

# Naracoorte Caves National Park Management Plan

South East

South Australia



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February 2001

Department for Environment and Heritage

This plan of management has been prepared and adopted in pursuance of  
Section 38 of the National Parks and Wildlife Act, 1972.

Published by the Department for Environment and Heritage  
February 2001

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ISBN 0 7308 5846 4

Cover photo by Steve Bourne  
Prepared by South East Region  
National Parks and Wildlife SA  
Department for Environment and Heritage

FIS 15514

## FOREWORD

This management plan sets out management objectives and actions for the Naracoorte Caves National Park. It has been prepared in accordance with the *National Parks and Wildlife Act, 1972*.

Located south of Naracoorte in the Upper South East of South Australia, Naracoorte Caves National Park is one of two reserves in the region offering unique cave features. The Park was listed as a World Heritage Property by UNESCO in 1994 together with the Riversleigh section of Lawn Hill National Park (QLD) as the “Australian Fossil Mammal Sites (Riversleigh/Naracoorte)” for their outstanding universal values. This Plan has been prepared to fulfil the requirements of the Department for Environment and Heritage and the Government of South Australia to the Government of Australia under the terms of the World Heritage Convention - The Convention concerning the Protection of the World Cultural and Natural Heritage.

This management plan provides the opportunity to institute management which reflects the need to protect, preserve and enhance the presentation of the international values of the Park as a result of the World Heritage listing. This is necessary given the increased awareness of these values in the wider Australian and International community, the resulting increased numbers of visitors and their expectations of such listing.

Blanche and Victoria Fossil Caves were listed in the State Heritage Register in 1984 for their natural features and because they represent two contrasting approaches to human utilisation of caves. The management plan offers the opportunity to reinforce the heritage values of these caves and outline management actions necessary for their future conservation.

Amendments to the Naracoorte Caves Conservation Park Plan of Management were released in draft form for public review in July, 1997, and five written submissions were received. Those comments, and the draft plan, were subsequently reviewed by the Reserve Planning and Management Advisory Committee of the South Australian National Parks and Wildlife Council, resulting in a number of changes being made to the plan text. These changes were subsequently endorsed by Council. Public involvement in the planning process makes a worthwhile contribution to better park management, and those who took the time to make representations are thanked for their efforts.

In recognition of the World Heritage values of the area, Naracoorte Caves was reconstituted as a National Park on 18 January 2001.

The plan of management for the Naracoorte Caves National Park is now formally adopted under the provisions of Section 38 of the *National Parks and Wildlife Act, 1972*.



The Hon. IAIN FREDERICK EVANS, BAppSc (Building Technology), MP  
MINISTER FOR ENVIRONMENT AND HERITAGE  
MINISTER FOR RECREATION, SPORT AND RACING

## **ACKNOWLEDGMENTS**

This park management plan has not been prepared in isolation, but rather in consultation with agencies, community groups and individuals.

NPWSA wish to acknowledge the assistance of members of the Australian Speleological Federation (ASF Inc) and the Australasian Cave and Karst Management Association (ACKMA Inc). In particular, valuable advice and comments were provided by Mr AG Davey, Mr AP Spate, Mr E Hamilton-Smith, Ms S White and Dr RT Wells. Staff of the Department for Environment and Heritage, and the World Heritage Unit, Department of Environment, Sport and Territories, Canberra provided invaluable support and comment. Mr KG Grimes of Regolith Mapping prepared the figures.

Nicholas White prepared the draft for this plan of management, and his work is appreciated by the NPWSA.

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## **1. INTRODUCTION**

### **1.1 Planning Process**

Section 38 of the *National Parks and Wildlife Act 1972*, requires the preparation of a management plan for each reserve constituted under the Act. Such plans set forth proposals to manage and improve reserves and the means by which the objectives of the Act will be accomplished. A management plan provides the framework for management of the park by stating the philosophy on which management should be based and by setting out objectives and actions for management. The objectives related to management of reserves are stated in Section 37 of the Act as:

- preservation and management of wildlife
- preservation of historic sites, objects and structures of historic or scientific interest within reserves
- preservation of features of geological, natural or scenic interest
- destruction of dangerous weeds and the eradication of disease of animals and vegetation
- prevention and suppression of bush fires and other hazards
- encouragement of public use and enjoyment of reserves and education in, and a proper understanding and recognition of their purpose and significance, and
- generally, the promotion of the public interest.

NPWSA as a matter of policy invites comments from key agencies, groups and individuals before the draft management plans are formally released for comment from the general public.

This internal review stage aims to gain a measure of understanding amongst various stakeholders, with a view to retaining that support before the subsequent public exhibition period. The Upper South East Consultative Committee was consulted during the internal review stage for this plan.

Once a draft management plan has been prepared, an announcement is made in the *Government Gazette* and the plan is placed on public exhibition for at least three months. Any person may make submissions in relation to the plan.

The plan and submissions are then referred to the National Parks and Wildlife Council who may make further comments or recommendations to the Minister.

The Minister, after considering all representations, may then adopt the plan with or without alterations. Notice of adoption is published in the *Government Gazette* and copies of the plan are made available to the public.

Once a plan is adopted, the provisions will be carried out in relation to the reserve in question, and no activities are undertaken in conflict with the management plan. A similar process applies for any amendment proposed to a management plan.

## **2. MANAGEMENT CONTEXT**

### **2.1 National Parks and Wildlife SA**

In South Australia, reserves constituted under the *National Parks and Wildlife Act, 1972* cover a wide range of landscapes from the hot sandy deserts, salt lakes, saltbush and mulga plains of the arid interior to the cooler, more humid hills, woodlands, swamps and coastlines of the southern continental fringe.

National Parks and Wildlife SA, a Division of the Department for Environment and Heritage (DEH), is a manager and custodian of land, wildlife and sites of natural and historical significance throughout South Australia. It is also an educational and advisory organisation which aims to assist the public in understanding and enjoying the State's heritage, and ensuring that it is preserved for future generations.

NPWSA has responsibility for the control and management of nearly 21 million hectares of land reserved under the *National Parks and Wildlife Act, 1972*. It acts as custodian of these areas as long as required by the South Australian community, and in appropriate areas provides for development of facilities for public education and enjoyment.

The objectives of reserve management by NPWSA can be summarised as:

- to promote and encourage conservation and public appreciation of wildlife and plant communities, and other natural and historical features by means of a reserve system, and provide for the management of plants and wildlife species and populations throughout the state, in accordance with the *National Parks and Wildlife Act, 1972*; and
- to identify and provide for recreational pursuits in specified parks or areas, which are in sympathy with the provisions of the *National Parks and Wildlife Act, 1972* and which assist in the promotion of community understanding of parks and their inherent values.

The classification that a reserve receives on being dedicated under the Act is a general statement of the purpose for which that area of land was acquired. National Parks are areas considered to be of national significance by reason of wildlife or features of that land. Naracoorte Caves has been recognised as internationally significant because of the presence of vertebrate fossils in the caves. This level of significance reflects that required of a National Park ie “...*the Governor considers to be of national significance by reason of the wildlife or natural features of that land*” (*National Parks and Wildlife Act 1972; Section 28*).

These points have been considered in preparing the Management Plan for the Naracoorte Caves National Park.

## **2.2 State Heritage and Development**

Victoria Fossil and Blanche Caves were entered in the State Heritage Register in 1984. These caves are significant for their reflection of changing human perceptions of the recreational and educational use of caves.

Blanche Cave demonstrates Victorian attitudes to recreation, its use as a social gathering place and development as a 'grotto' during the late 1800's and early 1900's.

While Victoria Cave had been similarly developed during this period, its re-development as Victoria Fossil Cave in the early 1970's provides a focus for scientific study and public education.

State Heritage listing obliges managers to consult about heritage values, extent of listing and the impact of any proposed development on the heritage values.

The *Heritage Act 1993* provides for the conservation of places of heritage value and the *Development Act 1993* provides for planning and regulating development, the management of land, and the design and construction of buildings. Section 16 of the *Heritage Act 1993* sets out the criteria for establishing the heritage values with Schedules 8 (referrals and concurrences) and 14 (State agency development) of the *Development Act 1993* providing the mechanisms for future development of Blanche and Victoria Fossil Caves.

## **2.3 World Heritage Listing and Naracoorte Caves**

Naracoorte Caves National Park together with the Riversleigh portion of Lawn Hill National Park (North Queensland) were jointly added to the World Heritage list as the Australian Fossil Mammal Sites (Riversleigh/Naracoorte) in 1994. They were listed for their outstanding natural universal values and fulfilling the following two of four possible criteria for inclusion on the World Heritage List as natural heritage:

- as outstanding examples representing major stages of the earth's evolutionary history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiogeographic features; or
- as outstanding examples representing significant ongoing ecological and biological processes in the evolution and development of terrestrial, freshwater, coastal and marine ecosystems and communities of plants and animals.

The Caves contain the fossil remains of tens of thousands of vertebrate animals making it one of the richest deposits of Pleistocene vertebrate fossils in the world. Represented are 96 species of amphibians, reptiles, birds, and mammals, but the site is most famous for the many giant fauna species found there, known collectively as Megafauna. These include a giant Tasmanian Devil, many giant Kangaroos, the Marsupial Lion, a giant Echidna and a giant Python.

International recognition of the site is not static and it carries ongoing obligations to ensure that the sites values are protected, preserved and presented in a way which reflects these values now and in the future.

The entire Park was recognised as a World Heritage Area, because vertebrate fossils occur in all of the caves and interpretation of the caves and fossil histories are interconnected.

The scientific study and research of the site is an ongoing process and the unfolding of the evolutionary and geomorphic history revealed by the studies enhances the values of the site.

The process of listing the Naracoorte Caves National Park as a World Heritage Area required:

- the site to be of adequate size to represent the recognised values;
- the site to have a management plan;
- the site should have adequate long-term legislative, regulatory or institutional protection;
- the boundaries of the site should adequately reflect the spatial requirements of protecting the phenomena that provided the basis for listing; and
- the boundaries should include sufficient areas immediately adjacent to the area of outstanding universal value in order to protect the site's heritage values from direct effects of human encroachment and impacts of resource use outside of the nominated area (World Heritage Convention 1972).

It should be noted that under the terms of the World Heritage Convention 1972, there is an on-going obligation to report on the integrity of listed properties to IUCN. There are mechanisms to place listed properties on the World Heritage in Danger list if the integrity of the property is threatened or in danger. No Australian properties have been placed on this list but there are a number of such places in danger in the world due to civil or ecological disturbance.

The palaeontological heritage is discussed more fully in Section 2.10 and the consequences of the World Heritage listing are embraced in the Objectives for the Park in Section 3 and in the policies and management actions proposed in Section 4.

## **2.4 Location, Regional and Historical Context**

Naracoorte Caves National Park is situated 11 kilometres south-south-east of the Naracoorte township. The Park has a total area of approximately 600 hectares, comprising Sections 463, 466, 647, 653 and 654 Hundred of Jessie; and Sections 82, 392, 395-8, 487, 499, 502-4, and 507 Hundred of Joanna (Figure 1). A portion of Section 387 was acquired in 1996 and dedicated as Naracoorte Caves Conservation Reserve in 1997. The location and boundaries of the Park are shown in Figure 1.

The Park lies within the South East region of South Australia. Its regional context is essentially one of a karst province, namely one in which the topography and hydrology of the area is determined by the solubility of limestone rock (Marker 1975). This has resulted in a diversity of solutional features, including the caves, which were the basis for the establishment of the Park. Within this region, Laut et al. (1977) distinguish the Naracoorte Environmental Association, characterised by calcarenite dune ridges overlain by sand with narrow and imperfectly drained interdunal areas.

The Naracoorte Caves National Park is one of five reserves contained within this environmental association. Each reserve exists as a remnant along the Naracoorte Range with their locations varying from as far north as Desert Camp Conservation Reserve to Glen Roy Conservation Park in the south.

The major feature of the Park is its many caves, which have been managed for their scientific, education, conservation and recreation value since 1885. The Park contains approximately one-third of the known caves in the Naracoorte dunes, in the Upper South East of South Australia. In addition to the scientific values of the vertebrate fossil deposits, the caves of the Park are sites of significance for other values viz. the biological values of the bats and invertebrates; historical, cultural, geological and geomorphological values. The natural values of the caves are complemented by various vegetation associations on the surface of the Park.

Historically, parts of this Park have strong community links. Blanche Cave has been a popular visiting spot since its discovery in 1845, while Stoney Point has been used by local residents for picnicking and swimming for over a hundred years. Development of the Park into an important regional tourist destination was greatly assisted by the discovery in 1969 in Victoria Cave of the largest known Australian Pleistocene vertebrate fossil cave deposit. An active research program of excavations is contributing to an interpretation of Pleistocene environments and the extinct and extant faunal assemblages living during this period.

Since transfer of management to the National Parks and Wildlife Service in 1972, as a Conservation Park, there has been continual upgrading of facilities and services to meet the needs of increasing numbers of visitors. Several allotments have been acquired and added to the Park to more fully represent the karst features. In December 1994 the Park was inscribed on the World Heritage List as part of the Australian Fossil Mammal Sites (Riversleigh/Naracoorte). These sites were nominated together as containing fossils representing stages in the evolution of Australia's mammals. The Riversleigh area is a diverse series of different sites of different ages from the Oligocene through to the Pliocene, each with a different fauna. The Naracoorte site is

Pleistocene in age ie more recent in geological terms. The Naracoorte fossil material is discussed more fully in Section 2.10.

In recognition of the International and National values of the area the Park was reclassified as a National Park, under the provisions of the *National Parks and Wildlife Act 1972*, in 2001.

## **2.5 Climate**

The region has a Mediterranean climate. Temperatures are cool in winter and mild in summer, and mean annual temperature of 14.4°C, reaching maxima in January - February and minima in June - July. The mean annual rainfall is 580 mm, with most precipitation occurring in winter. Humidity is higher during winter. Mean annual evaporation is 1800 mm, most of which occurs during summer.

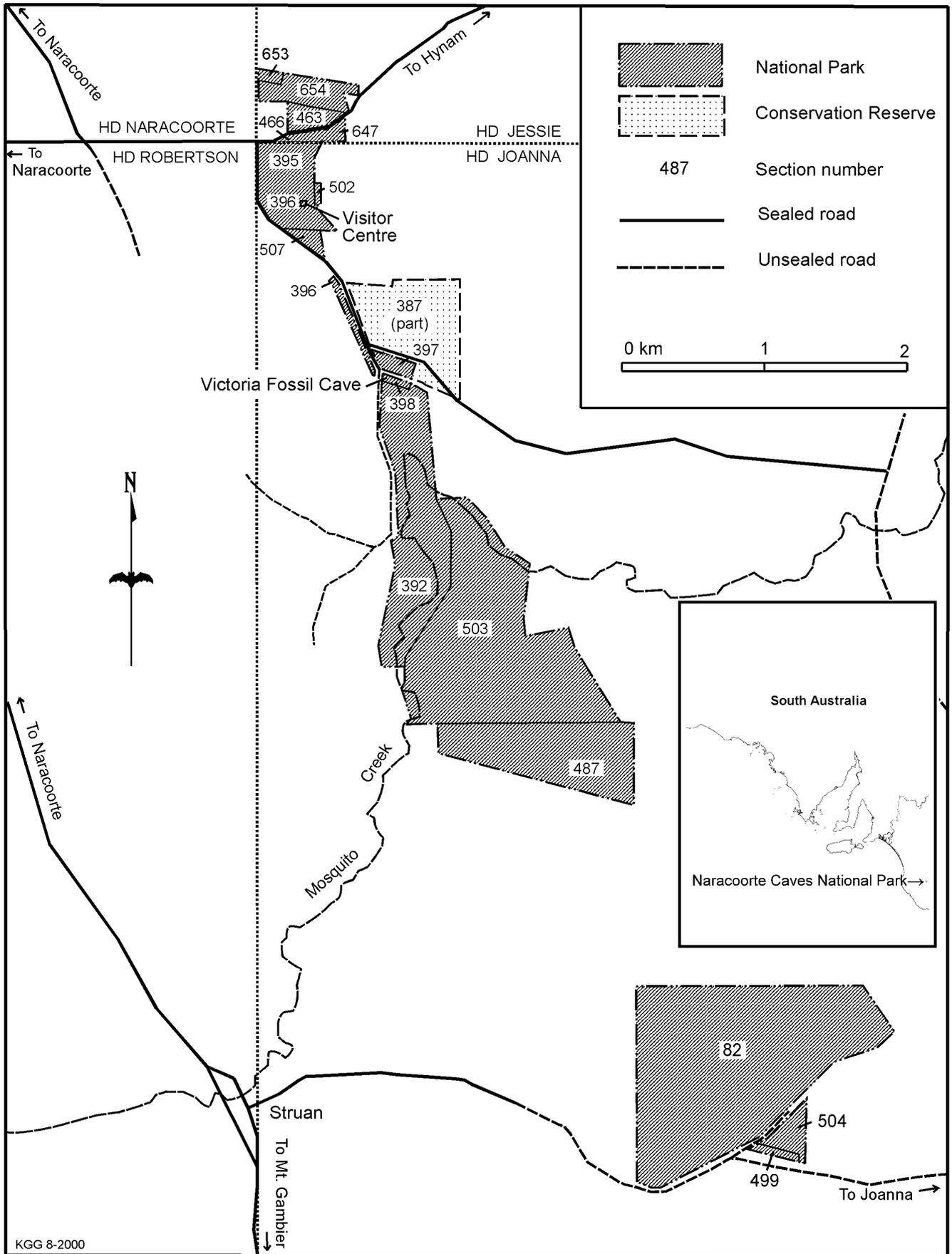


Figure 1. Park Location and Boundary Map

## **2.6 Geological Context**

The Park is situated in the South East of South Australia and is in the north-eastern section of the Gambier Embayment; part of the Otway Basin. The Gambier Embayment is a karst province characterised by low relief with dolines, cenotes, uvalas and caves predominantly in the ridges which consist of either or both of the Miocene Gambier Limestone or in calcarenite dunes of the Pleistocene Bridgewater Formation (Grimes 1992; Marker 1975; Lewis 1984). The Park is situated on a linear ridge of Miocene Gambier Limestone (limestone deposited in shallow seas some 25 million years ago) which is known as the Naracoorte East Ridge and is an expression of the nearby Kanawinka Fault within the underlying basement rock. It is distinguished from the Naracoorte West Ridge by its core of Gambier Limestone, but both ridges are capped by the more recent dune deposits of the Bridgewater Formation. The Gambier Limestone is a bryozoal limestone (contains fossils of aquatic colonial organisms) with a number of readily identifiable units. The caves have been formed in the Naracoorte unit which is a series of jointed beds of coarse shelly matter alternating with finer bryozoal limestone (Ludbrook 1961). Corals, sponges, echinoderms, brachiopods and molluscs are evident in the walls of the caves although larger marine species such as sharks and whales have been recorded (Glaessner 1955).

The overlying Pleistocene dune deposits of the Bridgewater Formation are calcareous and carbonate sands with prominent dune bedding. The area has been modified by a series of marine transgressions and regressions. These influenced the surface erosion/deposition patterns and the watertable, and evidence of both transgressive and regressive stages can be seen. The caves were predominantly formed by the phreatic action of water, but have been subsequently modified by roof collapse and further solution. There have also been various sedimentary phases, resulting in deposition of cave sediments, such as the fossil bearing sediments of Victoria Fossil Cave.

The soils show a close correlation with landforms. The ridges are characterised by an alkaline, shallow, reddish sand and an acid, bleached sand with a yellow-grey B horizon. These well-drained sands on the ridges are commonly stony and are characterised by rock outcrops, (Blackburn et al. 1965). The interdunal areas show either neutral, black, organic soils or alkaline, sandy, pedal, mottled-yellow duplex soils. These are generally deep and well developed but poorly drained.

## **2.7 Caves**

The 33 known karst features in the Park are part of a larger group of 105 karst features documented for the Naracoorte dunes (CEGSA Occasional Papers 5 & 6). Not all of these karst features are caves. Mostly formed in Gambier Limestone, the caves generally have collapse window or enlarged solution tube entrances, and low, wide passages with sandy floors connecting large collapse chambers with floors of large breakdown blocks. Four of the caves have been modified for public inspection, while many others have been modified during exploration and/or excavation of guano (Bat Cave) or building stone (Robertson Cave). Several karst features occur in the recently acquired allotments. These need speleological assessment.

The code preceding the cave names are those assigned to cave entrances by the Cave Exploration Group of South Australia and are part of an Australian data system on caves. The U prefix applies to caves of the Upper South East Region.

### **U1 Victoria Fossil Cave**

Over 3000 metres of collapse dome chambers connected by low passages and flatteners comprise this complex cave. These passages show strong influence from jointing. The toured section is mostly collapse chambers with the low connecting passages artificially enlarged. Artificial entrances have been excavated for ease of visitor access. The cave contains important vertebrate fossil deposits; the Fossil Chamber is the most extensively studied by scientists and visiting this chamber forms part of the visitor tour. The Upper and Lower Ossuaries are still to be studied and are not visited except for authorised research purposes. There is excellent extensive speleothem decoration throughout the cave. The cave is a place in the State Heritage Register. A plan of the cave is shown in Figure 3.

### **U2 Bat Cave**

A collapse window (8 metres x 12 metres) drops 8 metres to a rockpile in the entrance chamber. The cave develops for over 300 metres to the south-east and includes the main bat chamber (60 metres x 25 metres and 12 metres high) which contains extensive guano deposits that were mined in the 19th Century. Extensive decoration is present. The cave is the maternity site for the Bent-winged Bat (*Miniopterus schreibersii*) population of South East South Australia and South West Victoria. The Bats and their behaviour in the cave can be viewed by remotely controlled cameras placed at various points in the cave. The cave is also important for the invertebrates present: it is the type locality for a number of species. A plan of the cave is shown in Figure 2.

### **U3, U90 Alexandra Cave**

This cave comprises several well-decorated chambers connected by low sandy and floored passages. The northern passages have been enlarged to allow easy access for visitors. The original solution tube entrance has been extensively modified and an additional artificial entrance excavated. A plan of the cave is shown in Figure 2.

### **U4, U5, U6 Blanche Cave**

Blanche Cave has a long history as a show cave and is a place in the State Heritage Register. It is predominantly a line of large collapse passages and chambers with several roof windows (total length 250 metres). It is a good example of collapse beneath a calcrete caprock. The decoration, which had dried and degraded, has now rejuvenated as water percolation resumed after the removal of the pine trees over the top of the cave in the late 1980's. A plan of the cave is shown in Figure 2.

### **U7 Appledore Cave**

Two collapse entrances 20 metres apart lead into the cave which trends south-east for 70 metres and ends in a chamber 15 metres x 7 metres, 3 metres high.

### **U8, U9 Blackberry Cave**

Two window entrances 80 metres apart provide access. This is an extensive well decorated system of passages and domes. From the eastern entrance the cave extends

for 220 metres in an area known as the Butterfly Extension, while the major portion of the cave heads south from half-way between the two entrances for 350 metres. The cave continues north-west from this chamber for 140 metres. The southern section of the cave has a gate to control access. A plan of the cave is shown in Figure 2.

#### **U10, U11 Wet Cave**

This self-guided 'show' cave has 4 collapse window entrances leading to a group of interconnected chambers and passages showing both collapse and original phreatic features. The cave trends north-west to south-east. In the final chamber of the self-guided portion of the cave there is a flat roof with well developed avens and pendants. Part of the cave is used by bats as an over-wintering site. A plan of the cave is shown in Figure 2.

#### **U12, U13 Cathedral Cave**

A solution tube (U12) and roof window (U13) lead to a large chamber (30 metres x 10 metres x 15 metres high); then alternating areas of high collapse domes and passages and smaller phreatic and collapse chambers, passages and flatteners follow. The cave trends generally north-west to south-east. Some of the chambers have sandy beds containing bone deposits. The total length of the cave is 500 metres. A plan of the cave is shown in Figure 2.

#### **U17, U18, U19 Robertson Cave**

Two collapse windows lead to a series of domed chambers connected by short, low-level passages. Total length of the cave is 130 metres. A shaft was excavated to remove stone quarried from the cave and this area was used for rubbish disposal. Most rubbish is now removed and the shaft covered to provide suitable conditions for bats to re-establish use of the cave.

#### **U22 Fox Cave**

The only open entrance from a small collapse doline leads to a large cave (over 1000 metres) strongly influenced by north-east to south-west trending joints. The cave is a series of large domed passages and chambers connected by low crawlways and flatteners including an extensive lower section of very tight phreatic passages. This is a complex cave exhibiting several stages of cave development. There are some areas of excellent decoration and large sand cones and sediments.

#### **U44 Little Victoria Cave**

The 1.5 metres diameter window entrance drops 3 metres to the top of a rock pile. The cave consists of a complex network of passages through and around the rockpile for about 70 metres of passage.

#### **U49 - unnamed**

A 0.6 metres diameter tube drops 4 metres. Very little cave development.

#### **U50 - unnamed**

A small roof window entrance leads down the edge of a rock pile before choking off.

**U51 - unnamed**

A group of three small collapsed entrances 0.5 metres deep. No passages lead off this cave.

**U62 Saddle Cave**

A small window entrance drops 1 metre into a network of low passages mainly trending north-west to south-east. Small floor holes lead to low chambers. The total length of the cave is about 100 metres and depth about 15 metres.

**U72 Sand Funnel Cave**

A funnel-shaped doline in sand, 5 metres in diameter and 4 metres deep leads to a 0.3 metres wide tube which drops 12 metres to a chamber 130 metres long. Large blocks of rock cover the floor of the chamber. Smaller passages give the cave a total length of 500 metres and a depth of 30 metres. There is some reasonable decoration.

**U89 Peppertree Hole**

An undercut ledge in a doline 10 metres in diameter leading to a sandy floored passage about 3 metres long and 3 metres deep.

**U94 Pavy's Plunge**

A 3 metres diameter collapse in sand at the top of a sand ridge tapers down to 1 metre diameter at a depth of 5 metres.

**U98 Little Cathedral**

A small doline with bifurcating tube with 2 entrances, which leads to a single chamber.

**U119 Frog Hole**

A 1 metre diameter collapse to 2.5 metres deep.

**U122 - unnamed**

A small doline.

**U127 - unnamed**

A small window collapse entrance leads into a cave 3 metres long by 0.5 metres high and 5 metres wide.

**U128- unnamed**

A small cave in the bank of Mosquito Creek.

**U129 - unnamed**

A small cave in the bank of Mosquito Creek.

## 2.8 Vegetation

Little of the vegetation within the Park remains in a natural condition. The original vegetation communities would have been open forest of Brown Stringybark (*Eucalyptus baxteri*) with a sparse heath understorey on the sand dunes; open scrub dominated by Dryland Tea-tree (*Melaleuca lanceolata*) on rocky areas on the limestone ridges; and open forest or woodland of River Red Gum (*E. camaldulensis*) along the Creek and on its flats. The Brown Stringybark community is the only one of these three that is represented in a reasonably undisturbed condition in the Park. Despite this, much of the landscape retains a semi-natural character and there is considerable nature conservation value in maintaining even the disturbed vegetation, especially as habitat for native animals.

Several areas of native vegetation have been added to the Park. The main area of interest surrounds the Robertson Cave section of the Park and consists of open forest of Pink Gum (*E. fasciculosa*) with scattered South Australian Blue Gum (*E. leucoxylon*), *Acacia mearnsii* and *Banksia marginata*, or Brown Stringybark with scattered Pink Gum and Rough-barked Manna Gum (*E. viminalis ssp. cygnetensis*).

There are many introduced plants in the Park, ranging from herbs, annual grasses, broad-leaved weeds and garden escapees, to trees and shrubs. The latter include many Australian natives that are not indigenous to the area, numerous broad-leaved deciduous trees and palms. These introduced species reflect phases in the management history of the Park. Several sections of the Park were used for plantation production of softwood and hardwood.

Portions of Sections 463, 487 and 503 are former agricultural land, developed for grazing, and now support rank growth of introduced grasses and broad-leaved weed species.

## 2.9 Fauna

### 2.9.1 Surface Fauna

The extensive modification of landscape and vegetation has had an impact on the fauna of the district. Twenty-six species of native mammals and seven species of introduced mammals are thought to be present in the Naracoorte region. Two mammal species of particular interest are the Brush-tailed Phascogale (*Phascogale tapoatafa*) which is now very rare in South Australia with the last record in the Park in 1967, and the Sugar Glider (*Petaurus breviceps*). The diversity of bird species and the population numbers of each species have also generally been reduced by environmental modification across the region, however, 90 species (including four introduced species) have been recorded in the Park. Twenty-seven species of reptiles have been collected in the Naracoorte district, and most of these are probably present in the Park. Exotic fish species, particularly Brown Trout and Redfin Perch, now dominate the fish population of Mosquito Creek, but the River Blackfish (*Gadopsis marmoratus*) is still found there.

### 2.9.2 Cave Fauna

The major faunal feature of caves of the Park lies in its population of Bent-winged Bat (*Miniopterus schreibersii*). This bat utilises caves as shelter during the day, emerging at night to feed on free-flying insects.

Each population of Bent-winged Bats in Australia occupies a relatively discrete geographical range (Dwyer 1968). Within this range, one cave will be chosen as the maternity site and used for the birth and rearing of each generation of young. In the case of the Naracoorte population its range consists of south-eastern South Australia and south-western Victoria and the maternity site is Bat Cave. Like all such sites, this cave is shaped in such a way as to facilitate the capture and maintenance of warm air in ceiling domes, providing an incubator-like situation which is vital to the survival of the young bats.

The bats gather in the Bat Cave from September onwards each year, and birth of the young occurs during November and December. At 15 weeks old, they are weaned and capable of independent flight and hunting. Most of the population leave at this time, dispersing to other caves throughout their range and enter a period of relative torpor during winter. Several other caves in the Park are important roosting caves during the year (Blanche Cave, Wet Cave, Cathedral Cave and Robertson Cave).

Although currently numerous, this bat is an extremely vulnerable species. Disturbance at the maternity site can lead to premature births and subsequent death of the young or to massive death among juveniles. Similarly, disturbance during hibernation leads to depletion of fat reserves and subsequent death from starvation (Hamilton-Smith 1970). The population is entirely dependent on night flying insects for food.

Not only is the protection of Bat Cave vital for conservation of the species, but the nightly bat flight from November to March provides a visitor experience of great educational importance. The Bat Cave Televue Centre provides the opportunity for visitors to view bats and their behaviour without disturbance, and for research, which adds to our knowledge of bat behaviour and ecology.

The bat population also provides the environment for a wide range of invertebrate species including parasites and organisms that live in bat guano. Over 30 species of arthropods have been collected from the guano deposits of Bat Cave, some of which appear to be endemic to this cave (Hamilton-Smith 1972). The Bat Cave is the type locality of a number of these species. Another invertebrate of interest found in the Park is a species of cave cricket, *Novotettix naracoortensis*. Alexandra Cave is the type locality for this species.

## 2.10 Palaeontological and Environmental Heritage

Vertebrate fossils were described from Naracoorte caves in the 1860's (Woods, 1860, 1862, 1866). Stirling (1908) described a Marsupial Lion from Specimen Cave. It was not until 1969 when Wells and Gartrell discovered the Fossil Chamber deposit in the Victoria Fossil Cave that the values of the vertebrate fossil deposits in the caves was recognised. It has been the subsequent detailed excavation and study of this deposit conducted by Wells and others which has resulted in the reputation which Naracoorte now holds internationally (Wells 1975; Wells et al. 1985).

The Naracoorte vertebrate fossil material contains the most extensive and diverse fauna of any of the late Pleistocene sites in Australia. The Caves have acted as pit-fall traps, collecting animals over a period spanning the last 400,000 years. The Fossil Chamber of Victoria Fossil Cave is the most extensively studied site at Naracoorte. Early dating placed some material at around 18,000 but current dating suggests ages of in excess of 200,000 years (Ayliffe & Veeh 1986; Ayliffe, Moriarty, Marianelli & Wells 1997). The deposit has excellent preservation of material, which has led to a greater understanding of the species found here. The quantity and quality is complemented by many other deposits in Naracoorte Caves. Important information about the area's palaeontological and environmental heritage has been found within Victoria Fossil Cave, in the Ossuaries, White Chamber, Butch and Lake Chamber, and Starburst Chamber, as well as major sites in Cathedral, Wet, Robertson, and Fox Caves.

The taxa represented from the deposits represent all the families of marsupials known from the Pleistocene in Australia, as well as large numbers of reptiles and birds. The species represented include both extant and extinct species, many of them belonging to the now extinct Megafauna. So far, 96 vertebrate species have been identified from the main fossil chamber in Victoria Fossil Cave. Of these, 19 are extinct Megafauna which include 9 sthenurine kangaroos, a giant wallaby, *Protemnodon*, large Diprotodontids, *Zygomaturus trilobus*, and *Palorchestes azael*, a python *Wonambi naracoortensis*, *Thylacoleo carnifex*, *Macropus titan*, *Phascolarctus stirtonii*, *Megalibgwilia ramsayii*, *Sarcophilus lanarius* and *Progura naracoortensis*.

Continuing research and study of these deposits holds the promise of extending the time frame of this record to even earlier in the Pleistocene and providing a more comprehensive knowledge of the faunal and climatic changes during this period. Only further research and integration with other evidence will elucidate the interactions between climate, landscape development, megafaunal extinctions and the presence of man in Australia. There are international parallels with Northern Hemisphere faunas, which also underwent extinctions during extreme climatic changes, and interactions with man.

Modification of Victoria Fossil Cave to facilitate the interpretation of fossil deposits has revolutionised the nature of the visitor experience at Naracoorte and has given a specific importance to the Park as a visitor attraction. From a scientific perspective, it is a site of true world significance. Continuing research and interpretation of the research for the public will enhance the values of the Park.

## **2.11 History of Use of the Park and Caves**

Little appears to be known of the Aboriginal inhabitants of the Naracoorte area, and few artefacts have been recognised on the Park other than the famous "petrified Aborigine"; one of the stranger aspects of the Park's history. From the first discovery of Blanche Cave by Europeans in 1845, it was known that in an alcove near the end of the Cave was a dried-out body of an Aborigine, with some calcite encrustation that caused it to be thought of as "petrified". The body was stolen from the Cave on 10 September 1861 by a wandering showman, was returned to the Cave by court order, subsequently stolen again by the showman, and not recovered.

Tourists were visiting Blanche Cave by 1856 and at least some other caves were known at a relatively early date, and Bat Cave was mined for guano as early as 1871 (Lewis 1977, Hamilton-Smith 1997) and shown to visitors during the 1870's (Murdoch and Parker 1962). As a result of the popularity of the caves and their vulnerability to vandalism, a caretaker was appointed by the Woods and Forests Department in 1885. A systematic search for caves was rewarded by the first entry of Alexandra Cave in 1908. By this stage eight other caves were open to the public.

A number of caretakers, curators (since 1949) and rangers (since 1972) have been appointed with only a few having a significant or lasting impact on the Park, most notably William Redden, from the late 1880s until 1919, and Robert Leitch from 1921 until 1948.

Evidence of early development of the Show Caves includes: cut and benched steps, wooden handrails, tables and benches, and an iron grille in Blanche Cave; and the original constructed entrance and stairway, wire screens and ceiling-hung lighting in parts of Victoria Fossil Cave.

The major event of recent years has undoubtedly been the discovery in 1969 of the fossil chamber in Victoria Cave by Gartrell and Wells of the Cave Exploration Group of South Australia. They recognised that their discovery was not only of major importance from a palaeontological viewpoint, but potentially represented a new kind of opportunity for cave tourism and interpretation. They were supported in this view by the South Australian Tourist Bureau and the fossil chamber was first opened to the public on 20 December 1969. During the early 1970's the development within the cave was extended and it was re-opened as the Victoria Fossil Cave.

In 1972 responsibility for the Park was transferred to the National Parks and Wildlife Service.

Caves are an important element of the South East regional tourism industry attracting over 135 000 people annually, of which an average 50 000 (1975-98) visited Naracoorte Caves. This figure has ranged from a low of 35 000 (1991) to a peak of 70, 000 (1975). From the low in 1991 numbers increased to around 40 000 in 1997-98. In December 1998 a new site interpretation centre, focused specifically on the World Heritage values, was opened to the public and visitation for 1998-99 increased by 80% to 70 000, and to 78 000 in 1999-00.

Cave tours focus on giving visitors an appreciation of the processes which formed the caves and their contents particularly the fossil deposits, the aesthetics of caves and the biology and cultural history of the caves. The Park provides a regional focus for interpreting the South East of South Australia and this is provided through cave tours, interpretive material and displays in the visitor centre. The Park contributes to the range of recreational activities available in the South East. Apart from cave tours and exploration, the Park offers a range of opportunities such as picnicking, camping, nature observation, photography, and freshwater fishing.

In 1986 a program to provide Park visitors with the experience of cave exploration under supervision was introduced, as were guided tours to view the bat flight and interpret the significance of the Bat Cave. As a result of the popularity of these tours and the interest in the bats, video cameras were placed within the cave in 1995 to enable viewing of the bats without disturbance.

## **2.12 Infrastructure and Visitor Facilities**

### **2.12.1 Aboveground Development**

The main facilities are concentrated in Section 396 (Figure 2) near Alexandra Cave and include:

- visitor centre comprising a ticket office and general display area; (A)
- administration centre, cafe and public toilets; (B)
- fossil store and curation facility; (C)
- storage shed; (D)
- the Bat Cave viewing and interpretation building; (E)
- works depot; (F)
- car park for 80-100 cars and three coaches; (G)
- picnic areas and maintained lawns; (H)
- picnic area with electric BBQ cookers (I).

Redevelopment of facilities to provide for increased numbers of visitors and to enhance the interpretation of the World Heritage values of the commenced in 1996 and was completed in June 2000.

This involved:

- construction of a new interpretation/visitor centre;
- refurbishing existing buildings to provide office accommodation;
- fossil storage/curation facilities and food/refreshment outlet;
- relocation of camping facilities and construction of dormitory style accommodation on the adjacent land acquired for this purpose and dedicated as Conservation Reserve; and
- various changes to traffic circulation and management as well as landscaping and changes to parking at Victoria Fossil Cave.

Other visitor facilities include:

- car park and shelter near the entrance to Victoria Fossil Cave;
- fence stiles and informal picnic areas at several sites along the west bank of Mosquito Creek;
- walking tracks from the main visitor centre to Victoria Fossil Cave and south along Mosquito Creek; and
- picnic areas and BBQ shelters at “Stoney Point”, 2 kilometres south of Victoria Fossil Cave and adjacent to the main car park.

### **2.12.2 Underground Development**

Alexandra and Blanche Caves have undeveloped but defined pathways with handrails, steps and electric lighting.

Victoria Fossil Cave has a concrete pathway, handrails, steps and electric lighting throughout the visitor inspection section of the Cave.

The Stick Entrance of Wet Cave has a steel fabricated entrance stairway leading to a defined pathway with handrails and steps. Electric lighting has been installed in the Stick portion of the cave.

Cathedral Cave has a steel fabricated entrance stairway and pathways defined by trackmarkers.

Blackberry and Fox Caves have been fitted with internal gates to protect particular parts of these caves.

Bat Cave has five remotely controlled video cameras permanently fixed in key areas at the cave.

Outlines of the caves in relation to infrastructure are shown in Figure 2 and that of Victoria Fossil Cave in Figure 3.

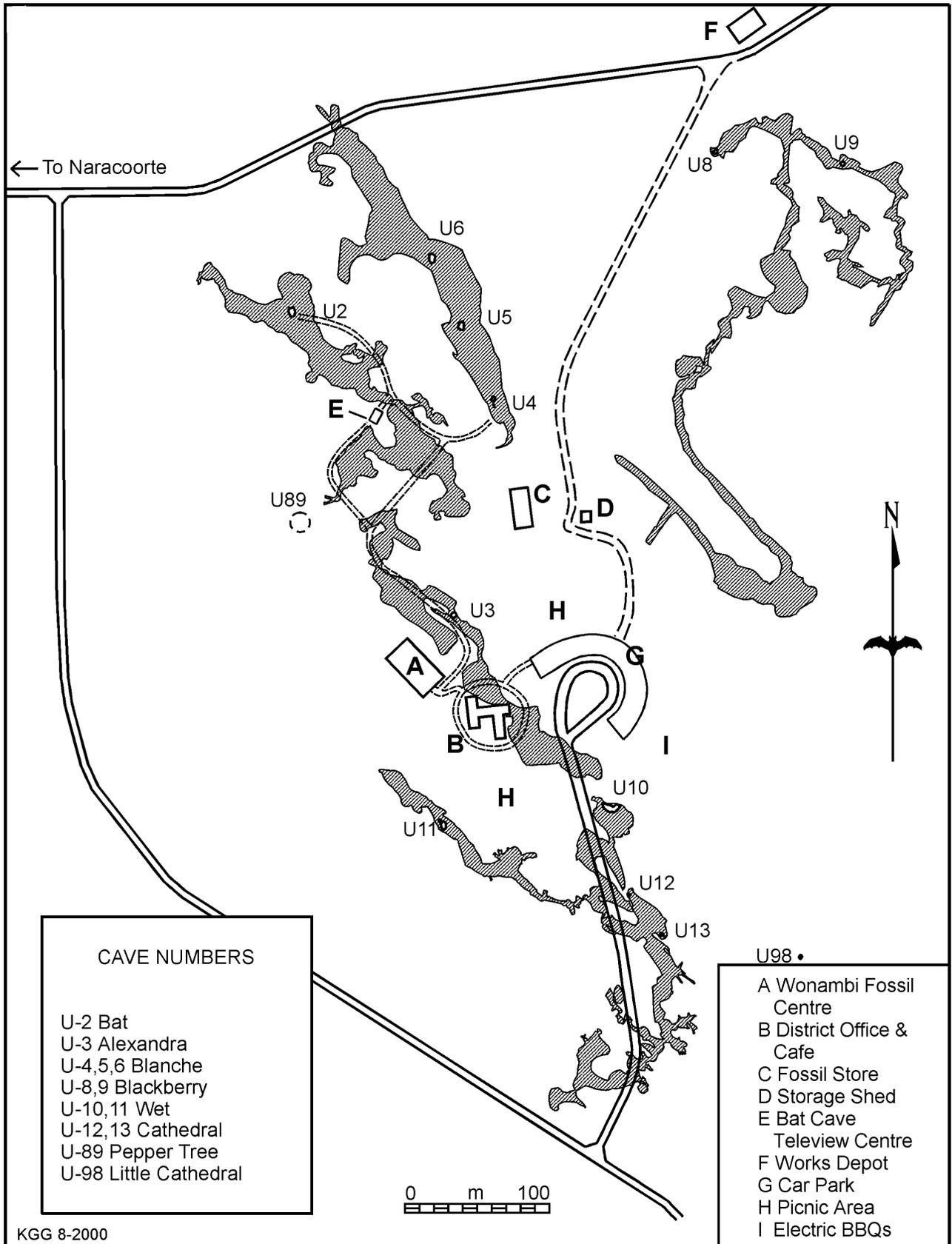


Figure 2. Park Infrastructure

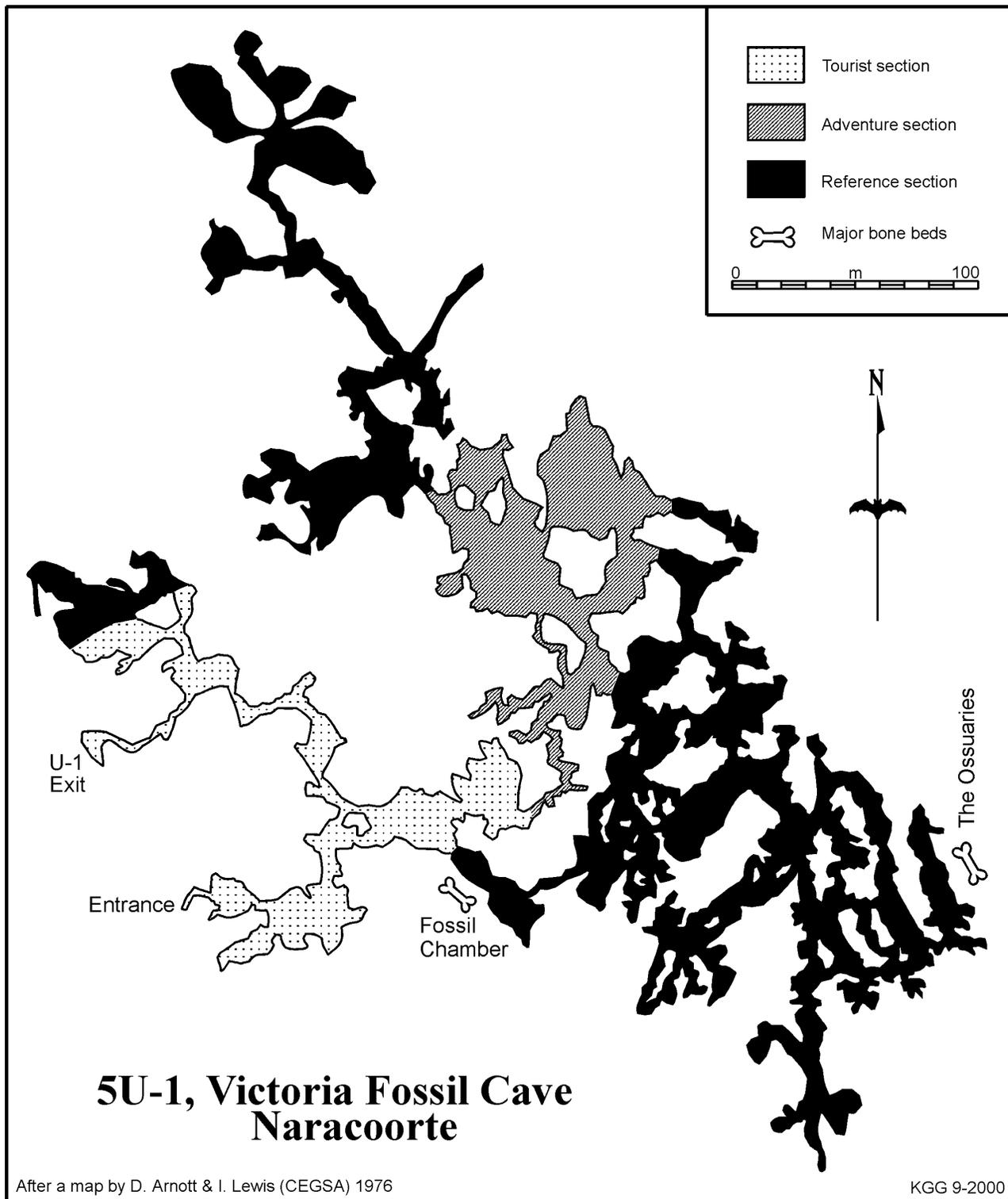


Figure 3. Victoria Fossil Cave Map

### **3. OBJECTIVES OF MANAGEMENT**

#### **3.1 General Objectives**

The general objectives relating to National Parks in South Australia are:

- preservation and management of wildlife;
- preservation of historic sites, objects and structures of historic or scientific interest;
- preservation of features of geographical, natural or scenic interest;
- destruction of dangerous weeds and eradication or control of noxious weeds and exotic plants;
- control of vermin and exotic animals;
- control and eradication of disease of animals and vegetation;
- prevention and suppression of bushfires and other hazards;
- encouragement of public use and enjoyment of reserves and education in and a proper understanding and recognition of their purpose and significance; and
- generally the promotion of the public interest.

#### **3.2 Park-Specific Objectives**

In this general context, the factors that have been taken into account in generating specific objectives and management proposals for the Park are:

- the caves in the Park and adjoining land are of outstanding international value. In particular, Victoria Fossil Cave contains vertebrate fossil deposits that are significant at a world level;
- Bat Cave is the maternity site for Bent-winged Bats, houses an invertebrate fauna that includes a number of endemic species, and is of national significance;
- Blanche Cave is significant at the national and State level because of its historic and aesthetic value;
- other caves of at least State significance include Alexandra, Fox, Blackberry, Cathedral Caves which all contain vertebrate fossil material yet to be investigated.

The natural features of the Park together with the new visitor facilities provide an outstanding opportunity for interpretation and the quality of the natural attractions is such that the Park is a primary destination for many visitors, a large number of whom then visit other parts of the region. The Park makes a substantial economic contribution to regional tourism.

The management objectives for the Park are:

- to protect and preserve the natural World Heritage values for which the Park was listed, and also other values including cultural;
- to conserve areas of natural vegetation and to manage other vegetated areas for their natural or historic conservation values;
- to provide and maintain appropriate access for vehicles and pedestrians;
- to provide appropriate facilities for visitor use and enjoyment;
- to provide opportunities for visitors to experience, understand and appreciate the significant natural and cultural values of the Park, in particular the caves and their contents;
- to ensure that the Park maintains its key role as a significant element in regional tourism;
- to ensure that protection practices are consistent with the maintenance of all the Park's values;
- to encourage, foster and facilitate appropriate research, inventory and monitoring of the natural and cultural features of the Park;
- to liaise with neighbouring landholders and instrumentalities to ensure that development and activities do not adversely affect Park values;
- to ensure through a program of monitoring and research using measurable objectives that impacts from uses and management actions and practices do not adversely affect the values of the Park.
- to utilise and build on the Park's World Heritage status to boost community support and understanding.

## **4. MANAGEMENT FRAMEWORK**

### **4.1 Natural Resources**

#### **4.1.1 Vegetation**

The floral composition and structure of the Park have been extensively modified by previous agricultural, silvicultural and cultural land use. Three distinct floral zones can be identified within the Park as:

- relatively undisturbed associations of native vegetation;
- landscaped areas with lawns, shrubs and trees of European and non-indigenous native species interspersed with naturally occurring species; and
- former agricultural and silvicultural lands supporting rank growth of pasture plants, pines and broad-leafed weed species.

Management of the landscaped and former agricultural and silvicultural areas is a major recurrent task. The remaining areas of natural and semi-natural vegetation should be managed to retain and enhance their natural qualities.

#### **Objective**

- natural associations of native vegetation will be maintained with specific regard to their value as habitat for native fauna;
- introduced species will be managed with specific regard to their historic and aesthetic value (see also 4.2.2 European History);
- former agricultural and silvicultural areas will be managed with specific regard to legislative responsibility to control pest plants, and to fire hazard reduction;
- develop alternative ways to protect and enhance areas of remnant native vegetation.

#### **Action**

- inspect areas of natural associations to detect invasion by exotic or non-indigenous native plant species, and remove such plants by physical or chemical means where possible and practicable;
- prepare and implement a landscape management strategy for areas of high public use including those places on the State Heritage Register in consultation with the Minister responsible for Heritage;
- revegetate areas of former pine plantation with appropriate indigenous trees/shrubs;
- manage improved pastures on former agricultural land to reduce the threat of wildfire occurring within or spreading through the Park, by removing rank grass growth by means of mowing, spraying or grazing;
- progressively displace improved pasture through a planned program of revegetation with indigenous trees/shrubs;

- control pest plant species by a planned program of mapping, treating and monitoring, with priority given to those species which threaten the integrity of undisturbed natural associations or neighbouring land use;
- maintain fire management access tracks around the Park, and between areas of natural associations and former agricultural land;
- prohibit the lighting and maintaining of open fires in areas of undisturbed natural associations and former agricultural land;
- maintain an inventory of the flora of the Park.

#### **4.1.2 Fauna**

Fauna includes both vertebrates and invertebrates. The value of caves as fauna habitat is linked to management of the above ground vegetation. The areas of native vegetation associations occurring within the Park have value as habitat for native fauna and in a regional context for biodiversity reasons. Bats (*M. schreibersii*) use the caves of the Park and congregate in particular caves at various times of the year. They form the top of an important food chain with an extensive number of invertebrates dependent on their guano. Conservation of caves as fauna habitat must be given priority when considering management activities. In particular, it is not just underground development and usage which can affect cave dwelling life but also above ground management particularly the vegetative cover in the vicinity of caves. Cave crickets (*Novotettix naracoortensis*) rely on vegetation and detrital material around cave entrances.

#### **Objective**

- existing free living, self-perpetuating populations of native species in the Park will be maintained;
- visitor access to caves with particular value as fauna habitat will be managed to minimise impact;
- physical barriers to prevent unauthorised entrance to caves will not diminish the value of the caves as fauna habitat;

#### **Action**

- encourage research into aspects of the ecology and distribution of rare, endangered or specific cave dependant species;
- manage visitor access to caves identified as having specific value as wintering sites for bat hibernation;
- provide access to Bat Cave for scientific studies that cannot be undertaken in any other cave through the use of the Scientific Research Permit system;
- encourage research on bat ecology and behaviour made possible with the infra-red video facility in Bat Cave;
- control introduced species such as cats, foxes, rats, rabbits and blackbirds which affect significant natural resources or neighbouring land use;

- maintain an inventory of the vertebrate and invertebrate fauna of the Park and its caves.

#### **4.1.3 Caves**

The caves in the Park are its most significant resource and providing for their protection was the sole purpose for Government acquisition and management of the area. They provide the community with educational and recreational opportunities, while preserving a broad range of geological, historical and palaeontological values for scientific research and aesthetic appreciation. Studies into the effect of human visitation on caves have effectively demonstrated that the carrying capacity of caves, their tolerance to visitation without discernible change, is minimal. The impact of human visitation on caves is therefore a primary issue for management and protection of cave values.

The *National Parks and Wildlife Act, 1972* provides for legislative protection of caves within reserves under Regulation 20 vis: “A person must not, without the permission of the Director:

- (a) enter a cave (except in the company of a warden or person assisting a warden);
- (b) remove or displace any rock, mineral or fossil in a cave;
- (c) disturb or interfere with any plant or animal (whether dead or alive) in a cave;
- (d) touch or interfere with any karst calcite formation (speleothem) in a cave;
- (e) urinate or defecate in a cave;
- (f) deposit any organic or inorganic matter in a cave;
- (g) disturb, touch or interfere with any Aboriginal art or artefact in a cave;
- (h) use any paint, dye or marker in a cave, or release any substance into the waters of a cave;
- (i) light a fire or burn any material in a cave;
- (j) smoke any tobacco product in a cave;
- (k) dive in the water of a cave or sink hole.”

Just as the caves vary greatly from one another, in regard to size and morphology, so do their specific values. Collectively the caves are recognised as of international significance through the World Heritage listing and are of outstanding universal value for the vertebrate fossils contained in the sediments. These values would not exist without the geomorphological processes, which lead to their emplacement in the caves. Other values of significance are biospeleological, archaeological or aesthetic. Two main approaches have been used to categorise significance. The first one is a consideration of whether a cave (site) is representative or is outstanding (Davey & White 1986). The second one derives from categorising a cave (site) as significant at the local, regional, State, National or International level (Rosengren et al. 1987). Each of these methods has its own merits but in the Naracoorte context the area with its caves and cave deposits has been categorised as being outstanding at the International level and together with the attendant geomorphological, biospeleological, aesthetic and cultural values needs specific protection. Cave usage whether it be in a show cave tour, as part of an adventure tour, for scientific purposes or for maintenance of

equipment and management needs careful regulation, control and monitoring. All management and access to the caves should reflect these values and should also recognise the potential for damage to the values whether deliberate or inadvertent. The problem of cumulative damage to cave values should not be underestimated and an ongoing monitoring program sensitive to changes should be established. Protection of specific values of individual caves therefore requires tailored management prescriptions for each cave or cave type. This can be best achieved by first classifying the usage of each cave according to a system developed and accepted by cave management authorities and speleologists throughout Australia. This cave management classification system comprises three categories of cave usage:

- *Public Access Caves* which are actively presented and interpreted to the public on guided or self-guided tours for aesthetic appreciation, education and recreation, and are subdivided into Adventure Caves which provide opportunities for aesthetic appreciation and physical recreation, usually with very little modification to the cave, and Show Caves, which provide opportunities for aesthetic appreciation, usually with significant modification to provide easy access by the public;
- *Special Purpose Caves* which need specific management to protect values of the cave, where these are not being actively presented to the public, and are subdivided into Reference Caves that provide for strict protection of relatively undisturbed baseline areas for scientific reference and/or monitoring, Special Natural and/or Cultural Value Caves that protect sites of outstanding scientific, nature conservation, educational or aesthetic significance, and provide opportunities for appropriate scientific research, aesthetic appreciation, education, recreation or other activities consistent with protection of the special values of the cave, and Dangerous Caves which are managed to protect human life where the cave is known to present extreme hazards; and
- *Wild and Unclassified Caves* which are managed to protect cave values, provide opportunities for research, responsible cave recreation and exploration, subject to the code of ethics of the Australian Speleological Federation Inc. and/or other codes of practice appropriate to the area concerned, and are subdivided into Wild Caves, which are all classified caves that do not appear under Public Access or Special Purpose, and Unclassified Caves that are caves awaiting classification and those not yet discovered.

Several categories or subcategories may be represented in any one cave.

The classification of caves within the Park are shown in Table 1.

## **Objective**

- management of the caves of the reserve is to be consistent with the overriding obligations of the World Heritage Convention;
- access to caves in the Park will be provided subject to provisions of the *National Parks and Wildlife Act, 1972* and its regulations, and the function of the cave as described by the management classification category into which it has been placed;
- Adventure Caves will be managed to provide guided tours with a balance between interest in the features of the cave and the challenge in its exploration along pre-determined routes that avoid exposure of vulnerable features to damage. Access will be only under direct supervision of guiding staff or with written approval for recreational caving or research;
- Show Caves will be managed to provide guided tours with a balance between education and aesthetic appreciation of cultural, geological and palaeontological values of the caves, and access will be only under direct supervision of guiding staff or with written approval for research;
- Reference Caves will be protected against further disturbance as far as is practicable, and access will be only with written approval for research specifically related to the baseline functions of the cave, and where such research cannot reasonably be carried out elsewhere in the State;
- Special Natural Value Caves will be managed to provide opportunity for properly authorised research consistent with the special values of the cave, and access will be only with written approval;
- Wild Caves will be managed to provide opportunities for responsible cave recreation, exploration and research subject to guidelines set out by the Australian Speleological Federation\*;
- new caves discovered within the Park will be classified as Special Natural Value Caves until sufficient research has been conducted, in consultation with speleologists and other relevant specialists, to determine their most appropriate classification;
- cave management classifications may be reviewed, in consultation with ASF approved speleological members and its Associates and the wider community, subsequent to changes in the values of caves;
- recreational and speleological access to caves of the Park will be subject to prior written approval of the manager;
- scientific access to caves of the Park will be subject to an approved scientific program and only with a Scientific Research Permit.

\* ASF 1990, 1992 and 1995

**Action**

- maintain and/or modify safety fences consistent with aesthetic principles around all caves in high visitation areas, principally in Sections 395, 396, 398 and 466;
- define and maintain predetermined routes for guided or self guided tours in those caves or cave parts classified Adventure;
- define accurately parts of caves where more than one classification applies;
- construct, install and maintain barriers as required to prevent unauthorised access to caves or parts of caves classified Reference and Special Natural Value;
- establish in consultation with relevant groups and institutions a schedule of known values for each of the caves within the reserve;
- provide and maintain appropriate facilities for safe public viewing, appreciation and education in Show Caves, with particular regard to the protection of the natural and cultural values of each cave;
- support ongoing research and encourage new research which provides information of scientific, cultural or cave management value consistent with the obligations to preserve, protect and present the World Heritage values of the reserve;
- maintain a record of development, management actions, maintenance and usage for each cave of the Park;
- establish an ongoing monitoring program for the caves which is sensitive to changes resulting from cave usage and management actions;
- provide periodic inspection of cave roof stability in areas of caves modified for public access;
- initiate and maintain best practice management actions consistent with sensitivity of cave sites and their values;
- establish a periodic review process to re-assess cave use classification.

**Table 1. Cave Management Classification and Usage**

<b>Cave Number</b>	<b>Cave Name</b>	<b>Classification</b>	<b>Usage</b>
U1	<b>Victoria Fossil Cave</b>	Show - part Reference - part Special Natural Value - part Adventure - part	Guided tours; adventure cave tours with guide; approved research in specific areas with Scientific Permit; access to Reference Areas only for activities related to baseline monitoring and each visit to be individually supervised and recorded.
U2	<b>Bat Cave</b>	Special Natural Value	Access restricted to management personnel only for maintenance of bat viewing infrastructure and to researchers with Scientific Permit for defined research for the cave. All visits to be recorded.
U3, U90	<b>Alexandra Cave</b>	Show - part Reference - part	Guided tours; access to Reference Areas only for activities related to baseline monitoring and each visit to be individually supervised and recorded.
U4, U5, U6	<b>Blanche Cave</b>	Show	Guided tours; entrance chamber may be used for approved community events.
U7	<b>Appledore Cave</b>	Wild	Adventure cave tours with guide; cave recreation, exploration and research.
U8, U9	<b>Blackberry Cave</b>	Wild - part Adventure - part Special Natural Value - part	Adventure cave tours with guide; cave recreation, exploration and research consistent with classification and Special Natural Value.
U10, U11	<b>Wet Cave (U10 Stick Entrance &amp; U11 Tomato Entrance)</b>	Show - part (Stick Section) Adventure - part (Tomato Section)	Self-guided show cave visits (Stick Section); adventure cave tours with guide (Tomato Section).
U12, U13	<b>Cathedral Cave</b>	Wild - part Adventure - part Special Natural Value - part	Adventure cave tours with guide; cave recreation, exploration and research consistent with classification and Special Natural Value.

*Naracoorte Caves National Park Management Plan*

U18, U19	<b>Robertson Cave</b>	Wild - part Special Natural Value - part	Cave recreation; authorised research consistent with classification of Special Natural Value (wintering bats).
U22	<b>Fox Cave</b>	Adventure - part Special Natural Value - part	Adventure cave tours with guide; authorised research consistent with classification of Special Natural Value.
U44	<b>Little Victoria Cave</b>	Wild	Cave recreation, exploration and research.
U49	<b>Unnamed</b>	Wild	Cave recreation, exploration and research.
U50	<b>Unnamed</b>	Wild	Cave recreation, exploration and research.
U51	<b>Unnamed</b>	Wild	Cave recreation, exploration and research.
U62	<b>Saddle Cave</b>	Reference	Access only for activities related to baseline monitoring and each visit to be individually supervised and recorded.
U72	<b>Sand Funnel Cave</b>	Reference	Access only for activities related to baseline monitoring and each visit to be individually supervised and recorded.
U89	<b>Peppertree Hole</b>	Wild	Cave recreation, exploration and research.
U94	<b>Pavy's Plunge</b>	Wild	Cave recreation, exploration and research.
U98	<b>Little Cathedral Cave</b>	Wild	Cave recreation, exploration and research.
U119	<b>Frog Hole</b>	Wild	Cave recreation, exploration and research.
U122	<b>Unnamed</b>	Wild	Cave recreation, exploration and research.
U127	<b>Unnamed</b>	Wild	Cave recreation, exploration and research.
U128	<b>Unnamed</b>	Wild	Cave recreation, exploration and research.
U129	<b>Unnamed</b>	Wild	Cave recreation, exploration and research.

## **4.2 Cultural Resources**

### **4.2.1 Aboriginal History**

Little is known of the significance of the caves to the Aboriginal inhabitants of the area, and this should be redressed if possible. Although a preliminary survey for Aboriginal artefacts in the caves has been conducted, a more thorough study is needed.

#### **Objective**

- sites and artefacts of previous Aboriginal occupation located in the Park will be protected.

#### **Action**

- encourage a survey of the caves for Aboriginal artefacts or other evidence of occupation.

### **4.2.2 European History**

The long history of visitation to the Park has developed strong cultural values. The physical and historic cultural resources of Blanche and Victoria Fossil Caves, and the landscape developments near the Show Caves reflect the popularity and extent of visitation, and are considered to be of significance. Each development of the caves and their surrounds has modified earlier cultural elements.

#### **Objective**

- cultural resources in the Park will be managed to present aspects of their historic values;
- research and documentation of the history of the caves and Park will be encouraged.

#### **Action**

- maintain the heritage values which reflect cultural use and examples of cave tourist development in Blanche and Victoria Fossil Caves;
- encourage further research and documentation of the history of the caves and park.
- developments will be planned in consultation with the Minister responsible for Heritage.

## **4.3 Presentation and Marketing**

Inscription on the World Heritage List in December 1994 brings with it a requirement to present the international significance and universal heritage value of the Park to visitors in a way which imparts an understanding of the geological and evolutionary processes that have contributed to the formation of the caves and their contents as we know them today.

Just as scientific investigation is never finished, scientific interpretation is not static. It is vital that the interpretation and presentation of the Park to visitors is up to date and retains the vibrancy of current science.

NPWSA provide a significant proportion of the opportunities for outdoor recreation in South Australia. The Naracoorte Caves National Park is promoted as a prime visitor attraction in the Naracoorte district, and plays a substantial role in regional tourism. The joint listing with Riversleigh provides an opportunity to present aspects of the Queensland section of the Australian Fossil Mammal Sites World Heritage Area. However, the provision of recreation opportunities must be balanced against the conservation objectives and the World Heritage values of the Park.

### **Objective**

- NPWSA will manage and present the Park to reflect its international significance and universal heritage values;
- facilities and appropriate opportunities for visitors to experience, understand and appreciate the natural and cultural values of the Park will be provided;
- maintain a continuing appraisal of relevant scientific advances;
- develop the Park's role as a significant element in international, national and regional tourism;
- the World Heritage logo will be integrated with park signage as appropriate.

### **Actions**

- develop a comprehensive presentation, interpretation and marketing strategy for the Park;
- investigate opportunities for development of new or specialist tours of caves and features of the park as appropriate;
- liaise with the appropriate authority in Queensland to develop joint promotional and interpretation strategy;
- incorporate new scientific findings and interpretations into displays and visitor presentations as appropriate;
- provide reasonable visitor access to Public Access Caves, with appropriate consideration for public safety and protection of the caves;
- provide facilities and services that enhance appropriate recreation and appreciation of the natural and cultural features of the Park;
- provide access for recreational caving in appropriate caves, subject to the established NPWSA procedure, ie applications for an intended caving expedition detailing the number of cavers, their levels of experience, the purpose of the visit, and which specific caves are proposed for visitation must be approved four weeks prior to the proposed visit;
- establish ongoing research and review of visitation levels and visitor impacts on Public Access Caves and other caves of the Park;

- include the World Heritage logo and the words “World Heritage Area” on all publications and promotional material produced for the Park.

#### **4.4 Management Support**

##### **4.4.1 Infrastructure**

Existing infrastructure serves two purposes: the management of Naracoorte Caves National Park, and administration and maintenance of many other parks in the Upper South East District. Infrastructure is located in two distinct areas in the immediate vicinity of the visitor centre, and in the works depot some 400 metres to the north (Figure 2). Further upgrading, rationalisation and relocation of infrastructure will continue as appropriate.

New accommodation facilities and camping ground have been developed on the adjacent conservation reserve. These facilities incorporate a camp ground, dormitory, showers and toilets, and a camp kitchen for groups to utilise.

##### **Objective**

- adequate infrastructure to service visitor, scientific research and administration needs will be provided and maintained as required.

##### **Action**

- ensure that new and replacement infrastructure, and maintenance and upgrading programs are implemented;
- prepare and implement a site layout and security plan for the Works Depot;
- provide and maintain appropriate facilities to support the scientific research program;
- liaise with the Minister responsible for Heritage to ensure any infrastructure development recognises the State Heritage values of Blanche and Victoria Fossil Caves.

#### **4.4.2 Commercial Activities**

Where appropriate and consistent with the maintenance of World Heritage values in the long term, and within the guidelines of the Policy Document (SANPWS 1987), NPWSA will make concessions available, under strictly controlled leasing arrangements, for the provision of appropriate visitor services. Other commercial activities, not of direct benefit to visitors but which facilitate management or promotion of the Park, will be provided for under licence.

##### **Objective**

- no concessions or licences will be issued to the detriment of the obligations to manage the Park as a World Heritage property;
- all concessions, licences and fees will be in accordance with the *National Parks and Wildlife Act, 1972*, and the Policies Document (SANPWS 1987), or any replacement;
- alien uses, such as agricultural production, and commercial filming and photography may be permitted under licence, subject to Section 35(3) *National Parks and Wildlife Act 1972*, where such land uses are consistent with the conservation of Park values, will facilitate management of the Park, and where commercial activities will not conflict with the World Heritage values or visitor use of the Park.

##### **Action**

- consider and determine any application for concession arrangements within the guidelines of this Plan and consistent with the management obligations of the World Heritage listing and the marketing and presentation strategy for the Park;
- monitor and ensure alien land uses and commercial activities are consistent with the maintenance of World Heritage values over the long term;
- review existing leases for alien land use to ensure their consistency with this Plan.

#### **4.5 Research and Monitoring**

Management actions have an impact on values. This must be recognised and action should not be initiated without first undertaking research and investigation on the effects of proposed developments. It is for these reasons that it is important that research is fostered, understood and taken account of in the preservation, protection and presentation of the Park and its values.

Scientific and karst management research is vital to adding to knowledge, to management of the Park's resources and to interpretation of the Park's values to the community. Some research creates physical disturbance. It is important to recognise this and manage such disturbance in a responsible manner scientifically and in a way that does not detract from the values of the Park. Some research entails the taking of specimens. These remain the property of South Australia and must be registered with

the South Australia Museum. Other than specimens on loan for approved research purposes the collection shall be securely stored at the Park. Responsible science is reported on through the scientific refereed literature. It is also the responsibility of scientists to report their findings to the manager.

Scientific research is conducted under Scientific Research Permits issued by NPWSA after consultation with the manager. These will stipulate access requirements; procedures for research methodology; specimen collecting and storage; and reporting requirements. In addition, Naracoorte Caves National Park requires a research program co-ordinating committee to facilitate research aiming to realise World Heritage values of the Park. The committee should represent the interests of NPWSA management, universities and other researchers, the South Australian Museum collection curator and the community.

Under the terms of the World Heritage Convention, South Australia is the Manager of the Naracoorte section of the A.F.M.S. World Heritage Area. There is a Ministerial Council consisting of the Ministers of the Environment of the Commonwealth, Queensland and South Australia Governments for the Australian Fossil Mammal Sites. This Ministerial Council is advised by the Australian Fossil Mammal Sites World Heritage Area Scientific and Management Committee. South Australia is responsible under the terms of reference of the agreement to provide periodic audit and review of the state of protection, conservation and presentation of the site.

The general public has an interest in the management, protection, and presentation of the Park through the Upper South East Consultative Committee convened under NPWSA auspices.

### **Objective**

- scientific research, which adds to knowledge of the Park's resources, will be encouraged;
- scientific research will be conducted responsibly and cooperatively with the manager;
- monitoring of the condition of the Park will be an ongoing component of management.

### **Action**

- establish a research program coordinating committee comprising NPWSA, the principle research group representative, the South Australian Museum collection curator and the community;
- conduct periodic reviews of scientific research being undertaken;
- conduct an ongoing monitoring program of the Park and caves which provides the information necessary for review, evaluation and assessment of changes in condition of the integrity of natural values of the Park;
- provide advice to the Minister for Environment and Heritage, South Australia as requested for the Minister's deliberations as representative to the Ministerial Council for the Australian Fossil Mammal Sites World Heritage Properties;

- provide advice and representation to the Australian Fossil Mammal Sites Scientific and Management Committee on both scientific research and management of the Park;
- maintain an inventory and library of the resources of the Park and relevant literature that is accessible to staff, researchers and the public;
- liaise with the World Heritage Unit of Environment Australia to develop an appropriate methodology to identify and monitor key indicators for reporting on the site's World Heritage values;
- monitor compliance with obligations under the World Heritage Convention and provide a monitoring report to the Ministerial Council for the Australian Fossil Mammal Sites.

## 5. PLAN IMPLEMENTATION AND PRIORITIES

This section provides a summary of management proposals, giving an indication of the priority and duration of each. No operation can be undertaken within the Park if it is not provided for within this Plan. Any additional operation found to be justified will only be carried out after the Plan has been amended in accordance with Section 38 of the *National Parks and Wildlife Act, 1972*.

ACTION	PRIORITY	DURATION	REF
<b>Vegetation</b>			
Inspect natural associations and remove invading plants	moderate	ongoing	4.1.1
Prepare and implement a landscape management strategy	high	ongoing	4.1.1
Revegetate former pine plantations	high	long	4.1.1
Manage improved pastures	high	ongoing	4.1.1
Revegetate improved pastures	low	long	4.1.1
Control pest plants	moderate	ongoing	4.1.1
Maintain fire access tracks	high	ongoing	4.1.1
Prohibit fires except in fireplaces constructed for that purpose	high	ongoing	4.1.1
Maintain an inventory of the Park's flora	moderate	ongoing	4.1.1
<b>Fauna</b>			
Encourage research on rare or endangered fauna and cave dependant species	moderate	ongoing	4.1.2
Manage access to bat sites	high	ongoing	4.1.2
Provide scientific access to Bat Cave	moderate	ongoing	4.1.2
Encourage research on bat ecology and behaviour	moderate	ongoing	4.1.2
Control introduced species	high	ongoing	4.1.2
Maintain an inventory of the Park's fauna	moderate	ongoing	4.1.2
<b>Caves</b>			
Maintain safety of cave entrances	high	ongoing	4.1.3
Maintain defined routes in caves	high	ongoing	4.1.3
Maintain cave usage classifications	high	ongoing	4.1.3
Maintain gates and barriers to caves to prevent unauthorised access	high	ongoing	4.1.3
Establish a schedule of known values for caves within the reserve	high	ongoing	4.1.3
Provide and maintain cave infrastructure for safety and protection of cave values	high	ongoing	4.1.3
Support and encourage speleological and scientific research related to World Heritage values	high	ongoing	4.1.3

## *Naracoorte Caves National Park Management Plan*

<b>ACTION</b>	<b>PRIORITY</b>	<b>DURATION</b>	<b>REF</b>
Maintain records of cave development, maintenance and usage	high	ongoing	4.1.3
Establish a monitoring program based around cave usage	high	ongoing	4.1.3
Periodically inspect cave roof stability	high	ongoing	4.1.3
Initiate and maintain best practice management to protect values of caves	high	ongoing	4.1.3
Periodically review cave use classification	high	ongoing	4.1.3
<b>Cultural Resources</b>			
Encourage survey for Aboriginal artefacts	moderate	short	4.2.1
Maintain historic artefacts	high	ongoing	4.2.2
Encourage historical research	moderate	ongoing	4.2.2
Developments will be planned in consultation with the Minister responsible for Heritage	high	ongoing	4.2.2
<b>Presentation and Marketing</b>			
Develop a presentation, interpretation and marketing strategy	high	short	4.3
Investigate new and/or specialist tours	moderate	medium	4.3
Liaise with Queensland authority to develop joint promotional strategy	moderate	medium	4.3
Incorporate research into interpretation	high	ongoing	4.3
Maintain facilities and provide visitor access to Public Access Caves	high	ongoing	4.3
Provide recreation opportunities	high	ongoing	4.3
Provide for cave recreation using prior approval system	high	ongoing	4.3
Establish research program on visitor impacts on all caves of the park	high	ongoing	4.3
Include World Heritage text and logo on promotional material	high	ongoing	4.3
<b>Management Support</b>			
Maintain visitor infrastructure facilities to high standard	high	ongoing	4.4.1
Maintain safe and secure Works Depot	high	ongoing	4.4.1
Provide and maintain facilities to support research	high	ongoing	4.4.1
Liaise with the Minister responsible for Heritage to ensure infrastructure development recognises Heritage values	high	ongoing	4.4.1
Consider and determine concession applications	low	ongoing	4.4.2
Ensure alien land uses and commercial activities are consistent with long term values	high	ongoing	4.4.2
Review existing alien land uses for consistency with plan	high	ongoing	4.4.2

*Naracoorte Caves National Park Management Plan*

<b>ACTION</b>	<b>PRIORITY</b>	<b>DURATION</b>	<b>REF</b>
<b>Research and Monitoring</b>			
Establish research program coordinating committee	high	ongoing	4.5
Monitor and review scientific research	Moderate	ongoing	4.5
Establish program to monitor conditions and change	high	ongoing	4.5
Advise Minister on World Heritage matters	high	ongoing	4.5
Provide ongoing advice on scientific progress and management of the Park as a World Heritage property	high	ongoing	4.5
Maintain library and information service	high	ongoing	4.5
Liaise with the World Heritage Unit on reporting methodologies of values	high	ongoing	4.5
Monitor compliance with obligations under the World Heritage Convention	high	ongoing	4.5

## SELECT BIBLIOGRAPHY

- ASF 1990 *ASF Inc Safety Guidelines Australian Caver No. 123, 3-9.*
- ASF 1992 *ASF Inc Code of Ethics and Conservation Australian Caver No. 130, 10-11.*
- ASF 1995 *ASF Inc Minimal Impact Caving Code Australian Caver No. .*
- Australian Speleological Federation Consultant Study Team 1984 *Preliminary Draft Management Plan for Naracoorte Cave Conservation Park* unpublished report for Dept. of Environment and Planning SA
- Ayliffe, L.K. and Veeh H.H. 1986 *Uranium Series dating of speleothems and bones from Victoria Cave, Naracoorte, S.A. Chem. Geol. (Isot.Geosci. Sect.), 72:211-234*
- Ayliffe, L.K., Moriarty, K.C., Marianelli, P.C., and Wells R.T., R.T. 1997 *Constraints on the ages of Mid-Pleistocene Megafaunal assemblages from southern Australia by U/Th dating of associated speleothems. Abstract, 1997 Archaeometry Conference, Sydney*
- Blackburn G, Bond RD, & Clarke ARP 1965 *Soil development associated with stranded beach ridges in south east South Australia CSIRO Soil Pub. 22:166.*
- Cook PJ, Colwell JB, Firman JB, Lindsay JM, Schwebel DA, & Von der Borch, CC 1977 *The later Cainozoic sequence of south east South Australia and Pleistocene sea-level changes S. Aust. Geol. & Geo. 2:81-88.*
- Davey AG & White S 1986 *Management of Victorian Caves and Karst*, report to the Caves Classification Committee. Dept. Conservation, Forests and Lands, Vic.
- Department of the Environment, Sport and Territories 1993 *Nomination of Australian Fossil Sites - The origin and evolution of Australian Mammals* by the Government of Australia for inscription on the World Heritage List, Department of the Environment, Sport and Territories, Canberra.
- Dwyer PD 1968 *Population ranges of Miniopterus schreibersii in south-eastern Australia Aust. J. Zool. 17:665-86.*
- Dwyer PD & Hamilton-Smith E 1965 *Breeding caves and maternity colonies of the bent-winged bat in south-eastern Australia Helictite 4:3-21.*
- Dwyer PD 1983 *Common Bent-wing bat Miniopterus schreibersii.* pp 336-337 in Strahan, R. (ed.) *The Australian Museum Complete Book of Australian Mammals*
- Glaessner MF 1955 *Pelagic fossils (Aturia, penguins, whales) from the Tertiary of South Australia Rec. South Australia Museum 11(4):353-72.*

- Grimes KG 1992 *The South-East Karst Province of South Australia* in Gillieson DS (Ed.) 1992 *Geology, climate, hydrology and karst formation: field symposium in Australia; guidebook*, **Special Publication No. 4 Dept of Geography and Oceanography, University College, Australian Defence Force Academy, Canberra, 115p.**
- Grimes KG & White S 1996 *Field Guide to Karst Features in Southeast South Australia and Western Victoria*, **Karst Studies Seminar, Naracoorte, Feb 1996.**
- Grimes KG, Hamilton-Smith E & Spate AP 1995 *South East Karst Province of South Australia*, **Australasian Cave & Karst Management Association.**
- Hamilton-Smith E 1965 *Distribution of cave-dwelling bats in Victoria* **Victorian Naturalist 82:132-7.**
- Hamilton-Smith E 1967 *Deaths of *Miniopterus schreibersii* Aust.* **Bat Res. News 7:3.**
- Hamilton-Smith E 1970 *Biological aspects of cave conservation* **Journal of Sydney Speleological Society, 14:157-64.**
- Hamilton-Smith E 1972 *The bat population of the Naracoorte caves area*, **Proceedings of 8th National Conference**, Aust. Speleological Federation. pp 66-75.
- Hamilton-Smith E & Spate A 1996 *The South-East Karst of South Australia, A Bibliography* **Australian Speleological Federation Commission on Bibliography Regional Bibliography Series 2 Publ. Sydney Speleological Society**
- Hamilton-Smith E 1997 *Bat Guano Mining in Australia*, **Aust. Zool.** (in press)
- Hand S 1988 *Draft Nomination of the Pleistocene Fossil Vertebrate Deposits of Victoria Fossil Cave Naracoorte, South Australia for inclusion on the World Heritage List*, unpub. report to SA National Parks and Wildlife Service.
- Hossfeld P 1950 *The late Cainozoic history of the south-east of South Australian* **Trans. Royal Soc. of S. Aust. 73(2):232-279.**
- Idnurm M & Cook PJ 1980 *Palaeomagnetism of beach ridges in South Australia and the Milankovitch theory of ice ages* **Nature 286(5774):699-702.**
- Laut P, Heyligers PC, Keig G, Loffler E, Margules C, Scott RM, & Sullivan ME 1977 **Environments of South Australia Province 1**, CSIRO Div. of Land Use, Canberra.
- Lewis ID 1976 *South Australian Cave Reference Book*, **Cave Exploration Group (South Australia) Inc. Occasional Paper Number 5:74-83.**
- Lewis ID 1977 *Discover Naracoorte Caves*, Subterranean Foundation, Adelaide.

- Ludbrook NH 1961 *Stratigraphy of the Murray Basin in South Australia*, Dept. of Mines, **Geological Survey of SA 36:29.**
- Luly, JG & Valentine, PS 1998 **On the Outstanding Universal Value of the Australian Fossil Mammal Sites (Riversleigh/Naracoorte) World Heritage Area - A report to the World Heritage Unit, DESA.** James Cook University, Townsville.
- Marker ME 1975 *The lower southeast of South Australia: A karst province*, **Dept. Geog. and Environ. Studies, Uni. of Witwatersrand, Occ. Paper 13: 168.**
- Merrilees D 1965 *Two species of the extinct genus Sthenurus Owen (Marsupialia, Macropodidae) from south-eastern Australia, including Sthenurus gilliisp* **J. Royal Soc. W. Aust. 48(1):22-32.**
- Murdoch J & Parker H 1963 *History of Naracoorte*, Naracoorte Chamber of Commerce, Naracoorte.
- National Parks and Wildlife Service of South Australia 1986 **Draft Management Plan Naracoorte Caves Conservation Park South East, South Australia**, Dept. of Environment and Planning, Adelaide.
- Osborne RAL 1981 *Towards an air quality standard for tourist caves: Studies of carbon dioxide enriched atmospheres in Gaden-Coral Cave, Wellington Caves, NSW* **Helictite 19(2):48-56.**
- Pilkington G, Mott K, Ninnes G (Eds) 1982 *Speleo-vision Field notes* **Cave Exploration Group of SA (Inc) Occasional Paper Number 6:57-67.**
- Richards AM 1965 *The effect of weather on Rhabdophoridae (Orthoptera) in New Zealand and Australia* **Annales de Speleologie 20:391-600.**
- Richards AM 1966 *The Rhabdophoridae (Orthoptera) of Australia - A new genus from South Australia* **Proc. Linn. Society NSW 91: 109- 130.**
- Richardson EG 1977 *The biology and evolution of the reproductive cycle of *Miniopterus schreibersii* and *M. australis* (Chiroptera: Vespertilionidae)* **J. Zool. Lond. 183: 353-375.**
- Rosengren, N and McRae-Williams, M 1987 *The selection and assessment of sites of geomorphological significance in karst terrain* in **Proceedings of the 13th Biennial Conference, Australian Speleological Federation, Cave Convict pp95 - 102.**
- Sprigg RC 1952 *The ecology of the south-eastern province, South Australia, with special reference to Quaternary coastline migration and modern beach development* **Bull. of Geol. Survey S. Aust. 29:1-120.**

Stirling EC 1908 *Report of the Museum Director* in **Rept. Board of Governors of the Public Library, Museum and Art Gallery of SA 1907-08**, Govt. Printer pp 8-9.

Tate GHH 1941 *Notes on Vespertilionid bats of the sub-families Miniopterinae, Murininae, Kerivoulinae and Nyctophilinae* **Bull. Amer. Mus. Nat. Hist.** **78:567-97.**

Tyler MJ, Twidale CR, Lina JK & Holmes JW (Eds) 1983 **Natural History of the South East**, Royal Society of South Australia, Adelaide.

UNESCO (1995) Letter Bernd von Droste, Director, World Heritage Centre, UNESCO to Mr M Pierce, Australian Delegate to UNESCO (30 January 1995)

Wells RT 1975 *Reconstructing the past: Excavation in fossil caves* **Aust. Nat. Hist.** **18 (6):208- 11.**

Wells RT, Moriarty K & Williams DLG 1985 *The fossil vertebrate deposits of Victoria Cave, Naracoorte; An introduction to the geology and fauna* **Aust. Zool.** **21:305-333.**

Woods JE 1860 *On some tertiary rocks in the colony of South Australia* **J. Geol. Soc. London** **16:153-60.**

Woods JET 1862 *Geological observations In South Australia: Principally in the district south east of Adelaide*, Longman, London.

Woods JET 1866 *On the geology and mineralogy of the Colony of South Australia, or that country lying between the River Murray, the 141st meridian of longitude and the sea*, Govt Printer, Adelaide.

Worboys G, Davey A, & Stiff C 1981 *Report on Cave Management* **Cave Man. in Aust. IV: 11 -19.**