Introduction To Rock Art Conservation

A Guide to the Preservation of Aboriginal Rock Art

Culture and Heritage Division

DECC

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CONTENT

Photographs: Plate 32, section 3.7 was taken by Tony Harwood (DECC).
Plates 35 and 36 section 3.8 were taken by David Kelly. All other photographs were taken by David Lambert (DECC).

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significant contribution to the DECC Rock Art Conservation Program by supporting both staff and Aboriginal community engagement in conservation works and
encouraging rock art training including support for the printing of this publication.

A personal thank you to my wife Marilyn, who has been my strongest supporter, enduring long absences over many years due to field work projects – there is no doubt that this publication would not have been completed without her support and encouragement.

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ABBREVIATIONS

AHCO
Aboriginal Heritage Conservation Officer (C&HD)

AHIMS
Aboriginal Heritage Information Management System (C&HD)

AHIP
Aboriginal Heritage Impact Permit (Section 90 or Section 87 of the NPW Act administered by CCEPG)

CCEPG
Climate Change and Environment Protection Group)

CH&D
Culture and Heritage Division

DECC
Department of Environment and Climate Change

LALC
Local Aboriginal Land Council

NPW Act
National Parks and Wildlife Act 1974

NPWS
National Parks and Wildlife Service (now Parks and Wildlife Group, DECC)

POEO Act
Protection of the Environment Operations Act 1997 (the key piece of environment protection legislation)

PWG
Parks and Wildlife Group

REF
Review of Environmental Factors (where an activity requiring approval occurs on park)

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1 INTRODUCTION

1.1 Purpose

It is essential that the information provided in this publication is considered an introductory guide to the practice of rock art conservation and is not to be used as a field manual for undertaking Aboriginal rock art conservation projects. This guide has been written to assist Department of Environment and Climate Change (DECC) staff, consultants and Aboriginal communities gain an understanding of conservation techniques and protocols for rock art conservation within NSW. Specifically this introduction is intended to be used by DECC field managers and to support conservation teams to plan for conservation works at rock art sites across NSW.

DECC staff and Aboriginal community members participating in rock art conservation projects are strongly encouraged to use this guide to supplement their knowledge and practical experience gained whilst undertaking rock art conservation training provided by Aboriginal rock art experts.

The Australian institute of Aboriginal and Torres Strait Islander Studies has kindly given permission to reproduce some of the figures and text used herein. These were taken from a publication entitled *Conserving Australian Rock Art: A Manual for Site Managers*

Field work supports the development of new conservation methods, and almost all field work requires the collaboration and participation of the Aboriginal Heritage Conservation Officers (AHCO). These DECC staff are located across the State and their knowledge of site locations and community contacts inform proper consultation prior to and during conservation projects. Many techniques develop during the implementation of community ideas in the field. Without the support of the AHCOs and Aboriginal community members the DECC Rock Art Conservation Program would not have progressed.

Many Aboriginal rock art sites are located on lands managed by the DECC Parks and Wildlife Group (PWG). PWG staff members play an essential role by contributing to the conservation of rock art. The expertise, labour and material support and contribution to rock art conservation of PWG staff is greatly appreciated

1.2 Background

Rock art is found throughout NSW exhibiting distinct regional styles, which reflect a range of media. It documents aspects of Aboriginal life over millennia, is of high heritage value, and has been recognised as contributing to both state and national heritage.

Rock art is produced in a variety of environmental and geophysical contexts, as engravings on rock surfaces, on open platforms and in rock shelters. Drawings and paintings using a variety of materials and binding agents are found in shelters distributed across NSW. Rock art is paradoxically both fragile and enduring, and it expresses and records Aboriginal culture. All regions with rock art sites are well known and are often actively promoted for visitation, which presents a challenge for both presentation and conservation. The deterioration and conservation of rock art is a critical priority for DECC.

NSW has extensive rock art sites, as well as suites of sites. As the majority of sites are situated

in conservation reserves, DECC is responsible for the majority of rock art sites in the state.

There are a number of styles of rock art which are represented in paintings, drawings and engravings. Some past conservation practices have led to the escalation of environmental impacts and have resulted in further damage to sites and it is for this reason that conservation measures and techniques must be carefully planned, evaluated and monitored. DECC staff have extensive experience in rock art conservation, and they have developed their conservation techniques by working with a range of people, from museum conservators to local Aboriginal community members. This work also involves close collaboration within DECC between the Culture & Heritage Division (C&HD), PWG and the Climate Change and Environmental Protection Group (CCEPG) and cultural heritage practitioners working within NSW.

Aboriginal rock art is frequently found on private land, and landowners can make a significant contribution to the conservation of rock art. Private land owners must be consulted during the planning stages of any Aboriginal rock art conservation project. The support of landowners is critical to undertaking successful rock art conservation programs on private land.

1.3 Aim of the DECC Aboriginal Rock Art Program

One of DECC's responsibilities is to protect, manage and revitalise Aboriginal culture and heritage in partnership with NSW Aboriginal communities, and to assist them to retain access to, and control of, that heritage. DECC is the largest single caretaker of Aboriginal rock art in NSW and is responsible for its protection. This document is one way in which this responsibility is being met. In its conservation of rock art, DECC is committed to, and guided by, the principles of the Burra Charter which aims to ensure minimization of impacts through conservation works and effectiveness of conservation techniques. The Burra Charter is available at the National Trust NSW web site: www.nsw.nationaltrust.org.au/burracharter.html.

1.4 Format

The remainder of this document provides details on the conservation of Aboriginal rock art.

Section 2 describes the management context for DECC's Aboriginal rock art conservation program, the legislative framework, and protocols for rock art conservation including a brief overview of the cultural context of rock art.

Section 3 details specific conservation techniques, including site survey and recording, conservation assessment, and site conservation works.

A sample checklist for site conservation assessment, recording, management and reporting is included in the Appendix. References and further reading, a glossary of terms, contact details for DECC staff and sources of further information are also provided as Appendices.

2 MANAGEMENT CONTEXT

2.1 Legislative framework

The *HYPERLINK "http://www.nationalparks.nsw.gov.au/Internet/link.nsf/Content/EL000" \t "blank" National Parks and Wildlife Act 1974* (NPW Act) protects all Aboriginal objects (Section 83) and Aboriginal Places (Section 84) in NSW. Aboriginal objects include rock art sites. Some rock art sites may also be part of a declared Aboriginal Place.

It is essential that any conservation works which may cause impacts (such as removing graffiti) are supported by appropriate authorisation under the NPW Act. Applications for Aboriginal Heritage Impact Permits (AHIP) are assessed by Aboriginal heritage staff within CCEPG. Relevant requirements, including Aboriginal community consultation can be obtained from the DECC website. Unauthorised works can attract fines and penalties. It should be noted that at the time of writing, Aboriginal communities are not exempt from the NPW Act. Works being undertaken by authorised officers of DECC may not require a specific AHIP provided they are in accordance with that authorisation and any agreed protocols for conservation works including a Review of Environmental Factors (REF), where an activity requiring approval occurs on park). Works may also require an environmental impact assessment whether or not a specific AHIP is required due to DECC's *Environmental Planning and Assessment Act* (1979) obligations.

DECC keeps an electronic register of Aboriginal sites and Places in NSW, called the Aboriginal Heritage Information Management System (AHIMS). Undertaking conservation works can result in locating previously unrecorded Aboriginal objects. Under Section 91 of the NPW Act there is a requirement for anyone who is aware of the location of an Aboriginal object to notify DECC. Aboriginal rock art, whether known or unknown, is protected by the NPW Act. All conservation works carried out on a site must be referred for recording on the relevant AHIMS site record. Such notification and recording of rock art sites should be made to DECC's AHIMS Registrar. Contact details and general information can be obtained from DECC websites (see Appendix XX).

2.2 Cultural context of rock art

Aboriginal rock art sites are a very important part of Australia's cultural heritage and many are on the register of the National Estate. Of paramount importance is the significance these sites have for Aboriginal communities. Rock art is one of the oldest surviving art forms, and rock art sites can provide a link between contemporary and traditional Aboriginal life and customs. Consultation and partnership with local Aboriginal communities is essential for the conservation, interpretation and presentation of rock art.

Many rock art sites are registered on AHIMS. AHIMS does not represent all sites in a specified area as there may be a number of unrecorded sites which may or may not be known to local

Aboriginal communities. Information held on AHIMS may be subject to access restrictions due to cultural protocols and include information about who to consult about specific sites.

2.3 Protocols for rock art conservation

DECC is committed to the promotion and involvement of Aboriginal people in all heritage management issues which are encapsulated by the concept of 'caring for Country'. DECC recognises the inherent custodial rights of Aboriginal peoples' in Country and -as expressed in the doucment *Aboriginal People, the Environment and Conservation* (June 2006) available at: www.nla.gov.au/anbd.bib-an000040456475

This section deals with a comprehensive range of conservation techniques and treatments in order to deal with problems and impacts that threaten rock art sites. The techniques have been refined in the field over many years and deal exclusively with problems encountered in NSW.

The aim of this section is to fully document successful techniques so that staff and community representatives who receive field training will have a more complete understanding of the principles involved.

3. 1 **Lichen impact and treatment**

3.1.1 Lichen

Lichen consists of a fungus and an alga co-existing in a mutually beneficial relationship. Each organism generally needs much wetter environments to survive than when combined as lichen which can tolerate harsh environments on exposed rock and in shelters.

3.1.2 Lichen in shelters

Lichen commonly occurs in shelters on damp areas where there is sufficient light. It grows mostly on the lower ledges of shelters where paintings and drawings are usually not found.

Where lichen grows over drawings and paintings, it can cover and damage pigments.
In addition, lichen can add to other weathering processes by retaining water and breaking down the rock underneath the art.

In higher areas of southern NSW and the ACT, a green–yellow lichen type known as dust or dry lichen (Chrysothrix candelaris) commonly occurs. It can completely cover art surfaces in shelters. While the dry lichen will quickly take hold under ideal light and moisture conditions, it is often present in small amounts, well away from any paintings or drawings. After fire or clearing, however, when more light falls on the higher walls of the shelter due to a more open canopy, the dry lichen may take hold and has been known to completely cover the art. When this happens, it is necessary to deal with the lichen in order to avoid damage to the rock art.

A study of dry lichen at Namadgi National Park in the ACT found that it grows only in a narrow range of light. Too much or too little light will kill it, therefore light may be used as an initial management strategy to impede the growth of the lichen and thereby reduce the risk of impact to the art.

3.1.3 Dry lichen treatment

Dry lichen can be removed either by washing or dry brushing. Washing the site will remove the lichen more thoroughly than dry brushing but is more likely to cause pigment damage. Dry brushing is the technique mostly used in the case studies below but will leave many spores behind to recolonise. The Namadgi National Park study referred to above suggests experimenting with reflected sunlight to kill the lichen by excessive exposure.

3.1.4 Case studies

a) Quiera

A long-standing example of dry lichen growing over rock art occurs at the Quiera site in Morton National Park (see Plates 1 and 2). A black and white photograph from around 1950 shows about half of the painted area of the shelter covered in dry lichen. By the 1980s, 40%–50% of the pigment had flaked off or been obscured. Clearly the dry lichen has been a feature at this shelter for a considerable time and, indeed, some of the paintings in white pigment are on lichen-covered rock. Changed conditions after fire opened up the understorey vegetation in the 1980s to allow more light and possibly moisture to the site which led to a dramatic resurgence of dry lichen growth. Clearing and grazing have also significantly altered the nearby vegetation and this may be a continuing factor in lichen growth.

Plate 1: Dry lichen growth over paintings at Quiera in Morton National Park. Old photographs indicate that growth has significantly increased since the 1950s. Investigating the cause of such an increase informs the continuing conservation approach for this and other similar sites.

Plate 2: The same site after treatment for dry lichen. Note that it is difficult to completely remove dry lichen.

The dry lichen was loosened from the rock using bronze brushes followed by 100 mm bristle brushes. Because of the poor condition of the pigment and the weak pigment-to-rock bond, only very light brushing could be tolerated. In some areas of the shelter it was only possible to remove lichen adjacent to figures, leaving the loosely bonded pigment with some lichen still attached. The last step was to wash both ends of the shelter where no art was present to obtain more complete lichen removal in these areas.

b) Gnatalia Creek

Dust lichen was removed at Gnatalia Creek, west of Nowra, in 2002. This is a damp site where a natural silica layer plays a valuable role in preserving the rock art. The lichen bloomed after fires, which burnt through the area. The dry lichen was starting to encroach onto the art and was easily removed by dry brushing before it was able to take hold (see Plates 3 and 4).

c) Dithol Creek

Dry lichen occurs at Pigeonhouse, or Dithol Creek, in Morton National Park. but it is not certain whether it is the same species as in the two previous examples. The shelters are located in a damp environment adjacent to a creek, and there had been no recent fire event. Excessive dry lichen growing over charcoal drawings was removed by dry brushing using 100mm bristle brushes and washing where appropriate. This process revealed drawings that were previously invisible (see Plates 5 and 6).

3.1.5 Summary of treatments to remove dry lichen in shelters

A number of points from the above examples may be useful for field teams planning rock art conservation projects.
Dry brushing with soft (bristle) brushes is the most effective, lowest impact method of removing lichen when changing the light conditions is not possible or is not effective.
Always test on a trial area in an undecorated section of the shelter.
If a large area is to be treated, a protective face mask and dust mask should be worn.
Try to conduct the work during a dry weather period as organic materials have the capacity to hold water and attempts at their removal in wet weather may result in smearing, making the job much more difficult.
Washing is a more thorough way of removing dry lichen provided there is no adverse impact on pigments.
The site will need monitoring to observe any re-colonisation. If this occurs in any substantial way, then a repeat treatment may be required.

3.1.6 Lichen damage to engravings

Lichen damage has been noted at several engraving sites on Sydney sandstone but it does not appear to be a problem elsewhere in NSW. The process is not well understood.

A number of lichen species grow on Sydney sandstone where engravings are common. When the lichen dies it sometimes leaves friable sandstone underneath which quickly weathers to a depth of about two or three millimetres before new lichen is able to re-establish.

There are no specific conservation treatments which have been applied to this problem of lichen growth. It is a simple matter to keep sandstone free from lichens by applying chemicals.

However most local Aboriginal communities and landowners would not welcome this approach and it would also leave the rock with an unnatural colour of quarried stone. Along with the scale and nature of the treatment, environmental considerations such as pollution issues should also be taken into account.

3.1.7 References

Ford, B., Officer, K. and MacLeod., I. (2002). A study of lichen invasion at Nursery Swamp 2, Aboriginal rock art site, Namadgi National Park, ACT. Unpublished report for ACT National Parks Association. 29p

Lambert, D.J. (1994). Conserving Australian rock art, a manual for site managers. Aboriginal Studies Press.

Plate 3: Dry lichen growth in a shelter at Gnatalia Creek. The dry lichen was near to, but not directly over, the rock art.

Plate 4: Dry lichen at Gnatalia Creek being removed by dry brushing. This work was carried out in 2002 and followed recent fires.

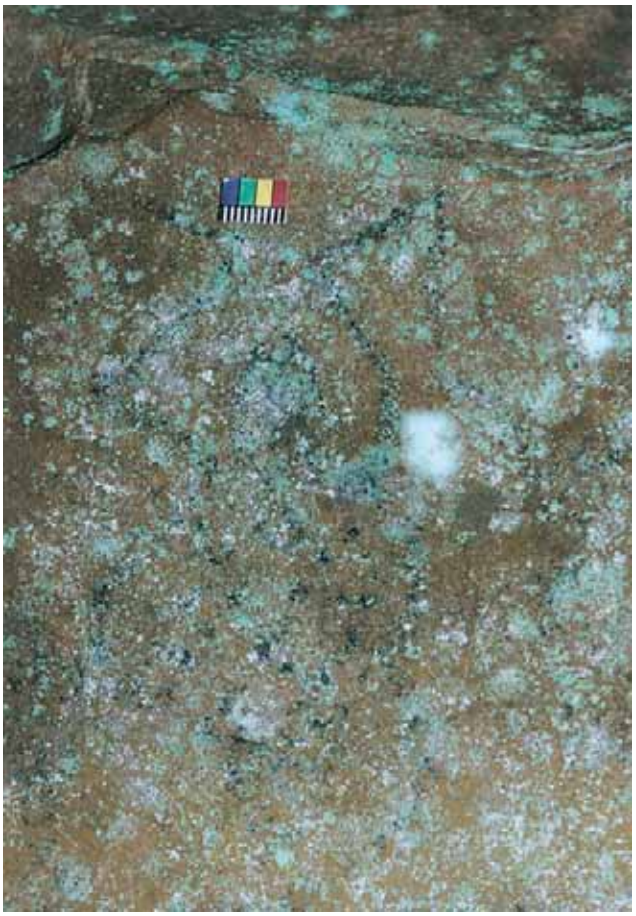

Plate 5: Lichen growth over charcoal drawings at a site at Dithol Creek in Morton National Park.

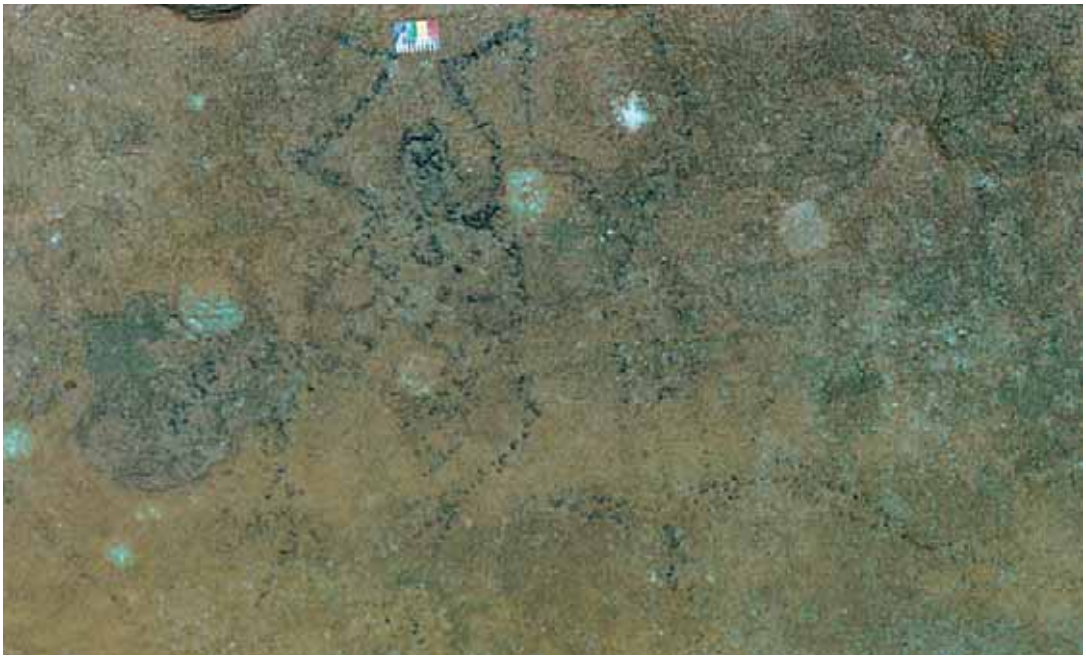

Plate 6: The same site after treatment by washing. Note that it is difficult to get complete removal of lichen

3.2 **Water impact and treatment**

3.2.1 Direct water erosion

Slow water seepage emanating from within the rock face sometimes results in a protective mineral cover, while rapid water flow, especially after rain, generally erodes pigments. Prevention of erosion by water in shelters is straightforward using simple water diversion techniques and driplines. Assessing direct water erosion is often difficult, particularly in areas where driplines have not been placed. The results of direct water erosion are as follows:

There is often a sharp vertical-tending division of art and clean stone, which may present as a white zone adjacent to a black zone at the boundary of the wash line.
Figures are often cut vertically. This dividing line may be sharp or gradual.

Direct water erosion is more commonly evident in:

- areas in western NSW such as Bourke and Cobar where rainfall is heavy but infrequent (see Plates 7 and 8)
- boulders where the shelter profile is shallow and no definite natural dripline is present in the shelter; this is often the case in granite shelters in areas such as Torrington, Glen Innes and Kosciusko (see Plate 9).

Water seepage, which may result in mineral accretion, is much less common than rapid water flow and takes on a different form by emanating from line or point sources.

3.2.2. Mineral accretion

This happens when a layer of minerals, introduced by seeping water, form over the rock art surface. While the composition of the surface-forming minerals can sometimes be complex, by far the most common is silica, also referred to as silcrete. This topic is dealt with more fully by Rosenfeld (1985:21–5).

In the field, the silica will vary in appearance from being invisible to the naked eye, to a thick milky white coating which can obscure the art. Good examples of this occur at sites shown in Plates 9–11. The main advantage of the silica formation is, however, that it appears to be the best known preserver of rock art and may hold the answer to long term conservation of rock art. The source of silica is most likely from solution seeping through cracks and point sources in the shelter wall (see Figure 1).

Plate 7: This painting site at Mt Grenfell, near Cobar, shows motifs which have been sharply cut by surface flowing water, and indicates the need for driplines. Note that the clean rock area to the right of the photo marks the area of surface water flow.

Plate 8: This example, also at Mt Grenfell, exhibits classical evidence of surface water erosion where a dripline is most appropriate. The clean rock zone at both sides of the photo is the area of water flow. The permanently dry area containing art is located in the black zone (centre), and is bordered by a white salt zone which is often the hydrated form of the black material (calcium oxalate).

Plate 9: This shelter shows silica mineralisation being deposited on the rock surface by seeping water. At the left of the photo, the covering is only light and is helping to preserve the rock art. To the right of the photo where the water flow is longer lasting, the silica layer is thicker and pigments are much harder to see.

Plate 10: Another example in the same shelter, however this time the water is seeping from a point source where some iron salts mix with the silica resulting in a brown stain near the source.

Plate 11: A second example of seepage from a point source bringing a mixture of minerals covering the art. This example is in a granite shelter at Back Creek near Inverell.

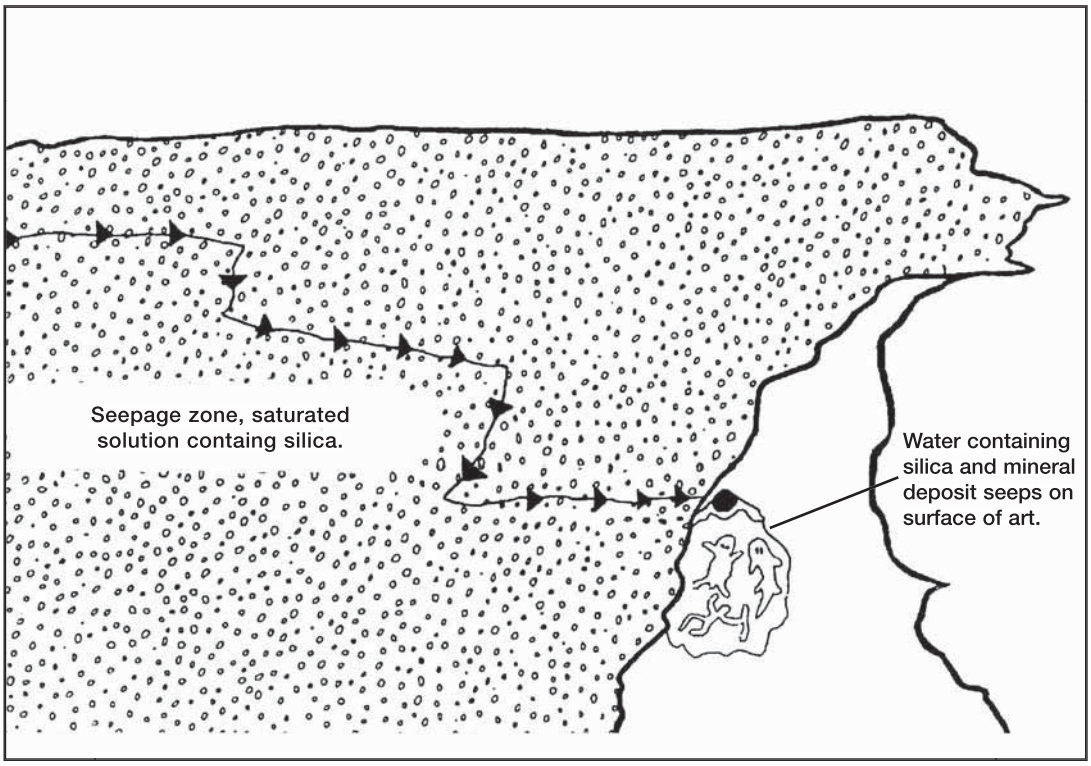

Figure 1: Silica accretion process and detail of seepage zone. Silica mineralisation has been observed below water seeps coming from within the rock.

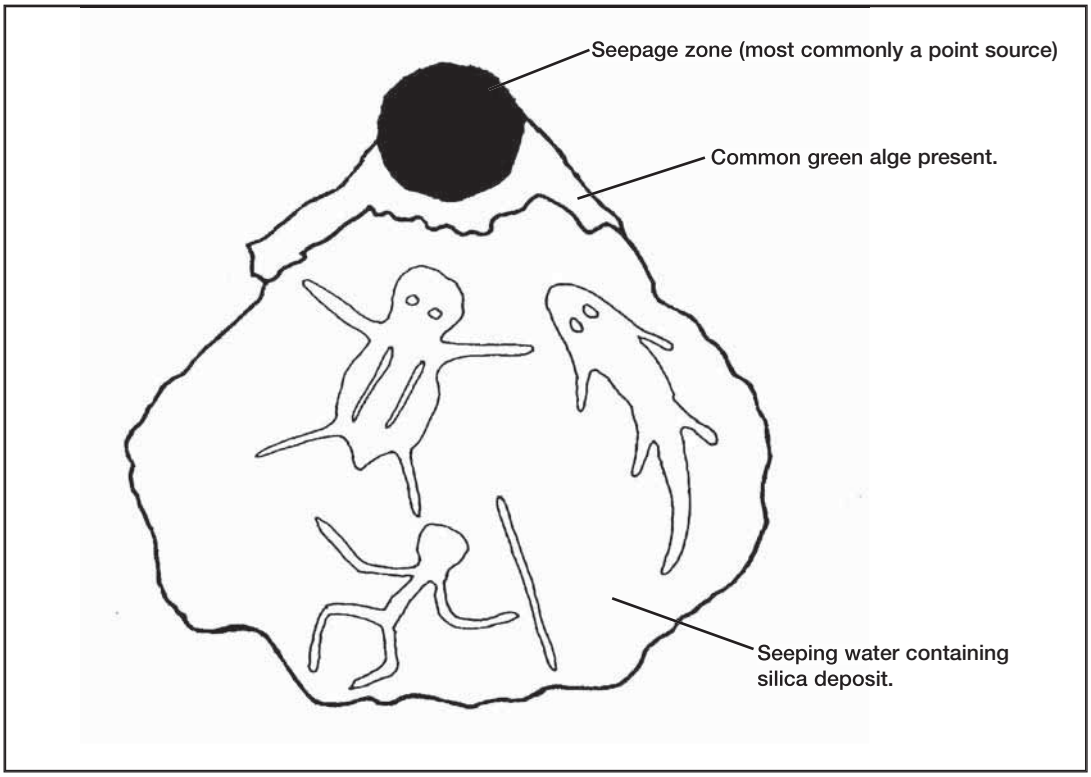

Figure 2: Detail of seepage zone.

3.2.3 **Frost damage**

Frost weathering in the form of flaking or exfoliation of the rock surface is most likely in the cold climate areas of Australia. The mechanism is quite simple: water expands on freezing. In addition, following confined freezing, pressure in the rock increases substantially as temperature decreases down to –22oC (Winkler 1973:177).

Whereas frost weathering is an area of major concern in cold countries like Canada (Wainwright 1985:25), there is no documentation of it at Australian sites. Observation at sites in the colder climates of the Snowy Mountains and New England areas in NSW would confirm whether frost damage plays a role in site deterioration. Water and green algae have been found behind rock flakes in granite boulder shelters in these locations and frost damage may result..The type of damage caused by frost is shown in Plate 12.

3.2.4. Treatment

The treatment for water related deterioration in rock art sites, other than salt damage, is the same in all cases. If the area to be protected can be kept dry then adverse impacts from direct water erosion, mineral accretion and frost will cease.

Water diversion outside the shelter should always be considered, but in practice is only applicable to a small number of sites. Surface drainage channels built on or upslope from the roof of the shelter may successfully divert water away from the site before it reaches the natural or artificial dripline.

a) Driplines

The aim of artificial dripline is to improve the efficiency of the natural dripline of a shelter. The silicone repels water and stops the flow from reaching the art. A frequent misconception is that the dripline channels water along its course. This is not the case and has probably resulted from the use of the term 'water diversion'.

Placement of silicone driplines and silicone fillers is outlined below.
The silicone is applied using a standard gun or dispenser. It is important to apply steady pressure to the gun in order to obtain an even bead of silicone. The nozzle should be angled in towards the rock to obtain good rock surface contact (Plate 13). By cutting the nozzle to an inverted shape the cross section of the dripline is sharpened resulting in a more efficient dripline. A practice run of the whole procedure on a piece of rock is recommended until the technique is mastered.

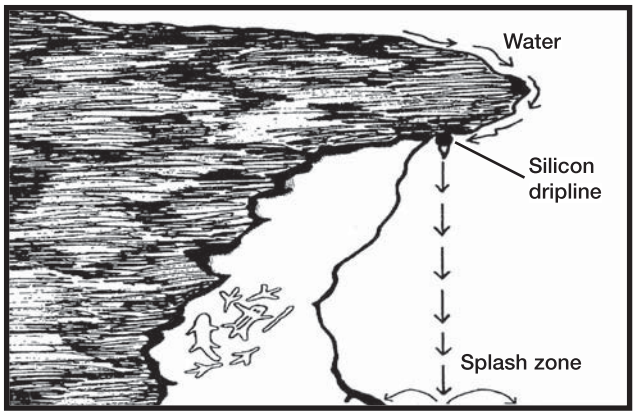

Figure 3: A silicone dripline is usually placed high in the shelter away from the main line of sight. The splash zone should direct water away from the art and not erode the floor. Care should be taken to obtain a dripline that is thick enough and placed in a position to keep the water away from the rock art.

b) Monitoring responsibilities

As with all site management, a maximum but practical level of monitoring and maintenance is recommended. The dripline may be peeled off by inquisitive visitors, a poor silicone-to-rock bond may have gone unnoticed, or the position of the dripline may have been inadequate for the conditions at the site. Any of these inadequacies will show up with time and, if the sites are revisited at later dates, these faults can be remedied.

The earliest driplines placed in shelters in NSW were at Mount Grenfell in 1978. There have been no adverse impacts observed to date. However there is an ongoing responsibility to monitor sites with driplines and check for any harmful effects.

Monitoring introduces two obligations on DECC field managers:

1. They should repeatedly (every five years) observe a sample of sites where driplines have been introduced for any adverse effects, and consult the local Aboriginal community as necessary.

2. They must be prepared to remove driplines in consultation with the local Aboriginal community if long term adverse impacts result.

This is in accordance with Article 2 of the Burra Charter (1981).

While the use of silicone driplines is reversible, it is difficult and time consuming to completely remove the dripline when it has been correctly applied. Although the main bead of silicone may be quickly removed, there is usually a skin of silicone firmly attached to the rock. This skin may still act as an efficient dripline and can only be removed by painstaking wire brushing and scraping. Accordingly, it is recommended that a conservative approach to dripline placement be taken, being careful not to overuse this technique. Driplines should only be applied in situations where actual or likely figure cutting by surface water can be demonstrated (Plate 7). In shelters where art is believed to be very old driplines are only warranted when evidence is present of changed environmental circumstances which present an immediate threat to the survival of the art.

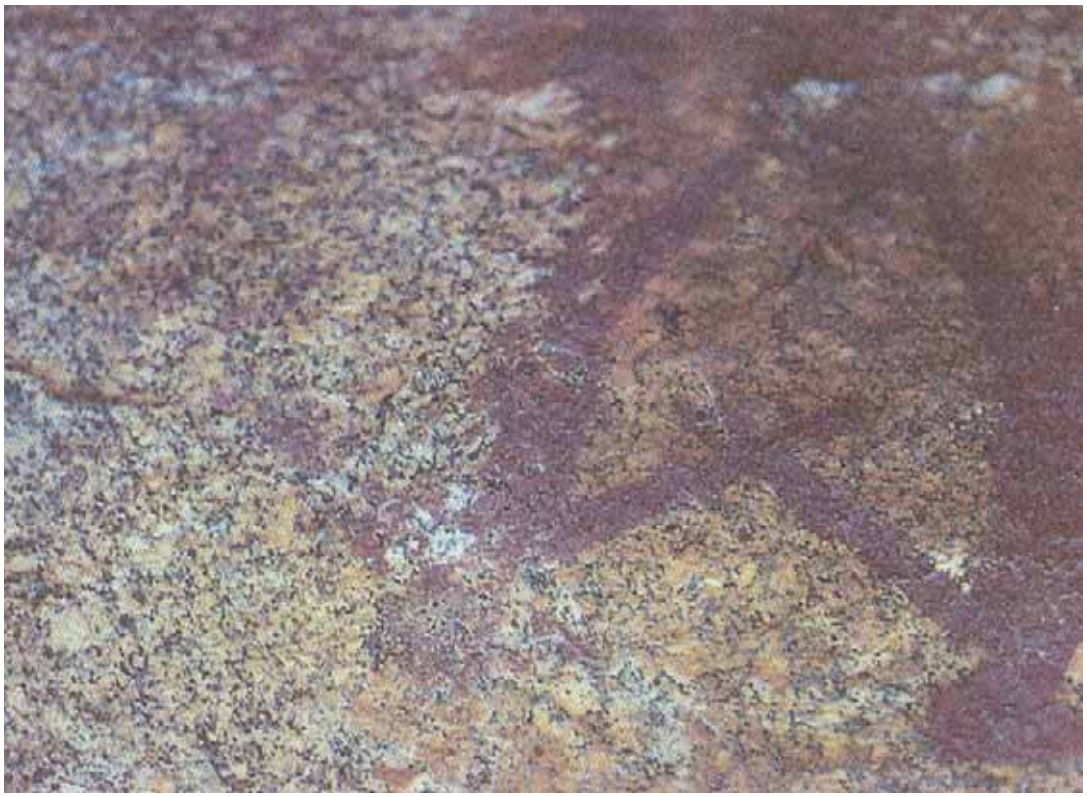

Plate 12: It is considered that the damage to this site is predominantly caused by frost. Freshly pitted rock occurs adjacent to undamaged motifs. There is no sharp vertical line cutting figures as displayed by surface water flow.

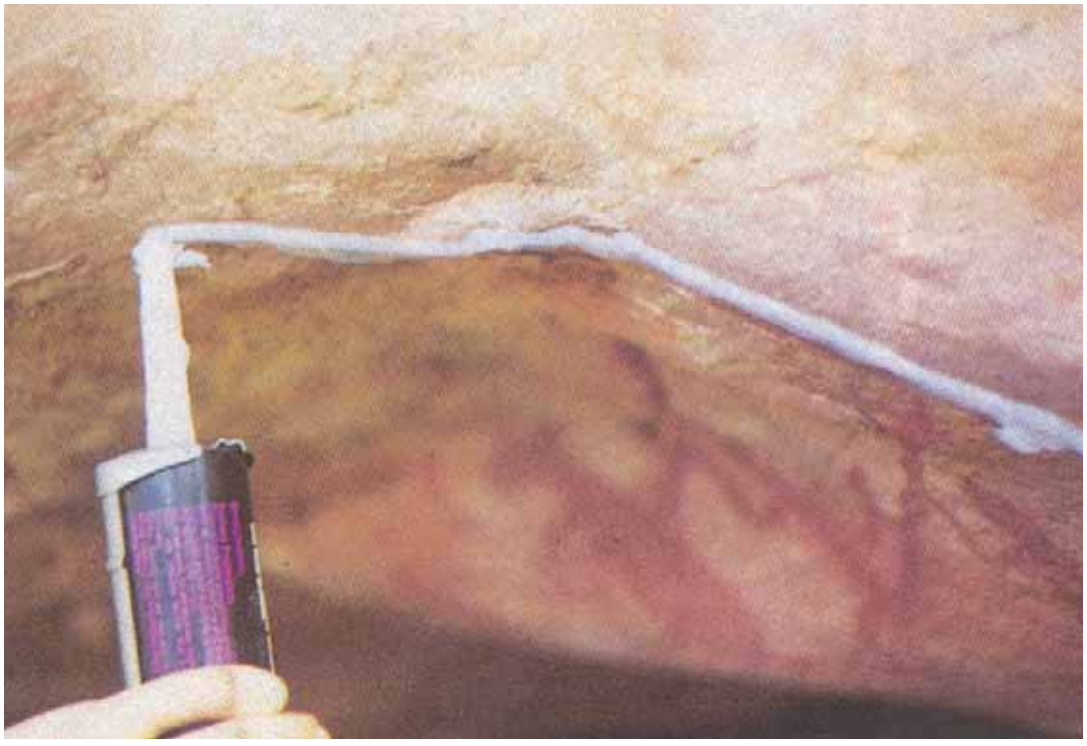

Plate 13: A silicone bead dripline being installed in a shelter near Cobar.

c) Driplines using silicone water repellent

An effective and visibly less obvious dripline can be produced by applying silicone water repellent to the drip area. A band approximately 200 mm wide is usually sufficient although this can be made as wide as necessary to divert the surface water for a particular site.

Application of the water repellent may need to be repeated every five years to rejuvenate the treated area. The great advantage of this less common technique is that the material used cannot be seen, although in some cases a colour contrast may be present where it is necessary to clean the rock surface before applying the band of water repellent.

It is important to choose a silicone water repellent that is suitable for use on dry stone.

The water repellent is applied most conveniently and accurately using an airless spray gun. Silicone water repellent may also be applied by brush but run marks and splash are difficult to avoid. It is advisable to treat a trial area first and test the efficiency of the dripline by spraying water above it. The trial application should be a small distance away from the main area to be treated as the rock surface must be completely dry before applying the repellent.

3.2.5 Redirecting water emanating from cracks or fissures

The surface preparation procedure is similar to that used for the installation of driplines. Narrow cracks or fissures when dry may be filled directly with silicone building sealant. However when the cracks are large (greater than about 4 mm), a product known as Schlarge foam is used to fill the spaces before applying the silicone sealant. Schlarge foam comes in the form of compressible foam rods of various diameters and can be easily compressed to fill an uneven crack or void. The seeping water must then be diverted to a safe area away from the art.

3.2.6 References

Lambert, D.J. (1979). Natural silica formation over Aboriginal charcoal drawings near Gosford NSW. ICCM Bull.5 (2): 45–8.

Rosenfeld, A. (1985). Rock Art Conservation in Australia. Special Australian Heritage Publication No. 2. Australian Government Publishing Service, Canberra.

Wainwright, I.N.M. (1985). The state of research in rock art, rock art conservation research in Canada. Bolletino del Centro camuno di Studi Priestorici Vol 22:15–46.

Winkler, EM. (1973) Stone: Properties, Durability in Man's Environment, Springer Verlag, New York.

3.3 **Salt decay and treatment**

3.3.1 Salt decay

Salt decay is most evident in sandstone shelters. In buildings this type of weathering is referred to as rising damp. The practice in building conservation is to separate the deteriorating stone from the water source by putting some form of damp course in place. Thus by removing the cause, any further damage is prevented.

Sandstone containing approximately 1% by weight of salt will be soft and badly deteriorated. Salt weathering of sandstone takes the appearance of fresh white stone, usually on a vertical face with a deposit of clean white sand at its base. The erosion zone often takes a scallop shaped form ranging from several centimetres to several metres across.

The salt is most likely to be derived both from rainwater (which contains low concentrations of salt), and groundwater which will give a more local flavour to the final salt composition. The salt is concentrated and builds up in areas of evaporation not capable of being flushed by rainwater (Figure 4).

The rate of erosion of sandstone due to salt is high and of the order of 0.1 mm per year (Lambert 1980:32) making salt erosion a major factor in the weathering of sandstone shelters (see Plate 14). It is also interesting to note that salt decay is also prevalent in inland shelters.

This type of stone decay has been well documented by Winkler (1973), Lambert (1980), Lewin (1982), Amaroso (1983) and Rosenfeld (1985).

3.3.2 Treatment of salt decay

Treatment for salt rock weathering has had mixed success. With rock shelters, the use of a damp course is impractical and other less effective, but often very helpful steps may be taken.

a) Water diversion

It is sound conservation practice to keep sites as dry as possible. Check that water does not collect on the roof of the shelter as this may be slowly directed towards the artwork through porous rock or through cracks and fissures in the roof. The rock shelter at Mt Grenfell, near Cobar in western NSW, is an example where water was directed off the roof by removing soil and vegetation from the roof and allowing the water to run off by opening natural drainage lines to the side of the shelter. In addition, some minor drainage channels were built on the roof of the shelter using sand, cement and rock. In this way, runoff was directed away from the site.

b) Water flushing

This treatment consists of spraying the affected salt weathering area with fresh water to flush out soluble salts. Areas containing paintings or drawings should not be sprayed however as these areas will be very friable and spraying will be likely to damage painted surfaces. Water spraying is simply a holding operation and has been observed to work in several Sydney sandstone sites. This treatment can be used where salt threatens to erode nearby art. The method is to lightly

spray water from a knapsack onto the affected area. The amount of water to be used is approximately 20 litres per square metre of salt damaged rock.
This method should be used with caution given the following:

The spraying must be regularly repeated – in Sydney sandstone, approximately every 1–2 years. The resultant water runoff must be able to escape freely from the shelter without causing damage to other parts of the site.

This method only helps to remove some of the accumulated salt while the source of the problem remains.

At sites in the Pilliga Nature Reserve north of Coonabarrabran the weathered sandstone runs much deeper than in other areas of the state (see Plate 15). Applying water to sites in this area is not recommended as wetting the affected stone results in it becoming extremely soft. More work is required in this locality in order to better understand the localised salt problem (see also Section 3.3.3).

c) Long fibre paper

Soluble salts located over and in painted surfaces can be removed by a series of fresh water poultices applied through a protective layer of long fibre tissue paper. Long fibre paper, also known as Japanese paper or hemp paper, maintains its strength when wet. It is used when working with water over water sensitive pigment such as white clay, or in cases where pigments are loosely bonded to the rock surface. While it is likely that most forms of long fibre paper would be suitable, hemp paper has been used successfully.

A small trial area should always be selected in an obscure part of the site low down in the shelter to avoid water washing down on to figures below before applying the technique over a large area.

The method used is as follows:

1 Lay a dry sheet of the paper over the trial area.

2 Ease the water into the paper using a clean 100 mm bristle bush or a small spray bottle; the wet paper will cling to the surface .

3 For poulticing add more layers of paper.

4 Allow the poultice to dry and remove.

5 Repeat as necessary to remove all traces of salt.

3.3.3 Monitoring prior to treatment

Washing of dry pigments used in drawings can result in some pigment loss. Accordingly it may be preferable to monitor the site prior to treatment. Salt weathering can be rapid so monitoring may only need to be carried out over one or two years in order to be certain that treatment is warranted. Plate 16 is a monitoring photo of suspected salt weathering causing damage to charcoal drawings at a site in Popran National Park north of Sydney which will be retaken to

ascertain whether a washing treatment is justified. If further damage is evident then the site will be treated using the above techniques. Monitoring photos can then be retaken a year after treatment to confirm whether the treatment has worked.

3.3.4 References

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Plate 14: Salt weathering undercutting engravings at Pilliga Nature Reserve north of Coonabarrabran.

Plate 15: Spraying water on a salt-affected area at the above site as a trial to see if weathering is reduced. Note that the sandstone here becomes friable when wet so a very light spray is required to avoid further erosion

Plate 16: Monitoring photo of suspected salt weathering of charcoal drawings at Popran National Park. This monitoring photo will be retaken to ascertain whether a washing treatment is justified. If further damage is evident in the repeated photo then treatment using water spray and long fibre paper will be undertaken. Monitoring can continue to determine if the treatment has been successful in stopping the erosion.

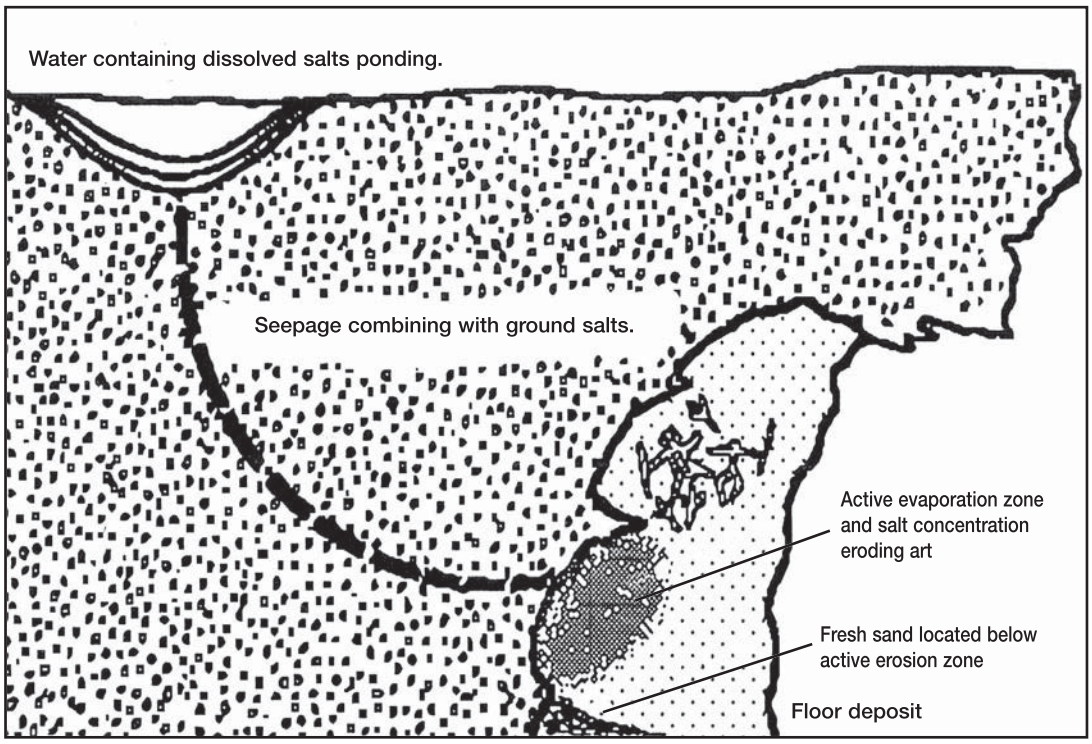

Figure 4: A simplified section of a shelter demonstrating the salt weathering process.

3.4 **Animal and insect impact management**

3.4.1 Damage by animals and insects

Damage has been observed in rock shelters from animal induced dust and urine. The most common and damaging impact, however, relates to animals coming in direct contact with the art.

Mud building organisms cause widespread damage to art by building mud nests and tracks over painted surfaces in rock shelters. Offenders include termites (Isoptera), mud wasps (Hymenoptera), and mud nests of birds such as the welcome swallow (Hirundo neoxena), distributed in the southern two-thirds of Australia, and the fairy martin (Petrocheridon ariel) which has an Australia-wide distribution (Slater 1992).

a) Termites

Termite damage to rock art sites is uncommon in NSW and is usually limited to damp shelters. Permanent damage to art occurs through contact with mud nests and mud runway tunnels.

b) Goats

Rub damage is from a height of 1.5 metres to ground level and can also be present on walls above ledges. It has a dirty, greasy appearance. There is usually plenty of dung on the floor which is similar in size to sheep dung, but ovoid rather than spherical. Goat hair and a characteristic goat smell may also be evident.

c) Macropods

Damage often appears in isolated camp spots but may extend along the wall of the shelter below 30 cm in height. It has a grey to black greasy appearance, but is usually less obvious than that of sheep and goats.

d) Pigs

Pigs like to scratch and rub after wallowing in mud. Accordingly, the affected area takes on a dirty or mud caked appearance 30–60 cm above floor height.

e) Cattle

With cattle, rub damage is confined to low ceilings, sloping wall areas and protruding sections, mostly a metre or more above floor level.

f) Lick damage

This is caused mainly by feral brumbies and cattle, which lick protected rock faces containing concentrated salts such as soluble chlorides. The problem is uncommon.

g) Mud nests

Mud building birds seem to prefer to nest where their predecessors are or have been.

Accordingly, the first step in conservation and future prevention is to completely remove all mud nests near art work and leave nests which are not causing any damage to the site.

h) Bird droppings

Bird droppings are found where birds nest or feed, and can result in pigment removal. Where deep shelters are preferred for mud nests, such as around Bourke and Cobar, droppings usually fall to the ground and not over painted surfaces.

3.4.2 Treatment of damage

a) Termite control

Two possible methods of control outlined by Watson and Flood (1987) are chemical treatment and nest destruction. The use of chemicals is not recommended on the basis of toxicity and related environmental and occupational health and safety aspects. There are additional problems of ensuring that a necessary and absolute chemical barrier is made in order to isolate the rock art surface from the soil below.

Nest or mound destruction is the most effective method of control. Earth mounds should be dug out, the queen found and destroyed, and the mound material dispersed. Where mounds occur in an archaeological deposit, advice should be sought before disturbing the earth mounds. Nests in trees should be destroyed within approximately 50 metres of the art work.

Monitoring for re-infestation is recommended, preferably at the end of the next wet season and then every two or three years, or as necessary. Existing termite runways should be left undisturbed unless they are threatening to cover previously intact areas of rock art, as newly constructed runways might extend the area of damage.

b) Removal of animal rubbing stains

There is no known method which successfully removes animal stains from rock surfaces, and it appears that this type of damage is permanent. Accordingly, the conservation approach is one of prevention, by site fencing.

c) Stock and animal fencing

This is the only practical method of animal damage prevention.Fences must be capable of excluding the animals which are damaging a site. Goat and macropod fences need to be at least 2 metres high and of sufficiently fine mesh so that goats do not get their horns caught in them with unfortunate results. Cattle fences need to be strongly reinforced with well anchored corner posts. Aesthetically it is preferable to bring fences out sufficiently from the site so as not to interfere with the viewing of the art, and to reduce the visual impact of the fence on the site as a whole. Finally it is also important when designing fences to consider the following questions:

Will the fence withstand bushfires?
Will vegetation growth inside the fence pose a fire hazard?
Is occupation deposit present which could be impacted by placing fence posts?

d) Floor grids

Floor grids have been used successfully to exclude goats and other hoofed animals in the Broken Hill area. These grids are an alternative to mesh cages which have a major visual impact when presenting the site. The grids need to be raised about 50 mm off the ground and can be designed to support human traffic. The grids in the two case studies below were underlayed with enviromat so that any new goat dung could be quickly spotted when revisiting the site. Two case studies are presented in Section 3.4.3 below.

e) Removal of nests and droppings of mud building birds

While the following deals specifically with swallow nests, the same procedures apply to the removal of fairy martin nests.

Mud nests of swallows have been identified as a particular problem in the Cobar and Bourke areas but are also present to a lesser extent in other parts of NSW. Around Cobar and Bourke, deep shelters present a desirable nesting habitat for this bird. Mud nests are built on the ceiling and overhead slopes with white droppings usually falling on the ground and not over painted surfaces. The paintings here are in red ochre and clay based pigments which have insufficient silica skin cover to allow the surface to be washed.

The unused outer mud nest is removed by hand or with a wooden prod leaving a dry, caked mud base on the rock surface. If the whole of the nest comes away it is important to check that no pigment has come away with the nest material. Even very small amounts of brightly coloured pigment are clearly visible against the dull brown colour of the nest material. If pigment is being removed with the nest material then a slower approach must be taken by removing smaller amounts of nest material; starting at the outer part of the nest and gradually working towards the centre of the art.

Most of the dried mud covering the art can be removed using a brass brush working carefully until the art work is revealed. A softer bristle brush should be used when coming in contact with the painted surface.

In cases where silica salts protect the pigments, water can be used to assist in the complete removal of the nest material. Water can be fed into the base of the nest using a 100 mm bristle brush. When the nest becomes friable it can be peeled away from the rock surface.

f) Removal of bird droppings

The following procedure is used where the site can be washed:

1 A trial area of rock covered by bird droppings is washed using non-ionic detergent (Lissapol N) and water. Choose an area away from the art and at the lowest part of the affected area.

2 If no adverse effects are observed immediately following the trial treatment, the washing area can be extended to art surfaces. Care must be taken to observe any deleterious effects, especially if dirty water flows down over further paintings.

3 After the entire area is washed it is then lightly sprayed with clean water.

Most of the bird droppings can be successfully removed. Complete removal may require harsh scrubbing which may cause damage to the site and so should be avoided.

The mud stains left by the former nest may remain with the art in this vicinity noticeably fainter.

Where the site cannot be washed without damaging the art the result will be less effective. Dry brushing can be tested on a small trial area, but may not be viable if smudging results. Plate 17 shows this procedure being carried out.

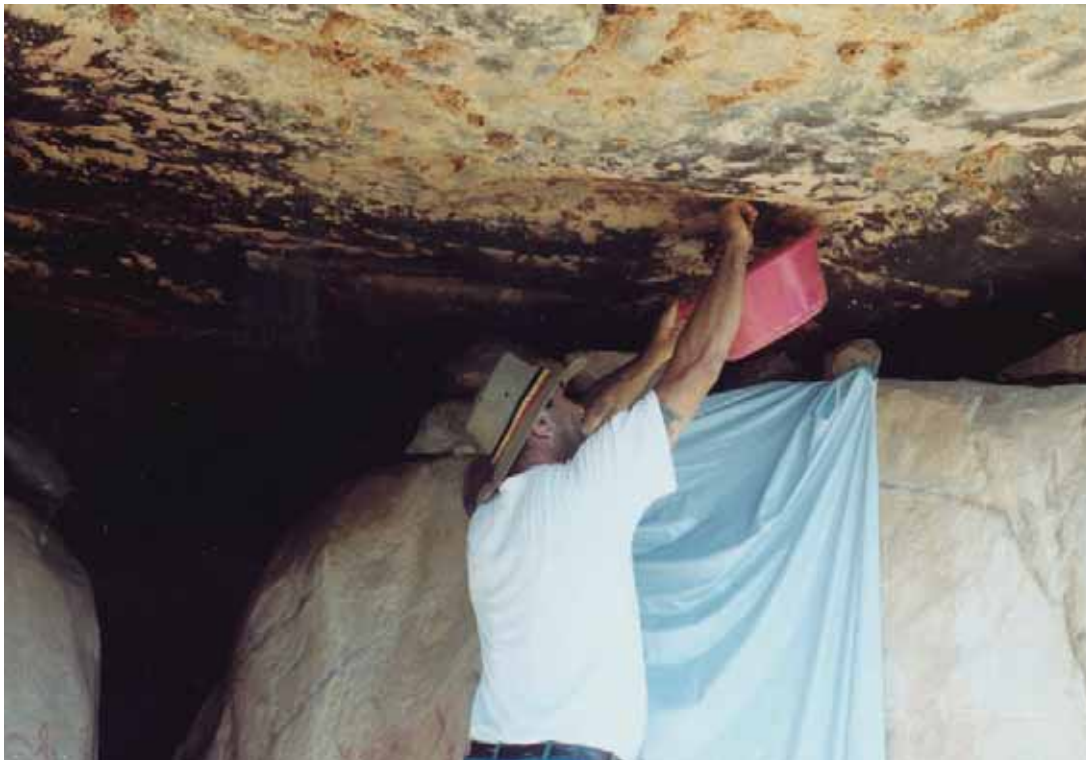

Plate 17: Swallow nest and associated droppings being removed at Wuttagoona, near Cobar NSW. Note that drop sheets used to reduce dust coming into contact with art.

g) Removal of mud wasp nests

It is recommended that mud wasp nests be removed from sites on the basis that:

When over rock art they may cause irreversible damage. Their presence appears to attract more nests (Naumann 1983:79).

Old nests often break up and may drop dust and organic material onto art surfaces below.

The procedure for removal is simple and may generally be carried out during a routine inspection as the following typical case study demonstrates.

3.4.3 Case studies

a) Removal of wasp nests at Goonoowigal, near Inverell

This is a granite boulder site with red pigment paintings on a vertical face. Mud wasp nests were typically located out of reach on the roof of the shelter in a dry, well protected part of the

site. The nests were located near to, but not on top of, the art panel.

Rock art located directly below the nests was covered with a section of polythene sheet. The project team member, while standing on a ladder, pulled off the mud nests by hand or knocked them off using the blunt wooden handle of a bronze brush. Most of the nest broke cleanly away from the rock surface and was thrown outside the shelter. Remaining dried mud was then brushed off the rock, using a dry 100 mm bristle brush or a brass brush for more persistent material. It was not necessary or desirable to wash the site.

Approximately 40 mud nests were removed in this way, taking a little over an hour to complete the job. Two new wasp nests were removed several years later following re-inspection of the site.

b) Moonavale

A site with no mesh screen gives a better visual impression (see Plates 18 and 19). A small amount of goat dung was found on the floor of the shelter and was possibly due to an isolated event where goats were chased in by dogs, as the site is not far from the homestead.

The mesh was sitting hard on the ground and the advantage of raising the mesh floor off the ground slightly was considered as a design improvement. There was no evidence of goat damage to the art so that, despite the fact that goats had entered the shelter, the mesh was still sufficient to protect the site.

c) Split Rock – Mutawintji

This site has a slightly raised platform 50 mm off the ground. There was no evidence of goat dung under the platform so there was little doubt that raising the platform excluded goats which were present in large numbers at this location.

3.4.5 References

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Plate 18. Inspection of the site and floor grid at Moonavale near Broken Hill. A small amount of goat dung was still evident after the grid had been installed and this was attributed to the grid not being raised off the ground.

Plate 19. Close-up of grid at Moonavale. The grid overlays an enviromat base so that evidence of goat dung can be observed easily. A small amount of dung was found so the grid was raised.

3.5 **Soil and vegetation cover impact management**

3.5.1 Impact of soil cover

a) Engravings

Many engraving sites are being encroached on by vegetation and soil. In some cases the construction of walkways and increased visitation has led to increasing soil cover, mainly working in from the edges of engraved rock surfaces. Also in undisturbed isolated sites it is necessary to remove mosses and associated soil cover to reveal engraved figures.

By allowing rock to become soil covered we are effectively moving from predominantly mechanical weathering to chemical and microbiological weathering. Traditional weathering theory deals with both weathering types but does not compare the two in terms of weathering rates.

Chemical weathering may render the rock more friable while it appears to be structurally intact. A freshly exposed engraving which was covered by moss or soil may appear sharp and intact (this may be accentuated by the light colour of the exposed rock), but in fact it may be more friable and quickly lose any groove integrity once exposed. For example, at Bulgandry, an engraving site developed for tourists, the groove profile of over half of a figure from which soil was removed is considerably more weathered compared with the other half of the figure which was continually exposed.

West Head in Ku-ring-gai Chase National Park is an example of engravings covered by surface soil and vegetation which was removed using brooms and shovels to within a few centimetres of the engraved rock surface. The remaining soil was washed away using a low-powered fire hose (see Plates 22 and 23). A wash-away area was created at the lower end of the site to allow surface water and sand to escape and to avoid future soil build-up.

The following conclusions are drawn:

Soil cover results in chemical weathering which causes the rock to become friable; however mechanical weathering is generally reduced.
The worst scenario is therefore one of repeated cover followed by exposure.
Previously uncovered engravings should be kept clear of encroaching soil and vegetation.
Engravings which have been covered for long periods resulting in a soft and friable rock fabric should either be left covered or, if exposed, consolidated in some way.

b) Paintings and drawings

At the Cathedral Cave site in Carnarvon Gorge, Queensland, while engravings extend down the main rock face for 90 cm below the earth floor, no ochred art is observed below ground level even though it is abundant on the walls. It appears that weathering is significantly greater below than above soil and that pigments may not survive when they are covered by soil.

There are many examples throughout Australia where the lower parts of figures painted on the wall of a rock shelter have disappeared, as the result of soil deposit or occupation. This effect is often present above floor level where dust has removed or damaged pigments.

From the evidence, it would seem that soil and dust have a detrimental impact on rock art and conservation should be directed towards prevention and removal of soil cover. Removal of occupational deposits requires consideration of an AHIP (refer 2.1).

3.5.2 Impact of vegetation

Vegetation growing near sites may have both positive and negative impacts for conservation. Positive impacts relate mainly to soil stabilisation, which may reduce the amount of free dust and dirt, either windblown or kicked up by visitors, particularly in arid environments. Negative impacts may include physical damage by the splitting of rock by tree roots, direct rubbing of plants on pigments which also provide fuel for fire. Drastic changes to vegetation structure may also lead to alteration of microclimate, which in turn may result in the growth of moss and algae.

In shelters, the splitting of rock by tree roots is documented by Walsh (1984:112–14) in the Central Highlands, Queensland, where the roots of rock fig trees penetrate narrow crevices, often leading to rock failure. At Whale Cave, south of Sydney, cave roof failure following mining subsidence was observed to partly follow cracks caused by tree roots from a eucalypt growing on the roof of the shelter.

Shrubs and trees have been observed growing close to or over painted surfaces. Large ferns were moved from Blackfellows Hands Shelter in the Blue Mountains National Park (Plate 20); these ferns were rubbing the rock surface, and had removed rock art. Plants have also been removed from sites at Wuttagoona in western NSW (Plate 21). In such cases the environmental effect of removal, together with the possibility that the removal of vegetation may offend Aboriginal people or landowners who have responsibilities for the site must be taken into account. These considerations are weighed against existing and potential damage if the vegetation is to remain, in terms of both physical and potential fire damage.

One final impact marked by vegetation change is considered here. In several cases this has resulted in an effect on microclimate which has in turn eventuated in the proliferation of microflora such as algae, fungi and moss. Lichen damage is covered in Section 3.1..

Plate 20. An example of vegetation growing too close to a site at Blackfellows Hands near Lithgow. Unchecked, direct rubbing of the rock surface will eventually damage the art at this site.

Plate 21. Removal of vegetation inside a goat exclusion fence at Wuttagoona near Cobar.

a) Considerations before removing vegetation

Removing vegetation is relatively straightforward, however several factors should be considered before proceeding such as the legislative requirements (2.1) and consideration of the Threatened Species Act and species recovery plan, for example.

Removal of vegetation should only be undertaken where the damage or potential damage to the site is obvious, for example direct rubbing or vulnerability to fire damage.

The adverse consequences of vegetation removal should be assessed; for example algal growth due to more light in the shelter or alterations to the microclimate with increased evaporation or encroaching rain.

The aesthetics and integrity of the site should be maintained or enhanced.

Aboriginal People or landowners may need to be consulted to avoid giving offence by the removal of vegetation.

Vegetation to be removed should be identified to determine whether it is indigenous. Plants that are uncommon to the area, or food plants, may have been introduced by members of the local Aboriginal community and hence may be considered part of the site.

The following guidelines are suggested for trees and associated branch rubbing.

b) Trees

Where trees cause rock face splitting and root damage, the only solution is to cut the tree down and paint the cut stump with undiluted glyphosphate.

An alternative is to poison the tree by cutting into the sapwood around the base of the tree and painting undiluted glyphosphate.

c) Branch rubbing

It is generally sufficient to prune the offending branch only.

3.5.3 Soil removal at engraving sites

The recommended procedure for soil removal is:

1 Assess the area to be cleaned. It may not be advisable to clear all soil and vegetation from the area. Pockets of vegetation, even if centrally located, may add to both the integrity and aesthetics of the site.

2 Remove vegetation with shovels or manually, taking care not to scratch the rock surface (Plate 22).

3 Wash down the site, using anything from a knapsack to a water tanker or fire truck, depending on the scale of the operation (Plate 23). In order to avoid the risk of surface damage, no high power water jet should be used.

4 Treat small areas and work down slope. Some shovelling may be required to move accumulated soil.

For a small scale operation (sites less than 20 square metres), it may be preferable to remove soil by dry brushing and let future rain do the final washing down.

The recommended procedure is:

1 As above.

2 Remove vegetation carefully as it often takes much of the soil with it.

3 If necessary remove soil up to 1 metre from the edge of the site to avoid future build-up.

4 Remove excess soil with a shovel, provided that this can be done without scratching the rock surface.

5 If the area is damp allow time for the site to dry. It may then be dry brushed by hand using 100 mm bristle brushes, or larger, soft nylon brushes.

6 To conserve the site, consider appropriate drainage and water diversion to prevent soil build-up (Plate 23).

Dry brushing has advantages over washing on a small site, in that it can be applied in isolated areas, and hand brushing allows close observation of its impact on the site. Dry brushing using soft bristle or nylon brushes usually has minimal impact.

3.5.4 References

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Plate 22. Removing soil and vegetation covering engravings by shovelling the upper soil layers and using low water pressure from a fire fighting striker unit. This site is located near West Head in Ku-ring-gai Chase National Park.

Plate 23. The final stages of the wash down. The drainage channel created at the right-hand side of the photo allows water and soil to run off and reducing future soil build-up.

3.6 **Visitor management**

3.6.1 Visitors to sites

Where visitors are already attracted to sites, it may be necessary to consider management options to protect the site. These may include improving the visitor experience while at the same time minimising damage to the site and maintaining site integrity. Site managers often feel that sites developed for visitation are sacrificed to tourism. Gale and Jacobs (1983:40) suggest that the presence of visitors appears to limit damage because acts of vandalism are less likely to occur when no-one else is present. Thus there comes a point at which increasing visitation will reduce acts of vandalism.

Examples of sites which fall into this high visitation category include:

West Head (Ku-ring-gai Chase National Park)
Mutawintji (Mutawintji National Park)
Bulgandry (Brisbane Water National Park)
Jibbon (Royal National Park)
Red Hands (Blue Mountains National Park).

3.6.2 Options to address overvisitation

In dealing with visitation, the site manager has a number of options which include doing nothing or:

promoting one site to reduce visitation to another site
restricting access
limiting the number of visitors
using signs
using a visitor book
providing on-site interpretive material
providing guided tours
using barriers such as:
- mesh screens
- low fencing or barriers
- footpaths and boardwalks.

Details of each of these options are given below

a) Promoting a site to reduce visitation to others

As a general practice, high visitation sites are selected for development as ‘tourist sites’ while, at the same time, site managers attempt to reduce levels of visitation at the remaining, undeveloped sites.

This practice may take several years to succeed, particularly near well populated areas where a high proportion of visitors are local. Attempts were made near Gosford to divert visitors from a famous complex of engravings known as the Feast Group to Bulgandry, a nearby developed site. The track to the undeveloped site of the Feast Group was partly obscured and allowed to

overgrow. Signs encouraged visitors to go to Bulgandry. Visitation has slowly been reduced at the ‘protected site’ to a level where very few people visit it.

b) Restricting access

To discourage visitation to a site it may be necessary to:

delete all references to the site from maps and written material

avoid public acknowledgement of the site’s existence

camouflage the start of the access track to allow revegetation.

c) Restricting information

Restriction of site register information, particularly location details of isolated sites, remains one of the best protective measures against visitor-related site deterioration. Discretion rests entirely with site managers and others managing the AHIMS or information promoting the site.

d) Visitor books

A visitor book has a two functions. It can provide insight as to who is visiting the site and what they think about it. Visitors who write in the book generally pass on comments on their first impressions and may make useful suggestions. Another function of the visitor book is to divert vandalism away from the site and into the book. Bad language or racist comments written in the book can easily be removed or the book replaced, whereas the same vandalism at the site is much more difficult to deal with. In one recent case at Dharug National Park it was possible to identify names scratched on an engraving site with a corresponding entry in the visitors’ book by a school group.

Here are some guidelines for leaving a visitors’ book at a site:

The book needs to be protected from the elements; a metal stand is often used (Plate 24).

The book should be hard-covered to make it easier to write in.

The pages should be ruled up, with headings on the left-hand page for date, name and address, and the right-hand page for comments.

The book should contain information about the site. A plan of the site and discussion of its history and features is also recommended. General information, publications or copies of relevant reports about sites and site protection can be included in the back of the book, together with the address of the nearest DECC office and local Aboriginal Land Council (LALC).

Remove graffiti and deliberately offensive comments, either racist or obscene, as soon as possible.

e) Signs

Signs in sites can be either official or interpretive. Each serves a purpose as described below.

Official signs give some sort of official acknowledgement and are applicable particularly to isolated sites of significant heritage. Visitors coming across a site in an isolated area may feel some right of ownership; if they think they have discovered a new site, graffiti or pilferage may result. An official sign reveals that the site is both known and monitored by the authorities.

A second function, as with visitor books, is to redirect vandalism from the site to the sign. Vandals appear to gain more satisfaction by striking at officialdom.

On-site interpretive signs vary in content and design. Sign content needs to be site specific. General information can be misleading and visitors' needs are best satisfied by information.

While it is difficult to formulate a definitive requirement for interpretive signs, people prefer to read signs which (Gale and Jacobs 1987:91–2):

contain few words
have photographs or diagrams and where possible utilise the back of the sign,
are well located.

Signs should be placed in a location which is visible inside the shelter. It is important not to draw attention to the site from outside, but be placed sufficiently away from the art so as not to interfere with photography.

Studies indicate that more people were likely to read detailed signs located at a car park rather than en route to or at the site. When the sign was located at the site it was important to the visitors that its position did not obstruct the view, particularly for photography.

f) Printed material

In cases such as Sydney engravings where motifs can be hard to see, a diagram of recorded figures will enhance the visitor experience, for example brochures for Bulgandry and Daleys Point. Similar material is readily available at sites like Jibbon in Royal National Park.

Recorded diagrams of painted and drawn figures may be attached to the visitor book; a good example is at Mount Manning art site on the Central Coast.

Printed on-site leaflets need to be site specific. However, this sometimes results in brochures littering the site and the need for regular maintenance.

In guided situations, littering does not seem to be a problem. Therefore, brochures can be successfully incorporated into guided tours.

A good example is the brochure for the Bulgandry engraving site near Gosford, which allows visitors to identify figures while viewing the site (see Attachment A end of section 3.6).

g) Guided tours

Guided tours of Aboriginal sites have been operating in several states. An extensive guided tour system is in operation at Kakadu National Park, and guided tours also operate at Mutawintji. Kakadu National Park runs a tour operator training course at the beginning of each tourism season. This greatly assists with educating tour operators in the correct behaviour at sites and provides accurate facts and information. The disadvantages of poorly guided tours, which

frequently result in a high level of touching of art by visitors with operators providing either incorrect information or no information at all. As a result responsible managers are obligated to train tour operators who take visitors to Aboriginal sites. A tour guide training program has been proposed at Mutawintji National Park.

In addition to commercial tours, there are Discovery Ranger (PWG) guided tours of sites, which are generally of a high standard of tour information and conduct.

h) Mesh screens

The NPWS built mesh screens during the 1970s and 1980s – these are person-proof steel mesh grills which have been erected at a number of sites in NSW. They generally consist of galvanised steel mesh fixed to a galvanised pipe frame, which is, in turn, attached securely to the cave entrance. The screens restrict visitor entry to a site and usually have a locked gate.

In all cases mesh screens were built in shelters which were thought to contain significant sites under visitor threat, either close to centres of population such as Sydney or in remote areas subject to tourism. In most cases the sites selected had already been vandalised by graffiti.

Mesh screens have not prevented further graffiti from occurring, with the worst example being Bull Cave near Campbelltown. In this case vandals broke into the cave and sprayed large amounts of bright red paint which could not be removed without damaging the site further. The visual impact of mesh screens on a site is the most striking disadvantage, and construction and installation costs are invariably high. Mesh screens were partly removed at the Appletree site in Wollemi National Park following requests by local community members. In most cases mesh screens were constructed during or before the 1970s when there was little community consultation.

Mesh screens to prevent unauthorised visitors entering a site have been built at:

Appletree in Wollemi National Park
Daleys Point in Bouddi National Park
Bull Cave near Campbelltown
Mt Grenfell near Cobar.

i) Low guidance fencing or barriers

Low barriers at sites are effective in guiding visitors. In comparison with other structures they are cheap yet effective. They may take the form of wooden fences, chain or rope barriers which, although easily climbed, present a line which clearly should not be crossed. Without this official line, it would seem that there are no standards or limits presented to visitors who may consider it acceptable to go up close and even touch the art. An effective low barrier located at West Head is shown in Plate 26.

A study by Gale (1984) at Ubirr in Kakadu National Park demonstrated the value of effective visitor signs, boardwalks and barriers. The area was first studied in June 1982 when paths had been marked out clearly but there were no on-site fences, barriers, signs or interpretation at any of the rock art sites. At this time some 21% of visitors were observed to have touched the art, and one person was observed vandalising it. In June1983, when visitor management material was introduced, only one person out of 611 was observed touching the art.

Examples of low barriers are located at:

West Head in Ku-ring-gai Chase National Park (see Plate 26)
Hands on the rock in Wollemi National Park (incorporated with a boardwalk)
The Galleries in Mutawintji National Park.

j) Walkways

A large number of paths and boardwalks have been constructed in NSW. Their function is to display the rock art clearly to a large number of visitors with the least impact to the site. Visitors must be able to see and photograph the art clearly from the boardwalk. Community consultation must take place before such structures are built as in some cases they may give offence to those responsible for the site.

Like most site structures in NSW, boardwalks have been constructed on a trial and error basis where managers have seen the need for some form of walkway and have used the knowledge and information available to build the most suitable structure for a particular site.

We are now in a position to look at various examples and, after studies by Gale (1984) and others, an evaluation can be made with regard to practical, structural, aesthetic and safety aspects of designs and construction. Accordingly, several case studies are dealt with below to establish guidelines for managers involved in boardwalk construction.

3.6.3 Guidelines for construction of walkways

The following considerations regarding walkway construction are strongly recommended and are supported by the case studies following:

Does the activity require an REF or DECC AHIP?
The community needs to be involved from the start, allowing for flexibility to modify the design, or withdraw altogether.
Before designing the boardwalk detailed records to incorporate all of the figures to be viewed. Detailed recording needs to happen.
If possible, all figures must be clear and able to be photographed from the walkway with a setback sufficient to prevent touching the art.
Staff with a long-term interest in the site should supervise construction work.
Materials should complement the aesthetics of the site. The use of local natural materials adds to the appeal and practicality of the structure and in some cases it has also reduced the cost of the project.
Safety aspects require professional consultation.
Modification of the design after installation should be anticipated, as has been the case at Bulgandry, after evaluation of visitor use.
A barrier limiting and defining the area where visitors are permitted to go should be incorporated into the design of the structure.
It is necessary to include interpretation, which is site specific, in order to provide protection to the site and enhance visitors' experience. This is now becoming accepted visitor management practice.
Avoid dead ends in the design as they are a target for vandalism. A circular path is preferred for this reason.
Boardwalks can be constructed without fixing and drilling into the rock base. This has proven to work at more recent boardwalk construction sites, such as West Head and Bulgandry which was

reconstructed after fire in 2003.
Fire damage to the rock surface is an important consideration when designing a boardwalk. Setbacks from flammable bush or leaf litter build up need to be considered if timber is to be used for construction. Alternatively, non-flammable materials such as non-staining metal prefabrication may be a good alternative.
Following the Finchley case study, no treated timber should be used in construction work at sites.

3.6.4 Case studies

a) Appletree in Wollemi National Park

The Appletree site is located in a remote area of Wollemi National Park (see Plate 25). Visitation is low (up to 100 visitors per annum) and the area has been identified as suitable for ecotourism and cultural heritage tours.
Following vandalism of the site in the early 1980s, a metal cage was installed to prevent further damage. The protective cage is no longer considered a suitable management structure for the site and requires some modification. Early discussions with the relevant Aboriginal groups in the area indicated that they were reluctant to see the cage fully removed. Following initial inspection it was determined to leave the cage in the main shelter and remove the other two cages. These two cages were successfully dismantled. There are numerous sites in the Western Division where mesh screens have been built as goat exclusion fences. These are discussed in Section 3.4.

Because of community objections and their failure to stop vandalism, mesh screens are not recommended as a protection strategy.

b) Mutawintji, near Broken Hill

This may be the first walkway constructed in an Australian rock art site, being substantially completed in July 1978. Visitors were meant to be conducted to the engraving site by guided tour so no signposting or interpretive material was incorporated into the project. Principally the NSW Public Works Department, whose emphasis was on public safety, drew up the design. The site is now included as part of a guided tour.

Partly because this was the first attempt, a number problems arose both before and during construction. A number of useful lessons have been learnt from this experience, however, and these are outlined as follows:

The walkway was the subject of objections to unguided visitation by the LALC. At the time of construction consulting the Aboriginal community was not considered necessary and therefore this result was unforeseen.
The walkway with handrails kept visitors off the site.
The position of the walkway did not allow visitors to adequately view or photograph the entire site but only part of it.
The material used was prefabricated metal, which did not blend well with the natural setting of the site.
Because of staff problems at the time, there was no local supervision at the time of construction. As a result, a number of mistakes were made, such as mixing cement on part of the site and the impairment of site drainage in the placement of concrete footings.
As this was the first walkway constructed, there was no previous experience to draw on, and the

listed defects were obvious only after construction.Considerable forethought was nevertheless put into the project, particularly with regard to aspects of public safety and prefabrication, in order to reduce the working time, and hence impact, on-site.

c) Bulgandry (near Gosford, NSW)

This low level boardwalk was constructed on an engraving site in order to cater for the public demand to view the engravings. The site was chosen because the figures were considered relatively visible and the site was located near a public road. There was an additional spin-off that visitors may have been diverted away from a nearby site known as the Feast Group, which is generally more difficult to see and considered more significant in terms of the number and style of figures present. Several additional points are noted about the design and construction of this boardwalk:

It was first designed using local timber (ironbark), which was left out in the weather for several months in order to leach out any tannins or resins which may have stained the rock surface.
An interpretive package including a site pamphlet and on-site interpretive signs were added later, giving specific site information (see pamphlet attached...is this attachment A?).
Following a visitor survey by Gale and Jacobs (1987), a number of relevant observations were made.
Some 30% of visitors were leaving the walkway and walking over the site. Construction of a low barrier to prevent this was recommended.
The generalised nature of the interpretive signs tended to confuse visitors (some looked under the walkway for the paintings), and some had no idea what they were looking at. This finding confirms the necessity for site-specific interpretation when information is displayed.
Sydney engravings are traditionally hard to see, and vandalism, in the form of scratching-in and outlining figures, has occurred. Clearly visible engravings in our eyes were not so visible to the untrained eye. The cause of other vandalism was put down to visitors not knowing what they were looking at, further emphasising the need for on-site interpretation. As a result of continuing vandalism, highlighting of engraving was undertaken (see Section 3.8.3).
The site was damaged by fire in summer 2003. Because the boardwalk is slightly raised off the ground, there was considerable heat resulting from the burning of sections of the boardwalk. This caused severe damage to the rock below (see Plate 27). It was necessary to rebuild the boardwalk in 2004. The site was re-surveyed at night and new engravings (which may have previously been soil covered) were identified and incorporated into a new boardwalk design. There was also opportunity to incorporate community consultation in the redesign and reconstruction process.
Other modifications included additional vegetation clearing to reduce the risk of further fire damage to the site.

The new boardwalk is shown in Plate 28.

d) Finchley engraving site

A boardwalk similar to Bulgandry was built at Finchley in 2000. Because white ants were a problem in the area, treated pine was used in the construction. In 2006, leachate from the timber was observed to be killing the surface organic material growing on the rock surface and creating a white, clean stone appearance directly underneath and down slope from the walkway. Some Aboriginal community members were also concerned about the introduction of arsenic chemicals to the local environment.

Following consultation with the management committee, the walkway was removed in 2006.

3.6.5 References

Gale, F. (1984) The Protection of Aboriginal Rock Art From Tourists at Ubirr, Kakadu National Park. In H. Sullivan(ed.), Visitors to Aboriginal Sites: Access, Control and Management, Proceedings of the 1983 Kakadu Workshop, Australian National Parks and Wildlife Service, Canberra, 32–40.

Gale, F. and Jacobs, J.M. (1987) Tourists and the National Estate: Procedures to Protect Australia's Heritage, Australian Government Publishing Service, Canberra (Special Australian Heritage Publication Series 6).

Plate 24. Metal stand housing a visitor's book and information specific to the site.

Plate 25. Main shelter at Appletree in Wollemi National Park – general view of the shelter and mesh screen which remains.

Plate 26. An example of a low barrier used to guide visitors over a site. This example is located at West Head in Ku-ring-gai Chase National Park and uses heavy 300 mm x 300 mm hardwood. Interpretive signs are mounted on the structure, and the rock is lighter in colour where visitors walk.

Plate 27. The old fire damaged boardwalk at Bulgandry. The heat generated by the fire caused damage to the sandstone.

Plate 28. The new boardwalk at Bulgandry. It is designed to sit on the rock rather than being fixed by drilling into the rock.

About Bulgandry

Some of the Bulgandry engravings were scientifically recorded in 1951 and ten years later the site was dedicated as a Reserve for Aboriginal Carvings and Drawings. Shortly afterwards it was incorporated into Brisbane Water National Park. From 1962 to 1965 more extensive records were made of all the engraved figures in the site.

In mid 1975, because of increasing recognition of Aboriginal culture, the National Parks and Wildlife Service decided to encourage the public to visit Bulgandry. This site was chosen because the images were easier to distinguish than those at many other sites.

Visitor facilities were carefully designed and constructed so that visitors could view the engravings without damaging them. The site was opened to the public in 1978.

■ *Photography*

Rock engravings can be difficult to photograph and the results are often disappointing. The images show up best on photographs taken in the early morning or late afternoon, when the sun strikes them at a low angle and throws shadows into the grooves. The figures also tend to stand out more distinctly after rain.

When photographing, please remember not to leave the walkway or touch the engravings, and that these are part of a living culture.

■ *If you want to know more...*

contact NPWS Central Coast Hunter Range Region office at Suites 36-38, 207 Albany Street North, Gosford, or phone 02 4324 4911.

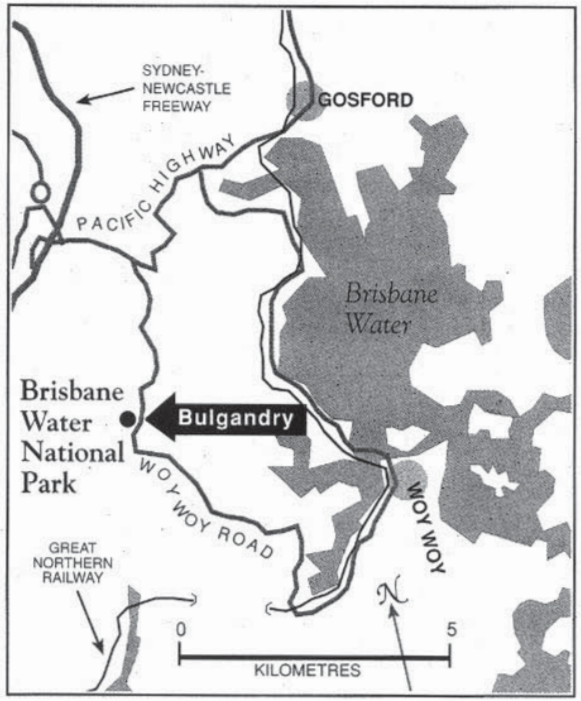
■ *Suggested reading*

Craigie, C. and Kelly, G. (1983) *Aboriginal Heritage Teachers Kit*, 3rd edit., NSW National Parks and Wildlife Service, Sydney.

Stanbury, P., Clegg, J. and Campbell, D. (1990) *A field guide to Aboriginal rock engravings – with special reference to those around Sydney*, Sydney University, Sydney.

Jones, A. (ed) (1988) *Aboriginal Sites of New South Wales*, NSW National Parks and Wildlife Service.

Walsh, G.L. (1988) *Australia's Greatest Rock Art*, E. J. Brill, Robert Brown and Assoc., Bathurst.



Getting there

Bulgandry engraving site is located off Woy Woy Road, 3 kilometres south of the Pacific Highway. There's a walk of around 250 metres from the carpark to the engravings.

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The NPWS is part of
NSW Department of Environment and Conservation

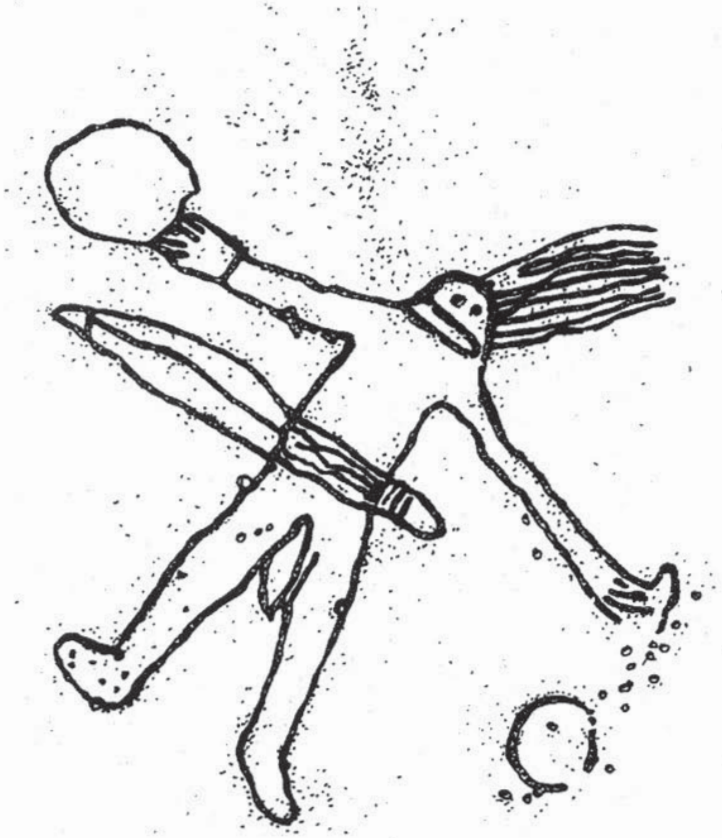
COVER: A large engraving from Bulgandry

General inquiries: 102 George Street, The Rocks, Sydney
Phone: 1300 361 967 **or** 02 9253 4600
Fax: 02 9585 6555 **Web site:** www.nationalparks.nsw.gov.au

VISITOR GUIDE

Bulgandry

Engraving site



In Brisbane Water National Park, 7 km south-west of Gosford, Bulgandry is an excellent example of Guringai rock art.

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The Bulgandry engravings

Art is an essential element of Aboriginal culture. Art is both an the expression of deeply held religious beliefs and the source of fertility and natural increase. Art records the stories of achievements and the events of everyday life.

In the coastal areas of New South Wales, rock engraving is a predominant traditional artform. Flat, exposed areas of Hawkesbury sandstone provide an ideal 'canvas'. This engraving style is unique in Australia—its hallmarks are large figures drawn with a single outline.

Hundreds of engraving sites are known to exist in the Sydney region. Some are small, with only one or two figures, others cover several hectares.

The Aboriginal communities of the area north of Broken Bay include Guringai whose traditional Country extends south to Sydney Harbour and north to Lake Macquarie.

European settlement has destroyed much evidence of traditional Guringai culture. As settlement expanded, Guringai were forced off land and lost access to traditional hunting and food collecting areas.

Engravings are made by first drawing the outline of a figure with charcoal, or scratching it with a stone. A hard pointed stone is then used to peck a series of holes along this outline.

The NPWS is working with communites to help renew Aboriginal language and culture and provide appropriate protection and interpretion of Bulgandry

■ Grinding grooves like these are often found on sandstone outcrops near water. They were formed by the sharpening of stone tools, including axes, being rubbed back and forth on the rock surface. Water is used as a lubricant in the same way we use water or oil on modern grindstones.

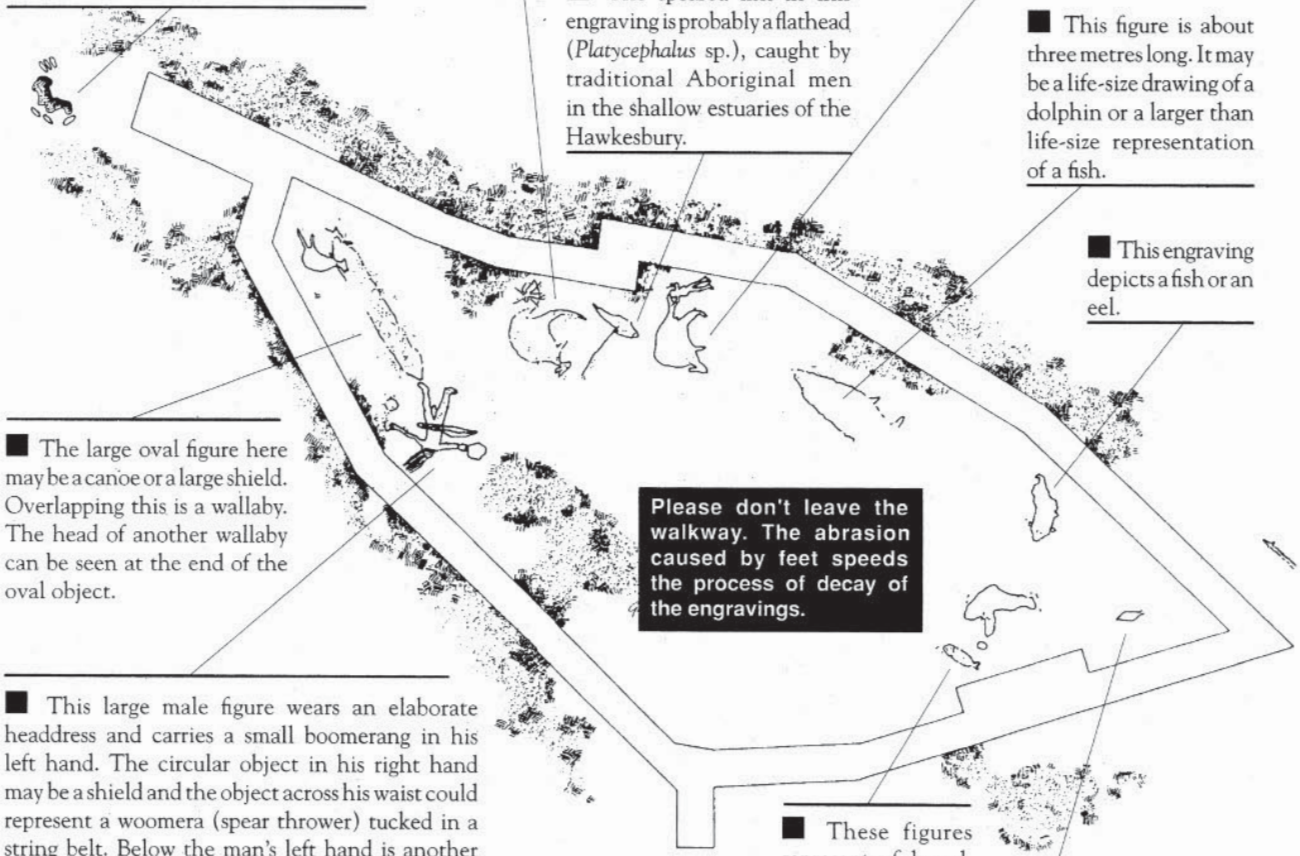
■ Like the wallaby nearby, this depiction is almost life-size. The eight armed figure positioned across its tail is possibly an octopus.

■ The wallaby in this image is about 2.4 metres long, approximately life-size. The smaller human female figure behind the wallaby appears to be either chasing or carrying it.

■ The speared fish in this engraving is probably a flathead (*Platycephalus* sp.), caught by traditional Aboriginal men in the shallow estuaries of the Hawkesbury.

■ This figure is about three metres long. It may be a life-size drawing of a dolphin or a larger than life-size representation of a fish.

■ This engraving depicts a fish or an eel.



Please don't leave the walkway. The abrasion caused by feet speeds the process of decay of the engravings.

■ The large oval figure here may be a canoe or a large shield. Overlapping this is a wallaby. The head of another wallaby can be seen at the end of the oval object.

■ This large male figure wears an elaborate headdress and carries a small boomerang in his left hand. The circular object in his right hand may be a shield and the object across his waist could represent a woomera (spear thrower) tucked in a string belt. Below the man's left hand is another circular object. The image may represent an ancestral 'culture hero'.

■ These figures represent a fish and, probably, a bird.

■ A fish with an incomplete tail. Fish are frequently depicted in Hawkesbury sandstone engravings. This probably reflects their economic importance.

Note: It is an offence to modify or otherwise impact upon this heritage.

NSW NATIONAL PARKS AND WILDLIFE SERVICE

3.7 **Vandalism and graffiti management**

3.7.1 Types of vandalism

Vandalism takes several forms and it is necessary for the conservator or site manager to categorise and examine the underlying reasons for it. Where figures are difficult to see, inflicted damage such as shooting, or souveniring and accidental rubbing or touching of art may result.

Graffiti comes in a variety of shapes, sizes, and materials such as paints, dyes, charcoal, chalk, crayon, scratching and engraving. There are different ways to remove or reduce the impact of graffiti, and an AHIP may be required.

While most graffiti can be removed, there are varying degrees of damage caused during removal, and removal must be followed up with an appropriate management strategy for each situation.

Conservation work at sites must be immediately followed by appropriate management strategies, otherwise vandalism will continue, thus negating the benefits of the conservation work. The main aims of removing graffiti are to reduce the visual impact and discourage repeated vandalism.

a) Considerations before removing graffiti

Removing graffiti from a site, particularly old graffiti over art, should not be attempted by anyone without previous experience. Graffiti removal is frequently carried out in NSW, and on-site training is available to any site manager by simply being an extra hand on a scheduled field trip. Very fresh graffiti on an otherwise unvandalised site should be removed immediately either by following the steps outlined in Section 3.9.5 or after further advice.

b) Community consultation

Graffiti removal involves touching and handling the site. This practice may be objectionable to Aboriginal people responsible for the site and community consultation is a prerequisite to graffiti removal.

c) Site recording

Graffiti is often drawn using materials such as charcoal which, if not entirely removed, may be later confused with the original art. It is therefore necessary to record the site before taking remedial action. One way is to record the art and graffiti using clear polythene on which the art is directly recorded in one colour and the graffiti in another. This method of recording requires storage of recording materials and retrieval of information and hence may require a DECC AHIP. Presently, the most efficient way of doing this is to reduce the scale of the 1:1 polythene sheet recording by photography from which accurate scale reduction drawings can be made. Alternatively, a series of photos can be taken before and after graffiti removal. The photographic record should be used in any report. Digital photography is recommended for providing accurate recordings. Hand drawings can also be used produced from these and augmented in the field to ensure that faint images are also captured for monitoring purposes (see Section 3.9).

d) Very recent graffiti

Graffiti in charcoal, chalk and some paints is much more simply removed when it is fresh. In cases where sites are closely managed and where they are otherwise free of vandalism, the procedure recommended is to simply remove the graffiti as soon as possible using the techniques outlined below.

e) Post contact art

In the case of drawings of a non-traditional style, consider the possibility of post-contact art which could be later considered an integral part of the site. In such cases it is often necessary to consult the community before removal of any figures. The general policy is, therefore, when in doubt, don't remove.

f) Historic graffiti

This may take the form of names, initials or drawings. It is generally agreed that names or initials of early explorers should stay, although there is often doubt as to their authenticity. Names of old local identities sometimes carry a lot of importance to the local community so a broad level of community consultation may be required. It is wise to consult recognised historians, particularly local historians, in order to make an adequate assessment.

h) The first inspection

During the first inspection several important steps are suggested:

1 Photograph the site, concentrating on areas where work is required. The photos may be used as before and after photographs when work is completed.

2 Note the materials used to draw the graffiti. Estimate what equipment and supplies which will be required, such as how the amount of water, or whether a ladder is needed.

3 Estimate the time it will take to do the job and the number of people required.

4 Test the removal techniques proposed on a small area of the site, away from the rock art, particularly for the most common form of graffiti present.

5 Consider if an AHIP is required and proceed after subsequent approvals have been obtained.

3.7.2. Managing graffiti removal

The procedure for cleaning begins with dry techniques. Washing is a second step for a more thorough and complete graffiti removal with the proviso that some pigments should not be wet.

a) Dry Brushing

Some of the following methods require experimentation (on-site training) and should only be undertaken by, or under the direction of, an experienced person. For removing dry pigment graffiti such as chalk and charcoal the following apply.

Start by using clean bristle brushes (a 100 mm paint brush is a good size to start with). Other brushes which can be used may be obtained from hardware stores or jewellers suppliers. These include a bristle bench brush, nylon bench brush and various sizes of circular machine brushes using goat hair, bristle and nylon fibres. These are designed for use on a machine but can also be hand-held. Brass brushes can be used with care if the softer fibres have little effect.

Select a small trial area away from the central focus of the site.

Observe very closely the effect which brushing has, both on the graffiti and the art. If this process is moving art pigment, then stop. In this case it will only be possible to remove graffiti not drawn directly over the art. It will also be necessary to use finer brushes over which more precision can be exercised when working close to the art. It will also be out of the question to wash such figures.

If the graffiti is smudging and the site cannot be washed, then do not work over the top of art. The smudging usually disappears after persistent brushing. Use finer brushes where graffiti occurs close to the art with more precise brushing.

It is imperative to continually observe the effect that the brushing is having.

Experiment away from the main part of the site until the technique has been mastered.

The results obtained using the bristle or nylon brushes are generally considered the most satisfactory and their use is highly recommended.

Plates 29 and 30: show the results of removing graffiti by dry brushing at Appletree in Wollemi National Park. Note that remnants of the charcoal graffiti remain but the visual impact of the graffiti is greatly reduced.

b) Air abrasive or air brushing

There has been limited use of this technique. A portable air abrasive unit for removing graffiti from rock art sites was constructed in 1991 with a small grant from the Australian Institute of Aboriginal and Torres Strait Islander Studies (Ford 1995) (see Plate 33). The unit delivers a fine spray of abrasive material which etches the surface. The abrasives used are soft particles such as dolomite or glass beads which are unlikely to scratch the rock surface.

Breathing apparatus such as a dust mask is essential as an occupational health and safety requirement.

c) Washing

Following dry brushing, a more satisfactory result may be obtained if it is possible to wash the site. Washing removes graffiti and can at the same time remove loose dust and microorganic material covering the art.

Surface mineralisation covering the art is common, but in varying degrees. The degree of mineralisation will determine whether the site can be washed without removing pigment or altering its morphology. Certainly, if freshly painted or drawn pictographs were washed, an unacceptable quantity of pigment would be removed. In addition, the appearance of the pigment may be significantly altered resulting in pigment migration or features such as run marks forming, or loss of surface brush markings.

The first thing to look for is whether or not the site ever naturally becomes wet. Signs of direct water erosion displayed by figure cutting, or salt deposits marking the edge of water seepage lines are the most common indicators. Second, look for evidence of surface minerals such as silica that most commonly takes the form of a slight milky sheen over the art. The lustre of the pigment is very important in this assessment. A pigment with a very flat, powdery appearance should not be considered for washing.

If, after examination the site is considered suitable for washing, the next step is to select a small trial area for testing, preferably in an obscure part of the site, following the procedures outlined below. The final consideration before starting is to avoid washing the entire site. There are two main reasons for this:

1 Washing has a potentially high impact on a site (it rates higher than touching); accordingly, washing should be kept to a minimum.

2 It is desirable to retain washed and unwashed sections of the site for future comparison. In this way, any long-term effects can be observed. Also, sites which require conser vation work may be badly damaged, and a question often asked when revisiting such sites is whether the figures were previously faint, or whether it is a result of past conservation work. In such cases it is reassuring to be able to compare areas that have notbeen touched with areas where graffiti has been removed.
An existing management framework designed specifically for the site will support decisions already made.

The method for washing is as follows (Clarke 1978:90):
First, divide the site into sections to be washed, each of which should be approximately 2 metres square.
Start from an inconspicuous area and work towards the centre.
Clean water with no additives may be used. Alternatively a detergent solution consisting of about 1:2000 (5 ml to 10 L of water) of Lissapol N (a non-ionic detergent) may be brushed

onto the graffiti area, using a clean bristle brush (50–100 mm). The solution is worked up into a thick froth where graffiti occurs.
Limit washing to the graffiti in the 2 square metre area, then lightly spray the area down thoroughly, working from top to bottom with clean water. A 20 L knapsack spray is useful for large jobs, otherwise a 1 L spray bottle can be used.
Where graffiti is not located over the art, washing may be repeated.
It is important to wet all the way down to ground level to avoid dirty water run marks remaining below the washed area.
Where necessary, use progressively harder brushes, suc as conventional scrubbing brushes or bronze brushes (used for cleaning suede). Steel wire brushes will mark the rock surface. The general rule is to use the softest fibre brush to achieve the desired result. Only pigments which are strongly bonded by covering minerals may be scrubbed in this way.
A site which has been washed to remove vandalism is shown in Plates 31 and 32. A hand stencil was drawn over the original art with a red vegetative material. The material would not respond to dry brushing and it was necessary to wash the site.

d) Removing wax crayon or waterproof crayon

These crayons are made from paraffin wax with a coloured pigment. In areas that can be washed lightly, run clean water over the affected area and simultaneously brush the graffiti using a bronze brush (two people are required). The wax crayon will float off in small complete chunks, leaving no residue.

In cases such as engravings where dark microorganic material is growing on the surface, the freshly treated area may appear distinctly clean and lighter in colour. However the former rock colour has been naturally restored within six months.

e) Paint removal

In the case of washable sites the method described by Clarke (1978) and described above is recommended.

Where feasible, paint should be removed as soon as possible from rock surfaces as exposure to sunlight and high temperatures can cause polymer cross linking and other changes which make the paint more difficult to remove.

Two brand name commercial paint removers are more effective and more practical to use. These products, Berger Strip and Poly Stripper, consist of a methylene chloride base with xylene and a gelling agent. They can therefore be applied to vertical or overhanging surfaces. They do not evaporate as rapidly as ungelled liquid solvents.

The paint stripper is applied by brush to the paint only, and allowed to act for about 10 minutes. The treated area is then scrubbed with a strong non-ionic detergent solution (5 ml Lissapol N in 10 ml water), until a thick froth is built up on the rock surface. The whole area is then washed with clean water. The procedure may need to be repeated several times to remove all paint.

In most cases a paintbrush is used for the scrubbing, but on hard, coarse, textured rocks, it may be necessary to use a wire brush. This is only done in extreme cases, as there is a risk of scratching the rock surface; it is preferable to leave minor traces of paint on the rock than to damage the surface.

This technique has been used successfully to remove paint from red-pigmented Aboriginal paintings without damage to the paintings. The degree of success depends on the pigment and rock type, and should only be attempted on siliceous rocks with haematite pigments.

There are several precautions to be taken when using this technique:

1 Protective clothing, gloves and a facemask are necessary.
2 The site must be well ventilated.
3 Methylene chloride or paint stripper must be used with caution as it burns the eyes and skin.

Both the paint remover and detergent will remove lichen from rock surfaces, as well as dust and dirt, and this will cause a clean patch in the area treated. In one case, a large painted name from the entrance to a rock shelter was removed but the name was still present as a silhouette of lichen-free rock. White rock art pigments are easily disrupted by organic solvents and should be avoided when using this method.

An assessment whether the technique would impact on any occupational deposits through contamination of the soil by such solvents is recommended. If occupational deposits are present then mitigation will be required.

Plates 31and 32: show before and after treatment of a graffitied stencil in Red Hands Shelter, West Head. The stencil had bee rubbed over with a red material so the definition of the stencil outline was difficult to make out. This infill material was removed using the washing technique described.

Plate 33: Air abrasive equipment which uses a light-weight compressor to drive a small air brush which delivers a fine stream of abrasive beads to remove graffiti.

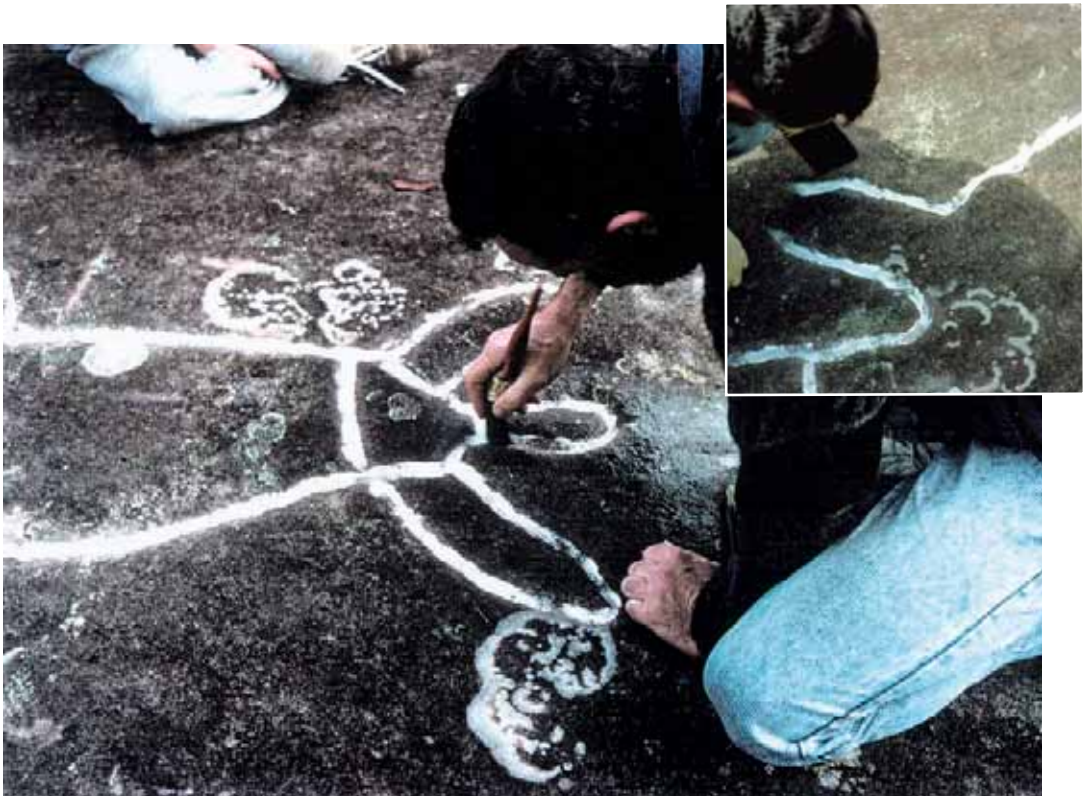


Plate 34: shows paint being removed at Finchley engraving site in Yengo National Park. Note that the rock will have a fresh appearance after completion; however the rock will discolour to its original dark lichen colour after about 12 months.

3.8 **Highlighting engravings for public display**

3.8.1 Sydney engravings and visitation

Engravings in the sandstone around Sydney have a unique style. They comprise outline figures from just a few centimetres across to large figures over 20 metres in length. There are numerous sites (in the thousands) which often consist of a large and complex series of motifs, such as life-sized whales and larger than life-size anthropomorphs.

When the engravings were first made, there would have been a sharp colour contrast between the freshly engraved white sandstone and the dark weathered surface. With age and wearing, the groove profiles can become shallow and eroded. Also the uniform colour of the dark organic material over the entire rock surface, both in and outside the groove, can render the images almost invisible even to the trained observer and more so to the general visiting public. Problems with site presentation to the public have resulted in visitors scratching the motifs, using stones, in order to highlight the grooves.

Before attempting to highlight engravings for public display, consideration should be given to pollution issues and requirements under the Protection of the Environment Operations Act 1997 (POEO Act). If approvals are required, do not proceed until these are in place. Information about the POEO Act can be found at: www.epa.nsw.gov.au/legal/aboutpoeo.htm#P23_1378.

The problem of site presentation became a serious management issue at Bulgandry near Gosford. In this case a walkway was constructed in the late 1970s and self-guided visitors were encouraged by way of brochures and signs. Defacement by vandals resulted in the loss of the original groove profile (see Plate 35). In the case of a wallaby motif, the vandal had mistakenly extended the forearm by following the line of a superimposed canoe figure. Repeated scratching resulted in the original motif design being permanently changed. It then became preferable to highlight the original motifs in order to avoid further vandalism and to restore the former design. Monitoring photographs taken 18 months later indicate that vandalism had been substantially reduced and that the former motif design has been restored (see Plate 36).

Highlighting has been carried out at several engraving sites around Sydney. These include The Basin (wheelchair access site in Ku-ring-gai Chase National Park), Strickland State Forest and Finchley in Yengo National Park. A follow-up case study at Bulgandry in 2000 is given in Section 3.8.4..

3.8.2 Understanding the fabric

The top few millimetres of rock surfaces invariably differ in colour to the parent rock below. In most cases, this colour change is due to the presence of surface microorganic material combined with altered (usually oxidised) surface minerals. The presence of surface mineral accretions (Rosenfeld 1985:27–32) may also bring about surface contrast, particularly in western NSW. Therefore, engravings which penetrate this surface layer will be easily visible by virtue of both colour contrast and surface relief. It is the lack of these two features that renders Sydney engravings almost invisible to a large

Plate 35: Vandalised engraving. Note that the scratched outline has missed the original groove and mistakenly followed an overlying canoe motif.

Plate 36: The same engraving one year later after highlighting. Note that the original groove outline, which was recorded well before the site was opened to the public, has been restored.

proportion of the visiting public. In this case shallow groove profiles combined with the uniform colour of dark organic material over the entire rock surface, both in and outside the groove results in the engravings being very difficult to make out especially during the day and also to the inexperienced eye.

3.8.3 Highlighting method

One method for highlighting is to clean the groove profile of organic material, revealing the lighter colour of the rock beneath and is described below.

1 Trickle fresh water over the rock surface. The water is partly absorbed by the organic material, making it softer and breaking the bond to the rock surface.

2 Lightly brush the groove using soft nylon brushes. Providing the brushing takes place with the water still trickling over the surface, the organic material is easily removed.

As the site is exposed to rain, fresh water is unlikely to cause any adverse impact to the site. The main precaution taken when using this technique is not to brush outside the groove, which may be difficult to see before cleaning.

3.8.4 Field work case study - Bulgandry

The following information provides details of a conservation fieldwork project carried out at the engraving site Bulgandry.

Bulgandry contains about a dozen motifs engraved in Hawkesbury sandstone. A walkway or viewing platform was built at the site in 1978 to facilitate visitation. However, as is typical with Sydney engravings, the relief of the groove is only slight, the colour contrast is low, and the figures were difficult to see, particularly on bright sunny days. Vandalism became a problem with some visitors infilling engravings with sand and scratching the rock surface by rubbing the engravings with stones in order to highlight the grooves. This defacement was resulting in the loss of the original groove outline. It then became prudent to highlight the original motifs, in order to deter further vandalism and to restore the former motif design.

The work was conducted in early January 2000 and involved 12 team members including DECC staff and Aboriginal community participants from the Darkinjung LALC.
The project planning enabled the project to be completed in one day provided an opportunity to learn and practice the technique.

One concern with this technique is that it needs to be repeated every 18 months to two years if visual contrast is to be maintained. Highlighting at this site was carried out for the third time in December 2000. There are presently no tested chemical treatments which may be applied to the rock surface to reduce the frequency of treatments required. Secondly, differential weathering in and outside the groove may result.
This is difficult to measure and may be a number of years before becoming apparent.

a) Other conservation work undertaken at Bulgandry

In addition to highlighting to reduce vandalism, several other engraving site conservation tasks were carried out. These included washing the site by hosing down using a fire hose under low pressure from a fire striker unit. Drainage maintenance, soil and tree removal was also undertaken.

Before and after photos together with some general photos to demonstrate the work done by participants on the day are shown in Plates 37-45.

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Plate 37: Engraving before groove cleaning. (photo David Kelly,NPWS)

Plate 38: Engraving after groove cleaning. (photo David Kelly,NPWS)

Plate 39 and 40: Darkinjung Land Council members working on the site.

Plate 41: Before groove cleaning, the area is wet down.

Plate 42: Highlighting the engraved area.

Plate 43: Removing soil and low tree (Casuarina) which was encroaching on the engravings.

Plate 44: Washing away soil and tree roots.

Plates 45 and 46: Final wash down after the work above had been completed.

3.9 **Monitoring and recording**

3.9.1 What is monitoring?

For site managers, monitoring of sites means revisiting a site to make sure there have been no damage and that there is nothing which is seriously impacting on the site. This often takes the form of a casual visit.

Monitoring is more effective if regular measurements are made; these can be repeated at a later date to evaluate the rate of change at the site. Such measurements can build up an accurate picture of how the site is changing and may also help to decide whether the management approach is satisfactory. Monitoring records and results must be put on AHIMS.

3.9.2 Monitoring paintings for pigment loss

This is done using close-up photographs to monitor the situation where, for example, clay based pigments come away in lumps. A general photo containing a standard millimetre colour scale is taken in order to locate the area which is being monitored. The close-up photo, usually printed on a 1:1 scale, is taken leaving the colour scale in place so that the area being monitored can be easily relocated at a future time. The close up photo (or pigment monitoring photo) will show pigment condition and will clearly show any future loss of pigment either by flaking or rock failure by exfoliation or spalling.

The general photo and close-up monitoring photo are shown in Plates 46 and 47. From these plates it can be seen that clay pigment may show advanced stages of failure by cracking and flaking. Flakes of pigment of the order of 1 mm diameter may fall from the painted surface giving the appearance of a faded motif.

3.9.3 Monitoring for colour change

Red ochre pigments show a very different mechanism of failure to that of the clay pigments. Their stability is dependent on the action of agents such as water wash, salts and underlying rock stability. Under these circumstances, it is the overall colour of the motif which is likely to change. For example, the rich vibrant red of a freshly painted ochre figure may fade to a more subdued colour in an old ochre painting.

a) The colour scale

The colour scale which is shown in Plate 49 acts as a colour reference and may be used at some future time to colour correct an old photograph. The colours in the scale are known colours, which are accurately reproduced on the scale. Because there is a range if primary colours present on the scale, the colours of the pigments taken in the monitoring photograph are capable of being corrected and compared even if the original photograph has faded.

3.9.4 Results of monitoring

Note that in most cases there will be no changes observed. However, Plates 50 and 51 demonstrate the type of change that can occur. In other cases (for example at Mt Grenfell), additional

microcracks in the order of 1 mm are evident over a 10-year period.

Plate 50 was taken in 1990 at Gunderbooka in western NSW and shows part of a human figure painted in white clay pigment. Plate 51 shows the same figure eight years later. Note the loss of approximately 0.2 square centimetres of white pigment representing approximately 2% of the area being monitored.

Given the results of monitoring in NSW so far, it appears that the method described above is satisfactory. Five-year intervals seem to be a reasonable period between measurements. Measuring colour change in red pigment is difficult and has not yet yielded any quantifiable results. The use of the colour scale, however, is a simple measure, which will undoubtedly add value in the future to any monitoring photos taken for this purpose.

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Plate 47: Photo for locating an area for monitoring. The colour scale is a reference point.

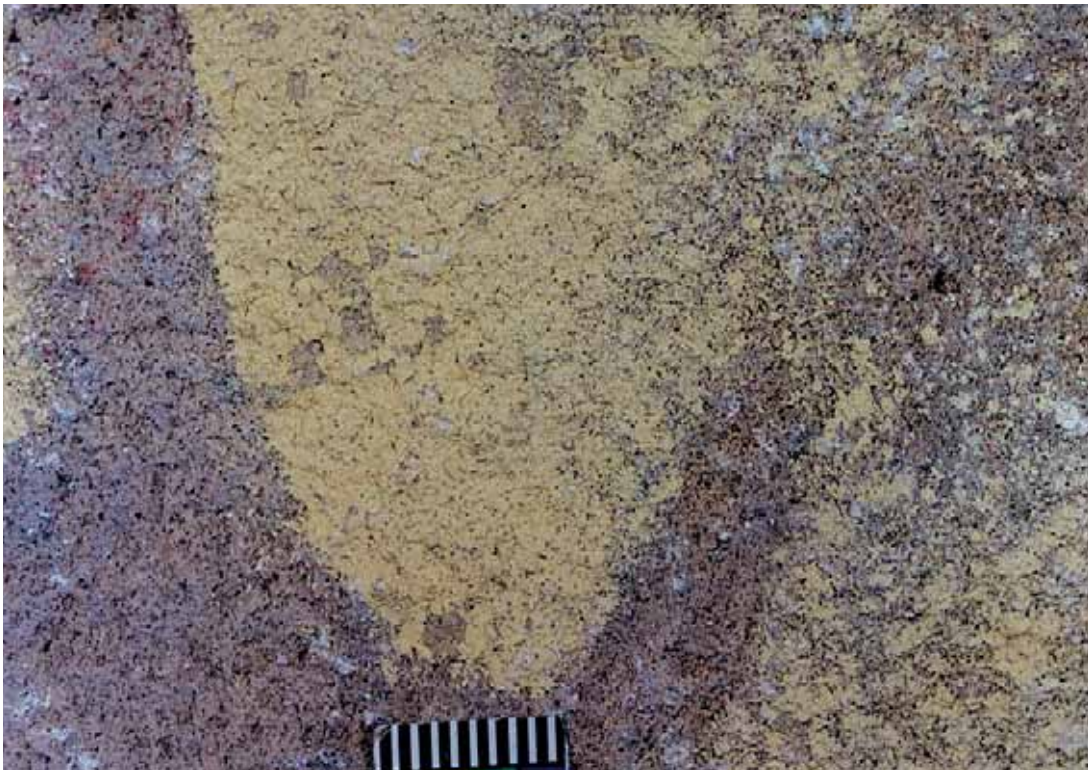

Plate 48: Monitoring photo to measure pigment loss. There are cracks evident in the clay-based pigment and also flakes of pigment have come away from the original motif.

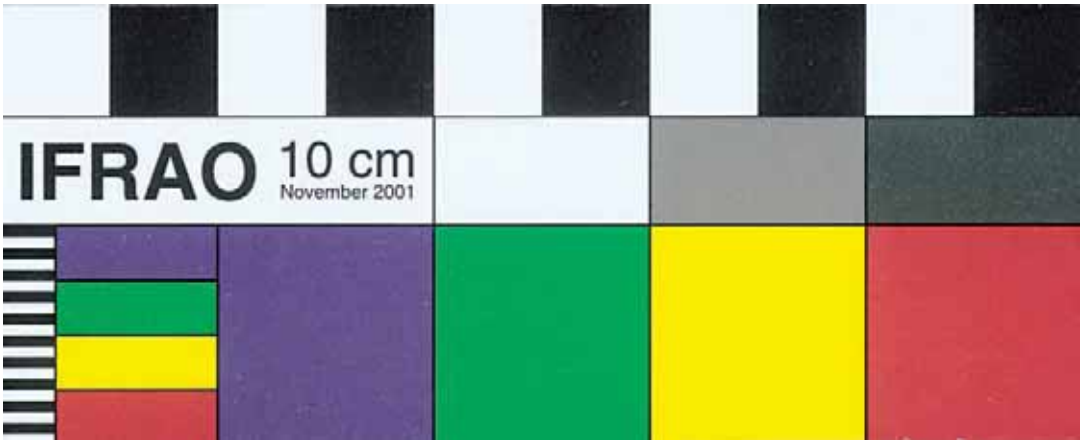

Plate 49: The standard IFRAO colour scale. The scale can be purchased from AURA, PO Box 216, Caulfield, South Australia.

Plate 50: A painted ochre figure used for colour monitoring. Note that there are no cracks visible in this pigment type and the assumed mechanism of pigment loss will be loss by water wash as has happened at the lower half of the figure, or in other cases by granular loss by salt action. An artificial dripline has been installed in this shelter to reduce further loss by water wash.

Plate 51: Gunderbooka – site 2 shows part of a human figure painted in white. Clay pigment photographed in 1990.

Plate 52: Gunderbooka – site 2. Follow up monitoring from 1990 report. Note loss of approximately 0.2 square centimetres of white pigment since 1990.

4. **Appendices**

4.1 Sample check list: assessment, recording, management and reporting

The following represents a process check list for assessment, recording, management and reporting to be followed.

Aim/objective of the work: Why is conservation work being considered in this context? What is the management context? (e.g. Aboriginal community concerns a priority or a long term management plan or specific visitation context).

What is the problem?

What is the environment of the site and how does it affect the site? What is the range of location influences, effects that are leading to the threats, changes to the environment that have exacerbated any negative effects on the site and the art, etc?

What criteria are being used to evaluate the method of intervention and the rationale to support management at this site (method, scale, etc)?

Assessment of the risk of any techniques adopted. Some conservation processes described over the last 20 years do have an inherent risk factor and conservation practitioners have identified some pitfalls which need to be assessed.

If it is contributing to the threat, can the environment be changed? Evaluation of no intervention. If the natural causes are intractable then what is the effect?

Detailed recording of the art and its context. Recording may in fact be the only conservation feasible. Recording provides the baseline for ongoing monitoring of the site and the art and the effectiveness of the method of conservation adopted.

An assessment of the conservation options being considered and their relative merits and risks.

Implementation of any physical monitoring techniques if no physical intervention thought necessary at this time and further assessment required.

Time frame for monitoring.

Monitoring and assessment of the effectiveness of any interventions undertaken.

Is authorisation required in accordance with legal requirements and agreed protocols for conservation, e.g. a REF?

Is an AHIP required?

As part of this assessment the Aboriginal community need to be participants in the decision making process and there may be cultural or traditional issues that need to be taken into account as part of this decision making process.

4.2 Useful Contacts and Information Sources

Rock Art Conservator DECC
Dave Lambert
02 4320 4235
David.Lambert@environment.nsw.gov.au

Rock Art Program enquiries
Manager Central Region Aboriginal Heritage Operations Branch
Level 7 43 Bridge St Hurstville NSW 2220
PO Box 1967 Hurstville NSW 1481
02 9585 6456
Kathleen.Schilling@environment.nsw.gov.au

Aboriginal Heritage Information Management System
AHIMS Registrar contact details:
www.environment.nsw.gov.au/index.htm
02 9585 6470
ahims@environment.nsw.gov.au

Aboriginal Cultural Heritage regulatory staff:
Climate Change and Environment Protection Group
Conservation Planning and Aboriginal Heritage Section
DECC Head Office: 02 9995 5000

DECC Internet sites:

DECC home page:
www.environment.nsw.gov.au

DECC contacts page:
www.environment.nsw.gov.au/npws.nsf/Content/dec_contacts

Culture & Heritage home page:
www.nationalparks.nsw.gov.au/npws.nsf/Content/Cultural+Heritage

AHIMS
www.canri.nsw.gov.au/nrdd/records/ANZNS0202000074.htm

Information about the POEO Act
www.epa.nsw.gov.au/legal/aboutpoeo.htm#P2_1378

Useful cultural heritage links
www.nationalparks.nsw.gov.au/npws.nsf/Content/Useful+curltural+heritage+links

National Trust
www.nsw.nationaltrust.org.au/burracharter.html

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4.4 Glossary

Accretion	a naturally occurring mineral or salt deposit formed on a rock surface
Deposit	occupational deposits may contain Aboriginal objects or other material which may be of heritage, including archaeological, value
Drip line	a line in a shelter where surface water drips onto the ground keeping the inside of the shelter dry
Drawings	images created on rock surfaces using dry pigments such as charcoal or ochre
Engravings	an outlines or filled-in figures created on rock surfaces by pecking, hammering or scraping
Highlighting	removing lichen from an engraved line
Monitoring	observing and measuring over time using photographs and other records
Organic	from a living organism
Paintings	images created using wet pigments on rock surfaces protected from direct rain and sun—in rock caves, shelters and on cliff faces
Re grooving	the process of re-engraving a faded or weathered engraving
Substrate	the rock base of the painting or drawing

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