Teacher Resource Pack

Piccaninnie Ponds Conservation Park

Government of South Australia
South East Natural Resources Management Board

Natural Resources South East

Introduction

The 862 hectares that make up Piccaninnie Ponds Conservation Park (CP) are truly unique. The park includes two rare wetland types and is one of the few remaining permanent freshwater wetlands in the lower south east of South Australia. A number of nationally and internationally threatened species find refuge in the park, whilst stunning crystal clear groundwater springs attract thousands of visitors a year keen to snorkel or dive in the deep ponds. The area has been recognised and protected under the Ramsar Convention due to its international significance. Piccaninnie Ponds CP provides for some wonderful nature based learning opportunities for students.

The resource pack

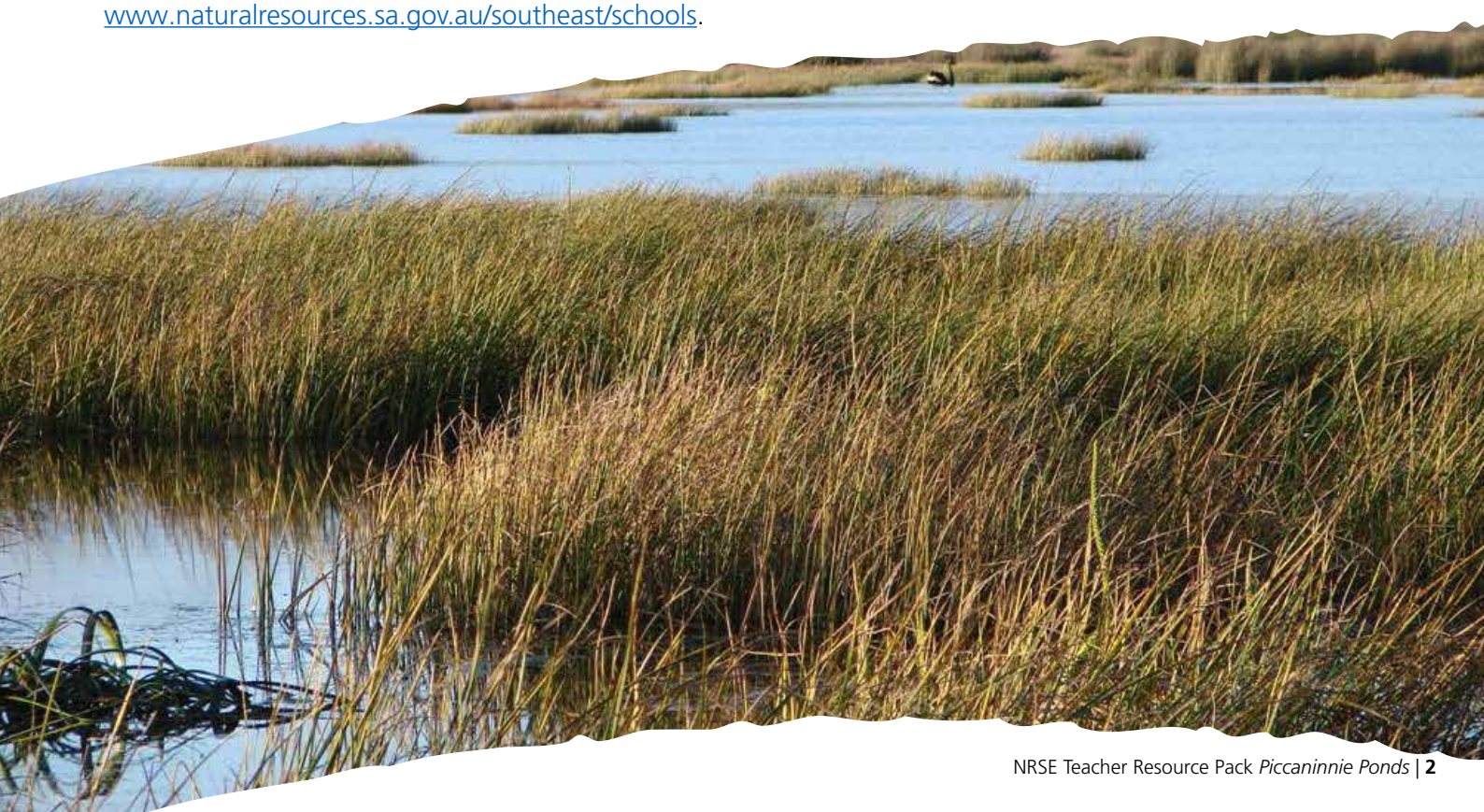
This Teacher Resource Pack provides background information on the biodiversity of the park, its hydrogeological history and current management. Suggested activities are also included along with a site map and self-guided excursion itinerary.

The activities provided are linked to the Australian curriculum and additional resources are suggested. Natural Resources South East staff are able to run education sessions on site, subject to availability. For more information, or to discuss opportunities for your school, please contact one of the NRM Education South East team members:

Environmental Education Coordinator
Upper South East
Naracoorte
Phone: 8762 9705
Mobile: 0427 015 531

Environmental Education Coordinator
Lower South East
Mount Gambier
Phone: 8735 1108
Mobile: 0477 309 353

You can also visit the Natural Resources South East website for further information: www.naturalresources.sa.gov.au/southeast/schools.



Contents

In 2018 we were deeply saddened by the sudden passing of Wetlands Conservation Ecologist Steve Clarke, and wish to extend our most sincere condolences to his family.

A passionate environmentalist, Steve has left a significant legacy through his landscape restoration work and connections with the community.

Steve was an inspiring colleague and friend; he is, and will be, greatly missed.

An overview of Piccaninnie Ponds Conservation Park

In the furthest south eastern corner of South Australia, 32 kilometres south east of Mount Gambier, you will find Piccaninnie Ponds CP (Figure 1).

Bordered by Victoria to the east and the southern ocean to the south, this 862 hectare park conserves an assortment of intriguing natural landscapes and amazing flora and fauna. However, what really makes Piccaninnie Ponds CP so unique is the makeup of its wetlands.

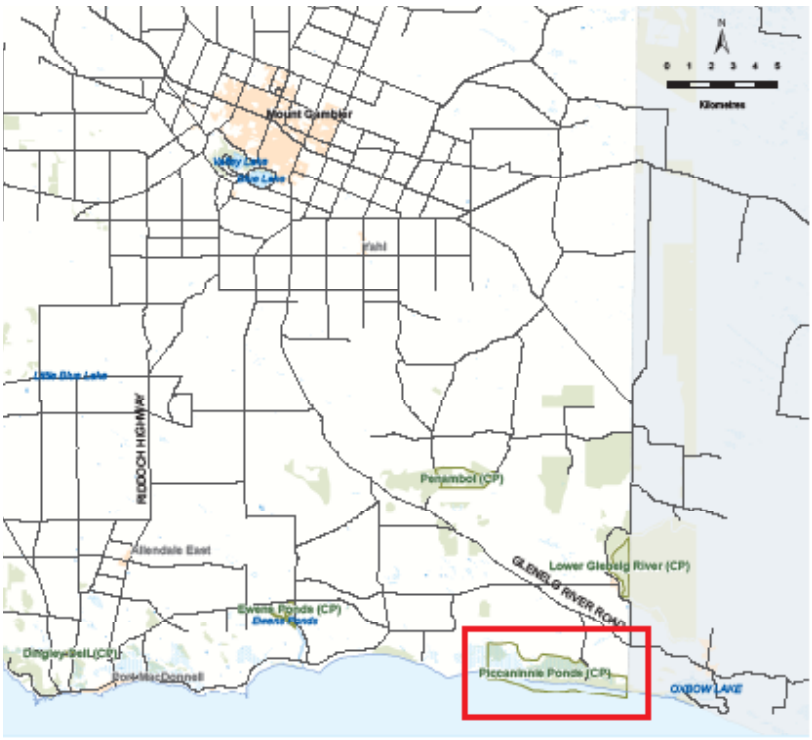
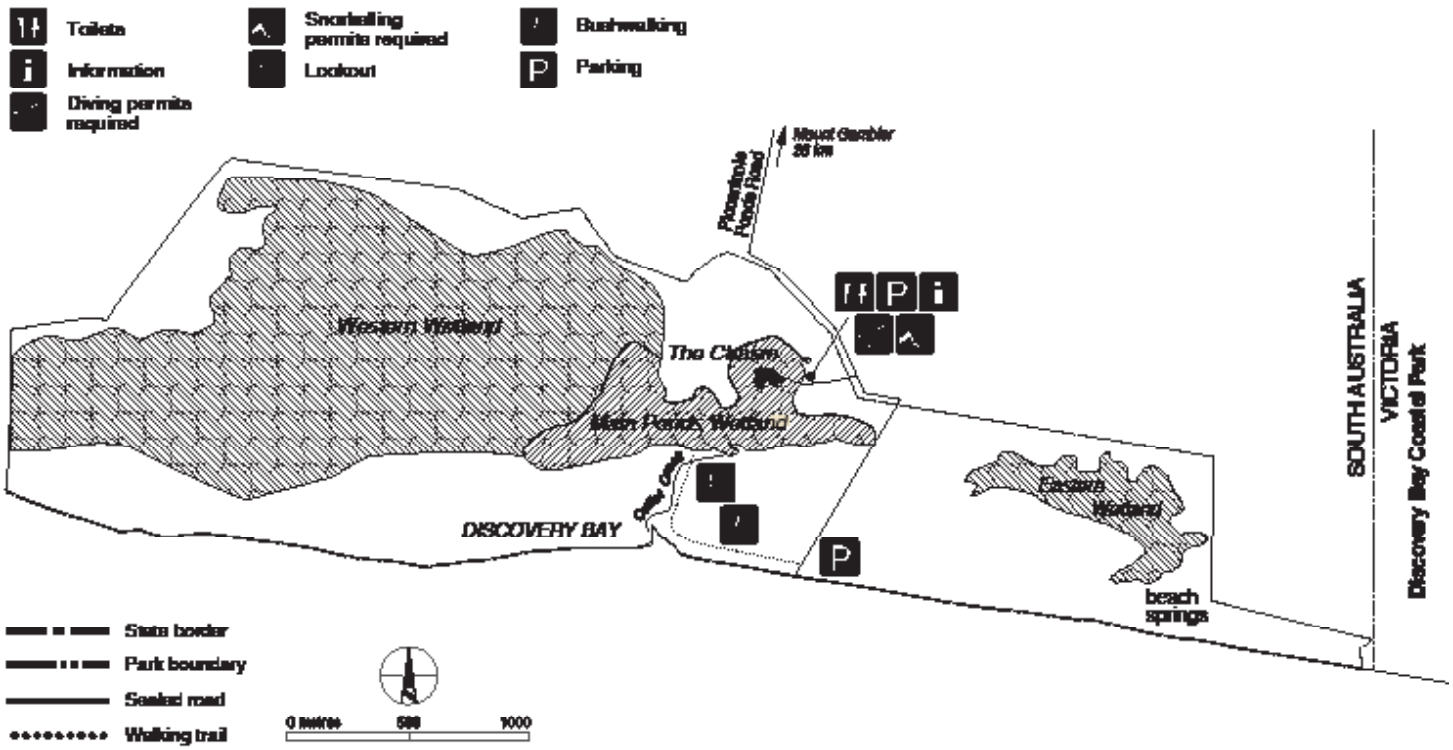


Figure 1: *Piccaninnie Ponds CP is located in the very south-eastern corner of South Australia, 32 kilometres south east of Mount Gambier (NRSE, 2018).*

There are four main wetland areas within the Piccaninnie Ponds CP (Figure 2):

1. *Main ponds* - consisting of three connected water bodies, the First Pond (10m deep), the Chasm (>110m deep) and the Turtle Pond (6m deep). An area of shrub dominated swamp surrounds these spring fed ponds.
2. *Western wetland* - comprising of dense closed tea-tree and paperbark shrub-land.
3. *Eastern wetland* – including the spring fed Hammerhead Pond (4m deep).
4. *Pick Swamp* - includes an area of fen wetland, marshes and sedge lands on peat soil and the spring fed Crescent Pond (86m deep). Located to the extreme west of the site.

Figure 2: *Piccaninnie Ponds CP contains several wetland areas (NRSE, 2018).*

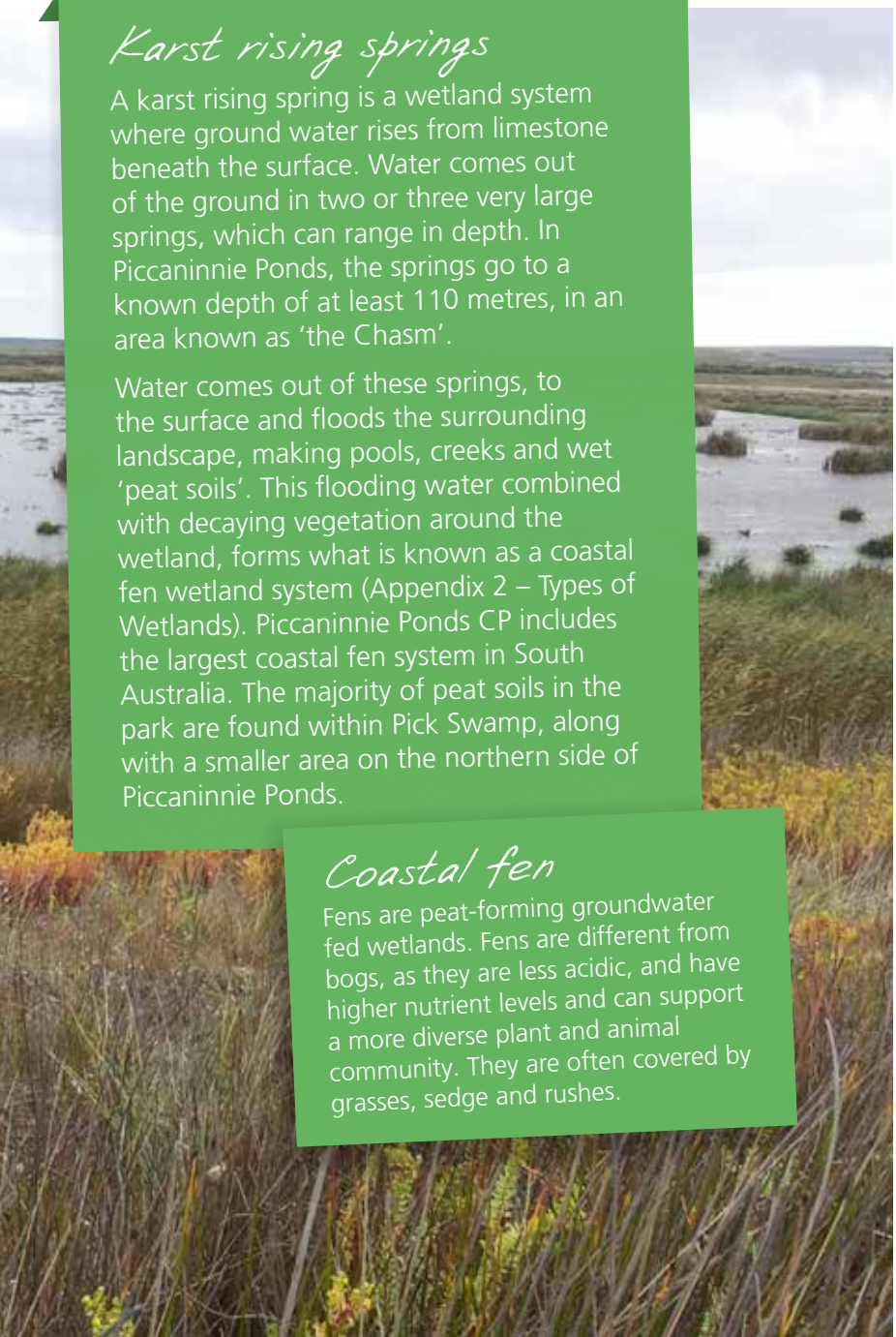


A protected park

Piccaninnie Ponds CP isn't simply a conservation park, it is also protected under the Ramsar Convention. This is an international agreement that aims to end and where possible, reverse the world wide loss of wetlands. The convention also aims to conserve those wetlands that remain through wise use and good management. One way the Ramsar Convention does this is by encouraging the inclusion of wetlands across the world that contain representative, rare or unique wetlands, or wetlands that are important for conserving biological diversity.

Piccaninnie Ponds CP was declared a Ramsar site in 2012 and was the 65th Australian site dedicated under the convention (Appendix 1 – Ramsar Convention).

The 862 hectares included are known as the "Piccaninnie Ponds Karst Wetlands" and cover the same area as the conservation park boundaries, extending to the adjoining beach areas right down to the low tide mark. The area contains two globally rare wetland systems which was an important reason for the Ramsar declaration. These two types of wetland systems are known as karst rising springs and coastal fen wetlands and they have a fascinating range of cultural and conservation values (Appendix 2 – Types of Wetlands). Because of this, the International Union for Conservation of Nature (IUCN) have also recognised karst rising springs in the South East (including Piccaninnie Ponds) as a critically endangered wetland community, giving it even greater significance.



Karst rising springs

A karst rising spring is a wetland system where ground water rises from limestone beneath the surface. Water comes out of the ground in two or three very large springs, which can range in depth. In Piccaninnie Ponds, the springs go to a known depth of at least 110 metres, in an area known as 'the Chasm'.

Water comes out of these springs, to the surface and floods the surrounding landscape, making pools, creeks and wet 'peat soils'. This flooding water combined with decaying vegetation around the wetland, forms what is known as a coastal fen wetland system (Appendix 2 – Types of Wetlands). Piccaninnie Ponds CP includes the largest coastal fen system in South Australia. The majority of peat soils in the park are found within Pick Swamp, along with a smaller area on the northern side of Piccaninnie Ponds.

Coastal fen

Fens are peat-forming groundwater fed wetlands. Fens are different from bogs, as they are less acidic, and have higher nutrient levels and can support a more diverse plant and animal community. They are often covered by grasses, sedge and rushes.

Ramsar Convention

Ramsar is an international agreement that aims to halt and where possible, reverse the world wide loss of wetlands. It also aims to conserve those that remain through wise use and good management. The Ramsar convention encourages the listing of wetlands across the world that contain representative, rare or unique wetlands, or wetlands that are important for conserving biological diversity (further details - Appendix 1).

There is only one other Ramsar site in the South East: Bool and Hacks Lagoon.

There are four other Ramsar listed sites in South Australia:

- Banrock Station Wetland Complex
- Coongie Lakes (Lake Eyre Basin)
- Coorong and Lakes Alexandrina and Albert Wetland
- Riverland

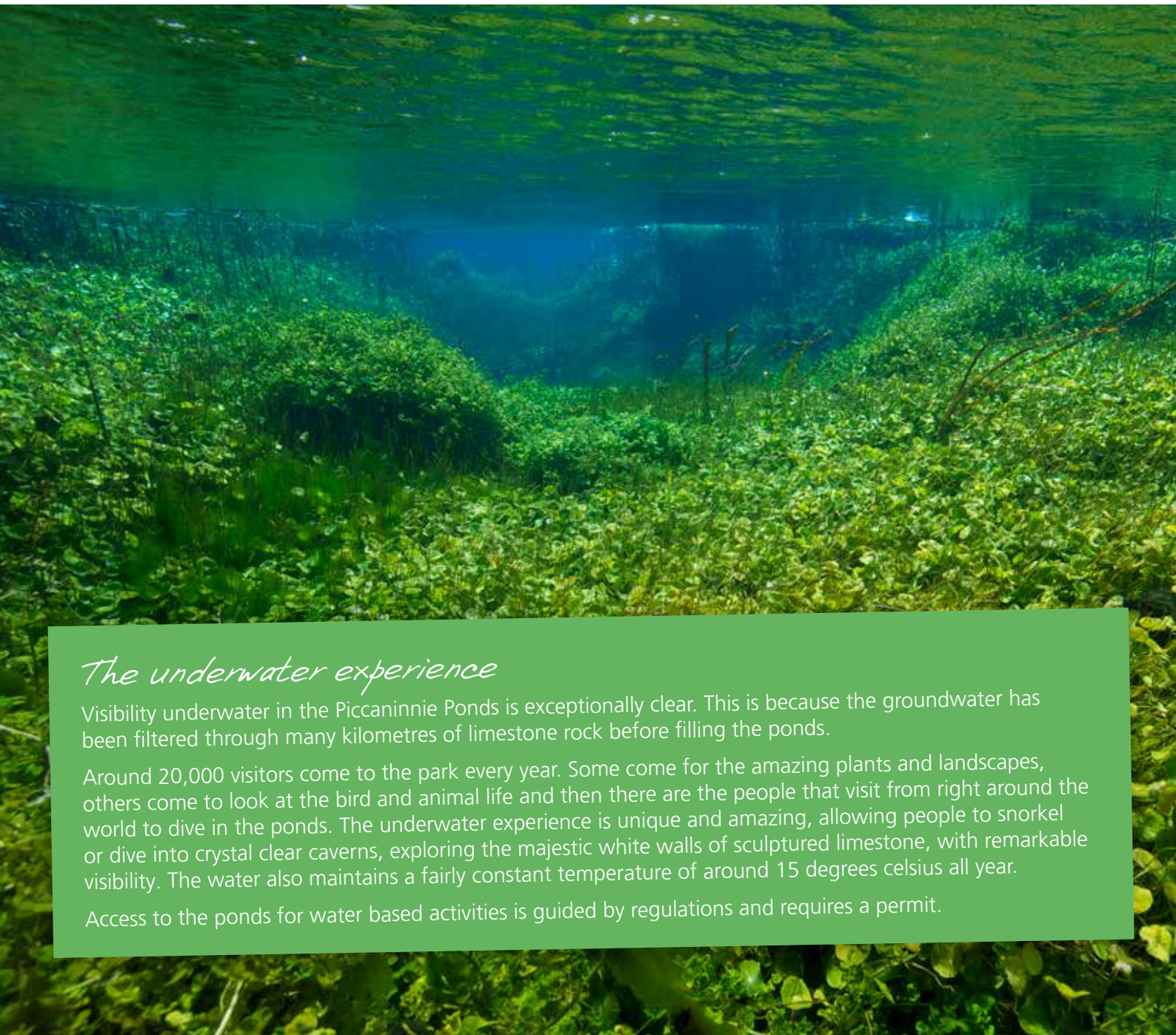
Life in the ponds

Piccaninnie Ponds wetland system maintains a permanent year round supply of water. This is one of the reasons it is so valuable to the ecosystem. As other wetlands and water sources in the South East start drying up each season, the water here remains and along with it, attracts a large array of bird life.

The wetland provides habitat for an amazing range of plants (flora) and animals (fauna). Some of these are commonly found in other parts of the region and/or state and some of them are of conservation significance. Piccaninnie Ponds CP provides an important refuge for 64 species that are listed at an international, national and/or state level. This includes 21 bird species, nine fish, one mammal, one reptile, seven invertebrates and 25 plant species (Refer Appendix C: Listed Species and Communities of Conservation Significance (available in, Butcher et al (2011b)) www.environment.sa.gov.au/managing-natural-resources/wetlands/piccaninnie-ponds

Currently there is not a comprehensive list of all species that have been recorded in Piccaninnie Ponds Conservation Park.

The Piccaninnie Ponds wetland system supports a variety of native fish, with ten different species being recorded. Seven of these species are unique in that they have physical adaptations that allow them to live in both fresh water and salty sea water. These species are known as diadromous and spend half of their lifecycle in the sea, and the other half in the fresh water of the wetlands. There are no introduced fish species in the Piccaninnie Ponds.



The underwater experience

Visibility underwater in the Piccaninnie Ponds is exceptionally clear. This is because the groundwater has been filtered through many kilometres of limestone rock before filling the ponds.

Around 20,000 visitors come to the park every year. Some come for the amazing plants and landscapes, others come to look at the bird and animal life and then there are the people that visit from right around the world to dive in the ponds. The underwater experience is unique and amazing, allowing people to snorkel or dive into crystal clear caverns, exploring the majestic white walls of sculptured limestone, with remarkable visibility. The water also maintains a fairly constant temperature of around 15 degrees celsius all year.

Access to the ponds for water based activities is guided by regulations and requires a permit.

Fish passageway

On the far western side of the park a one kilometre levee has been built along with a weir and a fish passageway. The fish passageway is very important because it provides a connection between the sea and the freshwater wetland, and allows migratory fish to move between the wetland and the ocean.

Sanctuary zone

A sanctuary zone – is a specially designated zone within a marine park. It is primarily established so that an area may be managed to provide protection and conservation for habitats and biodiversity within a marine park, especially by prohibiting the removal or harm of plants, animals or marine products.

Levee

Levee banks or levees are artificial embankments built to prevent and/or reduce the flow or movement of water. Levees generally play an important role in the management of floodplains and protecting built assets. They are also used in wetlands to assist in management of areas due to altered environmental conditions.

Before Piccaninnie Ponds became a conservation park it was leased grazing land. In 2005 a section known as "Pick Swamp" was added to the park and it was at this time that major restoration works began in the area. These works mainly focused on retaining water on the land. A water limiting device, called a regulator, was installed in Pick Swamp. This regulator allows park managers to adjust the water levels in this section of the wetland - holding some water back on the land, and allowing some water to still flow out to sea.

Before the restoration works commenced the wetland had a much lower water level than is seen today. Works to restore parts of the area have been so successful that the park is now a summer refuge of thousands of water birds (Refer to Hydrogeological History section).

Marine park and sanctuary zone

The Lower South East Marine Park covers the entire coastal boundary of Piccaninnie Ponds CP. Within the park there is a designated sanctuary zone called the Piccaninnie Springs Sanctuary Zone, located adjacent to Ewens and Piccaninnie Ponds, where the spring lakes filter through to the coast.

The area declared as a sanctuary zone has some special rules in place to provide even higher protection.

Within the rules there are allowances for recreational beach fishing. Line fishing is allowed from the beach, directly along the shoreline, however the collection of cockles (pippies) in any part of the zone is prohibited.

The marine park provides protection for the diverse habitats in the area, ranging from sandy beaches to different reef types (e.g. shore platforms, fringing and limestone reefs), kelp forests and algal communities.

All of the habitats within the marine park help support a range of flora and fauna which are important for conservation. For example, local sea birds and migratory shorebirds use these habitats, not only for feeding, but also for nesting and breeding. This includes species listed as vulnerable and endangered, such as the hooded plover.

These habitats are strongly affected by a natural phenomenon called the "Bonney Upwelling". This upwelling process causes an amazing natural burst of productivity in the regions coast and marine environment. The nutrients it brings stimulate the whole food chain, from microscopic plankton right through to gigantic blue whales.

The Bonney Upwelling

A marine phenomenon that occurs between Portland (VIC) and Robe (SA), taking place seasonally from around November to May.

Spring winds shift to the south east and drive an ocean current to the north west along the coast, where the surface waters drift offshore. This 'shifting' water is replaced with cold nutrient rich water from Antarctica, where it "wells up" from the deep sea floor and onto the continental shelf, which is nearest to the coast here.

Sunlight then converts the nutrients into food for a variety of marine species, and sea animal populations prosper.

Resource

You can access more great information regarding the Shorebirds of the South East by downloading this poster from Birdlife Australia: http://www.vwsg.org.au/PDFs /Blackfellows-Cave-Map-Sign.pdf

Park management

Conservation parks provide protection for our native flora and fauna and are dedicated to help conserve important habitats and wildlife – otherwise known as biodiversity. These areas also help keep the air and water clean, provide opportunities for us learn about the environment and provide space to enjoy all that nature has to offer.

Managing conservation parks is a complex task, with a wide variety of areas requiring consideration and resources. Some of the roles of park management include:

- providing facilities for visitors (signage, toilets and picnic spots)
- managing visitor impacts (for example; constructing and maintaing walking trails, undertaking patrols and emptying bins)
- pest plant and animal control (control programs for species such as foxes, boxthorn and polygala)
- monitoring and research in the park (understanding what occurs in the park)
- fire management (to try and minimise the impact and risk of wildfires)
- managing habitat and protecting biodiversity (restoration works and fencing)
- looking after threatened plants and animals (protecting species that are at risk of extinction).

Visitor management

Providing facilities for visitors and managing the possible impacts that visitors have on the park is a big component of overall park management and planning. Facilities that have been provided in Piccaninnie Ponds CP include; toilets, signage, picnic tables, shelters, boardwalks, viewing platforms, floating pontoons and bird hides.

Management actions put in place to help minimise the impact of visitors include:

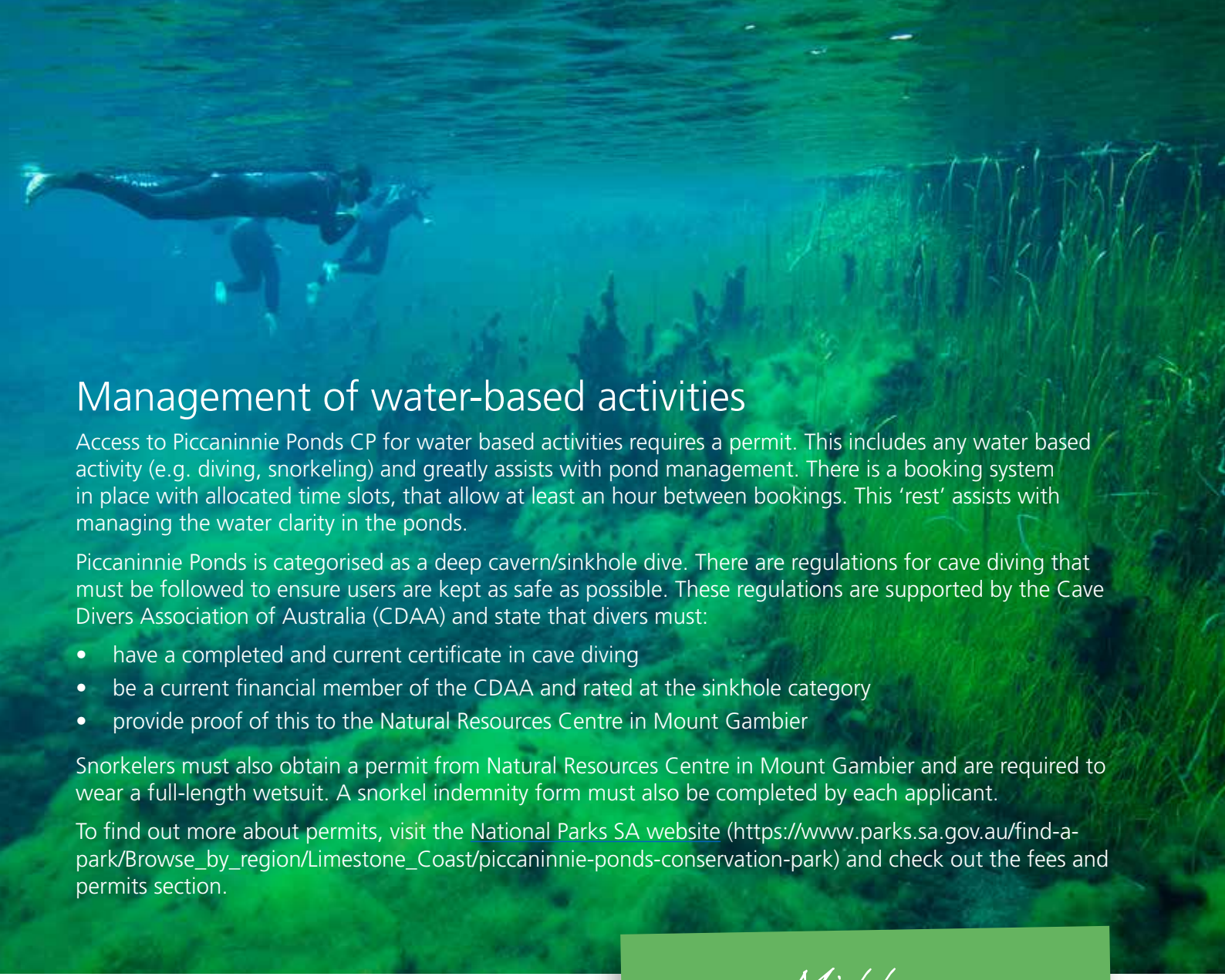
- providing walking trails to limit impacts on native vegetation
- restricting access to environmentally sensitive areas
- undertaking patrols to investigate inappropriate behavior
- educating the community regarding the 'Code of Conduct in Parks and Reserves'
- removing rubbish left by visitors
- restricting access to the ponds at certain times (snorkeling and diving permits are required to limit the number of visitors on the pond at any one time).

To find out more about permits, visit the Piccaninnie Ponds page (https://www.parks.sa.gov.au/find-a-park/Browse_by_region/Limestone_Coast/piccaninnie-ponds-conservation-park) on the National Parks SA website and check out the fees and permits section.

Rules can change from park to park, so visitors should always check the National Parks SA website (https://www.environment.sa.gov.au/parks/) before they go. There is a general Code of Conduct for all parks and reserves across the state. This code aims to help people understand some of the ways they can help protect these areas. These messages include:

- leave your pets at home
- take your rubbish with you
- observe fire restrictions, usually 1 November to 30 April (check the CFS Hotline on 1300 362 361)
- conserve native habitat by using liquid fuel or gas stoves
- camp only in designated areas
- respect geological, cultural and heritage sites
- keep our wildlife wild, do not feed or disturb animals, or remove native plants
- keep to defined vehicle tracks and walking trails
- be considerate of other park users.

Managers are always grateful to visitors who leave the bush in its natural state for the enjoyment of others.



Management of water-based activities

Access to Piccaninnie Ponds CP for water based activities requires a permit. This includes any water based activity (e.g. diving, snorkeling) and greatly assists with pond management. There is a booking system in place with allocated time slots, that allow at least an hour between bookings. This 'rest' assists with managing the water clarity in the ponds.

Piccaninnie Ponds is categorised as a deep cavern/sinkhole dive. There are regulations for cave diving that must be followed to ensure users are kept as safe as possible. These regulations are supported by the Cave Divers Association of Australia (CDAA) and state that divers must:

- have a completed and current certificate in cave diving
- be a current financial member of the CDAA and rated at the sinkhole category
- provide proof of this to the Natural Resources Centre in Mount Gambier

Snorkelers must also obtain a permit from Natural Resources Centre in Mount Gambier and are required to wear a full-length wetsuit. A snorkel indemnity form must also be completed by each applicant.

To find out more about permits, visit the National Parks SA website (https://www.parks.sa.gov.au/find-a-park/Browse_by_region/Limestone_Coast/piccaninnie-ponds-conservation-park) and check out the fees and permits section.

Cultural significance

The traditional owners of the land, the Bunganditj (Boandik) people, and local indigenous people of the South East have a strong connection with the Piccaninnie Ponds area.

They recognise the importance of the ponds and the connections between culture and the health of the environment. The wetlands are of great significance to the community as a permanent freshwater source, important for storytelling and an important source of materials to trade with other indigenous people.

The site traditionally provided food, shelter and other resources to the Bunganditj (Boandik) people, with middens and other signs of historical inhabitants remaining today.

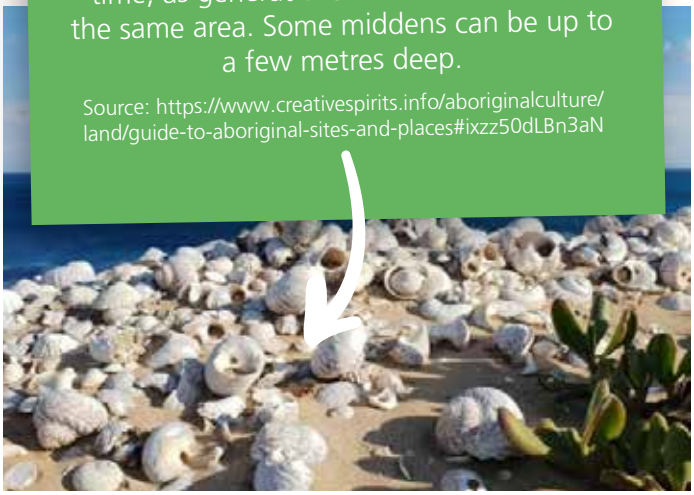
It is important that these sites are protected and respected by those who visit the area.

Middens

A 'midden' is a site where indigenous communities left remains of their meals, which largely consisted of shellfish. Oyster and cockle shells are often found in middens, as well as animal bones. Some middens also contain artefacts and tools made from stone, bone or shell.

At some sites very large deposits grew over time, as generations continued to utilise the same area. Some middens can be up to a few metres deep.

Source: https://www.creativespirits.info/aboriginalculture/land/guide-to-aboriginal-sites-and-places#ixzz50dLBn3aN



Prescribed burning

Prescribed (or planned) burning is the controlled use of fire for a particular area of landscape. Where fires are planned and carried out under controlled circumstances the general aims are to:

- reduce fire fuel hazards by removing excess build-up of vegetation
- manage native vegetation and enhance biodiversity

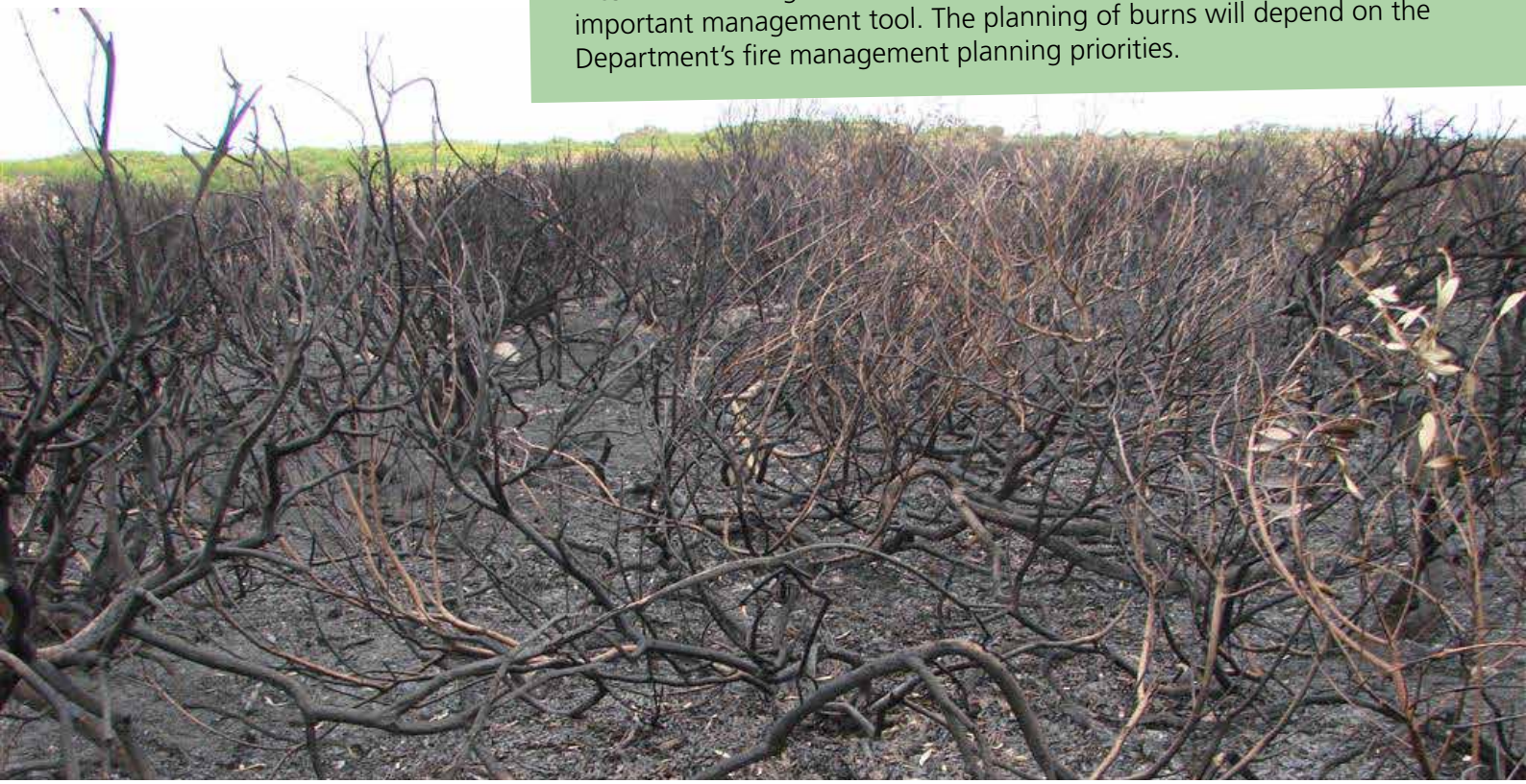
Prescribed burns are part of the Departmental fire management program, which aims to reduce fire fuel hazards. This can help make bushfires easier to control, help prevent a bushfire spreading to residential areas and ultimately save lives and property. Prescribed burning is also used for ecological reasons, such as:

- Protecting and maintaining animal habitats - some species of native animals prefer regenerating or 'new' vegetation, while others like long unburnt habitat. Prescribed burning helps to manage the landscape so that there is a mix of habitats for all species.
- Assisting the regeneration of plant species and communities that are reliant on fire - many native plants depend on fire for regeneration, and as a result many plants grow quickly after fire. Some grow from seed germination following fire, and some re-sprout buds from under their bark or roots.
- Providing conditions for improved biodiversity.

Several prescribed burns have been undertaken in Piccaninnie Ponds CP, each of these undertaken for different management reasons. Examples of these occurred in the following areas:

- **Eastern grass lands** – since 2007 two prescribed burns, of around 25 hectares, have been undertaken in this section of the park close to the Victorian border. The purpose of these burns was to enhance the native grassland habitat in the area, whilst at the same time controlling introduced grassland species.
- **Pick Swamp –** In March 2017 almost 10 hectares were part of a planned burn. The aim was to help reduce fuel loads in the area (assisting in reducing the risk of a naturally occurring bushfire spreading throughout the CP) and to assist the regeneration of native grass species.
- **Beach access road** – around four years ago, a block of heavy native vegetation was burnt on the main access road to the beach. The aim of this was to assist in reducing fuel loads, encourage the regeneration of fire dependant species and assist with the control of coastal wattle (Acacia longifolia var. sophorae), an abundant native plant species.

Prescribed burning will continue to be used in Piccaninnie Ponds CP as an important management tool. The planning of burns will depend on the Department's fire management planning priorities.



Monitoring

Monitoring is an integral part of managing a park as it provides information that helps to inform decisions. It is also an important tool to measure the success of management actions and allows managers to track the condition of park values. A variety of monitoring programs can be undertaken, depending on park priorities, time of the year, aims of the monitoring and available resources. Sometimes particular monitoring programs continue for many years assessing change over time, and sometimes only for a very short period.

In Piccaninnie Ponds CP there has been a variety of monitoring programs which have taken place.

Pick Swamp bird monitoring

Birdlife South East and Natural Resources South East have undertaken monthly bird monitoring in the Pick Swamp area for ten years. The monitoring project started in May 2007 shortly after the initial restoration works began in the area.

This monitoring helps to understand how the restoration works have changed bird populations and behavior in the area. Four areas of the swamp are monitored separately as different bird species are often found in each zone. An amazing 179 bird species have been recorded in the swamp area!

The monitoring has shown how different types of bird species (e.g. waders or woodland birds) move into or out of different zones as the swamp is restored. The monitoring has also shown how the swamp has become an important refuge area for rare species like the brolga and rare Australasian bittern.

Fish monitoring

A series of fish surveys were carried out over 2007/2008 in Pick Swamp and the Piccaninnie Ponds fish passageway. The objective was to better understand:

- the populations of fish that inhabit the system
- the population of Yarra pygmy perch (Nannoperca obscura) in Crescent Pond
- migratory patterns of diadromous fish entering and leaving Piccaninnie Ponds.

Diadromous Fish
Fish species that migrate between salt water and fresh water.

In July 2011 a fish monitoring program commenced at nine sites over the entire Piccaninnie wetland system. The program aimed to collect information on fish species, age groups and abundance every four to six months.

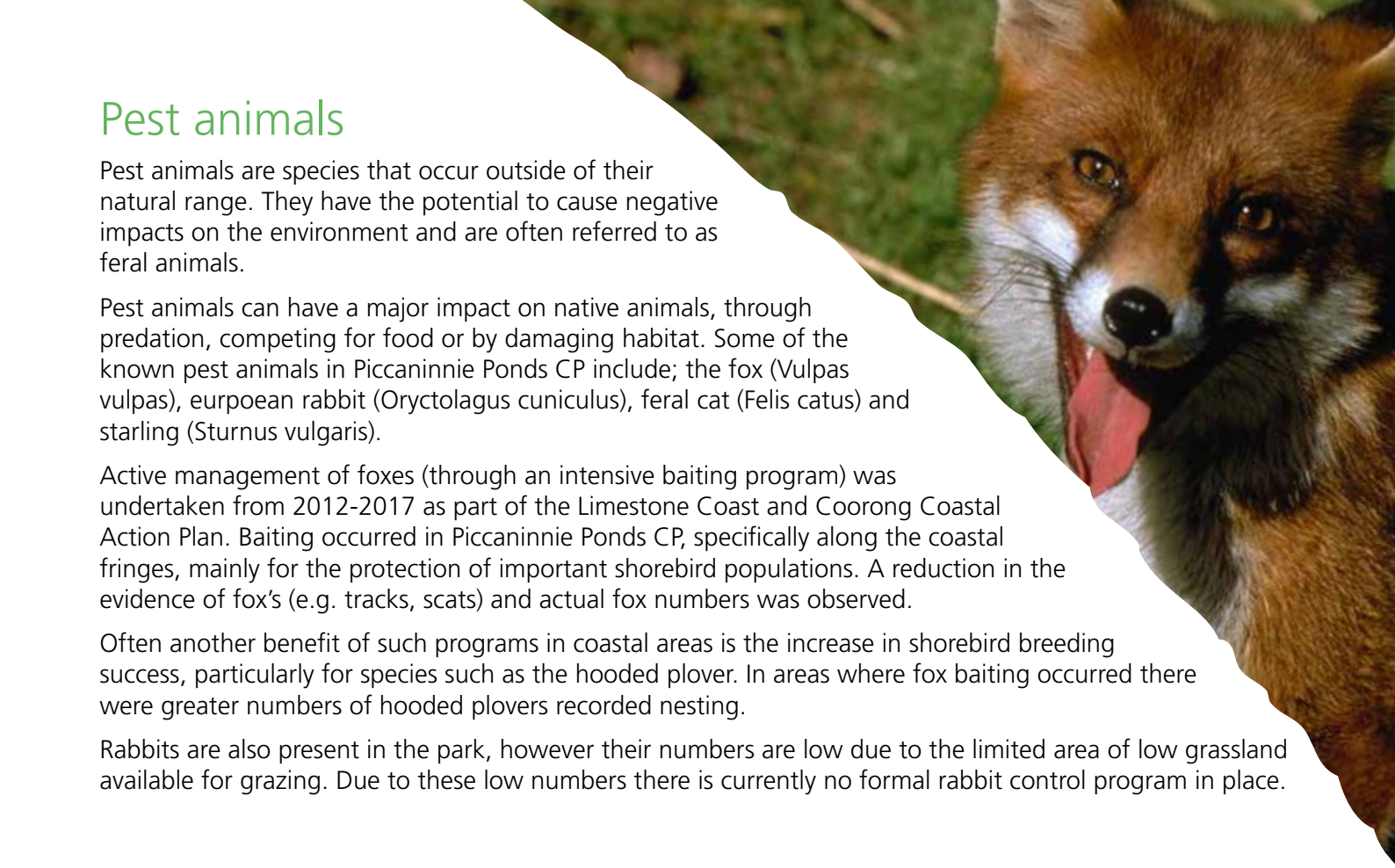
Shorebird monitoring

The Friends of Shorebirds South East have been involved in monitoring shorebirds through the South East of South Australia for 12 years. They are an active group in the Piccaninnie Ponds CP and have undertaken shorebird surveys to count the number and types of different shorebirds at different times of the year.

One species of particular interest is the hooded plover.

Vegetation monitoring

In 2006 a series of transects and quadrats were established to monitor vegetation changes through time. This helps to measure the response to changes in water levels bought about by restoration work at Pick Swamp. This survey was repeated in 2008. In addition to this program a series of photo points have also been established to monitor vegetation change.



Pest animals

Pest animals are species that occur outside of their natural range. They have the potential to cause negative impacts on the environment and are often referred to as feral animals.

Pest animals can have a major impact on native animals, through predation, competing for food or by damaging habitat. Some of the known pest animals in Piccaninnie Ponds CP include; the fox (Vulpas vulpas), eurpoean rabbit (Oryctolagus cuniculus), feral cat (Felis catus) and starling (Sturnus vulgaris).

Active management of foxes (through an intensive baiting program) was undertaken from 2012-2017 as part of the Limestone Coast and Coorong Coastal Action Plan. Baiting occurred in Piccaninnie Ponds CP, specifically along the coastal fringes, mainly for the protection of important shorebird populations. A reduction in the evidence of fox's (e.g. tracks, scats) and actual fox numbers was observed.

Often another benefit of such programs in coastal areas is the increase in shorebird breeding success, particularly for species such as the hooded plover. In areas where fox baiting occurred there were greater numbers of hooded plovers recorded nesting.

Rabbits are also present in the park, however their numbers are low due to the limited area of low grassland available for grazing. Due to these low numbers there is currently no formal rabbit control program in place.

Pest plants

Pest plants are flora species that occur outside of their natural habitat and have the potential to cause significant adverse economic, environmental and social impacts. Pest plants are also referred to as weeds. They invade natural areas, compete with native plants and can reduce habitat, shelter and food for native fauna.

Weeds can also clog up waterways and effect water quality, as well as impact on coastal dune environments. Some of the pest plants that are known to occur in Piccaninnie Ponds CP include; aleppo pines (Pinus halepensis), polygala (Polygala myrtifolia)) and spiny rush (Juncus acutus).

Since 2015 park managers have been actively controlling bull rush (Typha domengensis), a tall reed-like water plant with strap-like leaves. Bull rush is a native reed, however due to its thick clumping nature it tends to prohibit the growth of other native species, through competition.

The control program aims to allow other native vegetation species to establish and improve diversity in the area.

The work has focused on a section on the Pick Swamp side of the park. This has involved hand digging individual plants in conjunction with herbicide use two or three times a year. Reports indicate that this activity has reduced the amount of bull rush and improved the diversity and abundance of aquatic vegetation in this are.

Weed control has also included the control of spiny rush (Juncus acutus) on the access road into the park, and thistle control at Pick Swamp.

Flora and fauna of Piccaninnie Ponds Conservation Park

Piccaninnie Ponds CP provides habitat for a wide variety of flora and fauna species. Representing one of the few remaining permanent freshwater wetlands in the lower south east of South Australia, it is also an important drought refuge for a range of species, including resident and migratory birds.

The park supports a variety of flora and fauna species, which have been listed as rare or endangered and are important for conservation.

The Piccaninnie Ponds CP habitats are of international significance, which is highlighted by the Ramsar and IUCN listings (Appendix 1 – Ramsar Convention).

Flora

The amazing diversity of habitats and number of species that occur in Piccaninnie Ponds CP is due to the unique environmental conditions of the area. This includes the interactions between the geology, unique water systems and the vegetation.

The amount and type of vegetation that occurs within the wetland is mostly determined by how much water is in in the wetland and how this fluctuates over the seasons. Different species of flora have different adaptations depending on the patterns of inundation (or flooding) in the wetland system making every system unique.

Over 30 vegetation associations have been identified in Piccaninnie Ponds CP (Ecological Associates, 2008). Those of particular significance occur within the unique coastal fen wetland environments (refer Appendix 2), including the silky tea-tree (Leptospermum langigerum) and bottlebrush tea-tree (Melaleuca squarrosa). Both of these support a wide range of threatened flora and fauna. The aquatic plant communities that survive in the freshwater ponds are also incredibly important, providing habitat for species such as the short-finned eel. Other vegetation found within the park includes reeds, sedge swamp, open heath and tussock grassland.

There are 25 plants in the park that are listed at an international, national and/or state level as being of conservation significance. Of particular note are two that are listed nationally or internationally (Appendix 4 - Threatened Species):

- swamp greenhood - Pteostylis tenuissima
- maroon-leek orchid - Prassophyllum frenchii

The Ramsar Management Plan for Piccaninnie Ponds Karst Wetlands (Butcher et al. (2011a)) contains a list of the plant species recorded in Piccaninnie Ponds Karst Wetland (listed in Appendix C)

https://www.environment.sa.gov.au/managing-natural-resources/wetlands/piccaninnie-ponds

Resource

Bush Food Plants of the South East ID flip chart http://www.naturalresources.sa.gov.au/files/sharedassets/south_east/get_involved/aboriginal-bush-foods-identification-cards-gen.pdf

Fauna

Piccaninnie Ponds CP is an important refuge for a range of wetland and shorebird species, including resident and migratory birds. The resident birds live here all year round and can be seen anytime. Migratory birds come from as far as Siberia, thousands of kilometres away, arriving any time from September each year. They depart by the end of May to return to their breeding grounds in the northern hemisphere.

Over 170 species of bird have been recorded in the park, made up of resident birds, Australian nomadic birds and migratory birds, including international migratory species. Twenty one bird species are of conservation significance either internationally, nationally and/or at a state level. Two nationally or internationally listed bird species of conservation significance are known to inhabit the park:

- Orange-bellied parrot - *Neophema chrysogaster*
- Australasian bittern - *Botaurus poiciloptilus*

Some of the species you can expect to see throughout the year on a visit to Piccaninnie Ponds CP include, pied oystercatcher, red-capped plover and fairy tern. Migratory species that you may be lucky to spot seasonally include ruddy turnstone, curlew sandpiper and the double-banded plover.

Resources

Shorebirds brochure for Blackfellows Cave area: http://www.vwsg.org.au/PDFs/Blackfellows-Cave-Map-Sign.pdf

YouTube clip about shorebirds: http://youtu.be/eaqXTOsvhVg?list=PL4IsUu0-il4pbyAyLaDwZa3RmzdjRfrkw

There are a variety of fish species that inhabit the ponds, all of them native. What makes some of these species unique is that they are migratory, living between the freshwater ponds and the sea, depending on the time of the year. These species are called diadromous, whereas species which rely on permanent freshwater alone, are called obligate species.

There are a total of ten native fish in Piccaninnie Ponds CP including seven diadromous species and three freshwater obligate species. This includes the short-finned eel, dwarf galaxis, pouched lamprey, southern pygmy perch, common jollytail, small mouthed hardy head, congoli and the Yarra pygmy perch.

Three nationally or internationally listed marine species of conservation significance are known to inhabit the park:

- Yarra pygmy perch - *Nannoperca obscura*
- Dwarf galaxias - *Galaxiella pusilla*
- Glenelg spiny freshwater crayfish - *Euastacus bispinosus*

Several species of native mammals have been recorded in the park, including the eastern grey kangaroo, swamp wallaby, bush rat (*Rattus fuscapies*) and a critically endangered species which was once widespread in coastal wetlands, the swamp antechinus (*Antechinus minimus*).

Further information regarding the number and type of fauna found in the park can be found in the Piccaninnie Ponds Ecological Character Description (2011) found at https://www.environment.sa.gov.au/managing-natural-resources/wetlands/piccaninnie-ponds

Within this resource you can find:

- listed species and communities of conservation significance in Piccaninnie Ponds Karst Wetland (Appendix C);
- waterbirds found in Piccaninnie Ponds Karst Wetland (Appendix E); and
- fish species recorded in Piccaninnie Ponds Conservation Park (Table 11).

Wetlands

A wetland is a land area that is saturated with water, either permanently or seasonally. Wetlands support aquatic plants, which have adapted to the unique "wet-soil" conditions. They play a very important role in the environment.

Wetlands not only purify water and provide flood control, they are also considered the most biologically diverse of all ecosystems, providing habitats for a wide range of flora and fauna.

A recent study has shown that even a small seasonal wetland (the type that are often seen in a paddock) can support over 200 species throughout the period of a year!

Wetlands can be permanent, temporary or even seasonal bodies of water, usually natural, but sometimes human-made. They can consist of fresh, brackish or salty water but are usually shallow, slow moving or stagnant (still).

Wetlands of the South East

Prior to European settlement a mosaic of wetlands ran from the South Australian/ Victorian border right through to the Coorong. The majority of water flowed in a north westerly direction along broad inter-dunal flats (Figure 5).

The South East features three main wetland types:

1. Coastal and Marine

- estuarine waters e.g. Glenelg River estuary
- coastal brackish/saline lagoons e.g. the Coorong

2. Inland

- freshwater marshes e.g. Bool Lagoon
- subterranean karst wetlands e.g. Ewens and Piccaninnie Ponds
- permanent freshwater lakes e.g. Lake Bonney SE.

3. Human-made

- storm water treatment and water storage areas.

Historically, as agriculture and forestry expanded, drains were constructed throughout the South East. These altered the natural regional flows of water and drained excess water to the ocean. The area of wetlands in the South East region is now significantly different to pre-european settlement (Figure 3 and 4).

Many local agencies and groups are working together to restore some of the wetlands across the region. There are some excellent examples of success, such as Pick Swamp.

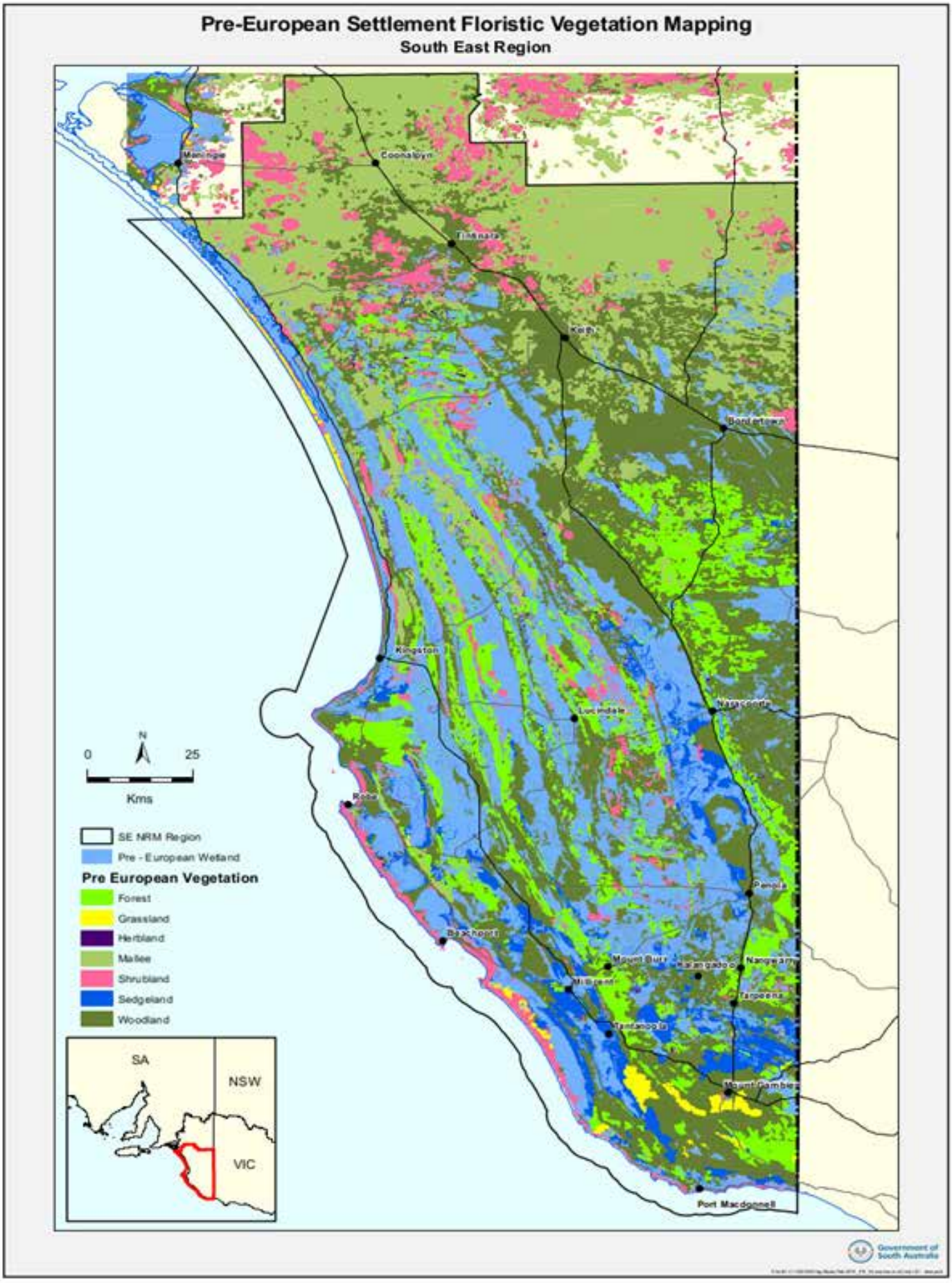


Figure 3: *Wetlands (depicted in light blue) in the South East pre-european settlement (Native Vegetation Floristic – Pre European 2010). Wetlands cover around five percent of the area they did prior to european settlement, mostly due to the development of the extensive drainage network and vegetation clearance in the region (refer Figure 4 for comparison).*

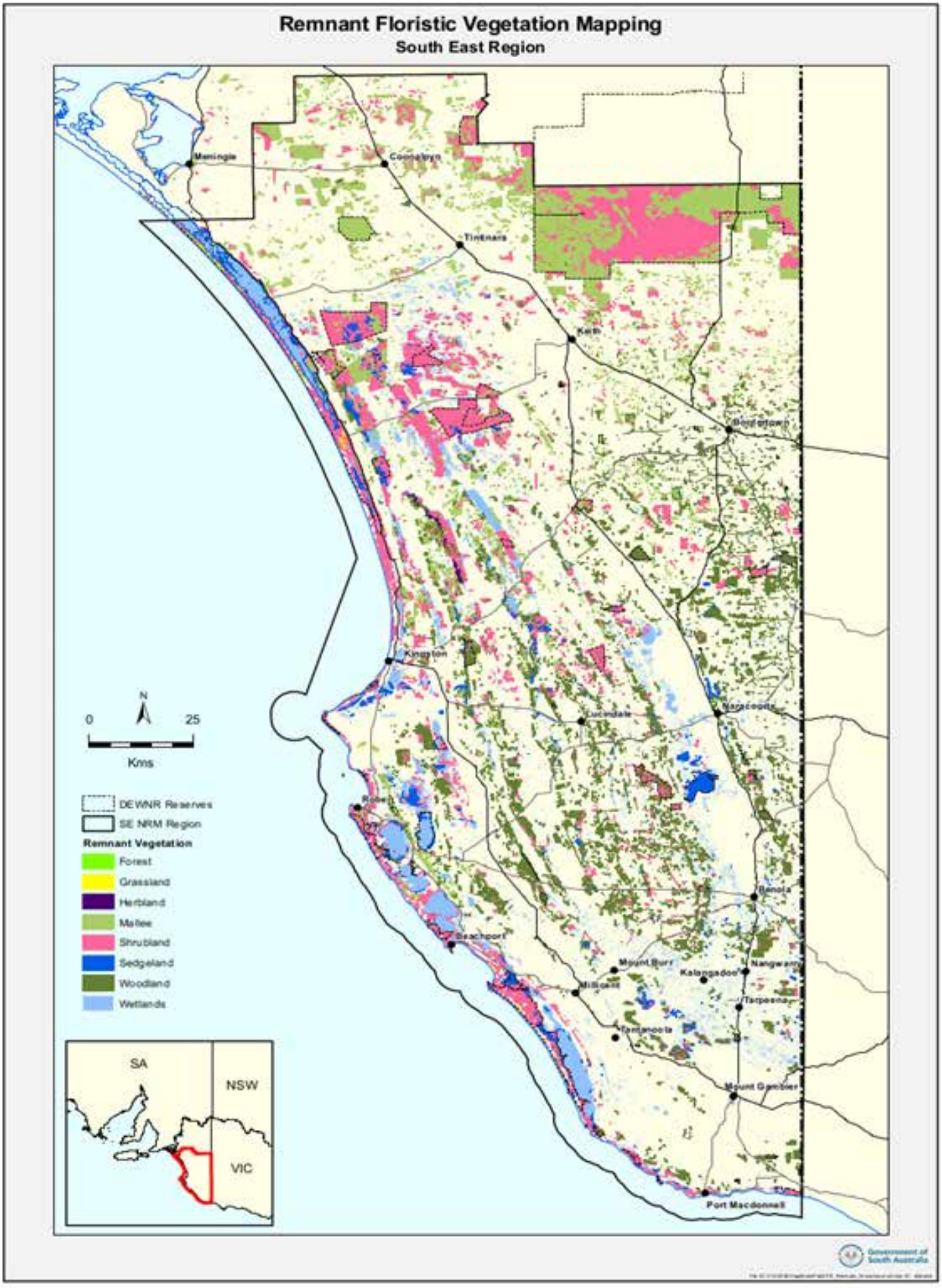


Figure 4: *Wetlands (depicted in light blue) in the South East post-european settlement (Native Vegetation Floristic – LMS Record 898, 2011)). Wetlands cover around five percent of the area they did prior to european settlement, mostly due to the development of the extensive drainage network and vegetation clearance in the region (refer Figure 3 for comparison).*

Threats to wetlands

Broadly speaking, the greatest threat to wetlands is human activity and this includes:

- changes in hydrology (or water flow)
- water pollution including increased nutrient levels
- introduction of plants and animals
- clearance of land.

Progressive encroachment on, and loss of, wetlands causes serious and sometimes irreparable environmental damage, and greatly reduces the benefits wetlands provide to ecosystems.

More than half of the wetlands across Australia have been exploited for other uses such as agriculture or urban development. Around 95 percent of the wetlands in the South East have been lost due to drainage and clearance. Piccaninnie Ponds is one of the few remaining wetlands in the South East with a permanent water supply.

The Picanninie Ponds system is an extraordinary and important wetland area. Recognised by the state as a Conservation Park, by Ramsar as a wetland of international significance and by the IUCN (International Union for Conservation of Nature) as critically endangered, the long-term protection and restoration of this wetland system is very important.

What is the IUCN?

The International Union for Conservation of Nature is an international organisation working in the field of nature conservation and sustainable use of natural resources.

IUCN's mission is to: "*influence, encourage and assist societies throughout the world to conserve nature and to ensure that any use of natural resources is equitable and ecologically sustainable*".

Source: www.iucn.org December 2017

Disappearing wetlands

Wetlands originally comprised around 46% of the region's landscape. They now account for less than 7% and much of this habitat is severely degraded.

Groundwater

Groundwater is a source of water that exists underground below the earth's surface. It accumulates over time as water from rain, rivers, lakes, wetlands and other sources of surface water migrate through the ground, where it is stored in porous soil and rock (known as an aquifer).

Groundwater is a very important resource making up 98% of the freshwater on the planet.

Groundwater in the South East

In the South East there are only a few creeks and rivers. Most of the water resource in the South East flows underground. Known as groundwater, it is stored in a limestone aquifer and is generally low in salinity compared to many other areas in Australia. This quality makes it an extremely valuable asset for our region. Groundwater flows for the South East can be seen in **Figure 5.**

When it rains water filters through the soil and recharges, or fills up, the porous limestone aquifer. This aquifer slowly drains in a south westerly direction toward the coast. The Blue Lake in Mount Gambier forms part of this system and it is estimated that water from the lake can take anywhere between 500 - 4000 years to reach the ocean! The time depends on where the water comes from and if the limestone is solid, fractured or has areas where water can flow faster, called conduits (see **Figure 6**).

The karst like nature of the limestone aquifer creates cracks, fractures and underground caves which, in certain locations, can help water move through more quickly. When the groundwater reaches the coast it comes to the surface or 'discharges' through what we call springs.

Groundwater and surface water often interact with each other. Local examples of this can be observed at Piccaninnie Ponds (and Ewens Ponds). It is here that groundwater has become surface water - the water is pushed to the surface under pressure. This is called a karst rising spring and there are a dozen or so in the area. There are also examples where the groundwater has become surface water through collapsed cenotes, different from karst rising springs. Hells Hole is an example of this.

Value of groundwater

Groundwater makes up a large proportion of the water people use for human consumption. In some areas entire townships are dependent on groundwater as their only source of water. Many residents of the South East rely on groundwater for a variety of purposes including:

- human consumption – groundwater provides a clean source of drinking water and household use
- farming – groundwater is accessed via bores for the irrigation of crops and watering of livestock
- biodiversity – in many places groundwater bubbles to the surface forming natural springs or wetlands. Many ecosystems depend on this water.

Threats to groundwater

Groundwater is a finite resource and can become depleted if extraction rates exceed replenishment or recharge rates i.e. if we use it faster than nature replaces it.

Groundwater is also vulnerable to contamination from two types of sources called point source and diffuse pollution, described as:

- point source – where contamination occurs at a specific location such as a leaking septic tank
- diffuse pollution – where contamination occurs over a large area such as fertilizer run off from farmland.

Once groundwater pollution occurs it can take a long time before natural processes fully remove the contaminants. The effects of increased nutrients in groundwater are:

- increased algal growth
- potential harm to freshwater aquatic and amphibian fauna species.

Suggested Activity: Sid's Lid (Appendix 4)

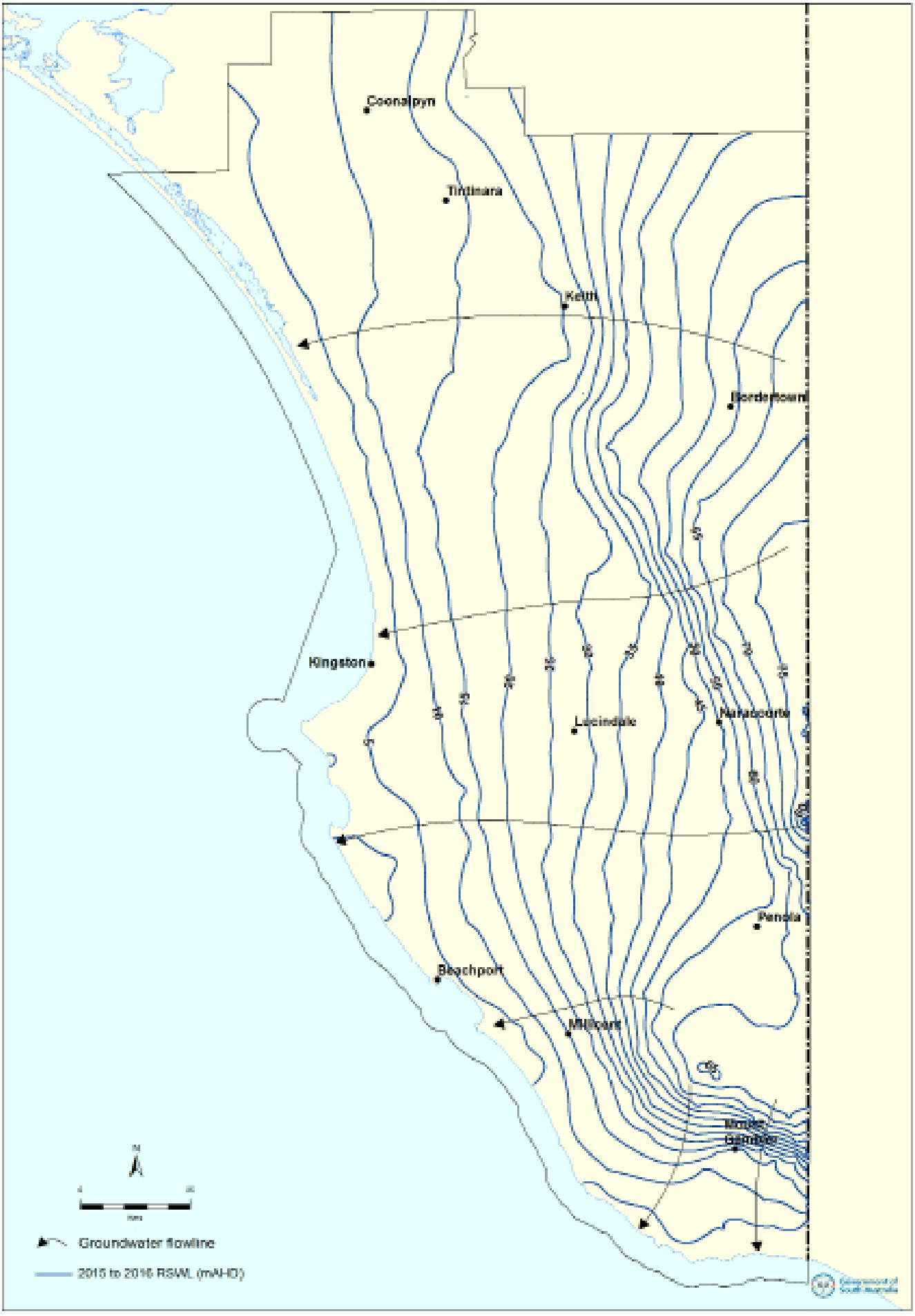


Figure 5: *South East Regional Groundwater flow, detailing water table contours (NRSE, 2018). Groundwater flows from shallow areas north of Mount Gambier (near Dismal Swamp) to the southern coast where it drains to the ocean. The porous gambier limestone allows much of the groundwater flow.*

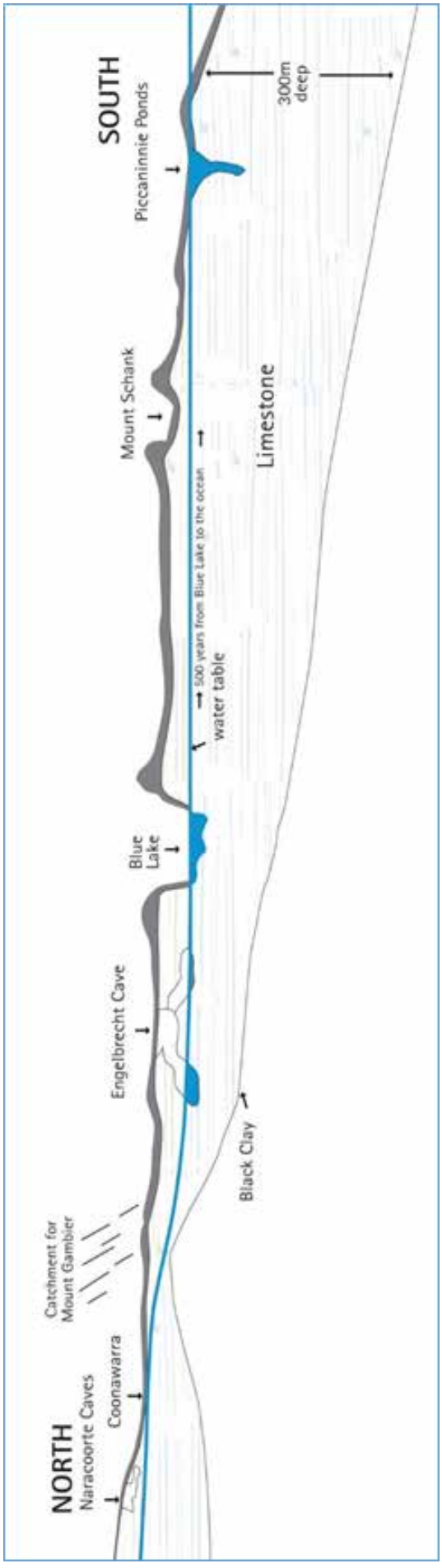


Figure 6: *Schematic north south cross section showing the direction of groundwater flow to the ocean from Naracoorte Caves to Piccaninnie Ponds (NRSE, 2018). Not to scale*

Hydrogeological history

The Piccaninnie Ponds CP wetland system historically covered around 1,100 hectares extending from Green Point (directly south of Wye) to the Glenelg River mouth (in Victoria). The system included large areas of open water, reed beds, mobile dune systems, grassy woodlands and dense shrublands.

An original surveyor's map from 1896 (found in Bachmann, M.R. (2016) link: https://onlinelibrary.wiley.com/doi/10.1111/emr.12207/full) indicates that a narrow band of dunes separated the coast from a much larger wetland system than is visible today. Historically water exited the system at the eastern end of the now conservation park, via Freshwater Creek, until the creek broke through the dunes to the sea in 1906. It is thought that the creek may have been deliberately cut through to allow it to flow.

In 1913 a petition was sent to the SA Commissioner of Public Works stating that the fishing in the Glenelg Estuary had deteriorated since the diversion and requested that the original flow path of Freshwater Creek should be reinstated. It read:

"Unfortunately, the fishing has deteriorated during the past few years, ever since an irresponsible individual diverted the course of a freshwater creek which used to flow into the River near the mouth….. Since the flow of the freshwater creek has been diverted – it now flows into the sea about a mile west of the mouth of the River – it is believed that the hungry sea bream do not come into the River in the same number as before the creek was turned off its course. During the fishing season the River is salt for some miles from the mouth….."

This gives some indication of the ecological changes that were brought about by the loss of natural fresh flows into the Glenelg River estuary almost 100 years ago.

The following timeline describes the steps taken to try and re-establish the original flow path and subsequent drainage attempts (after Bachmann, M.R. (2016)).

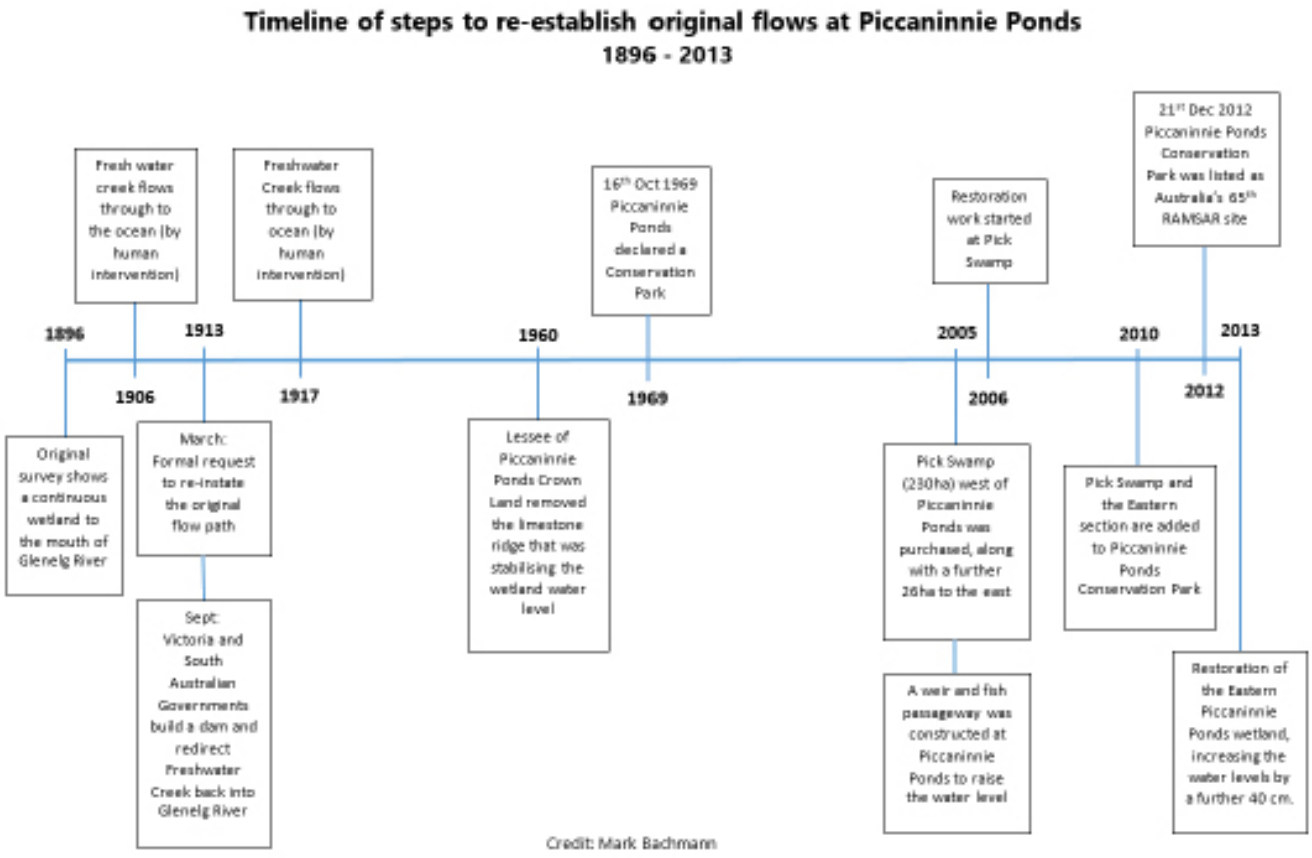


Figure 7: *Timeline of steps to re-establish original flows at Piccaninnie Ponds 1896-2013.*

Wetland restoration works at Piccaninnie Ponds Conservation Park

In 1969 Piccaninnie Ponds was declared a conservation park and approximately 450 hectares of the original 1,200 hectare system came under the protection of the state government.

During 2005, the 230 hectare property immediately to the west of Piccaninnie Ponds CP, called Pick Swamp, was purchased by the South Australian government for inclusion into the reserve system. At the same time approximately 26 hectares at the eastern end of the CP was also purchased.

Restoration works 2005-2014

(after Clarke, S. 2016)

2005 - A weir and fish passageway was constructed at the current Piccaninnie Ponds outlet. The weir allowed a greater area and depth of permanent aquatic habitat in the vicinity of the ponds. The fish passageway facilitated the migration of fish from the wetland to the sea or vice versa.

2006 - Restoration work began in Pick Swamp, beginning with the removal of farm infrastructure including ten kilometres of fencing and the blocking of around three kilometres of drains. A one kilometre levee was also constructed which incorporated a fish passageway and overflow spillway.

2011 - Preliminary survey work was undertaken to determine if hydrological restoration of the eastern Piccaninnie Ponds wetland was feasible. Piccaninnie Road was built possibly in the early 1960's, this road effectively isolated the eastern wetland from the sea. While this wetland is fed by its own springs, it has been deprived of surface water flows and the ecological influences of those flows such as fish movement.

The survey work proved fruitful and an engineering plan was written along with several proposals for funding to undertake the restoration works. Funding was finally secured through the Australian government 'Biodiversity Fund', and on-ground works started in February 2013.

2013 - On ground works began to:

- elevate Piccaninnie Road so that raised water levels would not damage it
- upgrade the pond outlet weir, levee and fish passageway
- install a bank of culverts under Piccaninnie Road to allow the flow of water from the western wetland to the eastern wetland
- excavate a landscaped swale from the culverts to the eastern wetland to facilitate the flow of water to the east
- construct a levee at the eastern wetland to contain the raised water level.

Future vision

The ultimate goal is to return the Piccaninnie Wetland system to its original extent. Even though flows from the 12 kilometres of wetland have reduced by a third over the last 150 years, there should be adequate quantities of water to fulfil that dream. Opportunities may arise to purchase the grazing properties at either end of the system returning the Piccaninnie Ponds system to its former glory.

Taking care of our wetlands and coastline

Wetlands in the South East historically covered a vast area, providing habitat for flora and fauna right across the region. Unfortunately these areas have been reduced to smaller disconnected or fragmented areas. Most of these wetlands have lost their former pristine nature due to a variety of impacts. Much of this loss is due to human activity, activities such as;

- overgrazing
- draining swamps and wetlands
- changing the movement of surface and ground water
- clearing vegetation
- increasing nutrient loads, through fertilizer application and runoff
- urban development
- weed and pest animal introduction.

While a few of these areas are protected for conservation through the proclamation of parks and reserves, some of these threats can still harm our wetlands. There is much remedial work and restoration that needs to be done to try and return these wetland areas to what they once were.

The coastline supports a large variety of animals and plants. Some live entirely in the water whilst others may spend all or part of their time on land. These areas also suffer from the impacts of human activity – things like urban development, vehicles on beaches and dunes, pollution from storm water and other inappropriate use.

By conserving coastal and wetland habitats we help to protect many animals and plants.

We need to take special care and look after our wetlands and coastal areas, so that they exist for future generations to enjoy, along with the biodiversity they support and their important role in environmental systems.

What is being done to protect these areas?

Many groups and land managers are working together to look after these areas. Some of the things that are happening are:

- controlling weeds and pest animals
- fencing areas off to remove grazing pressure from stock
- revegetation
- restoring water flows
- protecting and expanding wetlands under private conservation agreements
- constructing fish passageways so that weirs and locks do not inhibit natural movement of aquatic species.

Habitat
A habitat provides the right combination of food and protection for living things to survive.

One of the most important things we can do to look after our wetlands is to make sure groundwater is well managed, as around 90 percent of the wetlands in the South East rely on this water source! Natural Resources South East looks after groundwater through the Lower Limestone Coast Water Allocation Plan. The plan helps to ensure that water is managed for all types of requirements, such as industry, irrigation, biodiversity and any other uses. In general, water allocation plans are designed to:

- protect the resource for all water users, now and into the future
- establish the rules for managing, taking and using prescribed water
- provide security and equity between water users now and into the future
- balance the capacity and sustainability of the region's water resources and the needs of the environment
- take into account any potentially detrimental effects on the quality or quantity of water resources from taking or using water
- identify how water will be allocated and the amount of water available for allocation
- provide rules for transferring licenses and allocations, how trading of water will occur and the criteria for water affecting activity permits.

For more information about water allocation plans for the region, please visit:
http://www.naturalresources.sa.gov.au/southeast/water-and-coast/water-allocation-plans/lower-limestone-coast

What can you do?

Join a group

Join a local environmental group to learn more about our wetlands and coast and lend a hand!

For opportunities in our region, check out: http://www.naturalresources.sa.gov.au/southeast/get-involved/volunteering

Check your garden

Common garden plants are nasties in the coastal environment. You can help by:

- removing species in your garden known to create a problem
- using local native species in your garden
- disposing of your garden waste responsibly
- checking with your local council before you plant into natural coastal environments
- help out as a volunteer on coastal revegetation days.

The Coastal Planting Guide shows how to use a variety of native local plants in your garden.

Be careful

what you pour down the sink and drain – look after our water quality by keeping our waterways clean and pollutant free!

Get involved

Get involved in a local bird group, helping with:

- shorebird banding and surveys
- bird observations and monitoring
- protecting nesting hooded plovers

Clean up

Participate in or run your own beach clean-up! Waste and rubbish is one major risk to our marine species.

References

Bachmann, M.R. (2016) Restoration journey of the Piccaninnie Ponds Karst Wetlands, South Australia. Ecological Management & Restoration, Blackwell Science Vol 17 (2) pp 102-111. Link: http://onlinelibrary.wiley.com/doi/10.1111/emr.12207/full

Bachman, M.R. (2016) A concise history of Piccaninnie Ponds. Unpublished.

Butcher, R., Cottingham, P., Hale, J. Phillips, B., and Muller, K. (2011a). Ramsar Management Plan for Piccaninnie Ponds Karst Wetlands. DEWNR.

Link: https://www.environment.sa.gov.au/managing-natural-resources/wetlands/piccaninnie-ponds

Butcher, R., Hale, J., and Cottingham, P. (2011b). Ecological character description for Piccaninnie Ponds Karst Wetlands. Prepared for the Department of Environment, Water and Natural Resources.

Link: https://www.environment.sa.gov.au/managing-natural-resources/wetlands/piccaninnie-ponds

Clarke, S (2016) The Piccaninnie wetland system – History and restoration overview. Unpublished.

Web Resources

Bush Food
Bush food plants of the South East ID flip chart
Link: http://www.naturalresources.sa.gov.au/files/sharedassets/south_east/get_involved/aboriginal-bush-foods-identification-cards-gen.pdf

Coastal Planting Guide
Link: https://www.naturalresources.sa.gov.au/files/sharedassets/south_east/coast/coastal-gardens-planting-guide-gen.pdf

IUCN www.iucn.org

Marine Parks
Lower South East Marine Parks
Link: http://www.environment.sa.gov.au/marineparks/find-a-park/south-east/lower-south-east

Natural Resources South East
http://www.naturalresources.sa.gov.au/southeast/home

National Parks SA
General
www.environment.sa.gov.au/parks

Fees and Permits for Piccaninnie Ponds CP
https://www.parks.sa.gov.au/find-a-park/Browse_by_region/Limestone_Coast/piccaninnie-ponds-conservation-park#fees

Rasmsar
Ramsar fact sheets - https://www.Ramsar.org/resources/Ramsar-fact-sheets

Ramsar Site – Piccaninnie Ponds - https://rsis.Ramsar.org/ris/2136

Shorebirds
Birdlife Australia: "What shorebirds can I see in this area" poster
Link: http://www.vwsg.org.au/PDFs/Blackfellows-Cave-Map-Sign.pdf

Shorebirds - Youtube clip
Link: http://youtu.be/eaqXTOsvhVg?list=PL4IsUu0-il4pbyAyLaDwZa3RmzdjRfrkw

Volunteering
Link: http://www.naturalresources.sa.gov.au/southeast/get-involved/volunteering

Water Allocation Plans
Lower Limestone Coast Water Allocation Plan:
Link: http://www.naturalresources.sa.gov.au/southeast/water-and-coast/water-allocation-plans/lower-limestone-coast

Other useful resources
(not listed in TRP)

Caton, B., Quinn, J., Detmar, S., Fotheringham, D., Rubbo, N., Royal, M., Sandercock, R. and Laurence, S. (2011) Limestone Coast and Coorong Coastal Action Plan and Conservation Priority Study, South East NRM Board and Department of Environment and Natural Resources, Adelaide.

Link: www.naturalresources.sa.gov.au/southeast/water-and-coast/coast

Bioregion fact sheets
Bioregion Fact Sheet - Natural Resources SA Northern and Yorke

Blue Lake
http://www.naturalresources.sa.gov.au/southeast/about-us/our-region/blue-lake

Appendices

- Appendix 1 - Ramsar Convention
- Appendix 2 - Types of wetlands in Piccaninnie Ponds Conservation Park
- Appendix 3 - Examples of the threatened species in Piccaninnie Ponds Conservation Park
- Appendix 4 - Suggested activities relating to Piccaninnie Ponds Conservation Park
- Appendix 5 - Field Trips and Excursion Guides for Piccaninnie Ponds Conservation Park
- Appendix 6 - Curriculum links for Piccaninnie Ponds Conservation Park

APPENDIX 1 - Ramsar Convention

The Ramsar Convention is a global environmental treaty adopted in the Iranian city of Ramsar in 1971 – hence the name. This treaty provides a framework for the conservation of wetlands and their resources. The Convention's member countries cover all geographic regions of the planet.

The mission of the Ramsar Convention is "the conservation and wise use of all wetlands through local and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world."

Piccaninnie Ponds Karst Wetland was declared under Ramsar in 2012 and fulfills five of the nine Ramsar criteria for identifying wetlands of international importance (numbers 1, 2, 3, 4 and 8). These criteria outline that a wetland be considered internationally important if it:

1. Contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region.
2. Supports vulnerable, endangered, or critically endangered species or threatened ecological communities.
3. Supports populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region.
4. Supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions.
5. Regularly supports 20,000 or more water birds.
6. It regularly supports one percent of the individuals in a population of one species or subspecies of water bird.
7. Supports a significant proportion of indigenous fish subspecies, species or families, life-history stages, species interactions and/or populations that are representative of wetland benefits and/or values and thereby contributes to global biological diversity.
8. Is an important source of food for fishes, spawning ground, nursery and/or migration path on which fish stocks, either within the wetland or elsewhere, depend.
9. Regularly supports one percent of the individuals in a population of one species or subspecies of wetland-dependent non-avian animal species.

Another fundamental principle of the Ramsar Convention is the wise use of wetlands. Wise use is defined as "the maintenance of their ecological character, achieved through the implementation of ecosystem approaches, within the context of sustainable development".

At the heart of "wise use" is the principle that conservation and sustainable use of wetlands and their resources is undertaken for the benefit of humankind.

There are "three pillars" of the convention, and all signatories have committed themselves to:

- work towards the wise use of all their wetlands through national land-use planning, appropriate policies and legislation, management actions, and public education
- designate suitable wetlands for the List of Wetlands of International Importance (Ramsar List") and ensure their effective management
- cooperate internationally concerning transboundary wetlands, shared wetland systems, shared species and development projects that may affect wetlands.

Resources:

Ramsar fact sheets
http://www.Ramsar.org/resources/Ramsar-fact-sheets

Piccaninnie Ponds Ramsar site
https://rsis.Ramsar.org/ris/2136

APPENDIX 2 –Types of wetlands in Piccaninnie Ponds Conservation Park

Piccaninnie Ponds CP features two unique wetland types:

- open water karst rising springs (KRS)
- alkaline peatland fen.

Karst rising springs

The karst wetland was formed by the dissolution of the soluble limestone. Over time rainwater has seeped into the joints of the predominantly limestone ground, gradually dissolving them. Pressurised groundwater has then pushed up into the joints creating chasms (Figure 1). The deepest chasm in the Piccaninnie Ponds is <110 metres.

The defining features of a karst rising spring include:

- continuous discharge of fresh groundwater from the site (100ML/day);
- constant water temperature of approximately 14 degrees celsius
- salinity level of 1000-3000 uS/cm-1.

Aquatic vegetation can grow in deeper water in the springs, due the lack of suspended solids. This allows sunlight to penetrate the crystal clear water, and aquatic plants to thrive at depths of around 15 metres.

Coastal fen wetlands

Groundwater from the karst rising springs naturally spills into the surrounding landscape. When this is combined with decaying vegetation around the wetland, it forms peat soils. It is this process that leads to the creation of a fen wetland system (Figure 2).

Fen wetlands are rare within Australia (Butcher et al. 2011). Piccaninnie Ponds CP includes the largest coastal fen system in South Australia.

The major area of peat soils in the park is found within Pick Swamp, along with a smaller area on the northern side of Piccaninnie Ponds. These areas feature submerged and emergent grasses and herbs, reeds, rushes and sedges and sometimes closed shrub-land of silky Tea-tree (*Leptospremum langigerum*).

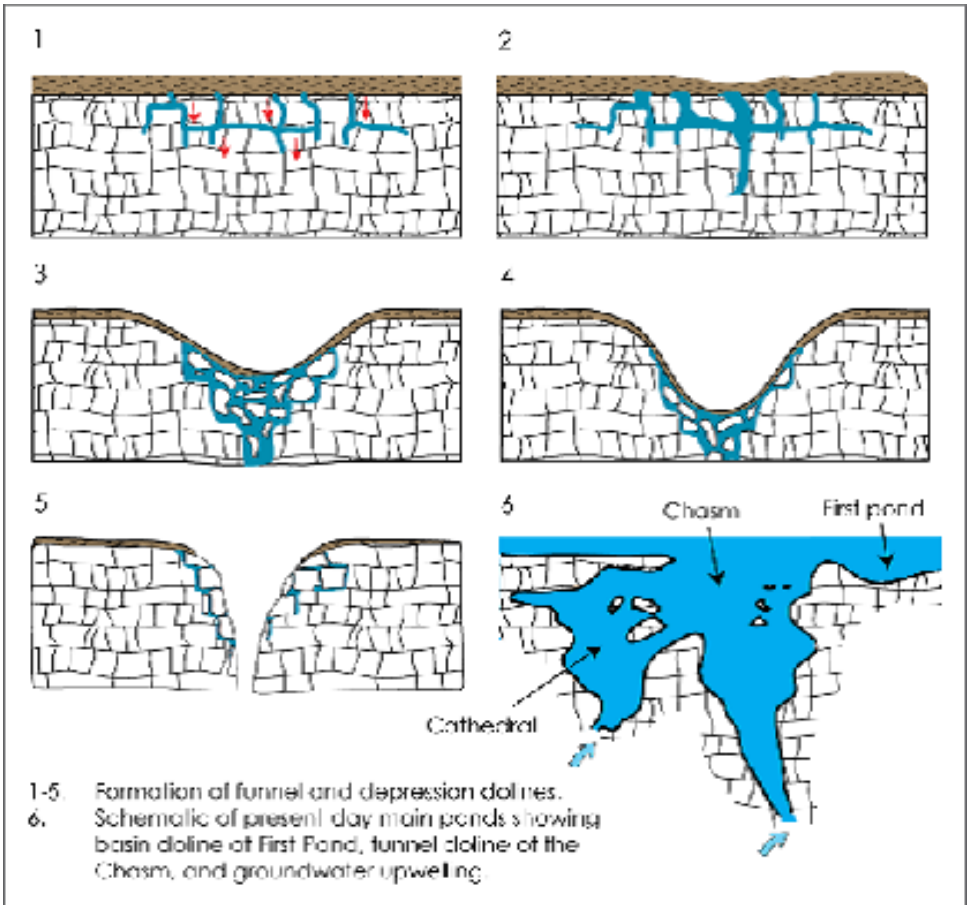


Figure 1: *Formation of karst wetlands at Piccaninnie Ponds (after Hallam and Thurgate 1992) and present day Main Ponds system. (Butcher et al (2011b)).*

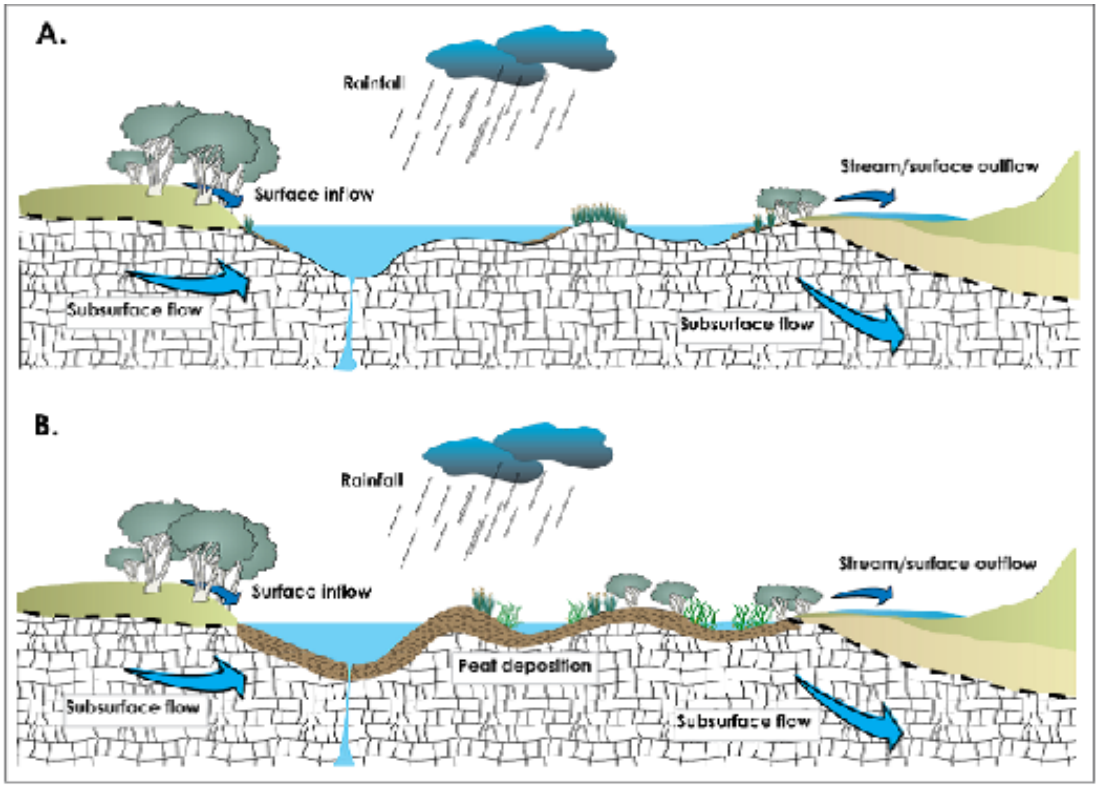


Figure 2: *A general conceptual model of a fen wetland formation.*
A. *Wetland area dominated by open water with initial peat deposits on edges of wetland.*
B. *Substantial peat deposition with reduced open water areas. Establishment of new vegetation associations, herb, grass and sedge dominated (Butcher et al (2011)).*

APPENDIX 3 – Examples of the threatened species in Piccaninnie Ponds Conservation Park

Swamp greenhood - *Pterostylis tenuissima*

EPBC Act listing status: vulnerable

State listing: vulnerable

The swamp greenhood orchid is very small and delicate and can grow up to 30 cm tall. It has a single translucent white flower with green stripes. The leaves are pointed in shape. Flowers can occur at any time of year but mainly in summer. The orchid is found exclusively in silky/ woolly tea-tree (Leptospermum lanigerum) scrubland.

Useful link: swamp greenhood SPRAT profile

swamp greehood fact sheet (http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=13139)

Photo Credit: Laura Weedon

Maroon leek-orchid - *Prasophyllum frenchii*

EPBC Act listing status: endangered

State listing: endangered

The maroon leek-orchid lives for many years on dry land due to an underground tuber. The orchid has an upright leaf which is often purplish in colour and about 60cm long. This leaf spike produces 20-60 flowers which flower between October and December. The flowers are quite fragrant and range in colour from green–yellow with hints of red to almost entirely red. The orchid is usually found in grasslands over limestone.

Useful link: maroon leek-orchid SPRAT profile (http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=9704)

Photo Credit: Peter Tucker

Glenelg spiny freshwater crayfish or pricklyback- *Euastacus bispinosus*

International Listing Status: endangered

State Listing: not listed

The Glenelg spiny freshwater crayfish is a large, long-lived freshwater crayfish, which is distinguished by its robust claws and spiny carapace (main body). This species is commonly olive green in colour, sometimes brown, with splashes of red on the joints of their claws and legs. They are known to grow up to at least 130 millimetres (length between eye and end of main body segment) and up to 1.1 kilograms in weight (Morgan 1986).

Useful Links: Glenelg spiny freshwater crayfish SPRAT profile (http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=81552)

Orange bellied parrot – *Neophema chrysogaster*

EPBC Act listing status: critically endangered
State listing: endangered

The orange bellied parrot is one of the rarest birds in Australia, with only around 50 individuals left in the wild. They feed on, and near, the ground. Adult birds reach about 21 centimetres in length. Their distinctive alarm call, an orange spot on their bellies and their bright grass-green colours can help to identify them against other Neophema parrots such as blue-winged or elegant parrots.

Useful link: http://birdlife.org.au/projects/orange-bellied-parrot-recovery

Australasian bittern – *Botarus poiciloptilus*

International listing status: endangered
State listing: vulnerable

A secretive brown wading bird, with a brown body, mottled black and rufous gold. A long neck, buff streaks on wings and underparts and short, pale green legs. Distinctive booming voice (heard more often than seen).

Useful Links: Botaurus poiciloptilus — Australasian bittern (http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1001)
Photo Credit: Dennis Kuhlmann

Yarra pygmy perch - *Nannoperca obscura*

EPBC Act listing status: vulnerable
State listing: endangered

Usually 3-4 centimetres in length, can grow up to 7.5 centimetres. Males develop jet black fins when spawning.

Prefers larger and more permanent water bodies rather than swamps, requires dense aquatic vegetation and feeds on a variety of invertebrates.

Threats include habitat loss, pollution and the introduction of gambusia.

Useful Links: Yarra pygmy perch SPRAT profile (http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=26177)
Photo Credit: Mark Hammer

Dwarf galaxias - *Galaxiella pusilla*

EPBC Act listing status: vulnerable
State listing: vulnerable

Also known as the eastern little galaxias. Can grow to 4 centimetres (female) and 3 centimetres (male) – most common 1.5-2.5 centimetres. In the spawning season adult males have a strong orange/red stripe and females a purple hue.

Prefers swamps and still flowing areas with heavy vegetation and changeable water levels. Feeds on small crustaceans, invertebrates and vegetable matter.

Only lives for one to two years but can seek refuge in yabby burrows during dry periods and is then ready to take advantage of freshly filled habitats. Excellent mosquito predator.

Useful Links: Dwarf galaxias SPRAT profile (http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=56790)
Photo Credit: Mark Hammer

APPENDIX 4 - Suggested activities relating to Piccaninnie Ponds Conservation Park

Danny the Drip

Danny the Drip – an active visual exercise emphasising the variety of pollutants that can enter waterways and how they accumulate.

Catchment Connections resource pack - a comprehensive resource package for schools to assist in the delivery of a variety of local environmental topics.

Sids Lid

'Sid's Lid' is a gross pollutant trap located on Bay Road in Mount Gambier. It is a good example of water sensitive urban design (WSUD) – designs for our towns that look after our waterways. Gross pollutant traps capture large pollutants from storm-water, things like empty drink containers, chip packets and leaf litter. These traps stop rubbish from getting into Mount Gambier's groundwater.

If you would like to learn more about cleaning out Sid's 'Lid, check out this short video - https://www.naturalresources.sa.gov.au/southeast/water-and-coast/Urban-water

Water Week

Each October, National Water Week makes a splash right across Australia, inspiring individuals, communities and organisations to work together to build community awareness and understanding around water related topics and challenges.

National Water Week provides an opportunity to remind ourselves and teach others that access to clean water is hugely important to every aspect of our lives, and we must do our utmost to protect our water environments and resources, use water wisely and respect its importance in our societies.

Natural Resources South East runs activities every year in Water Week, usually held in Term 4, Week 2.

Please contact staff at Natural Resources South East to find out more, and get involved!

APPENDIX 5 - Field Trips and Excursion Guides for Piccaninnie Ponds Conservation Park

Field Trips

Piccaninnie Ponds CP makes a great spot to take groups of students to see first-hand all the things detailed in the Teacher Resource Pack!

Two suggested itineraries and associated maps are provided as a starting point for developing a field trip specific to your needs. These field trips cover several topics which have been explored within the Teacher Resource Pack for this park.

Feel free to customise these to suit your own needs. If you would like advice, additional resources or to speak to a staff member about supporting your field trip, please contact Natural Resources South East.

Safety Warning

Please be aware that snakes are regularly seen at Piccaninnie Ponds Conservation Park. We suggest that students and teachers visiting the Park wear covered shoes and long pants. It is also a good idea to have an adult walk ahead of the students as they will be able to ensure the path is clear. Snakes will usually move off from any noise or disruption and usually do not show signs of aggression. Please ensure you give these animals enough space to safely move away. Please also ensure you have a suitable snake bite bandage in your excursion first aid kit just in case.

Please be mindful that because the park is situated close to the Victorian border the time displayed on mobile phones will often switch to Victorian time.

Field Trip 1

Suggested outline for Piccaninnie Ponds Conservation Park and surrounds field trip.

Piccaninnie Ponds Conservation Park features amazing wetland habitats and unique environmental features, such as cenotes, karst rising springs and pristine coastline. The Park and surrounding areas provide fantastic nature based learning opportunities.

This guide, in conjunction with the Teacher Resource Pack provides staff with information to run a self-guided field trip. Please contact the staff at NRM Education SE (located at the front of the Resource Pack) if you would like any further assistance or would like to discuss ideas.

Time: Full School Day

Resources Required:

Prior to the excursion we recommend reading the 'Teacher Resource for Piccaninnie Ponds Conservation Park' which includes information on the biodiversity of the park, hydrogeological history, current management and links to the Australian Curriculum.

A range of supporting documents and resources in 'Piccaninnie Ponds Education Kit' are available to borrow from NRM Education SE. The kit includes:

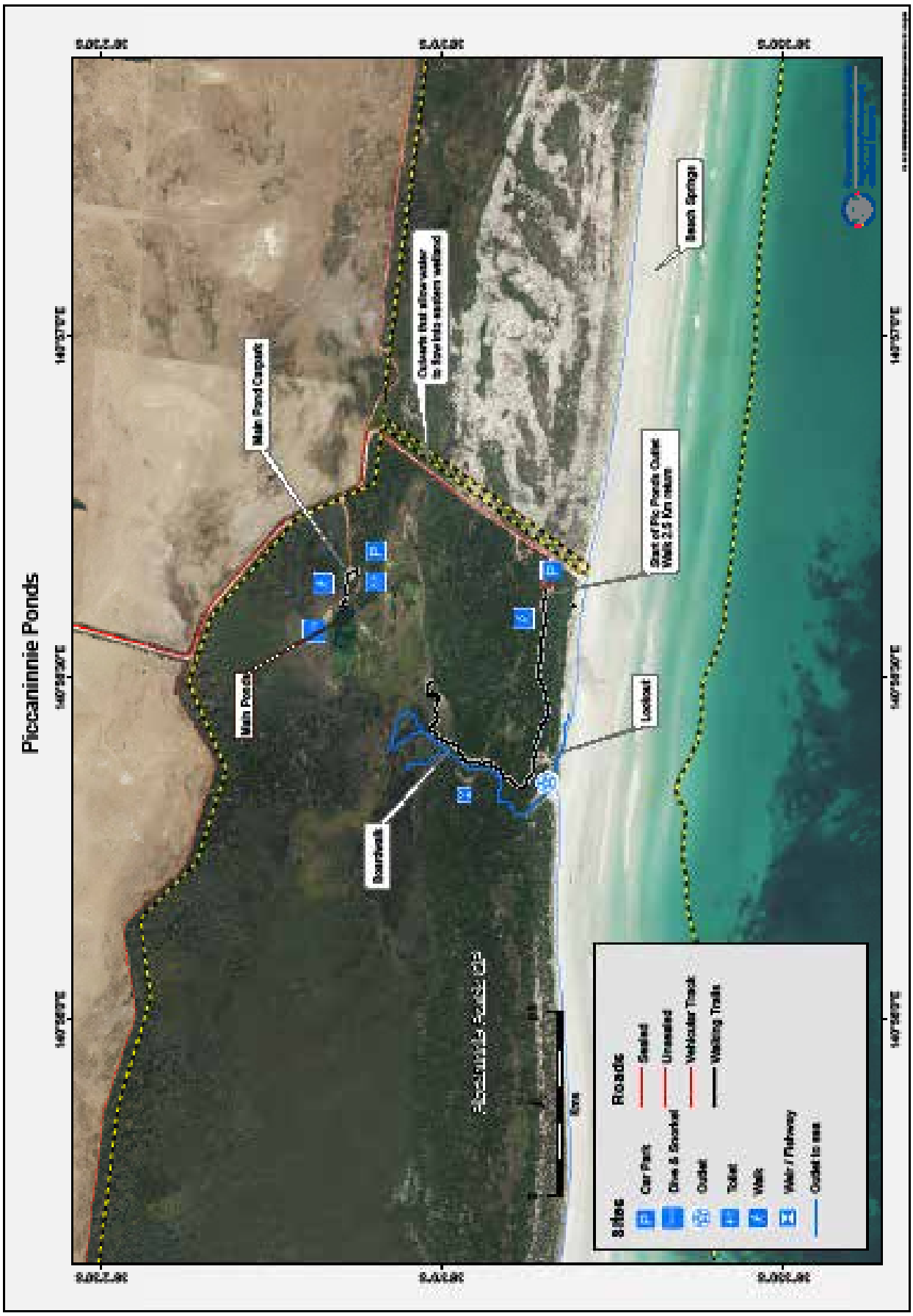
- bush foods ID charts
- aquatic macro-invertebrate nets, trays and ID charts
- water monitoring equipment (pH, salinity, temperature and turbidity)
- native and introduced fish ID charts
- frog ID charts
- shorebird and wetland bird ID charts
- Ramsar Management Plan

We suggest that you develop a worksheet relevant to your class year level to complement the field trip notes.

Time	Activity
8.50am	Leave School site on bus
9.20am	Arrive at Hells Hole (example of where the groundwater has become surface water through collapsed cenotes) – investigate area
9.40am	Leave for Piccaninnie Ponds CP
10.00am	Meet at first carpark to view main ponds and talk about the features of the site (see map)
10.30am	Drive to beach carpark – three group activity
	Rotate between three groups (30 minutes plus 10 minutes change over)
	Group 1 (30 minutes) Wetland ecology and management.
	Group 2 (30 minutes) Bush foods, biodiversity and water monitoring.
	Group 3 (30 minutes) Human impacts on the local area, marine parks, shorebirds, beach clean up and walk to the beach springs.
12.30pm	Depart for Port MacDonnell Visit Eight Mile Creek on the way to consider some of the human impacts that affect the creek.
1.15pm	Lunch at Port MacDonnell
1.45pm	Marine parks - advantages and disadvantages
2.15pm	Depart for School return

Figure 1: *Site map for suggested Piccaninnie Ponds Conservation Park and surrounds field trip*

Note this is an aerial photo taken following a prescribed burn in the area. You can see the sand dunes devoid of vegetation in the eastern section of the park. As this park continues to change and evolve you may find conditions such as water levels and vegetation cover differ from that shown in the photo.



Field Trip 2

Suggested outline for Piccaninnie Ponds Conservation Park self guided excursion.

Piccaninnie Ponds Conservation Park features the unique karst rising springs and pristine coastline providing fantastic nature based learning opportunities.

This guide, in conjunction with the Teacher Resource Pack provides staff with information to run a self-guided field trip. Please contact the staff at NRM Education SE (located at the front of the Resource Pack) if you would like any further assistance or would like to discuss ideas.

Time: 40 minutes driving time from Mt Gambier, 1 hour for the walk plus an extra 40 minutes for the optional beach walk (stops 7-9).

Resources Required:

Prior to the excursion we recommend reading the 'Teacher Resource for Piccaninnie Ponds Conservation Park' which includes information on the biodiversity of the park, hydrogeological history, current management and links to the Australian Curriculum.

A range of supporting documents and resources in 'Piccaninnie Ponds Education Kit' are available to borrow from NRM Education SE. The kit includes:

- bush foods ID charts
- aquatic macro-invertebrate nets, trays and ID charts
- water monitoring equipment (pH, salinity, temperature and turbidity)
- native and introduced fish ID charts
- frog ID charts
- shorebird and wetland bird ID charts
- Ramsar Management Plan

We suggest that you develop a worksheet relevant to your class year level to complement the field trip notes.

Session Outcomes

Students will:

- understand the importance of a Ramsar listed conservation park and learn about some of the key threatened species that occur within the park
- learn about groundwater in the South East, the unique karst rising springs and how the wetlands are managed for conservation
- use identification charts to identify birds, fish, bushfoods and macro-invertebrates.

Stop 1: Main Pond Carpark

Large school busses will need to park on the entrance road opposite the turn off into the main pond carpark and ask the students to walk the 100m to the carpark. Although the turning circle in the carpark is large enough for a bus there are often other vehicles parked there making it difficult to turn around.

Discussion points (use the Piccaninnie Ponds Teacher Resource for information):

- Acknowledge the traditional owners of the land which are the Bunganditj people
- Importance of the Piccaninnie Ponds CP – Ramsar site
- Where does the water come from? Talk about groundwater flow and karst rising springs
- Depth of the ponds – First Pond 10m, Chasm >110m, Turtle Pond 6m.
- The Chasm, is located next to the solar panel that can be seen on the pond's surface
- Discuss how The Chasm has been formed (groundwater slowly dissolves the soft limestone as it rises to the surface under pressure).
- Discuss the animals that live in the ponds (Refer to the 'Pond Dwellers' sign on the track to the pontoon). Native galaxias fish and eels are often visible looking into the water from the pontoon. Swans and cormorants are often on the water and frogs can be heard.
- Popular snorkeling and diving location for people across the world with visibility exceeding 40m. Discuss safety and why there is a requirement for a permit.

Image 1: *Turn off into the Main Pond carpark, showing the area off to the left hand side of the road suitable for bus parking*

Facilities:

- One unisex composting toilet
- Small shelter with table and chairs
- Interpretive signs
- Pontoon on main pond

Image 2: *View across the main pond with solar panel indicating the location of The Chasm.*

Stop 2: Culverts under the road

Discussion Points:

- Where has this water come from and where is it going?
- As part of the wetland restoration works these culverts were installed in 2013, under the road to allow the water to flow from the western wetland into the eastern wetland (its original flow path). Historically, Piccaninnie Ponds wetland system extended all the way to the mouth of the Glenelg River, the ultimate goal is to return the wetland to its original extent.
- As you continue to drive to the beach carpark, look at the vegetation on the left of the road, it was burnt in 2002 to control the invasive Coastal Wattle (Acacia longifolia var.sophorae), encourage the regeneration of fire dependent species and increase native plant species.

Image 3: *Culverts under road, installed in 2013 as part of the wetland restoration works.*

Stop 3: Beach Carpark

Discussion Points:

- Allow the students to look at the signs and discuss the native fauna found in the park in particular the threatened species and shorebirds. Ask if they know what a 'midden' is.
- Walk to the western end of the carpark to start the 2.4 kilometre (return) 'Outlet Walk', follow the blue markers. Take the Bush Tucker ID charts and ask the students to try and identify some of the native plants and their indigenous uses as they follow the track.

Facilities:

- Interpretive signs covering aboriginal culture, shorebirds and threatened species

Image 4: *Start of the outlet walk*

Stop 4: Beach/Outlet Creek lookout

Discussion Points

- Here you can see the outlet creek flowing from the Piccaninnie Ponds out to the ocean. The creek's path along the beach is often changing, altered by the tides and storm surges. Students can look out into the ocean which is part of a marine park. Discuss the Bonney Upwelling with the students.
- Keep a look out for the native muntries growing on this rocky outcrop.

Image 5: *View from the Outlet Creek walk lookout*

Stop 5: Outlet Creek

Discussion Points

- Ask the students to consider: which way the water is flowing? Is it salty or fresh? How much water is flowing past?
- Discuss the different plants and habitat types seen along the walk so far.

Image 6: *Viewing point of the Outlet Creek*

Stop 6: Fish passageway and weir

Discussion Points

- In 2005 a weir was constructed to allow the depth and extent of the wetland to be increased. Look at how the weir is used (the gates can be opened or closed) to manage how much water is released into the Outlet Creek). The fish passageway was required to ensure fish could continue to travel from the wetland to the sea and vice versa.
- Discuss which fish live in Piccaninnie Ponds, talk about Diadromous species (spend part of their lifecycle in freshwater and part in salt water) and the reasons for this.
- Talk about the importance of aquatic macro-invertebrates in the food chain, providing food for the fish which are then eaten by the water birds etc.

Image 7: *Weir*

You have reached the end of the walk, turn around and head back to the carpark.

Please note: If you continue along the track past the weir you will come to a boardwalk.

The boardwalk is currently not maintained as it is due to be replaced so that it does not get inundated by the rising water level in winter.

It can be a good location for water monitoring activities. If you walk to the end of the boardwalk you can view the open water of the main ponds wetland.

Image 8: *Fish Passageway (this gentle gradient has been specifically designed to allow fish to swim upstream and access the ponds from the ocean).*

Optional beach walk

Stop 7: Sand dunes (4WD track over the dunes to the beach)

Follow the 4WD track over the sand dune to the beach (send a teacher ahead to ensure there are no 4WD's coming up the other side).

Discussion Points

- how are dunes created?
- importance of dunes and how to protect them from erosion.
- discuss responsible actions e.g. driving and walking only on the designated tracks.

Image 9: *Start of the 4WD track (eastern end of the beach carpark) that goes over the sand dunes.*

Stop 8: The Beach

Discussion Points

- Talk about the resident and migratory shorebirds that can be found on the beach and what they feed on. Discuss their threats (4WDs, dogs off lead, feral animals, harvesting of seaweed).
- Undertake a beach clean-up and discuss the issues of marine debris. Refer to https://www.tangaroablue.org/ for a marine debris data sheet.

Image 10: *View of the beach and the Outlet Creek*

Stop 9: The Beach springs

At this stop you can view the groundwater rising up through the sand on the beach, students can taste that the water is fresh.

Discussion Points

- Talk about the flow of groundwater in the region and how it comes to the surface in karst rising springs such as Piccaninnie Ponds, but also bubbles up off shore under the ocean.

  It is thought that this fresh water helps to create a rich diversity in marine life along the coast.

Image 11: *The Beach Springs. Photo by: Michel Roggo*

Piccaninnie Ponds Conservation Park – Field Trip 2

Self guided excursion map

Piccaninnie Ponds

CURRICULUM PLANNING

Intended Learning: Connecting with Nature

Experiences in natural environments can ignite a sense of awe and wonder and a child's desire to learn more about the natural world.

Subject	Content Descriptions
SCIENCE *Understanding*	Year 7 **Biological sciences** Classification helps organise the diverse group of organisms (ACSSU111) Interactions between organisms, including the effects of human activities can be represented by food chains and food webs (ACSSU112) Sustainability
Science as a human endeavour	Years 7 & 8 **Nature and development of science** Science knowledge can develop through collaboration across the disciplines of science and the contributions of people from a range of cultures (ACSHE223)
Science Inquiry Skills	Years 7 & 8 **Questioning and predicting** Identify questions and problems that can be investigated scientifically and make predictions based on scientific knowledge (ACSIS124) **Planning and conducting** Collaboratively and individually plan and conduct a range of investigation types, including fieldwork and experiments, ensuring safety and ethical guidelines are followed (ACSIS125) Measure and control variables, select equipment appropriate to the task and collect data with accuracy (ACSIS126) **Processing and analysing data and information** Construct and use a range of representations, including graphs, keys and models to represent and analyse patterns or relationships in data using digital technologies as appropriate (ACSIS129) *View additional details about Numeracy Information and Communication Technology (ICT) Capability* Summarise data, from students' own investigations and secondary sources, and use scientific understanding to identify relationships and draw conclusions based on evidence (ACSIS130) *View additional details about Numeracy* *View additional details about Critical and Creative Thinking* **Evaluating** Reflect on scientific investigations including evaluating the quality of the data collected, and identifying improvements (ACSIS131) *View additional details about Literacy View additional details about Numeracy* *View additional details about Critical and Creative Thinking* Use scientific knowledge and findings from investigations to evaluate claims based on evidence (ACSIS132) *View additional details about Literacy View additional details about Critical and Creative Thinking* **Communicating** Communicate ideas, findings and evidence based solutions to problems using scientific language, and representations, using digital technologies as appropriate (ACSIS133) *View additional details about Literacy* *View additional details about Information and Communication Technology (ICT) Capability*

Subject	Content Descriptions
Understanding	Year 9 **Biological sciences** Ecosystems consist of communities of interdependent organisms and abiotic components of the environment; matter and energy flow through these systems (ACSSU176)
Science Inquiry Skills	Years 9 & 10 **Questioning and predicting** Formulate questions or hypotheses that can be investigated scientifically (ACSIS164) **Planning and conducting** Plan, select and use appropriate investigation types, including field work and laboratory experimentation, to collect reliable data; assess risk and address ethical issues associated with these methods (ACSIS165) Select and use appropriate equipment, including digital technologies, to collect and record data systematically and accurately (ACSIS166) **Processing and analysing data and information** Analyse patterns and trends in data, including describing relationships between variables and identifying inconsistencies (ACSIS169) Use knowledge of scientific concepts to draw conclusions that are consistent with evidence (ACSIS170) **Evaluating** Evaluate conclusions, including identifying sources of uncertainty and possible alternative explanations, and describe specific ways to improve the quality of the data (ACSIS171) Critically analyse the validity of information in primary and secondary sources and evaluate the approaches used to solve problems (ACSIS172) **Communicating** Communicate scientific ideas and information for a particular purpose, including constructing evidence-based arguments and using appropriate scientific language, conventions and representations (ACSIS174)

Examples in Parks

Wetland Ecology & Biology
- Classification of species - Birds, Mammals, Frogs, Fish & Aquatic macros
- Interactions and food webs
- Growth and survival
- Importance of wetlands as habitat
- Endangered Species

Water Testing
- Temperature
- pH
- Salinity
- Flow
- Biological – Fish, Frogs and aquatic macro invertebrates

Fish and Aquatic Macro-invertebrate Sampling
- Identifying and classifying different species
- Pollution sensitivity index for each species
- Habitat requirements for fish and macros

Ecological Burning
- Fire management techniques and how scientific knowledge of the park is key to a successful burn
- How fire is used to help native species
- Benefits to the landscape from burning e.g. weed control
- Fire adaptations of Australian native plants

Terrestrial Ecology
- Distinguish abiotic components of the ecosystem
- Plant ID
- Weed management
- Students can observe the different plant species in the park and observe any features that suggest an adaptation to the local environment
- Animal species can also be observed in the park or students can search for evidence of their presence including scats and tracks
- Bird monitoring has occurred monthly at the park since 2007 – 175 spp have been recorded to date

Coastal Ecology
- Marine Debris - sources, impacts, solutions
- Shorebirds
- Local and migratory species
- Threats
- Management
- Tracking
- Beach Springs
- Marine Parks
- Bonney Upwelling
- Blue Whales

Suggested Resources

Piccaninnie Ponds Information http://www.environment.sa.gov.au/managing-natural-resources/wetlands/piccaninnie-ponds

- Piccaninnie Ponds Karst Wetlands - factsheet
- Piccaninnie Ponds Karst Wetlands - Ramsar information sheet
- Piccaninnie Ponds Karst Wetlands - ecological character description
- Piccaninnie Ponds Karst Wetlands - Ramsar management plan

SE local species - Information on our local plants and animals including a threatened species brochure http://www.naturalresources.sa.gov.au/southeast/plants-and-animals/native-plants-and-animals

Landscapes of the South East booklet
http://naturalresources.sa.gov.au/files/sharedassets/south_east/education/190222-landscapes_of_the_south_east.pdf

Videos to watch - Steve Clarke, Wetland Conservation Ecologist describes what makes Piccaninnie Ponds such a unique ecosystem and its Ramsar listing.
http://www.environment.gov.au/water/wetlands/publications/video-piccaninnie-ponds

Cave Diving - Follow a scuba divers journey deep into the Piccaninnie Ponds.
https://youtu.be/WckQqGlETIQ

ABC Science – What Scat is that?
http://www.abc.net.au/science/articles/2007/09/26/2044094.htm

Bush Food Plant ID Cards
http://www.naturalresources.sa.gov.au/southeast/schools/teacher-resources

Water quality issues
http://www.epa.sa.gov.au/ Follow the links to environmental info - water quality

Wetlands as habitat
http://www.environment.sa.gov.au/managing-natural-resources/wetlands

Frog Watch SE – become a citizen scientist and help protect the frogs of the South East by recording where you hear them http://www.naturalresources.sa.gov.au/southeast/get-involved/frog-census

Native Birds - http://birdlife.org.au/

Shorebird migration
Check out the satellite tracking of the Grey Plover as it migrates from Australia to China
http://birdlife.org.au/campaigns/the-marvel-of-migration

Farewell shorebirds – watch this short but engaging clip which highlights the amazing distances shorebirds travel https://www.youtube.com/watch?v=44F0d5lZ7BQ

Marine Debris - http://www.bagitmovie.com/for_educators.html

Tangaroa Blue Foundation - an Australia-wide, not-for-profit organisation dedicated to the removal and prevention of marine debris http://www.tangaroablue.org/

Bonney Upwelling & Blue Whales -
https://en.wikipedia.org/wiki/Great_South_Australian_Coastal_Upwelling_System

Ecological Burning -
http://www.environment.sa.gov.au/firemanagement/

Fire Adaptations of Australian Native Plants - Rise from the Ashes - A short film describing how Australian native plants regenerate after a bush fire https://youtu.be/Z4Ur8ky-Q2I

Subject	Content Descriptions
GEOGRAPHY *Aim: Students develop a sense of wonder, curiosity and respect about places, people, cultures and environments throughout the world.*	Year 7 **Unit 1: Water in the world** The way that flows of water connects places as it moves through the environment and the way this affects places (ACHGK038) The quantity and variability of Australia's water resources compared with other continents (ACHGK039) Economic, cultural, spiritual and aesthetic value of water for people, including Aboriginal and Torres Strait Islander Peoples and peoples of the Asi region (ACHGK041)
Geographical Knowledge and Understanding	Year 8 **Unit 1: Landforms and landscapes** Different types of landscapes and their distinctive landform features (ACHGK048) Spiritual, aesthetic and cultural value of landscapes and landforms for people, including Aboriginal and Torres Strait Islander Peoples (ACHGK049) Geomorphic processes that produce landforms, including a case study of at least one landform (ACHGK050) Human causes and effects of landscape degradation (ACHGK051) Ways of protecting significant landscapes (ACHGK052) *This unit examines the interconnections between people and places through the products people buy and the effects of their production on the places that make them e.g. Dairy products – dairy production requires water use and fertiliser – how may this impact Piccaninnie Ponds?* Year 9 **Unit 1: Biomes and food security** Distribution and characteristics of biomes as regions with distinctive climates, soils, vegetation and productivity (ACHGK060) Human alteration of biomes to produce food, industrial materials and fibres, and the use of systems thinking to analyse the environmental effects of these alterations (ACHGK061) Challenges to food production, including land and water degradation, shortage of fresh water, competing land uses, and climate change, for Australia and other areas of the world (ACHGK063) **Unit 2: Geographies of interconnections** The effects of people's travel, recreational, cultural or leisure choices on places, and the implications for the future of these places (ACHGK069) *e.g. Visitor management on parks. Why do you think a permit is required to snorkel or dive in the Ponds and why is a there a limit imposed for the number of people in the Ponds at any one time?*

Geographical Inquiry Skills ***Key inquiry questions for Year 9 are:*** *What are the causes and consequences of change in places and environments and how can this change be managed?* *What are the future implications of changes to places and environments?* *Why are interconnections and interdependencies important for the future of places and environments?*	Years 8 & 9 **Observing, questioning and planning** Develop geographically significant questions and plan an inquiry using appropriate geographical methodologies and concepts (ACHGS055) **Collecting, recording, evaluating and representing** Evaluate sources for their reliability and usefulness and select, collect and record relevant geographical data and information, using ethical protocols, from appropriate primary and secondary sources (ACHGS056) Represent data in a range of appropriate forms, for example, climate graphs, compound column graphs, population pyramids, tables, field sketches and annotated diagrams, with and without the use of digital and spatial technologies ACHGS057) Represent spatial distribution of different types of geographical phenomena by constructing appropriate maps at different scales that conform to cartographic conventions, using spatial technologies as appropriate (ACHGS058) **Interpreting, analysing and concluding** Interpret geographical data and other information using qualitative and quantitative methods, and digital and spatial technologies as appropriate, to identify and propose explanations for spatial distributions, patterns and trends, and infer relationships (ACHGS059) Apply geographical concepts to draw conclusions based on the analysis of data and information collected (ACHGS060) **Communicating** Present findings, arguments and ideas in a range of communication forms selected to suit a particular audience and purpose; using geographical terminology and digital technologies as appropriate (ACHGS061) **Reflecting and responding** Reflect on their learning to propose individual and collective action in response to a contemporary geographical challenge, taking account of environmental, economic and social considerations, and predict the expected outcomes of their proposal (ACHGS062) Year 10 **Observing, questioning and planning** Develop geographically significant questions and plan an inquiry that identifies and applies appropriate geographical methodologies and concepts (ACHGS063) **Collecting, recording, evaluating and representing** Evaluate sources for their reliability, bias and usefulness and select, collect, record and organise relevant geographical data and information, using ethical protocols, from a range of appropriate primary and secondary sources (ACHGS064) Represent multi-variable data in a range of appropriate forms, for example scatter plots, tables, field sketches and annotated diagrams, with and without the use of digital and spatial technologies (ACHGS065) Represent spatial distribution of geographical phenomena by constructing special purpose maps that conform to cartographic conventions, using spatial technologies as appropriate (ACHGS066). **Interpreting, analysing and concluding** Interpret and analyse multi-variable data and other geographical information using qualitative and quantitative methods, and digital and spatial technologies, as appropriate, to make generalisations and inferences, propose explanations for patterns, trends, relationships and anomalies, and predict outcomes (ACHGS067) Apply geographical concepts to synthesise information from various sources and draw conclusions based on the analysis of data and information, taking into account alternative points of view (ACHGS068) Identify how geographical information systems (GIS) might be used to analyse geographical data and make predictions (ACHGS069)

	Communicating Present findings, arguments and explanations in a range of appropriate communication forms, selected for their effectiveness and to suit audience and purpose; using relevant geographical terminology, and digital technologies as appropriate (ACHGS070) **Reflecting and responding** Reflect on and evaluate findings of an inquiry to propose individual and collective action in response to a contemporary geographical challenge, taking account of environmental, economic, political and social considerations; and explain the predicted outcomes and consequences of their proposal (ACHGS071)

Examples in Parks

Indigenous Culture

- Connection to country
- How do Aboriginal connections to Piccaninnie Ponds compare with other cultures connections and perceptions of the Park?
- Indigenous perspectives
- Bush Tucker
- Middens
- The use of fire-stick farming (indigenous culture) and how this relates to fire management today

General

- Students can develop an understanding of the different people who use and manage the park

Water

- Observing or stopping at several sites on the way to Piccaninnie Ponds Conservation Park will encourage students to think about what this water is used for, its quality, quantity and where it comes from. For example: groundwater use for town water supply, irrigation, dairy, beef and lamb production and the fishing industry.

- Potential negative impacts on the quantity and quality of groundwater due to over extraction or contamination by fertilisers. The nutrient rich run off from farming land can cause increased algal growth in the groundwater springs, smothering vegetation and negatively impacting on the habitat of endangered species such as the Glenelg Spiny Freshwater Crayfish.

Suggested Resources

'Teaching with an Indigenous Perspective'
Four kits have been developed by Natural Resources SE for teachers. They include a wide variety of books, DVDs and artefacts as well as locally produced resources. To view some of the resources visit http://www.naturalresources.sa.gov.au/southeast/schools/teacher-resources

Please email damien.bickley@sa.gov.au to borrow the kit.

Geographical History of the South East
Shallow seabed created the limestone. Discussion of the previous shorelines and ancient sand dunes.

Volcano Movie at the Main Corner

SE Drainage Scheme - Water from the drains flows through the landscape into the ocean http://www.environment.sa.gov.au/managing-natural-resources/water-use/water-resources/south-east-drainage-network

History of the SE Drainage Scheme https://youtu.be/56ZUc3X8CN0

South Australian Museum
Field Guide to SA Fauna App
http://www.samuseum.sa.gov.au/learn/south-australian-museum-apps/field-guide-to-south-australian-fauna

Bio-region Geographic Fact Sheets
The Victorian Volcanic Plain Fact Sheet describes the habitats found in this bio-region and features four bio icons – Common Brushtail Possum, Southern Brown Bandicoot and the Red and Yellow tailed Black Cockatoos. http://www.naturalresources.sa.gov.au/adelaidemtloftyranges/education/for-educators/plants-and-animals/life-in-bioregions

Monitor the water use in your school -
The NRM Education team has collated a selection of teaching resources. Within each theme is a variety of tools such as: units of work, resources, student activities, examples from other schools & photo galleries. Themes include:

- air quality
- climate change
- energy
- education for sustainability
- food gardens
- natural learning spaces
- plants and animals
- waste
- water
- youth voice

Subject	Content Descriptions
DESIGN AND TECHNOLOGIES *Processes and Production Skills*	Years 7 & 8 Critique needs or opportunities for designing and investigate, analyse and select from a range of materials, components, tools, equipment and processes to develop design ideas (ACTDEP035) Generate, develop, test and communicate design ideas, plans and processes for various audiences using appropriate technical terms and technologies including graphical representation techniques (ACTDEP036) Select and justify choices of materials, components, tools, equipment and techniques to effectively and safely make designed solutions (ACTDEP037) Independently develop criteria for success to evaluate design ideas, processes and solutions and their sustainability (ACTDEP038) Use project management processes when working individually and collaboratively to coordinate production of designed solutions (ACTDEP039)

Examples in Parks

Marine Debris

- Research alternatives to plastics
- Design a product that is biodegradable so that it does not cause marine debris
- Design a product that could help clean up marine debris

Suggested Resources

Biodegradable algae based water bottle

http://www.sciencealert.com/this-biodegradable-algae-based-water-bottle-breaks-down-when-it-s-empty

Edible can rings

http://mashable.com/2016/05/20/edible-six-pack-rings-beer/#r3lH.xy9lqqy

Australian surfers design an ocean vacuum cleaner

http://www.abc.net.au/news/2015-12-20/seabin-designed-by-australian-surfers-to-start-cleaning-up-ocean/7044174

Subject	Content Descriptions
DIGITAL TECHNOLOGIES *Processes and Production Skills*	Years 7 & 8 Acquire data from a range of sources and evaluate authenticity, accuracy and timeliness (ACTDIP025) Analyse and visualise data using a range of software to create information, and use structured data to model objects or events (ACTDIP026) Define and decompose real-world problems taking into account functional requirements and economic, environmental, social, technical and usability constraints (ACTDIP027) Design the user experience of a digital system, generating, evaluating and communicating alternative designs (ACTDIP028) Design algorithms represented diagrammatically and in English, and trace algorithms to predict output for a given input and to identify errors (ACTDIP029) Implement and modify programs with user interfaces involving branching, iteration and functions in a general-purpose programming language (ACTDIP030) Evaluate how student solutions and existing information systems meet needs, are innovative, and take account of future risks and sustainability (ACTDIP031) Plan and manage projects that create and communicate ideas and information collaboratively online, taking safety and social contexts into account (ACTDIP032)

Examples in Parks

Wetland management

- GIS
- Digital Elevation Model (DEM)
- Lidar

Visitor Management

- Creation of QR codes that link to information that will enhance the visitor's experience in the park.
- Create QR code trails or a treasure hunt in the park

Shorebird Tracking

- Geo locator technology

Suggested Resources

QR Code creator http://www.qrstuff.com/

QR Code reader - download Quickmark barcode reader from the Google Play store