WARRAGAMBA DAM RAISING PROJECT 2021. REVIEW OF ENVIRONMENTAL IMPACT STATEMENT - EXPERT REPORT BY DR VALERIE ATTENBROW, SENIOR FELLOW, AUSTRALIAN MUSEUM, DECEMBER 2021.

This review of the Warragamba Dam Raising Environmental Impact Statement (EIS) is prepared for the Environmental Defender's Office (EDO) who are acting for Ms Kazan Brown, a Gundungurra woman and traditional owner for the area affected by the proposal to raise the wall of Warragamba Dam (the Project). Ms Brown is concerned that the Project will impact the Aboriginal cultural heritage of the Burragorang Valley, and seeks to make a submission on the EIS, in particular on aspects of the EIS addressing Aboriginal cultural heritage.

Ms Brown instructed the EDO to engage me to:

(a) review EIS Chapter 18 Aboriginal Cultural Heritage; and the appendices, prepared by Niche Environment and Heritage, upon which Chapter 18 relies: the Aboriginal Cultural Heritage Assessment (ACHA) (Appendix K; the Archaeological Assessment Report (AAR (Appendix K1); and the Cultural Values Assessment Report (CVAR), (Appendix K2); and,

(b) prepare an Expert Report to provide my opinions on the adequacy of Chapter 18 and the appendices Appendix K, Appendix K1 and Appendix K2.

I have read the 'Code of Conduct' and the Report complies with Division 2, Part 31 of the Uniform Civil Procedure Rules 2005 (UCPR) and the Harmonised Expert Witness Code of Conduct (Code of Conduct).

A review of the documents is presented first, then my opinions on specific EDO issues, the scientific significance of the sites in the Study Area, the existence of a very highly significant cultural landscape, and what the archaeological sites can potentially tell us about Aboriginal people in the Burragorang Valley in the past.

SUMMARY OF RESULTS OF THE FOREGOING TASKS:

- I have reviewed EIS Chapter 18 Aboriginal Cultural Heritage; and the appendices, prepared by Niche Environment and Heritage, upon which Chapter 18 relies: the Aboriginal Cultural Heritage Assessment (Appendix K); the Archaeological Assessment Report and the Cultural Values Assessment Report.
- The EIS is inadequate in three key ways:
  1. No-subsurface testing of deposits was undertaken. As such, Chapter 18 cannot portray a valid assessment of the archaeological sites and places.
  2. It downplays the scientific significance of the archaeological sites and places described in the report.
  3. It does not give adequate consideration to the high cultural values of the landscape.

- Given the number of archaeological sites, places and 'cultural values' with known high scientific value, and the potential very high scientific value of the cultural landscape with both cultural values and archaeological sites and places, the only conclusion that can be reached, is that the Project - the rising of the Warragamba Dam wall - should not proceed.
- the Burragorang Valley is a highly significant cultural landscape, comprising both 'cultural values' and archaeological sites and places, that is of great value to the Gundungurra and other associated groups who regard the proposed Project to be a continuation of dispossession of their Country;
- The 'cultural values' have been assessed as being part of a very highly significant cultural landscape;
- All archaeological sites and places in the Study Area would be inundated at some stage during the proposed Project and will become greatly diminished in value and significance, with some likely to have total loss of value;
- The two components, 'cultural values' and the archaeological report, should be viewed together, not separately;
- Together the archaeological sites and the 'cultural values' have the potential to inform on many different aspect of Aboriginal life in the Burragorang Valley, and with most of the Valley still having natural vegetation and fauna, have the potential to have very high scientific value and to be a very highly significant cultural landscape;
- If the sites and places are inundated, the cultural landscape will be greatly diminished in cultural and scientific values;
- No pro-active mitigation measures are possible and if the Project proceeds, sites and places will be inundated and subject to a variety of detrimental natural processes;
- All proposed mitigation measures are indirect and inadequate when compared against the loss of so many highly scientifically significant sites and places and a very highly significant cultural landscape;
- The lack of a test excavation programme for the open artefact scatters and deposits in rockshelters means their true scientific /research significance is currently unknown;
- Given the geographic proximity of archaeological sites with basal dates of 35-40,000 BP, and also the rich resources available in the Burragorang Valley, archaeological sites of this age or earlier are likely to be present in the Study Area, including the PUIA;
- The open artefact scatters and deposits in rockshelters have the potential to provide information on many different aspects of past Aboriginal life in the Burragorang Valley and adjacent country;

BACKGROUND AND REVIEW OF REPORTS

THE PROJECT

The Warragamba Dam Raising Project (the Project) involves increasing the height of the Dam wall for temporary storage in a dedicated flood mitigation zone above the Dam's current Full Supply Level (FSL). This would result in incremental inundation of country surrounding Lake Burragorang during flood mitigation events (ACHAR, section 1.2).

For the purposes of the EIS, several 'areas' were identified:

- **the EUIA (Existing Upstream Inundation Area:** the area likely to be inundated with the existing dam height and the area below full supply level (FSL) occupied by Lake Burragorang;
- **the PUIA (Project Upstream Impact Area):** the net incremental area that will likely be periodically temporarily inundated as a result of the Project. It is above the level of likely inundation for the existing dam height. It has an area of 1,401 ha.

1. the **Study Area:** includes the PUIA and an area above the PUIA that will be subject to very infrequent and short duration inundation; and the area potentially impacted by construction around Warragamba Dam;

- **the Subject Area:** the construction Study Area; the PUIA, and an area above the PUIA in the upstream Study Area.

Information about cultural heritage sites that is available to the public is published in Chapter 18 of the EIS. Detailed information for Chapter 18 is presented in separate redacted reports:

(a) the Aboriginal Cultural Heritage Assessment (Appendix K)
(b) the Archaeological Assessment Report (Appendix K, Appendix 1) CHAR
(c) the Aboriginal Cultural Values Assessment Report (Appendix K-Appendix 2) CVAR.

But the 'cultural values' and archaeological reports should be viewed together; they should not be viewed separately. The 'cultural values' in the Study Area are assessed by Waters Consulting of being part of a cultural landscape with a very high level of significance. Combined, the 'cultural values' and the archaeological sites and places are an even more impressive cultural landscape that is of very great scientific significance to both the Aboriginal communities and scientists (archaeologists). This is discussed further below.

THE ABORIGINAL CULTURAL HERITAGE ASSESSMENT AND REPORT (Appendix K)

The **Archaeological Assessment** (Report at **Appendix K1**) involved 76 days of field survey covering an area of **2,655 ha** (26.55 sq km) in the Study Area and adjoining lands. During the fieldwork, 464 ha (33%) of the PUIA were surveyed, and 43 archaeological sites and 12 'cultural values' were recorded. Based on the 33% sample, it was predicted there are a further 131 archaeological sites in the total PUIA, resulting in a predicted total of approximately 174 archaeological sites in the PUIA. The archaeological assessment found and recorded 334 cultural heritage sites in the Study Area.

However, the sampling strategy for the Study Area is not clearly described. The sites recorded in the PUIA may not be a representative sample of those in the total PUIA as the sampling strategy for the Study Area relied on where sites were found in the slope analysis. The predicted figures should be regarded as indicative only. (See Attenbrow 2004 for the stratified random sampling scheme for the Upper Mangrove Creek Catchment (UMCC).

As discussed below, an important component is missing from the fieldwork/assessment process - a test-excavation program for the open artefact scatters and deposit in rock shelters to investigate whether there is a sub-surface component of artefacts, and if so, its scientific and cultural significance. See further discussion below.

The surface artefacts are unlikely to represent what is under the ground surface, and the existence of a sub-surface assemblage may alter a site's scientific significance. Until sub-surface testing is undertaken, the significance of a site is unknown.

A 1997 study of the Cumberland Plain by McDonald (JMCHM 1997), found that:

- 17 out of 61 excavated sites (27.8%) had no surface artefacts before excavation.
- The ratio of recorded surface to excavated material was 1:25.

The character and composition of the excavated sites in McDonald's study could not be properly predicted on the basis of the surface evidence. In short, surface evidence (or the absence of surface evidence) does not necessarily indicate the potential, nature or density of sub-surface material. The results of McDonald's study clearly highlight the limitations of surface survey in identifying archaeological deposits in this landscape. The study also shows the importance of test excavation in establishing the nature and density of archaeological material. (McDonald JMCHM 2018, page 33).

CULTURAL VALUES ASSESSMENT REPORT (CVAR) (Appendix K2) (Section 18.7)

Original construction of Warragamba Dam took place in the 1950s. The Gundungurra people who were farming there at the time saw many of their Dreaming places and cultural sites inundated and/or access restricted. To present-day Gundungurra, the current proposed Project is seen as a continuation of the original Warragamba Dam construction and dispossession. The flooding of the Burragorang Valley is a part of the oral history of Aboriginal communities across the greater Sydney region, the South Coast, and the Bathurst Plains (Waters Consulting 2021 (CVAR), page 17). The Warragamba River and Burragorang Valley contain a diverse and valuable record of this history and stories explaining its creation and important cultural places still exist. Despite control and suppression, the Aboriginal communities have maintained and nurtured a strong connection to place.

The Cultural Values Assessment (EIS section 18-7; ACHA Executive Summary; Appendix K2) addresses the potential impact of the Project on intangible Aboriginal cultural heritage values within the PUIA and Study Area. It was undertaken by Waters Consulting and involved background research and limited consultation with the RAPs. Information gained during the Cultural Values Assessment comes from oral histories of present-day descendants of Aboriginal people who witnessed first contacts with non-Aboriginal people, and from early historical accounts of non-Aboriginal people, e.g. RH Mathews 1908. Documentary research in a range of national, state and local institutions, provided historical and ethnographic context for the assessment.

Consultation took place with Aboriginal cultural knowledge-holders, as identified by the registered Aboriginal parties (RAPs), regarding historical and cultural values within the study area. However, some RAPs and identified Aboriginal cultural knowledge holders chose not to formally engage in the cultural values assessment process (Waters 2021 (CVAR), page 17). Waters recognised that there is a substantial gap in the cultural values assessment process and that '[t]hese locations of "cultural value" cannot be considered comprehensive.'

This assessment documented six strands of distinct but interrelated 'cultural values' in the study area that contribute to the cultural landscape within which the Project is situated. There were 32 'cultural value' places identified in the Study Area, 29 of which are already impacted and would be subject to partial impact from the Project with the remaining 3 subject to infrequent inundation.

The ACHA states that the 'cultural values' recorded in the PUIA were 1 Dreaming Story Place, 7 Living Places and 3 cultural places that are at potential risk from the Project (ACHA, page 70).

- Gurrangatch-Mirrigan Dreaming Track: 19 distinct locations are indicatively mapped. Their locations map the journey of the Ancestral Beings which created this Country, illuminating the Aboriginal cultural perspective that the landforms and waterways themselves embody culture and hold cultural value
- Buru (Kangaroo) Dreaming Story Places: 2 distinct locations are indicatively mapped. Their cultural values highlight the significance of the cultural association of the Project area with the Buru (Kangaroo)
- Living Places (history of occupation and use): 10 distinct locations are mapped. They illustrate the range of locations that carry cultural values related to the history of occupation of the Project area by Aboriginal people traditionally and historically.
- Cultural Places (ritual life): 14 distinct locations are mapped. They hold cultural value for their representation of aspects of the social, religious, and ritual life of Aboriginal people in the Project area
- Archaeological Sites: tangible record of traditional occupation and use.
- Waterways: the Wollondilly, Nattai, Warragamba, and Coxs Rivers and their tributaries.

These six elements are said by Niche (ACHA, page 37) to highlight different aspects of the 'cultural values' of the Study Area and illustrate the understanding in all Aboriginal societies, traditional and contemporary, that landscape or Country is inherently cultural, having been formed and animated by the actions of mythological beings and maintained by the ongoing actions and interactions of Aboriginal people over many generations. See also CVAR, page 23**.** Other socially important aspects of life such as artistic expression; as seen in the number of shelters where the remains of drawings and stencils are still present, which may have been used for ceremonial or other social and cultural purposes, such as education and the passing down of the story Gurrangatch-Mirrigan Dreaming Track (ACHA, page 56).

Justine Coplin of the Darug peoples (cited in Waters 2021 (CVAR)) explains that: 'While people were living the traditional lifestyle, song, dance, art and ceremony was and still is a big part of daily life. People read the land and signs similar to reading maps today. There were signs left in the landscape showing tribal areas, ceremonial places, sacred places, burials, women's places, and resources. The Warragamba Dam area contains evidence of these ceremonial places, sacred places, women's places and resource areas that have been recorded during the Project.'

The landscape surrounding Warragamba Dam holds deep cultural values for the Aboriginal people (EIS, pages 18-21; see also Appendix K, Appendix 1 and Appendix 2). These values derive from both traditional knowledge and from social and historical associations with places, stories and cultural resources such as plants, animals and water. The most significant Aboriginal places were those associated with Aboriginal spiritual resources such as 'mythology', art and ceremony, and information about these is contained in the stories told by the Gundungurra people set in the Dreaming (gunyunggalung). Dreaming stories are also used to explain the origin, behaviour and appearance of many native animals and plants in Gundungurra country (Smith 2016).

It is important to note that the majority of the RAPs expressed to Waters their understanding of the Project as situated within a cultural landscape with a very high level of significance in relation to both intangible and tangible cultural values. They strongly expressed their high level of concern regarding the potential impacts of the Project (Waters 2021 (CVAR) pages 17-19).

RESPONSES TO SPECIFIC QUESTIONS FROM THE EDO

A. IN YOUR OPINION, WAS THE ABORIGINAL CULTURAL HERITAGE ASSESSMENT ADEQUATE? NO.

An essential and important component missing from fieldwork/assessment is a test-excavation program for the open artefact scatters and deposits in rockshelters

It is now well-known by archaeologists working in Australia – particularly those working in the Sydney Basin – that what is seen on the surface of an artefact scatter and the absence of any visible artefacts on the surface of a deposit in a rockshelter, is unlikely to be a true indication of what is present in the deposit sub-surface (e.g. Attenbrow 2004: 49-50, 96-97; McDonald et al 1994; Way 2017a, 2017b). These deposits are termed PADs [potential archaeological deposits] (Attenbrow 1981:12; Vinnicombe 1980:VIII:2-3). None of the sites in the Study Area have been test excavated to assess whether there are sub-surface artefacts and if so of what they comprise. In addition to stone artefacts, PADs in rockshelters may also have faunal assemblages (animal bones), ochre, and charcoal for dating. Such knowledge about the sub-surface deposits is necessary to assign a valid significance value to the site. Tests excavations of the open scatters and rockshelters with PAD are likely to reveal further stratified stone artefact assemblages of high and very high significance. Test excavations of sub-surface

deposits should have been carried out before assigning levels of significance to the deposits in the open and rockshelters and definitely before decisions are made about whether the raising of the dam wall should proceed.

> The correct scientific significance of the open artefact scatters and deposits in rockshelters is currently unknown.

B IN YOUR OPINION, DOES EIS CHAPTER 18 ABORIGINAL CULTURAL HERITAGE REFLECT THE ABORIGINAL CULTURAL HERITAGE ASSESSMENT? NO

Although Chapter 18 may reflect the significance assessments in the Archaeology Report, given the lack of a sub-surface testing programme for open artefact scatters and rockshelter deposits, Chapter 18 cannot portray a valid assessment of the archaeological sites and places.

In addition, Chapter 18 downplays the scientific significance of the archaeological sites and places – in presenting the level of significance in tables and text, low significance is always presented first, before high and medium. This ordering suggests that the important result is the large number of low significant sites and places. Whereas it is the relatively large number of highly significant deposits that is important. In discussions and tables below, I have reversed the order so that high value is presented first.

C. IN YOUR OPINION, ARE PREDICTIONS OF ANY LIKELY IMPACT ON ABORIGINAL CULTURAL HERITAGE APPROPRIATE.

Potential impacts from temporary inundation (Appendix K, section 9.2.1, Table 11, see also sections 9.3.2 and 9.3.2.5)

Most of the Study Area has been exposed to limited disturbance or modification, being protected as either a national park, state conservation area and/or water catchment (Special Area) (ACHA, page 35).

Archaeological sites potentially at risk of harm from the Project include

- 43 recorded archaeological sites in the PUIA and
- 11 'cultural values'
- 29 above the PUIA
- 174 archaeological sites are predicted by Niche to be in the PUIA (43 recorded and an estimated 131 in the unsurveyed portion). These sites include 117 open sites, 51 rockshelters and at least 6 other sites;
- an estimated 370 archaeological sites and places above the PUIA. Including scarred trees
- Construction works at the dam wall will not harm any known Aboriginal sites.

Archaeological sites and places within the PUIA are principally open sites containing flaked and ground stone artefacts. There are seven rockshelters with archaeological deposit and a rockshelter containing art.

Archaeological sites and places within the PUIA will be subject to temporary inundation of waters for a period of up to 11 days. Sites and places 'above the PUIA' will be subject to very infrequent inundation, lasting for shorter periods of time. The 29 known Aboriginal archaeological sites above the PUIA are within the Project's 1 in 100-year flood event modelling and at potential risk. While the Aboriginal archaeological sites located within the existing dam footprint (EUIA) are already impacted they may experience a greater duration of temporary inundation if the Project proceeds.
Submersion of a site can result in varying impacts depending on site type – see list in EIS Table 18-29:

- stone artefact sites will be subject to changed ground conditions such as waterlogging or erosion;
- sandstone shelter sites will be subject to altered conditions that may detrimentally effect deposits and/or rock art;
- scarred trees will be subject to more frequent flooding and drowning;
- axe grinding grooves and engravings will be more frequently submerged, altering natural conditions and possibly their preservation.

Aboriginal ceremony and Dreaming sites, and Aboriginal resource and gathering sites may occur in areas that have not yet been subject to archaeological survey. Even if they have no tangible components they may leave a visual impression. For example, access may be impossible at certain times, and more of the rugged country of the Cox and Wollondilly Rivers, in which the dynamic activities of Gurrangatch and Mirrigan took place, will be drowned and replaced by the serene waters of Lake Burragorang – a quite different atmosphere. Alteration of existing environmental conditions may cause impacts to the cultural landscape values and how they may be interpreted, enjoyed, and maintained by the members of the community.

Management measures as described will not remove the potential for harm to the Aboriginal sites but are designed to provide "intergenerational equity" should the Project proceed (EIS Table 18-29, page 18-76).

There is no capacity for pro-active management measures to avoid or minimise harm to the sites and places and if the Project proceeds, cultural and archaeological sites and places will be inundated and subject to a variety of detrimental natural processes. If the sites and places are inundated, the cultural landscape will be greatly diminished in cultural and scientific values

MITIGATION

The recommendations for mitigation relate to consultation, management, access to Country, site recording, cultural values recording and education. Impact with such indirect mitigation

does not achieve a conservation outcome, and is not aligned with the principles of inter-generational equity.

All proposed mitigation measures are indirect and inadequate when compared against the loss of so many highly culturally and scientifically significant sites and places and a very highly significant cultural landscape

Further detailed recording and impact assessment of all Aboriginal cultural heritage sites and places, including test excavation of open artefact scatters and rockshelter deposits to assess the scientific significance of the sites, places and objects, has been suggested (See AAR Section 14- Recommendations, page 172). However such works should be undertaken before a decision is made about whether the dam wall should be raised. Also a valid significance value for all sites should be taken into account when decisions are being made about whether the Project should proceed.

D. PLEASE PROVIDE ANY FURTHER OBSERVATIONS OR OPINIONS WHICH YOU CONSIDER TO BE RELEVANT, INCLUDING IN RELATION TO THE POTENTIAL IMPACTS OF THE PROJECT ON ABORIGINAL CULTURAL HERITAGE, AS THEY RELATE TO YOUR EXPERTISE IN THIS MATTER.

Two matters are discussed below: scientific significance assessment and the cultural landscape.

SCIENTIFIC VALUES AND SIGNIFICANCE ASSESSMENT

In assigning significance values to the archaeological sites and places, Niche considered The Burra Charter (Australia ICOMOS 2013), and The Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW (OEH 2011) (EIS sections 18.8.1 Assessment process and 18.8.1.1 Assessment framework). Cultural significance is seen as deriving from four values: Aesthetic, Historic, Scientific, Social (Table 18-17). My review of the EIS chapter and reports relating to the Warragamba Dam Raising Project focusses on the Scientific values of the archaeological sites, places and objects.

The scientific, archaeological or research value of a site or place will depend upon the importance of the data involved, on its rarity, quality or representativeness, and on the degree to which the place may contribute further substantial information about past human behaviour. Niche also cites two main themes in the overall Aboriginal cultural heritage significance assessment process, namely, the identification of the cultural/social significance of Aboriginal objects and/or places to Aboriginal people and the identification of the scientific (archaeological) significance to the scientific/research community (EIS section 18.8.1.3).

However, there is overlap in the parties interested in each type of significance and they cannot be viewed separately.

It is the potential to elucidate past behaviour which gives significance under this criterion rather than the potential to yield collections of artefacts. Matters considered under this criterion include the intactness of a site, the potential for the site to build a chronology and the connectedness of the site to other sites in the archaeological landscape.

Niche considered the following in assessing Scientific significance (see EIS section 18.8.1.3):

- the number of objects/and or art motif type and number and diversity of motifs; and
- the research potential of each Aboriginal cultural heritage site, and what the artefacts, or Potential Archaeological Deposit (PAD), art assemblage or other archaeological features could potentially indicate to future researchers regarding how Aboriginal people lived within the landscape.

High (archaeological) significance was assigned to sites that comprised multiple site features (a shelter with art, deposit and grinding grooves, for example) and characteristics such as shelters with undisturbed deposit, high density artefact scatters, axe grinding grooves and art that has been layered indicating extended use of the site over a longer period of time, that has also been well-preserved through environmental processes were also given a high (archaeological) significance assessment due to the further understanding they would provide to future researchers.

High or moderate scientific significance. Niche noted that in some cases, such as the hatchet with hafting resin still present [Warragamba 288] or an artefact with distinctive use-wear, or a particularly unique art motif, individual or isolated features can be assigned high or moderate scientific significance.

> However this does not explain why the hafted hatchet head is not listed in Table 18.20, or why Warragamba 88, an isolated chert flake, is listed in Table 18.20.

Moderate to high scientific (archaeological) significance was assigned to sites comprising high numbers of axe grinding grooves, artefacts in high numbers and densities and assemblages of art with high numbers of well-preserved motifs and/or a diversity of motifs, media and application techniques. This rating was assigned due to the ability of future research to be carried out regarding artefact development and site use over time.

Low scientific (archaeological) significance was assigned to Isolated Artefacts, sites with individual or low numbers of axe grinding grooves, instances where art was charcoal-indeterminate and where the artefacts, features or art had no distinctiveness or uniqueness. These sites were given this rating because only a limited amount of scientific information could be obtained from them.

Scientific significance ratings for Aboriginal sites within the Survey Area and PUIA from Chapter 18, Table 18-20 (Site type and contents were copied from Appendix K, Appendix 1, AAR- Annex 1.Table 1)

High significance: 40 in Study Area/ 5 in PUIA

- Policeman's Point (AHIMS ID#45-4-0186) Shelter with Deposit, Artefacts [18] and Axe Grinding Grooves [2 shelters; grooves in shelter and creek nearby];
- RC 1 (AHIMS ID#45-4-0967) Open Camp Site, 5 artefacts including axe with pits both faces. Pebbular 80% cortex;
- Joorilands Creek, Upper Burragorang (AHIMS ID#52-1-0045) Axe Grinding Grooves, two groups in creek bed, 3 and 15 grooves;
- Green Wattle Point OS-1 (AHIMS ID#52-1-0345) Open Camp Site, high density of artefacts, including axe flakes and cores plus potential glass and ceramic artefacts;
- Warragamba-110 (AHIMS ID pending) Open campsite, 14plus artefacts, including basalt bifacial core/axe and a basalt axe.

Moderate significance: 22 in Study Area /3 in PUIA

- Warragamba-88 (AHIMS ID pending) Isolated Artefact [1 chert flake]
- Warragamba-111 (AHIMS ID pending) Open Campsite [3 artefacts, only 2 recorded in detail]
- Warragamba-114 (AHIMS ID pending) Axe Grinding Grooves [27 grooves visible]

Low Significance: 272 **in Study Area** / **in PUIA** 35 [see Chapter 18 Table18-20 for list of sites]

Aboriginal sites in the **Study Area and PUIA**, with their scientific significance rating and a statement of significance is presented in Appendix K, Appendix 1 and provided in Table 18-20. The Scientific (Archaeological) value of the region and the Aboriginal objects contained within it is said to be demonstrated by the 334 identified Aboriginal archaeological and cultural heritage sites, including:

Aboriginal Resource and Gathering, Axe Grinding Grooves, Isolated Finds, Open Camp Sites, Scarred Trees, Stone Arrangements and Water Hole sites.

Table: Archaeological significance of Sites in the PUIA and Study Area (from Chapter 18.2 [pages 51-52])

Scientific [archaeological] significance	PUIA		Study Area	
	No of sites	%	No of sites	%
High	5	12	40	11
Moderate	3	7	22	7
Low	35	81	272	82
Totals	43	100	334	100

These scientific significance values (High, Moderate, Low), however, were assigned on the basis of the visible, surface archaeological evidence, without knowledge of the existence of sub-surface deposits. These values may change if test excavations were undertaken.

WHAT CAN THESE SITES AND PLACES TELL US ABOUT ABORIGINAL LIFE IN THE BURRAGORANG VALLEY?

The Aboriginal people of the Burragorang are part of the Gundungurra nation who occupied the watersheds of the Cox and Wollondilly Rivers, extending east to Picton and Mittagong and west to the Kowmung and Abercrombie catchments (Barrett 1995; Smith 2017).

The Project's Study Area falls within the Blue Mountains Plateau and the Hawkesbury and Nepean River systems, which include the Coxs and Wollondilly River systems, which is in the Sydney Basin an area dominated by sandstone country, except for the Cumberland Plain and parts of the Hunter Valley. Across this area the Aboriginal archaeology is similar (e.g. types of sites such as rock shelters, grinding grooves); stone artefact technology and sequence of temporal changes), although importantly there are regional variations which reflect the language groups who inhabited the Sydney Basin.

The Blue Mountains has been the focus of archaeological interest in Aboriginal occupation for a long time, notable researchers being McCarthy (1948, 1978), Johnson (1979) Kohen et al. (1981, 1984). Nanson et al. (1987), Stockton (1970), Stockton and Holland (1974). They investigated numerous sandstone shelter sites, including Shaws Creek 1 and 2, Springwood Creek, Kings Table, Lyre Bird Dell, Walls Cave, Blackfellows Hands shelter, Capertee 1-5, and Lapstone Creek. These sites contributed to the chronology of the Blue Mountains as well as to describing the stone artefact assemblages and their change over time. Rock art studies also have a long history in the Blue Mountains (Stockton 1993) and feature in recent studies, e.g. Brennan 2019; Smith 2017; Taçon et al 2010.

The archaeological record of the Burragorang Valley as documented by the Project fieldwork and site recording program includes rock-shelters with deposit, stone artefacts and art; axe grinding grooves in rock-shelters and open sandstone outcrops; as well as open artefact scatters and scarred trees. Niche (EIS Appendix K1, section 10.9) states "these sites present a range of activities and events, such as

- living places, camping;
- stone artefact manufacture;
- the grinding of stone axes, axe sharpening and grinding; and
- the use of flaked stone artefacts to prepare foods and utilitarian items;
- the grinding of plant foods to produce flour; and
- the removal of bark and cambium from trees for utilitarian items such as shelters and coolamon style dishes;

- ceremonial".

In addition to the 'activities and events' listed by Niche, the Burragorang Valley archaeological sites and places have the potential to address the following subjects that would contribute information about past Aboriginal activities. They would extend back in time the oral histories of people living in the Valley up to the 1950s when Warragamba Dam was built; as well as the early historical observations of non-Aboriginal people.

Chronology

Niche cites a date of 36,000 years BP from Pitt Town (Williams et al 2014), as well as similar dates for SGCD 16 (Fal Brook, in the Hunter Valley) (Koettig 1987) and the Parramatta Sand Sheet (McDonald 2008) indicating Aboriginal people likely visited and occupied the Sydney Basin from around 36,000 years BP (EIS Appendix K1 section 4.3.1).

While there is evidence that the Sydney Region has been occupied for at least 36,000 years BP (Williams et al. 2014), the earliest archaeological evidence for Aboriginal occupation in the Blue Mountains is much later - 22,000 years BP from Kings Table at Wentworth Falls (Stockton and Holland 1974). Niche, however, follow Bowdler (1981) and Johnson (1979) who reject this date. However, after examining Stockton's pre-publication notes and artefact distribution tables, I accept the date of 22,000 BP. Other Blue Mountains sites excavated by Stockton (e.g. Walls Cave at Wentworth Falls, and Springwood Creek) have dates for earliest occupation of between 12,000 and 8500 years BP (Stockton & Holland 1974).

Given the geographic proximity of sites with basal dates of at least-36,000 years BP, and also the rich resources available in the Burragorang Valley, sites of this age or earlier are likely to be present in the Study Area, including the PUIA.

Change over time

Change over time has been documented in excavated assemblages in the deposits of many sites in the Sydney Basin, for example in the type and number of artefacts, in faunal remains, in stone materials used for making flaked and ground stone implements. The number of sites and artefacts used in different time periods has been interpreted by some researchers as reflecting changes in population size (e.g. Lourandos 1983).

Niche says "Occupation evidence continues to be sporadic up until about 5000-4500 BP where an increasing and continued use of shelters has been identified (Attenbrow 1981)". Attenbrow 1981 is the report of the Mangrove Creek Dam (MCD) salvage excavations in the storage area in the NSW Central Coast. Since then further fieldwork in in the whole of the Upper Mangrove Creek Catchment (UMCC) and analysis of excavated materials was undertaken for my PhD thesis which was published as "What's Changing. Population Size or Land Use Patterns" in 2004. Further studies have also been undertaken on the UMCC excavated assemblages (see below)

Although my book *Sydney's Aboriginal Past* has been cited, I am surprised that Attenbrow 2004 and other recent Attenbrow publications were not used at all by Niche in the EIS, given that the sites and excavated materials discussed are in similar sandstone country and there are the same archaeological site types and artefacts recorded.

According to Attenbrow 2004, rather than a major increase in sites numbers at 5000-4500 years BP, there were continuing increases in rockshelter numbers until dramatic increases in the 2nd and 1st millennium BP. In contrast, the stone artefacts in the rock-shelters have a slight increase in numbers at 5000 years BP followed by a dramatic increase in the 4th mill BP and then a dramatic decrease in the 1st mill BP. I believe these trends based on the whole of the catchment area (albeit a 10% stratified random sample) have greater validity than those of the dam storage. Many researchers interpret these changes in sites and artefacts as reflecting population change (increasing or decreasing numbers), but I believe the UMCC studies show they can be due to changes in land-use patterns (Attenbrow 2003, 2004). In such an interpretation, minor small artefact scatters can be interpreted as places where activities took places while people were on their way from base camps to hunt animals and/or gather plants used as food or materials for making tools and weapons, or on their way to visit Dreaming places, or attend ceremonies where the exchange of tools and materials, songs took place, and relationships were re-established (Attenbrow 2003).

Whether from changing population numbers or changes in land use patterns, these changes may be associated with late Holocene climate change (Attenbrow, Robertson Hiscock 2009).

Such temporal changes may be present in the open and rockshelter deposits of the Burragorang Valley, and may help shed more light on the reasons for the changes in numbers of sites and artefacts over time.

Niche says the change over time in stone artefacts "known as the Eastern Regional Sequence (ERS) was identified by Attenbrow from the Mangrove Creek Catchment north of Sydney". This sentence suggests that Attenbrow devised the ERS; if so, it is incorrect as McCarty constructed the ERS from his excavations at Lapstone Creek and Capertee 3 (McCarthy 1948, 1964, 1976). McCarthy saw each phase characterised by a particular assemblage and implement; e.g. the Bondaian by Bondi Points, a form of backed artefact. For Mangrove Creek Dam artefact analysis Attenbrow 1981 presented the chronological changes in artefact type and raw materials in terms of Stockton's modified version of the ERS: Capertian, and Early, Middle and Late Bondaian (Attenbrow 1981:45-53).

However, the 2004 artefact analysis showed that changes in artefact types and raw materials do not happen synchronously, as described by McCarthy, and a millennial sequence was found to more correctly show the changes over time in different components of the stone artefact assemblages (Attenbrow 2004, 2010:101-102; see also Hiscock & Attenbrow 2005). In addition, a comparison of UMCC trends with other Sydney Basin regions showed there were regional

variations, e.g. in the last 1500- 1000 years BP backed artefacts drop out in the coastal sites, but are less common or not present in hinterland sites. There are also regional variations in the dominant raw materials used for making flaked stone implements depending on the geology of a region, e.g. silcrete is dominant across the Cumberland Plain and other parts of the Sydney Region, though chert (a volcanic rock that I and others call 'tuff') is used more frequently in early Holocene assemblages than in Middle and Late Holocene assemblages. From the current Burragorang Valley fieldwork tuff/chert appears to be a dominant flaked stone material (AAR Annex 1).

Further knowledge of the artefacts at currently recorded sites, and further survey for sites in other parts of the Study Area and the Burragorang Valley above PUIA flood levels, would provide a more accurate picture of the raw materials used for flaked and ground stone implements in the Burragorang Valley.

Trade and exchange systems/social networks: provenancing studies

The current Burragorang Valley fieldwork has recorded a number of ground-edged artefacts (whole and broken) (EIS Appendix K1: Table 59). Such implements, particularly those of volcanic rocks such as basalt, have a long history of being used in provenance studies to successfully identify rock sources and thereby exchange/trade systems and social relationships between various groups (e.g., McBryde 1984; Attenbrow et al 2012).

More recently, portable X-ray fluorescence (pXRF) technology has been used in provenancing studies to identify source locations for ground-edged artefacts in the Sydney Basin (Attenbrow et al 2017; Attenbrow et al 2019).

Reanalysis of ground-edged artefacts from Macdonald River MR/1 near Wisemans Ferry on the Hawkesbury River (Moore 1970, 1981), including pXRF analysis, revealed the source of basalt used at the MR/1 was a basalt outcrop (now a commercial quarry) at Kulnura in the NSW Central Coast (Attenbrow 2019). It also revealed an increase in use in hornfels over basalt ca 1,500 years BP. This change occurred at a time when several other changes occurred in the stone artefact assemblages of the Sydney Basin. This change in raw material suggests regional changes in exchange systems associated with social relationships may have occurred at this time.

The Australian Museum Archaeology Collection includes seven ground-edged hatchets (stone axes) which were collected from the Burragorang Valley. Recent analysis of these ground-edged artefacts (Attenbrow work in progress) identified two of them as having a form which McCarthy called 'Wiradjuri axes' as he believed they were made west of the Great Dividing Range and brought east through exchange systems. McCarthy 1939:100 identified the Coxs River Valley as a 'trunk route' from the coast to inland, which was part of an east coast exchange system. This trunk route – an exchange and travelling route - crossed through Gundungurra country.

Basalt is available in the Burragorang Valley at the top of peaks such as Mt Colong and The Peak, as well as in creeks with their headwaters flowing from the basalt peaks. Tuff=chert**,** is another volcanic rock which has the potential to be analysed using pXRF to trace the source of rock for making flaked stone artefacts. Tuff is exposed in Permian levels of the Burragorang Valley cliffs and other parts of the Blue Mountains (Bembrick 2015). It is also present as cobbles in the creeks with headwaters in the sandstone cliffs. Both basalt and tuff/chert are likely to vary in composition in different parts of the Blue Mountains. Source locations for obtaining tuff/chert may be different to those for basalt and hornfels and thus the exchange systems may have been different, and social relationships of groups engaged in the exchanges may have been different.

A pXRF analysis of excavated Burragorang Valley basalt axes and artefacts may reveal (a) the sources of rock used to make axes in the Burragorang Valley; (b) whether similar temporal changes occurred as at Macdonald River and thus whether temporal changes in exchange systems and social networks occurred; and (c) whether such changes involved the Wiradjuri with whom the Burragorang Valley people shared a common boundary

The tasks for which ground and flaked stone implements were used.

Analyses of use-wear and residues on both GEA and flaked stone artefacts can reveal the tasks for which they were used and thus the activities that were carried out in the Burragorang Valley. For example,

- backed artefacts have been shown to have been used for many different tasks and for working a variety of materials. (Robertson et al 2009) Robertson & Attenbrow 2008 Skin working. They were not only spear points as argued by many researchers, but functioned as cutting, drilling/awling, and scraping tools which were used to work materials such as wood, plants, bone, blood, skin and feathers.
- ground edged implements – as well as woodworking tools were also used for many other tasks, such as: anvils for cracking nuts (Kononenko et al 2021); mortars for pounding plants and ochre; scrapers for cleaning animal skins (Attenbrow et al 2008); hammers for knapping stone (Attenbrow & Kononenko 2019).

Similar studies of the use-wear and residues on Burragorang Valley flaked and ground stone implements have the potential to identify the tasks for which they were used and the raw materials worked by people living in the Burragorang Valley.

Faunal remains

Faunal remains are usually interpreted as food remains or implements. However, Aplin (2004) argued that changes over time in the proportions of different macropod species in the sites in the Upper Mangrove Creek Catchment were associated with late Holocene climate changes, i.e. the last 42000 years. Such interpretations have not been made elsewhere in the Sydney Basin.

If associated with climate change, such changes in faunal remains should be present in other sites in the Sydney Basin, and analysis of faunal remains in excavated deposits in Burragorang Valley rockshelters, may be able to shed further light on Aplin's conclusions. If supported, it suggests the current vegetation, fauna and ecology existed for the last thousand years.
In summary, the Burragorang Valley is within the Sydney Basin, an area dominated by sandstone country, across which there is a similar stone artefact technology and sequence of changes, although there are regional variations. These chronological changes in stone artefact assemblages are likely to be seen in the Burragorang Valley, though influences from the west (e.g. the Wiradjuri hatchet) may also be seen (Attenbrow 2012.
The PUIA and the Study Area contain a range of archaeological and cultural sites that have the potential to provide information about past Aboriginal land use and settlement of the Burragorang Valley. Information about the types and locations of sites and their contents can be used to shed light on the activities that took place in the past, and how the landscape and its resources were used in the past. The archaeological sites and places can contribute to the long-term history not only of the Gundungurra people but also their neighbours and people in their social systems and exchange networks which may extend over many kilometers.

A CULTURAL LANDSCAPE

- Sauer's (1925) classic definition is: The cultural landscape is fashioned from a natural landscape by a culture group. Culture is the agent, the natural area the medium, the cultural landscape the result.
- Parks Canada (2000) describes an Aboriginal cultural landscape as a place valued by an Aboriginal group (or groups) because of their long and complex relationship with that land. It expresses their unity with the natural and spiritual environment. It embodies their traditional knowledge of spirits places, land uses, and ecology.

"The study area is part of a cultural landscape that is rare in eastern Australia for its preservation of detailed Dreaming stories and a combination of associated sites and places, including sites of archaeological and historical value, existing in a visually striking 'natural' environment that imbues a strong sense of place."

"The Burragorang Valley cultural landscape is assessed to be of very high significance" (ACHA page iv)

The recorded and potential archaeological sites and 'cultural values' in the PUAI, EUAI, study area, and other parts of the Burragorang Valley, must be considered as a whole, not a series of disconnected points. Existing within a valley where vegetation, fauna, and ecology has been subject to minimal impact – it is truly a cultural landscape.

CONCLUSIONS

The collective level of significance that the 'cultural values' and archaeological sites and places in the Burragorang Valley PUIA and Study Area, which includes Dreaming sites such as the

story of the Gurrangatch-Mirrigan Dreaming Track, as well as a potentially highly significant archaeological record, warrants that they not be destroyed or disturbed by changing water levels during implementation of 'the Project'.

Following on from the foregoing discussions, the only conclusion that can be reached is that raising of the Warragamba Dam wall – the Project - should not proceed.

Biographical notes for Dr Val Attenbrow, Senior Fellow, Australian Museum BA(hons) 1976, PhD 1987, AHA. I joined the Australian Museum in 1989, retiring in 2011 as a Principal Research Scientist. I am currently a Senior Fellow with the Australian Museum, an honorary position, in which I continue my research into Australian Aboriginal history and archaeology, focusing on south-eastern Australia – in particular the Sydney Basin. My current research focuses on provenancing source materials from which ground-edged artefacts (e.g. stone axes/hatchets) were made (Attenbrow et al. 2017, 2019. Tracing the movement of artefacts from source rock to find-spot (the location at which they were found) enables identification of travelling routes for exchange/trade purposes and for attending ceremonies at which exchanges of material goods and intangible items were made. In turn, exchange systems and social networks can be revealed.

I have written two books (award-winning *Sydney's Aboriginal Past* [2002, 2003, 2010]*; What's Changing* (2004), and two jointly-authored books *Australia's Eastern Regional Sequence Revisited* (2005) and *Microscopic Revelations* (2019) (and written over 80 peer reviewed journal articles and book chapters, some of which address Blue Mountains Aboriginal archaeological sites (e.g. Attenbrow 2004, 2009). *What's Changing,* which contains the results of my PhD thesis, explores the archaeological record of Aboriginal people in the Mangrove Creek Dam catchment in the NSW Central Coast.

I am a Life Member of the Australian Archaeological Association and a Fellow of the Australian Academy of the Humanities. I received a lifetime achievement award at the Australian Museum in 2020; AAA Rhys Jones Medal in 2005 and the Australian Archaeology Association's Mulvaney book award in 2003.

During the 1960s to 1980s, as a member of the Kameruka Bushwalking Club, I walked and camped in many parts of the northern, central and southern Blue Mountains.

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