

WOMBEGAN KARST CONSERVATION RESERVE

Plan of Management

Jenolan Caves Reserve Trust

November 1999

This plan of management was adopted by the Minister for the Environment on 23rd November 1999

Acknowledgments:

This plan of management was prepared by the Jenolan Caves Reserve Trust. Acknowledgment is made to the work of Karen Jones, Ernst Holland, Michael Chalker and Alison Ramsay in preparing the draft plan which formed the basis of this plan of management. The assistance of those people who made submissions on the draft plan of management is also acknowledged.

The sketch of the Reserve was prepared by Steven Babka and the map by Kevin Harris.

Photograph of Chalker's Blanket, Junction Cave.

Crown Copyright 1999. Use permitted with appropriate acknowledgment.

ISBN 0 7313 6095 8

FOREWORD

Wombeyan Karst Conservation Reserve is one of four karst conservation reserves managed by the Jenolan Caves Reserve Trust.

Wombeyan Karst Conservation Reserve covers an area of 417 hectares and is within day-trip distance of Sydney, Wollongong, Goulburn and Canberra. It is a popular tourist destination and has won a number of tourism awards. The main attraction of the Reserve is the many caves with their spectacular formations and cave decorations. Four of the caves are used for guided tours while others provide for self-guided cave tours, adventure cave tours and speleological activities. The Reserve also provides for bushwalking, picnicking, barbecues, accommodation in dormitories and vans, camping and caravanning, school educational groups and conferences/workshops.

The Reserve contains a range of natural and cultural features in addition to the caves. These include the spectacular Victoria Arch and Mares Forest Creek gorge, the uncommon Chalkers wattle, over 70 bird species, a range of mammals including five species of bats, and the most diverse invertebrate cave fauna recorded in the State. There is also evidence of Aboriginal occupation across much of the Reserve and the caves are of mythological significance to Aboriginal people and feature in Aboriginal Dreamtime legends. In 1865 an area of 271 hectares around the current show caves became the first area in Australia to be reserved for the protection of caves and there are still structures dating from the early 1900s in some caves.

The plan provides for the continued protection of the special features of the Reserve and for their restoration or rehabilitation where appropriate. A monitoring programme is to be implemented both within the caves and in various locations on the surface. The plan also proposes that the visitor facilities within Wombeyan Karst Conservation Reserve continue to be upgraded.

This plan of management establishes a scheme of operations for Wombeyan Karst Conservation Reserve. In accordance with section 76 of the National Parks and Wildlife Act, this plan of management is hereby adopted.

BOB DEBUS
Minister for the Environment

CONTENTS

	Page
1. Introduction	1
2. Management Context	3
2.1 Karst Conservation Reserves	3
2.2 IUCN Guidelines for Cave and Karst Protection	3
2.3 Australian Charters for Conservation of Natural and Cultural Heritage	3
2.4 Wombeyan Karst Conservation Reserve	4
2.4.1 Location and Management History	4
2.4.2 Importance of Wombeyan Karst Conservation Reserve	4
3. Objectives of Management	8
3.1 General Objectives of Karst Conservation Reserves	8
3.2 Specific Objectives for Wombeyan Karst Conservation Reserve	8
4. Policies and Framework for Management	9
4.1 The Natural and Cultural Environment	9
4.1.1 Geology, Soils and Geomorphology	9
4.1.2 Water Quality and Catchment Management	11
4.1.3 Flora and Fauna	12
4.1.4 Aboriginal Sites	16
4.1.5 Historical Places	16
4.1.6 Fire Management	18
4.2 Use of Wombeyan Karst Conservation Reserve	19
4.2.1 Promotion and Interpretation of the Reserve	19
4.2.2 Recreation and Tourism Opportunities	21
4.2.3 Research	25
4.2.4 Management Operations	26
5. Plan Implementation	28
6. References	31
7. Glossary	32

1. INTRODUCTION

Wombeyan Karst Conservation Reserve is managed by the Jenolan Caves Reserve Trust. The Trust is responsible to the Minister for the Environment for care, control and management of Jenolan, Abercrombie, Wombeyan and Borenore Caves in a manner which is environmentally, culturally and commercially sustainable.

In 1997 the *National Parks and Wildlife Amendment (Abercrombie, Jenolan and Wombeyan Karst Conservation Reserves) Act* was passed which transferred management of Wombeyan Caves from the *Crown Lands Act 1989* to the *National Parks and Wildlife Act 1974*.

Part 5 of the National Parks and Wildlife Act provides that the Jenolan Caves Reserve Trust will prepare a plan of management for each area it manages. A plan of management is a legal document that provides guidelines for the conservation of the reserve and the provision of visitor facilities and services.

The procedure for the exhibition and adoption of a plan of management is specified in section 76 of the National Parks and Wildlife Act and involves the following stages:

- The Trust gives notice that a plan of management has been prepared.
- The plan is placed on public exhibition for at least one month and any person may comment on it.
- Following the expiration of the exhibition period, the plan and copies of all representations received are referred to the National Parks and Wildlife Advisory Council for consideration.
- The plan, together with any comments and suggestions of the Advisory Council, are submitted by the Jenolan Caves Reserve Trust to the Minister for the Environment.
- The Minister may adopt the plan after considering the recommendations of the Advisory Council or may refer the plan back to the Council for further consideration.

A plan of management for Wombeyan Karst Conservation Reserve was placed on public exhibition from 14th August to 30th November 1998. The exhibition of the draft plan attracted 15 submissions which raised 14 issues. All submissions received were referred to the National Parks and Wildlife Advisory Council for its consideration and advice. The comments and suggestions of the Advisory Council were in turn considered by the Minister when adopting this plan of management for Wombeyan Karst Conservation Reserve.

In accordance with the provisions of the *National Parks and Wildlife Act 1974*, this plan of management is to be carried out and given effect to by the Jenolan Caves Reserve Trust and no operations may be undertaken on Wombeyan Karst Conservation Reserve except in accordance with this plan.

The planning process leading to the development of this plan involved the collection and use of a large amount of information which, for reasons of document size, has not been included in the plan. Additional information or enquires relating to Wombeyan Karst Conservation Reserve or to this plan of management can be obtained from the Manager, Wombeyan Caves, PO Box 18, Taralga, NSW 2580 or by phone on (02) 4843 5976.

2. MANAGEMENT CONTEXT

2.1 KARST CONSERVATION RESERVES

Karst conservation reserves were established under the *NSW National Parks and Wildlife Act 1974* by the *National Parks and Wildlife (Karst Conservation) Amendment Act 1991*. The National Parks and Wildlife Act states that areas dedicated as karst conservation reserves are “areas of scientific, recreational, aesthetic or historic value within karst regions” (section 8(2)(c2)). The Act defines a karst region as “a region comprised substantially of soluble rocks such as limestone or dolomite and characterised by landforms produced by solution, abrasion or collapse or by underground drainage (or both)” and defines landforms as “surface features, caves and the decorative content of caves whether or not deposited from solution” (section 5).

In 1997 Jenolan, Abercrombie, Wombeyan and Borenore Karst Conservation Reserves were established as the first karst conservation reserves under the National Parks and Wildlife Act. At present all karst conservation reserves within New South Wales are managed by the Jenolan Caves Reserve Trust.

2.2 IUCN GUIDELINES FOR CAVE AND KARST PROTECTION

The International Union for Conservation of Nature and Natural Resources (IUCN), also known as the World Conservation Union, is an inter-governmental agency of which Australia is a member. IUCN seeks to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable.

In 1997 the World Commission on Protected Areas, a commission of the IUCN, produced Guidelines for Cave and Karst Protection (Watson et al., 1997). These guidelines were developed to increase awareness of cave and karst protection issues and the special management considerations essential for the protection of cave and karst areas. They were designed to provide a guide for planners, managers and users of karst. This plan of management is based on the IUCN guidelines, although not all are specifically mentioned and some strategies have been modified where appropriate to better apply to the management of the Wombeyan Karst Conservation Reserve.

2.3 AUSTRALIAN CHARTERS FOR CONSERVATION OF NATURAL AND CULTURAL HERITAGE

The Australia ICOMOS Charter for the Conservation of Places of Cultural Significance (known as the Burra Charter) was adopted by the Australian branch of the International Committee on Monuments and Sites (ICOMOS) in 1979. It has undergone a number of amendments since. The Burra Charter defines the basic principles and procedures to be observed in the conservation of important cultural sites, and guidelines for establishing cultural significance, conservation policy and the preparation of reports.

The Australian Natural Heritage Charter was prepared under the auspices of the Australian Heritage Commission and adopted in 1996 by the Australian Committee for IUCN to provide

guidelines for making soundly-based decisions on conservation of natural heritage. The Natural Heritage Charter relates closely in its general structure and logic to the Burra Charter.

This plan of management is based on the Australian Natural Heritage Charter and the Burra Charter. Management of the natural and cultural heritage of Wombeyan Karst Conservation Reserve will be undertaken in accordance with these charters.

2.4 WOMBEYAN KARST CONSERVATION RESERVE

2.4.1 Location and Management History

Wombeyan Karst Conservation Reserve covers an area of 417 hectares and is located in the Southern Highlands of New South Wales, 190 km south-west of Sydney, 77 km north of Goulburn and 63 km west of Mittagong. The Reserve is located within Wingecarribee and Mulwaree Local Government Areas. Within the Reserve the boundary between the two local government areas is Wombeyan Creek.

Wombeyan Karst Conservation Reserve encompasses the spectacular terrain of the Wombeyan Caves area and contains a range of geomorphological features and vegetation communities. Blue Mountains National Park adjoins the Reserve to the north. On the remaining boundaries are freehold lands which are used for a range of purposes including grazing, agriculture, forestry and quarrying.

Since its declaration in 1865 the Wombeyan Caves have been administered by various Government agencies including the Mines Department, Department of Intelligence, Department of Sport, Recreation and Tourism and the Tourism Commission of New South Wales. In 1989 the care, control and management of Wombeyan Caves was entrusted to Jenolan Caves Reserve Trust under the *Crown Lands Act 1989*. In 1997 the operations of the Trust became subject to the *National Parks and Wildlife Act 1974*.

2.4.2 Importance of Wombeyan Karst Conservation Reserve

Geological, Geomorphological and Karst Values

Terrain with distinctive characteristics of relief and drainage arising primarily from a high degree of rock solubility in natural waters is known as a *karst* landscape. Karst landforms are characterised by closed depressions of various size and form, disrupted surface drainage, caves and underground drainage.

Wombeyan's karst, which runs north-east/south-west through the Reserve, is totally surrounded by intrusive igneous rock. The intrusion of the igneous rock into the surrounding limestone metamorphosed the limestone into marble. This marble has developed one of the most cavernous karst areas in New South Wales (Osborne 1987).

Wombeyan has a wide range of karst features including dolines, blind valleys, springs, tufa deposits, surface solutional (karren) formations, steepheads, gorges and over 400 tagged cave entrances. The caves and associated features were formed by the infiltration of water through

the marble's cracks and joints. A variety of speleothems (cave decorations) can be found throughout Wombeyan's cave system including stalactites, stalagmites, helictites, straws, flowstone, pool deposits, stromatolites, cave shields and cave coral. These speleothems are a major feature of the cave tours. A number of caves contain unusual cave sediments that provide an insight to past climatic conditions and into the evolution of the geological features of the landscape.

The volcanic activity that changed Wombeyan's limestone to metamorphosed marble also destroyed most of the fossil evidence from which the history of the limestone could be studied. Only a few specimens of a certain kind of lamp shell and some obscure traces of corals and crinoids can be observed in some places (Dyson *et al* 1982). Despite this limited evidence, the study of Wombeyan's palaeokarst, breccias and cave morphology has provided some understanding of the geomorphological history of Wombeyan Caves.

Flora and Fauna Values

Wombeyan's vegetation reflects changes in aspect, soils and bedrock. The Reserve is dominated by woodland and grassland with forest species occurring along some water courses and ridgelines.

The uncommon Chalkers wattle (*Acacia chalkeri*) dominates Wombeyan's understorey, while yellow box (*Eucalyptus melliodora*) and kurrajong (*Brachychiton populneum*) are the main overstorey species.

Over 70 bird species have been recorded in the Reserve, including the glossy black cockatoo (*Calyptorhynchus lathami*) which is listed as vulnerable under the *Threatened Species Conservation Act 1996*.

Mammals found on the Reserve include the eastern grey kangaroo (*Macropus giganteus*), swamp wallaby (*Wallabia bicolor*), wombat (*Vombatus ursinus*), brush tailed possum (*Trichosurus vulpecula*) and echidna (*Tachyglossus aculeatus*). A colony of the vulnerable brush-tailed rock-wallaby (*Petrogale penicillata*) used to live in the entrance of Victoria Arch but it is believed that they are now extinct on the Reserve.

The formation of the caves and their stable environment has preserved various components that have since been lost from the surface landscapes. Numerous bone deposits can be found throughout the karst area. The first recognised remains of the mountain pygmy possum (*Burramys parvus*) were located on the Reserve in 1896. The bone material that is present in the cave sediments reflects past ecosystems and their related fauna.

A number of caves are used as roosting sites and possibly nursery sites by bats. Five species of bats have been recorded at Wombeyan including the vulnerable bent-wing bat (*Miniopterus schreibersii*) and the eastern horseshoe bat (*Rhinolophus megaphyllus*).

The invertebrate cave fauna recorded at Wombeyan is one of the most diverse in the State with 58 species and the highest number of troglobitic taxa (11) recorded in a single karst area within New South Wales (Eberhard and Spate 1995). Some species are endemic to the Wombeyan karst and can be classed as rare animals under IUCN criteria. These species

include a cave-adapted snail (*Fluvidona hydrobiidae*), the sheet web spider (*Badumna socialis*) and a springtail (*Adelphoderia regina*).

Historic and Cultural Values

The Reserve is located within the Wiradjuri tribal area. There is evidence of Aboriginal occupation across much of the Reserve and the caves are of mythological significance to Aboriginal people and feature in Aboriginal Dreamtime legends.

It is believed that the caves were first recorded by Europeans in 1828 while searching for grazing land. In 1865 an area of 271 hectares around the current show caves became the first area in Australia to be reserved for the protection of caves.

Development of the Reserve to cater for visitors began in 1865 and has gradually evolved since then. Pathways, ladders, lighting and bridges were constructed within a number of caves to allow easier visitor access and there are still structures dating from the early 1900s in some caves.

While grazing has been the primary European land use in the Wombeyan area, the caves have attracted many visitors to the area. Wombeyan's visitation has steadily increased from 152 visitors in 1887 to over 35,000 in 1997.

Recreation and Tourism Values

Located in the Southern Highlands of NSW, Wombeyan Caves is within day-trip distance of Sydney, Wollongong, Goulburn and Canberra. It is a popular tourist destination and has won a number of tourism awards. The main attraction of the Reserve is the caves, which are developed and used for guided tours, self-guided cave tours, adventure cave tours, and speleological activities. The Reserve also provides for bushwalking, picnicking, barbecues, accommodation in dormitories and vans, camping and caravanning, school educational groups and conferences/workshops. Support facilities, including a kiosk, amenities, accommodation units and recreational areas, are located within the main valley.

A number of walking tracks traverse the different environments of the Reserve including marble gorges, open woodland, lookouts, creek beds and moist closed forests.

Educational and Scientific Values

Guided tours by staff provide an interactive opportunity for the public to understand the cave system and the need for conservation. The knowledge of the guiding staff allows for specific geological, geomorphological, educational and historical tours to be conducted. Adventure tours can also provide educational experiences in a different setting and to a different audience.

The complex geology, geomorphology and hydrology of the Wombeyan area presents many opportunities for educational groups. In addition, they present on-going challenges for scientific investigation and there is scope for further research into the bone deposits, invertebrates and other animals, vegetation patterns, karst processes and impacts of people on the karst environment.

Scenic Values

The access roads from Goulburn and Mittagong introduce visitors to Wombeyan by providing glimpses of the spectacular karst landform set within the wider landscape, as the road winds its way through the open forests to the valley floor.

The contrast between the surrounding bush and the introduced plants of the Wombeyan valley, especially when the trees are in their autumn colours, is a distinctive feature of the Wombeyan Reserve.

Wombeyan's most prominent feature is the expanse of Victoria Arch at the southern end of the main valley. The walking track to the top of the Arch provides visitors with panoramic views of the valley and of the Arch itself.

3. OBJECTIVES OF MANAGEMENT

3.1 GENERAL OBJECTIVES OF KARST CONSERVATION RESERVES

The following general objectives, derived from Section 72 of the *National Parks and Wildlife Act 1974*, relate to the management of karst conservation areas in New South Wales:

- the preservation of the reserve and the protection of its special features;
- the maintenance of natural processes as far as is possible;
- the preservation of the reserve as a catchment area and its protection against fire and erosion;
- the conservation of wildlife;
- the preservation of Aboriginal sites and historic features;
- the encouragement of appropriate scientific and educational inquiry into environmental features and processes; and
- the regulation of appropriate use of the reserve.

3.2 SPECIFIC OBJECTIVES FOR WOMBEGAN KARST CONSERVATION RESERVE

In addition to the above general objectives, the management of Wombeyan Karst Conservation Reserve will be subject to the following specific objectives:

- protection of the karst system and associated features;
- protection of water quality in the Reserve;
- maintenance of the scenic values of the naturally vegetated ridges and hillslopes, and of the valley as a contrasting cultural landscape;
- provision of facilities and services which enhance visitor enjoyment and understanding of the Reserve, including a range of guided and self-guided tours, accommodation and recreational facilities and activities; and
- education of visitors as to the value of the Reserve and the natural and cultural processes which led to Wombeyan's formation and use.

4. POLICIES AND FRAMEWORK FOR MANAGEMENT

This chapter contains the policies and framework for the management of Wombeyan Karst Conservation Reserve together with relevant background information. Policies are summarised under the following section headings:

- The Natural and Cultural Environment
- Use of Wombeyan Karst Conservation Reserve

The strategies established in this plan of management will provide the framework for management consistent with anticipated resources available to the Trust and with anticipated community trends for the next five to ten years. Other activities may be undertaken over the life span of this plan consistent with the objectives and management strategies set out in this plan. Management will also be in accordance with the Trust's conditions of cave access and the Trust's permit system which are available on request from the Trust and not repeated in this plan.

4.1 THE NATURAL AND CULTURAL ENVIRONMENT

4.1.1 Geology, Soils and Geomorphology

Wombeyan Karst Conservation Reserve lies on the eastern edge of the Great Divide. It contains massive limestone, fine-grained biotite granite, and volcanoclastics such as tuffs and felsite.

Wombeyan limestone has been dated as being of Silurian age (430 - 400 million years ago), but unlike most other karst rocks in New South Wales it has undergone significant contact metamorphism, producing marble. The marble is surrounded and overlain by volcanoclastics.

The marble and volcanics were intruded by Columba granite during the late Devonian period (380 - 360 million years ago). Quartz sandstone, conglomerate and ironstone overlie the Wombeyan marble at a number of localities (Osborne 1987).

The karst area is typified by a high proportion of outcropping rock. Soils are thin (generally less than 0.3m) red coloured terra rossa soils, with a low to moderate fertility and are highly susceptible to erosion when the vegetation cover is disturbed.

The Reserve is deeply dissected in the south by Mares Forest Creek, which is a perennial creek below the marble gorge and intermittent above the gorge. Another significant water course in the area is the ephemeral Wombeyan Creek which is associated with a flat alluvial flood plain. The karst landform results in very little surface flow along drainage lines, with most of Wombeyan Creek's flow occurring underground.

Wombeyan is known as a *fluvial karst* landform. The caves, surface karst features and the general valley have been developed by the action of water and associated geomorphic processes. The caves have been formed by the infiltration of water through the marble's

cracks and joints. The dissolving of the marble by water, which has become slightly acidic as it passes through the soil, slowly enlarges the cracks thereby forming passages and chambers. Dissolved calcium carbonate in the water precipitates in the caves and forms stalactites, stalagmites and other cave decorations. This process of infiltration creates a high degree of integration between surface and sub-surface environments within karst landforms.

The modification or extraction of rocks, soil, vegetation and water will clearly interrupt the processes that produce and maintain karst, and therefore any such activities must be carefully planned and executed to minimise environmental impact. In addition, the natural flows and cycles of air through the landscape, including that through fissures and cracks in the rocks, must be maintained (Watson et al. 1997).

The caves are the most important feature of Wombeyan Karst Conservation Reserve and have significant conservation and recreation value. Speleologists have recorded over 400 cave entrances within the Wombeyan marble. Some caves have been developed for visitor use with pathways, bridges, steps and lighting, and there have been changes to the land surface including clearing of the native vegetation and construction of roads and buildings. These developments may have changed natural water flows and air currents and have increased light levels within the caves. There have also been changes to the caves caused by visitors, such as increased dust and deposition of lint and carbon.

Management Strategies

- ◇ All works carried out within the Reserve will be designed and undertaken so as to minimise impact on the geology, geomorphology, soils and natural drainage of the Reserve.
- ◇ Disturbed areas not required for public or management use will be restored using materials which are geologically compatible and be undertaken in accordance with Department of Land and Water Conservation guidelines.
- ◇ All earth works within the Reserve will be designed and undertaken in a manner which minimises soil erosion.
- ◇ As far as possible, the Reserve will be managed to ensure continuation of the various karst, biological and microbiological processes operating either on the surface or within the caves themselves.
- ◇ The show caves will be monitored regularly for introduced dust, lint and rubbish build-up and will be cleaned appropriately.
- ◇ No additional caves on the Reserve will be developed as show caves unless such development will lead to a net reduction in environmental impacts on the karst system as a whole.

4.1.2 Water Quality and Catchment Management

The most important component of a karst ecosystem is the role of water. The protection and continued equilibrium of a cave system is reflective of the conservation and management of its water catchment area.

The direct water runoff and infiltration into the caves means that the usual buffering provided by the soil against pollutants and changes in water flow does not occur. Many of the features in a karst landscape, particularly the stalagmites, stalactites and other cave decorations, are very susceptible to any change in the drainage systems. The invertebrate fauna found in caves are also affected by changes in water quality and quantity.

Watercourses that flow through the Reserve include Wombeyan Creek which flows underground through the marble from the north, and Mares Forest Creek which flows west to east through the karst gorge (see map, centre pages). Most of Wombeyan's upper catchment is outside the Reserve and is consequently subject to other management, either by the National Parks and Wildlife Service which manages Blue Mountains National Park or by private landholders. Increased nutrient and sediment levels from agriculture, quarrying activities and road works within the catchment have had an impact on water quality within the Reserve.

Part of Wombeyan Karst Conservation Reserve lies within the Warragamba Special Area, declared under the *Sydney Water Catchment Management Act 1998* to protect the water quality of Warragamba Dam which is the predominant water supply for the Sydney region. A Special Areas Strategic Plan of Management has been prepared jointly by the Sydney Catchment Authority and the National Parks and Wildlife Service. This plan of management is consistent with the Special Areas Strategic Plan of Management, which aims to ensure that the water supply catchments are ecologically healthy, provide high quality water in the reservoirs, and conserve the natural, cultural and spiritual values of the catchment areas.

Management Strategies

- ◇ Wombeyan Karst Conservation Reserve will be managed with the aim of causing no human activity induced decline in the quality and quantity of water flowing through the Reserve.
- ◇ All facilities, infrastructure and other works on the Reserve will be designed, located and managed so as to avoid pollution and changes to surface and underground water.
- ◇ The co-operation of local councils, the National Parks and Wildlife Service, other relevant land use authorities and local landholders will be sought to protect water quality within the catchment of the karst.
- ◇ Information will be provided through the Wollondilly Catchment Management Committee about the methods landholders in the catchment can use to minimise impacts on the karst
- ◇ Liaison will be undertaken with local councils and the Roads and Traffic Authority in regard to management of run-off from that section of the Mittagong-Taralga road within the catchment.

- ◇ The karst drainage system will be progressively defined and mapped.
- ◇ The water quality within Wombeyan Creek and Mares Forest Creek will be regularly monitored, with additional monitoring undertaken during and after flood events.

4.1.3 Flora and Fauna

Native Flora

Wombeyan's vegetation communities correlate to their aspect, slope, soil and bedrock. Forest communities that occur on the high granite ridgelines and along water courses are dominated by white stringybark (*Eucalyptus globoidea*) and silvertop ash (*E. sieberi*). Stands of river oak (*Casuarina cunninghamiana*) occur where water and shelter are plentiful. Native grasslands favour the northern facing granite slopes, while woodland communities of yellow box (*E. melliodora*) and kurrajong (*Brachychiton populneum*) are found on the terra rossa soils in sheltered valleys and on south facing slopes. Chalkers wattle (*Acacia chalkerii*) is the predominant understorey species throughout the Reserve. While this species is common on Wombeyan Karst Conservation Reserve, it has been classified as rare (Briggs & Leigh 1995) because it is found only in a very restricted area of Australia.

Recently another rare plant has been identified on the Reserve. *Bursaria salsicola* is a shrub that to date has only been found on limestone at Wombeyan, although further survey work may find that it grows in other limestone areas. The bryophytes found on the Reserve are of interest because they are a type more usually found in semi-arid areas, although they are also present in other cave areas in south-east New South Wales.

Up until 1981 grazing was allowed on the Reserve. The impacts of past grazing practices are evident in the dominance of understorey species. Natural revegetation is however occurring and overstorey species are gradually regenerating. In addition, the gathering of firewood has damaged bush and denuded areas surrounding the camping area.

Surface Fauna

Wombeyan attracts a wide variety of bird life including several thornbills, robins, parrots, honeyeaters, treecreepers, whistlers and pardalotes and the rock-warbler (*Origma solitaria*). The superb lyrebird (*Menura novaehollandiae*), eastern whipbird (*Psophodes divaceus*) and flycatchers are amongst the birds which inhabit the moist forest near the creeks. Birds of prey include the brown goshawk (*Accipiter fasciatus*), wedge-tailed eagle (*Aquila audax*), tawny frogmouth (*Podargus strigoides*) and southern boobook (*Ninox novaeselandiae*). The threatened glossy black cockatoo (*Calyptorhynchus lathami*) is also found on the Reserve.

Mammals found on Wombeyan Karst Conservation Reserve include the eastern grey kangaroo (*Macropus giganteus*), swamp wallaby (*Wallabia bicolor*), wallaroo or euro (*Macropus robustus*), common wombat (*Vombatus ursinus*), common brush tailed possum (*Trichosurus vulpecula*) and echidna (*Tachyglossus aculeatus*).

Victoria Arch and its surrounds once supported a colony of the brush-tailed rock-wallaby (*Petrogale penicillia*). After being reintroduced to Wombeyan in the 1980s, fox and cat

predation took its toll on the colony with the sole remaining survivor being relocated to Jenolan Caves Reserve in 1996.

In 1894 a deposit of bone breccia was found in a small depression near the top of the ridge to the west of Victoria Arch. It was identified by Broom (1896) as being the fossilised remains of the previously unknown marsupial, the mountain pygmy possum (*Burramys parvus*). Further studies have suggested that owls were responsible for the deposition of the bones. These studies also identified additional species including the extinct thylacine (*Thylacine cynocephalus*) and mainland long-tailed rat (*Pseudomys higginsi australiensis*). Other bone breccia sites have been recorded on the Reserve.

The most common reptiles at Wombeyan Caves Reserve are the southern leaf-tailed gecko (*Phyllurus platurus*) and the red-bellied black snake (*Pseudechis porphyriacus*).

Cave Fauna

The caves support a diverse invertebrate fauna which depends upon bat guano and organic material within the caves. Victoria Arch, Mares Forest Creek, Grants and Junction Caves in particular contain a wide variety of invertebrates. Other caves with important invertebrate fauna include Urinary Tract Cave, Freds Pool Cave, Desperation Point Cave, River Cave and River Cave Spring. Fauna found within the caves includes snails, slaters, spiders, springtails, flies, beetles, bats and bat parasites. Cave invertebrates are vulnerable to the trampling impacts of cavers and changes originating in the surface catchment, including changes in water quality, sediments and nutrient levels. Access to sensitive areas, including access to Sigma and Gu-rang-at-ch Caves, is restricted to protect the invertebrates. Consideration also needs to be given to restricting access to all or part of the other caves mentioned above.

The vulnerable bent-wing bat (*Miniopterus schreibersii*), the eastern horseshoe bat (*Rhinolophus megaphyllus*), little broad-nose bat (*Nycticeius greyii*), lesser long-eared bat (*Nyctophilus geoffroyi*) and large pied bat (*Chalinolobus dwyeri*) have been recorded at Wombeyan. Sections of Fig Tree Cave, Junction Cave, Glass Cave and Basin Cave are used as roosting and possibly nursery sites by these bats. Restrictions on access to part or all of these caves is necessary to protect the bat populations. Other caves with bat roosts include Bullio, New Glass, Wineglass, Oublette, Guineacor and Desperation Point Caves.

Introduced Species

Introduced species are those plants and animals not native to an area. Since European settlement the alluvial flats upstream of Victoria Arch have been planted with numerous introduced species. Most of the introduced plantings date from 1948/49 and 1972 and some may be of cultural and botanical interest (see section 4.1.5). Some of these species are spreading and having a negative impact on the surrounding native vegetation. The introduced plants in the valley attract large numbers of parrots and other birds not normally encountered in the local area (Bear 1982), including the gang gang cockatoo (*Callocephalon fimbriatum*), the glossy black cockatoo (*Calyptorhynchus lathami*) and the satin bowerbird (*Ptilonorhynchus violaceus*). They also provide a scenic contrast to much of the surrounding lands, which are native bush or have been cleared for grazing, and some may be of cultural and botanical interest.

Noxious weeds listed under the *Noxious Weeds Act 1993* which are found in the Reserve include serrated tussock (*Nassella trichotoma*), blackberry (*Rubus fruticosus*), Patersons curse (*Echium plantagineum*) and St Johns wort (*Hypericum perforatum*). The Noxious Weeds Act places an obligation upon public authorities to control noxious weeds on land that it occupies to the extent necessary to prevent such weeds spreading to adjoining lands.

Serrated tussock is widespread throughout the Reserve, however extensive weed spraying by staff over the past five years has contained the spread and regrowth of the tussock within the Reserve. Staff have also focused upon the control and containment of blackberry over recent years. Spraying of St Johns wort and Patersons curse has reduced the occurrence of these weeds to just the new seedlings. The Trust's weed spraying program targets the control and containment of all weeds, with priority on noxious weeds. Volunteers also assist in controlling weeds on the Reserve.

There has been no grazing on the Reserve since 1981 and no domestic animals, including dogs and horses, are permitted on the Reserve. A fence around the Reserve prevents stock straying onto the Reserve.

Introduced animals known to occur in the Reserve include foxes, cats, rabbits, goats and brown trout. These introduced animals cause damage to vegetation and prey upon native fauna. Myxomatosis is still present on the Reserve, and the rabbit calicivirus may provide a control mechanism for rabbits in the future. Regular control programmes including baiting, shooting, and trapping are undertaken, with priority given to the control of goats and regular control of foxes and cats.

Care needs to be taken when undertaking control programs that a stable vegetation cover is maintained so as to prevent soil erosion and that the herbicides and baits used to control introduced species do not affect water quality and hence cave invertebrates.

Management Strategies

- ◇ The native flora and fauna communities of the Reserve will be protected. Priority will be given to the protection of:
 - uncommon floristic communities such as Chalkers wattle; and
 - the habitat of threatened native fauna, including retention of hollow trees used by glossy black cockatoos.
- ◇ Access to parts of Fig Tree Cave, Junction Cave, Glass Cave and Basin Cave, and to Sigma Cave and Gu-rang-atch Cave will continue be restricted to special scientific and research purposes unless research shows that such restrictions are unnecessary.
- ◇ Other caves or parts of caves may have temporary or permanent access restrictions imposed if research indicates restrictions are necessary to protect native flora and fauna.
- ◇ Research into the behaviour, habitat and management requirements of the bat communities at Wombeyan will be encouraged.

- ◇ Where an activity uncovers bones or other sub-fossil material, further development will cease until an assessment is made of the scientific value of the material.
- ◇ Introduced animals, except registered guide dogs, will continue to be prohibited on the Reserve. No grazing will be permitted on the Reserve.
- ◇ Introduced plants and animals will be controlled and where practicable eliminated. Control of introduced species will be by techniques that cause minimal disturbance to the karst environment. Priority will be given to the control of introduced species where they:
 - have been declared noxious;
 - pose a threat to the karst environment;
 - compete or threaten native communities; or
 - are spreading or have a high chance to spread.
- ◇ Control programmes will be undertaken where practical in co-operation with the Rural Lands Protection Board, landowners within the karst's catchment area and Mulwaree and Wingecarribee Councils.
- ◇ Revegetation of the hillslopes surrounding the camping ground will be undertaken.
- ◇ Only native plant species indigenous to the area will be used for revegetation work or other plantings except for historic or landscape replacement species (see below).
- ◇ An assessment will be undertaken of the historic and landscape values of the exotic trees within the Reserve. Exotic trees within the valley that are not of historic value or have not been identified for their landscape values will be removed and replaced with native species endemic to the area.
- ◇ Those exotic trees identified as being of historic or landscape value will be retained, and will be replaced when they become senescent or die. Any replacement tree will be of the same species or of a visually similar species and will be planted to retain the appearance of a corridor along the roadways, although they may be planted at a further distance from the current roads.
- ◇ Introduced species of cultural or botanical value will be contained within the area of their original planting.

4.1.4 Aboriginal Sites

Wombeyan Caves Reserve lies within the Wiradjuri tribal area, and within the area of the Pejar Local Aboriginal Land Council.

Little is known of Aboriginal occupation of the Wombeyan area. It is believed that Wombeyan Caves were part of an Aboriginal travel route. Movement along these routes coincided with seasonal availability of food and interactions between the coastal and tableland Aboriginal groups. It is possible that Aboriginal people were present in the area up to the 1840s, as they are shown in sketches of this period by Conrad Martens and Harden Melville.

Although no evidence has been discovered it is believed that at least some of the caves were used by Aboriginal people for shelter, although it is thought they did not enter or occupy the 'dark zone' of the caves. The Dreamtime myth of Gur-rang-atc relates to the forming of Wombeyan and Jenolan Caves. The caves are said to have been formed during a contest between Gu-rang-atc, a mythical being that was part fish and part reptile, and Mir-ra-gan, a legendary tiger cat.

There is extensive evidence of past Aboriginal tool making activities, such as flakes and cores, across much of the Reserve. These have been dated to around 6,000 to 14,000 years ago. The location of these sites have been recorded but, to prevent damage, the locations are not publicised.

Management Strategies

- ◇ All Aboriginal sites within the Reserve will be protected from disturbance.
- ◇ Liaison will be maintained with the Pejar Local Aboriginal Land Council on all aspects of Aboriginal site management and interpretation.
- ◇ All development work proposed on the Reserve will be preceded by an inspection for Aboriginal sites.
- ◇ The location of Aboriginal sites will not generally be publicised.
- ◇ Non-destructive research into Aboriginal culture and use of the area will be encouraged.
- ◇ Any new developments, including walking tracks, will not be located close to Aboriginal sites unless the Pejar Local Aboriginal Land Council has agreed to the proposal and any management works necessary to protect the site from damage have been implemented.

4.1.5 Historic Places

Wombeyan Caves were first recorded by Europeans searching for grazing land in the area around 1828. Interest in the caves quickly spread and visitors soon followed. They generally travelled from Goulburn to the local township of Taralga and would then travel to the caves via buggy roads or a bridle track. The road to Wombeyan from Taralga was completed

around 1900, ten years after an accommodation house at the caves was completed. The accommodation house was destroyed by fire in 1934, and only a single plane tree (*Platanus* sp.) remains to mark the location.

In 1865 an area of 271 hectares at Wombeyan was reserved for the “protection of caves”. During that year Charles Chalker was officially appointed the first caretaker of the caves, later called Keeper of the Caves. The uncommon Chalkers wattle (*Acacia chalkeri*) was named in recognition of Charles Chalker and his brother Thomas Michael Chalker who were the Keepers of the Caves from 1865 until 1925. All the caves at Wombeyan currently used for guided tours were first developed during this time. The association of the Chalker family with Wombeyan Caves has continued since 1865 to the present.

In 1874 the NSW Department of Mines was formed and took over responsibility for all caves in New South Wales. In 1907 this control was transferred to the Department of Intelligence and later transferred to the NSW Tourist Bureau. More recently the Reserve has been under the management of the Department of Sport, Recreation and Tourism as well as New South Wales Department of Tourism. In 1989 the protection of the Wombeyan Caves Reserve (now 417 hectares) was entrusted to the Jenolan Caves Reserve Trust under the *Crown Lands Act 1989*, and in 1997 the controlling legislation became the *National Parks and Wildlife Act 1974*.

Electric lighting was first provided in the caves in 1927, when generator-powered electricity replaced the previously used magnesium lamps and candles. The alternator and motor that supplied the electricity were removed in 1958 when the caves were connected to the State electrical grid system, however the building that housed the generators is still located near Victoria Arch. It is currently used for storage. The generator shed and the power tower near the shed will be retained and interpreted.

For many years the valley was farmed by the Keeper of the Caves and Caves House to provide supplies for the staff and visitors. In 1948/49 ornamental European trees were planted in the valley, and the camping area and playing fields were constructed. The caravan park and associated plantings date from 1972.

The show caves have been attracting visitors for over 150 years. During this time pathways, fences and lighting have been installed within the show caves. During the upgrading of infrastructure, a number of historic features such as switchboards and ladders have been retained *in situ* in the caves as evidence of past practices. They are often incorporated in to the cave tours.

Management Strategies

- ◇ A representative sample of historic features and fittings within the caves will be conserved unless they pose a danger to public safety. If their removal or replacement is necessary, they will be recorded by description, mapping and photography prior to removal.
- ◇ Historic features and fittings within the caves will be regularly inspected to determine whether they pose a danger to public safety.

- ◇ All work involving ground disturbance within the Reserve will be preceded by a search for historic artefacts. Where an activity uncovers archaeological material, further development will cease until an assessment is made of the heritage value of the material.
- ◇ The plane tree will be retained and interpreted as a relic of the old caves house era. Other introduced trees of historic value will also be retained (see section 4.1.3).
- ◇ Appropriate uses for the old generator shed, such as a classroom or interpretation centre, will be investigated.
- ◇ The old power towers will be removed, except for the tower near the generator shed which will be interpreted.

4.1.6 Fire Management

While it is recognised that fire has had an important role in the development of Australia's landscape and natural ecology, it is thought that fire has not been instrumental in the development of Wombeyan's ecology. Wombeyan's surface karst features do not display a high level of fragmentation which relate to high intensity heat (Holland, pers comm 1996).

There are no records of major fires on the Reserve since the caves were first discovered in 1828 however a number of small fires have occurred, including Caves House burning down in 1934 and two fires that started in the quarry areas in the 1980s. These fires were quickly contained and suppressed.

A basic fire management plan has been prepared for the Reserve. It details actions to protect the buildings on the Reserve, locations of the nearest fire fighting equipment, evacuation points and a map of fire management tracks and water supply points. Fire management on the reserve will be in addressed as part of the Wingecarribee and Mulwarree District Bush Fire Risk Management Plans.

Wombeyan Karst Conservation Reserve lies within the area of the Caves Bush Fire Brigade and close liaison is maintained with the brigade. The staff at Wombeyan are trained bushfire brigade members and keep a fire tanker owned by Wingecarribee Council on the Reserve. This is for the protection of the Reserve and to assist neighbouring property landowners and both local councils if the need arises.

Management Strategies

- ◇ All wildfires on the Reserve will be extinguished as soon as practicable.
- ◇ In keeping with the natural fire regime, all activity undertaken on the Reserve will ensure the minimal risk of fire.
- ◇ Mechanical hazard reduction will be used in preference to prescribed burning to reduce the risk of wildfire on the Reserve.

- ◇ Fires will only be permitted in approved fire places.
- ◇ The fire management plan for the Reserve will be reviewed annually and updated as necessary so that it contains current contact names and numbers, equipment levels, etc.

4.2 USE OF WOMBEYAN KARST CONSERVATION RESERVE

4.2.1 Promotion and Interpretation of the Reserve

Wombeyan Karst Conservation Reserve attracts visitors from the local region, south coast, Goulburn, Canberra, Sydney and some international, interstate and other country New South Wales visitors. Wombeyan's current annual visitation exceeds 40,000 and this figure is expected to gradually increase. In both 1996 and 1997 Wombeyan Caves was awarded the "Major Tourist Attraction in Capital Country".

Visitation to the Reserve is highest on public/school holidays and weekends. Use is generally fairly low at other times of the year. Past trends indicate that various external forces including economic conditions, road and weather conditions can affect visitor numbers. Wombeyan's busiest period is during Easter and the October long weekend.

Wombeyan Caves offers an attractive and unique setting to pursue outdoor recreation activities as well understand natural resource management and karst ecosystems. The drive to the Reserve from Mittagong, which includes travelling through a tunnel cut in the rock as well as crossing the Wollondilly River and winding through spectacular scenery, provides a sense of adventure even before the Reserve is reached. Once on the Reserve there is a sense of being in a peaceful, secluded valley in the bush, yet with many options for adventure provided by the caves, the walking tracks, the gorge and the many recreation facilities of the Reserve.

Wombeyan Karst Conservation Reserve is located in the Southern Highlands and could be the focus of a country tour which includes major features of rural heritage including historic buildings, historic roads and the grazing history of the area. The Reserve also provides excellent examples of the natural landscape of the area prior to the rural development, geological processes and associated native vegetation, Aboriginal culture, the history of the development of the caves and different forms of lighting of caves, and other uses of limestone areas such as quarrying.

Emphasis in the promotion of Wombeyan Karst Conservation Reserve will be on its location close to Sydney, Goulburn and Canberra, the beauty of the camping and accommodation area, the range of recreational opportunities available which includes far more than seeing the caves, its excellence for families and the peaceful, relaxed atmosphere. Promotional material will also highlight the range of cave tours, educational and adventure tours, picnic facilities, bushwalking, the kiosk and the variety of accommodation facilities.

During weekends and peak seasons, visitors may purchase cave tickets and receive information about the caves and the Reserve from the visitors centre/guides office (see map and sketch). This small building near the kiosk contains information on the guided tours as well as a small display of interesting items relating to the Reserve. An information board

displaying cave tours and times is located outside the visitors centre. In non-peak periods visitors are directed by portable signs to the kiosk where cave tickets can be purchased. In order to provide a visitor information centre which is open all week it has been suggested that the section of the kiosk building currently used as the residence for the Reserve Manager could be vacated, allowing the visitor centre and office facilities to be relocated into the kiosk building. One staff member could then manage both the visitor centre and kiosk. The current guides office/visitor centre could be demolished or used for purposes such as additional storage space, staff accommodation or an education centre.

There are a number of directional signs around the Reserve, however on arrival it can be difficult to find the ticket office. Directional signs at the entrances to the valley, including a map of the Reserve, would assist visitors to orientate themselves.

Interpretative signs have recently been placed at points of interest along the Mares Forest Creek walking track. Interpretative material will also be developed for the other walking tracks on the Reserve. The recent development of a teachers resource kit for primary schools complements the existing interpretive signs and guided tours and increases the value of the Reserve for environmental education. The Trust is currently developing a policy on interpretation.

In addition to the self-guided walks, the complex processes and history of Wombeyan's cave system is presented to visitors through guided and self-guided cave tours. In 1977 Fig Tree Cave was changed from a guided cave to a self-guided cave with timed lights, commentaries and interpretive signs. Four guided cave tours are also offered to the public, as are special theme tours and historic tours. These tours provide more specialised information and allow interaction to occur with the guide creating a personal tour which provides the information the visitor is seeking.

Management Strategies

- ◇ The Reserve will be promoted as a place which provides opportunities for appreciation and understanding of the natural and cultural heritage of the Reserve and surrounding area through a range of tours, recreational and adventure activities as well as opportunities for reflection and relaxation.
- ◇ Promotion of Wombeyan Caves will emphasise:
 - the adventure of travelling to and enjoying a unique experience which includes caves, bush walking, canyons, and other recreational pursuits;
 - the atmosphere of visiting and staying in a beautiful secluded valley in the bush;
 - the opportunities to learn about the natural and cultural heritage of the area;
 - the number and variety of cave tours, including the self-guided tour and adventure tours; and
 - the range of accommodation and recreational activities which are available.
- ◇ Interpretation of Wombeyan Caves will emphasise:
 - the significant and varied geology and geomorphology;
 - the processes whereby caves and associated features are formed;

- the significant values and sensitive nature of the caves and the importance of appropriate use of caves;
 - the value of the Reserve for the protection of a wide range of native plants and animals and their associated habitats; and
 - the history and cultural significance of the Reserve.
- ◇ Strategies will be developed to encourage mid-week visitation to the Reserve, particularly by school groups.
- ◇ An interpretation plan will be prepared for the Reserve. This will include a review of directional signage, interpretation signs on walking tracks and in self-guided caves, and brochures for the Reserve.
- ◇ The relocation of the visitor centre and guides office into the accommodation section of the kiosk building will be investigated.

4.2.2 Recreation and Tourism Opportunities

Most visitors are attracted to Wombeyan by the guided and self-guided cave tours. Guided tours of the Wollondilly, Kooringa, Mulwaree and Junction Caves are conducted all year round. The guides emphasise the history, formation and features of Wombeyan's karst. Fig Tree Cave has also been developed so that visitors guide themselves through the cave, experiencing the cave's beauty at their own pace. Lighting in Tinted Cave leads walkers through the cave and onto a balcony overlooking Mares Forest Creek Gorge. The Trust also organises and runs adventure tours, in which visitors are guided through undeveloped caves using caving lights and helmets. Various caves are used depending upon the group's experience and capabilities.

Caving may also be undertaken on the Reserve by speleological clubs in accordance with a permit from the Trust. The Trust's cave entry criteria and the National Parks and Wildlife (Land Management) Regulation control activities which may be undertaken in caves, and the Australian Speleological Federation has developed codes of ethics, safety and minimal impact caving for recreational cavers. An independent Speleological Committee advises the Trust on speleological activities undertaken by recreational cavers within the Reserve and other matters relating to recreational caving.

Camping and accommodation facilities attract many visitors to the Reserve. Facilities include camp sites, en-suite cabin vans, on-site vans, caravan sites, a camp kitchen, dormitories and a three-bedroom cottage (see map, centre pages). To cater for visitor needs the on-site vans will be progressively replaced with en-suite cabin vans. Due to high demand, bookings are required for the dormitories, cottage and cabin vans.

While the dormitories can accommodate 52 people, cooking facilities are only available in the communal kitchen some 250 metres from the dormitories. In addition, if a large number of people are camping on the Reserve the kitchen facilities are not large enough to easily cater for all. If there is a large increase in people camping near the dormitories, the toilets and

showers near the dormitories could be inadequate. To increase the attractiveness of the dormitories, additional cooking and toilet facilities are required.

The layout and location of Wombeyan provides a safe recreational environment for children and families. Cycling, tennis and field sports are popular, as is walking. A number of walking tracks through the Reserve encourage visitors to experience the surface features of the Reserve including the native flora and fauna, Mares Forest Creek Gorge and Wombeyan Creek falls. One informal track takes visitors outside the Reserve to a lookout on neighbouring property. If satisfactory arrangements can be made with the neighbours, this track will be formalised and promoted as part of the walking track system. An additional formed walking track is proposed which will follow sections of the original bridle track and link the camping area to the Mares Forest Creek walk, thus providing a loop walk.

Picnic and barbecue facilities are available on the Reserve for visitors. The kiosk provides a range of take-away foods and souvenirs, as well as basic provisions for campers. Some picnic tables are poorly located near roads and new facilities will be provided in the vicinity of the tennis courts (see sketch). As previously mentioned (section 4.1.3) the gathering of firewood has damaged the bush. Lighting of fires outside provided fire places has also scarred the camping ground.

At present car parking near the visitor centre and kiosk overflows into the adjoining picnic area during peak periods. The existing car park can also be difficult to find and confusing for first time visitors. To help protect the native vegetation and visitor safety, public vehicle access will be only allowed on sealed roads and carparks and in the camping ground. Horse riding and trail bike riding are prohibited within the Reserve for the same reasons.

There is a small but growing demand for organised activities and commercial recreation within Wombeyan Caves Reserve. Commercial and other organised activities which are undertaken or might be proposed in the Reserve include guided walks, wildlife viewing, corporate team building exercises, photographic instruction, abseiling and educational tours. These activities can range in duration from less than an hour to several days.

These organised and guided activities increase the range of opportunities for public participation in nature-based activities and provide opportunities for professional instruction in the safety and minimal impact aspects of various recreational pursuits. Guided activities also have potential to interpret and promote the natural and cultural values of the Reserve, however it is important that organised activities are carefully managed to ensure the optimal provision of services to the public and the protection of the resource.

The positive role of organised and commercial activities needs to be balanced against the protection of the Reserve's natural and cultural resources and the overall high demand for access to the caves.

Management Strategies

- ◇ The cave infrastructure including walkways, handrails and steps will be maintained, and upgraded where necessary to meet safety standards in a manner which does not damage the caves.

- ◇ Tracks within the caves will be assessed for opportunities for the restoration or rehabilitation of natural cave processes.
- ◇ Speleological activities on the Reserve will continue to be permitted only in accordance with a permit from the Trust. The Trust's cave entry criteria and licensing conditions will be kept under review and amended as necessary in consultation with the Speleological Committee. When considering cave diving applications, permission will be on a case by case basis and dependent on the individual's experience and qualifications.
- ◇ Visitors to the caves will be made aware of cave regulations and restrictions; the impacts of caving on cave features and environments, bats and invertebrate fauna; requirements for safe caving; and practices and behaviour which minimise environmental damage.
- ◇ Speleological groups and adventure tours will be required to comply with the Australian Speleological Federation Incorporated (ASF) Code of Ethics and Conservation, Safety Code and Minimum Impact Caving Code, and for cave diving the ASF Cave Diving Code of Practice. Copies of the codes will be made available for these groups.
- ◇ Public vehicle access will only be permitted on sealed roads and carparks and within the camping area. Vehicle access to the cottage may be approved for visitors staying in the cottage and for disabled visitors.
- ◇ Camping will only be allowed in the designated camping areas within the Reserve.
- ◇ Fires will only be permitted in the fireplaces provided.
- ◇ The use of portable stoves or gas/electric barbecues as an alternative to wood fires will be encouraged.
- ◇ Wood fires on the Reserve will be progressively replaced with gas or electric barbecues.
- ◇ A walking track will be developed to link the camping ground to the Mares Forest Track.
- ◇ Negotiations will be held with a neighbouring landowner in regard to formalising a walking track to Camerons Rocks.
- ◇ Walking tracks will be monitored for erosion and safety on a six monthly basis. Maintenance will be undertaken as necessary.
- ◇ An electric barbecue will be provided near the dormitories.
- ◇ Subject to a viability/demand assessment and availability of financial resources, kitchen and toilet facilities may be constructed within the dormitory complex. These may be communal facilities or the dormitories may be redeveloped as self-contained motel-style units.
- ◇ The existing car park will be redesigned to provide better circulation patterns and to cater for all vehicles including buses.

- ◇ A picnic area will be created by the provision of electric barbecue facilities and native shade trees in the vicinity of the tennis courts.
- ◇ Where appropriate, facilities in the Reserve will be designed to permit use by disabled visitors.
- ◇ Activities which cause an unacceptable impact on the Reserve, including horse riding and trail bike riding, will not be permitted.
- ◇ Abseiling and similar activities will in future be moved away from the main visitor use area to the old quarry.
- ◇ Gates will only be placed on a cave entrance if considered necessary to protect the cave and associated features or for public safety. If placed, the gates will be designed so as to not be obvious and not interfere with cave fauna and other natural processes.
- ◇ All commercial and organised activities will be required to have a licence or permit from the Trust and Public Liability insurance. Licences for commercial operations within the Sydney Catchment Authority Special Area must also be approved by the Sydney Catchment Authority.
- ◇ All commercial caving activities will be supervised by a Trust staff member.
- ◇ Licences may prescribe the approved activities, location and frequency of activities, maximum group sizes and minimum guide ratios for each activity, guide standards, appropriate behaviour and other special provisions to ensure the long term protection of the Reserve, its visitors and its recreation opportunities. License conditions will be kept under review and amended as necessary.
- ◇ Activities will only be approved if they have a minimal impact on the environment, promote protection and improved understanding of the Reserve, are of commercial benefit to the Trust, and are consistent with objectives of management for the Reserve and management strategies contained in this plan of management.
- ◇ Commercial and organised activities will not be permitted where they compete with Trust operations, e.g. cave tours, or where they unreasonably restrict or exclude other visitor use of all or part of the Reserve.
- ◇ All commercial operators and organised activities will be monitored with respect to impacts, safety requirements and compliance with licence/permit conditions. Licenses and permits will be altered or revoked if unacceptable impacts or safety measures are found to occur or if licence/permit conditions are not complied with.
- ◇ Some commercial or organised activities which might normally be regarded as appropriate in a park or reserve but which have a high impact will be excluded from the Reserve if there are alternative venues available outside the Reserve.

- ◇ Fees will be applied to all commercial use of the Reserve. Fees will be set at a level which covers the costs of managing the activities and the licensing system and provides a reasonable return to the Trust. Fees for individual operators will be commensurate with their level of use of the Reserve. Both the structure and quantum of fees will be kept under review on the basis of the consumer price index, management costs and impacts of the activities.

4.2.3 Research

The purpose of scientific study in the Reserve is to improve the understanding of its natural and cultural resources and the processes that affect them. Research into geology, geomorphology, karst processes, bats, invertebrates, hydrology, sediments, flora and fauna and other subjects have been and are still being carried out by scientists from a number of institutions. Speleological groups also study the caves and related areas and provide valuable information.

An independent Scientific Committee approves research projects and advises the Trust on research being undertaken on Jenolan, Wombeyan, Abercrombie and Borenore Karst Conservation Reserves. Data and findings from research studies and surveys within the Reserve are utilised in ongoing management. In addition the Trust is currently undertaking a Social and Environmental Monitoring Program at Jenolan which will be extended to Wombeyan in the future.

Management Strategies

- ◇ Research which improves knowledge of the resources of the area and assists management will be encouraged.
- ◇ Only research which causes minimal disturbance to the natural and cultural values of the Reserve will be permitted, unless the expected results of the research offer significant benefits for improvement of management programs or knowledge of natural and cultural resources.
- ◇ The results of all research conducted on the Reserve are to be made available to the Trust.
- ◇ All research projects and studies must have the approval and permission of the Scientific Committee.
- ◇ Researchers must hold appropriate qualifications and licences relating to their field of research from other authorities or organisations where applicable.
- ◇ Liaison will be maintained between the Trust, Scientific Committee, researchers, speleologists and observers to obtain and provide as much mutual information and assistance as possible.
- ◇ Information collected from speleologists and researchers will be used to assist with future management of Wombeyan and karst conservation reserves.

4.2.4 Management Operations

A main road between Mittagong and Goulburn passes through the main visitor facility area of the Reserve (see map and sketch). This road, which is excluded from the Reserve, is maintained by the local councils. There are two old quarries on the Reserve which were used for maintenance of the road but are now closed and being rehabilitated.

The Reserve's visitor facilities, two staff houses and a workshop to service the Reserve are located on the floodplain of Wombeyan Creek (see map and sketch). The visitor facilities are bisected by the main road. In addition there are three management tracks on the Reserve which provide access to electricity lines which serve the Reserve and other properties, and are used for other management purposes such as weed control.

Waste effluent from the four amenities blocks, cabin vans and staff facilities at Wombeyan pass through septic systems. The combination of the karst terrain and expected demands upon the septic systems could eventually overload the existing systems. Garbage collected from the Reserve is presently being disposed of at the Taralga tip.

Wombeyan's water supply is taken directly from Wombeyan Creek just outside the northern boundary of the Reserve, from Mares Forest Creek near Tinted Cave, and from a bore which has recently been sunk on the Reserve. The water passes through an ultra violet disinfection system when exiting the water storage tanks. The bore should mean that there is no longer a need to pump water from Mares Forest Creek during peak season or from Wombeyan Creek during periods of low water flow.

In addition to management operations undertaken on the Reserve by the Trust and by local councils, there are also operations such as quarrying undertaken by private companies adjoining the Reserve, and until recently on the Reserve. Marble quarrying commenced on the Reserve in 1941 when the first mining lease was granted by the Department of Mines. Quarrying continued on the Reserve up until 1997 but has now ceased and rehabilitation of the quarries is being undertaken under an agreement with the mining company. An old steam crane, which was used at one of the quarries after being imported from England to construct the Spit Bridge in Sydney in 1925, has been given to the Trust by Melocco Pty Ltd. and will be retained on-site and interpreted. Omya Southern Pty Ltd holds a mining lease adjoining the Reserve and has a right of access to the quarry across part of the Reserve. At times there are impacts on park visitors caused by mining trucks travelling the roads to and through the Reserve.

Management Strategies

- ◇ Management tracks will only be utilised for fire control and management, emergencies, access by electricity authorities to electricity lines, feral animal and weed control.
- ◇ Garbage will continue to be disposed off the Reserve.
- ◇ Recycling and the removal of rubbish by visitors will be encouraged.

- ◇ Alternative sewage disposal systems, to replace the current septic system, will be investigated and an appropriate new system installed.
- ◇ Those above-ground sections of the old water pipe from Mares Forest Creek and Wombeyan Creek will be removed when the pipes are no longer required for water supply purposes.
- ◇ No further quarries or extraction activities will be permitted on the Reserve.
- ◇ In accordance to the Deed of Agreement, occasional site inspections of the old limestone quarries on the Reserve will be conducted by Trust staff.
- ◇ Negotiations will be continued with the holders of neighbouring mining leases to protect the Reserve, the karst and visitors from impacts resulting from mining operations.
- ◇ A conservation plan will be prepared for the old steam crane.
- ◇ Emergency works will be undertaken as necessary to ensure public health and safety and protection of the Reserve.
- ◇ Any lands added to Wombeyan Karst Conservation Reserve will be managed in accordance with the objectives and strategies outlined in this plan of management.

5. PLAN IMPLEMENTATION

This plan of management is part of a system of management developed by the Jenolan Caves Reserve Trust. The system includes the National Parks and Wildlife Act, the Trust's corporate plan, and management policies and cave entry criteria developed by the Trust.

The implementation of this plan will be undertaken in accordance with the annual review of the Trust's corporate plan and the budgeting and programming of the Jenolan Caves Reserve Trust. At this time, works and other activities proposed to be carried out on Wombeyan Karst Conservation Reserve will be evaluated in relation to the objectives and management strategies laid out in this plan. Priorities will be subject to the availability of necessary staff and funds and to any special requirements of the Trust or the Minister.

The environmental impact of all development proposals will continue to be assessed at all stages of the development and any necessary investigations will be undertaken in accordance with established environmental assessment procedures.

As a guide to the orderly implementation of this plan, relative priorities for the main activities which are outlined in this plan are summarised below. In general, activities identified as being of high priority will be undertaken within 3 years of adoption of the plan, medium priority activities will be undertaken within 3-6 years, and low priority activities will be undertaken within 6-10 years of adoption of the plan. Some high priority activities, although commenced within 3 years of adoption of the plan, will continue for the life of the plan.

ACTIVITY	RELATED SECTION
HIGH PRIORITY	
Institute monitoring program for dust, lint and rubbish in show caves.	4.1.1
Seek co-operation in protecting water quality in the karst catchment, including run-off from main road.	4.1.2
Provide information to Wollondilly Catchment Management Committee	4.1.2
Monitor the water quality in creeks on the Reserve.	4.1.2
Continue introduced species control programs. Seek co-operation with the Goulburn Lands Protection Board and landowners within the karst catchment area.	4.1.3
Liaise with Pejar Local Aboriginal Land Council re management and interpretation of Aboriginal sites.	4.1.4

HIGH PRIORITY (continued)	RELATED SECTION
Develop program to assess safety of historic structures in caves.	4.1.5
Participate in development of Wingecarribee and Mulwarree District Bush Fire Management Plans.	4.1.6
Undertake annual review of fire management plan for the Reserve.	4.1.6
Investigate relocation of visitor centre and office into kiosk building.	4.2.1
Maintain and upgrade cave infrastructure to public safety standards in a manner that does not damage the caves.	4.2.2
Obtain copies of ASF codes for distribution to cave groups.	4.2.2
Institute program for monitoring walking tracks.	4.2.2
Investigate and install alternative sewage disposal system.	4.2.4
Prepare conservation plan for old crane.	4.2.4
 MEDIUM PRIORITY	
Assess historic and landscape values of exotic trees	4.1.3
Interpret history associated with plane tree.	4.1.5
Remove old power towers except for tower near generator shed.	4.1.5
Prepare interpretation plan and review directional and interpretation signs and brochures.	4.2.1
Develop strategies to increase mid-week visitation.	4.2.1
Assess tracks in caves for opportunities for restoration/rehabilitation.	4.2.2
Develop new walking track to link camping area and Mares Forest Creek track.	4.2.2
Progressively replace wood barbecues.	4.2.2
Provide electric barbecue near the dormitory complex.	4.2.2
Redesign existing car park to cater for all vehicles including buses.	4.2.2

MEDIUM PRIORITY (continued)	RELATED SECTION
Provide BBQ facilities and native shade trees near the tennis courts.	4.2.2
Develop new abseiling area in old quarry.	4.2.2
Undertake occasional site inspections of both quarries in accordance to the Deed of Agreement until leases are surrendered.	4.2.4
Negotiate minimisation of impacts with neighbouring leaseholders	4.2.4
 LOW PRIORITY	
Remove exotic trees in the valley not of historic value or not identified for landscape values.	4.1.3
Revegetate hillslopes surrounding the camping ground.	4.1.3
Encourage research into bats.	4.1.3
Investigate alternative uses for old generator shed.	4.1.5
Liaise with neighbour re track to lookout. Formalise if agreement reached.	4.2.2
Assess viability/demand for kitchen and ablution facilities within the dormitory complex. Construct if demand warrants and resources available.	4.2.2
Develop commercial operator licensing system.	4.2.2
Remove old water pipes when no longer required.	4.2.4

6. REFERENCES

Anon (1868) "The Whombeyan Caves NSW with sketch" in *The Australian Journal*, December 1868, pp231-2.

Australian Heritage Commission (1996), *Australian Natural Heritage Charter*, Australian Heritage Commission.

Australian Speleological Federation (Inc) (1992) *Code of Ethics and Conservation*, ASF.

Australian Speleological Federation (Inc) (1995) *Minimum Impact Caving Code*, ASF.

Australian Speleological Federation (Inc) (1998) *Cave Diving Code of Practice*, ASF.

Bear, C. (1982) "Birds of the Wombeyan Caves Area" in *Wombeyan Caves*, Dyson et al. (eds), Sydney pp179-180.

Briggs, J.D. and Leigh, J.H. (1995, revised edition) *Rare or threatened Australian plants*, CSIRO, Australia.

Department of Land and Water Conservation (1995) *Wombeyan Caves Reserve Crown Land Assessment*, Sydney.

Dyson, H.J., Ellis, R. & James, J.M. (eds) (1982) *Wombeyan Caves*. Sydney Speleological Society Occasional Paper No. 8., Sydney.

Eberhard, S. and Spate, A. (1995) *Cave Invertebrate Survey: towards an atlas of New South Wales cave fauna*. Department of Urban Affairs and Planning and the Australian Heritage Commission.

ICOMOS (1988) *The Australian ICOMOS Charter for the Conservation of Places of Cultural Significance (The Burra Charter)*. Australia ICOMOS (International Council on Monuments and Sites).

Osborne, R.A.L. (1987) "Multiple karstification, A geological history of karsts and caves in NSW. Case study No.4 - Wombeyan Caves". PhD Thesis, University of Sydney .

Sydney Catchment Authority (1999) *Special Areas Strategic Plan of Management*. Sydney Catchment Authority and NSW National Parks and Wildlife Service.

Watson, J., Hamilton-Smith, E., Gillieson, D. & Kiernan, K. (eds) (1997) *Guidelines for Cave and Karst Protection*, IUCN.

Personnel Communications

Chalker, G.M. (1996)	Manager, Wombeyan Caves, Jenolan Caves Reserve Trust
Hamilton-Smith, E. (1997)	Director, Rethink Consultancy
Holland, E. (1996)	Karst Resources Manager, Jenolan Caves Reserve Trust

7. GLOSSARY

ADAPTATION An inherited characteristic of an organism in structure, function or behaviour which makes it better able to survive and reproduce in a particular environment. {1}

BAT A member of the order Chiroptera, the only mammals capable of true flight, having membranes between the toes of their forefeet. {1}

BED A depositional layer of sedimentary bedrock or unconsolidated sediment. {1}

BENTHIC Bottom dwelling, usually on the bed, floor. {1}

BLIND VALLEY A valley that is closed abruptly at its lower end by a cliff or slope facing up the valley. It may have a perennial or intermittent stream which sinks at its lower end or it may be a dry valley. {1}

BRECCIA Angular fragments of rock and/or fossils cemented together or with a matrix of finer sediment. {1}

CALCITE The commonest calcium carbonate (CaCO_3) mineral and the main constituent of limestone, with different crystal forms in the rhombohedral subsystem. {1}

CAVE A natural cavity in rock large enough to be entered by man. It may be water-filled. {1}

CAVE CORAL Very small speleothems consisting of short stalks with bulbous ends, usually occurring in numbers in patches. {1}

CAVE SHIELD A speleothem which consists of two parallel hemispherical plates separated by a medial planar crack, and which forms by water seeping through the medial crack. {2}

CAVE SPRING A natural flow of water from rock or sediment inside a cave. {1}

CAVE SYSTEM A collection of caves interconnected by enterable passages or linked hydrologically or a cave with an extensive complex of chambers and passages. {1}

CAVERNICOLE An animal which normally lives in caves for the whole or part of its life cycle. {1}

CAVING The entering and exploration of caves. {1}

DARK ZONE The part of a cave which daylight does not reach. {1}

DECORATION Cave features as a result of secondary mineral precipitation, usually of calcite. {1}

DOLINE A closed depression draining underground in karst. {1}

EROSION The wearing away of bedrock or sediment at the surface or in caves by mechanical and chemical actions of all moving agents, such as rivers, wind and glaciers. {1}

FISSURE An open crack in rock or soil. {1}

FLOWSTONE A deposit formed from thin films or trickles of water over floors or walls, usually of calcite. {1}

FOSSIL The remains or traces of animals or plants preserved in rocks or sediments. {1}

HELICITITE A speleothem, which at one or more stages of its growth changes its axis from the vertical to give a curving or angular form.

HYDROLOGY The scientific study of the nature, distribution and behaviour of water. {1}

JOINT A planar or gently curving crack separating two parts of once continuous rock without relative movement along its plane. {1}

KARREN The minor forms of karst as a result of solution of rock on the surface or underground. {1}

KARST Terrain with special landforms and drainage characteristics on account of greater solubility of certain rocks in natural waters than is common. {1}

LAMPENFLORA Flora grown entirely under the influence of artificial light. {3}

LIMESTONE A sedimentary rock consisting mainly of calcium carbonate. {1}

MARBLE Limestone recrystallised and hardened by pressure and heat. {1}

NATURAL ARCH An arch of rock formed by weathering. {1}

PALAEOKARST Fossil karst

POOL DEPOSIT (1) Any sediment which has accumulated in a pool in a cave.
(2) Crystalline deposits precipitated in a cave pool, usually of crystalline shape as well as structure. {1}

SHOW CAVE A cave that has been made accessible to the public for guided visits. {1}

SOLUTION In karst studies, the change of bedrock from the solid state to the liquid state by combination with water. {1}

SPELEOLOGY The exploration, description and scientific study of caves and related phenomena. {1}

SPELEOTHEM A secondary mineral deposit formed in caves, most commonly calcite. {1}

STALACTITE A speleothem hanging downwards from a roof or wall, of cylindrical or conical form, usually with a central hollow tube. {1}

STALAGMITE A speleothem projecting vertically upwards from a cave floor and formed by precipitation from drips. {1}

STEEPHEAD A steep-sided valley in karst, generally short, ending abruptly upstream where a stream emerges or formerly did so. {1}

STRAW (STALACTITE) A long, thin-walled tubular stalactite less than about 1cm in diameter. {1}

STROMATOLITE An organo-sedimentary deposit with an internal structure of fine, more-or-less planar laminations. Forms as the result of benthic microbial mats trapping and binding detritus and/or forming the locus for mineral precipitation.

TROGLOBITE A cavernicole unable to live outside the cave environment. {1}

TUFA Spongy or vesicular calcium carbonate deposited from spring, river or lake waters. {1}

REFERENCES

{1} Gilleson, D. (1996), *Caves*. Blackwell.

{2} Hill, C. and Forti, P. (1998) *Cave Minerals of the World* (2nd ed.). National Speleological Society.

{3} Elmes, D.C. (1990) *Cave Management*. CSU.