appropriate (eg applying to adjust the number of approved truck movements).

3.9.2 Resources

i Submission

Beattie

It is conjectured that the requirements of the Sydney metropolitan region for hard rock aggregates can be adequately serviced by Boral and Holcim quarries and that the proposed increase in production is premature given that the project has completed one sixth of its proposed 30 year life. Future expansion of the quarry beyond that proposed in the Modification 2 EA is raised.

ii Response

The justification for the quarry presented in EA Chapter 6. Additional socio-economic information is provided in Chapter 4 below.

3.9.3 Distance of residence from proposed activities

i Submission

Beattie

It is stated that the Beattie property (394 Brayton Road, Marulan) is within 89 m of the road and is equidistant from the quarry as 575 Brayton Road (Residence R1), However, the Beattie property is not specifically mentioned in the EA. It is noted that this property is 800 m from the Johniefelds Quarry.

ii Response

The residence at 394 Brayton Road will be about 2,000 m from the south-east boundary of the maximum pit extent. The residence at 575 Brayton Road (Residence R1) will be the closest residence to the Modification 2 footprint (about 570 m from emplacement bund) and 529 Brayton Road (Residence R3) will be the closest residence to the pit (about 600 m). As noted in Section 2.3.1, operational noise criteria will be met at R1 and R3, and therefore will be met at the residence at 394 Brayton Road.

The road traffic noise assessment assumed that the nearest receiver was within 71 m of Brayton Road south of the quarry (EA Appendix 3 Section 8.1). The assessment therefore applies to residences further from the road such as the residence at 394 Brayton Road. Therefore, the finding that traffic noise levels as a result of the modification will remain below the EPA *Road Noise Policy* criteria applies to 394 Brayton Road.

3.9.4 Requested monitoring

i Submission

Beattie

Traffic, noise, vibration, air quality and water quality monitoring was requested to be undertaken at 394 Brayton Road.

ii Response

As described in Section 3.9.3, 394 Brayton Road is much further from the existing and proposed quarry operations than R1 and R3 which are the closest sensitive receivers. Air quality monitoring has commenced at R1 (see Section 2.3.3) and noise monitoring will be undertaken in accordance with the Noise and Blast Monitoring Program (see Section 2.3.1).

Groundwater quality is monitored at locations close to the quarry. Any groundwater trends that indicate that the quarry may be having an impact on groundwater level or quality will be investigated based on the result of this monitoring. This will allow any impacts to be detected and mitigated long before they propagate to 394 Brayton Road, 2 km from the quarry. Groundwater monitoring is therefore not justified at this property.

As described in Section 3.4.1, dust deposition levels at the closest residences are not predicted to exceed EPA criteria. Therefore, dust deposition as a result of operations at the quarry is expected to be very low at 394 Brayton Road and will not impact rainwater used for drinking water.

3.9.5 Site rehabilitation

i Submission

Beattie

The adequacy of rehabilitation of existing bunds and the required rehabilitation of Modification 2 disturbance are raised.

ii Response

Sections of overburden emplacements can be revegetated once placement of material in the section is completed. The outer faces of the existing emplacement bund was recently completed and it was revegetated as soon as practicable with planting completed in May 2014. Similarly, the outer fasce of the extended emplacement bund will be rehabilitated as soon as practicable.

3.9.6 Historic decision regarding a proposed quarry in the area

i Submission

Beattie

It is raised that the findings of the NSW Land and Environment Court 1995 decision regarding another proposed quarry along Brayton Road be taken into account in the assessment of Gunlake Quarry.

ii Response

Gunlake Quarry was approved by the Minister for Planning in 2008.

The quarry proposal raised in the submission was not on the Gunlake Property. In 1995, the NSW Land and Environment Court refused consent for this proposed quarry on the grounds that the operational and transport noise impacts had not been addressed as there was no comprehensive noise assessment. in addition the judge stated that he had not been satisfied that the dust problems that are likely to be created by the had been adequately resolved. Both the noise and dust potential impacts and their mitigation have been fully addressed in the Gunlake EA.

4 Project justification

A project justification is provided in EA Chapter 6. Further information on the socio-economic justification for the modification is provided below.

The modification will provide a range of socio-economic benefits. Some of these can be quantified, eg the provision of additional employment. Other benefits cannot be accurately quantified, generally because they span large sections of the economy, although they may be as large as the quantifiable benefits. Both are described below.

4.1 Quantifiable economic benefits of the modification

The quantifiable economic benefits of the modification include the provision of jobs at the quarry or as truck drivers; the generation of 'flow-on' employment; monetary contributions to local, NSW and Australian government; and expenditure in the local and regional economy.

The modification will employ an additional 23 staff (5 at the quarry and 13 truck drivers). Assuming an average annual salary of $50,000, this represents total salaries of $900,000 per year. Assuming that employee 'on costs' are 30% of salaries, this is an annual economic benefit of about $1.2 million.

Flow-on employment is created for every job created in a primary industry. In [t]*he Contribution of Primary Industries to the NSW Economy: Key Data 2013*, NSW Trade & Investment (2013) report an 'employment multiplier' of 3.977 for jobs in the 'mining and services' sector[1]. In other words, 2.977 jobs will be created for each job created at the quarry. Therefore, the modification will result in the creation of about 53 jobs in the wider economy.

Over the approved life of the quarry, Gunlake's Section 94 Contribution obligation equates to approximately $4.05 million, this modification, if approved, will see this amount increase to approximately $6.45 million.

The payroll tax paid to the NSW Government by Gunlake will increase as a result of the additional employees required.

In addition, Gunlake paid company and other taxes to the Commonwealth Government. These are projected to increase when quarry production increases.

Gunlake's expenditure in the local and regional economy will increase by about 23% with the modified production rate.

[1] Extractive industries are taken to be included in this sector given that the other sectors are 'agriculture and services', 'commercial fishing' and 'forestry and logging'.

4.2 Broader economic benefits

i Gunlake's businesses

Gunlake's existing operations continue to contribute to the local, regional and NSW economy through:

- Gunlake Quarry which has a sufficient resource to supply local and Sydney markets for in excess of 100 years;
- Gunlake Concrete which has two concrete plants in Sydney and a third under construction;
- the provision of over 100 full time jobs throughout NSW; and
- expenditure of more than $1 million per month in local communities.

Gunlake is the only independent concrete and aggregate producer in Sydney and so assists to maintain a competitive market with lower concrete product prices for users such as construction firms. This in turn benefits the ultimate users of the built environment (eg businesses in offices, home purchasers and road users).

ii Gunlake Quarry

There is an immediate demand for 750,000 tpa of saleable product from Gunlake Quarry. The additional 250,000 tpa of product can be readily supplied with a small increase in the current quarry production. This product could not be supplied efficiently by a new quarry (which would also have higher environmental impacts).

A number of factors have increased the medium-term demand for quarry product since the *Gunlake Quarry Environmental Assessment* was submitted in 2008, including:

- the progressive closure of the Penrith Lakes quarries since 2008. Holcim and Hanson are no longer producing from their quarries in the area and Boral have confirmed that its Penrith Lakes operation will close in 2015; and
- the Commonwealth Government confirmation of Badgerys Creek as the new Second Sydney Airport site. Airport construction will require very large quantities of concrete and quarry products. The associated the major road developments (eg the Elizabeth Drive project) will require further very large quantities of concrete and quarry products.

Hence, the modification is required in the short-term because the demand for the quarry's product is greater than anticipated in 2008.

Demand for concrete will grow in the long-term due to the ongoing growth of Sydney. In *Population Household & Dwellings Projects: Sydney Metropolitan*, the Department of Planning and Environment predict that Sydney's population will grow from 4.29 million in 2011 to 5.06 million in 2021 and 5.86 million in 2031. This will require the construction of 664,300 homes and the supporting infrastructure required for this population growth between 2011 and 2031. This is reflected in the current Metropolitan Strategy that has increased the housing target by 17% and the minimum jobs target by 33% compared to the previous strategy.

The provision of housing and infrastructure to meet this growth will require an increase in the supply of heavy construction materials such as concrete and its constituents. Sydney currently uses almost 20 million tonnes of quarried aggregates every year. Historically, most of this aggregate has been extracted relatively close to Sydney. As these reserves are depleted, aggregate will have to be sourced further afield from quarries such as those at Marulan. Accordingly, the Department of Planning and Environment has determined that Marulan is a suitable area for the future supply of heavy construction materials for Sydney.

Gunlake is confident that demand for competitively priced quarry products will continue to grow to supply Sydney's ongoing growth. The modification will assist Gunlake to expand its production capacity to meet increasing demand in the Sydney. This will assist to bring the economic benefits of growth:

- where construction materials are sourced, in this case Goulburn Mulwaree Council local government area; and
- where they are used locally and in Sydney.

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Appendix A

Biosis response to OEH comments

21 January 2015

Ms Cassandra Thompson
Ecology Service Leader
EMM
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St Leonards NSW 1590

Dear Cassandra,

Gunlake Quarry, Marulan (Major Project Reference 07-0074 MOD 2) Proposed modifications: Response to OEH comments relating to biodiversity

Project no. 19474

I have reviewed and considered the comments from NSW Office of Environment and Heritage (OEH) in the letter from Allison Treweek (OEH) to Phillipa Duncan (Department of Planning & Environment) dated 21 November 2014.

My responses to the comments follow.

<u>Impacts to Box Gum Woodland Endangered Ecological Community (EEC)</u>

The vegetation communities of the entire property were mapped in the flora and fauna assessment for the original proposal (Ecotone Ecological Consultants 2008a)[1]. Only one Biometric vegetation type, as defined by the NSW BioBanking methodology, is relevant to the proposed quarry extension areas as determined from the quadrat data of the recent supplementary field assessment (Biosis 2014). A total area comprising no more than 0.2 ha of woodland (within benchmark for canopy) indicative of this vegetation type occurs in the proposed impact area.

The remainder of the proposed quarry extension area consisted of cleared land (9.1 ha). Open and largely degraded habitat was not mapped as native vegetation in the original 2008 assessment, even though at least parts of it may qualify as a derived grassland form of EEC using the definition of 50% of native species in the ground cover.

There are inherent difficulties involved in mapping particular areas of open, cleared grassland to determine where EEC occurs and where it does not. My practical experience with assessing derived grassland communities at other sites using objective quantitative methods is that areas that comprise 50% or more of native species in the ground layer are invariably 'patchy' in nature. The patches are usually surrounded by significant areas of grassland which consist of greater than 50% exotic species. Typically, the pattern is for some patches of the grassland to fall below and other parts above the 50% threshold, forming a complex mosaic pattern that is difficult or impractical to map. This is particularly the case for habitat that is subject to ongoing disturbance, such as sheep grazing, as is the case with the currently proposed impact areas.

The two BioBanking quadrats were deliberately placed in areas where at least some trees occurred to ensure that high value parts of the relevant plant community type were sampled. Accordingly, it was

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[1] In July 2014, Ecotone Ecological Consultants merged with Biosis. I have since maintained continuity with the project.

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expected that 'upper end' values for condition of the community would be obtained, thus minimising the risk of underestimating the ecosystem credits required. However, the areas covered by patches of trees where the quadrats were placed occupied well below 1% of the total impact area. Elsewhere in the extension area, it was noted during the field survey that substantial parts of the cleared grassland areas were highly degraded, as evidenced particularly by the presence of high abundances of the noxious weed Serrated Tussock *Nassella trichotoma* (Biosis 2014).

Hence, to account for the residual uncertainty regarding how much of the grassland areas would constitute EEC, a highly conservative approach was adopted for the current assessment as explained below, in which the entire impact area was assumed to consist of EEC. This approach is in line with correspondence received from DECC during the original 2008 assessment, in which Ecotone was advised that parts of cleared, open grassland could nevertheless fall within the definition of the EEC and should be included as part of the vegetation impacts for the purposes of offsetting. Accordingly, a 'worst case scenario' in terms of the extent of EEC impact was assumed.

As to possible alternatives to the current proposal, areas to be impacted for the quarry and stockpile extensions were deliberately selected by the proponent to minimise the level of disturbance to ecological values. As is apparent from the discussion above, some of the most highly cleared and disturbed parts of the property adjoining the existing quarry footprint have been selected for the extension areas. Particular areas of high quality habitat consisting of clusters of native trees and shrubs have largely been avoided.

<u>Unacceptable offset proposal</u>

It is understandable that OEH would consider that offsets used for a previous proposal are not available as part of an offset package to include the current quarry expansion proposal. This is one of the principles of NSW Biodiversity Offsets Policy for Major Projects (Principle 4 – offsets must be additional to other legal requirements). However, in this particular case, I consider a variation to this basic principle is justified for the reasons outlined below.

- The Department has still not approved or finalised the original offset areas.
- The estimation of offsets required for the original proposal was done in early 2008 when the BioBanking methodology was not available. Hence no objective calculation of offset ratios was required, as offsets were based on the nature and ecological condition of the habitat to be lost. Offsets were provided on a somewhat ad-hoc basis and varied substantially in the ratio of land offset to that disturbed for situations with similar attributes. For the Gunlake project, the areas that were formally offset at the time were negotiated with OEH following reductions in the original proposed impact footprint and increases in the areas to be offset (Ecotone Ecological Consultants 2008b). The offset ratio for the original proposal was 7:1 when mapped vegetation alone is considered.
- The impact assessment report (Biosis 2014) stressed the conservative nature of the assessment approach taken: "Because a conservative approach was adopted and the entire impact area may not actually consist of native vegetation, this credit requirement should be regarded as upper end or worst-case scenario" (p.19). For the original 2008 proposal, an offset ratio of 7:1 was calculated based on the patches of vegetation containing trees and / or shrubs only. Open, cleared pasture was not included. However, based on comments from DECC (now OEH) at the time that at least some of the grassland between the clusters of trees could be considered to constitute a derived grassland form of the EEC, for the current assessment it was decided to adopt the conservative approach and assume that all open grassland technically constituted the EEC even though parts of it may not fit the definition. An increased offset ratio of 18:1 was then negotiated which included cleared, degraded habitat intended to be regenerated. For comparison, the Department of Planning

accepted an offset ratio of 4.5:1 for clearing of Box Gum Woodland associated with the Marulan South Quarry Project (Department of Planning 2007).

- A much smaller offset ratio is likely to have been required for the original proposal had the BioBanking methodology been applied at the time. Given that the proposed offsets have not been finalised or approved, it was considered appropriate to revisit the offset calculations, with the newly available quantitative methods described under BioBanking (which were not available in 2008). This calculation was based on the results from BioBanking quadrats that were placed in areas where remnant trees occurred and therefore likely to have been in relatively good ecological condition compared to the surrounding areas of open pasture devoid of trees. As stated in p. 17 of the supplementary assessment report (Biosis 2014): "the vegetation would qualify as low condition were it not for the predominantly native ground cover" (in those areas).
- Based on calculations completed using plot data and information from the 2014 assessment, clearing of 7ha of EEC for the original proposal would have required a minimum of 26.6ha of similar quality vegetation. A total of 30.4ha of mapped vegetation meeting the EEC exists in the original offsets to compensate for this impact on a like for like basis. Therefore, an excess of 3.8ha of woodland and 46.2ha of grassland exist in the original proposed offsets. This excess should be available to offset the impacts of the proposed extension.
- For the proposed extension areas (assuming that it is all EEC), the credit calculator returned a requirement of 332 credits to offset the 9.3ha of habitat loss due to the proposal which translates to 35.7ha of equivalent habitat to be dedicated in an offset area, as estimated by the Credit Converter (Biosis 2014). The excess in the original offsets more than allow for this additional area (a total of 50ha is available), and provided some of this habitat in better condition than the impact site, making it like for like or better quality. This represents an estimated offset ratio requirement of 3.8:1 in accordance with offset calculator requirements, which is substantially lower than that provided for the original quarry impacts.
- I disagree with the assertion that the offsets are not like-for-like. If it is argued that open pasture areas could comprise EEC in the proposed impact areas, then the same assumption must be applied to the offset areas. Most of the impact area is highly degraded and so are most of the offset areas. Although BioBanking quadrats were not placed in the offset areas, results from the original flora surveys (Ecotone Ecological Consultants 2008a) indicate that the offset areas are similar in both floristics and condition to the impact areas (current and proposed). However, the degraded parts of the offset areas have the capacity to be regenerated, and would gain additional credit for substantial improvement in ecological condition (which has not been considered in the above calculations).

In summary, compliance with Principles for NSW Biodiversity Offsets for Major Projects is demonstrated below:

1. *Before offsets are considered, impacts must first be avoided and unavoidable impacts minimised through mitigation measures. Only then should offsets be considered for the remaining impacts:* The proponent (Gunlake Pty Ltd) has considered all feasible alternatives in relation to the proposal and will implement reasonable mitigation measures. Further information is provided by Gunlake in the Response to Submissions Report.
2. *Offset requirements should be based on a reliable and transparent assessment of losses and gains:* These have been determined objectively using a combination of a) the BioBanking methodology including data collected using prescribed methods for the impact areas and the credit converter (using data from the proposed extension area) and b) a conservative assessment of the quantum of offsets required for both the current and proposed quarry extension areas considered as a whole.

3. *Offsets must be targeted to the biodiversity values being lost or to higher conservation priorities (like-for-like offsets):* The existing offset areas are like-for-like to the impacted habitat in every sense according to this principle, as explained above.
4. *Offsets must be additional to other legal requirements:* The original offsets proposed have not been finalised or approved. As such, these are still open to negotiation to ensure that a suitable outcome is achieved. This modification seeks to amend the original offsets. Given recent more objective methods to determine areas and offset ratios required, the existing offsets have been found to more than satisfy the offset requirements of both the existing and proposed extension areas when assessed together.
5. *Offsets must be enduring, enforceable and auditable:* The offsets will be legally protected, able to be enforced and can be audited at any time.
6. *Supplementary measures can be used in lieu of offsets:* The proponent does not propose to use any supplementary measures in lieu of offsets.

As stated in the OEH comments, offsetting requirements under the Commonwealth EPBC Act are beyond the scope of the OEH review. In terms of Box Gum Woodland, more rigid criteria to determine if the Threatened Ecological Community (TEC) is present are applied under the EPBC Act than the TSC Act. The TSC Act merely requires key species to be present rather than common for the ecological community to qualify as a TEC. Additionally under the EPBC Act, for the TEC to be present, a number of criteria must be satisfied, including a patch size of at least 0.1ha and 12 or more native species (excluding grasses) to be present including at least one important species.

Looking at the quadrat data from the recent assessment (Biosis 2014), the impact areas from which the data was collected would fall short of qualifying as the Critically Endangered Ecological Community (CEEC) under the Commonwealth criteria (11 non-grass native species and one important species recorded in one quadrat and 8 non-grass native species with no important species in the other). Areas elsewhere may 'fall over the line', particularly patches of trees that are greater than 0.1ha in area. However, no individual patches larger than this threshold area occur within the proposed extension areas.

The important point to note is that, unlike the NSW definition, most of the open grassland would not qualify as the CEEC since the required number of native (non-grass) species including an important species is unlikely to be present. Since the vast bulk of the area to be offset is open grassland, the small area of vegetation potentially qualifying as a CEEC under the Commonwealth legislation to be impacted would be amply offset as provided within the excess areas of the existing, original offset areas.

I trust that these responses adequately address the issues raised. Please contact me if you require further information or clarification.

Yours sincerely

Stefan Rose

Stefan Rose
Senior Ecologist

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Appendix B

EMM flora survey results

B.1 EMM Flora surveys results

B.1.1 Introduction

EMM conducted a floristic survey to determine the condition of the grassland in the Gulake Quarry Modification 2 extension areas. The survey aimed to map Box Gum Woodland EEC and derived native grasslands that conformed to the community listing.

B.1.2 Method

A desktop review of the previous Ecotone (2008) and Biosis (2014) reports was completed. Regional geology, soil landscape and vegetation mapping was also reviewed.

Surveys were completed on the 12 and 13 January 2015 by Cassandra Thompson (EMM) and Roger Lembit (Gingra Ecological Surveys).

Systematic traverses were undertaken through the overburden emplacement extension area. A 40 m condition transect was completed to gauge the condition of the vegetation present. The dominance of native or exotic grass/forb species was noted at every meter interval along this transect. This was translated into a percentage to identify native grassland (requires >50% native species).

A 20x20 m floristic plot and a 40 m condition transect were completed in the pit extension area. The area was chosen as it contained native grassland. The abundance and diversity of native species was recorded to compare against the EEC listing.

Remnant trees were identified and mapped within and surrounding each of the extension areas to identify the likely species that would have occurred prior to clearing for agriculture. All flora species encountered during the traverses of the modification areas were noted.

B.1.3 Results

i Gunlake property

The majority of the Gunlake property is characterised by pink (Joaramin) and blue (Barrillier) ignimbrite — the hard rock resource that is quarried. In the extension areas, particularly the pit extension area, rock outcropping was common with pink ignimbrite present. The soils in this area are very shallow and considered to be a Hydrosol, as the area was heavily waterlogged during the survey after only moderate summer rainfall. As such, these areas have low fertility.

Soils along Chapman Creek and its tributaries are Quaternary alluvium. They are deeper and are more fertile than the surrounding slopes and hills. These areas were mapped by Ecotone and Biosis as containing vegetation indicative of the Box Gum Woodland EEC. The EMM survey found that vegetation consistent with the listing of Box Gum Woodland EEC tended to occur in these lower lying flats and drainage depressions, with deeper loamy soil profiles. Within the Gunlake property, this included areas dominated by Yellow Box (*Eucalyptus melliodora*) and Blakely's Red Gum (*E. blakelyi*) but also contain occasional Apple Box (*E. bridgesiana*) and Ribbon Gum (*E. viminalis*). Thin-leaved Stringybark (*E. eugenoides*) was also observed in these areas, particularly on lower-mid slopes, and where it dominated, the presence of the EEC is less likely. The community onsite conforms with the community described by Tozer et al (2006) as "GW p24 Tableland Grassy Box-Gum Woodland".

The slopes and rocky hills where remnant trees occur are characterised by Thin-leaved Stringybark, Apple Box, Red Stringybark and Broad-leaved Peppermint with a slightly different ground and shrub composition when compared to the Box Gum Woodland EEC, including Hoary Guinea Flower (*Hibbertia obtusifolia*) and Blackwood (*Acacia melanoxylon*). This conforms with the community described by Tozer et al (2006) as “GW p23 Tableland Hills Grassy Woodland”.

ii Extension areas

The vegetation in the overburden emplacement extension area contained mainly exotic-dominated pasture. Approximately 58% of the species in the area were exotic from the transect (Photograph B.1). Typical species included Rat’s Tail Fescue (*Vulpia spp,*), Windmill Grass (*Chloris truncata*), Sheep Sorrel (*Rumex acetosella*), Dandelion (*Taraxacum officinale*) and Serrated Tussock (*Nassella trichotoma*). Soils are coarse and rocky particularly on the higher slopes in this area.

The northern and southern parts of the overburden emplacement extension area contain some remnant paddock trees. The grassland surrounding these areas would be considered native, but weedy, pasture (Photograph B.2). While there are two Yellow Box trees as remnant paddock trees in these areas, the surrounding areas and other paddock trees were predominately Argyle Apple (*E. cinerea*) and Thin-leaved Stringybark. These are not diagnostic species of the Box Gum Woodland EEC. This combined with a largely exotic understorey means that the area does not meet the description of Box Gum Woodland EEC.

Photograph B.1 (left) Overburden emplacement extension area – location of flora condition transect

Photograph B.2 (right) the north-eastern end of the overburden emplacement extension area which is dominated by Argyle Apple and White Stringybark

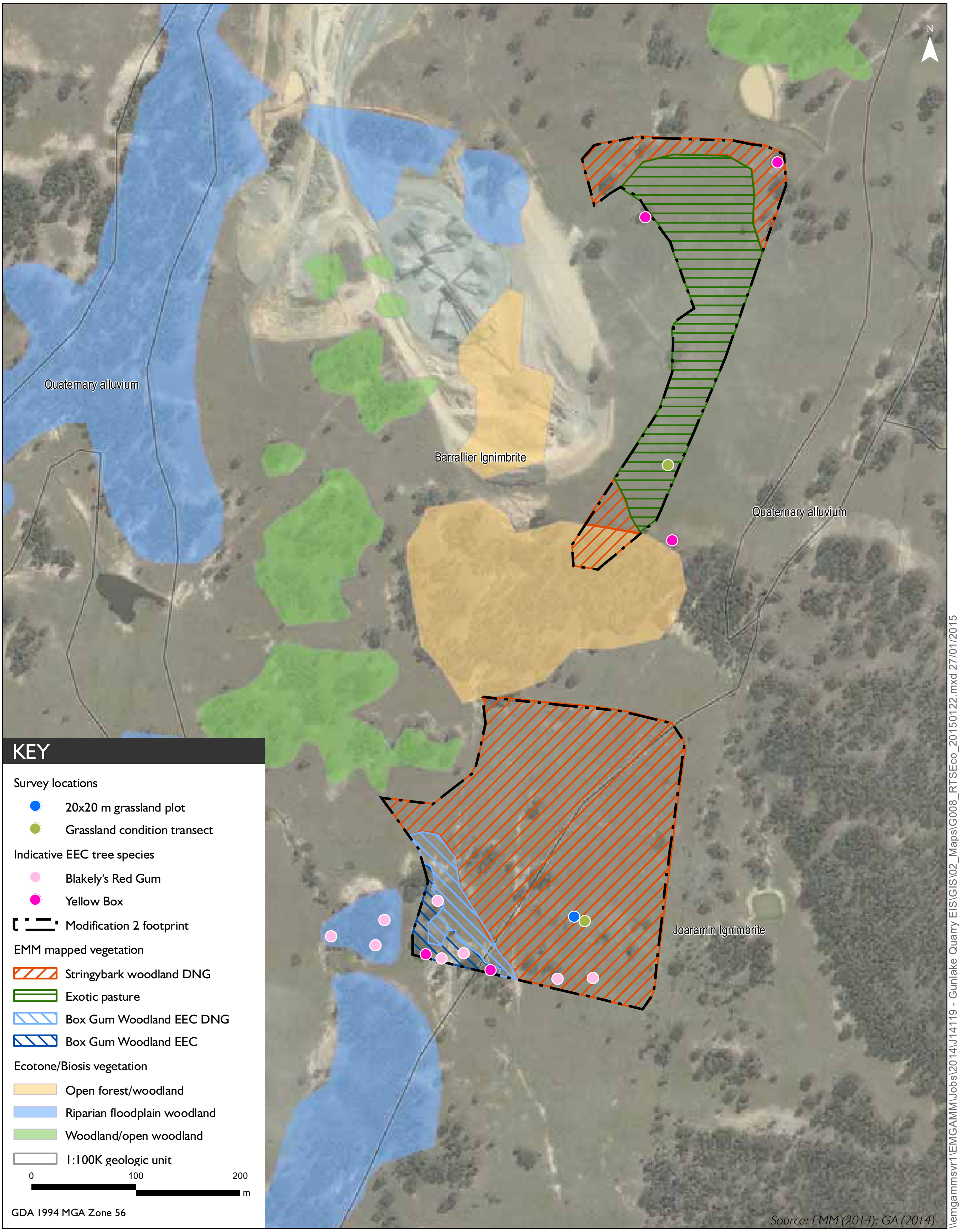
In contrast, the pit extension area was found to contain 75% native species along the transect. Topsoil through this area is shallow with rock outcropping and floaters throughout the area. This has probably prevented extensive pasture improvement or any cultivation in the past. There is a large amount of the noxious Serrated Tussock present (Photograph B.3). Typical species included Weeping Grass (*Microleana stipoides*), Peach Heath (*Lissanthe strigosa*), Snow Grass (*Poa sieberiana* subsp. *sieberiana*), Slender Tick-trefoil (*Desmodium varians*), Common Fringe-sedge (*Fimbristylis dichotoma*), Native Geranium (*Geranium solanderi*), *Cheilanthes sieberi*, Dandilion, Spear Thistle (*Cirsium vulgare)*, Sheep sorrel, *Lomandra filiformis* subsp. *coriacea* and *Oxalis perennans*.

Of the species recorded in the plot, only 13% represent Box Gum Woodland EEC (from the characteristic species in the determination). This is a poor correlation. In addition, the majority of the middle and northern parts of the pit extension area are on undulating topography on a mid to upper slope which, in this area, contains Stringybark-dominated woodland. Remnant trees in and surrounding the area include Blackwood, Thin-leaved Stringybark and Argyle Apple. Therefore, the middle and northern parts of the pit extension area are not considered to be grassland derived from Box Gum Woodland EEC.

There is a small area indicative of the Box Gum Woodland EEC in the southern portion of the pit extension area (see Figure B.1). The remnant trees in this area (Yellow Box and Blakelyi's Red Gum) are indicative of the EEC. The grassland in similar areas where the canopy has been cleared, that is lower slopes and drainage depressions with alluvial and deeper soils, would have also once supported this vegetation type.

Photograph B.3 (left) Pit extension area – middle part at the plot and transect site

Photograph B.4 (right) Argyle Apple in the northern part of the pit extension area



EMM

Revised vegetation in the extension areas
Gunlake Quarry Modification 2 Response to Submissions
Figure B.1

Photograph B.5 (left) **Yellow Box in the south-western part of the Pit extension area**

Photograph B.6 (right) **Yellow Box recruitment in the south-western part of the Pit extension area**

B.1.4 Assessment against the final determination

The vegetation in the extension areas was assessed against the NSW Scientific Committee final determination for the Box Gum Woodland EEC (Table B.1). The assessment concluded that the vegetation in the overburden emplacement extension area was not consistent with the Box Gum Woodland EEC. However, a small area of the pit extension area is the EEC. This area comprises remnant scattered trees which are dominated by species indicative of the community (Yellow Box and Blakely's Red Gum) with a native grass understorey, and includes an area of derived native grassland surrounding this in a similar landscape and with similar species composition.

A total of 0.6 ha of Box Gum Woodland EEC, 0.2 ha of scattered woodland and 0.4 ha of derived native grassland, has been identified in the extension areas by the EMM survey (Figure B.1).

Table B.1 Comparison of the vegetation in the modification areas with the Box Gum Woodland EEC final determination

<table>
<tr><th>Final determination element</th><th>Overburden emplacement extension area</th><th>Pit extension area</th></tr>
<tr><td>Found on relatively fertile soils on the tablelands and western slopes at an altitude of 170m to 1200m, within the Sydney Basin and NSW South Western Slopes Bioregion (among others).</td><td colspan="2">The site is mapped as containing Bindook Road soil landscape, which is of moderate fertility, capable of supporting Box Gum Woodland EEC. However, the geology mapping shows that the extension areas occur in Barrallier and Joarmin Ignimbrite geology. Rain prior to the EMM ecological survey and the soils were heavily waterlogged. They are therefore considered to be a Hydrosol, with rock outcropping evident throughout. This indicates that it is a low fertility landscape. The site up to 680 m AHD and occurs in the Sydney Basin Bioregion.</td></tr>
<tr><td>Woodland where one of the characteristic tree species includes one or more of the following species in varying proportions and combinations – White Box, Yellow Box or Blakely’s Red Gum.</td><td>Two individuals of an indicative species, Yellow Box, occurs in or immediately adjacent to the overburden emplacement extension area. The area is surrounded by Argyle Apple, Apple Box and Narrow-leaved Stringybark with occasional Silvertop Ash to the east and south. To the north, in a lower lying area remnant Yellow Box’s occur with other trees species, which are not initiative of the EEC.</td><td>Indicative species occur toward the south of the pit extension area. This area contains Yellow Box and Blakely’s Red Gum, which is indicative of the EEC. The EEC area occurs in a drainage depression and intermittent drainage line in deeper soils. Grassland with similar soil and topographic characteristics surrounding this area is also likely to have once contained such species.

The middle and northern parts of the pit extension area are rocky, with shallow soils (which were waterlogged at the time of the survey) with remnant trees including Argyle Apple and Narrow-leaved Stringybark and occasional Blackwood.</td></tr>
<tr><td>Grass and herbaceous species generally characterise the ground layer. In some areas the tree overstorey may be absent as a result of past clearing and at these locations only an understorey may be present. Disturbed remnants are still considered to form part of the community where the vegetation, either understorey, understorey or both, would under appropriate management, respond to assisted natural regeneration (natural soil and associated seedbank are still at least partially intact).</td><td>Two Yellow Box trees, with one within and one on the edge of the overburden emplacement extension area. However the grassland in this area is considered to be exotic pasture and is unlikely to respond to regeneration.</td><td>The pit extension area is less disturbed and although significant amounts of Serrated Tussock occur throughout, it contains a mainly native understorey with grasses and forbs present. It is considered to meet the definition of a derived native grassland.</td></tr>
<tr><td>Characteristic species are present</td><td>Two Yellow Box trees (which are characteristic of the community), with one within and one on the edge of the overburden emplacement extension area. However, the groundlayer is dominated by exotic pasture and weed species, with some native grasses in areas. Dominant groundcover species include Rat’s Tail Fescue (Vulpia spp.), Windmill Grass (Chloris truncata), Sheep Sorrel, Dandelion and Serrated Tussock. Species in this area are not indicative of the community.</td><td>Only 13% of species recorded in the plot in the middle of the southern modification area are indicative of the characteristic species of the EEC.

Characteristic species are present in the southern part where Yellow Box and Blakely’s Red Gum trees occur and surrounding native grassland areas.</td></tr>
</table>

Table B.1 Comparison of the vegetation in the modification areas with the Box Gum Woodland EEC final determination

Final determination element	Overburden emplacement extension area	Pit extension area
Conclusion	This area would have once contained vegetation dominated by Stringybark Woodland. According to the final determination, the overburden emplacement extension area does not meet the description of the EEC.	The middle and northern parts of the pit extension area would have once contained vegetation dominated by Stringybark Woodland and does not meet the definition of the EEC. The southern part of the pit extension area meets the description of the EEC (Figure E.1).

B.2 Species recorded

Table B.2 Plot results

Family	Exotic	Scientific Name	Common Name	Cover abundance
Adiantaceae		*Cheilanthes sieberi*	Rock Fern	2
Anthericaceae		*Tricoryne elatior*	Yellow Autumn-lily	2
Asteraceae	*	*Cirsium vulgare*	Spear Thistle	2
		Cymbonotus lawsonianus	Bear's Ear	1
	*	*Hypochaeris radicata*	Catsear	2
Campanulaceae		*Wahlenbergia gracilenta*	Annual Bluebell	1
Caryophyllaceae	*	*Paronychia brasiliana*	Chilean Whitlow Wort, Brazilian Whitlow	1
	*	*Petrorhagia dubia*	-	1
Chenopodiaceae		*Chenopodium carinatum*	Keeled Goosefoot	2
Convolvulaceae		*Dichondra repens*	Kidney Weed	1
Cyperaceae	*	*Cyperus brevifolius*	-	1
Ericaceae		*Lissanthe strigosa*	Peach Heath	2
Euphorbiaceae		*Chamaesyce drummondii*	Caustic Weed	3
Fabaceae (Faboideae)		*Desmodium varians*	Slender Tick-trefoil	1
		Glycine clandestina	Twining glycine	2
Geraniaceae	*	*Erodium cicutarium*	Common Crowfoot	1
		Geranium solanderi	Native Geranium	1
Juncaceae		*Juncus usitatus*	-	2
Lomandraceae		*Lomandra filiformis subsp. coriacea*	Wattle Matt-rush	1
Myrsinaceae	*	*Anagallis arvensis*	Scarlet Pimpernel	2
Oxalidaceae		*Oxalis perennans*	-	1
Poaceae		*Aristida ramosa*	Purple Wiregrass	2
		Austrostipa rudis subsp. nervosa	A Speargrass	1
		Bothriochloa macra	Red Grass	2
		Dactyloctenium radulans	Button Grass	2
		Eragrostis benthamii	-	2
		Eragrostis leptocarpa	Drooping Lovegrass	1
		Microlaena stipoides	Weeping Grass	1
	*	*Nassella trichotoma*	Serrated Tussock	6
		Poa sieberiana	Snowgrass	4
		Sporobolus creber	Slender Rat's Tail Grass	2
		Themeda australis	Kangaroo Grass	2
Polygonaceae	*	*Acetosella vulgaris*	Sheep Sorrel	1
Rosaceae		*Acaena ovina*	Acaena	2
	*	*Rubus anglocandicans*	Blackberry	1
Rubiaceae		*Asperula conferta*	Common Woodruff	1
	*	*Richardia stellaris*	-	1

Appendix C

Revised Aboriginal Cultural Heritage Assessment report

CULTURAL
HERITAGE
MANAGEMENT
AUSTRALIA

Gunlake Quarry, Marulan, NSW
Modification to Quarry Pit and Overburden Emplacement
Aboriginal Cultural Heritage Assessment

Final Report

AUTHORS NAME: Dr Sophie Collins

CLIENT: Gunlake Quarries

10.9.2014

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Executive Summary

Project Area and Description

This Aboriginal Cultural Heritage Assessment Report has been prepared by Cultural Heritage Management Australia (CHMA) for Gunlake Quarries Pty Ltd (GQ). Gunlake Quarries Pty Ltd operate the hard rock Gunlake Quarry located off Brayton Road, to the north west of Marulan in southern New South Wales. In 2008 Project Approval was granted for the construction and operation of the Gunlake Quarry and associated activities. Approvals were given for a 30 year quarry life, with hard rock reserves sufficient to enable quarrying activity for over 100 years. Due future demands for hard rock in the Sydney Region exceeding what can be provided within a 100km radius of Sydney, Gunlake Quarry is one of a number of new and proposed quarries intended to fill this demand.

The Project is classified as a Major Project under the State Environmental Planning Policy (Major Projects) (2005) and, consequently, the Minister for Planning is the approval authority. As a Major Project, it is to be assessed under Part 3A of the *Environmental Planning and Assessment Act 1979*. The Project Site received Project Approval in 2008. The current proposal represents a modification to the existing Project Approval and thus requires the submission of an Aboriginal Cultural Heritage Assessment Report prior to receiving approvals for the proposed modifications.

The current subject area is located within the existing Gunlake Quarry Project Site, which is located at 715 Brayton Rd, Marulan, New South Wales (see Figures 1 and 2). The Project Site lies within the County of Argyle, Parish of Billyrambija (Goulburn Mulwaree Local Government Area) and incorporates:

Lot	Deposited Plan	Title	Part/Whole
48	750003	Auto Consul 14176-39	Part
111	750003	Auto Consul 14176-39	Part
52	750003	Auto Consul 10774-211	Part
50	750003	Auto Consul 10774-211	Part
149	750003	Auto Consul 10774-211	Whole
73	750003	Auto Consul 7907-112	Whole
74	750003	Auto Consul 7907-112	Whole
260	750053	Auto Consul 7907-112	Whole
53	750003	Auto Consul 14176-38	Whole
148	750053	Auto Consul 14176-38	Whole
10	254042	Auto Consul 13729-90	Part
42	750003	Volume 12203 Folio 65	Part
76	750003	Volume 12203 Folio 66	Part
54	750003	Volume 1589 Folio 245	Part
1	750003	Volume 2300 Folio 46	Whole
1	328725	Folio Identifier 1/328725	Part

The boundaries of the Project Area are illustrated in Figure 2. The current subject area is located within the Project Area (see Figure 3) and incorporates:

Modified Quarry Pit

Lot	Deposited Plan	Title	Part/Whole
260	750053	Auto Consul 7907-112	Part
73	750003	Auto Consul 7907-112	Part

Modified Overburden Emplacement

Lot	Deposited Plan	Title	Part/Whole
53	750003	Auto Consul 14176-38	Part

Aims of the Investigation
The principal aims of this project are as follows:

- Review the available archaeological information for the study region;
- Undertake a field survey assessment within the bounds of the proposed modification area to be subject to impacts as defined in Figure 3;
- Record and plot the location of all Indigenous cultural heritage sites within the study area in accordance with the '*Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales*' (DECCW 2010b);
- Identify areas of potential archaeological sensitivity within the study area;
- Gauge the potential for subsurface archaeological materials to be present in the study area;
- Identify the nature and degree of impacts likely to be caused to sites by the current proposal;
- Assess the significance of all Aboriginal cultural heritage sites or objects identified within the study area;
- Develop a set of management procedures for all heritage sites and areas of potential archaeological sensitivity identified within the study area.

Project Methodology
The current assessment has been conducted in accordance with the OEH *Guide to Investigating Assessing and Reporting on Cultural Heritage in NSW* (2011a), and *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010b).

The project was undertaken in several stages comprising the following investigation components:

- Literature and database review - Aboriginal literature sources included the Aboriginal Heritage Information Management System (AHIMS) maintained by the Department of Environment, Climate Change and Water (DECCW) and all associated files, archaeological reports and site cards.
- Searches were also undertaken of the following heritage registers:
  - Aboriginal Heritage Information Management System (AHIMS) (NSW DECCW);
  - The National Heritage List (Australian Heritage Council);
  - The Commonwealth Heritage List (Australian Heritage Council);

    - Heritage Schedule from Goulburn Mulwaree Local Environmental Plan 2009
- Field survey – undertaken on foot on 21st August 2014 by Dr Sophie Collins
- Analysis of the data obtained from the field survey included:
    - analysis of the micro topography of the study area
    - relationships between site types, densities and environmental factors
    - assessment of the results accounting for factors such as surface visibility and survey intensity.
- Report production, development of management recommendations and impact assessment

Investigation Results and Significance Assessments
Despite an extensive and thorough investigation of the two modification areas, no Aboriginal sites were identified and no areas likely to contain potential archaeological deposits were identified. Close inspection of subsurface deposits exposed through mechanical disturbance, animal burrows and dam construction failed to provide any indication of Aboriginal occupation of the area.

These results are in keeping with those of AASC 2007, who's original survey also failed to identify any sites in this area, but slightly contradict the predictive model, which suggests the area has moderate-high archaeological potential. The primary reason for the difference between the two is the total lack of soil across the area. The entire study area is covered with rocky outcrops with little to no areas with any level of soil deposit. The area would have been far too rocky to camp in, making it an unattractive spot for anything but the briefest of visits. Consequently, whilst the landforms in the area and proximity to ephemeral water sources offer some utility (though not for permanent occupation as discussed earlier), the harshness of the ground itself would have been a considerable drawback.

While it is inevitable that Aboriginal people will have traversed and exploited the local area, the study area itself is unattractive as a locality for occupation. The available geology is ill-suited to artefact manufacture, the terrain is unappealing as a camping locality and permanent water sources are at least 1km from the area. Aboriginal people would have moved through the area on their way to more suitable campsites to the north and east adjacent to permanent water sources and where level, well drained and rock free ground is available for settlement. The archaeological potential of this area is therefore re-assessed as being low.

In the absence of any cultural heritage materials on site and recognizing the generally low archaeological potential of the broad area itself due to the rocky ground cover, any sites likely to occur within the study area will be very small, ranging from isolated finds to scatters of less than 5 artefacts, located within a highly eroded and disturbed context. These sites, if present at all, are therefore likely to have low/no archaeological significance.

Potential Impacts

The proposed development involves large open area excavation to depths of several hundred metres below the surface in the area of the proposed quarry pit modification. While the modified embankment emplacement will cover the ground's surface and be rehabilitated, never to be moved again. As such, the project will involve the complete obliteration of the landscape within the proposed quarry pit modification area, and the permanent covering of the landscape beneath the overburden modification area.

Impacts to the area by the proposed development will be therefore direct, complete and irreversible. Any undiscovered sites existing within the study areas will therefore be subject to direct impact by development.

However, as discussed in Section 5 the potential for sites with research value or significance is generally very low. This being said, a low-density spread of artefacts comprising a 'background scatter', with an unpredictable patterning, is known to occur throughout Australia and is therefore likely to be present and should be expected. Any artefacts within this general 'background scatter' may be subject to impacts from the development.

No other traditional Aboriginal cultural values or associations have been identified during the previous or the present surveys of the area.

It is therefore concluded that the effect of the development on the potential Aboriginal heritage resources of the area is very low based on the following:

- No sites of traditional or historical Aboriginal value have been identified in the study area, during either previous or the current survey of the area;
- The study area has low archaeological potential, based on existing geology and sedimentation and a lack of permanent water.

Avoiding and/or Minimising Harm

Avoidance or the mitigation of harm has not been considered an option in relation to the proposed development activities. In the absence of any known sites of heritage significance it is neither possible nor necessary to implement avoidance or mitigation strategies.

Conclusions and Recommendations

No heritage areas, objects or places were identified during the process of Aboriginal community consultation undertaken for this project (by AASC 2007) or either of two cultural heritage surveys undertaken on the site (AASC 2007 and the present study).

The entire proposal area is assessed as being of very low archaeological potential and the heritage value of the proposed impact area is assessed to be low.

As such, the following management recommendations are forwarded:

1. There are no identified cultural or archaeological constraints in regard to the proposal.
2. No areas were identified that could be characterized as places with a high probability of possessing subsurface Aboriginal objects of high potential conservation value. As such, archaeological test excavation can not be justified (NSW DECCW 2010a:24).
3. In accordance with the requirements of the NPW Act, any Aboriginal objects identified on the land that are not already recorded on AHIMS, are legally bound under s.89A of the Act to notify OEH as soon as possible of the object's location. As such, if an Aboriginal object is identified within the study area during works, the Office of Environment and Heritage should be notified as soon as possible.

Figure 1. Location of Gunlake Quarry within regional New South Wales

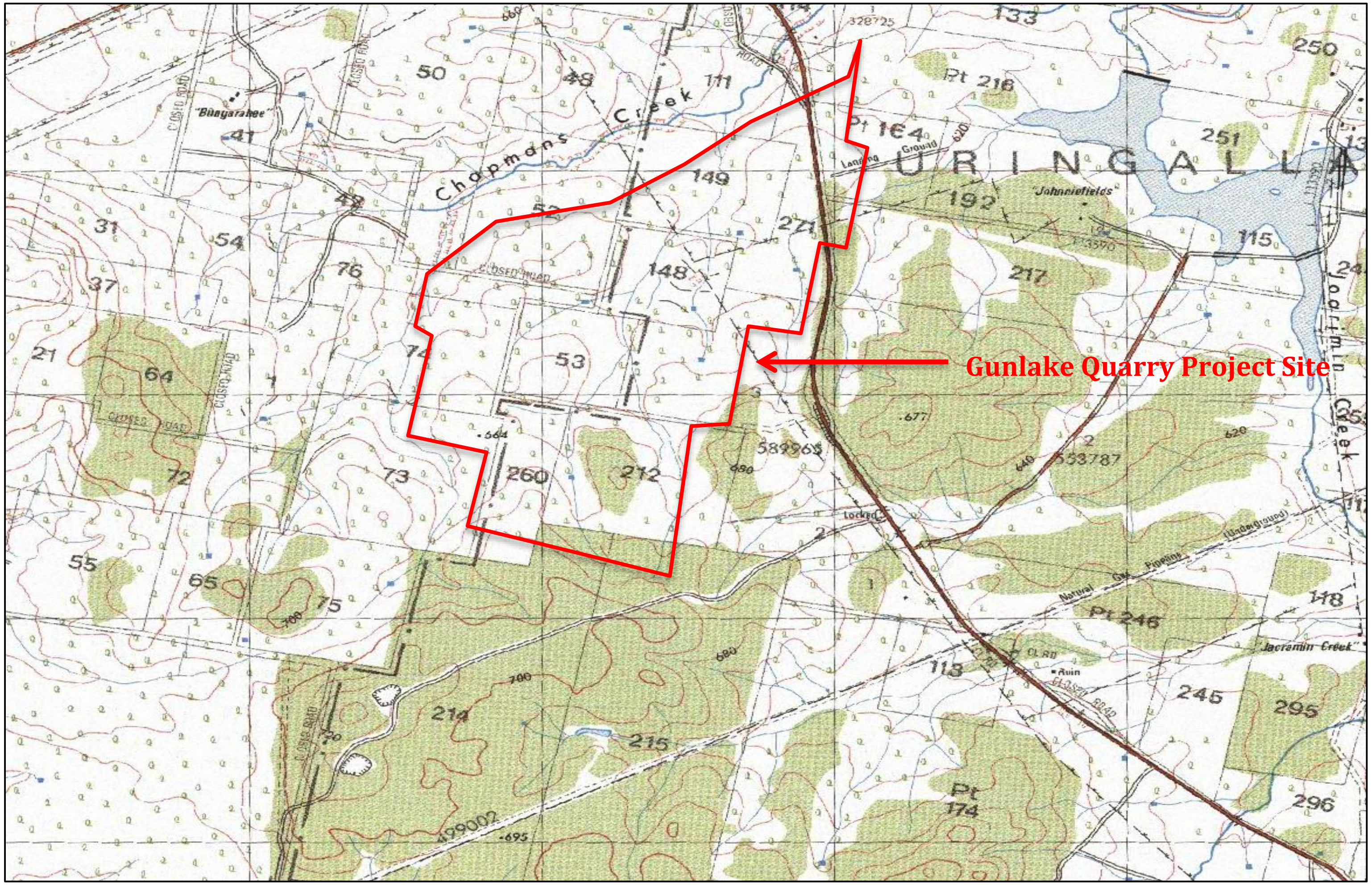

Figure 2. Approved Project Site for Gunlake Quarry

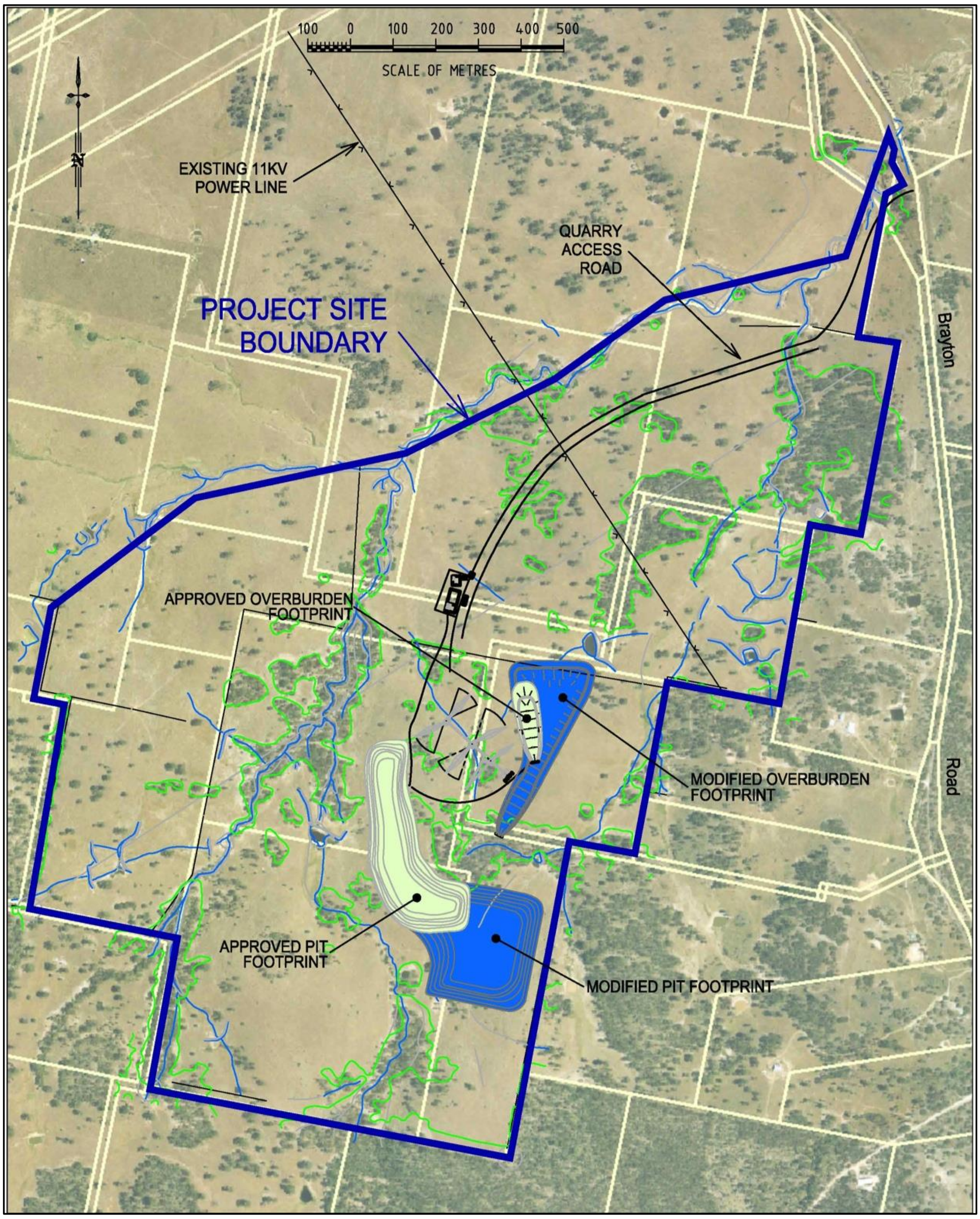

Figure 3. Existing footprint relative to modified footprints for Quarry Pit and Overburden (modification areas comprise the 'Study Areas' as discussed in this report).

1.0 Introduction

1.1 The Client: Gunlake Quarries Pty Ltd

Gunlake Quarries Pty Ltd operate the hard rock Gunlake Quarry located off Brayton Road, to the north west of Marulan in southern New South Wales. In 2008 Project Approval was granted for the construction and operation of the Gunlake Quarry and associated activities. Approvals were given for a 30 year quarry life, with hard rock reserves sufficient to enable quarrying activity for over 100 years. Due future demands for hard rock in the Sydney Region exceeding what can be provided within a 100km radius of Sydney, Gunlake Quarry is one of a number of new and proposed quarries intended to fill this demand.

Gunlake Quarries Pty Ltd is an independent quarry producer supplying its own operations in Sydney as well as markets elsewhere. It has two plants in operation at Smeaton Grange in the southwest and Glendenning in the northwest growth areas, with approvals currently being sought for a third concrete batching plant at Silverwater (OEC 2014).

The Gunlake Project was described in full in an Environmental Assessment undertaken in 2008 and entitled 'Gunlake Quarries Gunlake Quarry Project Environmental Assessment Report and Appendices' (4 Volumes) (Olsen Environmental Consulting (OEC) 2008).

1.2 Project Brief

In September 2013, Gunlake Quarries (GQ) received approval to undertake a minor modification to their original Project Approval, allowing the use of a purpose-built highway overpass connecting Red Hills Road and Brayton Road. GQ now seeks an additional Project Approval Modification to allow them to better respond to the increased demand for saleable product. This document provides an Aboriginal Cultural Heritage Assessment Report of the areas affected by the proposed modifications, an assessment of heritage impacts and recommendations for impact mitigation.

1.3 The Development Proposal

Operations at Gunlake Quarry currently include the quarry area and overburden emplacement, site facilities area, including quarry office and workshop, rock processing plant area including stock piling, crushing, screening and truck loading facilities, the quarry entrance and several internal roads.

The current proposal pertains only to the quarry area and overburden emplacement, with all other components of the Project Site remaining the same. Figure 3 illustrates the area of the proposed modifications; with both the quarry area and overburden emplacement to be enlarged to allow an increase from annual saleable production from 500,000 tpa to 750,000 tpa to meet increased demands for saleable product.

Expansions to both areas will result in significant and irreversible impacts to the study area. The landscape will be unrecognizably altered with all semblances of its original form obliterated by processes summarised below:

- Vegetation Clearing - the bulk of the vegetation (currently pasture) will be removed during via standard soil stripping processes
- Soil Stockpiling – wherever possible the stripped topsoil and subsoil are placed onto completed sections of the final landform, or otherwise in separate areas not exceeding 2-3m in height.
- Soil and overburden are removed by an excavator loading into 50t dump trucks, blasting is not required, but results in removal of up to 25mm of topsoil.
- The overburden emplacement bund has been constructed as a permanent location for overburden material.
- Once the overburden is removed, conventional drill and blast techniques are used to quarry the rock from the face heights of approximately 13m. Drilling in preparation for blasting requires a hydraulic drill, which prepares approximately 20,000t of rock material for each blast.
- Quarrying equipment utilised: Face Loader, 50t dump trucks, front end loader, drilling rig, excavator, grader, tip truck, maintenance truck, water truck.

The modified bund for the overburden emplacement will be built adjacent to the existing one, constructed in stepped benches from the north and east back towards the existing bund. The quarrying process will continue as it has been, with the modification being an enlargement of the area of impact (see Figure 3).

These activities will inevitably obliterate any Aboriginal heritage sites located within the impact areas. At best, heritage sites would be retained beneath the bund or entirely displaced within it.

1.4 Aims of this Heritage Assessment

The principal aims of this project are as follows:

- Review the available archaeological information for the study region;
- Undertake a field survey assessment within the bounds of the proposed modification area to be subject to impacts as defined in Figure 3;
- Record and plot the location of all Indigenous cultural heritage sites within the study area in accordance with the '*Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales*' (DECCW 2010b);
- Identify areas of potential archaeological sensitivity within the study area;
- Gauge the potential for subsurface archaeological materials to be present in the study area;
- Identify the nature and degree of impacts likely to be caused to sites by the current proposal;
- Assess the significance of all Aboriginal cultural heritage sites or objects identified within the study area;

- Develop a set of management procedures for all heritage sites and areas of potential archaeological sensitivity identified within the study area.

1.5 The Subject Area

The current subject area is located within the existing Gunlake Quarry Project Site, which is located at 715 Brayton Rd, Marulan, New South Wales. The Project Site lies within the County of Argyle, Parish of Billyrambija (Goulburn Mulwaree Local Government Area) and incorporates:

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The boundaries of the Project Area are illustrated in Figure 2. The current Study Area is located within the Project Area (see Figure 3) and incorporates:

<u>Modified Quarry Pit</u>

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73	750003	Auto Consul 7907-112	Part

<u>Modified Overburden Emplacement</u>

Lot	*Deposited Plan*	*Title*	*Part/Whole*
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The Project is classified as a Major Project under the State Environmental Planning Policy (Major Projects) (2005) and, consequently, the Minister for Planning is the approval authority. As a Major Project, it is to be assessed under Part 3A of the *Environmental Planning and Assessment Act 1979*. The Project Site received Project Approval in 2008. The current proposal represents a modification to the existing Project Approval and thus requires the submission of an Aboriginal Cultural Heritage Assessment Report prior to receiving approvals for the proposed modifications.

1.6 Investigation Methodology

The current assessment has been conducted in accordance with the OEH *Guide to Investigating Assessing and Reporting on Cultural Heritage in NSW* (2011a), and *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010b).

1.6.1 Literature and Database Review

A large volume of archaeological and ethnographic literature was reviewed for the Gunlake Quarry study area and its local area. This material was used to determine the presence of any known Aboriginal sites in the area under investigation, to facilitate the prediction of site patterning in the area based on known regional and local site patterns, and to place the area within its archaeological and heritage management context.

Aboriginal literature sources included the Aboriginal Heritage Information Management System (AHIMS) maintained by the Department of Environment, Climate Change and Water (DECCW) and all associated files, archaeological reports and site cards.

Searches were also undertaken of the following heritage registers:

- Aboriginal Heritage Information Management System (AHIMS) (NSW DECCW);
- The National Heritage List (Australian Heritage Council);
- The Commonwealth Heritage List (Australian Heritage Council);
- Heritage Schedule from Goulburn Mulwaree Local Environmental Plan 2009

1.6.2 Fieldwork and Project Personnel

Fieldwork for this project was undertaken by Dr Sophie Collins over half a day on 21st August 2014. The primary purpose of the fieldwork was to locate and record any sites within the study area and to assess potential archaeological sensitivity of the area as a whole.

The survey was undertaken on foot and involved walking a series of transects across the two areas proposed for modification; the extension of the quarry itself (covering approximately 5.8ha) and of the overburden emplacement (covering approximately 3.5ha). The survey track log is included in Figure 4 and involved walking across the entirety of the impact area, specifically targeting areas of increased visibility such as erosion scalds, cattle tracks and/or animal burrows.

1.6.3 Analysis and Report Writing

Analysis of the data obtained from the field survey included:

– analysis of the micro topography of the study area
– relationships between site types, densities and environmental factors
– assessment of the results accounting for factors such as surface visibility and survey intensity.

This Aboriginal Cultural Heritage Assessment Report was written by Dr Sophie Collins who is qualified to undertake the assessment. Relevant qualifications include an Bachelor of Arts (Hons), PhD and Post-Doctoral Fellowship from the

Australian National University specializing in Aboriginal archaeology and the identification, analysis and interpretation of stone artefacts. Dr Collins has been a practicing consulting archaeologist for more than 13 years and has also worked in a heritage management role within the ACT Public Service.

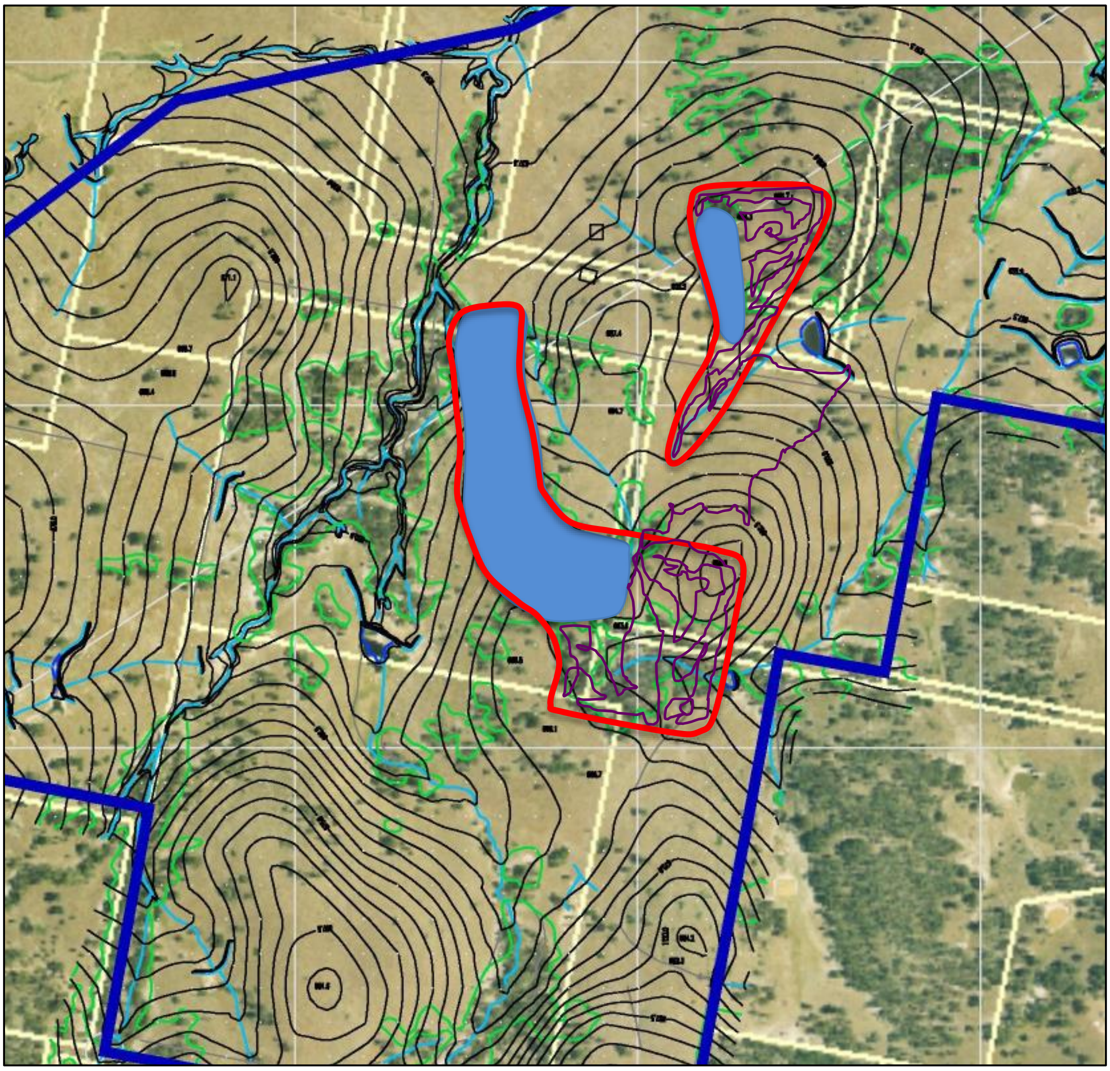

Figure 4. Survey track log through proposed modification areas (purple)

2.0 Previous Archaeological Work

2.1 Site Definitions

The most common site types located by archaeologists across this region of NSW are those that contain stone artefacts, either in isolation or as scatters (both low and high density) in both open and/or subsurface deposits. Other commonly identified sites include modified or scarred trees, grinding grooves, burials, rock shelters, middens, quarries and ceremonial sites. The following provides a brief definition of each site type for the purpose of understanding the subsequent discussion of the archaeological record of the Marulan region.

2.1.1 Artefacts

Stone artefacts are the most prolific markers of Aboriginal occupation in Australia. These items are the product of intentional manufacture by Aboriginal people for the purpose of using them as tools in a wide range of activities. Artefacts were manufactured from a wide range of materials including glass, bone and shell, however stone was by far the more common resource utilised. Artefacts may be identified by a series of morphological characteristics which separate them from fragments of rocks shattered through various mechanical agencies. Stone artefacts may occur in isolation or in varying sizes of scatters. They may appear as a surface expressions as well as buried sub-surface deposits.

2.1.2 Quarry

Quarries are raw material sources that can be demonstrated to have been extracted for the purposes of stone or ochre procurement by Aboriginal people. These sites characteristically show evidence of the removal of material/modification of surfaces in the form of flaking and reduction of the stone material at the source. The presence of quarries in any area will be directly dependent upon the underlying geology and its suitability for artefact manufacture.

2.1.3 Modified/Scarred Trees

These are trees, either living or dead, that can be demonstrated to have been modified by Aboriginal people removing the bark or wood from the tree and resulting in the formation of a scar. This sort of modification was undertaken for the purposes of manufacturing tools or other implements that were used in traditional cultural practices. Scarred trees will only be located in areas of old growth.

2.1.4 Grinding Grooves

These are smoothed areas or grooves on non-portable rock surfaces that have been created by grinding activity associated with food production such as seed milling, preparation of pigments, tool manufacture and/or maintenance and rituals. These types of sites are only found in the presence of suitable rock outcrops.

2.1.5 Rock Shelters/Art Sites

Rock shelters can be any place recognizable as a cave or overhang that may have afforded Aboriginal people shelter. Evidence of occupation may include the presence of stone artefacts, sub-surface deposits and art. Aboriginal rock art includes daubings, drawings, stencils, prints or any kinds of motifs on the surfaces of rocks and walls. Again, the presence of sites such as these will be contingent upon the geology of the area.

2.1.6 Burials

Aboriginal burial sites occur throughout the region and involve varying practices depending upon the landscape. These sites possess Aboriginal skeletal material and may also demonstrate Aboriginal mortuary/burial markers. Burials necessarily require sub-surface deposits of sufficient depth to cover the remains.

2.1.7 Ceremonial Sites

Ceremonials sites comprise any place used for a formal act or series of acts prescribed by ritual, belief in a mythological manifestation, religious belief or observance that is connected with the traditional cultural life of Aboriginal people in the past or present. Bora rings are one example of a ceremonial site.

2.2 Ethnohistoric Accounts of the Region

Ethnohistory entails the use of historical literature as a source for constructing ethnographic analogies and models in the study of the prehistory and contact history of indigenous peoples (McBryde 1979). Although ethnohistoric accounts have been recognised as a valuable source for providing insights into the lifeways of prehistoric people, their application can be problematical. These problems relate primarily to the nature of the sources, their accuracy and / or validity.

Flood (1980) identifies three types of ethnohistoric observations:

- the first hand, eyewitness observations made at the time of first contact with Europeans,
- first hand observations made at a later stage when Aboriginal society had become 'Europeanised', and,
- second-hand or generalised accounts of Aboriginal life.

Of these sources of information, the most valuable and reliable for the reconstruction of precontact Aboriginal life are the first-hand observations made at the time of first contact with Europeans. These include the accounts by explorers, surveyors and pioneer settlers. This does not necessarily mean that other forms of observations should be disregarded. However, caution must be exercised in their application.

These sources provide insights into aspects of Aboriginal life such as demography, material culture, language, social and political relationships, subsistence regimes, and ideological beliefs. Some of these will be discussed below. According to the best sources, the people living in the Study Area came from the language or 'tribal' group of people known as the Wiradjuri (Tindale 1974). Subsequent research (Jackson- Nakano 2001; 2002) has shown Tindale's tribal delineations to be more flexible than is implied by a strict 'boundary', and that this Study Area was inhabited by distinct cultural groups loosely affiliated as "Wiradjuri".

Paton (1990) gives a summary of many of the known primary and relevant secondary sources for the region around the Study Area. These sources have been supplemented by more recent studies (i.e. Jackson-Nakano 2001; 2002) in the discussion below.

The major water sources such as the large rivers (i.e. the Shoalhaven) and lakes, such as Lake George and Lake Bathurst, appeared to have been the focus of occupation by the local Wirradjuri groups. Early records from around 1810-30 seem to support the view that these water sources were a rich foci for occupation. Typically, as with many such landscapes in Australia, these were also the prime focus for European occupation when they entered an area. A similar story can be told for most of the large river systems: the thin, rich but fragile ecosystem was able to support a large and healthy Aboriginal population. Unfortunately however such ectotones tend to be marginal only a few hundred metres away from the river corridors, thus making them less than ideal when two cultures clash. Certainly, the clash of cultures occurred abruptly and with dire consequences in this region.

Historical accounts do not give a good indication of group sizes in this area apart from references such as a third hand account by Etheridge (1893:50) which refers to stories of a "gathering ground" along the Wollindilly River. By the time any sound observations were made, small pox, influenza and the affects of European settlement had decimated the local Aboriginal populations. (Mackaness 1941: 343; Goulburn Evening Post October 3, 1979; Butlin 1981: 24).

In 1836 the government surveyor Govett commented:

> *The kangaroos have either been killed, or have fled in search of more retired forests. Sheep and cattle have taken their place, the emu and turkey are seldom seen, the millions of parrots have even become scarce, and the few harmless blacks remaining, having lost their native energy, now even here court the white man for rum, his tobacco, and his bread!* (1836, July : 20).

It is estimated that by 1848 the local Aboriginal population was only 25 individuals. This is a small number considering that in 1839 Aborigines outnumbered Europeans by 10 to 1 at the Goulburn races. (Unfortunately we do not know the number of Europeans at the 1839 races, and so we cannot calculate the number of Aborigines).

The evidence for occupation away from the major rivers is sparse and tends to come mostly from wide ranging archaeological surveys (Flood 1980) and models of environmental determinism (Packard 1986). The supposed pattern based on these sources is occupation of the major water sources during the hotter drier months and a fanning out of people when rains filled smaller creeks and soaks. There is nothing to suggest this model has any major flaws, other than it requires more research to test its viability.

We can get an insight into what a typical Aboriginal campsite might have looked like through the eyes of Surveyor Govett who visited a settlement in the district in the early 1830's. Govett records:

After dark, the blacks seldom leave their own gunyas [huts], so that we went from one fire to another in order to observe the particular actions and employments of the several groups or families. The chief was sitting cross - legged between his two wives, and smoking a short black pipe. He was naked with the exception of the belt around his waist; upon his neck he wore a chain, to which was attached a brass plate in the shape of a half moon, on which was inscribed his name, etc., and he appeared as the light of the fire was reflected on him, a strong and muscular man. He had just finished his meal, and his two gins (or wives) were busily engaged in eating the fragments of opossums and kangaroo rats etc., every now and then poking out from the ashes small ground-nuts or yams. They occasionally gave a dog a slap with a stick...

The next gunya contained two young men, and one of these seemed to be employed with two double sets of strings, which by twisting and changing in a very intricate manner, he constantly drew out the back parts of his hands into a variety of forms and shapes . . . In other gunyas might be seen men and women of different ages, who were either smoking and chatting, or had fallen asleep; but wherever there were boys, infants, or adults, something appeared to be doing for the sake of amusement . . . Other children, were amused in various ways; some with little tomahawks were pretending to be cutting and hacking, while others were digging the earth with sticks, in imitation of their mothers, in search of food (Govett 1836: 256 (no. 264)).

This period of occupation by Aboriginal people has left a legacy of archaeological sites in the region including open campsites with stone tools, rock shelters, caves with living floors, axe grinding grooves, art sites, burial grounds and scarred trees. These are discussed further below. In addition to these archaeological sites, there are a number of other types of Aboriginal sites recorded by early European observers which reflect the more spiritual aspects of Aboriginal life. No physical evidence of these sites has been either remains or has yet been recorded.

An interesting example is tree carved tree sites noted by early explorers: two to the south-east of Goulburn and another on Mt Wayo 16 kilometres north of the city. These sites consisted of between 1 and 5 trees (Etheridge 1918: 53, Govett 1836). In each case a burial was associated with the trees. Govett gives an interesting account of the Mt Wayo site:

I had left my camp one morning to reconnoitre some ground near Mount Wayo, in Argyle, and after travelling for an hour, I crossed a rather steep grassy ridge, and descended into a rich forest-flat between the hills . . . my attention was attracted by sounds of human voices, wailing in wild and melancholy strains. I listened attentively, and the more I was struck with the peculiarity of the noise. Having made for the direction from which the sounds proceeded, I soon perceived before *me three native black women, and rode up to them. They were sitting round a mound of earth, with their heads depressed and nearly touching one another, nor did my presence at all disturb them, or rouse their attention, but they remained in the same postures, and did not even look up.*

I waited some time in astonishment observing their actions, and listening to their horrid lamentable yells. They were each of them striking their heads with a tomahawk, holding that instrument in their right hand, and wounding particularly the upper part of the back of the head. Their hair was besmeared with blood, which I could perceive trickling down behind their neck and ears. I called to them loudly but in vain. Determined, if possible, to find out the cause of the extraordinary scene before me, I dismounted, and tethered my horse at a little distance, and allowed them to remain undisturbed, while I took notice of the tomb and place around. The mound of earth might have been about three feet high; it was shaped as a dome, and built of a reddish clay: it was surrounded by a kind of flat gutter or channel, outside of which was a margin, both formed of the same material. The staves of the women were leaning upon it, and their nets, with their contents, thrown aside.

The appearance of the place was agreeable, though lonely and sequestered, and trees of various descriptions ornamented the rich pasture on the ground. The trees all round the tomb were marked in various peculiar ways, some with zigzags and stripes, and pieces of bark otherwise cut (Govett 1836: November: 182-183).

In addition to those burials associated with scarred trees, several others were noted in the early literature, though details about their locations are imprecise (Hardy n.d.; Goulburn Evening Post, October 3, 1979; MacAlister 1907:85; Wyatt 1941:110). The most precisely provenanced of these burials, recorded on a hill above the Landsdowne property (Wyatt 1941) was investigated by Hughes (1984) who said all traces of the site had disappeared.

The type of burial in this region is described in detail by Govett:

The method of their disposing of their dead is generally as follows, (and although few have ever witnessed the burial of a native, still the spot having been known, the corpse has been seen in the grave after burial): The body is removed to the place appropriated for its burial; the head is then bound down by strings of bark, close and nearly between the knees; the two hands are fastened behind each angle, so that the body is forced into a crouching form, and takes up as little space as possible. The grave, or hole, is made just large enough to admit the body, and deep enough to allow rather more than a foot of earth above it when interred. The body is buried naked, with the exception of the bandages of bark with which it is confined, and the cloak, spears, and other weapons of the deceased are claimed, and become the property, I believe, of the chief (Govett 1836: October 184).

A number of bora, or initiation grounds, were also noted in the region. They are located at Eastgrove and on the site of the Goulburn Railway Station (Lance and Koettig 1986 from Wyatt 1941:112) and near the site of the present Kenmore Hospital (MacAlister 1907:85). MacAlister says:

Near the Kenmore Hospital there is a little red hill, where the oft described man-

making ceremony (or 'bora') was performed. The prospective adults had to undergo a very severe ordeal before being admitted, by native law, to man's estate. Like the hermits of old, they observed a long period of solitude, during which their food was very coarse and scanty; they had, particularly to avoid the sight or company of females, and had to submit with stoic fortitude to a very severe 'birching' by several elders of the tribe. But their chief torture was the knocking out of one of their front teeth, in the case of each individual. To effect this, a sharpened kangaroo bone was held firmly against the 'doomed' tooth, and a strong Marra (black would punch the molar out by repeated blows on the kangaroo bone, with a stone hatchet. Within a few days of this event, the young hermits were brought into the camp, and a big 'baptismal' fire was lighted. The young men just 'created' were allotted places one side of this fire, and the other side was sacred to the gins.

With the arrival of European people into the region came dramatic disruption to the social and political structure of the Wiradjuri and the Onerwal. Eventually, the Aboriginal people were moved by the government from their traditional lands elsewhere. This culminated in the 1880's with the formation of the Aborigines Protection Board (Read 1988). With the development of government strategies for "management of the Aboriginal problem" came the development of managed mission stations and unmanaged stations or reserves, as well as a string of unmanaged Aboriginal fringe camps, which arose near European towns and settlements.

2.3 Previous Archaeological Investigations

2.3.1 The Surrounding Region

A large number of archaeological surveys and studies have been carried out in the wider region surrounding this Study Area, and provide useful information regarding site patterning in the landscape and the chronology of human occupation. By and large most of these surveys have been small-scale projects undertaken for environmental impact assessments. Perhaps the most fruitful information regarding site patterning can be found in the following studies which have discussed broad issues relating to either site distribution or chronology: Barber 1994; Hughes and Koettig 1983 (Dalton); Baker, Feary and Hughes 1984 (Lake Bathurst); Hughes, Barz and Hiscock 1984 (Lake George); Baker and Feary 1984 (Lake George); Lance 1985 (Bungendore); Attenbrow 1984 (Braidwood); Packard and Hughes 1983 (Yass River); Packard 1986; Ferguson 1988 (Braidwood); Paton 1990 (Goulburn); Shawcross 1998 (Boro); Keottig 1983 (Goulburn); Paton 2001 (Elmslea); Reeve and Thomson 2004 (Woodlawn); Navin and Officer 1998 (Woodlawn); Boot 2002; 1996a; 1996b; Navin Officer 2003.

Even though the range of environmental zones sampled by the majority of these surveys has been limited, the results when assessed at a general level show a distinct patterning in site location, with most sites being recorded on creek banks or high ground adjacent to permanent or semi-permanent water sources. In Koettig's (1983) survey of the Goulburn area, for example, 50% of the sites occurred on slopes near water. Similarly, in Attenbrow's (1984) wide ranging survey of the Welcome Reef Dam, 88% of sites were located on slopes adjacent to permanent or semi-permanent water. Lance (1985) detected the same pattern around Goulburn where most sites recorded were along water courses. There is no indication in any reports for the region that sites, other than the occasional small artefact scatter or isolated find, occur in waterless hilly terrain such as that found in the Study Area for this investigation (see for example the Woodlawn Study (Reeve and Thomson 2004) where isolated artefacts are found on locally flat, raised, waterless terrain).

Where surface surveys have been augmented by excavations it was found that surface results were not particularly reliable as indicators of sub-surface sites. Along the Wodonga – Wagga Wagga gas pipeline, for example, a surface survey was followed up by a test pitting program which showed that sites tended to cluster along creek lines, even though surface indications did not clearly demonstrate this pattern in the detail that the excavations revealed (Navin and Officer 1996; Navin, Officer and Kamminga 1998a). In a more recent experimental analysis, a surface survey was compared to a sub-surface inspection in the southern ACT. This was undertaken along a recently graded fire trail beside a creek. The survey compared the results of a 1 kilometre high visibility trail with a parallel transect 3 metres away. Six sites (all artefact scatters) were located along the trail, whereas only one was found on the parallel transect (Paton 2004). This again demonstrates the disparity between surface and sub-surface results, especially in terms of the most common site type.

Other sites recorded for the much wider area include scarred and carved trees, bora rings and ceremonial grounds, stone arrangements, and burials. Such sites tend to be comparatively rare and are often well known, and are generally unlikely to be detected via test excavations or in small surface surveys. Here other methods of investigation can be useful. Two detailed historic/surface archaeological studies of the area around Goulburn (Lance and Koettig 1986; Fuller 1989) show that such sites, while not common, certainly existed as part of the former range of places which were part of Aboriginal life. Unfortunately, as development of land occurred many of these sites were destroyed. In some instances, as is the case for the bora ground at Kenmore Hospital Goulburn, only historic accounts of these rarer sites remain.

By far the most frequently occurring site type in the region surrounding the Study Area is the open artefact scatter. Most of these are small sites containing less than 50 artefacts (often less than 10), with medium sized sites of up to 300 artefacts occurring intermittently. Very occasionally large sites with several hundred artefacts occur. The artefacts at these sites are usually manufactured from quartz, silcrete and fine-grained siliceous and volcanic rock. The artefacts types located during these surveys included flakes, flaked pieces, amorphous flakes, backed blades and hammer-stones, hatchet heads, and ground pieces of sandstone. Several sites had bipolar artefacts. Bipolar technology is thought to have been employed more extensively in the past 1500 years, and the presence of these 'types' may be useful for dating sites (see below).

The majority of these sites have been open campsites, surface scatters of artefacts with little or no sub-surface material and stratigraphy. The largest sites with stratigraphy have been found associated with sandy deposits along larger water courses or on the shores of Lakes (Baker, Feary and Hughes 1984 (Lake

Bathurst); Hughes, Barz and Hiscock 1984 (Lake George); Baker and Feary 1984 (Lake George); Ferguson 1988 (Braidwood); Paton 1990 (Goulburn); Keottig 1983 (Goulburn)). Apart from rock shelters, such sites which contain relatively undisturbed stratified deposits are generally the most suitable for dating, not that this precludes open artefact scatters as sources of dateable materials (Boot 2002).

The relative position of artefact types within the sediments of these stratified sites is thought to be important for documenting cultural change over time. Bipolar and microlith manufacture employ different technologies, which until recently were thought to be temporally separated. It was thought that in a typical 'south east Australian cultural sequence' microliths would be apparent from about 5000 years ago, but would eventually be replaced (or dominated) about 1500 years ago by a quartz industry based on a particular type of artefact manufacture, the bipolar technique. This technique involves removing flakes from very small cores by resting them on a rock and hitting them with a hard hammerstone. The core is often rotated to find good platforms from which other flakes can be struck. This results in the core having a distinctive pattern of flake removal, as well as crushing on two opposing edges (hence the name bipolar). The supposed replacement of microlith technology by bipolar at around 1500 years is now being questioned after the discovery of recent microlith horizons in several sites including Bulee Brook 2 with backed blades at 1480 + 70 (ANU-9374) and Kangaroo Hill 2 with backed blades at 420 + 60 (ANU-8436) (Boot 2002).

Hughes and Lampert (1977) in fact pointed out much earlier that the division of late Holocene assemblages (i.e. 5000 years old) into two phases might be inappropriate for the southern tablelands mainly on the basis that many of the sites may have been disturbed. They say that many southern tablelands sites are likely to have suffered post-depositional disturbance (trampling and treadage) as they lack resilient layers (i.e. shell) which serve to protect other deposits. Flood (1980) also noted that it was difficult to divide the southern tablelands sequence into two industries. She says microliths and bipolar pieces co-exist, and interprets this as cultural conservation (i.e where people do not give up microlithic production in favour of the new bipolar technology). Packard (1986:10-11) also noted problems with defining two stages of technology. He comments

it can be misleading to discuss 'Bondian versus post-Bondian' assemblages in a Southern Tablelands context, rather it would be better to discuss assemblages in terms of their significant features, i.e. backed blade dominated or bipolar dominated assemblages.

Tantalising historical evidence also hints that the two industry division may be inappropriate for the southern tableland sites. Surveyor Govett (circa 1830) in a series of articles in *The Saturday Magazine* describing his travels in the Goulburn district. In two articles he illustrates spears belonging to a "native of Mulwaree Plains in country Argyle". Both of these spears have a series of small barbs embedded near the tip. He says:

Their spears are generally from ten to twelve feet in length, frequently longer; some consist of one, others of two, and the longest of three distinct pieces, which are chiefly made of the iron bark wood . . . Some spears are hooked and jagged, and since the natives have become acquainted with glass, they have taken advantage of that material, by cementing the broken sharp splints of it, which are made to jut out of the top of the spear like the points of lancets, as a substitute for their common way of jagging. (Govett 1836:252 (No. 252).

Govett's observations, while certainly not conclusive, at least hints that the microlithic technological method may have been used until historic times, lending further support to the suggestion that there is no real division between an early microlith industry and a later bipolar technology.

The only sites where the division between the two technologies is in any way apparently clear are Butmaroo and Site G17 at Goulburn. Butmaroo is apparently a well dated site (6000 BP - 500BP), although the dates are not at the moment publicly available. What we know comes primarily from Packard (1986: 19-20). Based on personal communication with the excavator Rhys Jones, he says:

The upper portion of the deposit (light grey sand) contained a quartz- dominant assemblage with few bipolar artefacts and no backed blades. Radiocarbon dates for this layer were in the range of 500-1,000Y BP. The deposit under this layer (pink-yellow sands) displayed a poorly developed soil horizon which contained an assemblage of silcrete and quartz artefacts with backed blades made on both raw materials. Radiocarbon dates for this part of the deposit were in the range of 3,000 – 4,000Y BP. Below this layer a few quartz artefacts were found; a single quartz artefacts was found in a buried lag of weathered pebbles and cobbles. A radiocarbon date on charcoal from the sands above the lag (70cm below the surface) gave a date of approximately 6,000Y BP.

Similar dates are not available for Site G17 as no suitable carbon was located in the deposits. Nevertheless the same approximate pattern of artefacts was found in the deposits, as at Butmaroo. Yet at other southern tableland excavations, and at more recent sites described above (Bulee Brook 2 and Kangaroo Hill 2 – Boot 2002) this pattern is not clearly evident. These sites usually contain microliths or bipolar pieces, or neither (see for example Hughes and Koettig 1983 (Dalton); Baker, Feary and Hughes 1984 (Lake Bathurst); Hughes, Barz and Hiscock 1984 (Lake George); Baker and Feary 1984 (Lake George); Lance 1985 (Bungendore); Attenbrow 1984 (Braidwood); Packard and Hughes 1983 (Yass River); Ferguson 1988 (Braidwood)). As discussed previously, it may be the case that at Butmaroo and G17 the sequence may be a product of various pedogenic processes rather than cultural factors, given that the relatively young artefacts appear to be contained in very old sediments.

The weight of evidence must bring into question the appropriateness of maintaining a clear- cut distinction between microlith and bipolar industries. Butmaroo, G17 and sites like them may be the exception rather than the rule. Particularly since at both sites it is easy to demonstrate that the cultural material has worked its way into the sediments, rather than having been laid down as part of the stratigraphic processes.

The exact age of the beginnings of occupation in this area is far from resolved. Excavations have clearly demonstrated Aboriginal occupation in the southern highlands during the Holocene. Given the marginal environment, this had important implications for debates in the 1970's and 1980's about Pleistocene colonisation patterns and Holocene intensification. Detailed archaeological research on this question commenced in 1970, with Flood's study. Her thesis, published in 1973, led her to conclude that his region was unoccupied prior to the introduction of the Small Tool Tradition, approximately 5000 years BP. In the following ten years, eleven rock shelters and one open camp site were excavated in the region. None of these sites were found to be older than 4000 years. The oldest sites in the region being Sassafras 1 (located at the top of the coastal Budawang range), with a basal date of 3770 + 150 BP (Flood 1980) and Nursery Swamp 2 in the ACT, dated to 3700 + 110 BP. More recently these dates have been significantly expanded by Boot (2002; 1996a; 1996b) who excavated sites within 5 km of Sassafras to 10,850 + 300 BP (ANU-8313) at Bob's Cave and 18,810 + 160 BP (ANU 9375) at Brulee Brook 2. Another site, an open site, in the southern Highlands at Wombeyan Caves (Navin Officer 2003) has also been dated to the Pleistocene: 9,998 + 75 BP (Wk 11562) and 12,178 + 66 BP (Wk 11562).

Flood's excavation of the Birrigai rock shelter, situated in the northern fringes of the Southern Highlands, provided the first substantive evidence for Pleistocene occupation of the region, and remains the oldest known site. Three relatively distinct phases of occupation of the shelter were noted:

1. Occupation commences at around 21000 BP with a low intensity of occupation continuing through to 3000 BP;

2. At around 3000 BP occupation intensity increases dramatically, and continues to increase through till approximately 100 BP

3. In the period from 100 BP through to present, there is evidence of a continuation in the Aboriginal occupation of the rock shelter, coinciding with the onset of non- Indigenous activity in the area (Flood *et al* 1987)

Recent technological advances, in the form of high-precision calibration, has resulted in the refinement of these mid to late Holocene radiocarbon dates. Bullbeck and Boot (1991), provide a list of calibrated dates for sites in the region, which includes the more recent findings of Packard and other workers. A brief review of this list reveals a particularly striking feature. This being the very long interval between the date of earliest occupation of the Birrigai site and the earliest dates of occupation for other sites in the region, which appear to cluster between the third and the fifth millennium, this period coinciding with the onset of intensified occupation noted for the Birrigai site (Flood *et al* 1987). This phenomena has been interpreted as representing the onset of permanent, intense occupation in the Southern Uplands at no earlier than 3000 BP (Flood *et al* 1987). But, as Bullbeck and Boot (1991) point out, this interpretation is based on uncalibrated dates, and does not include the recent findings of other workers in the region. Taking these factors into account, the onset of intensive occupation in the region may have occurred somewhat earlier (i.e. around 4000-5000 BP).

2.3.2 Local Area

2.3.2.1 Results of the AHIMS Database Search

A basic search on AHIMS was undertaken on 13th August 2014, covering the land within the following area with a 1km buffer:

N6158500 to N6161000
E 771000 to E773000

The basic search identified 16 Aboriginal sites within the area defined above. Consequently an extensive search was ordered and returned on the 14th August 2014 under the client service identification number 144518. A copy of this site search is included in Appendix A, while a summary of relevant information is included in Table 1 below. A map showing the locations of each of these sites relative to the current study is included in Figure 5.

Table 1. Summary information for previously recorded sites located within 1km of the Gunlake Quarry Project Site

Site ID	Site Name	Easting	Northing	Site Type	Description
51-6-0074	MAS1	771450	6157600	Open site	Located on a hill slope within 500m of water.
51-6-0075	MIF 1	771900	6157800	Isolated Find	Anomaly in AHIMS – site is located in Michelago area well outside the bounds of the current investigation.
51-6-0077	MAS 5	771450	6157320	Open Site	Located on a ridge crest within 400m of water
51-6-0080	MAS 2	771300	6157320	Open Site	Located on a gentle slope within 400m of water
51-6-0737	HSP17	772905	6157718	Scatter and PAD	Located on a spur crest
51-6-0742	HSP24	772476	6157513	Scatter of 2 artefacts	Located on a locally flat, spur shoulder, with easterly aspect and adjacent to a spring fed stream. Approximately 1.3km north of Jaorimin Creek
51-6-0743	HSP25	773699	6158037	Scatter of +24 artefacts and PAD	Located on a broad, low gradient spur crest on the northern margin of an ephemeral tributary of Jaorimin Creek. Assemblage dominated by silcrete with some quartz.
51-6-0746	HSP28	773309	6157867	Scatter of 4 artefacts	Located on a basal slope with southerly aspect, adjacent to a tributary of Jaorimin Creek.
51-6-0709	HSP17(23-24)	772837	6157693	Scatter of Artefacts (unknown quantity)	Relocation Point following salvage and subsurface testing.
51-6-0386	LA 31	770149	6157993	Scatter of 6 artefacts and PAD	Site located on low gradient, north-facing slope above a tributary of Lockyersleigh Creek. Assemblages comprises flakes and a flaked piece manufactured from quartz,

Site ID	Site Name	Easting	Northing	Site Type	Description
					quartzite and chert.
51-6-0387	LA 32	770355	6157884	Isolated Find	Located on low gradient basal slope adjacent to a drainage line. Flake manufactured from quartz.
51-6-0388	LA 33	771087	6157544	Isolated Find	Located on low gradient basal slope on watershed exposed surface.
51-6-0747	GL1 - Gunlake Quarry 1	771978	6159494	Scatter of 6 artefacts	Located on flat of a saddle hill with an open aspect. Artefacts manufactured from quartzite, chert and silcrete.
51-6-0748	GL2 - Gunlake Quarry 2	772251	6159535	Scatter of 6 artefacts	Located on a gently westerly slope. Artefacts manufactured from silcrete
51-6-0749	GL3 - Gunlake Quarry 3	772393	6160148	Scatter of 4 artefacts	Located on gently sloping ground with northerly aspect. Artefacts manufactured from silcrete and metamorphic materials
51-6-0750	GL123 (Gunlake Quarry) relocated GL1, GL2 and GL3	772269	6159941	Scatter of 15 artefacts	Relocation point for salvaged artefacts.

From the sites listed in Table 1, one (51-6-0075) is in fact located to the south of Michelago and over 100km from the current study area. From discussions with OEH staff, it is unclear why the site was included in the AHIMS extensive site search. It is not related to the current investigation.

Two other sites (61-5-0709 and 51-6-0750) are relocation points for artefacts previously salvaged. Neither is located within the current study area.

The remaining 13 sites therefore comprise 8 open artefact scatters, 3 scatters with associated PADs and 2 isolated finds. These sites were all identified in a series of cultural heritage assessments undertaken in areas immediately bordering Gunlake Quarry Project Site as well as a previous investigation within the Project Site itself. These investigations are discussed below, with the study area for each illustrated in Figure 6.

2.3.3 Cultural Heritage Assessments in the Immediate Area of Gunlake Quarry

In 1995, AASC undertook a cultural heritage assessment of a portion of land located immediately to the south of the Gunlake Quarry Project Site. During this investigation, sites MAS1, 2 and 5 (listed in the AHIMS Extensive Site Search detailed in Table 1) were identified, along with two other open camp sites (MAS 3 and MAS 4). Unfortunately, a copy of this report is no longer available from the Office of Environment and Heritage, and the boundaries of the study area are unknown. However a summary of the results of the study were included in a more recent report by Umwelt (2005). All available information for these sites is included in Table 1.

Two large studies were undertaken to the west and south of the Gunlake Quarry Project Site in 2005; one for a subdivision (Saunders 2005) and another for a the hard rock Lynwood Quarry site (Umwelt 2005).

2.3.3.1 Lockyersleigh Subdivision - Saunders 2005

In 2005 Saunders surveyed six sample areas within a very large rural area proposed for subdivision. The study area incorporated areas around Narambulla Creek and Osborne's and Lockyersleigh Creeks (both tributaries of Wollindilly River to the north) and resulted in the identification 33 Aboriginal sites. Sites comprised 23 stone artefact scatters and 10 isolated finds.

In the southern and western portions of the study area Saunders notes the presence of siltstone, quartzite and quartz, which may have provided a source of raw materials as far east as the Gunlake Quarry area.

Saunders (2005) utilised a predictive model established by Lance and Koettig (1986) and later refined by Fuller (1989), based on models of site location for the Goulburn region. The model divides the landscape into zones based on landforms. Table 2 summarises this model.

Table 2. Predictive Model of Aboriginal Site Location for the Goulburn region by Fuller (1989), table from Saunders (2005).

Zone	Landform	Topography	Potential Sensitivity	Potential Significance
1	Major Watercourse		High	High
2a	Undulating Hills and Plains	Lower slopes near water courses	High	Moderate
2b		Gently undulating lands or plains	Low	Low
2c		Low hills (<700m asl)	Moderate	Low
2d		Moderate hills (700-750m asl)	Low	Low
2e		High hills(>750m asl)	Low	High
3	Hill Tops		Low	High
4	Built Up Areas		Moderate	Low

Saunders (2005:18) also identifies that the most common sites in the broader region are in fact open artefact scatters adjacent to ephemeral watercourses.

From the 33 sites identified during Saunders' investigation, 13 (39%) were located on basal slopes, nine (27%) were associated with major creek lines, four (12%) associated with ephemeral drainage lines, three (9%) in upper slope contexts, three (9%) on hill crests and one (3%) site was located in a saddle.

A sample of 125 artefacts were measured on site via a system of selective sampling. Artefact types recorded included flakes, flaked pieces, cores, 'chips', blanks, manuports, hammerstones and modified pebbles manufactured from silcrete, quartz, quartzite, chert, chalcedony and tuff.

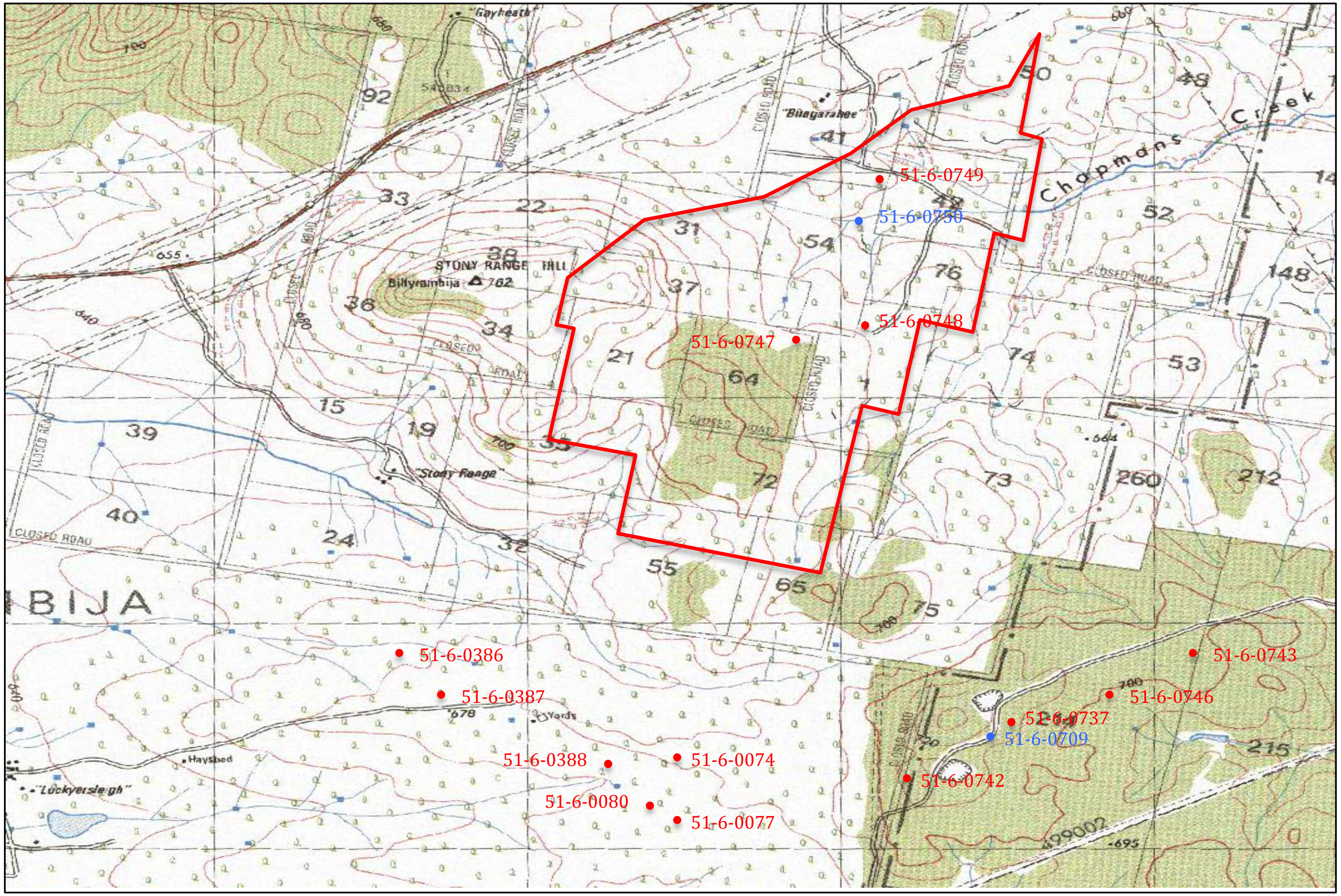

Figure 5. Locations of Previously Recorded Sites on AHIMS within 1km of the current Study Area (blue dots = relocation points)

Saunders observed a strong pattern of site location, in which 'Creek margins (taken as a 10m wide strip either side of the creek bank) represented only 1.9% of the total area surveyed but contained 27% of the recorded sites' (2005:35). Some 82% of sites occurred within 150m of a creek or drainage line, with artefact densities also observed to be highest at sites along creek lines. Artefact densities were observed to decrease at upper elevations. Over 73% of assemblages contained fewer than six stone artefacts, however all but three of the sites identified were assessed as having at least some potential to be more extensive and contain higher artefact numbers.

2.3.3.2 Lynwood Quarry Site - Umwelt 2005

In 2005, Umwelt undertook a cultural heritage assessment for the Proposed Lynwood Quarry site, located immediately to the south of the Gunlake Quarry Project Site. A total of 350ha was surveyed via 5 transects, resulting in the identification of 52 previously unrecorded Aboriginal sites. These 52 sites comprised of 29 artefact scatters, 12 isolated finds, seven scarred trees and two stone arrangements.

Drawing on available environmental activity, coupled with known patterns of site location for the broad area, Umwelt 2005 established a predictive model, summarised below:

- there will not be grinding grooves, rock overhangs, rock overhangs with art or carved trees;
- Scarred trees and burials are unlikely;
- erosion in the area meant in situ deposits are unlikely;
- seasonal occupation is anticipated, short stays but small group of people resulting in sites containing <10 artefacts; Larger sites may be related to ceremonial gatherings or targeted resource exploitation;
- sites will utilise small amounts of locally available materials such as quartz and porphyry but the majority of materials will have been imported from elsewhere;
- scatters and isolated finds are the most likely site types, also located on slopes and spurs.
- most sites will be located close to creek channels;
- all sites are likely to have suffered a loss of integrity due to environmental conditions in the area, post-depositional processes and erosion;
- locally outcropping quartz and porphyry are anticipated to have been used for tool manufacture, however the majority of raw materials are likely to have been imported;
- bipolar reduction of quartz, chert and silcrete is anticipated to be common;
- ceremonial sites (stone arrangements/Bora grounds) may be in the area, but are likely to have been adversely affected by natural geomorphic processes and/or European land-use practices (ERM 2005:4.3).

Umwelt's survey results largely confirmed this predictive model, with the exception of finding higher than anticipated numbers of scarred trees in areas of selectively retained mature trees. Approximately 80.5% (N=33) of sites had less than 10 artefacts within them, four sites contained between 10 and 20 artefacts, 3 sites between 21 and 50 artefacts and one site had in excess of 50 artefacts. The largest site was argued to be associated with resource targeting.

Assemblages comprised flakes, flaked pieces and cores manufactured from quartz (mainly pebble quartz with minor reef quartz), silcrete, quartzite, chert, porphyry, granite and volcanic (pebbles). The majority of materials were thus transported to the area also conforming to the predictive model.

More than 50% of identified sites were located within 30m of a watercourse, and located along the banks of minor tributary channels (24%) and along the banks of the main tributary channels (28%). Away from watercourses, 8% of sites occurred on lower slopes, 6% on midslopes and 4% on upper slopes. Crests and saddles contained 30% of all sites.

The archaeological integrity of identified sites also conformed with the predictive model, with deep deposits of sand present from the build-up of colluvium at the lower slope/footslope boundary, or from the *in situ* weathering of porphyry. However in all cases, site integrity had been compromised by various weathering and land use processes. None of the sites were assessed as being likely to have archaeological integrity.

Three subsequent phases of subsurface testing were undertaken in 2008, 2009 and 2011 (by Umwelt). Topographical units included ridge crests, spur crests, moderate and gentle slopes and saddles. Geological units included Bindook Porphyry, Porphyritic Adamellite, Siliceous Dyke, Marulan Granite and Andesite. Several areas included riparian corridor.

Stage 1 subsurface investigations were focused around the substation and emplacement of power poles. Testing at 20 pole locations resulted in 10 with artefacts and 10 without any cultural material. Four locations contained 5 artefacts or less, three contained between 5 and 8 artefacts, one had 15, one had 129 and one had 135. All localities with artefacts occurred on land with gradients of <3°, with the largest numbers of artefacts recovered from pole locations with gradients of <1°. Two pole locations produced particularly high numbers of artefacts: both occurred within topographically unique contexts (for the area). Both were associated with deep alluvial/colluvial soil deposits associated with tributaries of Joarimin Creek. Artefacts at P13 were thought likely to have derived both from use of the area and from the redeposition of artefacts in alluvial deposits from flood events and also within colluvial deposits from the adjacent gentle slope (Umwelt 2008:4.9). Artefacts at P17 were located on the highest crest of the spur subject to investigation, in an area of extensive rock outcropping. This is site was identified as not being in situ but definitely being associated with the spur crest.

In addition to the pole locations, 22 test-pits were excavated at each of five Archaeological Terrain Unit locations. A total of 52 artefacts were recovered from the 110 pits. All had poor integrity.

Stage 2B investigations were undertaken in 2009 and 2011 at a number of Archaeological Terrain Units. Again 22 test-pits were excavated at each area, resulting in the recovery of 22 artefacts at one locality, and 7 artefacts at another (Umwelt)2009. Both were classified as being of low significance. Subsequent investigations (2011) resulted in higher artefact densities with 54 artefacts recovered at one ATU located adjacent to an abandoned channel of Joarimin Creek. Monitoring of grader scrapes at other localities across the study area also resulted in the identification of a single quartz flake, with two of the four sites explored found not to be artefact bearing (Umwelt 2011).

2.3.3.3 Navin Officer 2010
In 2010 Navin Officer Heritage Consultants were engaged to undertake a cultural heritage survey for the proposed Highlands Source Project, a scheme designed to secure a water supply to Goulburn by transferring water from the Wingecarribee Water Supply Reservoir to the Goulburn Water Treatment Plant over a length of approximately 83km. Approximately 68km of the proposed route was surveyed over two stages (2010a and 2010b) resulting in the identification of eight (8) isolated finds, 23 artefact scatters (11 with associated PADs) and eight (8) Potential Archaeological Deposits (PADs).

Due to the extremely large area traversed by the pipeline, the predictive model established was necessarily broad in structure. The general model they present in relation to the current study area is summarised below:

- artefact scatters are the most common site type and have the highest potential to occur;
- higher site densities occur in rolling terrain on metasedimentary bedrock and tertiary alluvium;
- small artefact scatters are predicted to occur throughout the topographic region present;
- sites tend to be located away from probably areas of cold air drainage;
- sites are most likely to occur on flattened ridge tops, knolls and flats adjacent to permanent drainage lines and sand bodies, particularly those adjacent to water and within floodplain contexts;
- scarred trees have the potential to occur wherever old growth trees survive.

Twenty five of these sites were recorded within the Goulburn Mulwaree Shire: nine were located on spur crests, one on an alluvial terrace, one of a drainage line, one on a ridge crest, one adjacent to a drainage line and another in a saddle. Six sites were located on basal slopes, two on mid-slopes, one on an upper slope and one on a simple slope. Areas identified as having subsurface potential were found to correspond to well drained, low gradient landforms in close proximity to reliable water sources. A more detailed evaluation of the predictive model is not provided.

Identified PADs were to be subject to subsurface investigations (NOHC 2010a, 2010b). These investigations were carried out in 2012, however unfortunately, the OEH does not hold a copy of this report providing the outcomes of subsurface investigations, total artefact numbers for various sites or the total number of artefacts relocated to site 51-6-0709.

2.3.3.4 AASC 2007

The study most relevant to the present one was that of AASC in 2007, which involved a cultural heritage assessment of portions of the Gunlake Quarry Project Site for the initial Project Application for Gunlake Quarry. AASC were engaged by Gunlake Quarries to undertake a cultural heritage assessment of those areas of impact associated with the proposed quarry (1250m x 500m), the processing and stockpile area (270m x 100m), the overburden emplacement (300m x 450m), the quarry site haul road (2000m x 9m) and the proposed haul route/road which incorporates the existing Red Hill Road connecting to the Hume Highway (4000m x 9m). Figure 7 shows the placement of the proposed areas of impact, however the areas surveyed in 2007 exceed these boundaries.

The existing impact area of the quarry site is 19.9ha, however AASC surveyed 62.5ha in 2007. Similarly, the existing impact area of the overburden emplacement is 1ha, with AASC surveying 13.5ha around this area. Consequently, though not explicitly articulated within the 2007 report, the two proposed modification areas within the Gunlake Quarry were both surveyed during the 2007 heritage investigations (AASC 2007). No evidence of Aboriginal occupation was identified in either area.

AASC observed that artefact scatters, the most common site type, typically occur on locally raised, flat terrain near water. The terrain of the study area is mildly undulating and contains several ephemeral water sources. As such, AASC predicted the occurrence of small artefact scatters within the area. The age of the vegetation in the area precluded their having been used as Aboriginal scar trees, however other site types were identified as being possible in the area, though of low probability due to a general absence of these site types in the region.

While the sandy deposits in the study area may also contain artefacts, given the age of these sediments (i.e. much older than human occupation) they are unlikely to be in situ, instead having worked their way into the deposits via natural pedogenic processes.

AASC divided the landscape into three zones, based landform terrain (Figure 8):

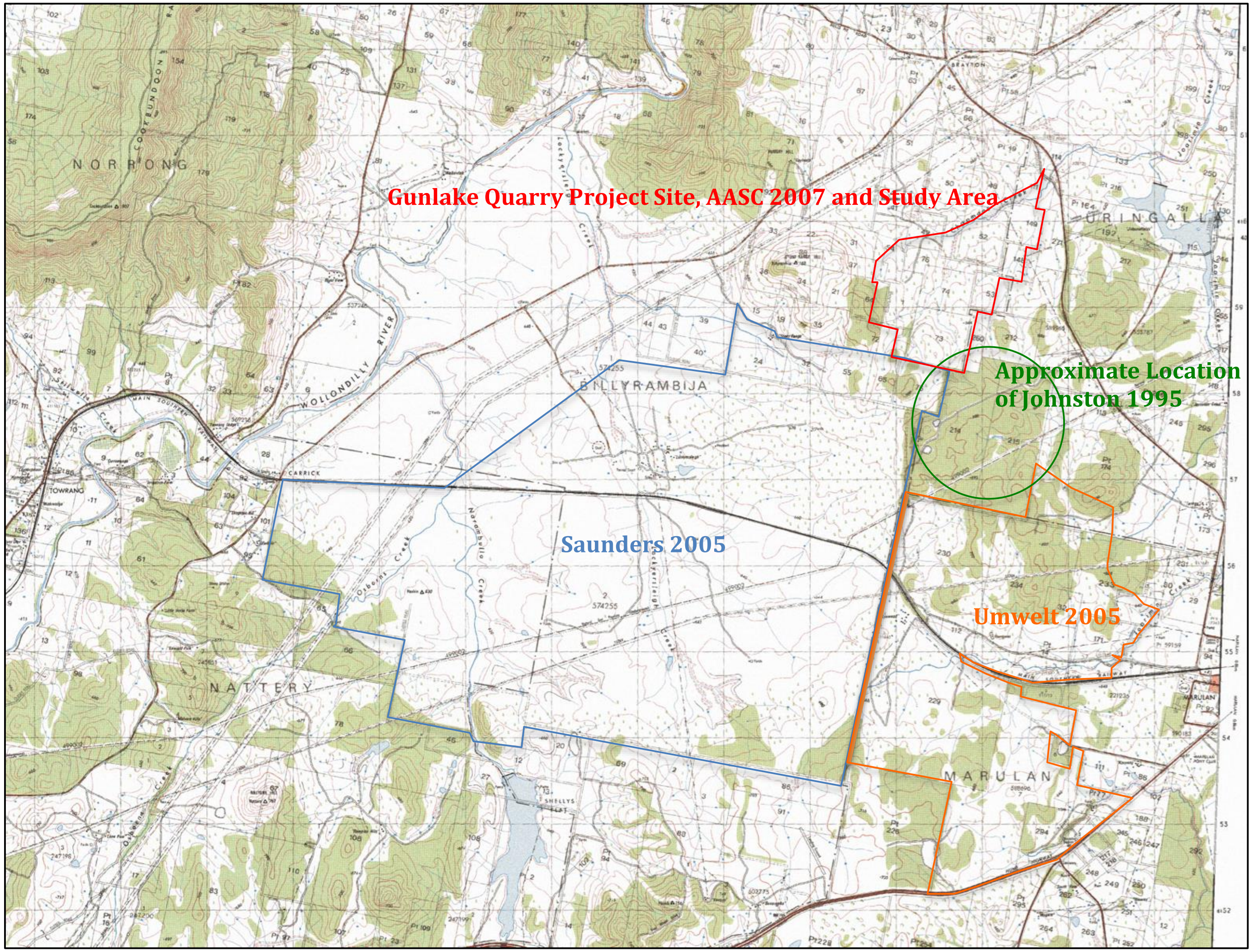

Figure 6. Location of previous archaeological studies within the local region of the Study Area

Zone 1 – comprising gently undulating slopes near permanent or semi-permanent water sources (up to 75% of the study area). This zone is predicted to contain larger artefact scatters than Zone 2, although still small on a regional scale. Sites are predicted to be found close to the watercourses on elevated, flat terrain – typical of most site localities in the region. Moderate potential for subsurface deposits is identified within these areas. This zone is assessed as having Medium to High archaeological potential.

Zone 2 – comprising hill crests/ridge lines above semi permanent/permanent water sources (covers approx. 15% of the study area). This zone is predicted to contain sub-surface deposits similar to those at Butmaroo and Site G17 in Goulburn. Deposits are likely to be highly disturbed and laid down within the sediments naturally rather than culturally. This zone is assessed as having Low to Medium archaeological potential.

Zone 3 – comprising hilly terrain (covers approx. 10% of the study area). This zone is predicted to contain small artefact scatters in localised areas and a thin veneer of isolated finds. Large sites and/or sub-surface deposits are unlikely to be encountered in the thin soils. This zone is assessed as having Low to Medium archaeological potential.

During the course of the field survey five (5) Aboriginal archaeological sites were identified, consisting of one (1) isolated artefact and four (4) small open scatters containing less than 10 artefacts each. Summary details for each of these sites is provided in Table 3. Sites GL4 and GL5 occur well to the south of the current study area.

Table 3. Previously recorded sites within the Study Area (now salvaged)

Site Name	Site Type	Grid Reference (WGS84)	Site Details
GL1	Artefact Scatter	E771978 N6159494	6 artefacts on erosion scald on saddle
GL2	Artefact Scatter	E772251 N6159535	6 artefacts on gently sloping dirt track
GL3	Artefact Scatter	E772393 N6160148	4 artefacts on erosion scold on gently sloping flat
GL4	Isolated Find	E225442 N6157488	1 artefact on west bank of creek
GL5	Artefact Scatter	E226975 N6157325	2 artefacts on moderate hill slope

These results accorded with AASC's predictive model with three of the five sites identified occurred within the medium to high archaeologically sensitive Zone 1 (sites GL2, GL3 and GL4) amongst the undulating gentle terrain close to semi permanent/permanent water sources. AASC hypothesized also that the density of these sites would have been greater in areas directly adjacent to creek lines, prior to European settlement and associated environmental alteration (AASC 2007).

The remaining two sites – GL1 and GL5 were recorded within Zone 2, on hill crests above permanent/semi permanent water sources and Zone 3, hilly terrain, respectively. Both these terrain units were assessed as being of low to medium archaeological sensitivity, and occur in excess of 1km to the south of the current study area.

AASC recorded vegetation coverage as an impediment to visibility across the area, with stock grazing and land clearance forming some of the only areas of visibility. Whilst providing visibility however, these processes of erosion also meant that artefacts once located on the surface of the soil may now be contained within subsurface deposits or have been redeposited to other surface locations.

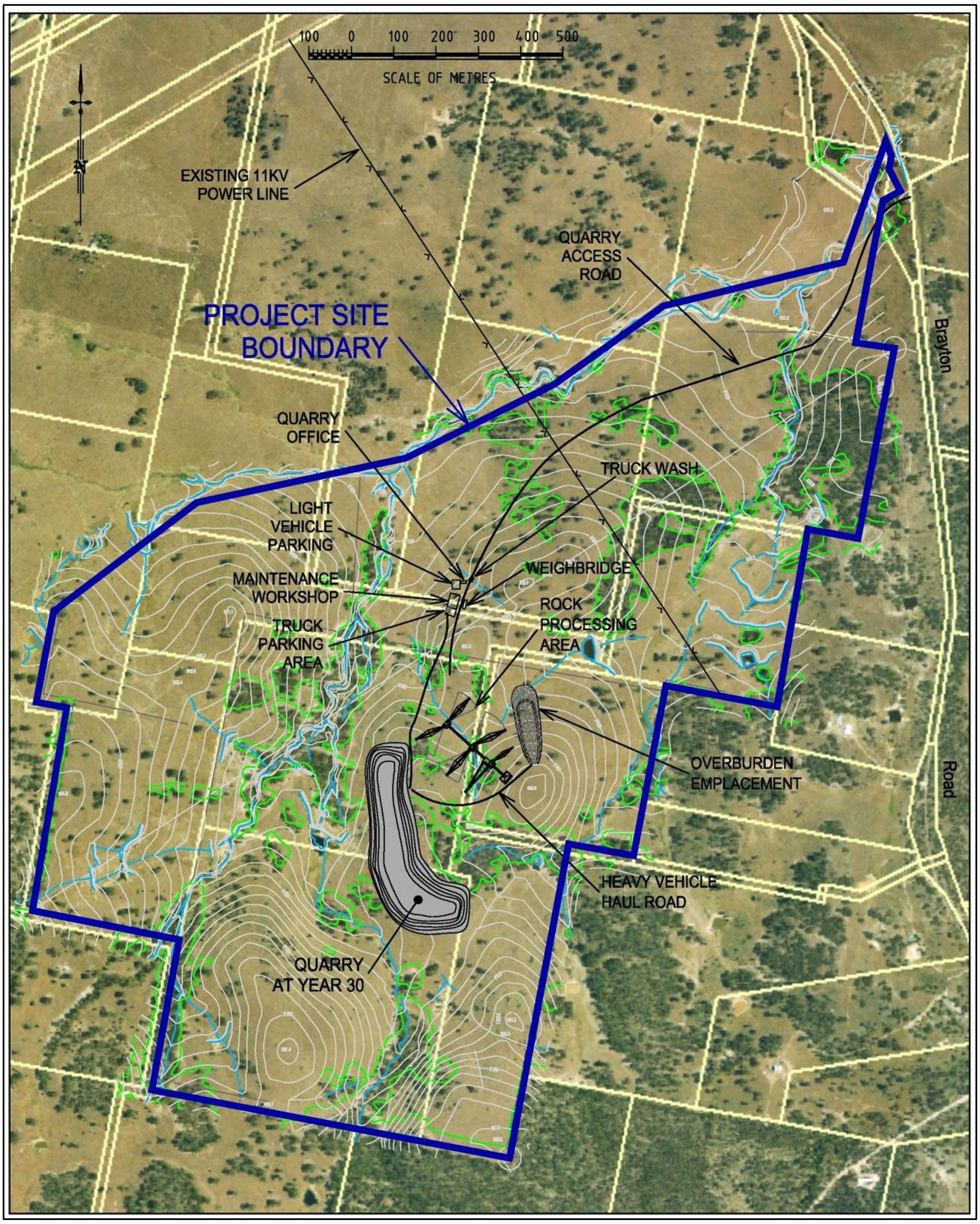

Figure 7. Impact area i.e. 'Study Area' previously surveyed by AASC (2007). Image from OEC 2008 Figure 2.1 pp2-5)

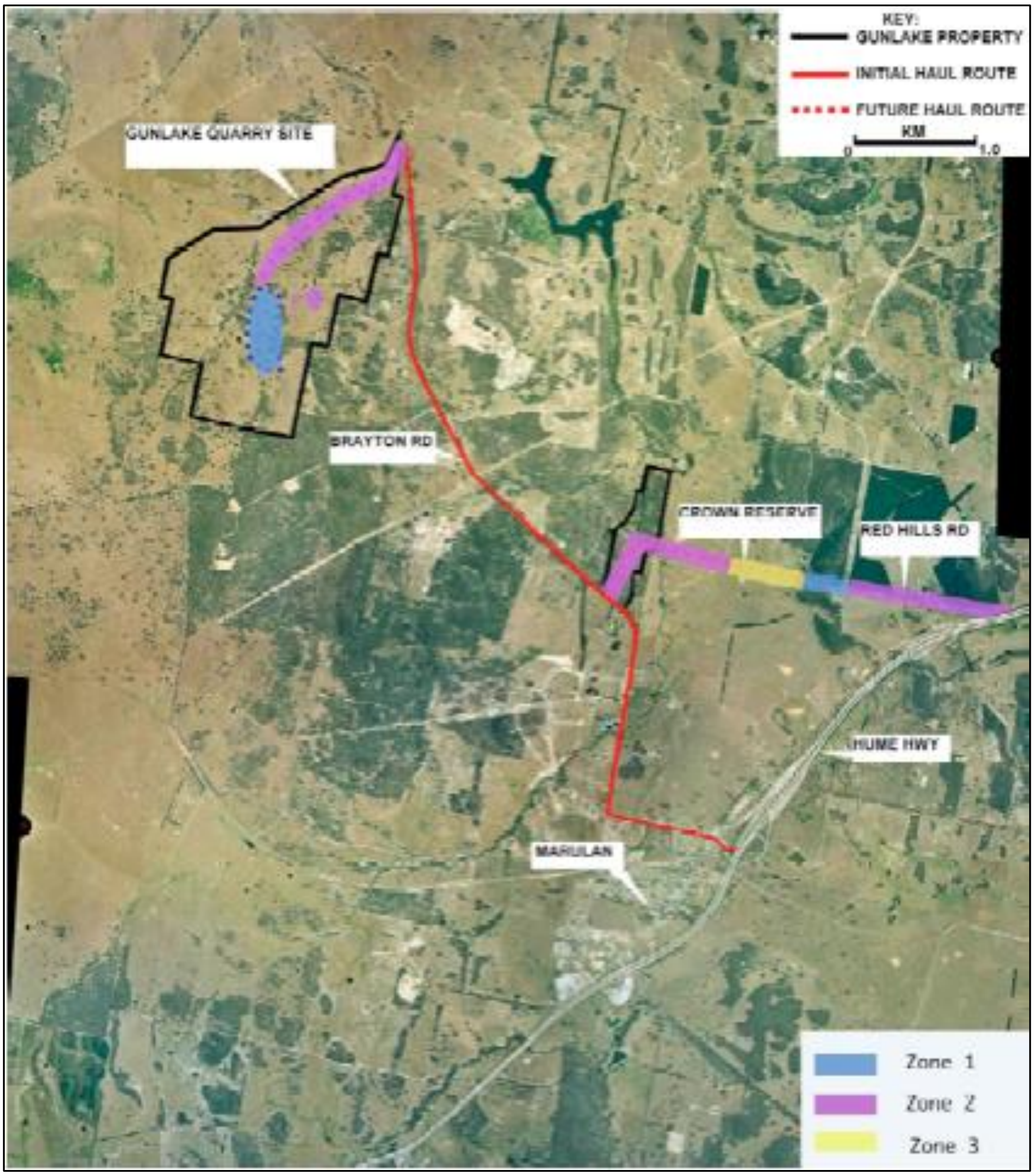

Figure 8. Terrain Units identified by AASC 2007 (image taken from AASC 2007:20).

3.0 Environmental Context

The nature and distribution of Aboriginal archaeological sites across Eastern Australia are known to be strongly influenced by landscape and environmental factors. The bedrock geology of a region, its landforms, soils, vegetation and climate, all combine to influence the distribution and availability of resources considered to be of importance to prehistoric Aboriginal groups (these include plant and animal resources, water, raw materials for artefact manufacture, ochre and suitable campsites). These factors also directly affect the movement of people throughout the landscape. As such, in order to properly understand, or indeed predict patterns of Aboriginal activity within a region, an understanding of the environmental setting of the area is essential.

3.1 Topographical Setting

Gunlake Quarry Project Site is located approximately eight kilometres northwest of Marulan and straddles the headwaters Chapman Creek, an ephemeral tributary of Joarimin Creek. The vast majority of the quarry Project Site occurs within gently undulating terrain ranging in elevation between 620-690m AHD. These areas were identified by AASC (2007) as having moderate to high archaeological potential to contain low-density open scatters.

The topography of the proposed modified overburden emplacement area comprises the gentle northern side slopes and southern slopes of two knolls. The angle of these slopes is approximately 6 º and 4 º respectively. A west to easterly flowing drainage line runs between these two knolls, however it is very shallow and lacks sufficient flow or energy to meet any higher order drainage lines.

Further to the south, the proposed modification to the quarry pit extends to the south beyond the existing boundary to incorporate the northern slopes of a moderately inclined knoll (10-12º slope), a small saddle and the crest of a gentle ridge extending from south to north.

3.2 Climate

Minimal rainfall – means only the main channels of creeks would have retained water for any time after rain.

3.3 Hydrology

The study area is located within the upper catchment of Chapman's Creek, which flows to the east to join Joarimin Creek approximately 1km downstream from the site. Joarimin Creek is a fifth order stream with a catchment area of approximately 5440ha, which flows in a northeasterly direction to join the Wollondilly River, located approximately 4km to the north of the site. Ephemeral drainage lines associated with Chapman's Creek traverse the study area.

These ephemeral drainage lines are likely to have been utilised sporadically by Aboriginal people in the past, moving through the area at times when the Creek contained water. This type of activity would result in the small, low density artefact scatters identified by AASC (2007) as being characteristic of the general area). More permanent settlement/occupation is likely to have been reserved for areas adjacent to the permanent water sources of Joarimin (1km east) or Wollondilly (4km north).

3.4 Geological Setting

The project site is positioned to exploit a tuffaceous rhyodacite deposit (Bindook Porphyry) associated with the Bindook Porphyry Complex. The complex comprises a folded and deformed base sequence of Devonian age volcanic rocks, which also incorporates the Barralier Ignimbrite and Joarim Ignimbrite. Within this complex are three main geological zones. Lockhersleigh Adamellite occurs beneath the majority of the quarry site. The ademellite, classified as rock consisting of equal parts of orthoclase and plagioclase, is a form of granite, a common compositional element of aggregate (Mayer 1976:48). To the north of the site and off the east side of Chapman's Creek occurs Bungonia Limestone, containing limestone, shale and ferruginous sandstone. The Bindook Porphyr which occurs in a large section to the east and south of the site and Hume Highway (Australian Geoscience 2007) consists of quartz, feldspar, porphyry, dacide, felstik and tuff (Australian Geoscience 2007) and may also be used in aggregate composition.

Neither granite nor porphyry are preferred raw materials for the manufacture of stone artefacts (though porphyry has been recorded as being used in expedient technologies in the Hunter Valley (Umwelt 2004). However, granite rock types are often associated with quartz veins and pockets, providing a local source of quartz. A discussed in the previous section, quartz has been widely utilised within the broader region. Whilst quartz is widely utilised in the manufacture of stone tools, it is a highly unpredictable material that is often difficult to work (with the exception of high quality crystal quartz). It is therefore generally utilised to supplement the supply of better flaking materials transported to the area.

It is therefore likely that the majority of stone materials utilised in the area have been brought in from elsewhere. With local quartz used to supplement these materials.

3.5 Soils and Erosion

Weathering across the broader area appears quite extensive. The weathering profile is generally comprised of decomposed porphyry with essentially clay properties (overburden) to a mixture of jointed hard and softer brown rock (weathered porphyry) (ERM 2005:2.4). Large scale downslope movement has been caused by repeated cycles of heavy rain followed by long dry spells and/or bushfires. The study area itself is characterized by skeletal soils as a result of this massive downslope movement, with rock outcropping extensively across the area.

Colluvial aggredation has been observed at the base of some lower slopes, while alluvial aggredation and floodplain development are noted to be largely absent (ERM 2005:2.5).

Given these processes, it can be expected that the majority of artefacts located on slopes will have been subject to both vertical and horizontal movement. The lack of floodplain development means that buried alluvial deposits containing Aboriginal sites are unlikely. However, where colluvial deposits have built up at boundary between lower slopes/footslopes the potential remains for there to be some buried in situ sites (subject of course to alternative causes of post-depositional disturbance - see Land Use History below) (ERM 2005:2.5).

3.6 Vegetation

The site itself and surrounding areas have been mainly cleared of native vegetation, with small, scattered pockets of bush and scrub remaining. Remnant woodland occurs mainly within immediate proximity to creek lines or on hilltops. Patches of immature Eucalypt species also occur, but are of a relatively young age. The majority of the site comprises cleared grassland representative of having been cleared for agricultural purposes.

3.7 Land Use History

The current study area has been cleared of its original vegetation for the purpose of stock grazing and other agricultural activities. These activities have a number of potential implications for Aboriginal site location and integrity:

- the removal of scarred/carved trees during land clearing
- the removal of plant species once valued economic resources
- competition for prey species;
- the introduction of non-endemic flora and fauna;
- alterations in the hydrology of the creeks and thus in their morphology and associated endemic flora and fauna;
- exposure and redeposition of artefacts; such that artefacts once located on the surface may now be contained within subsurface deposits or have been re-deposited to other locations;
- damage/destruction to sites such as bora rings, stone arrangements or individual stone artefacts through activities such as cultivation or stock trampling.

4.0 Regional Character

The combined ethno-historic records and results of archaeological investigations for the region indicate that the area was the location of sporadic occupation by Aboriginal in the prehistoric past. The area is characterized by low-to-moderate density open artefact scatters and isolated finds located near creeks, on locally raised, flat terrain.

Generally low levels of rainfall were such that only the main channels of the creeks were likely to have retained water for any time after rain. As a determining factor in settlement, it is therefore likely that the main campsites would be in close proximity to the main creek channels to the north and east. The current study area is likely to have been utilised for transient and sporadic use in the winter when rainfall was highest and the creek-lines would have contained water.

Based on known site patterning for the region, the topography of the study area, comprising mildly undulating landforms and several ephemeral water sources is likely contain small, low density artefact scatters (i.e. less than 10 artefacts).

Locally available quartz and porphyry are likely to have received limited use for the manufacture of stone artefacts, with the majority of materials being transported to the area from elsewhere. Sources of siltstone, quartz and quartzite are reported occur to the west of the study area (Saunders 2005).

4.1 Predictive Modeling

Predictive modeling, in an archaeological context, is a fairly straightforward concept and has been utilised by archaeologists in Australia for a number of years as a tool for undertaking research into Aboriginal heritage sites. In summary, predictive modeling involves the collation of information generated from previous archaeological research in a given region, and using this information to establish patterns of Aboriginal site distributions within the landscape of that particular region. On the basis of perceived patterns of site distribution, archaeologists can then make predictive statements regarding the potential for various Aboriginal site types to occur within certain landscape settings, and can make preliminary assessments regarding the potential archaeological sensitivity of landscape types within a given region.

4.1.1 Predictive Models: Strengths and Weaknesses

It should be acknowledged that most, if not all predictive models have a number of potential inherit weaknesses, which may serve to limit their value. These include, but may not be limited to the following.

1. The accuracy of a predictive model is directly influenced by the quality and quantity of available site data and information for a given region. The more data available and the greater the quality of that data, the more likely it is that an accurate predictive model can be developed.
2. Predictive modeling works very well for certain types, most particularly isolated artefacts and artefact scatters, and to a lesser extent scarred

trees. For other site types it is far more difficult to accurately establish distribution patterns and therefore make predictive modeling statements. Unfortunately, these site types are generally the rarer site types (in terms of frequency of occurrence) and are therefore generally the most significant sites.

3. Predictive modeling (unless it is very sophisticated and detailed) will generally not take into account micro-landscape features within a given area. These micro features may include (but is certainly not limited to) slight elevations in the landscape (such as small terraces) or small soaks or drainage depressions that may have held water. These micro features have been previously demonstrated to occasionally be focal points for Aboriginal activity.
4. Predictive modeling to a large extent is often predicated on the presence of watercourses. However, in some instances the alignment of these watercourses has changed considerably over time. As a consequence the present alignment of a given watercourse may be substantially different to its alignment in the past. The consequence of this for predictive modeling (if these ancient water courses are not taken into account) is that predicted patterns of site distributions may be greatly skewed.

4.1.2 Implications for Aboriginal Site Type, Patterning and Integrity Given Environmental Context

The environmental context identified in Section 3 has the following implications for Aboriginal site types and integrity within the study area:

- clearance of the land for agricultural use means few mature trees remain, lessening the likelihood of Aboriginal scarred/carved trees occurring in the area;
- areas of the site subject to cultivation, stock grazing and the observed downslope movement of soils in the area will have affected both the vertical and horizontal placement of artefactual materials, in these areas, compromising site integrity;
- these same processes indicate that cultural sites such as stone arrangements and Bora rings are unlikely to have survived intact;
- given the climate of the region, the preferred period for Aboriginal occupation would have been late spring, summer and early Autumn (avoiding the coldest months);
- minimal rainfall during these periods, however, means main creek channels are likely to have been preferred locations for the establishment of longer term campsites;
- local outcrops of quartz and other materials are anticipated to have been exploited for artefact manufacture, however the majority of materials are likely to be of a higher quality and to have been transported from elsewhere;
- the absence of rock hangings in the area precludes the possibility of finding rock art sites in the study area;
- the skeletal nature of soils on crest and slope contexts means there is little likelihood of PADs occurring on these landforms;
- sites located close to creek lines are likely to suffer loss of artefacts through scouring and flooding (Umwelt 2005);

- PAD areas are most likely to occur in areas of weathered porphyry or where colluvium has aggraded at the lower/slope/footslope boundary (Umwelt 2005).

4.1.3 Implications for Aboriginal Site Type, Patterning and Integrity Based on Ethnographic and Archaeological Data for the Region

Available ethnographic and archaeological data for the region indicates:

- numbers of Aboriginal people regularly utilizing the area are likely to have been small;
- artefact scatters are the most common site types identified;
- sites have been most commonly located in direct association with watercourses with artefact densities increasing beside more permanent water sources;
- sites are smaller in size and occur in fewer numbers on slopes and ridge crests;
- sites commonly occur on locally flat, elevated landforms in close proximity to water and in areas where the soils are well drained;
- the geology/topography of the area is not conducive to grinding grooves, rock shelters or rock art sites (none of which have been previously identified within the granitic country of the Marulan area);
- scarred trees are likely to be few in number, though they may occur in pockets of mature/uncleared vegetation;
- assemblages are dominated by broken and complete flakes, flaked pieces and cores. Formal types such as backed artefacts and edge ground axes have been recorded in the broad region but not in association with very small assemblages;
- the most commonly utilised raw materials for artefact manufacture are quartz, silcrete and chert with small amounts of quartzite, chalcedony, volcanic and siltstone;
- the nature of the available quartz lends itself to bipolar reduction.

4.1.4 A Predictive Model of Site Type Distributions for the Study Area

The results of previous investigations within the broad region and within the immediate vicinity of the study area, as well as the predictive models presented and supported by Umwelt (2005), Saunders (2005), Navin Officer 2010a, b, c) AASC's (2007) work within the study area itself, indicates that Aboriginal site patterning and occupation intensity is fundamentally guided by topography, water and resource availability, with continual site visitation (and thus the development of larger sites) dependent upon each of these three factors being met.

Combining these results with the environmental factors previously identified, it is possible to establish a clear predictive model for the current investigation.

The most common site type anticipated is low density, open artefact scatters. Scatters are anticipated to occur in close proximity to a watercourse, on relatively level, well-drained ground with some degree of shelter from prevailing winds. Site and artefact densities will be comparatively lower away from water courses. Within the current study area, locally flat areas adjacent to Chapman's Creek present the highest potential for sites.

Given the topography of the area and the seasonal availability of water from Chapman's Creek, the current study area is predicted to demonstrate evidence of sporadic use by prehistoric Aboriginal people, in the form of infrequent, low density open artefact scatters comprising less than 10 artefacts. Large campsites are anticipated to occur further to the north and east within a closer proximity of the permanent water sources of the Joarimin Creek and Wollondilly River.

The local availability of quartz in the area makes it a likely source of raw material for the manufacture of tools, however the generally poor flaking properties of quartz and the difficulties associated with predicting the flaking path during manufacture, indicates that the majority of raw materials are likely to have been imported from elsewhere.

Previous studies have demonstrated that the most common raw materials in the area are those of silcrete, quartzite, chert, metamorphic and some quartz. The most common artefact types recorded for the area include unretouched and retouched flakes, cores and the occasional volcanic manuport.

The environmental data for the area indicates that site types such as grinding grooves, rock overhangs and rock art will not be present in the current study area. Burials are also unlikely, as are scarred trees, except in odd patches of remnant growth.

The high levels of erosion noted in the area indicate that open scatters or PADs retaining in situ deposits are highly unlikely. Due to the extensive downslope movement of soils from crests and slopes, as well as scouring of footslopes adjacent to creeks during flooding, means most sites will have suffered a loss of integrity.

4.2 Statement of Archaeological Potential

The entirety of the current study area occupies landforms that are well suited to settlement, are adjacent to an ephemeral water source (Chapman's Creek) and within easy travelling distance to more permanent water sources. Its archaeological potential is therefore assessed as being moderate-high, however, the potential archaeological significance of identified sites is likely to be low, consisting of small artefact scatters, artefact types and raw materials that are well represented in the archaeological record of the region.

5.0 Results

5.1 Archaeological Survey

5.1.1 Survey Coverage and Effective Survey Coverage

The archaeological survey was conducted on foot. The discrete nature of the two study areas allowed for a comprehensive survey; no sampling was required. Multiple survey transects were walked across both areas resulting in 90-100% survey coverage. Summary details for each survey area are provided in Table 4. Figure 4 illustrates the survey track log. Effective survey coverage has been conservatively calculated in Table 4 based on a survey coverage of 90%.

Visibility was generally quite poor in both study areas (between 5-10%), with thick vegetation present across the area comprising exotic grass species and weeds such as thistles (see Plate 1). Areas of increased visibility were provided by a number of forms of disturbance and erosion, including wombat and animal burrows, erosion scalds at the base of trees, machine disturbance affecting up to 30cm of deposit in some cases, vehicle and animal tracks and large areas of sheet erosion. Images of these are provided in Plates 2 to 11.

Plate 1. Grassed ground cover

Plate 2. Visibility provided by vehicle tracks

Plate 3. Looking to west to existing overburden emplacement from easternmost point of modified area

Plate 4. Disturbance associated with dam construction

Table 4. Effective Survey Coverage by Survey Unit.

Survey Unit	Area	Survey Coverage	Vegetation and Land Surface	% Visibility	Types of Visibility	Effective Survey Coverage
Overburden Emplacement	35 000m²	90% (31500m²)	Thick ground cover comprising introduced species and thistles. Large and extensive areas of porphyry and granite outcropping. Skeletal soils.	10%	Rabbit and wombat burrows, vehicle and animal tracks, erosion scalds, construction of dam, machinery disturbance.	10% x 90%= 0.1 x 31 500m² = 3 150m² or 9%
Quarry Pit	58 000m²	90% (52200m²)	Thick ground cover comprising introduced species and thistles. Large and extensive areas of porphyry and granite outcropping. Skeletal soils.	5%	Erosion scalds, vehicle and animal tracks, machinery disturbance.	5% x 90% = 0.05 x 52 200m² = 2 610m² or 4.5%
Entire Study Area	93 000m²	90%	Thick ground cover, exotic species, skeletal soils and extensive outcropping of bedrock.	7.5%	Rabbit and wombat burrows, vehicle and animal tracks, erosion scalds, construction of dam, machinery disturbance.	3 150m² + 2 610m² = 5760m ² or 6.2%


Plate 5. Visibility provided by sheet erosion


Plate 6. Visibility around stone outcrops


Plate 7. Visibility provided by rabbit burrows

Areas of high visibility were greater within the proposed overburden emplacement modification area than within the quarry pit modification area; approximately 10% visibility in the overburden emplacement modification area and 5% in the quarry pit modification area. With visibility in the quarry pit area largely obscured by extensive outcropping of bedrock material (see Plates 12 to 13).

Plate 8. Visibility provided by anthill

Plate 9. Machine disturbance within quarry pit modification area

Plates 10 and 11. Machine disturbance across northernmost portion of modified overburden emplacement area.

Plates 12 and 13. Showing surface outcrops of porphyry and granite

5.2 Survey Results

Despite an extensive and thorough investigation of the two modification areas, no Aboriginal sites were identified and no areas likely to contain potential archaeological deposits were identified. Close inspection of subsurface deposits exposed through mechanical disturbance, animal burrows and earthworks failed to provide any indication of Aboriginal occupation of the area.

These results are in keeping with those of AASC 2007, who's original survey also failed to identify any sites in this area, but slightly contradict the predictive model, which suggests the area has moderate-high archaeological potential and differs dramatically from the findings of Lynwood Quarry to the south. There are several reasons for these differences.

The first is the lack of soil across the area. The entire study area is covered with rocky outcrops with little to no areas with any significant soil depth. The area would have been far too rocky to camp in, making it an unattractive spot for anything but the briefest of visits (see Plates 17 to 21). This is a major point of difference with the Lynwood Quarry to the south, which is located within the same geological zone. At Lynwood, soil depths of between 20-110cm and including 'deep sands' (Umwelt 2009) were recorded, while soil probes immediately adjacent to Gunlake, along Brayton Road, indicate maximum depths of up to 40cm for C horizon soils, with A horizon soils confined to the upper 15-30cm of deposit and intermixed with porphyry bedrock. Further to the east of the study area, towards Chapman's Creek, an increased build up of alluvium is recorded, but falls well outside of the current study area.

A second major area of difference between Lynwood and Gunlake is the presence of water sources. The primary water source in the Gunlake area is Chapman's Creek, which flows intermittently and for the majority of its length through the Gunlake property, it is dry. It is only in the last sections of the creek on the Gunlake property that occasional pools appear, which dry rapidly when rain ceases. Chapman's Creek flows into Joaramin Creek approximately 1.4km downstream of the Gunlake property. Joaramin Creek, which traverses the centre of the Lynwood Quarry flows into the Wollondilly river some 4km further down stream from the junction of Chapman's and Joaramin Creeks. Conversely, the Lynwood Quarry site incorporates the headwaters of Joarimin, Lockersleigh and Marulan Creeks, it has a multitude of ephemeral and semi permanent water sources dispersed across the area. The presence of these headwaters in and near the Lynwood Quarry area would have inevitably been accompanied by additional plant and animal resources for Aboriginal exploitation. The water sources, associated subsistence resources and availability of sandy deposits upon which to camp, makes the Lynwood area a considerably more attractive locality for settlement.

Consequently, whilst the landforms in the area and proximity to ephemeral water sources offer some utility (though not for permanent occupation as discussed earlier), the harshness of the ground itself would have been a considerable drawback at the Gunlake property. While it is inevitable that Aboriginal people will have traversed and exploited the local area, the study area itself is unattractive as a locality for occupation. The available geology is ill-suited to artefact manufacture, the terrain is unappealing as a camping locality and permanent water sources are at least 1km from the area. The total lack of soil across the area also precludes the possibility of subsurface finds. Aboriginal people would have moved through the area on their way to more suitable campsites to the north and east adjacent to permanent water sources and where level, well drained and rock free ground is available for settlement. The archaeological potential of this area is therefore confirmed as being low.


Plates 14 and 15. View south to extent of quarry pit modification


Plates 16 and 17. Views west to existing quarry pit and southeast over proposed quarry pit area, respectively.


Plates 18 and 19. Views north and east respectively from southern end of modified quarry pit area.


Plates 20 and 21. Images of extensive outcropping of porphyry bedrock


Plates 22 and 23. Images of extensive outcropping of porphyry bedrock

6.0 Scientific Values and Significance Assessment

While there were no sites retaining cultural heritage values identified within the current study area, the following provides a summary of heritage significance assessment guidelines for future reference.

6.1 Assessment Guidelines

There are several different ways of defining types of significance, and many practitioners have developed their own system of significance assessment. However, as Sullivan and Pearson (1995) point out, there seems to be a general advantage in using a set of criteria, which is already widely accepted. In Australia cultural significance is usually assessed against the Burra Charter guidelines and the Australian Heritage Commission guidelines (ICOMOS 1988, 1999, Lennon and Mathews 1996).

6.2 The Burra Charter

Under the guidelines of the Burra Charter 'cultural significance' refers to the 'aesthetic, historic, scientific, social or spiritual value for past, present or future generations' of a 'place' (ICOMOS 1999:2). The guidelines to the Burra Charter comment:

"Although there are a variety of adjectives used in definitions of cultural significance in Australia, the adjectives 'aesthetic', 'historic', 'scientific' and social' ... can encompass all other values".

The following provides the descriptions given for each of these terms.

<u>6.2.1 Aesthetic Value</u>

Aesthetic value includes aspects of sensory perception for which criteria can and should be stated. Such criteria may include consideration of the form, scale, colour, texture and materials of the fabric; the smells and sounds associated with the place and its use (Marquis-Kyle & Walker 1992).

<u>6.2.2 Historic Value</u>

A place may have historic value because it has influenced, or has been influenced by, an historic figure, event, phase or activity. It may also have historic value as the site of an important event. For any given place the significance will be greater where evidence of the association or event survives in situ, or where the settings are substantially intact, than where it has been changed or evidence does not survive. However, some events or associations may be so important that the place retains significance regardless of subsequent treatment (Marquis-Kyle & Walker 1992).

<u>6.2.3 Scientific Value</u>

The scientific or research value of a place will depend upon the importance of the data involved or its rarity, quality or representativeness and on the degree to which the place may contribute further substantial information.

A site or a resource is said to be scientifically significant when its further study may be expected to help current research questions. That is, scientific significance is defined as research potential (Marquis-Kyle & Walker 1992).

6.2.4 Social Value

The social value of a place is perhaps the most difficult value for heritage professionals to substantiate (Johnston 1994). However, social value is broadly defined as 'the qualities for which a place has become a focus of spiritual, political, natural or other cultural sentimental to a majority or minority group' (ICOMOS 1988:30). In What is Social Value, Johnston (1994) has provided a clear definition of social value:

"Social value is about collective attachment to places that embody meaning important to a community, these places are usually community owned or publicly accessible or in some other way 'appropriated' into people's daily lives. Such meanings are in addition to other values, such as the evidence of valued aspects of history or beauty, and these meanings may not be apparent in the fabric of the place, and may not be apparent to the disinterested observer". (Johnston 1994:10)

Although encompassed within the criterion of social value, the spiritual value of a place is a new addition to the Burra Charter (ICOMOS 1999:1). Spiritual value is predominantly used to assess places of cultural significance to Indigenous Australians.

The degree to which a place is significant can vary. As Johnston (1994:3) has stated when trying to understand significance a 'variety of concepts [are] used from a geographical comparison ('national', 'state', 'local') to terms such as 'early', 'rare', or 'seminal''. Indeed the Burra Charter clearly states that when assessing historic significance, one should note that for:
'any given place the significance will be greater where evidence of the association or event survives in situ, or where the setting are substantially intact, than where it has been changed or evidence does not survive (ICOMOS 1988:29).'

6.3 Significance Criteria Relevant to Aboriginal Sites

Aboriginal heritage sites and places may have educational, tourism and other values to groups in society. However, their two principal values are likely to be in terms of their cultural / social significance to Aboriginal people and their scientific / archaeological significance. These are the two criteria that are commonly used in establishing the significance of Aboriginal sites. The following provides an explanation of these criteria.

1) Aboriginal Cultural / Social Significance

This relates to the value placed upon a site or suite of sites by the local or regional Aboriginal community. Almost all Aboriginal heritage retains contemporary significance to Aboriginal people as it represents an important tangible link to their past and to the landscape. The identification and assessment of those sites that are significant to Aboriginal people is a matter for

Aboriginal people. This assessment can only be made by the appropriate Aboriginal representatives of the relevant communities.

2) Scientific (Archaeological) Significance
Archaeological significance values (or scientific values) generally are assessed on the potential of a site or place to generate knowledge through archaeological research or knowledge. Bowdler (1984) states that the scientific significance should be assessed according to timely and specific research questions (research potential) and site representativeness.

Research potential entails the potential of a site or suite of sites for scientific research and excavation. This is measured in terms of a site's ability to provide information on aspects of Aboriginal culture. In this respect, the contents of a site and their state of preservation are important considerations.

Representativeness takes account of how common a site type is (Bowdler 1984). That is, it allows sites to be evaluated with reference to the known archaeological record within the given region. The primary goal of cultural resource management is to afford the greatest protection to a representative sample of sites throughout a region. The corollary of a representative site is the notion of a rare or unique site. These sites may help to understand the patterning of more common sites in the surrounding area, and are therefore often considered of archaeological significance. The concept of a rarity cannot be easily separated from that of representativeness. If a site is determined to be rare, then it will by definition be included as part of the representative sample of that site type.
The concepts of both research potential and representativeness are ever changing variables. As research interests shift and archaeological methods and techniques change, then the criteria for assessing site significance are also re-evaluated. As a consequence, the sample of site types, which are used to assess site significance, must be large enough to account for the change in these variables.

Acknowledging the fact that Aboriginal people are the only suitable people to assign levels of cultural significance to sites, the following assessment focuses the potential scientific/archaeological significance of the sites identified within the study area. The statements of significance provided in no way imply that scientific values override or should be prioritized over cultural values. The scientific significance values provided here must not lessen the importance of the opinions of the Aboriginal community.

6.4 Scientific (Archaeological) Significance of Aboriginal Sites Identified in the Study Area

In the absence of any cultural heritage materials on site and recognizing the generally low archaeological potential of the broad area itself due to the rocky ground cover, any sites likely to occur within the study area will be very small, ranging from isolated finds to scatters of less than 5 artefacts, located within a highly eroded and disturbed context. These sites, if present at all, are therefore likely to have low/no archaeological significance.

7.0 Impact Assessment

7.1 Proposed Activity

The proposed development involves large open area excavation to depths of several hundred metres below the surface in the area of the proposed quarry pit modification. While the modified embankment emplacement will cover the ground's surface and be rehabilitated, never to be moved again. As such, the project will involve the complete obliteration of the landscape within the proposed quarry pit modification area, and the permanent covering of the landscape beneath the overburden modification area.

Impacts to the area by the proposed development will be therefore direct, complete and irreversible. Any undiscovered sites existing within the study areas will therefore be subject to direct impact by development.

7.2 Type of Harm

The nature of the proposed activity is such that the proposed works would result in the *direct harm* of any Aboriginal sites located within the study area.

However, as discussed in Section 5 the potential for sites with research value or significance is generally very low. This being said, a low-density spread of artefacts comprising a 'background scatter', with an unpredictable patterning, is known to occur throughout Australia and is therefore likely to be present and should be expected. Any artefacts within this general 'background scatter' may be subject to impacts from the development.

No other traditional Aboriginal cultural values or associations have been identified during the previous or the present surveys of the area.

It is therefore concluded that the effect of the development on the potential Aboriginal heritage resources of the area is very low based on the following:

- No sites of traditional or historical Aboriginal value have been identified in the study area, during either previous or the current survey of the area;
- The study area has low archaeological potential, based on existing geology and sedimentation and a lack of permanent water.

8.0 Management and Mitigation Measures

8.1 Avoiding and/or Minimising Harm

Avoidance or the mitigation of harm has not been considered an option in relation to the proposed development activities. In the absence of any known sites of heritage significance it is neither possible nor necessary to implement avoidance or mitigation strategies.

8.2 Conclusions and Recommendations

No heritage areas, objects or places were identified during the process of Aboriginal community consultation undertaken for this project (by AASC 2007) or either of two cultural heritage surveys undertaken on the site (AASC 2007 and the present study).

The entire proposal area is assessed as being of very low archaeological potential and the heritage value of the proposed impact area is assessed to be low.

As such, the following management recommendations are forwarded:

1. There are no identified cultural or archaeological constraints in regard to the proposal.

2. No areas were identified that could be characterized as places with a high probability of possessing subsurface Aboriginal objects of high potential conservation value. As such, archaeological test excavation can not be justified (NSW DECCW 2010a:24).

3. In accordance with the requirements of the NPW Act, any Aboriginal objects identified on the land that are not already recorded on AHIMS, are legally bound under s.89A of the Act to notify OEH as soon as possible of the object's location. As such, if an Aboriginal object is identified within the study area during works, the Office of Environment and Heritage should be notified as soon as possible.

9.0 Statutory Obligations

The following provides a summary of State and Commonwealth legislation relevant to the protection and management of Aboriginal heritage. During the current investigations, no heritage items listed for indigenous values under the *NSW Heritage Act 1977, Aboriginal and Torres Strait Islander Heritage Protection Act 1984, Environment Protection and Biodiversity Conservation Act 1999* or the *Australian Heritage Council Act 2003*, were identified. However, Aboriginal sites/objects summarized in section 6 or this report are protected under the *NSW Parks and Wildlife Act 1974*.

9.1 Commonwealth Legislation

They primary legislation providing protection to heritage in NSW is enacted by the State (see section 8.2), however several Acts administered by the Commonwealth are also relevant. The main Acts comprise the *Environment Protection and Biodiversity Conservation Act 1999, The Australian Heritage Council Act 2003* and the *Aboriginal and Torres Strait Islander Heritage Protection Act 1987*.

Environment Protection and Biodiversity Conservation Act 1999 (Comm)(EPBC Act)

This Act is the primary Commonwealth legislation for the management and protection of areas of national environmental significance. In 2003 the EPBC Act was amended to through the Environment and Heritage Legislation Amendment Act (No1) 2003 to provide protection for cultural heritage sites, in addition to the existing aim of protecting environmental areas and sites of national significance.

The 2003 amendments to the Environment Protection and Biodiversity Conservation Act 1999 have resulted in the inclusion of indigenous and non-Indigenous heritage sites and areas. These heritage items are defined as:

> *'indigenous heritage value of a place means a heritage value of the place that is of significance to indigenous persons in accordance with their practices, observances, customs, traditions, beliefs or history;*

The environmental assessment process within the EPBC Act protects matters of national environmental/heritage significance where actions are proposed on/will take affect on, Commonwealth land or where Commonwealth agencies are proposing to take action. The Act also promotes the ecologically sustainable use of natural resources, biodiversity and the incorporation of community consultation and knowledge.

Any proposal identified as having the potential to significantly impact on a matter of national environmental significance (including cultural heritage) requires the proponent to refer the project to the Department of Sustainability, Environment, Water, Population and Communities. The matter is then made public and referred to state, territory and Commonwealth ministers for

comment, before the Minister decides whether or not the project must be assessed under the EPBC Act. The action may be approved, not approved or approved with conditions, following assessment by the Minister.
Items identified under this legislation are given the same penalty as actions taken against environmentally sensitive sites. Specific to cultural heritage sites are §324A-324ZB.

In addition to the above amendments to the *Environment Protection and Biodiversity Conservation Act 1999* to include provisions for the protection and conservation of heritage, the Act also enables the identification and subsequent listing of items for the Commonwealth and National Heritage Lists (ss. 341D & 324D respectively). The Act establishes the *National Heritage List*, which enables the inclusion of all heritage, natural, Indigenous and non-Indigenous, and the *Commonwealth Heritage List*, which enables listing of sites nationally and internationally that are significant and governed by Australia.

Substantial penalties (and, in some instances, goal sentences) can be imposed on any person who damages items on the National or Commonwealth Heritage Lists (ss. 495 & 497) or provides false or misleading information in relation to certain matters under the Act (ss.488-490). In addition, the wrongdoer may be required to make good any loss or damage suffered due to their actions or omissions (s.500).

Australian Heritage Council Act 2003 (Comm.)

The *Australian Heritage Council Act 2003* established an independent body of experts – the Australian Heritage Council – whose role it is to advise the Minister on all matters relating to heritage and on the listing and protection of heritage places in particular.

Until 19 February 2012 the Australian Heritage Council facilitated the management of the Register of the National Estate (RNE), which comprised a list of more than 13,000 heritage places throughout Australia (compiled since 1976 by the former Australian Heritage Commission). The RNE is no longer a statutory list and currently acts as an archive of information with relevant heritage places now listed on state or commonwealth registers. References to the RNE no longer occur within the EPBC Act or the *Australian Heritage Council Act 2003.*

The Aboriginal and Torres Strait Islander Heritage Protection Act 1987.

The Aboriginal and Torres Strait Islander Heritage Protection Act 1987 provides protection for Aboriginal heritage, in circumstances where it could be demonstrated that such protection was not available at a state level. In certain instances the Act overrides relevant state and territory provisions.

The major stated purpose of the Act is to preserve and protect from injury and desecration, areas and objects of significance to Aborigines and Islanders. The Act enables immediate and direct action for protection of threatened areas and objects by a declaration from the Commonwealth minister or authorised officers. The Act must be invoked by, or on behalf of an Aboriginal or Torres

Strait Islander or organisation.

Any Aboriginal or Torres Strait Islander person or organization may apply to the Commonwealth Minister for a temporary or permanent 'Stop Order' for protection of threatened areas or objects of significant indigenous cultural heritage.

The Commonwealth Act 'overrides' State legislation if the Commonwealth Minister is of the opinion that the State legislation (or undertaken process) is insufficient to protect the threatened areas or objects. Thus, in the event that an application is made to the Commonwealth Minister for a Stop Order, the Commonwealth Minister will, as a matter of course, contact the Queensland Environmental Protection Agency to ascertain what protection is being imposed by the State and/or what mitigation procedures have been proposed by the land user/developer.

In addition to the threat of a 'Stop Order' being imposed, the Act also provides for the following:

- If the Federal Court, on application from the Commonwealth Minister, is satisfied that a person has engaged or is proposing to engage in conduct that breaches the 'Stop Order', it may grant an injunction preventing or stopping such a breach (s.26). Penalties for breach of a Court Order can be substantial and may include a term of imprisonment;
- If a person contravenes a declaration in relation to a significant Aboriginal area, penalties for an individual are a fine up to $10,000.00 and/or 5 years goal and for a Corporation a fine up to $50,000.00 (s.22);
- If the contravention is in relation to a significant Aboriginal object, the penalties are $5,000.00 and/or 2 years goal and $25,000.00 respectively (s.22);
- In addition, offences under s.22 are considered 'indictable' offences that also attract an individual fine of $2,000 and/or 12 months goal or, for a Corporation, a fine of $10,000.00 (s.23). Section 23 also includes attempts, inciting, urging and/or being an accessory after the fact within the definition of 'indictable' offences in this regard.

The Commonwealth Act is presently under review by Parliament and it is generally accepted that any new Commonwealth Act will be even more restrictive than the current legislation.

9.2 State Legislation

The protection of Indigenous cultural heritage in New South Wales is principally governed by two pieces of legislation, the *National Parks and Wildlife Act 1974 (NPW Act)* (as amended) and the *Environment Planning and Assessment Act 1979*.

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

The NPW Act provides the primary basis for the legal protection and management of Aboriginal sites within NSW. The implementation of the

Aboriginal heritage provisions of the Act is the responsibility of the NSW Department of Environment and Conservation (DEC).
The general rationale behind the Act is the prevention of unnecessary, or unwarranted destruction of relics, and the active protection and conservation of relics which are of high cultural significance.

Section 90 of the Act provides statutory protection for all Aboriginal 'objects', whereby it is an offence (without the Minister's consent) to:

> *damage, deface or destroy Aboriginal sites without the prior consent of the Director of the National Parks and Wildlife Service.*

The Act defines an 'object' as:

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

The Act, together with the policies of the NPWS provide the following constraints and requirements on landowners and managers.

- It is an offence to knowingly disturb an Aboriginal artefact or site without an appropriate permit.
- Prior to instigating any action which may conceivably disturb an 'object' (generally land surface disturbance or felling of mature trees), archaeological survey and assessment is required.
- When the archaeological resource of an area is known or can be reliably predicted, appropriate land use practices should be adopted which will minimize the necessity for the destruction of sites/objects, and prevent destruction to sites/objects which warrant conservation.
- Documented and appropriate consultation with relevant Aboriginal Community representatives is required by the OEH as part of the prerequisite information necessary for endorsement of consultant recommendations or the provision of Consents or Permits by the OEH.

Section 86 of the NP&W Act specifies the offences and penalties relating to harming or desecrating Aboriginal places and objects:

1) A person must not harm or desecrate an object that the person knows is an Aboriginal object.

   Maximum Penalty:
   (a) in the case of an individual – 2,500 penalty units or imprisonment for one year, or both or (in circumstances of aggravation) 5,000 penalty units or imprisonment for two years, or both, or
   (b) in the case of a corporation – 10,000 penalty units (currently $1,100 000).

2) A person must not harm an Aboriginal object ('strict liability offence').

(a) in the case of an individual – 500 penalty units or (in circumstances of aggravation) 1,000 penalty units, or
(b) in the case of a corporation – 2,000 penalty units (currently $220,000).

Under s86(4) of the Act it is an offense for a person to harm or desecrate an Aboriginal place, with maximum penalties of 5,000 penalty units or imprisonment for two years, or both, for individuals and 10,000 penalty units for corporations.

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.

Harm to an Aboriginal object or place is defined under s5(1) as any act or omission that:

(a) destroys, defaces or damages the object or place, or
(b) in relation to an object – moves the object from the land on which it had been situated
(c) is specified by the regulations
(d) causes or permits the object or place to be harmed in a manner referred to in paragraph (a), (b) or (c), but does not include any act or omission that:
(e) desecrates the object or place, or
(f) is trivial or negligible, or
(g) is excluded from this definition by the regulations.

Exemptions and defenses to offences under s86 of the Act to exist and include the following:

- Offenses under s86(1), (2) and (4) have a defense against prosecution under s87(1) in which the harm or desecration was authorized by an Aboriginal Heritage Permit (AHIP) and the conditions to which the AHIP were subject have not been contravened.

- The strict liability offense under s86(2) has a defense against prosecution under s87(2) if the person exercised *due diligence* to determine whether the act or omission constituting the alleged offence would harm and Aboriginal object and reasonably determined that no Aboriginal object would be harmed. Due diligence may be achieved through compliance with industry specific Codes of Practice approved by the Minister, such as the DECCW (2010a) *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW*.

  The ‘due diligence’ process is intended to provide a defense against the strict liability offense under s86(2) of the Act, if an activity where subsequently to unknowingly harm an Aboriginal object without the presence of an AHIP. If Aboriginal objects are present or likely to be present and an activity will harm them, an AHIP application is required (excluding Part 3A Projects).

The DECCW (2010a) *Due Diligence Code of Practice fro the Protection of Aboriginal Objects in NSW* outlines procedures to determine the presence or likely presence of Aboriginal objects, the identification of activities that may harm Aboriginal objects and the need for AHIPs, the level of assessment is not generally sufficient to satisfy the assessment requirements outlined under Parts 5 and 5 of the EPBC Act (see below).

- A second defense to the strict liability offense under s86(2) is provided under section 87(4) if the person shows that the act or omission constituting the alleged offense is prescribed by the regulations as a low impact act or omission. Clause 80B of the National Parks and Wildlife Regulation 2009 describes low impact acts or omissions, most of which centre around land that is considered to be already disturbed. For the purposes of clause 80B, land is classified as 'already disturbed' if it 'has been the subject of a human activity that has changed the land's surface, being changes that remain clear and observable' (for example soil ploughing, construction of rural infrastructure such as dams and fences, construction of roads, tracks and trails, clearing of vegetation, construction of buildings, installation of utilities, substantial grazing involving the construction of rural infrastructure, or construction of earthworks related to the above).

- The defense of honest and reasonable mistake of fact applies under s86(5) to the strict liability offense of s86(2) and to offenses against Aboriginal places under s86(4).

- Offenses under s86(1) and (2) do not apply under s86(6) with respect to an Aboriginal object that is dealt with in accordance with s85 (see below)
- Exemptions are also available under s87A to s86(1)-(4) for emergency situations pertaining to conservation works and agreements

- And exemptions are available under s87B to S86(1), (2) and (4) for Aboriginal people in relation to the carrying out of traditional cultural activities.

Consent regarding the use of or destruction of relics is managed through the OEH Aboriginal Heritage Impact Permit (AHIP) system, as outlined in s90 of the NP&W Act clauses 80D and 80E of the Regulations. The issuing of permits is dependent upon adequate archaeological review and assessment, together with an appropriate level of Aboriginal community liaison and involvement. Failure to do so will result in a rejection of the permit application and the inability to undertake any collection of artefactual material (outside of the developmental area) or sub-surface testing.

Aboriginal archaeological assessments must be undertaken in accordance with the OEH (2011a) *Guide to Investigating, Assessing and Reporting on Aboriginal*

Cultural Heritage in NSW, which involves conducting an assessment in accordance with the DECCW (2010b) *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* and consultation with the Aboriginal community in accordance with the DECCW (2010c) *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* policy.

In accordance with the DECCW (2010b) *Code of Practice for Archeological Investigation of Aboriginal Objects in NSW,* the key features required for heritage assessments include:

- Investigations must be undertaken by people with appropriate skills and experience as specified in s1.6.

- Archaeological sub-surface investigation will be necessary when it can be demonstrated through Requirements 1, 2, 3, 4 and 5 of the Code that sub-surface Aboriginal objects with potential conservation value have a high probability of being present in an area, and the area cannot be avoided by the proposed activity (irrespective of whether or not there are objects present on the surface).

- A s90 AHIP is not necessary for test excavations undertaken in compliance with the Code (however in all cases implementation of the Aboriginal Cultural Heritage Consultation Requirements for Proponents Policy must be undertaken).

Clause 80D of the NP&W Regulation 2009 dictates that the cultural heritage assessment report which accompanies an AHIP must address the following:

- The significance of the Aboriginal objects and/or places that are the subject of the application;

- The actual or likely harm to those Aboriginal objects/places from the proposed activity that is the subject of the application;

- Any practical measures that may be taken to conserve/protect those Aboriginal objects/places;

- Any practical measures that may be taken to avoid or mitigate any actual or likely harm to those Aboriginal objects/places;
- Include any submission received from registered Aboriginal parties under clause 80C and the applicant's response to that submission.

Evaluations of AHIP applications are guided by the OEH (2011a) *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW*, OEH (2011b) *Applying for an Aboriginal Heritage Impact Permit: Guide for Applicants,* and OEH (2011c) *Guide to Aboriginal Heritage Impact Permit Processes and Decision-Making Policy*.

AHIPs may be issued in relation to Aboriginal objects, places, land activities or persons or specified types or classes of Aboriginal objects, places, land, activities or persons. They may be transferred or varied at the approval of the Director

General, and may also be refused. An application is taken to be refused 60 days after the date of receipt by the Director-General (unless otherwise granted or refused earlier).

The Director-General may attach any conditions deemed necessary to any AHIP granted, with failure to comply with a condition deemed a contravention of the Act (under s90J). Such offenses may result in a maximum penalty of 1,000 penalty units for each day the offence continues for an individual: these fines are doubled for a corporation.

Under s90K of the Act the Director-General must consider the following matters when making a decision in relation to an AHIP:

a) The objects of the Act;

b) Actual or likely harm to the Aboriginal objects/place that are the subject of the permit;

c) Practical measures that may be taken to protect and conserve the Aboriginal objects/place that are the subject of the permit;

d) Practical measures that may be taken to avoid or mitigate any actual or likely harm to the Aboriginal objects/place that are the subject of the permit;

e) The significance of the Aboriginal object/place that are the subject of the permit;

f) The results of any consultation by the applicant with Aboriginal people regarding the Aboriginal objects/place that are the subject of the permit (including submissions made by Aboriginal people as part of the consultation required by the regulations);

g) Whether the consultation process complied with the consultation requirements set out in the regulations (specified in s90 of the NP&W Act, clause 80C of the NP&W Regulation 2009 and in the DECCW Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010);

h) The social and economic consequences of making the decision;

i) Accompanying documentation including public submissions made under the EP&A Act in connection to the activity which is the subject of the permit and that has been received by the Director-General;

j) Any other matter prescribed by the regulations.

Appeals against the decisions made on an AHIP can be made to the Land and Environment court under s90L of the NP&W Act. The appeal must be made within 21 days following notice of the decision that is being appealed. However, the decision of the Land and Environment Court is final and binding on both the

Director-General and the applicant.

Section 85A of the NP&W Act allows the Director-General to 'dispose' of Aboriginal objects that are the property of the 'crown' in the following ways:

a) By returning the Aboriginal objects to an Aboriginal owner/s entitled to and willing to accept possession, custody or control of the Aboriginal objects in accordance with Aboriginal tradition, or

b) By dealing with Aboriginal objects in accordance with any reasonable directions of an Aboriginal owner/s referred to in paragraph (a), or

c) If there is/are no such Aboriginal owner/s – by transferring the Aboriginal objects to a person, or a person of a class, prescribed by the regulation for safekeeping (implemented by way of a Care Agreement between the OEH and the Aboriginal person/organization).

Section 85A(3) of the NP&W Act makes provision as to the resolution process for any dispute concerning the entitlement of an Aboriginal owner/s to possession, custody or control of Aboriginal objects for the purposes of this section.

Section 91AA of the NP&W Act allows the Director-General to place a stop work order for up to 40 days, should they be of the opinion that any action is being or is about to be carried out that is likely to significantly affect an Aboriginal place/object or any other item of cultural heritage situated on land reserved under the Act. Emergency situations are exempt from this section of the Act, as are approved developments under the EP&A Act. Contravention of a stop work order may result in penalties up to 1,000 penalty units with an additional 100 units for every day the offence continues (10,000 units and 1,000 units respectively in the case of a corporation). Under s91A, the Director-General may also make recommendations to the Minister for an Interim Protection Order in respect of land which has cultural significance, including Aboriginal objects, for up to 2 years duration. The existence of an AHIP does not prevent the making of a stop work order or an interim protection order (Section 90D).

Section 91L of the NP&W Act provides for remediation work to Aboriginal places or objects that have been harmed as a result of offences under the Act. This work may involve protection, maintenance, conservation, remediation or restoration of the harmed Aboriginal object or place. The maximum penalties under s91Q for contravening a remediation direction are 2,000 penalty units and 200 penalty units for each day the offence continues for a corporation.

Environment Planning & Assessment Act (1979)

The EP&A Act and its regulations, schedules and associated guidelines require that environmental impacts are considered in land use planning and decision making. Environmental impacts include cultural heritage assessment.

The EP&A Act has three main parts that are of direct relevance to Aboriginal cultural heritage. These are part III which governs the preparation of planning instruments, Part 4 which relates to development assessment processes for local government (consent) authorities and Part 5 which relates to activity approvals by governing (determining) authorities.

Part 3 deals primarily with development planning in which sites and places sacred or significant to Aboriginal communities are to be assessed and are to be taken into consideration in initial studies. Planning New South Wales (formerly DUAP) has produced guidelines on the preparation of planning instruments such as State Environmental Planning Policies (SEPP's), Development Control Plans (DCPs) and Local Environmental Plans (LEP's) that explicitly list Aboriginal sites and places of significance as values which should be assessed as part of initial planning studies.

Part 4 of the Act deals with decisions to be made within the context of development applications (Das). As a component of this legislative section, an Environmental Impact Study will, under Section 79C (1)b include consideration of the potential impacts a proposed development may have on Aboriginal cultural heritage. If Aboriginal objects are known to exist on the land to which the DA applies prior to the application being made, Par 4 of the EP@A Act requires the use of an 'Integrated Development Application' (IDA). Any IDAs approved for development must therefore be consistent with the General Terms of Approval or requirements provided by the relevant State Government agency (such as OEH).

Part 5 of the Act relates primarily to activities that do not require consent but still require an environmental evaluation, such as proposals by government authorities. State Government agencies which act as the determining authority on the environmental impacts of proposed activities must consider a variety of community and cultural factors in their decision making, including Aboriginal and Historic cultural heritage values.

The *Environmental Planning and Assessment Act, 1979*, as amended, provides for the listing of heritage items and conservation areas and for the protection of these items or areas through environmental planning instruments (like LEPs or REPs) at the Local government and State planning levels. These statutory planning instruments usually contain provisions for the conservation of these items and areas as well as an assessment process to reduce the impacts of new development on the heritage significance of a place, building or conservation area.

In 2005, the NSW Parliament passed amendments to the EP&A Act, which were designed to facilitate major and critical infrastructure developments. Part 3A of the Act was repealed under these amendments, however under Division 4.1 of Part 4 ' State Significant Development' is treated in a similar manner to the former Part 3A. Under Part 3A of the amended EP&A Act, separate approvals or permits are not required from DECCW, with regard to cultural heritage issues, although the DECCW may be consulted to ensure that best practices are being undertaken.

A complex interplay therefore exists between the NP&W Act and Regulation and the planning system. The specific level of Aboriginal heritage assessment and community consultation required for a given development, as well as the requirement for an AHIP is therefore dependent on the nature of the proposal, the Part and Division of the EP&A Act under which planning approval is required, the NP&W Act and Regulation, any particular project requirements imposed by the DP&I and/or the OEH and the presence/absence or potential for Aboriginal objects to occur (Kuskie 2012).

9.3 Local Legislation

In accordance with the Environmental Planning and Assessment Act 1979 (EP&A Act) the Minister may produce planning instruments such as Local Environment Plans to be administered at a local level. These plans establish the objectives and developmental controls for land in local government areas.

The study area falls within the existing Goulburn Mulwaree Local Environmental Plan 2009 (LEP). Part 5, Clause 5.10 of the LEP pertains specifically to Heritage Conservation and details what controls apply to the development of heritage items and relics, relevant restrictions, application requirements and conservation incentives for heritage items. A full list and descriptions of recognised Heritage Items for the bounds of the LEP is provided in Schedule 5.

Outlined heritage objectives within the LEP are as follows (subclause 1):

a) to conserve the environmental heritage of Goulburn Mulwaree,
b) to conserve the heritage significance of heritage items and heritage conservation areas, including associated fabric, settings and views,
c) to conserve archaeological sites,
d) to conserve Aboriginal objects and Aboriginal places of heritage significance.

Subclauses 2 and 3 deal with the requirement for consent and conditions under which developers may be exempt from consent. The subsequent subclauses relate to examining the impacts of developments on heritage significance, the need for heritage assessments, conservation management plans, assessments of heritage significance and existing conservation incentives.

None of the heritage items listed in Schedule 5 of the LEP occur within the current study area.

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APPENDIX A – RESULTS OF AHIMS SITE SEARCH PROVIDED BY OFFICE OF ENVIRONMENT AND HERITAGE

Basic Search Results

AHIMS Web Services (AWS)
Search Result

Your Ref Number : Gunlake Quarry
Client Service ID : 144518

Cultural Heritage Management Australia - (Australian Archaeological Survey Consultants)
Date: 13 August 2014

GPO Box 9463
Deakin Australian Capital Territory 2601
Attention: Sophie Collins

Email: sophcollins@me.com

Dear Sir or Madam:

AHIMS Web Service search for the following area at Datum :GDA, Zone : 55, Eastings : 771000 - 773000, Northings : 6158500 - 6161000 with a Buffer of 1000 meters, conducted by Sophie Collins on 13 August 2014.

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

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

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

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

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

Important information about your AHIMS search

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

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

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

Extensive Search Results

Office of Environment & Heritage NSW Government

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref Number : Gunlake Quarry
Client Service ID : 144518

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
51-6-0074	MAS1	AGD	55	771450	6157600	Open site	Valid	Artefact : -	Open Camp Site	99404
	Contact	**Recorders**	Mr.David Johnston					**Permits**		
51-6-0075	MIF 1	AGD	55	771900	6157800	Open site	Valid	Artefact : -	Isolated Find	99323,99404
	Contact	**Recorders**	Mr.David Johnston					**Permits**		
51-6-0077	MAS 5	AGD	55	771450	6157320	Open site	Valid	Artefact : -	Open Camp Site	99404
	Contact	**Recorders**	Mr.David Johnston					**Permits**		
51-6-0080	MAS 2	AGD	55	771300	6157320	Open site	Valid	Artefact : -	Open Camp Site	99404
	Contact	**Recorders**	Mr.David Johnston					**Permits**		
51-6-0737	HSP17	GDA	55	772905	6157718	Open site	Valid	Artefact : 1		
	Contact	**Recorders**	Navin Officer Heritage Consultants Pty Ltd,Doctor.Rebecca Parkes					**Permits**		
51-6-0742	HSP24	GDA	55	772476	6157513	Open site	Valid	Artefact : 1		
	Contact	**Recorders**	Navin Officer Heritage Consultants Pty Ltd,Doctor.Rebecca Parkes					**Permits**		
51-6-0743	HSP25	GDA	55	773699	6158037	Open site	Valid	Artefact : 1, Potential Archaeological Deposit (PAD) : 1		
	Contact	**Recorders**	Navin Officer Heritage Consultants Pty Ltd,Doctor.Rebecca Parkes					**Permits**		
51-6-0746	HSP28	GDA	55	773309	6157867	Open site	Valid	Artefact : 1		
	Contact	**Recorders**	Navin Officer Heritage Consultants Pty Ltd,Doctor.Rebecca Parkes					**Permits**		
51-6-0709	HSP17(23-24)	GDA	55	772837	6157693	Open site	Valid	Artefact : 1		
	Contact	**Recorders**	Navin Officer Heritage Consultants Pty Ltd					**Permits**		
51-6-0386	LA 31	AGD	55	770149	6157993	Open site	Valid	Artefact : 6		99620
	Contact Searle	**Recorders**	Archaeological Heritage Surveys					**Permits**		
51-6-0387	LA 32	AGD	55	770355	6157884	Open site	Valid	Artefact : 1		99620
	Contact Searle	**Recorders**	Archaeological Heritage Surveys					**Permits**		
51-6-0388	LA 33	AGD	55	771087	6157544	Open site	Valid	Artefact : 1		99620
	Contact Searle	**Recorders**	Archaeological Heritage Surveys					**Permits**		
51-6-0747	GL1 - Gunlake Quarry 1	GDA	55	771978	6159494	Open site	Valid	Artefact : 6		100850,102040
	Contact	**Recorders**	Mr.David Johnston,AASC and CHMA					**Permits**		
51-6-0749	GL3 - Gunlake Quarry 3	GDA	55	772393	6160148	Open site	Valid	Artefact : 3		100850,102040
	Contact Ms.Delise Freeman	**Recorders**	Mr.David Johnston					**Permits**		
51-6-0750	GL123 (Gunlake Quarry) relocated GL1, GL2 and GL3	AGD	55	772269	6159941	Open site	Valid	Artefact : 15		100850,102040
	Contact Ms.Delise Freeman	**Recorders**	Mr.Edward ONeil					**Permits**		
51-6-0748	GL2 - Gunlake Quarry 2	GDA	55	772251	6159535	Open site	Valid	Artefact : 6		100850,102040

Report generated by AHIMS Web Service on 13/08/2014 for Sophie Collins for the following area at Datum :GDA, Zone : 55, Eastings : 771000 - 773000, Northings : 6158500 - 6161000 with a Buffer of 1000 meters. Additional Info : Archaeological reporting. Number of Aboriginal sites and Aboriginal objects found is 16

This information is not guaranteed to be free from error omission. Office of Environment and Heritage (NSW) and its employees disclaim liability for any act done or omission made on the information and consequences of such acts or omission.

Page 1 of 2

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref Number : Gunlake Quarry

Client Service ID : 144518

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
	Contact	Recorders	Mr.David Johnston,AASC and CHMA					Permits		

Report generated by AHIMS Web Service on 13/08/2014 for Sophie Collins for the following area at Datum :GDA, Zone : 55, Eastings : 771000 - 773000, Northings : 6158500 - 6161000 with a Buffer of 1000 meters. Additional Info : Archaeological reporting. Number of Aboriginal sites and Aboriginal objects found is 16

Appendix D

Response to RMS comments by Transport & Urban Planning Pty Ltd

TRANSPORT & URBAN PLANNING PTY LTD
TRAFFIC ENGINEERING - TRANSPORT PLANNING -
ROAD SAFETY & PROJECT MANAGEMENT CONSULTANTS

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18 December 2014

Mr Phil Towler
EMM
PO Box 21
ST LEONARDS NSW 1950

Email: ptowler@emgamm.com

Dear Phil

Re: RMS Response to Gunlake Quarry Modification to Quarry Expansion Traffic Impact Assessment

I have reviewed the email from the RMS dated the 3 December 2014. I understand that the RMS' main concern is the left turn out of Redhills Road at the Hume Highway for trucks with the Modification in place. Before I address that specific issue, I would like to comment on some of the issues raised in the RMS email.

1. Truck Volumes

The RMS undertook counts on the road network and made comparisons to the counts undertaken by Transport and Urban Planning Pty Ltd for the traffic assessment. At the time of the Transport and Urban Planning Pty Ltd counts, Gunlake Quarry was restricted to 100 truck movements per day as it was still clarifying its approval with the Department of Planning regarding the intent of this condition. It subsequently lodged an application to vary its consent allowing up to a maximum of 150 truck movements per day provided that over a one month period the total truck movements averaged 100 movements per day. This was subsequently approved by the Department of Planning in October 2014. Therefore it is feasible that Gunlake's traffic generation was higher on some of the days, during the RMS counts.

Notwithstanding the above, the RMS counts show that other quarry trucks (in addition to Gunlake) were using the Bypass Road at the time of the RMS counts. This is shown in the hourly summaries provided in the RMS email. For 6 of the 11 hours where truck movements are shown, the number of Class 9 and 10 trucks in the Redhills Bypass Road exceeds the traffic generation of Gunlake Quarry (which is shown on the count Brayton Road, east of Gunlake Quarry). These trucks are likely to have been generated by the Jonniefields Quarry.

A comparison of all the truck movements in the RMS summary shows that on weekdays Jonniefields Quarry generated between 2 and 12 trucks per hour including 7 hours where the truck movements ranged between 5 to 12 trucks.

Jonniefelds will cease operation in the near future when Lynwood Quarry is fully operational. Therefore there would be no use of the Redhills/Bypass Road by this quarry.

2. Hourly Volumes

There seems to be some misunderstanding by the RMS about the hourly volumes used in the traffic modelling for the intersections in the Traffic Impact Assessment.

While comparisons were made to average hourly and daily volumes between the existing situation and with the Modification in place, the traffic modelling for all the intersections was undertaken for a busy hour at Gunlake Quarry (ie for the hourly maximum number of trucks from the Quarry). The Quarry currently has the capacity to load 11 truck and dog combinations per hour and this will continue with the Modification in place. Therefore the busy hour will not change.

For the traffic modelling, a total of 11 loads plus the return trips in the hour, (i.e. total of 22 truck movements) was adopted.

Section 4.32 of the Traffic Assessment which addresses the impact on intersections details this and **Figure 7** in the report shows the product truck volumes during a busy hour. Reference to this figure shows nine trucks turning left out of Redhills Road (with two travelling south on Brayton Road).

3. Redhills Road/Hume Highway Intersection

The modelling for this intersection assumed there would be nine trucks per hour turning left from Redhills Road into the Hume Highway. This is approximately one truck every 5.5 minutes. The maximum hourly total volume out of Redhills Road is approximately 15 vehicles per hour including light vehicles. This will not change with the Modification as the maximum number of trucks dispatched from the Quarry in a given hour will be the same as the current maximum number of trucks dispatched (restricted by the Quarry's loading capacity). The model calculated delays of around 9 seconds in the various periods for the left turn out of Redhills Road.

The SIDRA traffic model is a widely used and accepted RMS approved traffic model and it is generally recognised as providing inherently conservative estimates of vehicle delay.

The traffic counts undertaken as part of the assessment at the intersection (11 June 2014), as well as the observations undertaken at the intersection during various periods did not identify excessive delays for vehicles turning left out of Redhills Road, due mainly to the large gaps that appear in the Hume Highway traffic. In fact, delays were observed to be relatively low and consistent with Level of Service A operation.

The modelling used the standard gap acceptance times recommended in the SIDRA models which is based on research undertaken by the author of that model. I believe the model was and is calibrated to the existing intersection conditions for the observed delays of the low number of light vehicles and trucks that turn left out of Redhills Road. Sensitivity testing where the gap acceptance times for heavy vehicles turning left out of Redhills Road was increased to 12 seconds, indicates that average vehicle delays would be in the order of 15 seconds per vehicle which still represents a very good operation and relatively low vehicle delays.

Industry practice accepts delays in the order of up to 42 seconds per vehicle is a desirable limit, i.e. Level of Service C with an absolute limit of Level of Service D which provides an average vehicle delay in the order of 43 to 56 seconds. RMS Guidelines permit up to a Level of Service D operation.

In concluding this point, no further delay surveys are considered required to calibrate the SIDRA model for this intersection. Large trucks from the Quarry already turn left out of Redhills Road and the maximum number per hour will not increase with the Modification in place. The modelling has been undertaken for a busy hour using peak truck volumes.

There is sufficient information to conclude that the delays for trucks turning out of Redhills Road will be relatively low, and certainly within the limits normally accepted as satisfactory.

4. Vehicle Speeds in the Hume Highway

The RMS has suggested that speed counts in both lanes, before and after the intersection, could be undertaken to substantiate that the Hume Highway traffic will not be disadvantaged by slow moving trucks entering from Redhills Road.

As previously noted, the maximum number turning left out of Redhills Road is likely to be 9 trucks per hour, or one truck every 5.5 minutes. I do not consider that speed counts are required given the traffic volumes using the Hume Highway, and the fact that the quarry truck volumes are low, have been previously been approved and are already occurring at the intersection.

There is a truck parking area for northbound traffic in the Hume Highway on the southern approach to Redhills Road. This location is immediately south of the start of the deceleration lane for left turn vehicles into Redhills Road. Trucks regularly use this parking area and exit and enter the northbound carriageway without the benefit of either deceleration lane or an acceleration lane. I am unaware of any issues/problems with trucks using this truck parking area which of course, would require other following vehicles that were using the left lane in the Highway to change lanes to avoid a slow moving truck which may have re-entered the Hume Highway after using the truck parking area.

In my opinion, trucks turning left out of Redhills Road is representative of what occurs at the existing truck parking area. Sight distance in the Hume Highway is good and vehicles needing to change lanes to avoid a slower moving truck that might have turned out of Redhills Road have significant opportunities to do so, without the need for excessive braking and or acceleration. I do not believe further studies or analysis is required to reach this conclusion.

Yours faithfully

T. Lawrence

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