

Department for Environment and Heritage
Management Plan



Tantanoola Caves Conservation Park
2008



Government
of South Australia

This plan of management was adopted on **22 July 2008** and was prepared pursuant to section 38 of the *National Parks and Wildlife Act 1972*.



Government of South Australia

Department for Environment
and Heritage

Published by the Department for Environment and Heritage, Adelaide, Australia

Cover: Tantanoola Cave (courtesy of Steve Bourne, DEH)

ISBN: 978 1 921466 15 1

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This document may be cited as 'Department for Environment and Heritage (2008) *Tantanoola Caves Conservation Park Management Plan*, Adelaide, South Australia'

FOREWORD

Tantanoola Caves Conservation Park, located along the Princes Highway between Millicent and Mount Gambier in the South East of South Australia, conserves significant karst features, including the spectacular Tantanoola Cave, a dolomite cavern filled with stalactites and helictites. This 14 hectare park is one of South Australia's oldest reserves, first dedicated in 1930, and was the first in Australia to provide wheelchair access to a show cave. Together with Naracoorte Caves National Park, Tantanoola Caves Conservation Park plays an important part in the conservation of karst systems in the South East, and offers visitors the opportunity to learn about these unusual environments.

Since it was discovered in 1930, Tantanoola Cave has been cherished by South Australians as a tourism destination to view the visually impressive cave. The land comprising the park is also home to the attractive Up-and-Down Rocks, a stranded marine cliff that towers over the Princes Highway, and a number of smaller caves and karst features. Of geological significance is the hidden beauty of Lake Cave, an underground cave used by scientists as a reference site for other karst features in the region.

In a region dominated by agriculture and forestry, Tantanoola Caves Conservation Park will be managed to conserve its outstanding geological values, and the objectives and strategies of the plan reflect this intention. Recognising the tourism value of the cave, the vision for Tantanoola Caves Conservation Park is to continue to allow people to visit Tantanoola Cave while conserving its distinctive geological features, which have formed over thousands of years. The important link between the surface and the cave environment will also be protected through targeted revegetation and pest plant control activities, to be integrated with local and regional biodiversity conservation works.

I now formally adopt the plan of management for Tantanoola Caves Conservation Park under the provisions of section 38 of the *National Parks and Wildlife Act 1972*. I encourage you to read the plan and visit and enjoy this remarkable park.



HON GAIL GAGO MLC

MINISTER FOR ENVIRONMENT AND CONSERVATION



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1 PARK LOCATION AND FEATURES

Tantanoola Caves Conservation Park was constituted by statute in 1972 under the *National Parks and Wildlife Act 1972* to conserve the important geological features in the park. Specifically, the park conserves two caves (Tantanoola Cave and Lake Cave) in a former marine cliff known as Up-and-Down Rocks, as well as a number of smaller caves and karst features. The 14 hectare park is located in South Australia's lower south-east, approximately 30 kilometres north-west of Mount Gambier and 21 kilometres south-east of Millicent, and is bordered to the south-west by the Princes Highway (Figure 1). The dominant land uses within the region are forestry plantation, agriculture and mining. Gower Conservation Park lies approximately one kilometre east of Tantanoola Caves Conservation Park, and a number of Native Forest Reserves, managed by Forestry SA, are scattered within 10 kilometres to the north, east, and south of the park. The park comprises all of Section 213, Hundred of Hindmarsh.

Tantanoola Cave has been open to visitors since its discovery in 1930. The park was listed on the Register of the National Estate in 1980 in recognition of the significant natural values of the landscape. Very little of the original vegetation is conserved in the park, which is dominated by introduced grassland interspersed with ornamental trees of native and exotic origin.

Tantanoola Caves Conservation Park is one of two reserves dedicated to the conservation of distinctive karst features in the South East, and together with the World Heritage-listed Naracoorte Caves National Park is a useful resource for visitors to learn about karst landscapes. The ancient marine dolomite cliff known as Up-and-Down Rocks, a significant geological feature in itself, separates the park into two distinct areas, a lower level that slopes steeply to a relatively flat strip adjacent the highway, and an upper level that slopes gently northwards to a broad, shallow valley beyond the north-eastern park boundary. The two main caves and the former marine cliff form the primary features of the park, although several smaller caves occur along the cliff.

The more frequently visited cave is Tantanoola Cave, which has been managed for tourism since late 1930. The cave is decorated with speleothems (such as stalactites) and contains a number of features of scientific and general interest. Lake Cave, formerly known as North Cave, is located on the northern boundary of the park, and as its name suggests, contains an underground lake. However, because access is restricted by a narrow, twisting tunnel, development of the cave for visitor use has not been considered appropriate for both public safety and maintaining the integrity of the cave.

Since its discovery by local resident Boyce Lane, Tantanoola Cave has been an important tourist destination in the lower south-east region, gaining status as a Pleasure Resort under the former *National Pleasure Resorts Act 1914* in 1930, and then as a Conservation Park in 1972. Visitor numbers have historically been as high as 40,000 visitors annually, and visitors to the park almost always cite the opportunity to view Tantanoola Cave as the main reason for visiting. Visitors also make use of the visitor centre, walking track, and picnic facilities available at the park. The walking track offers a panoramic view of the coastline to the west of the park, whilst the visitor centre offers environmental education opportunities. Because of the Mediterranean type climate of the region, visitor numbers have traditionally been higher in summer and autumn.

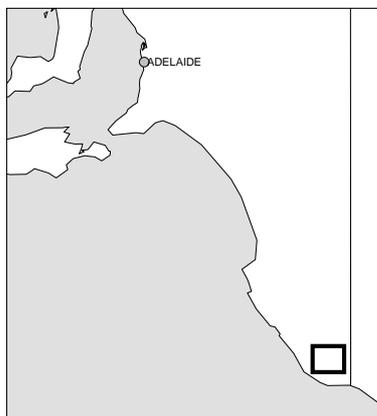
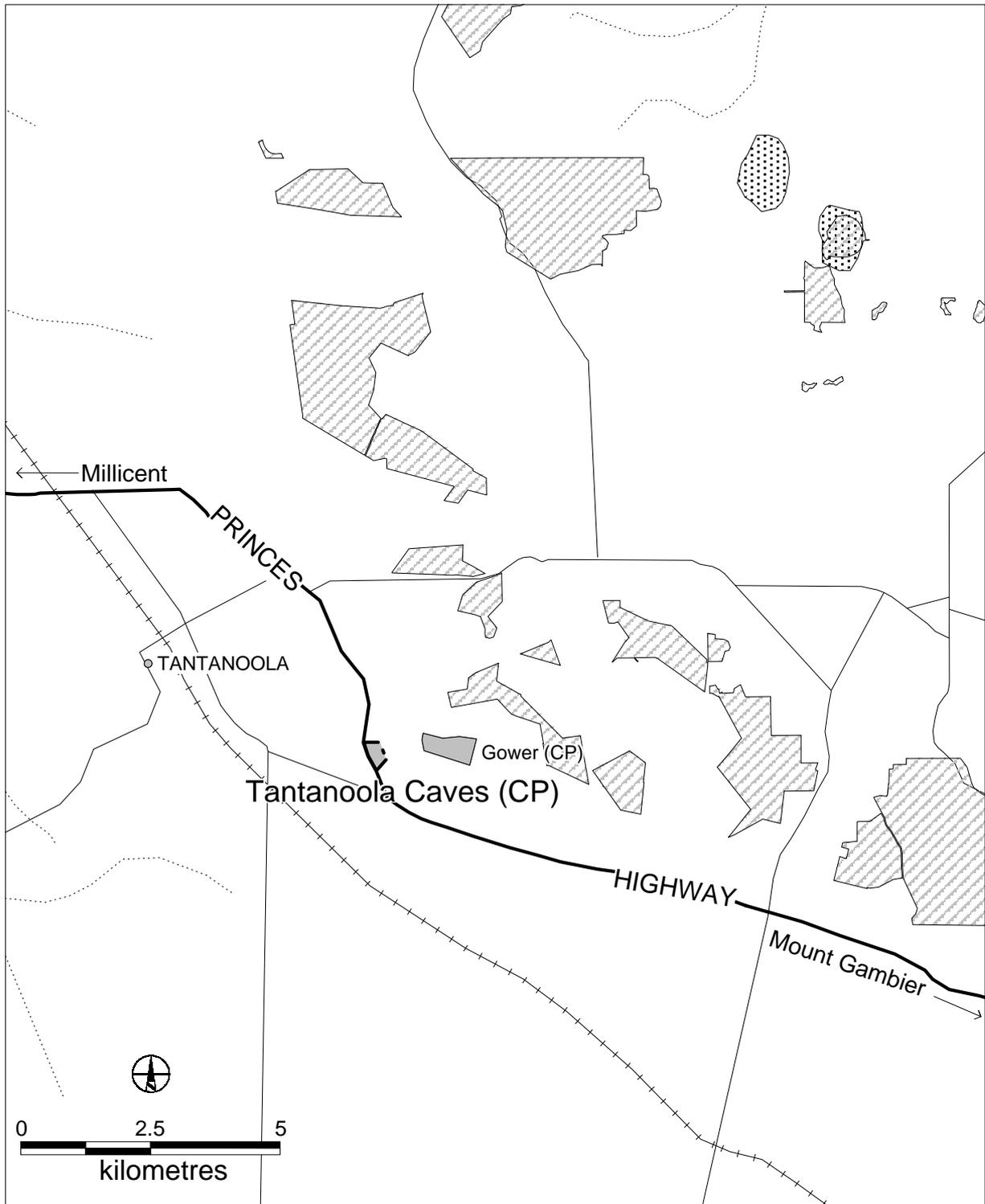
Because of the long history of visitor use and associated developments to support tourism (such as the installation of lighting and handrails), the habitat value of Tantanoola cave is believed to have diminished substantially. However, a population of Cave-Weta (crickets) is known to survive in the cave, and visitor activities have been modified to accommodate the continued existence of the population and to encourage the survival or return of other cave fauna.

Since constitution, the majority of management activities have focused on maintaining the cave environment to provide for cave tours. In 1982, the then Department for Environment and Planning lowered the cave entrance and installed gently sloping paths, enabling wheelchair access; this made Tantanoola Cave the first cave in Australia with wheelchair access. As part of this process, the lighting system in the cave was upgraded. Following advice from the Australian Speleological Federation in 1982, Tantanoola Cave has been closed periodically to control lampenflora (algal growth) on the speleothems within the cave. Accumulation of lampenflora is a known result of artificial light exposure, and leads to a degradation of the visual amenity of the speleothem and, importantly, the erosion of the formation (Johnson, 1979). The upgrading of the lighting systems at this time was designed to limit the impact of the lampenflora on the fragile cave formations.

Until January 1983 a section of the park including the Tantanoola Cave and visitor centre was leased to the District Council of Millicent (now incorporated into the Wattle Range District Council) for the operation of tourism-related activities. This arrangement was an extension of an informal agreement by the South Australian Government and the then District Council of Tantanoola for local administration, established soon after the land was declared as a Pleasure Resort. On 24 October 1978 a formal lease for the part of the park, including the tourist cave and associated improvements, was signed between the then National Parks and Wildlife Service and the District Council of Millicent "for the convenience for the public as a tourist facility". The lease was terminated in January 1983, and the Department for Environment and Heritage (DEH) has managed the park in its entirety since that time, with an on-site manager and tour guides.

In partnership with volunteer organisation GreenCorps, DEH has undertaken some minor infrastructure maintenance and environmental restoration works in and around the visitor centre in recent years. The focus of these works has been to restore the integrity of the walking track and to reinstate native vegetation to improve the natural values of the park.

This management plan replaces the 1992 *Tantanoola Caves Conservation Park Management Plan*.



LEGEND

- (CP) Conservation Park
- NP&W Act Reserve
- ▨ Native Forest Reserve
- Main Road
- Road
- + + + Railway
- ⋯ Drainage

Figure 1

Tantanoola Caves Conservation Park

Location

Map Produced from PAMS
 Projection: MGA Zone 54 (GDA 94)
 Date: April 2007

This map is indicative and only intended for the purposes of this management plan.

2 LEGISLATIVE FRAMEWORK

2.1 National Parks and Wildlife Act 1972

Reserves are managed by the Director of National Parks and Wildlife subject to any direction by the Minister for Environment and Conservation or the Chief Executive of the Department for Environment and Heritage (DEH). When managing reserves, the Director is required under section 37 of the *National Parks and Wildlife Act 1972* to have regard to, and provide actions that are consistent with, the following objectives of management stated in the Act:

- preservation and management of wildlife;
- preservation of historic sites, objects and structures of historic or scientific interest within reserves;
- preservation of features of geographical, natural or scenic interest;
- destruction of dangerous weeds and the 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 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;
- generally, the promotion of the public interest; and
- preservation and protection of Aboriginal sites, features, objects and structures of spiritual or cultural significance within reserves.

Section 38 of the Act states that a management plan is required for each reserve. A management plan should set forth proposals in relation to the management and improvement of the reserve and the methods by which it is intended to accomplish the objectives of the Act in relation to that reserve.

DEH is responsible for preparing management plans and undertaking the prescribed community consultation process for the park. A standard management planning process is mandated to ensure that all statutory obligations are met. Help and guidance with plan preparation is sought and obtained from individuals, community groups or relevant advisory committees, although the Minister ultimately decides whether to adopt a management plan.

In accordance with the Act, the provisions of this management plan must be carried out and no actions undertaken unless they are in accordance with this plan. In order to achieve this, each year park managers, taking regional and district priorities into account, draw up work programs to implement strategies proposed in management plans. Implementation of these projects is determined by, and subject to, the availability of resources (eg staffing and funding).

2.2 Native Title Act 1993

Native Title describes the rights and interests Aboriginal and Torres Strait Islander People have in land and waters according to their traditional laws and customs. Commonwealth legislation, in the form of the *Native Title Act 1993* was enacted to:

- provide for the recognition and protection of native title;
- establish ways in which future dealings affecting native title may proceed and to set standards for those dealings;
- establish a mechanism for determining claims to native title; and
- provide for, or permit, the validation of past acts, and intermediate period acts, invalidated because of the existence of native title.

This management plan is released and adopted subject to any native title rights and interests that may continue to exist in relation to the land and/or waters. Before undertaking any acts that might affect native title, DEH will follow the relevant provisions of the *Native Title Act 1993*.

3 VISION

The vision for Tantanoola Caves Conservation Park is a reserve that conserves significant geological features and associated cave fauna in a natural state, allows access to Tantanoola Cave for the education of visitors, and restores natural surface features.

Key Value

- Significant geological features, including Up-and-Down Rocks and Tantanoola and Lake Caves.

Key Pressures

- Developments within and surrounding the park that may impact on the karst features and disturb hydrological regimes.
- Impacts of visitors and visitor infrastructure on geological, karst and palaeontological values of Tantanoola Cave, such as artificial light, deteriorating infrastructure and inappropriate visitor access.

Key Management Strategies

To protect the key value and address the key pressures, the following strategies from within the management plan are priorities to be addressed during the term of this management plan.

- **Geology, Soils and Landform:** Identify and maintain the values of the geological, karst, and palaeontological features. Undertake remedial works when and where necessary; this may require the temporary closure of Tantanoola Cave.
- **Hydrology:** Encourage research into the hydrology affecting karst features in the park, including identification of threats to the immediate catchment area for both Tantanoola and Lake Caves, and implement management actions as required.
- **Managing Tourism and Recreation:** Provide visitor access to Tantanoola Cave in the form of hosted cave viewing during periods of high visitor demand and by appointment through prior arrangement with the DEH District Office at Naracoorte, ensuring impacts on the sensitive cave environment are minimised. The cave may be closed during times of low visitor demand or to protect the cave environment.
- **Managing Tourism and Recreation:** Conduct periodic reviews of the operation of Tantanoola Caves in relation to other regional cave experiences, and evaluate the need to provide cave experiences as part of these reviews.

4 ZONING

Section 39 of the *National Parks and Wildlife Act 1972* provides for the designation of zones in a reserve. Zoning aims to ensure that public use and management actions remain compatible with the protection of reserve values and constrains the use of land in zones to the conditions specified in an adopted management plan.

The management zones described below, and shown in Figure 2, establish a framework for the sustainable use of the reserve during the life of this plan. The designation of the reserve as a Conservation Park provides for the protection or preservation of any wildlife or the natural or historic features of the land, which in the case of Tantanoola Caves Conservation Park are the karst features within the park. As karst features form a significant part of the landscape, management strategies must consider that actions aboveground can significantly impact karst processes. Therefore, the management zones described below are designed to ensure that management strategies reflect the varying degrees of environmental sensitivity throughout the park.

The Tantanoola Cave is the dominant feature in the park and the protection of the park's caves was the primary purpose for its dedication. The pressures placed on Tantanoola Cave's fragile environment by long-term visitor use have led to a discernable deterioration of the cave's natural values, particularly through development for visitor access and the effect of changes in light exposure and air moisture on the karst processes. The importance of the cave to regional educational and recreational opportunities cannot be overstated, yet in order to maintain the cave's features, a system of management needs to be implemented. Worboys and Butz (1979) proposed a cave classification system to guide sensitive management of karst features, particularly caves. The system of classification has been modified slightly and is now recognised and accepted by cave management authorities and speleologists throughout Australia (DEH, 2001). Broadly, three categories are identified:

- (i) *Public Access Caves* – are actively presented and interpreted to the public on guided or self-guided tours for aesthetic appreciation, education and recreation. These cave types 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;
- (ii) *Special Purpose Caves* – need specific management to protect values for the cave, where these are not being actively presented to the public. These cave types are:
 - 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
- (iii) *Wild and Unclassified Caves* – 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. These caves 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.

Show Cave Protection Zone

Given its long history as a tourist cave, the significant developments that have been installed, and its role in providing a regional karst interpretive experience, Tantanoola Cave will be classified as a *Public Access Show Cave*. This classification will allow for the continuation of visitor access to the cave under the supervision of DEH staff, whilst also allowing for the sensitive features of the cave to be protected by providing for the cave to be closed as and when deemed necessary. Access to the cave with DEH staff will be provided during peak times and by prior arrangement with the DEH District Office at Naracoorte. The Show Cave Protection Zone incorporates Tantanoola Cave and the surface features necessary to its continued development, as outlined in Section 5.2 Hydrology.

The role that Tantanoola Cave plays in regional education as a cave experience, and in regional tourism, will be periodically reviewed, and its classification as a show cave reassessed based on the results of the periodic review (see Section 9 Managing Tourism and Recreation).

Conservation Zone

This zone comprises most of the park, including the Up-and-Down Rocks dolomite ridge and Lake Cave. The difficulty of access to Lake Cave has so far led to its protection from development as a show cave, resulting in a relatively undisturbed cave environment in a region where degradation of karst features by activities such as inappropriate development or rubbish dumping has been widespread. The development of the cave would be extremely difficult and costly, and most importantly would be detrimental to the sensitive cave environment. Furthermore, opening the cave to visitors would only provide viewing of one chamber, an experience that is already offered by Tantanoola Cave, and other caves in the region such as Naracoorte Caves National Park.

Given the integrity of Lake Cave's environment, and the increasing support for the conservation of karst systems by both the scientific and general communities, Lake Cave, already managed as a *Special Purpose Reference Cave* (Worboys and Butz, 1979) on advice from the Australian Speleological Federation, will retain this classification. Access to the cave will be by written approval of the DEH District Office at Naracoorte for research specifically related to the baseline functions of the cave, and where such research cannot reasonably be carried out elsewhere in the State. A gate over the entrance to the cave will be maintained to prevent unauthorised access. The small caves situated in Up-and-Down Rocks are yet to be classified using the system of Worboys and Butz (1979) and will therefore be managed under the principles of the *Wild and Unclassified Caves* category.

The majority of the Conservation Zone is recovering from the negative environmental impacts associated with the park's long history of inappropriate visitor use, mining (quarry in north of park), and past agricultural use. To provide for the continued recovery of the park's natural resources, the protection of the karst system, and to protect public safety, it is important that visitors are educated about possible impacts, and as much as possible, that impacts are confined to designated walking trails within the zone. Monitoring and remedial action may be undertaken by DEH to mitigate visitor impacts, particularly soil erosion along Up-and-Down Rocks (see Section 5.1 Geology, Soils, and Landform), and the threatening processes associated with introduced plants and animals (see Section 6.2 Introduced Plants and Animals). Additionally, the impacts of any management activities in the vicinity of Lake Cave should be minimised to protect the sensitive karst system.

Visitor Precinct Zone

Encompassing the visitor precinct, this zone is the centre of public recreation within the park, immediately adjoining the Cave Protection Zone for Tantanoola Cave. This zone is at the base of the Up-and-Down Rocks, which towers over the visitor centre and car park, acting as an enticement to visitors to explore the majestic landmarks protected within the park. The visitor precinct provides public amenities such as toilet blocks and picnic tables, and interpretive experiences in the visitor centre. No further development of the visitor precinct is envisaged for the life of this plan.

District Council Development Plan

The park is located within the Primary Industry 4 Zone of the Wattle Range Council Development Plan. Objectives for the Primary Industry 4 Zone are directed towards maintaining amenity values, but are intended for land used for agriculture, farming, pastoral, and forestry purposes rather than biodiversity conservation. This category is not appropriate for land set aside as a conservation

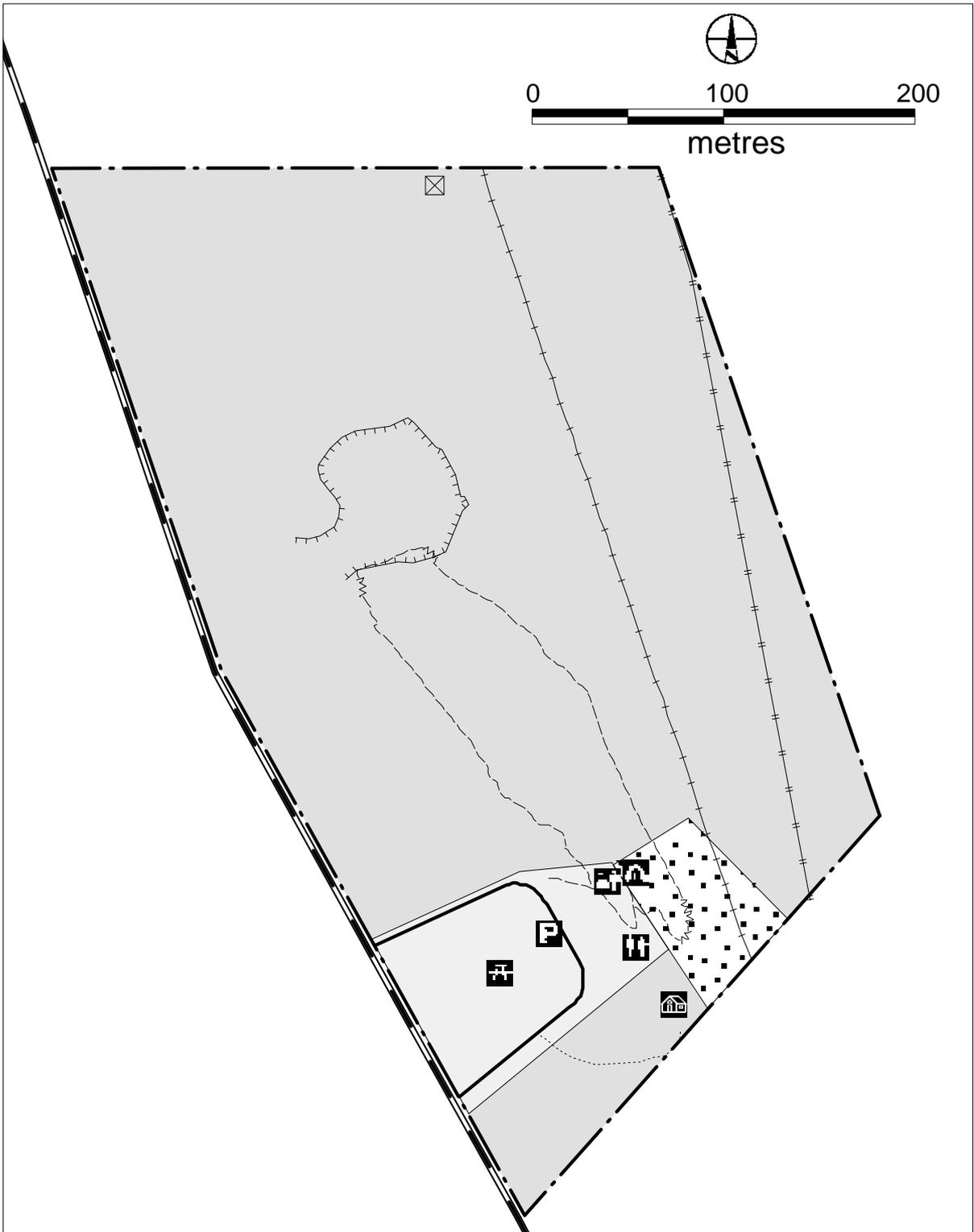
park. Therefore, it is suggested that when the Wattle Range Council Development Plan is next reviewed, DEH will encourage the inclusion of Tantanoola Caves Conservation Park within a zone that reflects its primary use, which is conservation.

Objective

Zone Tantanoola Caves Conservation Park for the conservation of the karst features of the park, whilst allowing for public access and education.

Strategies

- Zone the park as indicated in Figure 2 and manage the park in accordance with zoning guidelines.
- Ensure that Wattle Range Council considers including the park within a more appropriate zone when the Wattle Range Council Development Plan is next reviewed.



LEGEND

- | | | | |
|---|--------------------------------|---|----------------|
|  | Park Boundary |  | Visitor Centre |
|  | Show Cave Protection Zone |  | Car Park |
|  | Conservation Zone |  | Picnic Area |
|  | Visitor Precinct Zone |  | Residence |
|  | Major Road |  | Show Cave |
|  | Public Road / Management Track |  | Gate |
|  | Walking Trail / Stairs |  | Disused Quarry |
|  | Fence / Historic Fence | | |

Figure 2

Tantanoola Caves Conservation Park

Zoning and Features

Map designed and created by
Reserve Planning using PAMS
Projection: MGA Zone 54 (GDA 94)
Date: April 2007

This map is indicative and only intended
for the purposes of this management plan

5 MANAGING GEOLOGY AND HYDROLOGY

5.1 Geology, Soils, and Landform

Tantanoola Caves Conservation Park falls within the Mount Burr Environmental Association, characterised by forestry plantations and native forest over low broad hills, isolated calcarenite dunes, and small ash cones (Laut et al., 1977). The park is also part of the South East Karst Province, an area of significant geological importance, featuring a spectacular array of karst landscapes, including caves, cenotes and surface karren (Grimes, 1992).

Geology and Soils

The South East region of South Australia is characterised by thick Miocene bryozoal (marine) limestone (Gambier Limestone) underlying a series of parallel dune ranges laid down during the Pleistocene transgressions and recessions of the sea. The Gambier Limestone contains fossils of marine organisms such as bryozoa, sponges, echinoderms, brachiopods and molluscs, and in places has distinct flint horizons (Cochrane, 1952). In places, the bryozoal limestones have undergone dolomitisation, obscuring the original nature of the sediments to varying degrees, and leaving stranded cliffs of hard dolomite as the unaltered and less-resistant limestone eroded (Cochrane, 1952). The porosity, permeability and erodibility of the rocks of the Gambier Limestone has led to the creation of an extensive karst province of generally low relief, with dolines, cenotes, uvalas and a range of cave types, as well as syngenetic karst features in the Pleistocene Bridgewater Formation calcarenite dunes (Grimes, 1992).

Tantanoola Caves Conservation Park is situated on a linear ridge of Miocene Gambier Limestone that has undergone localised and irregular dolomitisation by magnesium intrusion, forming the scenically spectacular Up-and-Down Rocks that dissects the park. The dolomitisation of the bryozoal limestone is of unpredictable intensity and variation over short distances (Cochrane, 1952). The cause of the magnesium intrusion is not fully understood, but may be the result of volcanic activity associated with the nearby Mount Burr, an extinct volcano. The dolomite ridge, in which the caves formed, is a stranded marine cliff of the Mount Burr beach ridge complex, an extension of the Reedy Creek beach ridge sequence considered to be approximately 300,000 years old (Idnurm and Cook, 1980). The dolomite ridge is overlain in places by shell deposits associated with the Pleistocene marine incursions, although the sea is thought to have been shallow over this area because of the presence of littoral, often tightly cemented, conglomerates. The shell deposits and conglomerates extend into the caves where cliffing has intersected enlarged joints or solution tubes (Cochrane, 1952). As the sea continued to recede, it eroded the ridge to its current stark form, and created a wave-cut nick point in the dolomite, indicating that sea level was 'stranded' to just below this level at some stage (Cochrane, 1952). As the sea receded to its current level, beach sands were deposited over the aeolianite limestone along the cliff base and over the eastern and southern aspects of the cliff (Cochrane, 1952).

Blackburn (1959) identified three soils occurring in the park, all within the Mount Burr association, with minimal development resulting in poor nutrient loads and water relationships. Terra rossa soils of the Hindmarsh sandy loam (Stephens et al., 1941) remain only as fragments on depressions in the dolomite ridge and in solution pipes, although historically the soil was deep enough to cultivate. The extensive loss of this soil type is attributed to cultivation prior to the park being protected. Podsolised wind-blown sand of the Mount Burr (Blackburn, 1959) and Young (Stephens et al., 1941) sands occur on the remainder of the park, with the Mount Burr sands being derived from the Pleistocene shell deposits, and the Young sands forming from the aeolian deposits of recent age. The Mount Burr sands occur mostly on the eastern parts of the park, are light in colour at the surface, becoming darker with depth, and have been eroded, albeit to a lesser extent than the sandy loams. They also occur in patches on the slopes below the cliff. Found mostly on the western slopes of the park, the Young sands are fine, yellow to grey in colour, and some are hydrophobic. Tindale (1933) described a talus of volcanic ash at the entrance to Tantanoola Cave and a variably thick layer surrounding the entrance to Lake Cave.

Although visitors are primarily interested in viewing Tantanoola Cave, a walking trail that traverses the ridge and the base of the cliff is provided (see Section 9 Managing Tourism and Recreation). Current levels of use are low; however, given the current condition of the soil, increased traffic and stormwater run-off may accelerate the risk of further erosion, particularly on the steeper, shallower ridge-top. Soil characteristics need to be considered when making decisions about possible management activities such as relocating tracks and weed control operations to minimise negative impacts on soil stability. Access may need to be restricted or re-routed in areas where erosion is already evident or where bare soil has been exposed or disturbed, and visitors should be

advised of potential problems and encouraged to remain on designated routes to avoid further damage.

Karst Features

Karst features may be expressed at the surface in the form of dolines, cenotes or karren or underground in the form of caves or narrow, interconnected passageways. These features are formed when carbon dioxide-rich water moves through and dissolves calcite-rich rocks such as limestone or dolomite, typically in areas of high rainfall and abundant vegetation (Press and Siever, 2001). The process of karst formation where the rocks are completely immersed in water is known as phreatic development or solution. The volume of dissolved carbon dioxide in the water influences the extent of limestone dissolution, and in well-vegetated regions, water moving through soil typically accumulates more carbon dioxide, which is given off by plant roots and other soil-dwelling organisms (Finlayson and Hamilton-Smith, 2003; Press and Siever, 2001). The South East of South Australia showcases a well-known karst landscape, known as the South East Karst Province, dominated by cenotes, dolines, and caves (Grimes, 1992). The province, lying predominantly on the Gambier Embayment in the north-western part of the Otway Basin (of Cretaceous to Tertiary age) east of Millicent, is developed on the Miocene Gambier Limestone and the Pleistocene Bridgewater Formation limestones (Grimes, 1992). The karst features protected in Tantanoola Caves Conservation Park are part of this larger karst landscape, designated by Grimes (1992) as the Gambier Karst Region.

Tantanoola Cave

Tantanoola Cave is a relatively large elliptic chamber (25 metres by 18 metres by 8 metres approximately), modified by calcite decoration and marine processes. The form of the cave indicates a phreatic development (solution below the water table). The likely sequence of development is of phreatic solution followed by intrusion of marine sediments when the regression and subsequent stranding of the sea cut back the cliff, allowing marine sediments to enter the cave. The age of the cave has not yet been determined; however, it is likely that the cave pre-dates the Mount Burr beach ridge complex (Department for Environment and Planning, 1983), which formed approximately 300,000 years ago (Idnurm and Cook, 1980).

Following this initial cave formation, groundwater levels in the area receded, and the cave became air-filled and subject to near-surface karst processes, such as the percolation of acidic rainwater through the soil and dissolving the calcite in the rocks. This process has resulted in the development of cave decorations known as speleothems, which are created when this calcite-rich rainwater reaches the cave ceiling and the calcite is deposited either by the loss of carbon dioxide from the water or evaporation of the water (Finlayson and Hamilton-Smith, 2003). Over time, the accumulation of calcite both on the ceiling and on the cave floor formed speleothems known as stalactites (extending from the ceiling) and stalagmites (rising up from the floor). Columns are formed when stalactites and stalagmites combine, and are typical in caves where this process has taken place over an extended period of time. Tantanoola Cave also showcases helictites, speleothems that grow from the cave roof and wall in a variety of directions, including upward. These unusual and fragile decorations are formed by tiny drops of calcite-rich water, are extremely susceptible to changes in the cave environment, and their growth-rate is often too slow to be observed over the course of a year or even a decade (Finlayson and Hamilton-Smith, 2003).

At some stage in the past it appears that the opening to the cave was either closed over or reduced, resulting in the preservation of speleothems by limiting the impact of light, air and animals on the decorations. The presence of large spectacular helictites and stalactite forms in Tantanoola Cave suggest that it was sealed for a relatively long period. More recently, the cave was reopened by natural processes, leading to the discovery of its impressive decorations by Boyce Lane in 1930.

Tantanoola Cave will be managed as a *Public Access Show Cave* according to the classification system of Worboys and Butz (1979) (see Section 4 Zoning).

Lake Cave

Lake Cave was first described by Tindale (1933) as North Cave, being situated on the northern boundary of the park. The entrance consists of a narrow twisting tunnel leading to a slope of massive boulders resulting from collapse in a large complex chamber. A narrower tunnel at the eastern end of this chamber leads to a further large chamber (approximately 50 metres by 30 metres by 25 metres), which contains a lake some 30 metres in diameter and 10 metres in

depth. Divers examining the lake noted a narrow underwater extension of unknown length; however, as access into the extension was considered dangerous it has not been fully explored. The development of Lake Cave is likely to have followed a similar process to Tantanoola Cave, but does not appear to have been subject to marine intrusion as it is located away from the cliff-face of Up-and-Down Rocks. The lake at the base of the largest chamber is believed to be the surface of the local groundwater table.

Lake Cave is assigned to the Worboys and Butz (1979) category of *Special Purpose Reference Cave*, with access to the cave restricted to scientific research and monitoring through written approval from the DEH District Office at Naracoorte (see Section 4 Zoning).

Other karst features

Karst features other than caves are not well developed on the park although some features are worth noting. Aerial weathering has fretted the cliff face, displaying the bedding planes of the limestone now transformed by volcanic activity to dolomite. Solutional enlargement of minor pits and the development of tubes aligned along bedding planes can also be seen. On top of the cliffs the unloading joints parallel to the cliff line also exhibit solutional enlargement to produce flat elliptical tubes. Karst pavements with solution pans and tubes are exposed over much of the ridge crest. A small doline is located in the extreme south-west corner of the park.

Five small caves have been found in the park all at roughly the same level in the cliff as Tantanoola Cave. Tindale's Cave D, now known locally as Devil's Lair, is about 50 metres north-west of Tantanoola Cave and consists of 10-12 metres of phreatic maze passages in which bone material has been found. These caves are yet to be classified and will be managed as *Wild and Unclassified Caves* as per the classification system of Worboys and Butz (1979) (see Section 4 Zoning).

Fossils

The unaltered Miocene Gambier Limestone underlying the park is dominated by fossil remains of bryozoa such as *Cellepora gambierensis* and *Retepora* spp., as well as the brachiopods *Magellania* and *Magasella*, although remains of a cephalopod and several shark teeth have also been uncovered in quarry sites in the Up-and-Down Rocks (Cochrane, 1952). Shell fauna common to the overlying Bridgewater Formation is mostly from the reef suite *Haliotis* spp., whilst *Brachiodontis hirsutus* and *Turbo undulates* are also plentiful (Cochrane, 1952).

Tindale (1933) and Tidemann (1967) made small collections of vertebrate fossil material from Tantanoola Cave and the smaller caves in the park. These collections included extinct megafauna *Zygomaturus trilobus* and sthenurine kangaroos, and fossils of an unidentified seal, indicating the marine actions in the development of the cave. Some of this material remains visible in the wall of Tantanoola Cave and should be preserved.

During the 1982 excavations to provide wheelchair access to Tantanoola Cave, recent (Holocene) invertebrate and vertebrate fossils were recovered, including a significant number of native molluscs (FW Aslin, personal communication, 2007).

Objectives

Conserve the soils within the park.

Conserve the geological, karst, and palaeontological features within the park.

Strategies

- Consider soil types and properties, including evidence of seasonal wetting or erosion potential, when undertaking management activities. To maintain soil stability, ensure pest plant removal projects are staged and complemented by natural regeneration or revegetation.
- Monitor visitor activities to prevent further human-induced soil erosion; this may require relocating or closing access to the walking trail temporarily or permanently.
- Identify and maintain the values of the geological, karst, and palaeontological features. Undertake remedial works when and where necessary; this may require the temporary closure of Tantanoola Cave.
- Restrict access to Lake Cave to research approved by the DEH District Office at Naracoorte to maintain the fragile and unique cave environment.

5.2 Hydrology

Tantanoola Caves Conservation Park falls within the Gambier Embayment of the Otway Basin geological province of southern Australia (South East Catchment Water Management Board (SECWMB), 2003). Prior to European settlement the geology of the region played an important role in defining surface and groundwater regimes: in the Tantanoola district the porosity of the Gambier Limestone, which forms the region's main unconfined aquifer, has limited the formation of surface water features (SECWMB, 2003). The relatively high rainfall of the lower South East, combined with the general lack of surface flows, led to the surface being inundated for extended periods, enabling direct infiltration to the unconfined aquifer below, which in places is less than five metres from the land surface. Following European settlement, there have been significant changes to the South East landscape, through artificial drainage, agriculture and farming practices (Croft et al, 1999). In turn, these landscape-scale changes have significantly changed the hydrology of the region by altering natural surface water flows (Croft et al., 1999) and water table levels (SECWMB, 2003). As has been described in Section 5.1 Geology, Soils and Landform, the role of hydrology in the formation and maintenance of karst features is important, therefore changes in hydrology are likely to impact on cave features (Watson et al., 1997). In addition, changes in vegetation cover are also likely to have an impact as the loss of vegetative cover, which contributes carbon dioxide to water passing through the soil, may have altered the volume and chemical composition of water infiltrating the surface (SECWMB, 2003). The effect of these changes on the cave environments in Tantanoola Caves Conservation Park is poorly understood; however, they may impact the karst processes that contribute to the caves' continuing development (Watson et al., 1997).

Until such knowledge of the hydrology of the local area and its relationship to the karst features within the park is known, future developments within the catchment area of the park should take into consideration the possible impacts on karst-forming processes. In particular, aboveground works such as track maintenance or realignment, weed control using pesticides, and revegetation should consider the possible risk of changes to the caves' water regimes. Boundaries of karst areas are often difficult to define and actions well beyond the park boundary could impact the park's values. It is therefore important that DEH liaises with the relevant authority managing the region's water resources (currently the South East Natural Resources Management Board) to ensure the protection of the important karst features protected in the park.

Objective

Protect the hydrological regimes that influence the continued existence of karst features within the park.

Strategies

- Manage the surface features of the park in a manner that contributes to the restoration and protection of the surface and groundwater flow regimes.
- Encourage research into the hydrology affecting karst features in the park, including identification of threats to the catchment area for both Tantanoola and Lake Caves, and implement management actions as required.
- Highlight the role that hydrology plays in preserving and maintaining the continued development of cave features to the South East Natural Resources Management (SENRM) Board.
- In liaison with the SENRM Board, develop landscape-scale strategies to ensure cave features are maintained.

6 MANAGING BIODIVERSITY

6.1 Native Flora and Fauna

Native Flora

The vegetation of Tantanoola Caves Conservation Park is highly disturbed as a result of the long history of agriculture, mining/quarrying and tourism in the district. Very little original vegetation remains on the park, although Crocker (1944) described and mapped the Brown Stringybark (*Eucalyptus baxteri*) / Messmate (*Eucalyptus obliqua*) low open forest association, currently protected in nearby Gower Conservation Park, as the dominant vegetation community of the Mount Burr Ranges prior to European settlement. The Biological Survey of the South East of South Australia (Foulkes and Heard, 2003) supports Crocker's findings, with the association being mapped in areas of the Mount Burr Range likely to be on relics of the ancient marine cliff that is exposed in the park.

The Brown Stringybark / Messmate association is highly variable across its distribution in the Lower South East, driven by variations in topography, soils and climate (Foulkes and Heard, 2003). Messmate likely dominated the dry sclerophyll open forest of the Tantanoola Caves area, with an understorey of Black Wattle (*Acacia mearnsii*), Blackwood (*A. melanoxylon*), Drooping Sheoak (*Allocasuarina verticillata*), Silver Banksia (*Banksia marginata*) and Moonah (*Melaleuca lanceolata*), and Bracken (*Pteridium esculentum*) in the more open areas. The mid-strata likely comprised shrubs such as Native Cranberry (*Astroloma humifusum*) and Coast Beard-heath (*Leucopogon parviflorus*). The groundlayer, of which little original vegetation remains, is likely to have been a mixture of native grasses such as Spear Grasses (*Austrostipa* spp.) and Tussock Grasses (*Poa* spp.), and herbs such as Native Leek (*Bulbine bulbosa*), Spreading Goodenia (*Goodenia heteromera*; SA:R; SE:V) and Scaly-buttons (*Leptorhynchos squamatus*).

The cliff-face of Up-and-Down Rocks supports some of the least modified vegetation in the park, with the scrambling succulent *Tetragonia amplexicoma* trailing over the cliffs and fallen boulders. This community also contains a variety of shrubs and small trees, including Black Wattle, Golden Wattle (*Acacia pycnantha*), Silver Banksia, and Native Cherry (*Exocarpos cupressiformis*). Remnants of a Spear-grass (*Austrostipa* spp.) / Tussock-grass (*Poa* spp.) grassland can be found on the cliff-tops behind the visitor precinct.

The vegetation of the park has not been systematically surveyed, contributing to the lack of certainty concerning the composition of the park's original vegetation; currently only 45 species are recorded for the park, with a number of those recorded only to genus level, and the most recent record from 1987. Of the species listed for the park, four species are of conservation significance in South Australia (Table 1).

Table 1: Flora of Conservation Significance Recorded in Tantanoola Caves Conservation Park

Scientific Name	Common Name	Conservation Status*	
		SA	SE
<i>Acacia gunnii</i>	Ploughshare Wattle	R	T
<i>Clematis aristata</i>	Mountain Clematis	V	V
<i>Goodenia heteromera</i>	Spreading Goodenia	R	V
<i>Mentha diemenica</i>	Slender Mint	R	R

* See Appendix A for Conservation Status Codes

As discussed in Section 5.2 Hydrology, the change in vegetative cover over the surface of the park may have altered the volume and chemical composition of water infiltrating the caves, and is a process listed as a major threat to caves and karst in the IUCN Guidelines for Cave and Karst Protection (Watson et al., 1997). For the continued evolution of the karst features of the park, it is important that natural processes are restored as much as possible, particularly hydrogeological processes that involve surface and groundwater flows, which may be achieved via the restoration of surface vegetation among other activities. Because of the lack of contiguous native vegetation in the vicinity of the park and the serious threat posed by pest plants (see Section 6.2 Introduced Plants and Animals), the opportunity for viable natural regeneration of the surface vegetation is limited at best. Therefore, revegetation using locally sourced native seed stock is regarded as the most appropriate method for restoration of natural surface cover. Revegetation using local provenance seed has already taken place in previously ornamental gardens in the

vicinity of the visitor precinct; these areas may provide a suitable seed source for revegetation in other areas in the park.

Phytophthora

Cinnamon Fungus (*Phytophthora cinnamomi*) and other species of *Phytophthora* are introduced plant pathogens that cause disease and death in a range of native plant species. *Phytophthora cinnamomi* is recognised by the Australian Government as a key threat to the survival of native plants and animals and has developed a National Threat Abatement Plan (Environment Australia, 2001).

The South East is classified as being at Moderate Risk from the threat of *Phytophthora* (*Phytophthora* Technical Group, 2006). One of the key factors placing the South East at risk is that it receives 400 mm or more average yearly rainfall. Although there is yet to be any confirmation of *Phytophthora* within the parks of the South East, many plant species within the region are known to be susceptible to this fungus-like organism (*Phytophthora* Technical Group, 2006). It is highly important that *Phytophthora* is prevented from establishing in the reserves of the South East.

Phytophthora prefers moist, warm soils with a low to neutral pH, poor drainage and low nutrient concentrations (*Phytophthora* Technical Group, 2006). The soil found throughout the majority of Tantanoola Caves Conservation Park is alkaline and freely draining, due to its sandy consistency and underlying geology. These soil conditions are not conducive to the establishment of *Phytophthora*. However, the patchy terra rossa soils in the park are conducive to *Phytophthora* because of their water-holding capacity. It should be noted that the park protects a number of species that are known or suspected to be susceptible to *Phytophthora* (*Phytophthora* Technical Group, 2006): Drooping Sheoak (*Allocasuarina verticillata*), Silver Banksia (*Banksia marginata*), Brown Stringybark (*Eucalyptus baxteri*), Messmate (*E. obliqua*), Tea-tree (*Leptospermum* spp.), Common Beard Heath (*Leucopogon virgatus*), and Grass-trees (*Xanthorrhoea* spp.).

While symptoms of *Phytophthora* dieback have not been observed in Tantanoola Caves Conservation Park, it is important that the park remains free of *Phytophthora*. Unfortunately, an effective treatment for *Phytophthora* once present in the soil is not currently available and it is extremely difficult to prevent the spread of *Phytophthora* from an infested area. However, the spread of *Phytophthora* into this reserve can be prevented by using the management strategies outlined in the DEH Standard Operating Procedures for *Phytophthora* Threat Management (DEH, 2002), which apply to all users of reserves. These strategies are aimed at minimising the transfer of *Phytophthora* in soil, water and plant roots by controlling access, adopting hygiene procedures, modifying work plans, and ensuring awareness of *Phytophthora*.

Mundulla Yellows

Mundulla Yellows is a syndrome that affects eucalypts and other native plants, resulting in the death of the affected plants over several years. It is characterised by progressive yellowing and die-back of foliage. A great deal of research has been conducted into the cause of Mundulla Yellows. Numerous biotic causes have been suspected and were either unconfirmed or dismissed (Mundulla Yellows Task Group, 2004; Luck et al., 2006). The latest research findings have shown that the symptoms of Mundulla Yellows are caused by a complex interaction of nutrients and soil properties (texture and parent material), soil compaction, water availability, increased alkalinity and salinity, and the accumulation of bicarbonate in the soil solution (Czerniakowski et al., 2006).

Mundulla Yellows symptoms are primarily recognised in trees that are situated along roadsides, natural and man-made watercourses, sparsely separated trees in pastured paddocks (Croft et al., 1999), and along the edge of native bush. According to the Mundulla Yellows Task Group (2004), Wattles (*Acacia* spp.), Drooping Sheoak (*Allocasuarina verticillata*), Sweet Bursaria (*Bursaria spinosa*), Brown Stringybark (*Eucalyptus baxteri*), Messmate (*E. obliqua*), Tea-trees (*Melaleuca* spp.), and Grass-trees (*Xanthorrhoea* sp.), which are found in Tantanoola Caves Conservation Park, are known to be affected by Mundulla Yellows.

Given that the soil found in the park can be of an alkaline or saline nature, which is known to be one of the soil properties that can result in Mundulla Yellows symptoms, these species should be monitored in the park. To date, none of the plants within the park have been found with Mundulla Yellows symptoms.

Native Fauna

Records of the native fauna in the park are scarce, with birds visiting or nesting in the scattered vegetation in the park forming the main focus of observations. Many opportunistic sightings of native fauna are reported to and by park staff, and will guide the management actions outlined in this plan until a more comprehensive list is compiled. Species of conservation significance are listed in Table 2.

In order to appropriately manage and restore the natural values of the park, it is important that a comprehensive survey of the biodiversity is undertaken. Understanding the extent of both native and introduced species within the park will allow for more effective and integrated management, particularly in relation to the restoration of native vegetation, where it is important to use locally sourced plants. It is important to integrate any conservation actions undertaken in the park with local and regional level conservation programs to ensure that the actions taken have a greater likelihood of long-term success.

Table 2: Fauna of Conservation Significance Recorded in Tantanoola Caves Conservation Park

Scientific Name	Common Name	Conservation Status*	
		SA	SE
<u>Mammals</u>			
<i>Macropus rufogriseus</i>	Red-necked Wallaby	R	
<i>Trichosurus vulpecula</i>	Common Brushtail Possum	R	
<i>Wallabia bicolor</i>	Swamp Wallaby	V	
<u>Birds</u>			
<i>Accipiter cirrhocephalus</i>	Collared Sparrowhawk		U
<i>Anthochaera chrysoptera</i>	Little Wattlebird		U
<i>Calyptorhynchus funereus</i>	Yellow-tailed Black Cockatoo	V	V
<i>Climacteris picumnus</i>	Brown Treecreeper		U
<i>Cormobates leucophaeus</i>	White-throated Treecreeper		U
<i>Cracticus torquatus</i>	Grey Butcherbird		U
<i>Entomyzon cyanotis</i>	Blue-faced Honeyeater	R	R
<i>Eopsaltria australis</i>	Eastern Yellow Robin		U
<i>Haliastur sphenurus</i>	Whistling Kite		U
<i>Melanodryas cucullata</i>	Hooded Robin (south east ssp.)	R	U
<i>Melithreptus lunatus</i>	White-naped Honeyeater		U
<i>Myiagra inquieta</i>	Restless Flycatcher	R	U
<i>Neophema chrysostoma</i>	Blue-winged Parrot	V	V
<i>Pachycephala pectoralis</i>	Golden Whistler		U
<i>Pachycephala rufiventris</i>	Rufous Whistler		U
<i>Pardalotus punctatus</i>	Spotted Pardalote		U
<i>Petroica multicolor</i>	Scarlet Robin		U
<i>Phaps elegans</i>	Brush Bronzewing		U
<i>Stagonopleura bella</i>	Beautiful Firetail	R	R
<i>Strepera versicolor</i>	Grey Currawong		U

* See Appendix A for Conservation Status Codes

Mammals

Three mammal species of conservation significance in South Australia are recorded for the park (Table 2). The State vulnerable Swamp or Black Wallaby (*Wallabia bicolor*) has recently been observed in the park, and the State rare Red-necked Wallaby (*Macropus rufogriseus*) has been recorded in the vicinity of the park. These species may use the scattered trees as shelter or refuge and their presence in the park should be confirmed so that appropriate management actions may be developed and implemented. The Common Brushtail Possum (*Trichosurus vulpecula*) has been observed in the park. Possum population numbers in regional South Australia have declined significantly and the species has recently been listed as rare under the Schedules of the *National Parks and Wildlife Act 1972*, as amended in 2008. Possible impacts of management activities on

possums should be minimised. Other mammals observed or known to visit the park include the Short-beaked Echidna (*Tachyglossus aculeatus*), Common Ringtail Possum (*Pseudocheirus peregrinus*) and Grey Kangaroos (*Macropus* spp.).

Birds

Records of birds visiting or inhabiting the park are the most comprehensive, with 79 species recorded to date. Of these, five are of State conservation significance and 20 are regionally significant (Table 2). The Yellow-tailed Black Cockatoo (*Calyptorhynchus funereus*) and Blue-winged Parrot (*Neophema chrystoma*) are State and regionally vulnerable, the Blue-faced Honeyeater (*Entomyzon cyanotis*) and Beautiful Firetail (*Stagonopleura bella*) are rare at both State and regional levels, and the Restless Flycatcher (*Myiagra inquieta*) and south east subspecies of the Hooded Robin (*Melanodryas cucullata*) are State rare and regionally uncommon.

Reptiles and Amphibians

At least five species of reptile are known to inhabit the park, although it is likely that a greater number of smaller lizards such as skinks are present owing to the prevalence of rocky outcrops, which provide cracks and holes that act as burrows or refuges. Sleepy Lizards (*Tiliqua rugosa*), Bluetongue Lizards (*T. scincoides*), Bearded Dragons (*Pogona barbata*), and snakes including Lowland Copperheads (*Austrelaps superbus*) and Eastern Tiger Snakes (*Notechis scutatus*) are common in the introduced and native grassland vegetation of the park. Fossil remains of five species of frog were recovered from the mouth of Tantanoola Cave during excavations to permit wheelchair access in 1982 (Tyler, Aslin and Bryars, 1992). These were Eastern Banjo Frog (*Limnodynastes dumerilli*), Eastern Common Frog (*Crinia signifera*), Painted Frog (*Neobatrachus pictus*), Spotted Grass Frog (*L. tasmaniensis*), and Southern Brown Tree Frog (*Litoria ewingi*). It is uncertain whether any of these species are still found in the park.

Invertebrates

Invertebrate records for Tantanoola Caves Conservation Park are limited to sparse observations of cave fauna in Tantanoola Cave. Cave fauna are classified according to their dependence on the cave environment for their survival, identified by the prefix 'trogl' or 'stygo' for aquatic or groundwater cave fauna. Troglobites rely entirely on the cave environment for their survival, and often have evolved specialised features for underground living such as reduced or absent eyes and extended antennae; they are generally confined to the deep or completely dark areas of the cave. Troglonites are cave dwellers with no specific adaptations to living underground yet can spend their entire life cycle in the cave environment. Lastly, troglonites are partly adapted to living in the cave environment, but must leave the cave for food. For Tantanoola Cave, invertebrates comprise the entire assemblage of cave fauna, most likely because the cave was almost entirely enclosed for the majority of its development, restricting the ability of vertebrates such as bats to gain entry into the cave. No information exists for the cave fauna of Lake Cave; however, it is assumed that the undisturbed cave environment would provide habitat for a highly diverse assemblage of both troglifauna and stygofauna.

Information relating to cave fauna in Tantanoola Cave is currently limited to the Weta (Macropanathinae; cave crickets), Black Rock Scorpion (*Urodacus manicatus*), aquatic waterlice (*Heterias* spp.), and cave mites (undescribed), and is for the most part incomplete.

In 1990, J. Thomas observed a number of both adult and juvenile Cave Weta in Tantanoola Cave (Department of Environment and Planning, 1992). Up to that point, the population of Cave Weta was thought to be extinct as a result of development of the cave for tourism. Little is known of this species' ecology, although it is understood that like all troglonites, the Weta leaves the cave for food, generally at night, and forages in vegetation and detrital material around cave entrances. The taxonomy of the Weta in Tantanoola Caves and in the South East overall is unclear, and further research into this intriguing animal is encouraged.

The invertebrate fauna of nearby Fossil Cave was examined as part of broader investigations into fossils contained within the drowned cave. The research has uncovered a number of rare endemic freshwater invertebrates, including a freshwater crustacean (*Koonunga crenarum*), freshwater amphipod shrimps (*Uronyctus longicaudus* and *Austrochiltonia* spp.), aquatic waterlice (*Heterias* spp.), and an undescribed species of snail (*Fluvodinia* Nov spp.). Given the proximity of Fossil Cave and the likelihood of connectivity of the karst landscape and thus a shared groundwater resource, these invertebrates or their close relatives, as well as Hydrobiid snails, are expected to be

present in Tantanoola and Lake Caves, particularly as there is permanent water in both caves (R Leijts, personal communication, 2007).

DEH encourages systematic investigations of cave fauna in the karst features of Tantanoola Caves Conservation Park, provided the research is in accordance with the zoning provisions of this plan and the sensitive nature of the cave environments is given due consideration.

Objective

Protect and restore the natural biodiversity values of the park, and minimise the threats to biodiversity, particularly species and communities of conservation significance.

Strategies

- Support and encourage biological surveys of the park to identify the biodiversity values of the park, particularly flora and fauna of conservation significance, and develop and implement appropriate management strategies.
- Support and encourage research into the invertebrate diversity of the caves, particularly the Cave Weta in Tantanoola Cave and the stygofauna of Lake Cave, and develop and implement appropriate management actions to ensure their continued survival.
- Ensure that revegetation to restore the surface vegetation of the park utilises local seed sources, and encourage partnership arrangements with other agencies, authorities, volunteer groups, and the managers of nearby land so that as far as is feasible, revegetation efforts are integrated on a regional basis.
- Consider the threat of *Phytophthora* and Mundulla Yellows and take steps to prevent the introduction of either whenever practicable, report and investigate suspected infections, and treat whenever possible.

6.2 Introduced Plants and Animals

Introduced plants and animals pose a major conservation threat to the biodiversity values of the South East by displacing or competing with native species, and in the case of introduced predators, preying on native fauna (Croft et al., 1999). The impact of edge effects from agriculture and forest plantations, such as weed infestation and higher pest animal populations, is typically greater in smaller habitat remnants, and is a significant management issue in the 14-hectare Tantanoola Caves Conservation Park.

Introduced Plants

The park has been extensively modified after a long history of agriculture, mining, and tourism, which has resulted in the majority of the park suffering from major weed infestations. At least 20 introduced plant species have been recorded for the park; however, because a comprehensive survey of the park has yet to be undertaken, the actual number of weeds present is likely to be much higher. Of particular management concern are the environmental weeds African Boxthorn (*Lycium ferocissimum*), Apple of Sodom (*Solanum linnaeanum*), Bridal Creeper (*Asparagus asparagoides*), Monterey Pine (*Pinus radiata*), and roses and briars (*Rosa* spp.), as well as pasture grasses such as Wild Oats (*Avena* spp.) and Quaking Grasses (*Briza* spp.). DEH is required to control weeds declared under the *Natural Resources Management Act 2004* (Table 3). The control of weeds will be critical to the restoration and protection of native vegetation in the park.

Table 3: Declared pest plants recorded in Tantanoola Caves Conservation Park

Scientific Name	Common Name	EPBC Act 1999*	NRM Act 2004^
<i>Asparagus asparagoides</i>	Bridal Creeper	*	*
<i>Cirsium vulgare</i>	Spear Thistle		*
<i>Hirschfeldia incana</i>	Buchan Weed		*
<i>Lycium ferocissimum</i>	African Box-thorn		*
<i>Rosa canina</i>	Dog Rose		*
<i>Rosa rubiginosa</i>	Sweet Briar		*

* Environment Protection and Biodiversity Conservation Act 1999

^ Natural Resources Management Act 2004

Grassy weeds are the most widespread pest plants in the park, and because they are already well established, will prove difficult to control or eradicate without intensive management intervention, such as annual slashing, or selective burning or grazing to prevent seeding and reduce leaf-litter fuel loads. Some positive results have been achieved through selective herbicide spraying by GreenCorps volunteers along the restored sections of the walking trail above the visitor precinct, and should continue. The revegetation activities proposed in Section 6.1 Native Flora and Fauna may assist in the long-term control of these grassy weeds through increased competition for space, light, water and nutrients by successively restoring the natural woodland / forest canopy layers.

Bridal Creeper, one of the most significant weed threats to biodiversity in the State, and listed as a Weed of National Significance by the Australian Government, requires control under both the *Environment Protection and Biodiversity Conservation Act 1999* and the *Natural Resources Management Act 2004*. Although the abundance of Bridal Creeper in the park is relatively low and its distribution localised, it has a potential to rapidly spread throughout the park, and it has therefore been treated with a biological control agent, the rust fungus *Puccinia myrsiphylli*, as part of a regional control program, with positive results to date.

Apple of Sodom is a minor agricultural weed typical to sandy, calcareous soils. A native of South Africa, this prickly shrub forms dense thickets, shading out other plants and providing cover for pest animals such as Rabbits (*Oryctolagus cuniculus*), as well as preventing the movement of stock and farm machinery. The distribution of this species is so far limited to the north-eastern corner of the park, where it has spread from the adjoining grazing property.

Forestry SA plantations of both Monterey Pine and Tasmanian Blue Gum (*Eucalyptus globulus*) are within a ten kilometre radius of Tantanoola Caves Conservation Park and feral seedlings from both species are frequently found in the park. DEH has developed a memorandum of understanding with Forestry SA to coordinate regional resource management activities.

For the term of this plan, pest plant control activities should focus on controlling and eradicating declared pest plants and other species deemed to be a threat to biodiversity on-park, such as Apple of Sodom and Monterey Pine. In order to achieve this, an integrated, regional approach needs to be adopted, and liaison should be undertaken with surrounding property owners / managers, such as the Wattle Range District Council, Forestry SA, and the South East Natural Resources Management (NRM) Board. Pest control activities should give consideration to the protection of karst processes and features, particularly that soil-water relationships are not inadvertently disturbed through soil erosion following the removal of large areas of weeds. It is envisaged that weed control, and eradication where feasible, will contribute to the restoration of natural surface and groundwater flow regimes necessary for the protection of the karst landscape. Chemical pest control around cave entrances should take into consideration possible impacts on the sensitive cave fauna, and alternatives sought where possible.

A number of ornamental trees have been planted in the park, of both exotic and native origin, presumably as part of the early development of the park as a Pleasure Resort under previous legislation. In particular, non-indigenous Cypress (*Callitris* spp.) and Norfolk Island (*Araucaria heterophylla*) pine trees were planted along the park's roadside boundary and in the open space in front of Up-and-Down Rocks, obscuring the view of this spectacular feature from passing visitors. Inappropriate revegetation has also taken place in the old dolomite quarry in the northern section of Up-and-Down Rocks. Removal of non-indigenous plants is accepted practice in reserves, and will be undertaken following an environmental risk assessment that will investigate the invasive nature of the plants, and risks to public safety.

Introduced Animals

Because of its small size and highly simplified habitat, the park does not provide suitable habitat for introduced animals. However, the Feral Cat (*Felis catus*), European Rabbit (*Oryctolagus cuniculus*) and Red Fox (*Vulpes vulpes*), pest animals that are widespread in the South East, are likely to be present in the park. A more detailed survey of the park would likely reveal the presence of other introduced species, particularly small mammals such as House Mice (*Mus domesticus*) and Rats (*Rattus* spp.), and birds such as the House Sparrow (*Passer domesticus domesticus*) and Common Blackbird (*Turdus merula*).

Rabbits are known to impede the recruitment and growth of native vegetation, and actively contribute to soil erosion through removal of native vegetation and altering soil structure. Rabbits

are also more prevalent in sandy areas, where they can burrow easily, and encourage the spread of pest plants. Furthermore, Rabbits provide a reliable and abundant food source to introduced predators such as Cats and Foxes, leading to over-inflated populations of those species. In the Lower South East, Rabbits are not generally as serious a threat as in other, drier areas of the State because of a combination of ongoing physical control, the effects of biological controls such as Rabbit Haemorrhagic Disease (RHD; calicivirus) and myxomatosis, and a wetter climate (Croft et al., 1999). However, if Rabbit numbers increase in the vicinity of the park, DEH will implement management strategies that comply with national and State legislation and DEH policy, which may involve the use of 1080 baiting and pindone poisons.

Foxes are implicated in the decline of a number of native animal species (Department of the Environment and Heritage, 2004). In the South East, Fox numbers are related to Mice and Rabbit numbers; when the numbers of their preferred prey are low, Foxes switch to preying upon native animals, particularly ground-dwelling small mammals and birds, as well as domestic animals such as lambs and poultry (Croft et al., 1999). Active Fox control using 1080 baits is not currently undertaken on the park; however, should Fox numbers increase, DEH will investigate the risks to biodiversity values, and may implement a fox baiting program using 1080 baits, in line with the DEH Standard Operating Procedure (SOP) on Fox Control for Biodiversity Conservation. The SOP outlines a 'good neighbour' approach, whereby control programs are undertaken in cooperation with neighbouring landowners, providing benefits to both DEH and landowners.

The threats posed by Cats, Foxes and Rabbits have been identified as Key Threatening Processes under the *Environment Protection and Biodiversity Conservation Act 1999*, and Threat Abatement Plans have been prepared to enable a coordinated approach to their management. Foxes and Rabbits are also declared under the *Natural Resources Management Act 2004*. Given the small size of the park and the nature of surrounding land uses, on-park pest animal control is unlikely to provide an effective long-term solution to the threats posed by pest animals. Integrated and strategic pest management, through partnership with surrounding landowners including the Wattle Range District Council, Forestry SA and the South East NRM Board, will ensure that pest animal numbers are reduced with minimal impact on native flora and fauna.

Cattle have been known to stray into the south-eastern portion of the park from time to time and adjoining property owners need to be reminded of the need to ensure their stock do not stray into the park. Grazing by domestic stock inhibits natural regeneration through selectively removing palatable native plant species, seedlings and new plants. Grazing also contributes to soil compaction and erosion, changes in soil nutrient status, and the spreading of pest plants (Croft et al., 1999). To allow for the natural regeneration of native vegetation, DEH will liaise with the adjacent landowner to ensure park values are protected and enhanced.

Objective

Control, and eradicate where possible, introduced plants and undertake measures to control introduced animals in the park, and integrate with regional initiatives, giving due consideration for the protection of karst processes.

Strategies

- Continue to control, and eradicate where possible, pest plants within the park, focusing on identified priorities, and undertake coordinated projects for pest plant control, land rehabilitation, and revegetation where necessary using native species of local provenance.
- Liaise with managers of the forestry plantations adjacent the park regarding appropriate management of the plantation to limit the spread of feral seedlings into the park.
- Undertake environmental risk assessments for ornamental species in the park, and investigate options for removal of ornamental plantings, particularly the Cypress and Norfolk Island Pines in and around the visitor precinct, based on the risk assessments.
- Monitor populations of pest animals, particularly Rabbits and Foxes, and prevent their spread in the park.
- Work cooperatively with the South East NRM Board and volunteer organisations to implement regional pest plant and animal control programs that address identified priorities for pest control in the park.
- Liaise with the managers of neighbouring properties regarding maintenance of boundary fencing to protect park values.

7 MANAGING FIRE

Fire is a landscape process that is pivotal in shaping Australian ecosystems. It is therefore important that land management in reserves incorporates informed fire management practices where fire is an issue.

Tantanoola Caves Conservation Park is not known to have experienced fire since its dedication in 1930, although its fire history prior to proclamation is unknown.

The current extent of introduced plants in the park poses a potentially significant fire risk. Fuel loads contributed to by grassy weeds are likely to carry fire through the park, adjoining agricultural land and surrounding forest reserves. It is envisaged that the implementation of pest plant control strategies as per Section 6.2 Introduced Plants and Animals, in conjunction with fuel reduction activities, will minimise the fire hazard associated with grassy weed fuel loads.

The effect of fire on karst landscapes appears to be unpredictable, and loosely related to geology, soil type, surface vegetation, and fire interval and intensity. Altered fire regimes have been linked to changes in hydrology in Jewel Cave, Western Australia, whereby the change in floristic composition resulting from extended fire intervals altered available surface flows and groundwater recharge, leading to a lowering of the water level in the cave (Eberhard, 2004).

The Australian Speleological Federation (Webb, 1998) considers that fire can have the following affects on karst and cave systems:

- the leaching of carbon deposits into caves;
- the impacts of smoke and ash on secondary cave deposits and cave fauna;
- the degradation of cave entrances through denudation followed by rainfall;
- the spalling (breaking up or splitting) of limestone throughout the karst; and
- fracture and collapse due to heating.

Fire management planning for Tantanoola Caves Conservation Park should give consideration to the protection of the karst landscape, and particularly karst processes associated with vegetative cover and surface water flows. Post-fire monitoring concentrating on floristic composition and surface water flows should be conducted wherever possible.

Fire access to the park is the main park entrance from the Princes Highway, which provides access to the western portion of the park at the base of the Up-and-Down Rocks. Given the small size of the park, fire management is an issue that needs to be addressed in an integrated manner with the owners/managers of neighbouring properties. In recognition of this approach, park neighbours have in the past consented for access to the eastern portion of the park for fire management activities to be provided through their properties. This strategy should continue during the term of this management plan and be considered for incorporation into any future fire management planning for the park. Park managers should continue to maintain a cooperative and consultative relationship with park neighbours.

Fire management planning for Tantanoola Caves Conservation Park will be incorporated into the regional fire management planning process, which will involve consultation with adjoining Country Fire Service Groups and the District Bushfire Prevention Committee, to integrate district fire management. Stakeholders and the wider community will also be consulted to ensure an understanding of the fire risks and mitigating actions being proposed or undertaken in the park.

Fire management planning will:

- identify fire related risk to natural and cultural heritage values and built assets;
- define objectives for fire management in the planning area; and
- identify strategies to achieve these objectives incorporating:
 - a framework for the management of bushfire suppression, including identification of strategic fire access and infrastructure; and
 - a framework for prescribed burning to assist in built asset protection and for ecological management purposes.

Objective

Manage fire to ensure the protection of life and property, the maintenance of biodiversity and the protection of natural, cultural and built values.

Strategies

- Develop, implement and review fire management plans in association with CFS and other stakeholders.
- Continue to work with the relevant District Bushfire Prevention Committee, CFS, and park neighbours to minimise risk to life and property within and surrounding the park.

8 MANAGING CULTURAL HERITAGE

8.1 Aboriginal Heritage

Bunganditj Culture and Heritage

The land comprising Tantanoola Caves Conservation Park forms part of the 'Country' of the Bunganditj people (Tindale, 1974). For Bunganditj people, land and waters have many interconnected complex meanings and values.

Following colonial settlement, the Bunganditj population was substantially reduced as a result of introduced diseases, dispersal, dispossession of their land and water supplies, and sometimes through violent conflict.

The Bunganditj people had a unique culture and language, and some of the language and traditional stories have been recorded (Smith, 1880). However, to date, the full extent of Aboriginal heritage at Tantanoola Caves Conservation Park has not been comprehensively researched. The area surrounding Up-and-Down Rocks is believed to have been a popular campsite, probably due largely to the permanent springs found in the vicinity. The artefacts found on and near the park, including a number of flint flakes and some core-stones from which flakes have been struck, support this theory (Department of Environment and Planning, 1983).

However, due to historical or cultural reasons, any knowledge of the cultural heritage of the region may be privileged to selected Bunganditj people and therefore unable to be recorded. Given the lack of existing information, it is considered important that further research be undertaken in order to gain a better understanding of the Aboriginal occupancy and use of the area.

Aboriginal Heritage Act 1988

The purpose of the *Aboriginal Heritage Act 1988* is the protection and preservation of Aboriginal sites, objects and remains. 'Aboriginal site' and 'Aboriginal object' are defined under the Act as 'an area of land or an object that is of significance according to Aboriginal tradition; or that is of significance to Aboriginal archaeology, anthropology or history.' The Aboriginal Affairs and Reconciliation Division (AARD) of the Department of the Premier and Cabinet maintains a Central Archive, including the Register of Aboriginal Sites and Objects.

Currently two archaeological sites are listed on the Central Archive for Up-and-Down Rocks, part of which is protected in Tantanoola Caves Conservation Park. However, these recordings do not reflect a comprehensive survey of the park and there may be other, as yet unidentified, Aboriginal sites, objects and remains in the park. In carrying out the activities and strategies proposed in this plan, DEH will ensure that it complies with the *Aboriginal Heritage Act 1988*.

To ensure the protection of sites, DEH shall consult with AARD and the relevant regional Aboriginal heritage committees before commencement of significant development works.

Objective

Ensure that any Aboriginal sites, objects and remains are protected and preserved.

Strategies

- Consult with the relevant regional Aboriginal heritage committees and relevant Government Aboriginal heritage authorities in decisions regarding the management of Aboriginal heritage.
- Identify and protect any Aboriginal sites, objects and remains in cooperation with the relevant regional Aboriginal heritage committees, AARD and other relevant authorities.
- In consultation with the relevant regional Aboriginal heritage committees, submit cultural sites and stories that relate to the park for inclusion on the AARD Central Archive.

8.2 Non-Aboriginal Heritage

Tantanoola Caves Conservation Park has a long history of European occupation, with the first development of the land being a large pastoral run leased to Samuel Davenport, George Glen, and William Vansittart in the 1840s. From July 1889 the area comprising the northern portion of the park was gazetted as a Stone Reserve and Reserve for Road Purposes, and quarrying was carried out along a section of Up-and-Down Rocks to provide railway ballast and material for road making. A borrow pit in the far north-west boundary of the park provided a source of sand for

local industries. The locations of the quarry and borrow pit are clearly visible from the walking track, and may be suitable for minimal impact interpretation.

After Boyce Lane discovered Tantanoola Cave in 1930, the land was proclaimed as a Pleasure Resort and the cave developed for tourism. This included the installation of lighting and development of the visitor precinct with a kiosk and toilet facilities. Other developments included a wishing well erected by the Rotary Club of Millicent, and the provision of car parking. These features remain, forming the focus of visitor use in the park, although the design and long-term viability of some of the buildings may need to be re-assessed as they detract from the visual attractiveness of Up-and-Down Rocks.

Old fences are all that remains of past grazing and cropping of the eastern portion of the park, including the cliff-top, and should be removed to address possible safety risks (see Section 10.1 Management Infrastructure and Public Utilities).

Despite the above, no significant non-Aboriginal cultural heritage items are recorded for the park on the State Heritage Register. However, the history of this park has ongoing implications for management, and a thorough investigation of the non-Aboriginal cultural heritage values of the park should be made to formally locate and record all sites.

Objective

Ensure that any sites or items of heritage significance are appropriately protected and interpreted.

Strategies

- Support and where appropriate facilitate surveys of and research into historic sites and stories that relate to the history of the park; map and document sites, objects, and structures associated with the park's former land uses.
- Give consideration to interpreting non-Aboriginal cultural heritage and sites that highlight the history of the park, particularly the former mine workings, and associated public safety risk issues.

9 MANAGING TOURISM AND RECREATION

Tantanoola Caves Conservation Park was established with the aim of protecting the unique karst features of the park, namely the dolomite caves and Up-and-Down Rocks. The primary objective of management is to conserve these features so that natural ecosystems can flourish whilst providing for sustainable access for visitors to appreciate, understand and support the protection of the park.

Visitor use of the park is centred on viewing the spectacular Tantanoola Cave under the supervision of DEH staff. Tantanoola Cave caters to a variety of visitors and was the first show cave in Australia to provide wheelchair access. Other recreational activities undertaken in the park are of a passive nature and include sightseeing, picnicking and nature study. In the past, Up-and-Down Rocks has been used for rock climbing, an activity considered to be incompatible with the conservation focus of the park as it may disturb the surface vegetation and the shallow soils of the cliff. Under the *National Parks and Wildlife Act 1972*, rock climbing is prohibited in reserves without prior permission. Because of the small size of the park, the type of recreation opportunities offered, and the average length of stay being less than two hours (Market Equity, 2002), there is no provision for camping in the park, and vehicle access is limited to the car park in the visitor precinct. The use of the park for scientific research, particularly of the cave systems, must be in accordance with the provisions of this plan, and researchers are required to obtain a scientific permit.

To ensure the conservation of park values surface activities will be restricted to those of a low impact nature, including walking, bird watching, photography, nature study and other similar activities. The impacts of visitors on the park will be monitored and reviewed, and controlled if necessary.

Access to enter Tantanoola Cave was historically provided in the form of daily guided tours, whereby visitors were required to wait for tours to begin. A recent visitor survey indicated that guided cave tours were the most important park feature for 81% of visitors surveyed, with more than 75% of the visitors being first-time visitors to the park (Market Equity, 2002). Visitor numbers, based on ticket sales for the guided tours, were greatest during summer and autumn, with peak periods during Easter, long weekends and school holidays. To cater for travelling visitors, access arrangements to enter Tantanoola Cave have recently been modified to allow visitors to enter the Cave on arrival in the park. Entry to the cave will be under the supervision of a DEH 'cave host' that remains with the visitor for the length of their stay to provide a 'hosted cave experience'. Entry to Tantanoola Cave will be provided during peak times and by prior arrangement with the DEH District Office at Naracoorte. Visitor access should be conducted in accordance with the zoning provisions outlined in this plan, ensuring minimal impact on the sensitive cave environment.

In order to effectively manage the cave environment, the cave may be closed during non-peak times to protect the sensitive cave environment from visitor impacts such as the accumulation of lint on cave decorations, and during times of low visitor demand. The public will be notified of any closures of the cave by notices in DEH offices, regional tourist information centres, and other means as appropriate.

Visitor facilities are concentrated in the Visitor Precinct Zone and include a visitor centre and car park, toilets, picnic areas and a walking trail (Figure 2), and allow for the enjoyment of the natural and cultural features of the park. Entry to the park is via a one-way entrance road from the Princes Highway, which leads directly to the car park in front of the visitor precinct before turning back to the Princes Highway.

The visitor centre and associated facilities form the focus for visitors to the park through the provision of access information and interpretation of the park's natural and cultural features, as well as regional tourism information. The visitor centre is also the administrative hub for park management. The visitor centre was recently upgraded to make better use of the limited space available. Future upgrades or additional visitor facilities will be assessed according to the provisions of this plan and should be sensitive to the visual amenity of the park's significant geological features, particularly Up-and-Down Rocks; no further developments are proposed during the term of this plan. Any development of the existing structure needs to take consideration of the asbestos materials used in the building's manufacture, ensuring that legislative requirements are met.

Tantanoola Cave, as the main show cave, has been significantly developed for visitor access and includes a lockable door, lighting and associated electrical fittings, handrails, and a walking track that includes ramps suitable for wheelchair access. In the past, development of the cave has been inappropriate for the protection of the sensitive cave environment, and a major upgrade of facilities was undertaken in 1983 to bring the cave up to the show cave standards of the time. It was at this time that the cave was made accessible for wheelchairs, the first show cave in Australia to offer this service. Any future development of the show cave should be consistent with the objectives of this management plan and should also be complementary to the cave environment. Additionally, the lighting system in the cave should be periodically reviewed to determine the impact on lampenflora accumulation on speleothems, and preventative or remedial action taken to limit the effect on the sensitive cave formations.

A walking trail that traces the crest of Up-and-Down Rocks before descending down through the old quarry and following the base of the Rocks back to the visitor centre provides opportunities for the interpretation of the park's natural and cultural values. An assessment of the trail based on viability, maintenance considerations, safety, and need will be conducted in line with current DEH strategic directions for trails. Following this assessment, the trail may be realigned or sections of or the entire trail may be closed and rehabilitated. If the assessment calls for realignment of the trail, options for realignment that maximise education and interpretation opportunities and minimise public safety risks and impacts on natural park values will be investigated. If the trail is realigned, the former sections of the trail will be closed and rehabilitated. Options for the development of a self-guided brochure and associated trail markers that facilitate appreciation and understanding of the park's natural and cultural values, as well as the importance of the South East Karst Province, should also be explored.

Patterns of visitor use have changed in recent years. Historically, annual numbers of visitors to the park were as high as 40,000 (Department of Environment and Planning, 1983), although visitor numbers have since been gradually declining, with 13,295 visitors recorded during 2005-06. A periodic review of the operation and importance of Tantanoola Cave to the regional tourism experience in comparison to alternative DEH and other cave activities will be conducted by the DEH District Office at Naracoorte. The demand for the provision of tours hosted by DEH staff will be evaluated as a result of these reviews.

Private tour operators undertaking commercial activities within Tantanoola Caves Conservation Park are required to hold a Commercial Licence, pursuant to regulation 37 of the *National Parks and Wildlife (National Parks) Regulations 2001*. Licence fees are paid into the General Reserves Trust and are used to improve visitor services and facilities within reserves. No commercial operators currently utilise the park, but there is potential for managed, commercial tourism operators to offer guided tours of Tantanoola Cave during non-peak times and at other times by prior arrangement with the DEH District Office at Naracoorte. Commercial tour operators must comply with licence conditions, which could include:

- the provisions of this plan and Regulation 22 of the *National Parks and Wildlife (National Parks) Regulations 2001* are strictly adhered to;
- tours are delivered and structured in such a way so as not to impact on the sensitive cave environment;
- attainment of appropriate accreditation, as per advice from the DEH District Office at Naracoorte; and
- reasonable notice to be provided to the DEH District Office at Naracoorte prior to entering the reserve (minimum of five days, unless otherwise negotiated).

Together with Naracoorte Caves National Park and other cave experiences at Mount Gambier and Nelson, the park plays an important role in the education and interpretation of the significant karst features of the South East. For the purposes of improved cross-promotion it is recommended that joint interpretive materials be provided at DEH-managed reserves, and strategies for a regionally integrated marketing resource should be investigated.

Objectives

Provide opportunities for tourism and recreation within the Show Cave Zone consistent with conservation objectives.

Ensure that visitors who use the park understand and appreciate its natural values, respect its primary role for karst conservation, and have minimal impact on the park environment.

Strategies

- Manage the park for low-impact visitor use. Upgrades or additions to visitor facilities should have consideration for the visual amenity of the park and be consistent with the provisions of this management plan.
- Provide visitor access to Tantanoola Cave in the form of hosted cave viewing during periods of high visitor demand and by appointment through prior arrangement with the DEH District Office at Naracoorte, ensuring impacts on the sensitive cave environment are minimised. The cave may be closed during times of low visitor demand or to protect the cave environment.
- Review the suitability of lighting systems in Tantanoola Cave on a regular basis to ensure minimal impacts on cave speleothems.
- Maintain interpretive information in the park to enhance visitor experience and advise on appropriate and safe behaviour.
- Conduct an assessment of the walking trail based on viability, maintenance considerations, safety, and need. If required, investigate options for the realignment of the walking trail to address issues of safety and sustainability, and explore opportunities for self-guided interpretation of the park's natural and cultural values featured along the trail.
- Conduct periodic reviews of the operation of Tantanoola Caves in relation to other regional cave experiences, and evaluate the need to provide cave experiences as part of these reviews.
- Consider requests to allow private sector and other parties to undertake commercial tourism ventures on the park. Issue Commercial Licences under section 35(4) of the *National Parks and Wildlife Act 1972* for appropriate use of the park by tour operators, if their activities are consistent with the objectives of this management plan.
- Liaise with local government and regional tourism authorities to promote cave-based tourism across the region.

10 MANAGING RESOURCE USE

10.1 Management Infrastructure and Public Utilities

Development of the Tantanoola Cave for public inspection resulted in a number of built structures to support the activity: a visitor centre, public toilets, entrance road, car park, picnic tables, a wishing well and a permanent residence, all within the Visitor Precinct Zone. Other infrastructure and built assets include a storeroom that is used to house equipment and materials used in park management programs, a walking trail, signs and other interpretive material, and fencing; concrete mounting blocks are all that remain on the old quarry site. A gate locks the entrance to Lake Cave to prevent unauthorised access, and should be maintained to minimise disturbance to the cave (see Section 4 Zoning). The existing infrastructure will be rationalised and any not of practical value will be progressively removed.

The wishing well, located between the visitor centre and the cave entrance, was installed by a local community organisation, and is known to attract bees, creating a public safety risk. Maintenance responsibilities of this feature are as yet unresolved; consultation with the community organisation should be undertaken to determine the long-term viability of the structure.

The permanent residence at the southern extent of the visitor precinct was formerly the manager's residence and is now the subject of leasing arrangement; a management strategy for the residence is provided in Section 10.3 Leases and Licenses.

During the life of this plan, boundary fencing should be progressively rationalised to protect park values and remnants of old internal fencing removed to address safety issues.

The concrete mounting blocks at the base of the dolomite quarry are all that remains of the former mine workings and may have historic or interpretive value. Any structures without historic or practical value will be progressively removed to allow restoration of the site to a more natural condition.

There are no public utilities located within or over Tantanoola Caves Conservation Park, and DEH would oppose the establishment of any new public utilities on the park, given its small size and significance for biodiversity conservation. DEH policy discourages the location of utilities on reserves, unless proponents can demonstrate that alternative locations have received full consideration and the utility will not compromise the conservation values of the park.

Protection of reserve values is a priority, and reserves should not be considered to be a convenient option for the location of public utilities due to their status as public land. Any future proposal for public utilities within the park will be subject to an environmental assessment, and must be consistent with DEH policy and the provisions of this management plan.

Objectives

Provide a suitable level of park infrastructure to fulfil management requirements.

Ensure that all future public utilities proposals for developments within the park are consistent with park values.

Strategies

- Assess the practical value of existing infrastructure and progressively remove non-essential items; resolve issues surrounding the wishing well as part of the rationalisation process.
- Rationalise boundary fencing to ensure park values are enhanced and protected.
- Request an environmental assessment for all proposals to locate public utilities within or over the park, and ensure that all proposals are consistent with current DEH policy and the provisions of this management plan.

10.2 Exploration and Mining

The old dolomite quarry was utilised for the production of railway ballast for many years prior to the discovery of Tantanoola Cave in 1930 (Cochrane, 1952) and for some time subsequently. Weathering of most of the faces has now proceeded to the extent where the rock blends in with the cliff lines and only the shape of the quarry and the benches stand out. In the lower part of the quarry diagenetic flint nodules and marine-worked boulders and cobbles are exposed, and

Cochrane (1952) reports a fossil nick point. In the north-west corner of the park below the talus slope considerable quantities of fine aeolian sand have been removed, in some places down to bedrock. No other mining activities are known to have taken place in the park. The old quarry offers important interpretation opportunities and should be kept in a safe and stable condition. Remediation and restoration of old mine workings not useful for interpretation, including the borrow pit and lower section of the dolomite quarry, is desirable.

Access under State mining legislation was prohibited when Tantanoola Caves Conservation Park was constituted by statute in 1972.

Adjoining the park to the south-east is a large quarrying complex from which dolomite is being extracted for manufacturing purposes. The impacts from the complex include dust, noise, and potential damage to the cave decorations in Tantanoola Cave through blasting. In consultation with DEH, the operators of the quarry modified blasting procedures and implemented a monitoring and reporting program in 2005 to identify any impacts on the fragile cave features from blasting in an attempt to ameliorate any such effects.

Lake Cave is just within the current boundary of the park, and may extend under land adjoining the park. As discussed in Section 5.2 Hydrology, the hydrology of the local area and its relationship to the karst features protected in the park is poorly understood. It is also suspected that the known caves in the park are part of a larger karst system, and that a series of subterranean passages and chambers connect these caves. In this case the sandy basin to the south-east of the park may play a role in the hydrologic system influencing Lake Cave and other local karst features. DEH would be supportive of research that aims to more accurately define the boundaries of karst features and determine the hydrologic system influencing its development.

As noted in Section 5 Managing Geology and Hydrology, the karst system is likely to extend beyond the park boundary and relationships between the hydrology and the local karst system is not clear. Even though the karst system extends outside of DEH-managed land, this management plan can only refer to land managed by DEH. Therefore, when tenements are granted for exploration and mining activities, DEH recommends the designation of a Special Karst Protection Zone¹ encompassing the local karst system by the regulatory authority administering State mining legislation (currently PIRSA Minerals and Energy Resources). Such a zone would seek to ensure that activities within the catchment do not disturb the karst system, either directly through structural damage or indirectly as a result of changes to the proper functioning of karst processes, including the removal of surface vegetation and the alteration of hydrological cycles. Further, such a zone would seek to ensure that proponents of mineral exploration and extraction activities are aware of the need to consider how their operations may impact on the karst system. DEH maintains close liaison with PIRSA and exploration and mining proponents in relation to on-reserve resource use for other DEH reserves, and such liaison is encouraged for any exploration and mining activities proposed for land adjacent to Tantanoola Caves Conservation Park to ensure the karst system as a whole is protected from undue disturbance.

Objective

Ensure that exploration and mining does not negatively impact on the processes involved in developing and maintaining the significant karst features of the park.

Strategies

- Remediate former mine sites to a more natural condition; retain the quarry for visitor interpretation, ensuring the site is kept in a safe and stable condition.
- Establish and maintain effective liaison with PIRSA and proponents of mineral exploration and extraction activities on adjoining land to ensure the karst system is adequately protected; this may require the designation of a Special Karst Protection Zone by PIRSA.
- Continue to monitor the impacts of blasting and other mining activities on Tantanoola Cave.

¹ This refers to a zone under the provisions of the *Mining Act 1971*, not a zone under the provisions of the *National Parks and Wildlife Act 1972*.

10.3 Leases and Licences

There are currently no commercial leases or licenses affecting management of Tantanoola Caves Conservation Park, although the former manager's residence is occupied under a leasing arrangement between DEH and the tenants. DEH will develop suitable arrangements in liaison with tenants regarding maintenance and issues of mutual interest.

Historically, the area now incorporating the visitor precinct and walking trail was leased to the local government authority to manage the tourism operations associated with Tantanoola Cave. This lease was terminated in 1983; however, there may be a future role for the private sector in supporting some of the proposals and activities referred to in this plan. For example, the involvement of commercial operators in the provision of guided tours is an option that should be explored and would require more secure tenure and a longer-term lease or leases over land or buildings (see Section 9 Managing Tourism and Recreation).

Approval for any such (unspecified) commercial proposals would be subject to their meeting all planning and legal requirements and not compromising the values or management of the park or interfering with legitimate visitor use. They would need to demonstrate acceptable environmental, recreational, cultural, and aesthetic impacts, and may need to achieve such accreditation as determined by the DEH District Office at Naracoorte to ensure the protection of the karst system.

Objective

On-park commercial leases or licences operate under strict conditions within a management framework consistent with the objectives of this plan.

Strategies

- Maintain the lease arrangements for the manager's residence, ensuring maintenance and other issues are resolved in a timely manner and to the mutual benefit of all parties.
- Explore alternatives for out-sourcing visitor facility management and assess any other leasing/licensing proposals. If and when approved, set lease/licence terms and conditions and monitor compliance, ensuring operations are consistent with the natural, cultural, and historic values of the park.

11 INVOLVING THE COMMUNITY

DEH supports and promotes partnerships and cooperative management arrangements to ensure integrated natural resource management. This requires the development of effective working relationships with government agencies, local authorities, non-government organisations, and the local community, particularly park neighbours. The integration of park management with land management programs being undertaken by adjacent landowners should be supported, especially to find ways of strengthening any native vegetation corridor linkages to other areas of habitat.

With regard to Tantanoola Caves Conservation Park, this involves forging management links with the Wattle Range District Council, the South East Natural Resources Management Board, conservation groups, the immediate park neighbours, and with South East community stakeholders generally. A memorandum of understanding between DEH and Forestry SA, which recognises the mutual benefits of shared resources and conservation programs in protecting and management biodiversity in the Lower South East, is currently in place and should be maintained. As noted in Section 10.2 Exploration and Mining, liaison between DEH, PIRSA and exploration and mining proponents is encouraged for any exploration and mining activities proposed for land adjacent to Tantanoola Caves Conservation Park to ensure the karst system as a whole is protected from undue disturbance.

Partnership arrangements should be developed to provide a positive direction for the shared development and management of the park to fulfil the objectives of this plan. Moreover, with changes in land use within the region, it is important for DEH to actively work with the Wattle Range District Council and development bodies to ensure proposed developments do not adversely impact on biodiversity conservation and park values.

While there is no Friends group formally involved with Tantanoola Caves Conservation Park, the Friends of Mt Gambier Area Parks and Friends of Naracoorte Caves have been involved in some conservation and maintenance activities on-park. An active group of GreenCorps volunteers has also contributed significantly to management in recent years. Walking track maintenance, revegetation, and pest plant control are the main areas where volunteer input has been significant.

The protection of Lake Cave and associated karst system may necessitate the purchase of additional land to the north and east of the current park boundary to ensure that Lake Cave is adequately protected within the reserve. However, developing a cooperative management arrangement with the owners/managers of surrounding land could be a cost-effective method to achieve strategic conservation objectives and good environmental outcomes without a large capital outlay. Options for protecting the important surface features associated with the continued evolution of Lake Cave should be investigated in conjunction with park neighbours, conservation groups, and key community stakeholders.

Objective

Maintain cooperative working relationships for conservation outcomes.

Strategies

- Consult with local council, relevant management boards, the local community, adjoining landholders, key stakeholders and other relevant bodies to explore the benefits of partnership arrangements that will support future management decisions on issues of common interest and ensure the protection of karst values outside of the park.
- Provide opportunities for volunteer and community groups to assist in the management and monitoring of the park by facilitating the implementation of programmed activities.

SUMMARY OF MANAGEMENT STRATEGIES

ZONING
<ul style="list-style-type: none"> • Zone the park as indicated in Figure 2 and manage the park in accordance with zoning guidelines. • Ensure that Wattle Range Council considers including the park within a more appropriate zone when the Wattle Range Council Development Plan is next reviewed.
MANAGING NATURAL HERITAGE
<p>Geology, Soils and Landform</p> <ul style="list-style-type: none"> • Consider soil types and properties, including evidence of seasonal wetting or erosion potential, when undertaking management activities. To maintain soil stability, ensure pest plant removal projects are staged and complemented by natural regeneration or revegetation. • Monitor visitor activities to prevent further human-induced soil erosion; this may require relocating or closing access to the walking trail temporarily or permanently. • Identify and maintain the values of the geological, karst, and palaeontological features. Undertake remedial works when and where necessary; this may require the temporary closure of Tantanoola Cave. • Restrict access to Lake Cave to research approved by the DEH District Office at Naracoorte to maintain the fragile and unique cave environment.
<p>Hydrology</p> <ul style="list-style-type: none"> • Manage the surface features of the park in a manner that contributes to the restoration and protection of the surface and groundwater flow regimes. • Encourage research into the hydrology affecting karst features in the park, including identification of threats to the catchment area for both Tantanoola and Lake Caves, and implement management actions as required. • Highlight the role that hydrology plays in preserving and maintaining the continued development of cave features to the South East Natural Resources Management (SENRM) Board. • In liaison with the SENRM Board, develop landscape-scale strategies to ensure cave features are maintained.
<p>Native Flora and Fauna</p> <ul style="list-style-type: none"> • Support and encourage biological surveys of the park to identify the biodiversity values of the park, particularly flora and fauna of conservation significance, and develop and implement appropriate management strategies. • Support and encourage research into the invertebrate diversity of the caves, particularly the Cave Weta in Tantanoola Cave and the stygofauna of Lake Cave, and develop and implement appropriate management actions to ensure their continued survival. • Ensure that revegetation to restore the surface vegetation of the park utilises local seed sources, and encourage partnership arrangements with other agencies, authorities, volunteer groups, and the managers of nearby land so that as far as is feasible, revegetation efforts are integrated on a regional basis. • Consider the threat of <i>Phytophthora</i> and Mundulla Yellows and take steps to prevent the introduction of either whenever practicable, report and investigate suspected infections, and treat whenever possible.
<p>Introduced Plants and Animals</p> <ul style="list-style-type: none"> • Continue to control, and eradicate where possible, pest plants within the park, focusing on identified priorities, and undertake coordinated projects for pest plant control, land rehabilitation, and revegetation where necessary using native species of local provenance. • Liaise with managers of the forestry plantations adjacent the park regarding appropriate management of the plantation to limit the spread of feral seedlings into the park.

<ul style="list-style-type: none"> • Undertake environmental risk assessments for ornamental species in the park, and investigate options for removal of ornamental plantings, particularly the Cypress and Norfolk Island Pines in and around the visitor precinct, based on the risk assessments. • Monitor populations of pest animals, particularly rabbits and foxes, and prevent their spread in the park. • Work cooperatively with the South East NRM Board and volunteer organisations to implement regional pest plant and animal control programs that address identified priorities for pest control in the park. • Liaise with the managers of neighbouring properties regarding maintenance of boundary fencing to protect park values.
<p>MANAGING FIRE</p>
<ul style="list-style-type: none"> • Develop, implement and review fire management plans in association with CFS and other stakeholders. • Continue to work with the relevant District Bushfire Prevention Committee, CFS, and park neighbours to minimise risk to life and property within and surrounding the park.
<p>MANAGING CULTURAL HERITAGE</p>
<p>Indigenous Heritage</p> <ul style="list-style-type: none"> • Consult with the relevant regional Aboriginal heritage committees and relevant Government Aboriginal heritage authorities in decisions regarding the management of Aboriginal heritage. • Identify and protect any Aboriginal sites, objects and remains in cooperation with the relevant regional Aboriginal heritage committees, AARD and other relevant authorities. • In consultation with the relevant regional Aboriginal heritage committees, submit cultural sites and stories that relate to the park for inclusion on the AARD Central Archive.
<p>Non-Indigenous Heritage</p> <ul style="list-style-type: none"> • Support and where appropriate facilitate surveys of and research into historic sites and stories that relate to the history of the park; map and document sites, objects, and structures associated with the park's former land uses. • Give consideration to interpreting non-Aboriginal cultural heritage and sites that highlight the history of the park, particularly the former mine workings, and associated public safety risk issues.
<p>MANAGING TOURISM AND RECREATION</p>
<ul style="list-style-type: none"> • Manage the park for low-impact visitor use. Upgrades or additions to visitor facilities should have consideration for the visual amenity of the park and be consistent with the provisions of this management plan. • Provide visitor access to Tantanoola Cave in the form of hosted cave viewing during periods of high visitor demand and by appointment through prior arrangement with the DEH District Office at Naracoorte, ensuring impacts on the sensitive cave environment are minimised. The cave may be closed during times of low visitor demand or to protect the cave environment. • Review the suitability of lighting systems in Tantanoola Cave on a regular basis to ensure minimal impacts on cave speleothems. • Maintain interpretive information in the park to enhance visitor experience and advise on appropriate and safe behaviour. • Conduct an assessment of the walking trail based on viability, maintenance considerations, safety, and need. If required, investigate options for the realignment of the walking trail to address issues of safety and sustainability, and explore opportunities for self-guided interpretation of the park's natural and cultural values featured along the trail. • Conduct periodic reviews of the operation of Tantanoola Caves in relation to other regional cave experiences, and evaluate the need to provide cave experiences as part of these reviews. • Consider requests to allow private sector and other parties to undertake commercial tourism ventures on the park. Issue Commercial Licences under section 35(4) of the <i>National Parks and Wildlife Act 1972</i> for appropriate use of the park by tour operators, if their activities are consistent with the objectives of this management plan.

<ul style="list-style-type: none"> • Liaise with local government and regional tourism authorities to promote cave-based tourism across the region.
<p>MANAGING RESOURCE USE</p>
<p>Management Infrastructure and Public Utilities</p> <ul style="list-style-type: none"> • Assess the practical value of existing infrastructure and progressively remove non-essential items; resolve issues surrounding the wishing well as part of the rationalisation process. • Rationalise boundary fencing to ensure park values are enhanced and protected. • Request an environmental assessment for all proposals to locate public utilities within or over the park, and ensure that all proposals are consistent with current DEH policy and the provisions of this management plan.
<p>Exploration and Mining</p> <ul style="list-style-type: none"> • Remediate former mine sites to a more natural condition; retain the quarry for visitor interpretation, ensuring the site is kept in a safe and stable condition. • Establish and maintain effective liaison with PIRSA and proponents of mineral exploration and extraction activities on adjoining land to ensure the karst system is adequately protected; this may require the designation of a Special Karst Protection Zone by PIRSA. • Continue to monitor the impacts of blasting and other mining activities on Tantanoola Cave.
<p>Leases and Licences</p> <ul style="list-style-type: none"> • Maintain the lease arrangements for the manager's residence, ensuring maintenance and other issues are resolved in a timely manner and to the mutual benefit of all parties. • Explore alternatives for out-sourcing visitor facility management and assess any other leasing/licensing proposals. If and when approved, set lease/licence terms and conditions and monitor compliance, ensuring operations are consistent with the natural, cultural, and historic values of the park.
<p>INVOLVING THE COMMUNITY</p>
<ul style="list-style-type: none"> • Consult with local council, relevant management boards, the local community, adjoining landholders, key stakeholders and other relevant bodies to explore the benefits of partnership arrangements that will support future management decisions on issues of common interest and ensure the protection of karst values outside of the park. • Provide opportunities for volunteer and community groups to assist in the management and monitoring of the park by facilitating the implementation of programmed activities.

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APPENDIX A: CONSERVATION STATUS CODES

Australian Conservation Status Codes

The following codes are based on the current listing of species under Section 179 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

- EX Extinct:** there is no reasonable doubt that the last member of the species has died.
- EW Extinct in the Wild:** known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
- CE Critically Endangered:** facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
- E Endangered:** facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
- V Vulnerable:** facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
- CD Conservation Dependent:** the species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.

Note: Prescribed criteria as defined under the IUCN Red List of Threatened Species.

South Australian Conservation Status Codes

The following codes are based on the current listing of species under the Schedules of the *National Parks and Wildlife Act 1972*, as amended in 2008. To align with other States, Territories and the Commonwealth (EPBC Act) listing categories and ratings, the IUCN criteria were used as a basis for determining threatened species status under the *National Parks and Wildlife Act 1972*. For IUCN criteria see:

IUCN (1994) *IUCN Red List Categories*. Prepared by the IUCN Species Survival Commission. IUCN, Gland, Switzerland (www.redlist.org).

IUCN (2001) *IUCN Red List Categories and Criteria: Version 3.1*. IUCN Species Survival Commission. IUCN, Gland, Switzerland and Cambridge, United Kingdom (www.redlist.org).

- E Endangered:** (Schedule 7) in danger of becoming extinct in the wild.
- V Vulnerable:** (Schedule 8) at risk from potential or long term threats which could cause the species to become endangered in the future.
- R Rare:** (Schedule 9) low overall frequency of occurrence (may be locally common with a very restricted distribution or may be scattered sparsely over a wider area). Not currently exposed to significant threats, but warrants monitoring and protective measures to prevent reduction of population sizes.

Regional Status Codes

The categories below apply to the species distribution at a regional level. There are no regional conservation status categories developed for mammals, reptiles or amphibians to date.

Birds

Regional conservation status for birds follow:

Carpenter and Reid (1998) *The Status of Native Birds in the Agricultural Areas of South Australia*. Unpublished and regularly updated database.

The regions are defined as follows:

ML	Mount Lofty	MN	Mid-North	SE	South-Eastern	KI	Kangaroo Island
MM	Murray Mallee	EP	Eyre Peninsula	YP	Yorke Peninsula		

Plants

Regional conservation ratings for plants follow:

Lang, PJ & Kraehenbuehl, DN (2001) *Plants of Particular Conservation Significance in South Australia's Agricultural Regions*.

Department for Environment and Heritage (undated) *Florlist*. Unpublished and regularly updated database.

The regions are as defined by the State Herbarium (Plant Biodiversity Centre), illustrated in the front cover of:

Barker, WR, Barker, RM, Jessop, JP and Vonow, HP (Eds) (2005) *Census of South Australian Vascular Plants. Fifth Edition. J. Adelaide Bot. Gard. Supplement 1*. Botanic Gardens of Adelaide and State Herbarium, Adelaide.

NW	North-Western	FR	Flinders Ranges	NL	Northern Lofty	SL	Southern Lofty
LE	Lake Eyre	EA	Eastern	MU	Murray	KI	Kangaroo Island
NU	Nullarbor	EP	Eyre Peninsula	YP	Yorke Peninsula	SE	South-Eastern
GT	Gairdner-Torrens						

In order of decreasing conservation significance:

- X Extinct/Presumed extinct:** not located despite thorough searching of all known and likely habitats; known to have been eliminated by the loss of localised population(s); or not recorded for more than 50 years from an area where substantial habitat modification has occurred.
- E Endangered:** rare and in danger of becoming extinct in the wild.
- T Threatened:** (*Plants only*) likely to be either Endangered or Vulnerable but insufficient data available for more precise assessment.
- V Vulnerable:** rare and at risk from potential threats or long term threats that could cause the species to become endangered in the future.
- K Uncertain:** likely to be either Threatened or Rare but insufficient data available for a more precise assessment.
- R Rare:** has a low overall frequency of occurrence (may be locally common with a very restricted distribution or may be scattered sparsely over a wider area). Not currently exposed to significant or widespread threats, but warrants monitoring and protective measures to prevent reduction of population sizes.
- U Uncommon:** less common species of interest but not rare enough to warrant special protective measures.
- Q Not yet assessed:** but flagged as being of possible significance.
- N Not of particular significance:** (*Plants only*) also indicated by a blank entry.
- C Common:** (*Birds only*) also indicated by a blank entry.
- O Occasional Visitor Only:** (*Birds only*) not considered of conservational status.