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South Australian Arid Lands Natural  
Resources Management Board



CARING  
FOR  
OUR  
COUNTRY



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South Australian Arid Lands Natural Resources Management Board

# Landscape assessment and analysis of the Cooper Creek Catchment, South Australia

Gini Lee

# **LANDSCAPE ASSESSMENT AND ANALYSIS OF THE COOPER CREEK CATCHMENT (SA SECTION)**

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Report to the South Australian Arid Lands Natural Resources Management Board

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Cooper Creek at Embarka Waterhole (L) after the wet, April 2011 and (R) in recovery, September 2012

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## EXECUTIVE SUMMARY

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This report, *The Landscape assessment and analysis of the Cooper Creek Catchment (SA Section)*, presents the findings of a regional-scale landscape and cultural assessment of the Cooper Creek catchment. It is one component of the South Australian Arid Lands Natural Resources Management Board Water Projects group project *Managing the high ecological value aquatic ecosystems of the Cooper Creek catchment (SA section)*. The landscape assessment of the cultural values of the Cooper Creek has been undertaken through support from the national Caring for our Country program. This research contributes to the SAAL Regional NRM Plan Resource Condition Target (RCT) 4: “By 2020, at least 50% of documented natural ecosystems of particular cultural significance that are suffering from disturbance are in improved condition”. The RCT recommends the development of a landscape assessment framework for the SAAL NRM Region by 2014 to inform development and best practice land management standards.

The cultural landscape assessment and analysis component of the management of the *high ecological value aquatic ecosystems* project assesses the physical and cultural characteristics of selected waterholes and other waterbodies in the Cooper Creek Catchment. The *Landscape assessment and analysis of the Cooper Creek Catchment (SA Section)* is a companion to the *Cultural landscapes assessment and analysis of the Neales Catchment and Algebuckina Waterhole Report* (Lee 2011), which established the methodology for including cultural assessment as a component for the scientific baseline data assessment of inland surface water systems. This detailed cultural landscape assessment into the physical features and human influences of the region uses a landscape design based methodology. A landscape design approach identifies the environmental, economic, cultural and social values associated with landscape features associated with Cooper Creek water systems including watercourses and their riparian and flood zones. It seeks to provide practical observations, such as identifying impacts from tourism pressure, and suggests design strategies for visitor management options through consultation with stakeholders and reference to scientific knowledge. It identifies the Aboriginal cultural importance of waterbodies and options for a co-management approach.

The communities and stakeholders who use and experience the various waterbodies and their environs inform the landscape attributes study of individual sites: as a resource, as places of cultural and spiritual importance, and as places for recreation, meeting, education and research.

Four other scientific studies associated with the *high ecological value aquatic ecosystems* project provide the biophysical context and inform the landscape assessment methodology to enable a whole of catchment perspective for this multidisciplinary project – geomorphology, hydrology, aquatic ecology, vegetation and ecological diversity. Building upon recognised bioregional themes that typify the ecosystem attributes of the area, the cultural landscape assessment study develops four broad cultural themes to overlay the ecological conditions with descriptions drawn from the ways Cooper Creek landscapes are used and valued.

Nominated as the Conservation Landscape, the Industrial Landscape, the Productive Landscape and the Storied Landscape, these cultural themes are useful indicators of the particular dynamics of landscapes where natural and human systems coincide. Applying these themes across the range of waterbodies and their systems enables management approaches for the protection and conservation of critical waterbodies and water systems to be negotiated across stakeholders.

The project captures feedback from face to face community consultation alongside on-the-ground mapping and analysis as it documents the landscape character and values of the Cooper Creek Catchment. The Cultural Landscape Assessment Matrix is a key organisational tool for this landscape assessment. It provides an understanding of the complex overlay of water–landscape relationships at the regional and local scale, and the mapping of associations between water and social and cultural systems. The matrix identifies key stakeholders and landscape conditions and their interconnectivity. The results of the matrix survey are collated into individual, illustrated site reports. (see Section 6 Landscape Assessment).

The Cooper Creek Catchment is a cultural landscape in which diverse waterbodies located along the Cooper Creek system are magnets for people and ecosystems. The landscape character of the Cooper Creek Catchment exhibits basic structural elements and a range of uses and attributes:

- The major Cooper Creek ephemeral river systems flow generally towards Lake Eyre through extensive braided streams and floodplains, shallow wetlands, flood-outs and longitudinal dunes, tablelands and gibber plains interspersed with playa lakes and sand plains. The North West Branch diverges to the north below Innamincka to replenish the Coongie Lakes wetlands system, while the ephemeral Strzelecki Creek rises at Innamincka to flow southerly towards Lake Callabonna and Lake Frome, in times of extreme flood.
- Aquatic environments of the Cooper Creek Catchment are places of intense ecological activity overlain with tourism, mining and pastoral pursuits. The visible impacts of human induced use upon fragile riverine ecologies and historic sites are evident after periods of fine weather and drought following floods.
- The scale of the Cooper Creek system supports a boom and bust economy for pastoralism and tourism alike due to its history of long droughts interspersed by regular massive flooding, predominantly fed by Queensland tropical rains as water pulses that may continue to flood down the system over a number of years.
- Only two major roads head north following historic exploration routes and crossing the Cooper Creek at two places; on the Birdsville Track floodplain just north of Etadunna Station and the Strzelecki Track at Innamincka township.
- The stories of human occupation over thousands of years are held by the Dieri and the Yandruwandha and Yawarrawarrka peoples, with the visible evidence found in middens and other cultural sites usually closely associated with reliable waterbodies.
- More contemporary histories are evident in the sparse settlements, tracks and campsites located at places of European explorer histories, which coincide with preferred tourist destinations today. Pathways can be tracked along creek lines, pastoral stock routes and

watering points, tourist campsites and fishing holes, each journey offering up information about the many layers of occupation present in the landscape.

- Mining activity has brought a new industrial landscape to the remote dunescapes, swamps and wetlands through an intensive system of roads, seismic lines, pipes and pumping infrastructure
- New industrial roads, GPS location devices, the internet and mobile applications, have improved access to these remote areas, where touring and mobile economies are facilitated by improved knowledge of once hard to access places.
- The high conservation value of the Cooper Creek system is recognized through the Ramsar Convention recognition of a large portion of the Cooper Creek reach; in the SA Section stretching from the Queensland border to Lake Hope in the southwest, to above the Coongie Lakes in the north. The specific requirements associated with managing high ecological value landscapes across an area where pastoral, Aboriginal cultural, conservation and mining activities coexist is an example of co-management principles in practice.

Four key waterbodies with high landscape quality, Indigenous and pastoral heritage, and intensity of use from a number of contemporary stakeholders, have been identified as critical areas for landscape assessment and possible management strategies:

- The Upper Cooper Creek complex including Cullyamurra Waterhole and Choke and Burke's Grave to the east, the Innamincka Complex of waterholes including the Town Common, to Tilcha Waterhole and Wills Grave Site to the south west.
- Coongie Lakes and Kudriemitchie Waterhole tourist and conservation sites along the Cooper Creek North West Branch pastoral, mining and designated conservation wetlands country.
- The Lake Hope historic mission site and contemporary fishery on pastoral country.
- Lakes Killalpaninna and Kopperamanna playa lakes to the west of the Birdsville Track as important Aboriginal cultural places, the site of early missionary settlement and the development of the pastoral industry.

Through travelling across country with the research team, and further informed by meeting with a range of local and economic stakeholders, important understanding has been gained of Cooper Creek Catchment landscape qualities and the cultural values that the waterbodies and their environs embrace. The stakeholders raised a number of points that can inform future management approaches:

**Understand the dynamics of arid zone water regimes:** The variable nature of rivers, creeks, waterholes, wetlands and floodplains, and the current and emerging resource-driven practices that impact on them, affect their future sustainability in the face of climatic and economic change. Identifying and valuing the landscape qualities of the country in which they operate will influence such dynamic practices.

**Access to water:** Identifying and mapping who accesses water and for what purpose, should be established to protect waterbodies and their riparian zones and drainage systems including providing enough water for floodplains and wetlands. The relation between human use and the ecological and cultural importance of water supply to arid lands also includes



places where ground water is extracted through bores and wells and stored in dams and borrow pits.

**Flood, drought and recovery:**

Beyond seasonal changes; summer, autumn, winter and spring, the arid lands are subject to the cycles of flood and drought with varying periods of recovery between. The Cooper Creek system has been described as being attached to the Queensland rivers via an umbilical cord, as the tropical rain systems to the north replenish the system beyond what local rains can achieve. The flood time affects everyone equally due to reduced access to remote places in floodplains and through the often-impassable dirt road system.

The period of recovery between flood and drought is the time of great ecological and social/economic abundance and is the most productive moment in arid places. In the end, despite many of the damaging practices at key waterhole sites being visually and ecologically unpalatable, community feedback suggests that flood management removes many of these problems downstream, and management can recommence when the waters have cleared.

**Changing resource use: mining, pastoral, tourism practices and communities:**

Contemporary pastoral practices have influenced the demise of old infrastructure, which focused stock into fragile watercourses and intense use of limited water points. With new technology and the increasing use of artesian water, resource industries are better able to weather drought than pastoral, or to some extent, tourism industries. All year round activity has the potential to support local communities, despite the fly in - fly out management regimes of big mining. Conversely, the changing ownership of pastoral properties from family to mining or other corporation ownership often is accompanied by a loss of local knowledge and support due to temporary management regimes.

Deep Mapping techniques leading to multilayered maps are seen as a way forward to record the range of values held by stakeholders for important water places, the qualities and attributes towards negotiated management programs.

**Awareness of cultural values:** Awareness of shared and distinct Aboriginal and non-Aboriginal cultural values is critical to developing environmentally responsible management through understanding community aspirations attached to water places.

**Landscape assessment, heritage and ecological values:** Aquatic environments assessment requires relevant information on landscape qualities to evaluate where ecological health and cultural values coexist. The evidence of issues such as pest threats and control programs can be influenced by particular landscape characteristics and/or proximity to roads and networks that aid the distribution of pest and weed species.

**Involvement of Aboriginal stakeholders in expanded programs:** A number of cultural protocols and priorities for cultural mapping Aboriginal knowledge of, and sites on, Country have been developed in collaboration with the mining industry. Expanding engagement into partnerships and co-management programs with the Dieri and the Yandruwandha and Yawarrawarrka communities is an important objective. Utilising Aboriginal language and

naming protocols for places on country is an essential and visible component of the cultural landscape.

**Impacts upon riparian zones adjacent to waterholes and water points:** Stakeholders report that stream bank modification by tourists is causing destabilisation (e.g. step cutting, bank compaction, path making, firewood gathering) and is potentially more long lasting than any stock damage.

**Management of tourism drivers and impacts through landscape design:** Identify critical issues, and develop management programs and on the ground design projects for the protection, rehabilitation and management of critical water ecology sites and culturally important places currently visited by tourists.

**Communication, information and access:** Signs and fences can prevent access to vantage points for the majority of visitors but are only marginally effective when visitors leave designated tracks. Communication of local knowledge to other stakeholders and visitors can improve behaviour through increased understanding of the dynamics of arid landscapes and their water systems and related ecologies.

**Government programs and support:** Research to identify a range of management approaches requires funding programs and management assistance that enables change across public and private landscapes and sites.

Waterbodies - creeks, waterholes, lakes and wetlands - are the focus of ongoing human existence in the outback. The appeal of arid zone landscapes is increased by the visual presence of water and/or the indication that water sources exist to sustain vegetation. Natural waterholes and springs are refuges for animals and humans in dry times, and are places for sustenance and recreation. Preferred landscapes exhibit high biodiversity, viewpoints overlooking visibly pristine landscapes and/or heritage sites that may be in ruins. Constructed dams, bores, tanks, ponds and pits, are indicators of pastoral and mining activity and contribute to the cultural landscape, but there is a preference for 'natural' and preferably pristine waterbodies. Conversely, there is also a preference for 'safe' places to camp and walk associated with waterholes, creeks and lakes where clear visibility of the surrounding area and ground conditions is possible. There is also a preference for occupation at the margins of waterholes, in creek beds, lake edge beaches and riparian edges.

The presence of fish and other wildlife at healthy waterholes contributes to the desert experience and promotes an important opportunity for recreation and social meetings for locals and visitors. The landscape quality of watercourses and waterbodies is reduced by visible signs of human-induced impacts such as vehicular tracks, multiple campfires, damaged trees, stock tracking, erosion gullies, compacted ground, litter and inappropriate signage and infrastructure.

Drawing upon this multidisciplinary research it is recommended that landscape management strategy plans for high ecological value aquatic ecosystems and their environs be developed as a priority. Documentation of landscape character, ecological diversity and cultural values,

and the evaluation of impacts inform projects for bank and vegetation rehabilitation and ongoing management strategies.

Additionally, this cultural landscape research proposes that four culturally derived themes are applied to landscapes and places throughout the Cooper Creek Catchment based upon the land uses and values that are described through the individual assessments. The broad descriptors are used to define the layered qualities of places according to cultural, social and economic conditions and values evident in the landscape assessment and in the information that was communicated during discussions with local communities and stakeholders.

- **Industrial landscape:** Areas where large scale infrastructure and permanent or mobile settlements are arranged over wide areas of plains and/or wetlands and swamps are components of the landscape of mining exploration and extraction. The inscribed lines of roads, pipelines and seismic works alongside site installations of extractive machinery and the Moomba site characterise the structure and networks of the industrial landscape.
- **Conservation landscape:** Areas of critical importance to the ecological and cultural health of arid landscapes and their waterbodies characterise conservation landscapes. Often places of great aesthetic beauty as well as scientific importance, the regions and sites are often recognised through natural and cultural heritage surveys or proclaimed as reserves or national parks.
- **Productive landscape:** Areas where the production of food and resources over time has been established. This theme can apply to both natural and social/economic systems as for examples floodplains are particularly productive areas for fish as they are for pastoral pursuits. Townships and settlements can also provide the focus on productive social outcomes.
- **Storied landscape:** Occupation of landscape over time result in stories about the landscape and its people and their experiences being written down, recorded through maps and imagery or handed down through oral history and language. Named places are an example of marking the storied landscape. The tales told in storied landscapes don't have to be true for them to resonate in history and across cultures.

Focusing on the four distinct cultural landscape character types studied in the South Australian section of the Cooper Creek it is possible to extrapolate across a range of landscapes and their uses to propose wise management strategies. The main structural characteristics of the relationships between aquatic ecosystems and their waterbodies, and human use lies in:

- the connectivity along the river and creek channels for pastoralism, tourism and Aboriginal cultural activities. People follow the presence of water according to seasonal conditions, arriving at the permanent waterholes and lakes when other ephemeral systems dry up.
- the networks established across the landscapes of dune, floodplains and swamps in association through mining enterprises and artesian water extraction to support human and pastoral existence. The presence of reliable water linked to geological

resources provides an alternative map of the landscape that is less reliant on surface water to structure movement.

Management regimes for the waterholes and creeks of the Upper Cooper Creek system are co-managed through negotiated arrangements across stakeholders to provide systems for traffic and visitor control of the designated waterholes and camping areas of the Innamincka complex and for the Coongie Lakes area. A range of interpretation and vehicular landscape projects are generally agreed to be working well.

Further west in the lakes, floodplains and dunes areas local management and access regimes are more dispersed and monitoring of use has less support. It is important to negotiate access to sites of critical yet ephemeral ecological importance influenced by seasonal water flows. Fragile and important historical and cultural sites require conservation and visitor management plans if they are to be subject to tourism visitation and interaction with pastoral or mining and water supply requirements. The combination of pre-existing heritage studies and Aboriginal oral knowledge is critical to providing information supporting wise use of these remote areas.

Suggested landscape driven projects for the Cooper Creek catchment include:

- Develop strategies for walking trails, access to waterholes and creek and lake margins and designated clearings to prevent erosion and guide visitors in the wise use of riparian zones, particularly in areas of steep banks and dense understorey planting.
- Develop a publicly accessible cultural landscapes annotated visual database for the Cooper Creek Catchment as a resource for the community and management of waterholes and other cultural sites (e.g. photo library, photostory, place stories options). Establish a mechanism for ongoing engagement with local communities and stakeholders, State Government agencies and researchers to enable ongoing development of a cultural landscapes database.
- Develop appropriate protocols for access to and research on Aboriginal cultural sites on public and privately held lands of the Cooper Creek Catchment and the Strzelecki and Birdsville Tracks in partnership with Yandruwandha and Yawarrawarrka and Dieri peoples.
- Expand upon local education programs and interpretation strategies on the ecological and landscape attributes of the waterbodies of the northeastern South Australian arid zone to Lake Eyre.
- Undertake a series of Deep Mapping projects for selected aquatic ecosystems and cultural landscapes in collaboration with all identified stakeholders for each place. Waterbody datasheets based upon the combined landscape assessment findings across disciplines prepared for public information and dissemination via the web.

# 1 INTRODUCTION

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## 1.1 Background and context

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This cultural landscape assessment and analysis project for the Cooper Creek Catchment is a component of a larger scientific study into the systems and dynamics that affect the ongoing viability of ecological refugia in the arid lands of central South Australia. The *Managing the high ecological value aquatic ecosystems of the Cooper Creek catchment (SA section)* project is managed by the South Australian Arid Lands NRM Water Projects group funded by the national Caring for our Country program. The *Landscape assessment and analysis of the Cooper Creek Catchment (SA Section)* is a companion to the *Cultural landscapes assessment and analysis of the Neales Catchment and Algebuckina Waterhole Report* (Lee 2011), which established the methodology for including cultural assessment as a component of ecological, hydrological and geomorphological assessment of inland surface water systems. These ‘critical refugia’ are typically fresh or semi-saline waterholes located in large generally dry river systems, wetlands and ephemeral lakes. The more permanent waters become the only refuge for isolated or relict populations in times of severe drought and form a network of refugia linked by the extensive floodplains that fringe central Australia’s inland rivers. Their healthy condition is essential to the continuing presence of animal and human populations and livelihoods.

If these waterbodies become marginal, either through climatic change or due to unsustainable human use, then their ecological value becomes under threat. Most stakeholders in remote South Australia recognise the need for management programs driven by local knowledge and supported by state and national government policies and frameworks. Additionally these stakeholders all agree that improved communication of the findings of research into ecosystems and the cultural aspects of managing water systems in the catchment is critical to developing shared futures across the region. The prediction of a drying climate has highlighted the urgent need for action towards sustainable management regimes to prepare for future conditions. Despite extensive rainfall since 2010, the current drying pattern reinforces arid area records of historical boom and bust, and drought and flood regimes, to testify that drought will return and management for extreme dry conditions will continue to be of critical importance.

The systems most at risk from a range of climatic and human induced effects on fragile ecosystems are the aquatic ecosystems and riparian zones associated with river catchments of arid South Australia. The waterholes, saline lakes and wetlands in the Cooper Creek catchment are significant ecosystems that have been studied over a number of years from hydrological, ecological and aquatic perspectives. Ongoing research is needed to document seasonal factors and subsequent physical change and the contributing effects on the animals and plants that rely on the health and longevity of these systems to survive. It is also important to note that the recovery period between drought and flood is the time when the most productive ecological and social activities take place in the outback. Increased use of resources during recovery, when access is at a premium, impacts upon semi-permanent and permanent waters from a range of industries, such as pastoralism, mining and tourism (Trevor Whitelaw, pers comm., 2011).

To gain an understanding of the impacts on critical refugia scientific data is used to assess the health of ecosystems within the natural landscape context, whereas the gathering of local knowledge from a cultural landscape perspective provides an assessment of the human factors, behaviours and aspirations for these ecosystems.

This provides the basis for the cultural landscape assessment and analysis approach for the Cooper Creek Catchment waterbodies that documents the dynamics of the riverine and wetland systems alongside human interaction with natural resources. On ground management regimes including designing for human activity, particularly in the form of increasing mining and tourism activities requires this knowledge to plan for infrastructure and interpretation programs for waterholes, wetlands, lakes and heritage places in the catchment.

This project contributes to the SAAL Regional Natural Resources Management Plan 2010 through addressing RCT 4: “By 2020 at least 50% of documented natural ecosystems of particular cultural significance that are suffering from disturbance are in improved condition”.

The RCT specifically refers to the listing of priority natural ecosystems and their cultural features of significance with a key focus on Aboriginal sites. It recommends the development of a landscape assessment framework for the SAAL NRM Region by 2014 to inform development and best practice land management standards.

## **1.2 Project description**

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This research project develops a methodology for documenting the landscapes of the Cooper Creek Catchment through fieldwork informed by; knowledge of the region’s historical exploration, settlement and development over time, on the ground site surveys and associated community engagement. This component undertakes a detailed cultural landscape assessment into the physical features and human influences of the Cooper Creek catchment (SA section) using a landscape design based methodology and cross-disciplinary approach.

A landscape design approach identifies the environmental, economic, cultural, and social values associated with landscape features. Practical solutions for landscape conservation and/or improvement are recommended, such as, identifying impacts from tourism pressure and designing visitor management options through consultation with stakeholders and reference to scientific knowledge.

The cultural landscape assessment provides an understanding of the human involvement and links to the biophysical properties of aquatic resources. The landscape features addressed in this project include a range of water typologies (e.g. waterholes, wetlands, lakes, floodplains) and sites of cultural and social significance (e.g. Aboriginal heritage, tourism sites).

The two landscape based components are:

- an overall landscape character assessment of selected waterbodies in the context of the 'natural system' of the Cooper Creek Catchment and the coexistent 'cultural' systems located along the Cooper Creek and the Strzelecki and Birdsville Tracks.
- a detailed case study component for the critical refugia of the Cullyamurra and Innamincka complex of waterholes, Coongie Lakes wetlands and the saline lakes systems of Lakes Hope, Killalpaninna and Kopperamanna. A multi-disciplinary approach to understanding critical water ecosystems, including human use, informs landscape based infrastructure, restoration and community engagement projects towards sustainable management.

The first component aims to assess the cultural, social and ecological landscape characteristics of the Cooper Creek Catchment through a multi-faceted or deep mapping approach to collecting baseline biophysical information combined with observations of human interaction with places over time. The project then analyses and produces datasheets of landscape qualities for specific water places to distribute findings to a community audience, and inform further consultation towards developing workable management strategies. The multidisciplinary method identifies key processes that influence ecological function and community aspirations through gaining expert knowledge into the catchment's hydrology and fish distributions, geomorphology, ecology and landscape character, historical records and community knowledge. Demonstrating the connectivity between natural and cultural systems that occurs at waterbodies is a key aspect that frames the research method and proposals for developing various management approaches.

An understanding of why, how, when and where the community use natural resources for recreation, enjoyment, employment and production provides direction for the SAAL Board to implement sustainable management solutions. For example, an assessment of the intersection between the major Cooper Creek waterholes and the two key transport corridors, the Birdsville and Strzelecki Tracks provides an understanding of user patterns and potential impacts in areas of ecological and cultural sensitivity.

## **1.3 Objectives, outcomes and organisational frameworks**

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### **1.3.1 Objectives**

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- to apply a landscape design and cross-disciplinary methodology in the study of the Cooper Creek Catchment engaging scientific and landscape design based methods to contribute to the management and sustainable development of aquatic systems.
- to identify the range of practices that impact upon the sustainability of the waterholes, wetlands and lakes, and their aquatic systems, to fill key knowledge gaps regarding the cultural, ecological and productive importance of the Cooper Creek Catchment.
- to collate information of the natural resources and visitor management issues through community engagement; identifying issues relevant to Aboriginal community members and landholders, tourist groups, other industries, NRM regional bodies and government agencies.



- to develop spatial and site analysis data identifying views, water features, vegetation, occupation, access, interpretation, and issues requiring management.
- Contribute to a pest threats workshop targeted at landholders, visitors and government agencies
- Provide design recommendations addressing issues identified during the site analysis work, such as for visitor management at key waterhole sites

### 1.3.2 Outcomes

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The project will contribute to the protection and understanding of the diversity of systems, patterns of use, management and long-term sustainability of aquatic systems of the Cooper Creek catchment. The aim being to develop cultural and ecological management protocols for the future management of the diverse range of waterbodies and assets of the Cooper Creek region.

- The landscape-based overview site analysis and visual datasheets of the representative range of waterbodies across the Cooper Creek region propose landscape character types. The overview is informed by site visits and discussion with community representatives, where possible on site, to ascertain landscape qualities and values.
- The illustrated technical report records and nominates landscape design based concepts for key waterbodies to suggest a range of management approaches for preserving existing landscape qualities, managing threats and impacts from external factors, and from climatic change.
- Detailed site analysis interpretation of key waterhole, wetland and lake and aquatic environments highlighting impacts, cultural, social, and biophysical values. Landscape design recommendations contribute to the identification of effective investment priorities for on-ground actions.
- The detailed study focuses on the Innamincka Complex of waterholes on Cooper Creek in the Innamincka Regional Reserve, the Coongie Lakes internationally recognised wetlands and the culturally significant Lake Killalpaninna adjacent the Birdsville Track.
- These pilot studies work towards integrating landscape design perception, cultural history and ecological knowledge into developing effective and locally driven management options for places where natural and cultural occupation coincides.

### 1.3.3 Organisational Frameworks

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A number of organisational frameworks and strategies underpin and provide direction for the landscape assessment and community engagement component of the project.

### **South Australian Arid Lands NRM Board Regional Plans**

The SAAL NRM Board Regional Natural Resources Management Plan (2010) and the South Australian Arid Lands Biodiversity Strategy (2009) are two important frameworks for determining conservation priorities for biodiversity in the Cooper Creek catchment. These plans identify a range of risks to natural terrestrial systems, natural aquatic ecosystems, surface water resources, cultural features, geological features, iconic landscapes and infrastructure of the major 'assets' of the region. These plans nominate key issues such as; excessive grazing, terrestrial pest plants and animals, soil erosion, disruption of natural river flows, decline in water quality, inappropriate vehicle access, poorly maintained infrastructure and inadequate response to climate change events as the primary issues of concern. (SA Arid Lands Natural Resources Management Board 2010, p90)

The SAAL NRM reports describe the landform systems through which the Cooper Creek passes, and nominate the north eastern Channel Country bioregion drainage lines and floodplains, the stony plains and the dunefields and sand plains as key areas for conservation and attribute priorities. The nominated priority areas in the Sandy Deserts Simpson-Strzelecki Dunefields bioregion to the west and south include; drainage lines and floodplains, salt lakes, dunefields and sand plains. Conservation priorities in both areas include; ecological responses to water flows in the landscape, conservation of important permanent and semi-permanent waterholes in the Cooper Creek drainage systems, threatened ecological communities on drainage lines, low dunes and sand plains, floodplains and swamps, mulga low woodland on low dunes and sand plains and response of birds to water flow along the drainage systems. (SA Arid Lands Natural Resources Management Board 2010, p.91, 94)

Resource condition targets (RCT) and management action targets (MAT) form a comprehensive framework for a cultural landscape assessment program for the Cooper Creek Catchment. Specific areas for evaluation in relation to RCT's include: improving the condition of vegetation cover and aquatic ecosystems, reducing risks to ecological communities overall, reducing human-induced soil erosion, encouraging ecologically sustainable natural resource-based industries, and improving the quality of groundwater and surface water systems.

The MATs that describe the methods to attain these RCTs include: undertaking surveys and mapping places for environmental water requirements, registering regionally significant sites, engaging Aboriginal communities to participate in projects, improving adaption to climate change, reducing total grazing pressure, implementing protection, management and/or rehabilitation of priority aquatic systems, developing landscape assessment frameworks for the SAAL region, sustainably developing new water points, developing best practice guidelines for tourism and accrediting environmentally aware tourism operators, and improving the knowledge base and information dissemination of water resources in the SAAL region.

The Biodiversity Strategy for the SA Arid Lands nominates five Priority Actions (PA) that set goals that include: Improving ecological knowledge, decision making and capacity (PA1), reducing the impact of climate change (PA2), invasive species (PA3), total grazing pressure (PA4), and land use pressure (PA5) on biodiversity. MATs and Action targets also recommend biological surveys, vegetation mapping, environmental water requirements and

engagement with landholders to fill gaps in the knowledge and to increase preparedness for drought and other climate based events. Of specific relevance to landscape assessment are targets to minimise effects of grazing pressure and support alternative strategies, conservation and protection regimes for water resources, best practice standards for nature based tourism, parameters for disturbance thresholds, guidelines for infrastructure development and strategies for monitoring. (The Biodiversity Strategy for the SA Arid Lands, Overall Strategy Volume 1, 2009)

In 2008 the South Australian Government, through Planning SA, identified the following priority issues relating to economic development:

- Expanded mining activities and support industries are bringing employment opportunities to the region, but are also leading to a loss of people from towns to work in the mines.
- Decreasing employment opportunities in the pastoral industry and a shift from family to corporate ownership, including mining companies and Aboriginal companies.
- Need for economic diversity to provide resilience to boom and bust cycles of mining industry.
- Future development needs to support retention of the unique character of towns and pristine environments, as these are critical to the tourism industry.
- Need to attract and retain a skilled workforce (health professionals, police, trades) – including through provision of affordable housing and rental accommodation – to ensure ongoing services in towns to counter loss of people to the mining industry (SA Arid Lands Natural Resources Management Board 2010, p.38)

These issues have implications for the management of the Cooper Creek water systems and sites where social and ecological uses coincide such as around settlements, tourism sites, Aboriginal cultural places and mining infrastructure. Issues include the human dimension such as retaining people in these areas to monitor and manage critical refugia sites.

### **Pastoral Board**

The Pastoral Board has jurisdiction over South Australia's rangeland pastoral properties through its pastoral programs that provide technical advice, mapping, inventory, development planning, and inspection services. It also facilitates public access via public access routes (PAR). Walkers Crossing, is crucial to the access and use of the northern link from Innamincka to the Birdsville Track, via 15 Mile Track, for pastoral use as well as for mining and tourism access. PARs enable access via the public road system and are an ongoing source of management concern due to their remoteness and need for maintenance and appropriate signage.

### **South Australian Tourism Commission**

Cultural tourism in places of natural and cultural significance may provide benefits such as restoration of ecological and heritage sites, and conservation of historical fabric and access routes. Sustainable tourism seeks to limit degradation from overuse of sites and improve visitor use. Effective interpretation for cultural tourism can help visitors value landscapes.

The SA Tourism Commission *Principles of Sustainable Tourism* leaflet 2003–2008 quotes a World Tourism Organisation statement: "Sustainable tourism is "tourism which meets the

needs of present visitors and host regions while protecting and enhancing opportunity for the future". ([http://www.tourism.sa.gov.au/tourism/plan/design\\_guidelines.pdf](http://www.tourism.sa.gov.au/tourism/plan/design_guidelines.pdf))

The South Australian Tourism Plan 2009-2014 provides an overview of four main strategies for building South Australia's tourism identity. However it focuses on Adelaide and key coastal and food and wine areas. In the context of outback tourism frameworks the Cooper Creek region and its tourism assets are not mentioned at all. Their key principles can be summarised as:

- development based upon the attributes and strengths of the destination
- achieving authenticity through sites which are genuinely relevant to history, industry, culture, lifestyle and natural resources of the district
- representing the past, present and future aspirations of the community in a living and dynamic way
- developing specialised products based upon the inherent attributes of the area
- understanding the motivation for travel to experience beyond their everyday
- adding value to existing attributes to help diversify the local economy
- respecting natural and cultural values
- achieving conservation outcomes – mutually beneficial alliance between tourism and conservation
- tourism development to interpret natural, social, historic and ecological features
- achieving excellence and innovation in design
- providing mutual benefits to visitors and hosts
- building local capacity and collaboration with the community.

In the cultural landscape, the combined knowledge of community and visitor held landscape values, combined with conservation principles for natural and historical features, support well designed infrastructure and interpretation materials implemented by the local community.

### **Outback Communities Authority**

The Outback Communities Authority (OCA) was established in 2010, out of the Outback Areas Community Development Trust, to support and manage public services and facilities to outback communities and as a communication forum for outback views and aspirations. Overseen by a Board comprising outback residents, the OCA considers and advocates for the maintenance, replacement or development of infrastructure for public use through the community, and in State and national forums. Their Strategic Management Plan 2011 – 2015 identifies the following issues for outback people including: increased mining and tourism activity, planning and policy development and standards of infrastructure provision, availability and capacity of community volunteers, and fundraising capacity (OCA 2011, p.7). OCA's relevant priorities are to:

- build and maintain relationships with people who live and work in the outback.
- articulate the views, interests and aspirations of outback communities to policy and decision makers.
- manage the provision of public services and facilities to outback communities.
- promote and facilitate improvements in the provision of public facilities and services to outback communities.
- support outback people in their community development aspirations

## 2 THE COOPER CREEK CATCHMENT AREA: SOUTH AUSTRALIA OVERVIEW

### 2.1 Scope and inventory: catchment overview

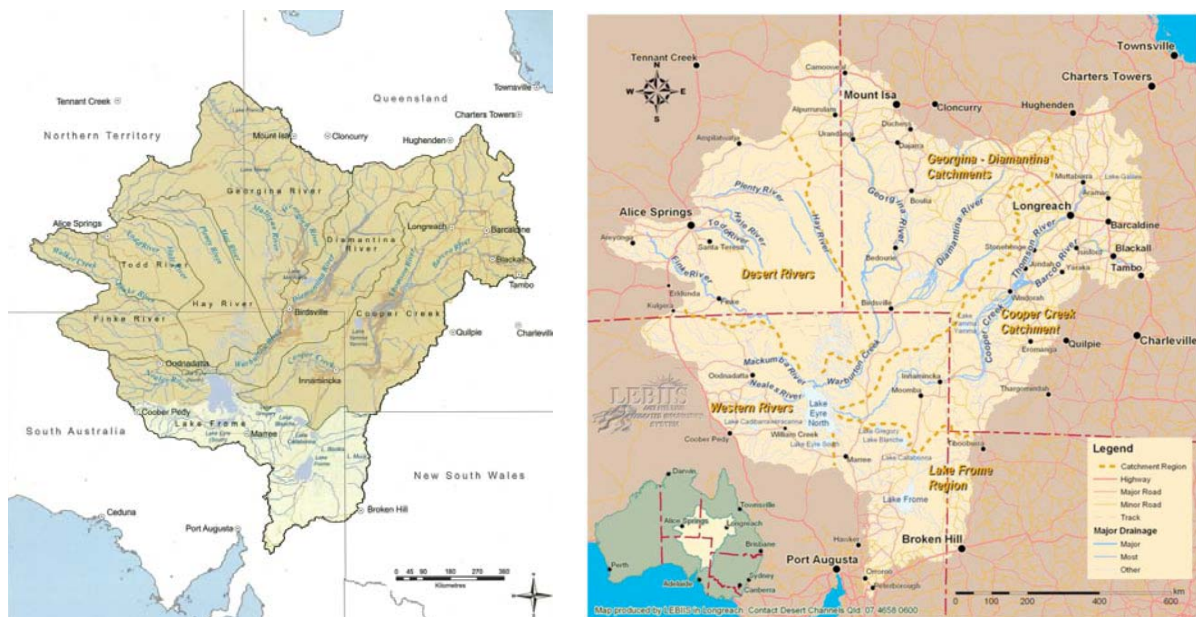


Figure 2.1.1 Lake Eyre Basin (LEB): Cooper Creek and other major river systems flowing westerly from Queensland towards Lake Eyre North, South Australia. Source: Australian Government DEWHA 2010 and the location of the Cooper Creek Catchment in relation to the LEB major river catchment areas. Source: LEBIS Desert Channels Queensland.

The Cooper Creek Catchment (SA Section) is located in the Channel Country and Sandy Deserts Simpson-Strzelecki Dunefields bioregions of the Australian rangelands, encompassing the major river system that rises in the northeast of Queensland, crossing into South Australia to eventually drain towards Kati Thanda-Lake Eyre. Channel Country landscapes are characterised by the huge drainage system of braided streams and their waterholes, shallow wetlands, flood-outs and longitudinal dunes. Below Lake Hope the braided channel system gives way to a single meandering Cooper Creek channel, extensive floodplains, gibber country and saline lakes, until it joins the eastern margins of Lake Eyre North. The North West Branch of the Cooper Creek forks to the north beyond the Innamincka complex of waterholes to flow into the Coongie Lakes wetland system.

During extreme wet times, as witnessed in 2010, 2011 and into 2012, the river system transforms into vast interconnected wetlands and lakes. Vegetation associations along creek lines, swamps, floodouts and dunefields include; Coolibah and River Red Gum woodlands, Lignum, saltbush and chenopod shrublands, and seasonal grasses dependent upon saline or non-saline conditions. The Strzelecki Creek diverges from the Cooper Creek at Innamincka and flows southwards through the dunefields and sand plains of the Strzelecki Desert. This sparsely populated country consists of low shrub and grasslands cut occasionally by the meandering and usually dry Strzelecki Creek.



The diverse geology of the Cooper Creek and the 35,000 square kilometre Cooper Basin region is seen in the changing landforms from the Channel Country river systems, swamps and wetlands in the north-east to the Sandy Deserts dunefields, playa lakes, dry creeks and floodplains to the west along the Cooper Creek to the Stony Plains gibber plains and stony plateaux towards Lake Eyre. Over 500 million years the various layers set down during cold and dry periods were interspersed by warm and wet times with forest growth, lakes and swamps. The oil and gas seams and mudstones of the Cooper Basin resulted from the deposits of these warmer times. The sandy dunefields developed during arid and windy drier times through lake evaporation that exposed significant limestone sheets. (Krieg, et al, 1990)

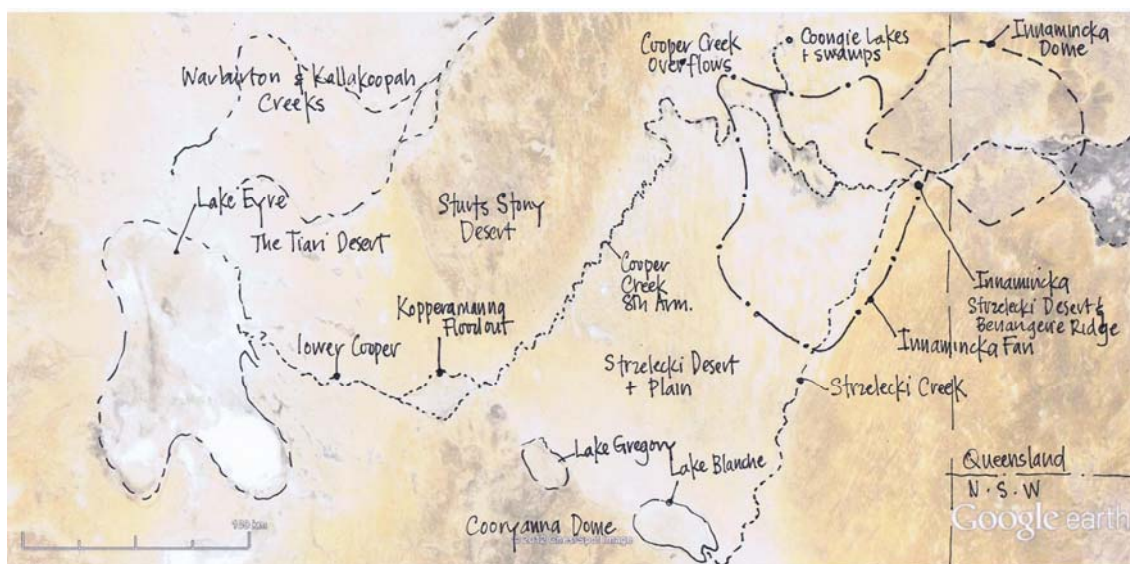
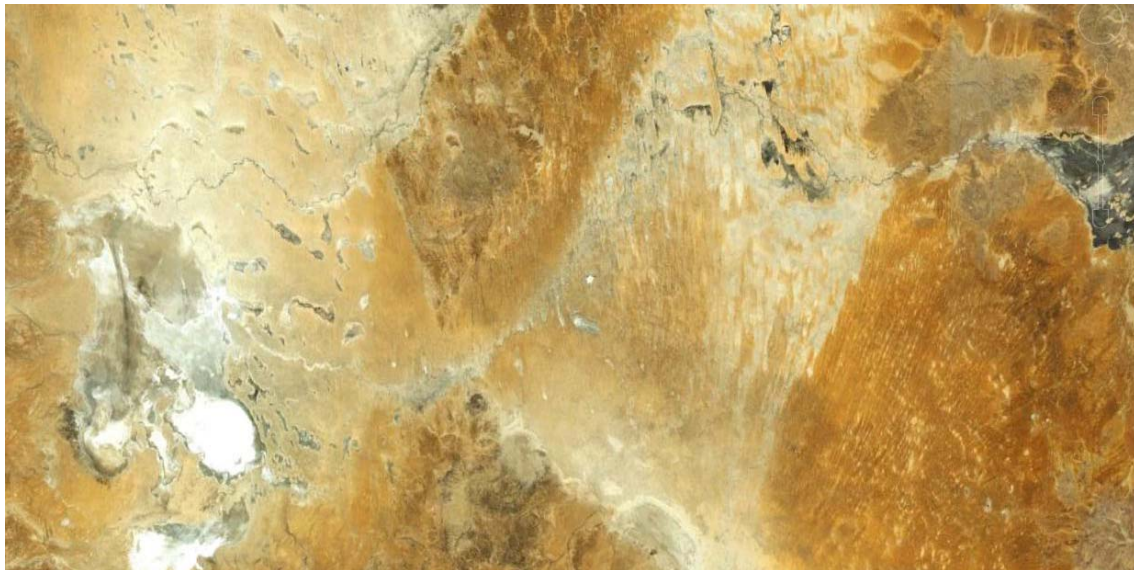


Figure 2.1.2: Cooper Creek Catchment (SA Section) stretching from beyond the Queensland border to North Lake Eyre indicating the Cooper Creek Channel, major geological and landscape features and named places. Source: Google Earth, November 2011

Aboriginal occupation by the Dieri and the Yandruwandha and Yawarrawarrka peoples over thousands of years pre-dated these modifications to the landscape; they introduced a range of fire and localised water resource management practices that have subtly modified the landscape and, over time, built up layers of knowledge of land and aquatic systems. The

landscape comprises multiple cultural sites, particularly associated with waterholes, lakes and wetlands and their nearby dunes. Movement through the landscape is directed by roads and tracks following creek lines across floodplains or linking a sequence of saline lakes particularly to the west. Water places are frequently named in both Aboriginal and non-Aboriginal language, which provides rich interpretation of the relationship between the environment and its use over many years.

Although land use is predominantly designated as pastoral leasehold, with mainly cattle production on the floodplains, the study area is also characterised by extensive mining through gas or oil exploration and extraction operations in the Cooper Basin. Once extensive pastoral leases, the Innamincka Regional Reserve, Coongie Lakes National Park and the Strzelecki Regional Reserve are now co-managed for conservation by the SA Government, yet also support a range of multiple-use activities including pastoralism, mining and tourism.

The Birdsville and Strzelecki Tracks are the major north-south communication routes with the landscape between crossed by fence lines, tracks, communication and mining exploration lines, often building upon routes established by early exploration and pastoral activities. The only permanent settlements beyond Innamincka and Moomba on the Strzelecki Track are pastoral homesteads and a number of ruins of early settlements defeated by drought are marked and interpreted along the Tracks. Semi-permanent mobile mining camps now dot the designated mining areas to the east and west of Innamincka, linked by good quality unmade roads.

Limited water has concentrated use and occupation around waterholes and the floodplains, with the development of bores and dams as reliable water supplies. Subsequent degradation around these waterholes and bores from grazing, feral animals, and tourism, has resulted in erosion, compaction, tracking, and loss of vegetation and native animals across the Cooper Creek Catchment.

The interaction between water availability and human existence in the desert environment is the central story of the Cooper Creek Catchment landscape. Due to the unreliability of water, particularly in the western reaches south of Lake Hope and adjacent the Birdsville Track, and across the floodplains, dunefields and swamps that support mining, the predominance of ground water rather than surface water use is notable. Large borrow pits and tailings ponds associated with mining sites and roads now provide additional water resources for fauna and some human use. After rains and floods these remnant pools may survive for lengthy periods.

The Cooper Creek system channels, waterholes, wetlands and lakes are the major focus of this landscape assessment study, which identifies and classifies the range of landscape character types in the area. The other major focus is the extent and type of human interaction with, and occupation of, the landscapes associated with the various waterbodies that connect with the river. This assessment focuses on landscape assessment of the following aspects of the Cooper Creek catchment:

- general review of the landscape qualities of nominated Cooper Creek aquatic systems and associated cultural occupation and uses,



- permanent and semi-permanent waterholes located along the Cooper Creek channels from Nappa Merrie in Queensland, and from Cullyamurra Waterhole to Tilcha Waterhole - nominated the Innamincka Complex in this report, and important to pastoralism, Aboriginal cultural practices, tourism and mining,
- the wetlands and campsites of the Coongie Lakes, Kudriemitchie and Coongie, subject to conservation management and tourist visitation,
- the ephemeral Lakes Hope (Pando) and Lake Walpayapeninna (Red Lake) as productive lakes, and
- the saline lakes of the lower Cooper Creek west of the Birdsville Track, in particular Lake Killalpaninna and in association Lake Kopperamanna as cultural and heritage places.

## 2.2 Landscape and water typologies

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The Birdsville and Strzelecki Tracks trace a range of landscape character types and land use typologies. Waterholes and wetlands are the places most impacted by the overlay of various activities including grazing, mining and tourism. The ephemeral lakes provide focus for cultural and tourism activities, with some pastoral use. However, due to their intermittent water supply and remoteness from easy access to the major tracks, they are locally important recreation sites, unless they are major historic sites, such as at Lake Killalpaninna. Aboriginal cultural practices and recreation, pastoral uses, and tourism visitation and general recreational activities such as fishing and 4WD journeys, all coincide at the waterholes. The range of activities may have existed over time but the impacts on these places intensify with use. The visible effects of their cultural use on their ecological health are mapped in this research.

Two South Australian government publications seek to describe the landscape types of the Cooper Creek region. The Atlas of South Australia describes Region 8.4, The Lake Eyre Basin Environmental Region and its environmental associations and the South Australian Arid Lands Biodiversity Strategy (2010) describes the bioregion attributes and land uses including identifying major threats. These two references comprise the base information for the overall landscape typologies from which the terminology of this landscape assessment is sourced.

### 2.2.1 Landscape Typologies

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Figure 2.2.1.1 Strzelecki Desert Environmental Association 8.4.2, Cooper Creek Environmental Association 8.4.4, Stony Desert Environmental Association 8.4.6 Source: SA Atlas 2013

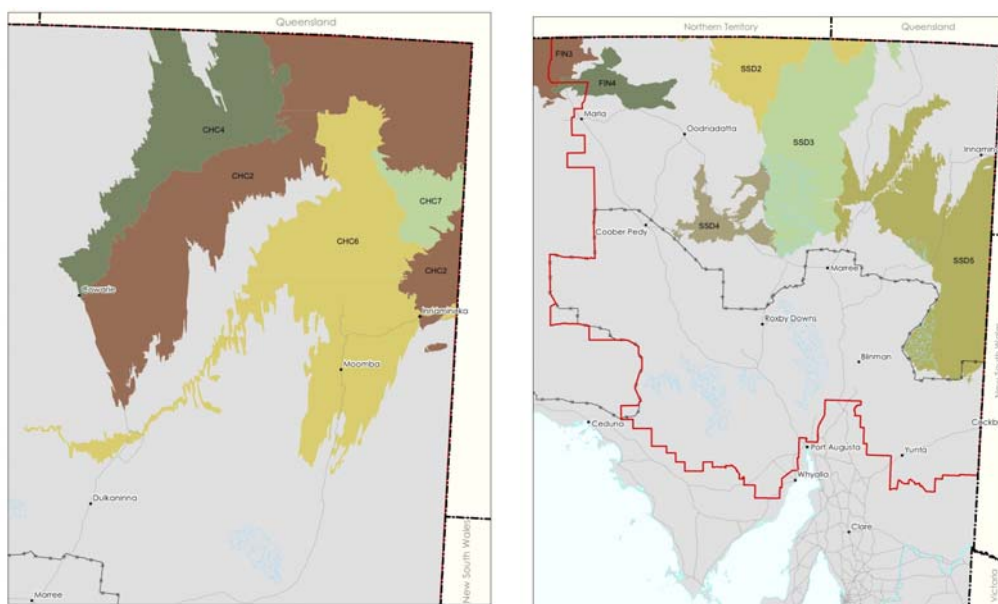
The Cooper Creek drainage system is part of a region of red sand dunes, concentrations of claypans, low stony tablelands and salt lakes and pans. The dunes are characterised by tall shrublands with understoreys of grasses, whereas the claypans have diverse vegetation of grasses and chenopods according to soils, salinity and flood frequency. Woodland communities fringe the creeks, drainage lines and waterholes with *Eucalyptus* and *Bauhinia* species naturally occurring. The high dunes enable a variety of views over the surrounding landscapes while interdune corridors provide detailed perspectives on the vegetation associations that change markedly from wet to dry seasons.

Of the Lake Eyre Basin Environmental Region's range of environmental associations four are specific to the Cooper Creek Catchment study area:

- Strzelecki Desert (Environmental Association 8.4.2): An extensive very low continental dunefield with numerous small claypans with low chenopod shrubland, hummock grassland and grassland.
- Cooper Creek (Environmental Association 8.4.4): An extensive very low continental dunefield of parallel dunes and interconnected claypans subject to flooding by the Cooper Creek. A mixed cover of chenopod shrubland, tall shrubland, hummock grassland, grassland, and fringing woodland.
- The very low duricrusted tablelands of the Stony Desert (Environmental Association 8.4.6) comprise undulating gibber pavements, occasional dunes and small isolated silcrete-capped mesas. Low shrubland, grass understory or low open woodland vegetation. (SA Atlas, 2013)

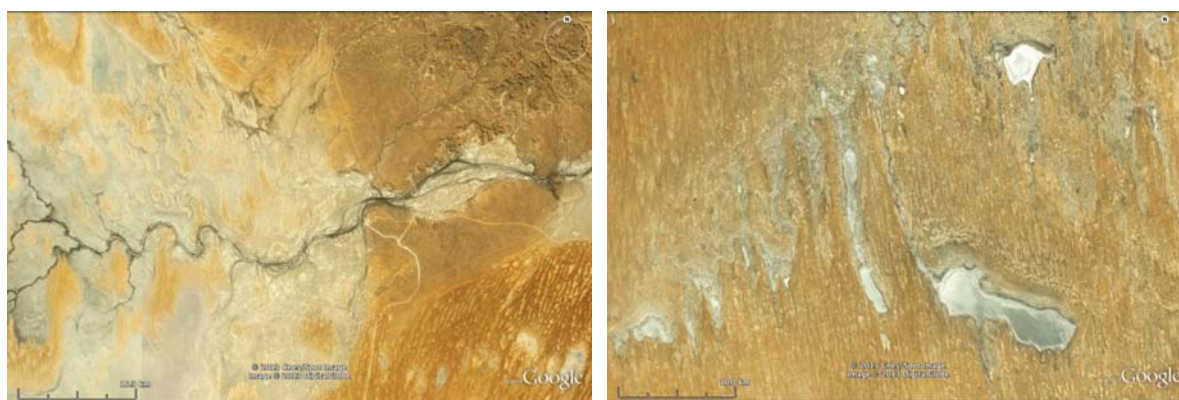
The Channel Country bioregion previously described in 2.1 also comprises Interim Biogeographic Regionalisation of Australia (IBRA) subregions of which the Sturt Stony Desert (CHC2) and the Coongie (CHC6) are relevant to the study area. The Sandy Deserts bioregion IBRA comprises the Strzelecki Desert (SSD5) and Dieri (SSD3) subregions. These classifications also note the land systems descriptions drawn from District Plans. In summary the landscape typologies of these areas are:

- Sturt Stony Desert (CHC2): undulating gibber plains supporting Mitchell Grass and Bladder Saltbush, occasional swamps, scattered long red sand dunes
- Coongie (CHC6): Coolibah-lined watercourses, waterholes, channels, floodplains and ephemeral lakes of the Cooper and Strzelecki Creeks, dunefields and periodically flooded interdune flats. (South Australian Arid Lands Biodiversity Strategy, Vol.2, p8, 2010).
- Dieri (SSD3): extensive dunefield and claypans grading into a large playa complex of salt lakes, gypsum dunes. The surrounding plains exhibit channel and dune systems.
- Strzelecki Desert (SSD5): extensive dunefield, numerous small claypans, a chain of interconnected salt lakes with gypsum dunes (South Australian Arid Lands Biodiversity Strategy, Vol.5, p8, 2010).



### 2.2.2 Water Typologies

Seven types of waterbodies present in the Cooper Creek study area are outlined below according to variously published definitions arising from SAAL NRM publications in order to achieve consistency in terminology. This study is focused on surface water systems, which include water flowing over land as a result of rains from within the Cooper Creek Catchment. The results of such rains are captured in waterholes, wetlands and in the artificial dams and ponds associated with pastoralism and mining. However, the existence of human occupation in the dry northeast of South Australia can only be maintained through groundwater extraction from subsurface aquifers and the GAB flowing into bores, tanks or wells. It is in the interaction of the (unreliable) surface water and (reliable) groundwater use and management upon which the cultural landscapes of the Cooper Creek community rely.



## Watercourses: Rivers and Creeks

Cooper Creek watercourses are typified as natural watercourses; rivers, creeks, braided channels, extensive floodplains (often kilometres wide), lakes through which water flows,

and permanent or semi-permanent waterholes in the deeper sections of river and creek beds. Over the course of seasons that can be described through wet and dry conditions often encompassing numbers of years, these watercourses are more usually dry with intermittent areas of remnant water. In South Australia watercourses and wetlands are designated for the purposes of the NRM Act 2004, a Development Plan under the Development Act 1993 or by an NRM plan. (SA Arid Lands Natural Resources Management Board 2010)

### **Waterholes**

Fresh, semi-saline or saline waterholes are located in the deeper and wider sections of the multiple channels of ephemeral rivers and creeks. They are surface fed, by local rainfall, through overland flows from associated hills and sloping plains, or as a result of flooding, they are characterised by a range of bank and riparian conditions. Generally easily identified through aerial survey in the dry, they are often concealed from view by riverine vegetation and topography or under flood conditions. Evidence of occupation is generally limited but may include pastoral and road based infrastructure and tourism campsites and facilities. The few permanent waterholes and their banks are important refuges for humans, fauna and flora and are often held in high cultural regard.

### **Wetlands**

Wetlands comprise land that is saturated permanently or seasonally inundated with water and takes on the characteristics of a distinct ecosystem with characteristic vegetation adapted to local hydric soil conditions. Wetlands may be fresh to saline where water inundation promotes biological diversity, water purification and flood control. In the Sandy Deserts, semi-permanent wetlands provide refuge areas for survival during dry periods, supporting the animal and plant life that normally inhabit the adjacent dunefields and sand plains. Artificial wetlands for water quality and local water use have been established in conjunction with the Moomba mining settlements.

### **Lakes: playa, watercourse and saline**

Dry or playa lakes are ephemeral lakebeds or the remnants of an endorheic, terminal or closed lake system that allows no outward flow of water into other drainage regimes. Such lakes are often very wide but are characteristically shallow depressions in the surface of the landscape. Watercourse lakes are wide, shallow basins also connected to the channels of the larger river systems but allowing flow maintenance from flood events further up the system. They may retain freshwater status for longer as they are not closed systems and can be replenished through river and creek flows of sufficient amplitude. Fresh water from local rain or the greater Cooper drainage system flooding collects in these fine-grained sedimentary depressions, and evaporates over time through sun and wind action leaving surface salt to form salt pans.

### **GAB bores**

Artesian water is extracted under pressure through drilled wells to underlying rock layers and tapped to provide some management of water delivery. Pastoral and/or mining infrastructure such as yards, machinery and tracks are associated with bores. Mining operations, homesteads and townships rely on local bores and associated water storage infrastructure. These bores are often named according to proximity to the settlement or original pastoral or mining lease.

## **Dams**

Constructed dams comprise a deeper, usually circular or square, formed waterhole surrounded by extensive walls that rise above the surrounding landscape. Dam walls are usually un-vegetated and may be formed by materials adjacent or distant to the site, which provide contrast to local soils. Outback dams either stand alone in the landscape in relation to drainage lines to capture rain and overland flows or are situated in river channels to capture river flow. Frequently associated with water management infrastructure, such as windmills and tracks, they are artificial incursions into the natural landscape character.

## **Water Infrastructure: tailings ponds, borrow pits and wastewater**

Mining operations require soil for road making forming depressions along mining access roads and station tracks, which fill with water during rain and flood events thus providing ephemeral habitat for fauna and flora on the dune plains. Water that has been used or extracted for domestic or industrial purposes and is then discharged as waste may contain tailings ponds located adjacent mining infrastructure typically attract birdlife and local fauna and provide artificial habitat support.

## **Water for the environment and cultural water**

Water as a resource for outback natural and cultural communities includes 'all aspects of a water resource, including the water, organisms and other components and ecosystems that contribute to the physical state and environmental, social and economic value of a water resource' (SA Arid Lands Natural Resources Management Board 2010, p.17). The definition states that resource waters are watercourses or lakes, surface water, underground water, stormwater and effluent.

While not strictly typologies, the concepts of **environmental water** and **cultural water** are increasingly a component in the assessment of water systems and regimes for mining and other resource-based development. 'Water for the environment', also referred to as environmental flows include both surface and groundwater systems needed to provide sufficient water to sustain the ecological values of aquatic ecosystems, including their processes and biological diversity.

In Indigenous terms, water in the living cultural landscape is inseparable from land, people, ancestors and social relations' (Altman, 2009), and the concept of cultural water attached to place, networks and customary practice adds to the cultural mapping of Cooper Creek landscapes. While environmental flows are scientifically mapped and recorded, the idea of cultural flows - meaning the importance of sufficient quality waters legally available to support and improve traditional, healthy and economically beneficial lives – must be regarded as overlapping and not distinct qualities (Collings & Falk, 2008). Cultural flows include but are not limited to periodic flooding, recognising the primacy of the river, respecting connectivity between water, country and life and caring for places (Duff, 2011). The conception and management of cultural flows need ongoing custodianship and input of Indigenous people on their country.

## 2.3 Climate: flood and drought cycles

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The dominant narrative of the Cooper Creek area revolves around climatic conditions, the availability of water and the cycles of boom and bust typified by drought, flood and the recovery times between. Records since European settlement indicate that drought times are longer and more devastating to biotic inhabitation than the wet times. Predictions drawn from climatic change science combined with local records indicate long-term hotter and drier times for future years.

Climatic conditions range from hot summers (36-39 degrees C daytime) to temperate-cold winters (18-24 degrees C) in winter, and from prolonged droughts to periods of intensive flooding over extended periods. High evaporation exceeding rainfall, combined with often-windy conditions, contribute to the drying climate and affect maintaining healthy water, riparian and floodplain ecologies. Records of median annual rainfall are at the 100-150mm mark with high seasonal rainfall variability. However, in good years wetter summers may result in 450-500mm rainfall and drier winters recording 90-100mm. (Allan, 1990)

Local rainfall does not in itself provide sufficient water to flood the rivers and drainage lines to enable flows to the northern wetlands and downstream to the Lower Cooper Creek. Sub-tropical/tropical water flows from the Cooper's northern upstream tributaries feed the major river systems to replenish the Coongie wetlands, the Cooper Creek (SA Section) system waterholes and associated lakes, and the Strzelecki Creek, but in only the wettest years. For most of the time many of these riverine systems are characteristically dry sandy or stony creek beds interspersed with occasional permanent and semi-permanent waterholes.

Large flood events are clustered around the phasing of El Nino Southern Oscillation (ENSO) events and catchment processes and flood regimes result in locally specific water quality, intensity and floodplain inundation events. For example, waters in Coongie Lakes become warmer and more transparent over successive floods and therefore more productive in terms of fish and bird visitation and breeding (Reid, 2009, p101).

The relationship between rainfall upstream and catchment and runoff processes downstream impact upon fish production and hence bird populations. In years of successive floods waterbirds including ducks and pelicans that depend on extensive river, floodplain and lake systems are drawn inland to the ephemeral and freshwater lakes.

## 2.4 Relevant research and policy frameworks

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There are a number of programs that have direct reference to community involvement and landscape and tourism management in the region.

### **The Lake Eyre Basin Intergovernmental Agreement (2011):**

The Ministers' report to the LEB community confirmed the 'need to maintain the important environmental, social and economic values associated with the Lake Eyre Basin'. (Lake Eyre Basin Inter-governmental Agreement, October 2000). The focus of the agreement is the 'sustainable management of the water and related natural resources associated with cross-border river systems in the Lake Eyre Basin to avoid downstream impacts on

associated environmental, economic and social values.’ It notes guiding principles for action noting the intersection of ecological, pastoral, cultural and tourism reasons, as key drivers towards a precautionary approach to management based upon local knowledge. Key programs established under a five year action plan relevant to the Cooper Creek Catchment include:

- The Lake Eyre Basin Rivers Assessment (LEBRA) is a program to review the condition of all watercourses and catchments within the Agreement Area. Under a 3-year program it is monitoring the condition of the catchments, including the rivers, floodplains, overflow channels, lakes and wetlands in the area. The need for ‘strong stakeholder engagement and effective collaboration’ is highlighted.
- A Strategic Adaptive Management approach to the LEBRA, based on three key foundations: ‘the long term nature of the LEBRA (requiring reporting every ten years), the conviction that monitoring should lead to real management decisions, and the clear need to partner with key stakeholders’. (LEBMF, 2011)

The Lake Eyre Basin Ministerial Forum of 2010 undertook a series of community workshops that confirmed a number of key messages:

- the importance of retaining natural flow patterns across the Basin,
- the importance of Aboriginal and other community stewardship,
- the continuing need to transcend jurisdictional boundaries in favour of natural/cultural units, and
- the need for decentralised regional leadership, governance and participatory processes that favour preventative and proactive management for long-term social/environmental goals in preference to reactive management for short-term economic goals. (LEBMF, 2011)

### **SAAL NRM Strategy for Aboriginal Partnerships (2013):**

Everybody’s land: a strategy for Aboriginal partnerships in the South Australian Arid Lands Natural Resources Management Region is a draft report that acknowledges the country of the Traditional Owners of the cultural landscape of the Cooper Creek. Key aspects of the Strategy include developing foundations for effective partnerships in natural resources management for SAAL NRM programs on arid lands landscapes. Guiding principles commit to effective partnerships through 8 principles:

- Aboriginal people have rights and responsibilities for traditional lands and waters
- Aboriginal cultural diversity, knowledge and obligation to country is acknowledged, respected and incorporated into decision making
- Information and knowledge regarding natural resources management will be shared and communicated in a culturally appropriate way
- Adequate time will be allowed for genuine and meaningful participation
- Adequate support will be provided for Aboriginal people to participate
- The partnership is based on fairness, equity and mutual respect
- The partnership is a learning process for all parties, and involves a long-term commitment
- Partnership initiatives and practices will be accountable within an overall integrated



approach to natural resources management consistent with the SAAL Regional NRM Plan (SAAL NRM, 2013, p4)

Strategies and objectives for implementing the plan include: building relationships through engagement and participation, partnership and capacity building through gaining skills and increasing cultural awareness, delivery and resourcing through agreed partnership models and establishing funded priorities, and governance and accountability through communication and relationship building with traditional owners and community leaders (SAAL NRM, 2013, pp5-6).

**Mining Company agreements and procedures:**

Acknowledging that the right to access the traditional country, subject to native title, of Aboriginal peoples for mining and exploration purposes, cultural heritage management plans are being developed and implemented through direct negotiation between mining companies and traditional owners in association with the oversight of the South Australian Government.

For example, Santos has published the *Procedure for Management of Indigenous Cultural Heritage Sites* manual for personnel and contractors, which establishes principles and on the ground guidelines for working with Aboriginal people towards cultural clearance of sites, and educating contractors in culturally appropriate methods. All mining and exploration companies operating in the area have developed cultural heritage procedures for working with Aboriginal traditional owners. Non-Indigenous heritage is less well understood in terms of published management policy.

**Wild Rivers Act 2005 (Queensland):**

The purpose of the *Wild Rivers Act 2005* is to

- a) Preserve the natural values of rivers that have all, or almost all, of their natural values intact: and
  - b) provide for the preservation of the natural values of rivers in the Lake Eyre basin.
- (Wild Rivers Act 2005 p.5)

In summary the Act includes definitions and declarations of areas that include high preservation areas, preservation areas, floodplain management areas, special floodplain management areas and sub-artesian management areas. It seeks to minimise the effects of development and the taking of natural resources from wild rivers to 'preserve the wild river's natural values' (Wild Rivers Act 2005 p.5 p6)

It further establishes that wild rivers and their catchments are to be treated as a single entity (section 3(c) and therefore for the Cooper Catchment the *Act 2005* confirms that the regulatory framework for the ongoing health of the system that transcends state boundaries. This is specifically noted in section 3(f) in terms of encouraging the 'preservation of the wild river's natural values in the other state' (Wild Rivers Act, p.5 p6).

In developing a wild river declaration section 14 of the *Act 2005* confirms the information that must be provided including: description and maps of the river, its tributaries and its area, its natural values for preservation, special features, locations of specific preservation areas, floodplains and their management, sub-artesian systems and their management, the nomination of activities and taking of natural resources, water availability and management,

threshold limits and vulnerable plant species. It specifically also covers the need for information on types of works that interfere with overland water flow in the floodplain management area, and the types of works for taking sub-artesian water in designated management areas.

Recent proposed amendments to review and/or repeal certain provisions of the *Act 2005* in relation to the Cooper Creek and Georgina and Diamantina Wild River declarations (as of February 2013) have been published by the Department of Environment and Heritage Protection for the Queensland Government. In summary the amendment are to “ improve safety for remote workers and provide greater efficiencies for petroleum and gas companies whilst maintaining environmental standards within the river systems” (cooper-gd-amend-fact-sheet, 2013).

The original policy states it is intended to ensure protection of the high preservation areas (HPA) and special floodplain management areas (SFMA) and therefore to allow only limited petroleum activities to be undertaken in these areas. The extent of the proposed amendments appears to be limited to mining interests as no mention of other community interests such as pastoralism, Aboriginal native title interests or tourism are included in the information document. Concessions allow for more extensive workforce accommodation, expanded areas for multi-well sites, increased fuel storage and compression facilities and pipeline infrastructure within HPA and SFMA areas.

The proposed amendments to the *Wild Rivers Act 2005* have garnered both local and national community support, and in equal measure, concern, in terms of the impact upon the natural and cultural landscape and the communities and economies who live and work in these arid environments subject to extreme climatic change. The planning mechanisms afforded by Wild Rivers declarations over the Cooper Creek and its catchment seek to limit big development such as dams, irrigation and mining in river systems further upstream into the Queensland section. Additionally Aboriginal cultural practices such as fishing in waterholes rights are explicitly protected and not restricted. Concerns raised by landholders, traditional owners and communities include a lack of protection against irrigation, mining and CSG extraction on leasehold and private land, and concerns for water quality and supply.

Areas which would be most likely to be affected by upstream extraction and management of surface water include the Ramsar nominated wetlands of the Coongie Lakes and the North West Branch of the Cooper Creek, and the eastern string of waterholes and river and floodplain systems from Nappa Merrie on the Queensland South Australia border to the Innamincka Complex to the west.

Three heritage and tourist driven research reports are particularly pertinent:

**Lake Eyre Basin Heritage Tourism Future Directions Summary Report (2003, 2010):**

This 2003 report and its subsequent review in 2010 advocate a heritage tourism approach to outback tracks. It does not specifically focus on the Cooper Creek, or the Birdsville or Strzelecki Tracks, but confirms that tracks are cultural routes that often follow traditional communication lines, tracing settler and Indigenous histories, which include the ongoing need for access to water and sites that exist due to the presence of water.

Key outcomes addressed in the report include:

- manage access onto pastoral leases, tracks and sites
- improve roads and associated infrastructure development along tourism flow lines, including protocols for informing of road closures in times of rain
- develop protocols to manage the environmental impacts of tourism on water quality and water-dependent ecosystems
- integrate tourism and natural resource management processes to manage natural assets
- nominate key sites to the National Heritage list of places with outstanding heritage value
- preserve natural and cultural heritage values
- develop an outback 'sense of place' through appropriately designed infrastructure
- plan and coordinate effective priority projects including waste management strategies, sustainable management of campfire use, awareness of noxious weed movement
- maintain and further develop inventories of historic heritage assets and prioritise key historic heritage sites for restoration and interpretation
- develop Aboriginal tourism and mentor new enterprises including protection, access and management of Aboriginal sites open to the public
- improve interpretation and provide information about heritage places and travel routes online
- support people and products through on the ground officers and internet-based programs.

The single focus for the Cooper Creek area is the designated high priority place for listing is the Innamincka/Cooper Creek Heritage Precinct. Based upon community consultation feedback, Priority 1 recommends the need for a consolidated and holistic approach to dealing with tourists. Long term plans for infrastructure, housing, power, waste disposal and water supply are necessary alongside improved interpretation and communication plans. Priority Project 4 - Telling the Aboriginal Story and Priority Project 5 – Travelling Tracks are highly pertinent to the Cooper Creek area although no direct proposals have been put forward in this plan (Earthcheck, 2010, pp28-30, Econsearch, 2008).

#### **Flinders Ranges & Outback SA Region Integrated Strategic Tourism Plan (2008–2014):**

The plan discusses key attributes and themes, and the need to conserve and protect arid rivers and associated waterholes as tourism assets. It advocates building infrastructure at popular destinations and developing environment management frameworks at areas of high conservation value such as on the Cooper Creek. Appropriate activities are noted: walking, fishing (with proviso) and driving on 4WD tracks only; and the impacts described: erosion, trampling, littering, imported animals, disturbance of sediment and fish stocks. Camping in these areas is not covered in detail.

Despite a general lack of detailed focus on the Cooper Creek area, it does recommend boat cruises on Cooper Creek, which have commenced again in 2012, after previous operations had closed for reasons including drought and subsequent lack of enough water. It is possible to extrapolate FROSAT recommendations in line with tourism activities associated with waterholes and their landscapes. Supporting night and dusk activities is seen as a driver for visitors to meet local people, and developing information to increase knowledge of geological and cultural heritage are also priorities. The use of new technology to support increased access to places off the main routes and tracks and to build itineraries that match

travellers' interests to the available experiences is both an opportunity and a threat to fragile water holes which have remained in healthy ecological and cultural condition due to lack of visitation FROSAT suggests that this opportunity could be piloted by working with existing operators on the Birdsville Track. The final recommendation is to 'Continue to develop the interpretive facilities associated with rail, mining, pastoral and other aspects of our regional heritage' (URPS, 2009).

### **The Birdsville and Strzelecki Track Heritage Survey (2002):**

This substantial study provides an inventory of national, state and local heritage places based upon the built architectural and settlement planning of heritage places along the Birdsville and Strzelecki Tracks. Places of natural significance or Aboriginal cultural sites are also nominated but are less represented. The Survey was carried out on 110 properties in a 50 kilometre corridor either side of the Tracks with the objective to make recommendations about potentially significant places for national, state and local heritage listing. It identifies heritage themes and tourism itineraries connecting heritage places and includes a comment on the application of multiple place names and spellings in relation to the use of Aboriginal languages with multiple spellings and European nominations of places. Places nominated in the study area include: Burke and Wills Site on Cooper Creek, Strzelecki Creek, Kopperamanna Mission Site, Strzelecki Creek State Heritage Area, Coongie Homestead Ruins, Kudriemitchie Outstation and Innamincka No 1 Well.

This review of the survey summarises the key themes in relation to issues regarding the management and conservation of water places. A century ago, the population was more dispersed, yet permanently settled in the area, with greater diversity of industries than in the now more concentrated and mobile environment in which we exist.

The Australian Historical Themes, as adopted by the Australian Heritage Commission, are listed as an historical tool to evaluate the historical evidence and field surveys into a coherent narrative. The Survey describes in detail the historical attributes that support application of the following historical themes to the Cooper Creek study area. Brief summaries here link the themes to aspects of water use and cultural appreciation of the landscape.

*Historic Theme 2.1: Living as Australia's earliest inhabitants* in relation to the networks of Aboriginal peoples who have lived in and travelled trading and communication routes over time. The sparse occurrence of semi-permanent waterholes in major creek is noted.

*Historic Theme 3.3: Surveying the Continent* identifies The Explorers: South Australia who found the strategic water resources of the region in the permanent waterholes of the Cooper and Strzelecki Creeks, despite focusing the hoped for waters of the inland lakes.

*Historic Theme 3.5: Developing Primary Production* includes the records of the Early Pastoral History and their endurance over good times and drought. The presence of reliable water and effective management skills allowed certain pastoralists to prosper while others abandoned their properties.

*Historic Theme 8.6.7: Running Missions to Australia's Indigenous People* documents the history of Killalpaninna and Kopperamanna Missions and their settlement in proximity to the large ephemeral lakes from which they drew their Dieri names.

*Historic Theme 2.6: Fighting for Land* relates the conflict between explorer, settler and Aboriginal people in competition for scarce water and food resources, particularly as stock were moved into places of reliable water and drought conditions exacerbated already limited supplies.

*Historic Theme 3: Moving Goods and People* documents the extensive routes taken across Australia in moving stock from fattening lands to market, requiring reliable watering points at regular intervals. The Strzelecki Track was a long distance route requiring movement from waterhole to waterhole along the Strzelecki Creek, influenced by the location of a railhead at Farina. The Birdsville Track historically is recorded as providing sufficient water for stock, however the provision of artesian bores supplemented natural watering places and enabled the route to be straightened out. The use of camels over horses occurred due to their adaption to arid conditions and their need for very little water.

*Historic Theme 4.5: Making Settlement to Serve Rural Australia* discusses the history of Innamincka due to its strategic crossing point of Cooper Creek and proximity to permanent fresh river water. Oil and gas discovery at Gidgealpa revived the town's fortunes after 1963. The survey relates the evidence of Chinese market gardeners providing fresh produce on the alluvial soil of river flats beside reliable waterholes, including a Chinese eating house at Innamincka.

*Historic Theme 3.11: Altering the Environment* discusses water, bores and pests in relation to the utter reliability of the pastoral industry on water. The silting of natural water holes due to intensive stocking and grazing along river and creek banks required the sinking of wells. The survey documents the problems associated with wells, salinity and the water table. The distinction between a well – usually dug by hand and shallow and bores that utilised drill rigs to tap into deep artesian waters. Pests, such as rabbits and drought reduced the landscape to an eroded and devastated countryside, exacerbated by large stock numbers, while dingoes flourished with new food sources supplied by the rabbit population.

*Historic Theme 3.5: Developing Primary Production* principally discusses the development of the Sidney Kidman empire in the fattening country of the Cooper and Diamantina channels and floodplains.

*Historic Theme 3.16: Struggling with Remoteness, Hardship and Failure* states that the most common cause of premature death was thirst and dehydration. During floods and wet times, people were often drowned in flooded creeks, suffered fevers or were isolated for months, whereas in drought times water supplies turned stagnant, with loss of human and animal life as the result.

*Historic theme 3.4: Utilising natural resources* traces the development of the oil and gas industry and the establishment of Moomba in 1969 as the first new settlement in the area since Innamincka in 1890. The fragility of the desert was exposed in the bulldozed shot lines, clearly observed from outer space, the damage to historic sites and poor

environmental practices, have been improved to now embrace 'sustainable production and environmental and cultural management regimes'. The survey does not mention of the need for water extraction to support mining operations and attendant township requirements.

*Historic Theme 3.8.7: Building and Maintaining Roads* relates the terrible conditions of the Strzelecki Track crossing over the Cobblers<sup>1</sup> prior to mining related road building and energy infrastructure, which at first bypassed the town of Innamincka. Following the massive floods of 1974, new road alignments and pipeline location resulted in new roads, which now cut across flood and dune plains. The outcome for water systems being that in some areas natural flows are interrupted and increased use of water is necessary to maintain the once pastoral roads that now are specified for constant industrial transportation.

*Historic Theme 3.23: Catering for Tourists* suggests that outback exploration by tourists and 4WD and navigation technologies enable recreation visitation and attendant economic benefits to townships as places for shelter, information and supplies (Historical Research, 2002, pp. 17-87).

The survey summarises the three staple modern industries as pastoralism, mining and resource extraction and tourism linked to land conservation and appreciation of the natural environment, noting that coordination across the three potentially conflicting activities is necessary to maintain a viable future for the landscape and communities of the region.

<sup>1</sup> The Cobbler Sandhills near Lake Blanche is a section of the Strzelecki Desert where the dunes are replaced by small eroded knolls, mostly with vegetation on the top. This area provided great difficulty for early attempts to cross the desert by car, and the name relates to the sheep which were the most difficult to shear, known as the "cobblers".

## 3 LANDSCAPE BASED METHODOLOGY

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### 3.1 Cultural assessment, landscape analysis and assessment and community engagement

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The general principles adopted for this landscape survey are drawn from a variety of methodological sources that embrace landscape ecology, landscape planning, landscape design and scenic assessment. They are underpinned by cultural mapping principles from other regions in Australia. The multidisciplinary nature of the project combines landscape assessment and design expertise in a collaborative process informed by a range of scientific perspectives used to assess the ecologies and geomorphology of the rivers, lakes and waterholes and their cultural associations.

The Cooper Creek Catchment project investigates the expanded landscape in a range of scales and qualities evident in the Channel Country, Sandy Deserts and Stony Plains regions of the Lake Eyre Basin. The site specific, local, regional and nationally significant attributes of this arid landscape contribute to the nomination of seven themes (Section 3.4) critical to understanding the dynamics and future threats to, and potential for, the area and its waterholes.

The structured method of landscape assessment for Cooper Creek rivers and drainage lines, waterholes, wetlands and lakes, links **description** of landscape systems, **classification** of a range of types and attributes, **analysis** of scenic, ecological, cultural and spatial landscape qualities, and overall **evaluation** of the regional landscape at a local scale. Community interaction with, and attitudes to, these waterbodies is presented through observations of built forms and traces of occupation informed by conversations with a variety of stakeholders and visitors during fieldwork.

In general, this methodology follows a hybrid of typical landscape assessment approaches in order to engage with scientific methods and findings.

**Landscape measurement** forms an inventory of the structural and visible elements in the landscape in scale, form, pattern and recognisable natural features and constructed infrastructure. Natural and cultural landscape systems are mapped as co-existing.

**Landscape values** are attributed through investigation and nomination of community value judgments for occupying landscapes. This study includes historical, recreational and commercial use values alongside ecosystem value in the natural landscape drawn from scientific fieldwork and evaluation.

**Landscape character evaluation** is a generally numerical score of the relative scenic amenity of the area in terms of individual or societal preferences for landscape types, in complexity, simplicity, degree of intactness, viewpoint, accessibility and consistency with local landscape character types.

The working methodologies for the landscape assessment of the Cooper Creek Catchment:

- identify the geographical region and extent of the stakeholder community

- review all previously known information and research in order to confirm existing knowledge and identify gaps
- propose themes for consultation based upon a cross-disciplinary approach including ecological, hydrological, landscape, heritage, pastoral management and tourism interests
- negotiate themes and information requirements across researchers and project managers
- establish ethics protocols for the landscape research component
- engage stakeholders in the scope and proposed outcomes of the project and invite their contribution, establish availability and method of consultation and feedback
- negotiate and confirm the research program based upon cross-disciplinary and layered methodologies
- develop a Cultural Landscape Assessment Matrix for the project based on the themes
- include science-based fieldwork methodologies, surveys and evaluations into landscape-based approaches to be work-shopped with the research team
- include a deep mapping methodology for landscape based literature review and fieldwork to ensure that the many layers of activity over time are mapped to inform perspectives on the cultural landscape
- develop a database of existing knowledge based upon stakeholder themes: pastoral, ecology, geomorphology, aquatic ecology, hydrology, tourism, heritage, mining, government and landscape
- establish a timeline for fieldwork consultation with stakeholders based upon survey aims and objectives
- determine the availability of stakeholders and provide preliminary information and briefing
- undertake fieldwork to record and assess the landscape character of a range of agreed waterholes and other waterbodies in relation to team research and places of focused natural and human interaction
- develop a graphic dataset of the results of consultations and field work around a series of annotated maps to scale for future overlay purposes
- disseminate the results of fieldwork back to stakeholders, researchers and project managers to consult on possible management approaches and landscape design strategies.

### **3.2 Literature review: cultural landscape assessment and design**

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An annotated literature review for the project focused on gathering the range of recording, testing, assessing and implementation methods employed by geographers, landscape architects, planners, cultural studies and heritage researchers, and by the stakeholders who operate in these complex landscapes. The methods analysis is developed from a detailed matrix-based annotated bibliography of cross-disciplinary methodologies for the cultural and ecological landscape assessment of arid areas water resources, arranged under the themes of Design, Planning and Landscape Assessment, Ecological/Scientific, Consultation, Cultural/Historical and Heritage/Interpretation. The literature review also collated various local, regional and state government environmental and strategic reports to assess the available data, and pertinent ecological, heritage and tourism research and management



projects completed for the waterhole and region. Determination of recognised terminology and description of the diverse range of waterbodies specific to the arid landscapes of the Cooper Creek (SA Section) is also an important component drawn from the literature and State Government strategy documents.

The useful summary of landscape assessment and evaluation methodologies in *Ecological planning A historical and comparative synthesis* (Ndubisi 2002) documents a range of conceptual and practical methodologies for ecologically based landscape assessment projects. Expanding upon Ian McHarg's well-known landscape suitability framework that overlays mapped natural features to determine fitness of land for a particular use (McHarg 1992), a number of alternative approaches were reviewed such as:

- the applied landscape ecology approach which investigates landscape structure evolution in relation to natural and human influences
- the scenic landscape values and perception approach which evaluates aesthetic values based on values and preferences derived from landscape experience
- deep mapping of layers of occupation to develop trace concepts approach (McLucas, 2001)
- cultural landscape heritage methods and guidelines to assess comparative significance.

Recording and mapping types and techniques, both formal and informal, are also collated to develop methods for how the region can be graphically represented for landscape character assessment and design approaches that can be easily interpreted by the range of stakeholders.

### 3.3 Landscape matrix, deep mapping and landscape assessment approach

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**Landscape survey fieldwork** should ideally be completed over an appropriate timescale, including return visits to disseminate information and to ground-truth the results of initial consultation. On-the-ground consultation maps local knowledge of the history, management systems, environmental, cultural, economic and management concerns of the variety of stakeholders. In effect, the range of stakeholders is asked to inform the process of drawing, diagramming, marking up and photography of waterholes and other particular places of interest. These recordings spatially and visually support talking about local knowledge, management regimes and concerns as the basis for a visualised approach to information gathering. Such surveys are ideally undertaken alongside the researcher/consultant in order to record current conditions, but this is often logistically impossible in remote areas due to timelines and the need for favourable weather. Equally, a historical perspective that includes gaining access to each stakeholder's personal records of conditions and systems from the past is made possible through conversations around kitchen tables, around waterholes and over maps.

**Deep Mapping** is a method through which the many layers of the physical and ecological landscape, and its occupation over time, can be mapped and represented. It draws upon historical approaches to mapping places to include oral history, stories, anecdotes and local knowledge 'to record the grain and patina of place...everything you might ever want to say about a place' (Shanks and Pearson, 2001). Further, Clifford McLucas posited a number of

elements to be followed when making deep maps about places. He suggests that deep maps should be:

- responsive to large scale elements in the landscape,
- be slow moving at the speed of landform or weather,
- record places using graphic, time based video and database components
- engage with locals and visitors
- collaborate across science and art, amateurs and professionals, national and local perspectives
- challenge conventional cartography to use new methods to document people and places
- be open to change and negotiation with people and places (McLucas, 2001)

The collection and collation of the information from consultation, literature review and fieldwork is a complex task, which requires both text and graphic information to be read simultaneously. The landscape assessment documentation methodology employs a matrix based approach where the layers of information and interaction can be added to the Cultural Landscape Assessment Matrix. The matrix is composed of two sections and is used in the field to both document landscape characteristics at each site and to collate other verbal and literature based information.

The Cultural Landscape Assessment matrix documents activities and interests at each waterhole or waterbody site and locates them within a grid reference system. The first matrix grouping is organised vertically by stakeholder group sections (Chapter 5). These are the active participants to be consulted on the active agents of the landscape, the biota and their elements. The horizontal organisation includes activities such as pastoralism, tourism, local amenity, aquatic ecology, hydrology, geomorphology and landscape, Aboriginal cultural, mining, heritage, government and other. Additional, existing interpretation, documentation, specific qualities, impacts and change over time and management regimes where they exist are also noted. This simple and repetitive organisation tool enables cross-referencing of activities and interest groups for each site in relation to landscape attributes to evaluate the range of stakeholders involved in future management approaches.

The detailed site analysis matrix is used to record the landscape elements of each site through notes, sketches and photographic imagery in the layers:

**Form:** Scale, Structure, Topography

**Riparian zones:** Types, Qualities, Materials

**Views:** Within, Over, Along

**Water feature:** Type, Quality, Permanent, Ephemeral

**Vegetation:** Type, Density, Associations

**Occupation inventory:** Buildings, Ground works, Infrastructure, Materials

**Access:** Roads, Tracks, Materials

**Interpretation:** Type, Materials

Chapter 6 documents the outcomes of the cultural landscape character mapping and evaluation and includes content drawn from discussions with stakeholders. The combined use of the populated Cultural Landscape Assessment Matrix together with the summary

analysis of the landscape qualities, issues and ideas to support management approaches forms the basis of a package to be returned to stakeholders for ongoing planning and development of management regimes.

As all information collected and evaluated must be disseminated in an ethical and confidential manner, the direct results of interview and the populated Cultural Landscape Assessment matrices do not form part of the published documentation of this technical report.

### **3.4 Multidisciplinary approach: science and landscape collaboration**

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This cultural landscape character assessment methodology is also informed by four scientific assessment studies and one heritage tourism study for a whole of catchment perspective alongside the mapping of specific waterhole attributes:

- Geomorphologic assessment and analysis of the Cooper Catchment by Gresley Wakelin-King (Wakelin & Associates)
- Ecological condition assessment and evaluation of waterbodies in the Cooper Creek Catchment by Jake Gillen and Julian Reid (ANU)
- Assessment of fish habitat, refugia and connectivity in the Cooper Creek Catchment by David Schmarr (SARDI)
- Hydrological assessment and analysis of the Cooper Catchment by Justin Costelloe (University of Melbourne)
- Tourism Management and Interpretation Framework by Joc Schmiechen

Project organisation focused on methods to coordinate a multidisciplinary perspective and overview of critical refugia waterholes and catchment systems. The sequence of activities was:

- fieldwork undertaken by all researchers, where possible at the same time, in concurrent locations to enable different survey methods, community engagement, mapping and documentation practices to be shared on site
- team project meetings to discuss work in progress findings and coordinated dissemination of outcomes
- cultural landscape discussions undertaken with the above researchers to identify important themes, issues and potential overlaps based upon geomorphology, aquatic ecology, hydrology, ecology, tourism and landscape assessment from results of individual fieldwork.

Working themes allow the various researchers to investigate and interpret the range of attributes and conditions of their areas of interest. One outcome of the Critical Refugia Project for the Neales Catchment was a series of themes for the group of disciplines, to allow overlapping perspectives of ecological, landscape form and function and processes of change to be captured. While not so far applied to this project, the seven themes are pertinent to the dynamic values and conditions of change for the Cooper Creek system and are noted here as possible directions for further evaluation of the findings of this research.

**Time:** Water quality varies from season to season, dry to wet, and the Cooper Creek system faces constant changing circumstances.

**Landscape:** Record Cooper Creek landscape aesthetic values, cultural heritage and ecological diversity – water systems are magnets in the landscape. Make design strategies for tourist camping, walking and driving areas to rehabilitate and protect fragile riparian zones and floodplains.

**Salt:** Manage salinity by enabling flows and minimising extractions to promote healthy vegetation and reduce destabilisation from impacts to creek and waterhole banks.

**Refugia:** Document the most important places for fish in the Cooper Creek to gain understanding of waterholes, wetlands and lakes independent core refuge status. Retain healthy riparian vegetation to provide good food sources for fish and animals alike.

**Pathways:** Greater access to all through improved technologies: gain understanding of the critical overlap between the ecology, the culture of the drainage systems, waterholes and catchment, including the movements upstream and downstream, up and down roads and tracks, and across internet and GIS systems.

**Vulnerability:** Understanding the type of places where intense use occurs around water including tourist campsites, pastoral practices and mining access and infrastructure enables the development of strategies for managing impacts

**Futures:** Plan for education and interpretation programs with the local community, embracing heritage, ecology, Dieri and Yandruwandha - Yawarrawarrka cultural protocols, pastoralism, mining and tourism.

These overarching themes allow landscape assessment outcomes to place emphasis on human activities, processes and stories associated with places rather than just classifications by type or function of a place.

The **Landscape** theme summarises key underpinning multidisciplinary concepts that include:

- investigating the broad catchment and its landscape features
- understanding the dynamics of waterhole, wetland and lake existence and change over time
- locating the range of aquatic refugia and describing their typologies
- investigating other surface systems such as dams and groundwater systems to gain understating of both hydrological and cultural water formed landscape systems
- analysing rainfall events and waterhole landscape quality linked to flood and drought
- recording fish distribution from a scientific perspective, expanded through spatial landscape analysis of waterhole and waterbody habitat conditions
- describing the aesthetic qualities of waterholes linked to ecological processes and geomorphology
- documenting and discussing with communities and stakeholders their deeply held cultural associations with and resource use of the waterholes.

### **Summaries of consultation with team members**

In order to gain understanding of the ecological and geomorphological conditions that determine the cultural landscape framework, discussions were undertaken with Justin Costello (hydrology), Gresley Wakelin-King (geomorphology), David Schmarr (aquatic ecology) and Jake Gillen and Julian Reid (ecology). Key findings and concepts include:

**Hydrology:** capturing and assessing refugial waterbodies and their characteristics including mapping the branches in the river and channel systems. Recording the timing of flow down the system in order to provide a model for the Upper Cooper system and then continuing into the lower reaches. Through satellite imagery, identify where the water is going and the splits, connection points and where the waterholes and persistence of water from past flooding is situated. Confirming the magnitude of pulses from upstream and associated deposition on lower floodplains. The sediments on the Innamincka fan are an example. Observations to inform the cultural landscape assessment:

- Indicators of waterhole persistence and health include where big turtle habitats are found: at Cullyamurra upstream near the Choke,
- Location of homestead on the higher ground adjacent permanent and semi-permanent waterholes that are deep holes on a single channel, often adjacent a choke formation such as at Innamincka Choke and at Embarka, Nappa Merrie, Innamincka, and Gidgealpa,
- The landscape is crisscrossed with causeways constructed through the mining operations, particularly Santos and Beach Energy,
- Borrow pits allow for connections between natural water systems and therefore the spread of feral animals,
- The intermittent connection between the Cooper Creek and the source of the Strzelecki Creek at Innamincka is formed by the levee, which has been constructed by pastoralism or through mining operations to limit flow down the Creek,
- The waterholes most sensitive to management and change are in the Innamincka area,
- Feral animals impact roadside culverts and borrow pits as they search for water and food, and
- Cullyamurra, Nappa Merrie and Marpoo Waterholes are the most likely to be cane toad friendly due to their formation, riparian zone and persistence

**Ecology:** Through undertaking early morning transects from the creek to the outer floodplain, the presence of birdlife is mapped in relation to vegetation and proximity to water quality. Vegetation density and associations indicate changes across riparian zones to form multilayered woodlands; for example at Scrubby Camp the upper storey is composed of River Red Gums, Coolibah, Acacia and Pittosporum. An ecological indicator is that River Red Gums do not persist beyond Coongie or the upper Cooper Creek (SA Section) waterholes beyond Tilcha due to increasingly saline conditions. Similarly the frequency of bird species also reduces as the Cooper flows towards Lake Eyre, to only find desert species close to the Lake. Riparian woodland bird species in the Upper Cooper are similar to those in central Queensland due to the relative conditions of the water systems and their associated vegetation. Observations to inform the cultural landscape assessment:

- The special nature of riparian zone vegetation layers along creeks, waterholes and lake edges require protection from human pressure. The top, middle and lower strata, their diversity and density are critical to the health of waterbodies and ecologies, and
- Despite chronic overgrazing of the stony gibber plains over many seasons, the extreme wet conditions over the past 3 years has seen the Mitchell Grass return.

This indicator of the health of the Stony Plains is evidence that if dominant and perennial grasses are not completely lost during dry times, and the impacts of feral and other grazing, then ecosystems can respond

**Geomorphology:** the landscape-scale review of the geomorphology that underlies the formation, structure and dynamics of the Cooper Creek system is undertaken at vast spatial and time scales. Critical areas for detailed study are the Innamincka Dome and Choke and their relationship to the waterholes and river morphology downstream, the Innamincka Fan and Strzelecki Plains, the channel split at the North West Branch and its relationship with Coongie Lakes, and the relationships between waterholes and floodplains, and Lake and dunal systems. Predictions for future change due to climate and/or human induced change, especially in relation to industrial operations in the region can be made. Observations to inform the cultural landscape assessment:

- The high floodplain surface is an appropriate location for permanent infrastructure as it lies above the level of modern floods. Issues with building on the plains however include possible erosion from overuse from human access, including road and walking tracks, so it best to limit public access to these areas,
- It is necessary to map the extent of modern floodplains in relation to planning for and establishing tourist camping areas, which are often preferred in these zones of sediment replenishment during flood.
- Tracks and roads from gibber plain need be planned and managed to avoid the creation of gullies along infrastructure zones. Similarly, the use of small, vegetated gullies for access to water, boat launching and vertical foot traffic should be discouraged to prevent erosion.
- Riparian vegetation traps sediment and influences the maintenance of waterhole banks and depth. Tourist camping needs to be managed to preserve vegetation and to rehabilitate degraded areas. Strategies for management may include: rotating camping spots, discouraging vehicles and tents under trees and active replanting,
- Investigate places around the Innamincka Choke and other areas of constriction along river channels as cane toad and other feral animal monitoring sites.

**Aquatic ecology:** Through detailed surveys over a number of years, of fish populations and their dynamics across a variety of waterholes and lakes across the system, the health and capacity of waterbodies are evaluated according to the climatic change and evidence of human use. Observations to inform the cultural landscape assessment:

- Floodplains are extremely important to the spawning of fish species due to their high nutrient value
- Lateral flow in creeks and waterholes is important for fish movement and should not be restricted.

- Infrastructure works such as bridges and roads and the earthworks around them as they cause changes to the subtle gradients that characterise the Cooper Creek floodplains
- Cullyamurra Waterhole is likely to be the last refugia in extremely dry times in the Upper Cooper Creek system.

## 4 CULTURAL LANDSCAPES OF THE COOPER CREEK CATCHMENT

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### 4.1 Definitions and landscape concepts

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The idea of the cultural landscape has developed since the late nineteenth century. In general a cultural landscape is defined as displaying modification of the natural or wilderness landscape due to human presence and activity.

The Cultural Landscape category of the World Heritage Convention describes 3 overview categories as guides for implementing cultural landscape assessment:

Category 1 is the **clearly defined landscape intentionally designed** and created. It includes landscape constructed for aesthetic reasons such as gardens and parklands.

Category 2 is the **organically evolved landscape** that reflects the process of development of its features and consists of two subsections: a relict landscape that retains material features but is now subject to no further change; and the continuing landscape that exists often in relation to traditional lifestyles, and displays evidence of evolution over time.

Category 3 is the **associative cultural landscape** that refers to cultural associations with natural elements characterised by ephemeral, narrative or material evidence (UNESCO WHC 2008).

For the Cooper Creek Catchment project it is useful to adopt a definition where extensive areas of natural and sparsely settled landscapes are common. Lennon and Mathews' working definition has been applied to a number of remote and rural landscapes across Australia, and is adopted here as appropriate to this study.

*A cultural landscape is a physical area with natural features and elements modified by human activity resulting in patterns of evidence layered in the landscape, which give a place its particular character, reflecting human relationships with and attachment to that landscape (Lennon & Mathews 1996, p4)*

The landscapes of the Channel Country, Sandy Deserts and Stony Plains regions of South Australia, containing the Cooper Creek Catchment, do not generally convey visible patterns of human evidence across wide stretches of landscape. The lines of exploration, communication and road and track pathways made by Aboriginal, settler, pastoral and tourism movements across the landscape are made evident through the connections between water sources and their associated settlements or compounds. Where these systems coincide – usually at permanent or semi-permanent waterholes, ephemeral lakes and wetlands, bores and dams – is also where the ecological and cultural refuges in the outback are usually found.



Yet, with the increasingly industrialised landscapes of mining exploration and extraction, lines of infrastructure including roads, pipes and mining and pumping equipment convey a visibly altered aesthetic to widely held assumptions that these remote arid places are empty and devoid of human intervention.

Three landscape categories follow from the above working definition:

- **Designed landscapes:** created according to a plan or strategy, often at a certain point in time, such as the Innamincka Town settlement, The ruins at Lake Killalpaninna or the Moomba Industrial Complex.
- **Evolved landscapes:** developed more organically over time in the absence of a plan but as the result of opportunity afforded by exploration, pastoralism, mining or tourism or the need for infrastructure such as the Innamincka waterholes complex.
- **Associative landscapes:** more intangible landscapes influenced by the meanings attributed to them through Aboriginal and local community cultural practices, such as waterholes and lakes, geological formations, and river and creek lines, and their associations with Cooper Creek waterways and associated wetlands.

## 4.2 Cultural landscape identification and assessment

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In order to identify, describe and then assess cultural landscapes a number of methodological approaches are customarily applied to cultural landscape mapping and description across Australia. From a national perspective the Burra Charter, the Australia ICOMOS Charter for Places of Cultural Significance, states that 'cultural significance is embodied in the place itself, its fabric, setting, use, associations, meanings, records, related places and related objects' (ICOMOS 1999, p2). While this perspective is necessarily place specific, it is an important basis from which to expand the assessment methodology for the interconnected places and landscape features that form the cultural landscapes of the Cooper Catchment. In particular, Article 13 recognises the co-existence of cultural values and confirms that these values should be respected and encouraged, especially in cases where they conflict (ICOMOS 1999, p5).

Understanding how to assess cultural significance through a system of values is also an essential aspect of cultural landscape assessment. Values attributed to the aesthetic, archaeological, architectural, historical, scientific and/or social significance of a place are described in terms of the physical, aesthetic, contextual setting and association with places over time (Heritage Victoria 2009). Although useful in providing the necessary categories to enable recording of landscape conditions and qualities, this perspective falls short of prescribing values for the fundamental connectivity between cultural and natural landscapes that are central to the Cooper Creek Catchment research. Landscape assessment requires gaining understanding of the broad context and influences on the place or locale and usually involves general building and settlement classifications such as: structures, complexes, sites, features and linear networks.

In the Cooper Creek Catchment environment, an expanded review is necessary to include documentation and analysis of natural features, in particular framed through the lens of water formed landscapes and places. The minimum elements to be described are: vistas, vantage points and landmarks, circulation networks, general patterns in the landscape, imprints of past uses, waterbodies, vegetation characteristics, structures - their formation

and individual features, divisions within the landscape, building materials and construction techniques, extent of earthworks, current land use and infrastructure patterns and networks generated by mining activity (Lennon 2009, pp12-13). For the Cooper Creek Catchment in particular, it is important to map and describe the overlay of extractive, pastoral and cultural uses in order to highlight management implications for diverse surface and groundwater waterbodies. The research focuses on information sourced from the field supported by historical and policy literature, alongside stakeholder, community and project team knowledge to ensure that landscape and ecological systems perspectives influence landscape assessment.

Drawing upon World Heritage principles, Lennon describes key management issues for heritage landscapes, the relevant aspects are summarised below:

- The need for awareness and general education regarding the value of cultural landscapes and their use to society,
- Cultural landscape values to be recorded and defined for specific landscape types, and site-specific training put in place for sensitive management of the places and their values,
- Manage tourism access to and appreciation of the landscape,
- Ensure the economic viability of operations to maintain the values including income-generating activities, such as user pays schemes,
- Develop landscape conservation practices to protect existing features and qualities and to allow the insertion of new elements to maintain the qualities of places,
- Develop strategies to manage threats and external developments that impact upon the cultural landscape values of places and or regions, and
- Support communities to maintain heritage values within the cultural landscape, especially where the associative values of the landscape reside with those communities (Lennon, 2011, p55).

**Structural categories** of rivers and creeks, waterholes, wetlands, lakes and other water systems have been established as typically general concepts. They are based on structure and activities in the landscape, to help identify issues that ultimately inform potential landscape-driven conservation and infrastructure management projects.

- **Form:** includes location, scale and description of the local and contextual landscape structures that influence the specific waterhole(s), creek and/or lake and its environs; and describes the spatial and topographical structures that influence the landscape character.
- **Riparian zone:** describes the relationships between banks, waterbodies and vegetation, including schematic sectional relationships between natural systems and identification of cultural use where applicable.
- **Views:** demonstrates major views in and over the waterbodies, vantage points, and the spatial quality of view across a range of landscape types and features.

- **Water feature:** describes the scale, natural and/or cultural qualities and permanence, impermanence of the waterbody(s), in various times of drought and/or flood; and the quality of the aquatic environment from a visual and landscape structure perspective.
- **Vegetation:** describes the vegetation type, assembly, relative density and distribution along and around the waterbody(s) and its/their environs.
- **Occupation:** gives evidence of occupation, both permanent and ephemeral, including patterns of use, impact and visual, historical and cultural qualities with a specific focus on human/waterbody interaction. Where possible includes notation on the presence of fish and other faunal species, whether native or pest.
- **Access:** documents visible roads, pathways, tracks and desire paths for humans and animals, including the greater networks employed by mining, Aboriginal and tourism interests.
- **Interpretation:** gives evidence of physical interpretation and signage materials at the site and/or along the track; and discusses interpretation due to the presence of built structures and other human induced information
- **Other aspects:** discusses specific aspects of historical and cultural associations and impacts due to cultural and natural influences
- **Issues requiring management approaches:** summarises analysis of the qualities of each waterbody or water complex, condition and potential use and current impacts and issues to inform a range of landscape driven management approaches.

### **4.3 Landscape character types for the Cooper Creek Catchment:**

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This research focuses on water landscapes in relation to recording and describing interactions between natural and cultural systems. The character types below are based upon expanded character types from biogeographic classifications but with emphasis on where water systems and human occupation coincide. Below is an overview of the landscape character types based on data collected during field trips and collated into the structural categories (Chapter 6). These cultural landscape types and qualities also coincide with landscape descriptors used for ecological zones. As the assessment was undertaken over a period of intense wet (April 2011 and April 2012) and then moving into a time of recovery (September 2012 and June 2013), these character types have been influenced by the presence of water and the lush vegetation that emerged as the water subsided, particularly on the dunes and grasslands.

The natural and cultural landscape character of the Cooper Creek study area exhibits the following features:

- wide floodplains, swamps, wetlands and the surrounding tablelands in the Upper Cooper area of the Channel Country are the backbone of the pastoral industry. The landscape comprises outback dirt roads and rare creek crossings, scattered pastoral

settlements and farm infrastructure such as fences, windmills and bores and stockyards.

- interspersed along the roads, on the horizon or appearing from behind red and yellow dunes, the equipment, infrastructure and road signs present a highly developed networked landscape.
- the Strzelecki Desert north-south running dunefields of highly coloured, predominantly red sands with interdunal claypans and darker floors, grading lighter to the white sands lumpy dunes to the south. Rare roads snake over the dunes, while the traces of pastoral life inhabit the vegetated claypans and interdunal flats.
- stony tablelands with occasional, red and yellow mesas rising above the rolling plains. Tree-lined creek lines cut across the lower slopes and red treeless gilgai pavements shine into the distance. After wet years the plains are covered with golden, waving Mitchell Grass, cut only by dirt roads and now the occasional mobile camp of caravan and heavy equipment to support mining exploration.
- tree-lined creeks and small channels, predominantly *Eucalyptus coolabah* (Coolibah) and *Eucalyptus camaldulensis* (River Red Gum), with often dense understorey *Acacia* species and *Lignum* in riparian zones, snake across expansive floodplains and dunescapes, towards the rocky gibber plains and desert groundscapes to the west; evidence of intensive Aboriginal and sparse non-Aboriginal occupation at waterholes and ephemeral lakes, seen in the detritus left on the ground, or on tracks and clearings in riparian zones.
- ephemeral lakes nestled in the vast dune plains, come across after following floodplains and dunes along farm roads and past stock yards and the occasional dam or bore. Wide open expanses of water after the flood times drying to sandy and salty margins where dead shrubs and the presence of birds and ruins of past human occupation sometimes endure.
- depending upon seasonal and climatic conditions, the presence of water in ephemeral and permanent waterholes and lakes contributes to high landscape quality and is the focus for intensive tourist visitation due to their rarity in these arid landscapes; evidence of such occupation revealed through abandoned camp areas, signage, tracks and pathways made across the landscape, some historic constructions and litter.
- the appearance of a town or settlement is so rare that the appearance of Innamincka in its setting alongside the verdant tree-lined Cooper Creek, is an oasis in the open rolling plains that precede arrival. Between town and creek is the white sand camping area that appears a 'natural' beach in the outback, lined with campers marking their spaces under the coolibahs and red gums with cars, 4WD and all manner of trailers.

Additionally, this cultural landscape derived research proposes that four culturally derived themes are applied to landscapes and places throughout the Cooper Creek Catchment

based upon the land uses and values that are described through the individual assessments. The broad descriptors are used to define the layered qualities of places according to cultural, social and economic conditions and values evident in the landscape assessment and in the information that was communicated during discussions with local communities and stakeholders.

- **Industrial landscape:** Areas where large scale infrastructure and permanent or mobile settlements are arranged over wide areas of plains and/or wetlands and swamps are components of the landscape of mining exploration and extraction. The inscribed lines of roads, pipelines and seismic works alongside site installations of extractive machinery and the Moomba site characterise the structure and networks of the industrial landscape.
- **Conservation landscape:** Areas of critical importance to the ecological and cultural health of arid landscapes and their waterbodies characterise conservation landscapes. Often places of great aesthetic beauty as well as scientific importance, the regions and sites are often recognised through natural and cultural heritage surveys or proclaimed as reserves or national parks.
- **Productive landscape:** Areas where the production of food and resources over time has been established. This theme can apply to both natural and social/economic systems, for example, floodplains are particularly productive areas for fish as they are for pastoral pursuits. Townships and settlements can also provide the focus on productive social outcomes.
- **Storied landscape:** Occupation of landscape over time result in stories about the landscape and its people and their experiences being written down, recorded through maps and imagery or handed down through oral history and language. Named places are an example of marking the storied landscape. The tales told in storied landscapes don't have to be true for them to resonate in history and across cultures.

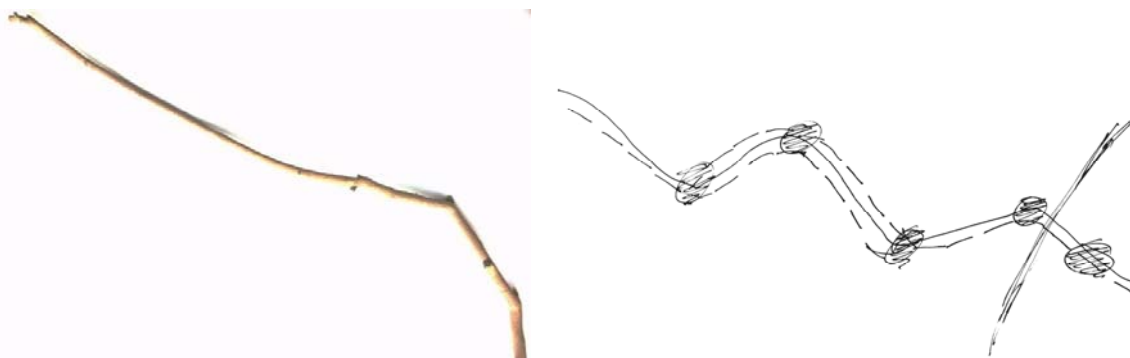


Figure 4.3.1 Schematic model of ecological/cultural overlay at Cullyamurra and Burke Waterholes and the Innamincka Complex of waterholes further west as described by Dieri man, Willie Dawson.

Figure 4.3.1 illustrates a conceptual model of the primary landscape character element for the Upper Cooper Creek (SA Section) and the line of cultural travel that traverses the landscape beside the major river channels and through the floodplains. In conversation with Willie Dawson on a walk along the Cooper Creek at Cullyamurra, he used this stick to explain that it was a very accurate representation of the spatial relationships of the

waterholes to the river. Each node on the stick refers to a waterhole and the use patterns along the system practiced over the years by Aboriginal people, for fishing and cultural purposes. The crossing line indicates the rare road crossing that intersects the natural flow of the creek and the people and ecosystems that move along it.

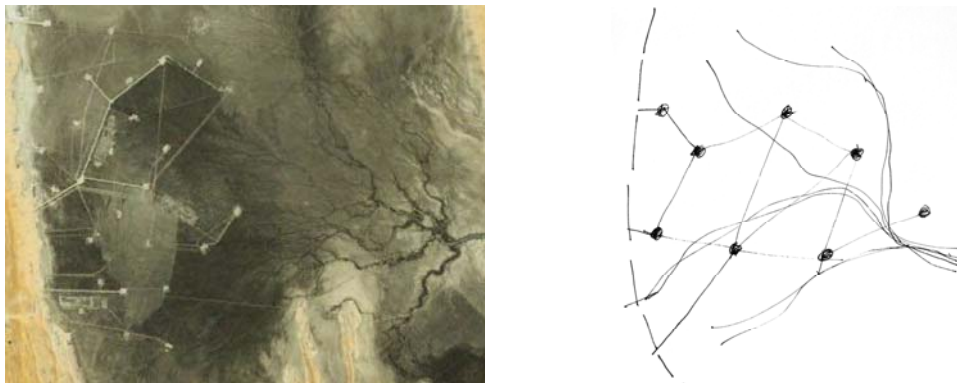


Figure 4.3.2 Schematic model of ecological/industrial overlay at Gidgealpa showing the overlay of mining networks and the dendritic ecological landscape

Figure 4.3.2 illustrates a conceptual model for the industrial landscape character for the mined areas of the Cooper Creek (SA Section). Through observation from above the patterns of development of mining sites reflect the geological record and aquifers below the surface. They inscribe contained areas over which a network of points and lines overlay the swampy landscape of distributed water lines and low ground. Access roads traverse the landscape on higher ground to form an expanded network of artificial access over the topographical landscape.

Where river and water systems are present and suitable river crossings can be constructed, a concentration of rich environmental conditions for both natural ecosystems and human occupation coincide, such as at Innamincka. Specific areas for cultural landscape assessment based on this connectivity principle include the important local features and complexes of:

- the Innamincka complex including from Town Camp to Tilcha waterhole/Wills Grave site permanent and ephemeral waterholes
- Cullyamurra and Burke/Mulkonbar Waterholes Cooper Creek riverine environment towards the Innamincka Choke
- Lakes Killalpaninna and Kopperamanna historical and cultural sites and terminal salt lake and associated camping areas on Etadunna Station
- Coongie Lakes wetlands, Kudriemitchie Waterhole and Coongie camping areas
- the Strzelecki and Birdsville Tracks string of historical sites based on servicing trade and communication routes, their creek crossings, ephemeral and groundwater systems and infrastructure.

#### 4.4 Landscape heritage in the Cooper Creek Catchment

In a report prepared to assess the Natural Heritage Values of the Lake Eyre Basin for World Heritage Assessment (Morton, Doherty and Barker, 1995) the unique values of the aquatic systems of the South Australian section have been described as worthy of consideration for World Heritage standing.

“...we consider that the natural values of the aquatic systems of the South Australian section of the Basin are sufficiently unusual within Australia to warrant further assessment against World Heritage criteria. ...aspects of the aquatic system appear to stand out:

- The remarkable nature and scale of the endorheic drainage system reaching Lake Eyre from the east and the ecological responses to that drainage system (Morton, Doherty and Barker 1995, p67)”

That this drainage system forms part of one of the largest unregulated floodplain river systems in the world is key to the landscape quality and scientific standing of the Cooper Creek Catchment in South Australia. Cooper Creek is characterized by its boom and bust cycles of drought, flood and recovery together with its low gradient that results in extensive floodplains suitable for a range of cultural and pastoral activities. Morton, Doherty and Barker (1995) note that the outback cultural emblem is clearly evident in the Lake Eyre Basin and name a number of Indigenous and non-Indigenous historical and cultural activities that have occurred across the Cooper Creek channels and floodplains. The high tourism and pastoral industry and continuous Aboriginal occupation values of the river and its important water assets has been established through a number of heritage and historical studies and nominations alongside recognized natural values.

Typical of the catchment are exploration stories and legends, pastoral industry settlement, communication systems and networks established across arid country, aesthetically beautiful and unique landscapes, important waterholes as oases in the desert in contrast to the vast floodplain and dune systems, and a growing tourism industry in search of wild landscapes.

The Aboriginal landscape has deep religious meaning brought to presence through creation stories connected by a network of alliances influenced by the mobility of groups moving according to water needs, climatic conditions and transformations during the wet and the dry. One such story of the Seven Sisters creation story which is seen in the stars of the night sky, is related by Luise Hercus and mapped by her below. Across Aboriginal Australia the nomination of seasons is linked to temporal and vegetative conditions such as; the hot time, green time, cold time and dry time in sequence with the four European seasons summer, autumn, winter and spring. Aboriginal movement patterns followed the seasons and the climate to minimise impact on the landscape through population dispersal towards the wise use of limited water and food resources.





Figure 4.4.1 Overview of part of the Seven Sisters story area with the yellow line showing the places through which the seven sisters passed, and the white line joins places through which the Whirlwind passed. Source: Luise Hercus. Lake Kopperamanna, September 2012

Another important consideration is the language of water places, which is more extensive and nuanced than western descriptions. In relation to central Australia, Clarke distinguishes the eight types of landscape features that produce drinking water; soak, rockhole, spring, creek or river, billabong, swamp, claypan and salt lake and discusses seasonal variation and the impact on traditional uses, and the strategies and practices employed to contain and/or harvest water. Seasonal variations are recognised from three to five conditions depending upon location (Clarke, 2003).

## 4.5 Implications for management and policy

Defining cultural significance as an annotated, graphically illustrated statement, enables guiding policy to be prepared that informs future management approaches based upon conservation principles that take into account contemporary systems and influences. A general approach to establishing cultural significance deals firstly with assessment in terms of collection of information and data, which is the focus of this technical cultural landscape assessment report.

A single statement of cultural significance for the Cooper Creek Catchment as a whole is unfeasible; a number of place-related nominations for critical sites such as The Innamincka Waterholes complex should be considered. This will require engagement with various stakeholders to ascertain, and would require further policy development across a number of stakeholder groups. In the context of this multidisciplinary research project, proposed outcomes include combined assessments of the scientific and landscape qualities and features of the range of waterholes in the system, which will contribute to documenting significant water systems in the Cooper Creek.



## 5 STAKEHOLDERS, COMMUNITY ENGAGEMENT AND LANDSCAPE VALUES

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### 5.1 Key stakeholders

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A critical driver of the Cooper Creek Catchment project is to provide pathways for meaningful community engagement in developing management approaches for critical refugia waterholes and other waterbodies. Both the Regional Natural Resources Management Plan for the South Australian Arid Lands (2010) and the SAAL Biodiversity Strategy (2009) state the importance of including stakeholder and community knowledge and support in all programs. Local experience, gained over time, is an essential component of data collection, along with fieldwork research and report-back mechanisms for ground-truthing landscape assessment findings. Key stakeholder groups were first identified by the SAAL NRM, through their interactions with, and influence on, sites and catchments. Additionally, previous research by a range of government agencies was collated, and key people and communities identified. The current stakeholders and community interests in the Cooper Creek Catchment environment are identified through two descriptors: the broad stakeholder group and local communities who operate in the area on a day-to-day basis.

**The broad stakeholder group** covers regional, state and national and international perspectives and includes: Australian and South Australian government agencies such as the SAAL NRM and National Parks and Wildlife SA, pastoralism, arts and culture and nature based tourism, mining industry, Indigenous interests, scientific and academic research organisations, conservation organisations, heritage and interpretation interests, and educational organisations.

**Local community groups** with direct interest in the stewardship and ongoing management of the catchment and its waterbodies include: landholders and pastoral workers, Dieri and Yandruwandha and Yawarrawarrka traditional owners and communities, tourism operators and service providers along the Strzelecki and Birdsville Tracks and Innamincka, tourists/campers from the region, researchers and state government project officers engaged in ongoing surveys and assessments, conservation groups, local schools and community groups such as the OCA.

The Cultural Landscape Assessment Matrix for landscape-derived data recording was organised around stakeholder involvement with the range of waterholes and waterbodies in order to document the current range and type of interests held by each stakeholder and/or local group. As the engagement methodology was being developed, the research group noted that the natural landscape is also a stakeholder and this element was also included in the matrix. The intent of the matrix approach was to uncover the degree to which multiple interests are engaged in each studied waterhole/waterbody and the issues that arise from often competing rather than complementary interests.

## 5.2 Community engagement principles

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The range of stakeholder and community interests in the Cooper Creek and its regional environment are both diverse and geographically dislocated. A number of consultations with various groups and individuals over the past years have been undertaken as a mixture of face-to-face interviews and questionnaires predominantly focused on gaining information on broad land management regimes and as background for scientific studies of waterhole conditions.

Just as important to effective community consultation as the gathering and recording of outcomes, is evaluation and feedback to the community of the consultation results. It is essential to integrate community engagement processes and feedback with fieldwork data and current knowledge. Research needs to be actively drawn out of reports and used in participative programs that provide mechanisms for feedback and negotiation in both the knowledge obtained and the uses to which such feedback is put. From the landscape perspective, community and stakeholder feedback is necessary to inform design, infrastructure and interpretation projects for critical waterholes that are under pressure from human use and over use.

The approach to community engagement and information gathering for the Cooper Creek Catchment is intended to involve stakeholder communities in a cyclical and ongoing process, which brings demonstrable outcomes. It is equally essential that the results of previous consultation are built upon rather than repeated and that the information gained from the community is linked into the database of information available for the catchment and particularly its critical waterholes, lakes and wetlands at Innamincka, Coongie Lakes and west of the Birdsville Track at Lakes Killalpaninna and Kopperamanna on the Cooper Creek channel.

Applied research into the engagement practices and outcomes of consultation for housing provision in remote area Aboriginal communities of South Australia found that the consultation had often been regarded as unsatisfactory, and people thus became less inclined to share knowledge. It was reported time and again that very often people were over-consulted, outcomes were not reported back to communities or that demonstrable outcomes were not forthcoming to support change and improved conditions. These issues are further exacerbated by remote conditions, which include large distances to travel, difficulties with the availability of busy people with social and business obligations, and the need to find appropriate, transparent methods for feedback and communication that meet agreed privacy and ethical conditions (Lee and Morris 2005). Lee and Morris propose five principles for effective Aboriginal community engagement that are equally appropriate for the broader community:

**Engagement:** through initial contact followed usually through face-to-face meeting to gain negotiated and mutual understanding of the reasons for consultation and an appropriate method supported by agreed protocols. It is preferable that engagement with communities is both verbal and web-based supported by on-the-ground interviews and meetings focused on uncovering site knowledge. An appropriate fieldwork schedule allows enough time to meet on site and walk, drive and/or fly the area to visually survey and map, and to confirm oral histories and management regimes uncovered through discussions.

**Communication:** appropriate communication tools based upon local conditions and a good working and geographical knowledge of the area need to be developed early in the process. Different community groups require different methods of communication and it is essential that consultation and recording methods are known and agreed. In particular, for the various Aboriginal community stakeholders in the Cooper Creek Catchment as many people as possible should be gathered together over time. Ideally, they should meet at the waterholes and their environs. A range of visual tools for recording spatial information of local conditions, including maps and computer-based technologies for visualising and transferring information, should be developed.

**Reciprocation:** reciprocal relationship building based on local and visitor/researcher knowledge and expertise where the research contributes to the community, can be seen as part of, or at least close to, the aspirations for the community – working together towards an agreed aim. An important component of effective consultation is the visitor/researcher and the community developing structures and mechanisms for mutual support. In remote Aboriginal and non-Indigenous communities, it is essential to engage beyond information gathering and to offer something back that is of immediate benefit to the community, such as negotiated tourism management plans around water systems.

**Feedback:** extends information gathering to embrace ongoing community involvement in confirming the accuracy of information, including new material and leaving the way open for future engagement in useful programs and/or projects. Protocols and mechanisms with a feedback loop for dissemination of information, aid in the ongoing success of projects founded upon local knowledge. Such mechanisms increasingly adopt the information and communication technologies available to remote area communities.

**Continuity:** development of effective and ongoing communication systems, including readily accessible databases and programs that include ongoing evaluation of the works associated with consultation, is desirable, supported by ongoing engagement of stakeholders. Effective engagement programs link talking and information-gathering over time and as a result build new communities, often involving stakeholders with different aspirations and management regimes for the same country, in a mutually understood framework for action. The continuity of communication with diverse communities is essential to the ongoing sustainability of programs in complex environments.

Ramsar has made a case for the importance of local and Indigenous people's involvement in recognised Ramsar wetlands such as Coongie Lakes, and has also produced guidelines for:

‘...community involvement and participation in management decision-making for sites included in the List of Wetlands of International Importance (Ramsar sites). These guidelines were conceived with the premise that local and Indigenous people's involvement in wetland management can substantially contribute to effective management practices that further Ramsar's wise use objectives. (Ramsar, 1999)’

Participatory management arrangements are recommended for developing and/or maintaining sustainable livelihoods, including activities such as: ‘fishing and hunting, reed harvesting and collection of forest products, salt extraction, recreational uses and ecotourism; and water for domestic consumption’. The Ramsar guidelines also advance

other benefits of a non economic or recreational basis including: 'maintaining spiritual and cultural values associated with a wetland, more equitable access to wetland resources, increased local capacity and empowerment, and maintaining ecosystem functions such as flood control and improved water quality'. Government agencies are seen to benefit from participatory management arrangements through: 'improved ecosystem viability, reduced management costs, assistance with monitoring and surveillance, fewer infringements, and enhanced social sustainability and quality of life for communities dependent on wetlands.'(Ramsar, 1999)

### **5.3 Community engagement for the Cooper Creek Catchment: approaches and methods**

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Due to diverse geographical locations the range of appropriate information available is layered, complex and contained in a range of databases and reports. Therefore, a good deal of supporting information is available, although dispersed, to assist consultation with the broad stakeholder group through web-based and already identified information contained in scientific reports and transcripts. The approach to consulting with stakeholder and local community groups can begin with engagement through at-distance telephone and internet based communication, supported where appropriate with meetings framed around a series of thematic concepts, supported by maps where necessary. Reporting protocols include submission of transcripts of interviews and regular updates through web-based technologies and follow-up meetings held where appropriate.

The aim in consulting with the broad stakeholder group is to uncover the various policy, research, environmental, economic and cultural program frameworks that impact upon the cultural and economic use and the environmental management of the catchment and its identified critical water areas.

Local stakeholders are identifiable with current management regimes and community activities and are able to identify immediate issues, define areas for study and confirm protocols for access and engagement. Additionally, transient populations such as tourists, service providers and transport operators are nonetheless identified as engaged with and are impacting upon the ongoing use and well-being of the waterholes and cultural places along the tracks and its various access tracks.

The social engagement issues associated with fly in - fly out mining industry workers in remote areas infer that most shift workers are dis-engaged from the landscape in which they work. However, personal communication with workers living at the more remote worksites associated with areas of high ecological quality including permanent or semi-permanent waterholes confirm that these areas are highly valued and used for recreation and more cultural pursuits during rest times.

Working with Dieri and the Yandruwandha and Yawarrawarrka people in the area, Santos has developed a series of protocols for working on traditional country culminating in an agreement to establish best practice cultural heritage management for mining operations. It 'acknowledges the importance of engaging traditional owners in the management and protection of Aboriginal cultural heritage' and promotes '...working with the Dieri on the next stage of our working relationship, focusing on employment, education, training, enterprise

and capacity building'. The response from Shane Kemp, Chairperson of the Dieri Aboriginal Corporation has been to welcome further discussion on reconciliation in order to work on resource development in light of creation stories and of the spirits and places of significance to Dieri people (Santos, 2011).

Monitoring field trips and additional air surveys contributed to the landscape assessment and initial contact and engagement components of the project.

The April 2011 aerial survey sought to:

- map the landscape in times of drought provide a compendium of images tracking up the Strzelecki Track and over the Cooper Creek to the east. Then following the main channel as far as it could be recognised in the immense floodplains that had formed from around Innamincka to Lake Hope. Further to the west, the Lower Cooper main channel could be followed, crossing the Cooper Crossing at the Birdsville Track to reach the inlet at Lake Eyre North, and
- provide visual records of the floods to share with team members and to be available for the use of local stakeholders and government agencies.

The April 2012 field trip sought to:

- identify the scope of the water systems and the people involved with the Cooper Creek Catchment (SA Section) through initial team member, SAAL NRM and stakeholder engagement in the field,
- identify the range of practices that impact upon the sustainability of the rivers, waterholes, wetlands and lakes and fill key knowledge gaps regarding their cultural, ecological and productive importance,
- identify and undertake a series of preliminary surveys of key waterbodies together with the geomorphology, hydrology, aquatic ecology and vegetation ecology researchers, to confirm areas to study in detail, and
- undertake the first landscape assessment, during the end of the wet, of the range of waterbodies identified though the larger project with focus on places where natural and cultural systems coincide to support strategies for management

The September 2012 field trip sought to:

- undertake on-the-ground detailed landscape assessment surveys of selected waterholes, wetlands, lakes and selected artificial waterpoints and their environs,
- undertake cultural and heritage landscape surveys of the Birdsville and Strzelecki Tracks to map places where water systems and waterbodies interact with human use,
- undertake a follow up aerial survey to observe and record the landscape and its major waterbodies under the time of recovery between flood and drought,
- confirm landscape assessment research methodologies for gaining ecological and hydrological data, monitor fish and identify pest species, and
- engage with Aboriginal community knowledge on key issues for access to and collaborative management of waterholes, lakes, rivers and wetlands in relation to interpretation and cultural landscape management engagement.

The June 2013 Field trip and community workshop at Innamincka sought to:

- inform the local community and stakeholders of the initial survey outcomes and findings
- complete the landscape assessment survey of Coongie Lakes after access was restored after the 2010-2012 floods
- engage with the local community and stakeholders to fine tune the technical report findings and to develop strategies for cultural landscape management and potential landscape design projects

Generally all trips achieved their stated aims, however, there was reduced access to places and people and lower than expected consultation with local stakeholders in the early stages of the research due to the impacts of extensive flooding throughout the floodplains. As the cultural landscape survey is undertaken by using publicly accessible roads to map and track where and how tourists and the range of users navigate the landscape, it was necessary often to take the long way round if floodwaters or pastoral activities precluded the use of station and/or mining roads. In April due to the closure of the 15 Mile Track from Innamincka and the Walkers Crossing PAR, it was necessary to traverse the Strzelecki and Birdsville Tracks to access the western lakes and the eastern waterholes. The main tourist access road to Coongie Lakes remained closed during 2012 therefore reducing our ability to record both the landscape characteristics and the cultural use of the Kudriemitchie and Coongie camping areas until June 2013.

From this technical report it is possible to prepare a range of graphic material as mechanisms for feedback and ongoing consultation. Maps and an illustrated executive summary publication, can support ongoing discussions and on the ground meetings at important sites to confirm management approaches and key projects. They can facilitate communication with all stakeholders who desire to access and conserve water resources and important cultural places. Through them, a practical management strategy can be developed for the accessible waterholes, lakes and wetlands of the Cooper Creek Catchment.

A range of information sheets and questions were used as prompts during face-to-face meetings on-site at pastoral properties, community businesses and when logistically possible at waterholes. Everyone who participated was very forthcoming with information and discussion on the various issues affecting them, either directly or in ways that were seen as trends for the future. Themes for conversation included the ecology and landscape of the waterholes and water systems, and the social, historical, environmental and economic conditions that currently exist.

A series of discussion points guided the conversations, and it was made clear that this information will contribute to the development of negotiated management approaches for the waterholes. The questions are included for information in the body of the report as they can be evaluated as contributing to the development of cultural and ecological themes alongside on the ground management issues.

- What is your interest in the area? Do you have current and past management strategies for the waterholes, creeks, floodplains, lakes and wetlands?

- Can you describe the extent and quality of (the named) waterholes, wetlands or lakes of the river systems? Can we update the existing maps to see where watering places are located and their names? Are there access tracks to these places?
- Can you describe how the water systems including both surface waterholes and groundwater bores are used on your lands? And over time how has this use changed due to varying water quality and availability? Which ones persist during dry times?
- What is the history of use? Do you have any maps or photographs that record these histories?
- What are your memories of droughts, floods and other events and how have these events affected the waterholes?
- Where do you take people? Are there any places that you think are high quality places for visiting, camping, food, refuge?
- Where do you notice that tourists now go? Can you comment on the impact that occurs from visits? Are these impacts more obvious at particular times?
- For tourists, can you describe your journeys and where you best like to camp? Do you look for water and other services when deciding upon your trip plan?
- What changes are you noticing? Are there vegetation changes over time in relation to the creeks, waterholes and lakes?
- What do you see are the competing interests?
- Do you have a sense of future scenarios? What would you like to see happen?

The cyclical nature of engagement makes this technical report the base information for returning to the stakeholders to confirm the cultural landscape assessments and findings around the individual waterbody case studies. Ideally, as this landscape assessment has been undertaken during flood and recovery times, a useful third future component would be to return under the condition of drought to record the waterbodies and their access routes in the dry.

## 5.4 Critical issues and findings

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Stakeholders and local communities commonly raised issues on access to and management of waterholes and their associated natural and cultural systems:

**Understand the dynamics of arid zone water regimes:** It is critically important to research, document and gain understanding of the changing nature of rivers, creeks, waterholes, floodplains, wetlands and lakes, and the current and emerging resources driven practices, that impact upon waterbodies such as mining and tourism operations. Their future sustainability in the face of climatic and economic change will be influenced by methods that promote identifying and valuing their landscape qualities.

**The intersection of mining practices, pastoral life, natural systems, heritage and community cultural values:** Increasing national and multinational management of pastoral properties alongside co-management of pastoral, conservation and mining interests on the same landscape is seen by long term residents to result in changing community dynamics. The subsequent loss of long-term experience and local knowledge of water events and impacts to inform management approaches is contrasted by a new and mobile population of workers without investment in the cultural and ecological values in the landscapes in which

they work. Deep Mapping techniques leading to multilayered maps are seen as a way forward to record the range of values held by stakeholders for important water places, the qualities and attributes towards negotiated management programs.

**Awareness of Aboriginal and non-Aboriginal cultural values:** Diverse cultural values must be documented and mapped to achieve greater awareness of the cultural, social and ecological values necessary to support community desires for working with the landscape towards environmentally responsible management. Recent work on arid lands management regimes, especially with regard to mining cultural clearance and environmental impact research, acknowledge these shared values with calls to establish protocols for researching traditional sites, gaining negotiated access to places, and protecting critical areas from the impacts of excessive human and animal use.

**Landscape assessment, heritage and ecological values:** Knowledge of water systems requires relevant information on landscape qualities together with reliable methods for assigning attributes to evaluate ecological health and cultural values. Graphic, text and digital/internet based systems promote easy understanding by a range of users. A combination of visual assessment, landscape character assessment, historical accounts and scientific research provides the detail to enable the range of positive and negative attributes of water places and their environs to be recorded and valued. For example, when landscape cultural values are documented, evaluated and incorporated into assessment programs alongside ecological research, this contributes to developing a whole of waterbody understanding, to inform future management and establish priorities for protection and ongoing resource use.

**Involvement of Aboriginal stakeholders in expanded programs:** The Dieri and the Yandruwandha and Yawarrawarrka traditional owners of these arid landscapes have the knowledge to contribute to documentation of the histories of water places from cultural, spiritual and environmental perspectives, including knowledge handed down over long time periods. In some instances the knowledge has been lost, but contemporary Aboriginal knowledge is essential to develop a shared understanding of the complex conditions of landscape subject to climate, economic and social change.

**Access to water:** Develop programs to identify who documents and maps issues regarding sustainable access to water, to establish a framework for access protocols for the range of users, to aid in protecting fragile waterbodies and their riparian zones. The visible short and long term impacts on water points due to commercial and public use and the persistence of pest species such as feral animals, (erosion, gullyng, tracking, compaction, fire, vegetation disturbance) negatively affects the quality and public perception of culturally important landscapes and places.

**Impacts upon riparian zones adjacent to waterholes and lakes:** Stakeholders report that bank modification by tourists potentially causes worse destabilisation than any stock damage (step cutting, bank compaction, firewood gathering, vegetation clearance, weed dispersion). Management regimes for tourist resources including responsible and well-publicised guidelines for fire making and landscape design projects to reduce car and foot traffic impacts along extensive riparian zones are recommended.



**Management of tourism drivers and impacts:** Develop programs for infrastructure, education, interpretation, and tourist access management that take account of the specific conditions encountered in arid zones. The programs should be based on detailed knowledge of tourist movements, vehicular and associated equipment, navigation systems and seasonal activities. Critical issues must be identified, and negotiated programs developed for protection, rehabilitation and management of critical ecological and culturally important water places currently visited by tourists. To assist in managing access and behaviour, utilise internet-based surveys focused on private tourism websites to provide culturally appropriate, current information and interpretation of arid lands dynamics, to tap into the informal net-based holiday and touring reports currently universally accessible.

**Access and information:** Signs and fences can prevent access to vantage points for most visitors but are only marginally effective when the tourist explorers leave sanctioned tracks. It is reported that the few can cause great damage particularly when armed with GPS that enable people to explore widely without good understanding of local conditions and potentially impassable and dangerous landscape conditions.

**Relationships to government organisations with regard to programs and support:** Research into existing conditions to identify a range of management approaches requires funding regimes and management assistance that enable change implementation across public and private landscapes and sites. Workable policy and implementation programs tailored for local conditions are needed for coordination of stakeholder engagement, participation and funding requirements.

## 5.5 Future projects arising from engagement

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Stakeholders also asked for assistance in managing a range of critical problems of public access and use on pastoral lands and inappropriate visitation to Dieri and the Yandruwandha and Yawarrawarrka peoples' cultural places. Several projects in landscape design and interpretation have the potential to be useful.

- Use the combined findings and knowledge as a point of discussion with local stakeholders to develop negotiated management approaches to the hierarchy of water places in relation to their cultural requirements, heritage conservation and use patterns. Informed plans can respond to the variety of perspectives in working meetings held over prepared plans, visual material and on-site ground-truthing.
- Review current best-practice at sites along the Cooper Creek complex of waterholes at Innamincka to expand current tourism infrastructure and spatial design plans, to manage walking and foot traffic access and the impact of tourism at popular destinations.
- In the more remote sites, such as lakes and wetlands, identify critical areas for protection, renovation or as sites for intensive use (in effect sacrificial sites), and negotiate spatial landscape design areas and vehicular and walking tracks for tourist, pastoral, mining and other access
- Develop a visual and information database of places and regions in the study area and confirm the management of such information for release in websites and publications.
- Develop an educational, deep mapping and interpretation strategy for the heritage and ecology of Cooper Creek catchment's publicly accessible waterpoints in consultation with local and regional experts, both on and off the Birdsville and Strzelecki Tracks.

- In conjunction with the traditional owners, develop a tourist management plan for important cultural water places, including landscape design to prevent impacts upon fragile occupation zones, and priorities for which places to present to the public and also for the places which should not be subject to public access.
- Undertake a project to provide both Aboriginal and non-Aboriginal naming for agreed sites along the Cooper Creek and its environs.
- Undertake a cultural program alongside ecological monitoring of selected sites to identify the dynamics of feral animal impacts and management including the potential for cane toad movement into the region and their predicted impacts on local fauna and habitat.

# 6 COOPER CREEK LANDSCAPE ASSESSMENT

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## 6.1 Overview and context

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The key driver behind the Cooper Creek project is the presence and absence of water in the landscape and the activities focused around waterbodies in and associated with dry rivers and their drainage systems. This detailed landscape analysis identifies sites of importance in the broader river catchment and works outwards along the more accessible roads and tracks with the intent of gaining understanding of the impacts on local conditions in a regional perspective. Scientific approaches and design-based strategies are linked through systematic recording, coordinated mapping, and the development of common language and concepts. One of the project's critical aspects revolves around providing a visual language (through images, photographs and sketches) that allows information to be shared and coordinated through mapping and interpretation drawn from a landscape design approach.

### 6.1.1 Site mapping and analysis

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Drawn from the literature review and landscape architecture practice, a range of routine site mapping procedures and GPS-based techniques are employed alongside alternative techniques undertaken by design, design research, landscape character and scenic assessment and interpretation methodologies. The Google Earth aerial visual mapping system has been adopted utilising the 2007 and 2011 data capture, which was taken during a time of extreme drought followed by extreme flood. The Google base maps provide an easily recognisable visual perspective of the landscape, geographical coordinates and relative scale that are easily translated across research data and for the general public.

The Cultural Landscape Assessment Matrix mapping technique includes on-site freehand sketch mapping of plan and section (not to scale) and site notes in the categories: form, bank margin zones, water feature/type, vegetation, occupation, access, interpretation, views, other (associated information) and issues with implications for future management approaches. All identified mapping of the various waterbodies at local, regional and national scales, has been collated to include aerial imagery and interpretation, major roads and access points, historic features and sites, popular tourism and ecological/hydrological processes analysis. Panoramic photographic imagery enables spatial characteristics and traces of use of natural systems around waterbodies to be evaluated. Immediate site conditions and details are also mapped through photographs and collection of materials and vegetation that contribute to the place's character.

Additionally, informal mud maps, produced during consultations with both locals and researchers, indicate local knowledge of the systems and situations that impact upon river and waterhole conditions and management regimes. This informal diagramming is a valuable tool for use in consultation and information dissemination.

## 6.2 Water typologies and landscape quality assessment (2011-13)

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The research has been expanded from its focus on assessing the physical and cultural attributes of the Cooper Creek rivers, drainage lines and associated floodplains, waterholes, lakes and wetlands systems to include general assessment of pastoral and mining bores and surface water fed dams and borrow pits.

In part this has been influenced by the fortunate timing of the research during the 2011 to 2013 period of flood and recovery where the landscape was transformed by the extensive flooding of the Cooper Creek floodplains. The resulting landscape quality assessment became a regional overview due to the disappearance of many of the waterholes as they were overtaken by the river system in 2011. The April 2012 and September 2012 assessments document the process of recovery and the intense period of vegetation growth that transformed the usually dry landscape. The remark that these lush conditions would not be seen again in some people's lifetimes was often heard in conversations with locals and with ecologists and local pastoralists. These 'unique' conditions provided the impetus for many new visitors to the area to witness the outback in bloom in the context of extensive water across the landscape. The changing nature of waterbodies in the landscape, and their associated riparian zones, are an important component of the assessment findings in this technical report.

This overview identifies the variety of ways that water is found or captured in the landscape and enables a comprehensive perspective on the relationships between water as a resource and as a cultural magnet in the landscape. Importantly, the expanded landscape assessment component now traces the trajectory of the more extensive geomorphology, hydrology and aquatic ecology field studies that range further along the creeks of the system. However, the final selection of waterbodies for landscape evaluation is framed through their association with human historical development and current interfaces. A total of thirteen waterhole systems and four lakes are assessed in detail with an oversight of associated drainage lines and wetland and groundwater infrastructure provided.

Applied to the water typology assessment is Lennon's (1996) cultural landscape mapping overlay that relates landscape character to human occupation and intervention. The three general categories: designed, evolved and associative landscapes are attributed to each site. There are few waterbody-originated designed landscapes in the Cooper Creek Catchment, with the predominant sites conveying the evolved landscape condition. Associative landscape types also abound in the small and/or more remote waterholes, wetlands and lakes that exhibit high 'natural' landscape quality. Additionally, the suggested Cooper Creek specific themes; Industrial, Conservation, Productive and Storied are also applied to each place. In most cases, waterbody types exhibit qualities of more than one of the local themes.

### 6.3 Cooper Creek: Landscape characteristics overview

**Location:** From Nappa Merrie Qld 141° 04' E 27° 37' S Elev: 65m to Lake Eyre 137° 36' E 28° 21' S Elev: -6m (scope of this study)



Figure 6.3.1 The Cooper Creek SA section: land forms and landscape elements overview Source: Gresley Wakelin-King and [www.earthgoogle.com](http://www.earthgoogle.com) retrieved 19/11/2011.

#### General landscape character

To the east the landscape follows the Cooper Creek Channel from the Queensland border; from the richly vegetated braided channels and confined floodplains ranging downstream to the dunescapes of the Strzelecki Desert and Benangerie Ridge, the Innamincka Dome and below it the depositional Innamincka Fan. Beyond the complex of Cooper Creek waterholes associated with the Innamincka formations, the channel disperses into a vast floodplain dotted with salt lakes, as it traverses the Cooper Creek South Arm through the expansive Strzelecki Desert and dune plains to the south and the gibber plains of Sturt Stony Desert to the north. The North West Branch of the Cooper Creek flows northwards to terminate in the Ramsar nominated Coongie Lakes wetlands and swamps. Beyond Lake Hope the Cooper becomes a single channel with extensive floodplains and ephemeral waterholes filled only after extreme flood events. Beyond the 10 kilometre wide floodplain at the Birdsville Track crossing, the Kopperamanna floodout encompasses a number of expansive playa lakes before winding its way to its termination at Lake Eyre North. The only major publicly accessible settlement in the area is the small Innamincka Township whereas the privately managed complex of Moomba is an industrial incursion in the open scrubby desert plains.



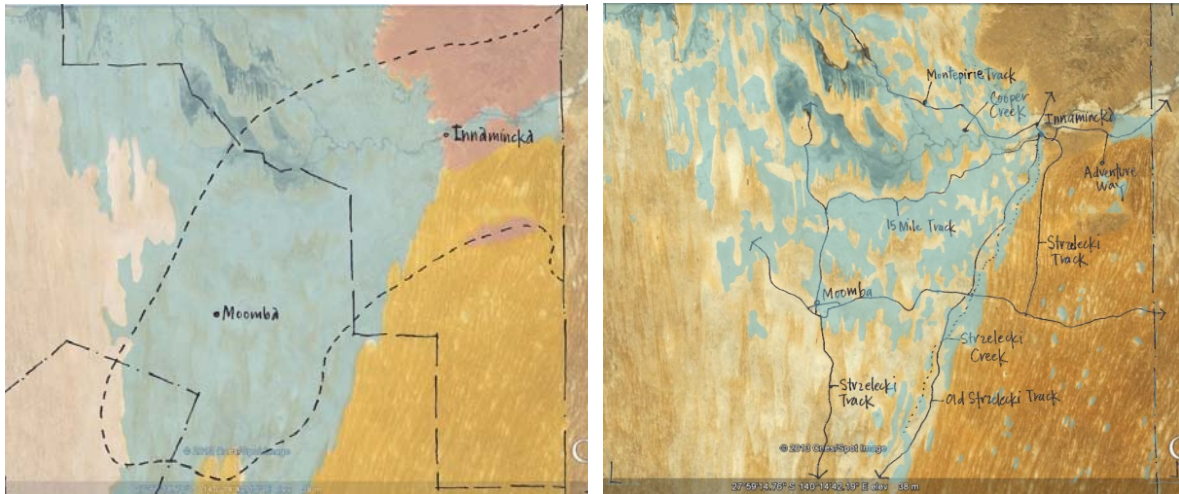


Figure 6.3.2. The Cooper Creek SA section land systems and inundation. Left key: Pink – Mernini, blue – Cooper, beige – Hope and yellow – Tingana, the small dash contains Nappamerrie Trough, the long dash the Innamincka Regional Reserve and the dot-dash the Strzelecki Regional Reserve. Right key: recorded extent of inundation in extensive floods relative to access tracks. Source: [www.earthgoogle.com](http://www.earthgoogle.com) retrieved 19/11/2011.

The landscape reveals an array of vegetation types, ranging from dense Coolibah woodlands and shady River Red Gums to sparse Mitchell Grass communities and herbs that cling to mobile sand dunes. Mulga and Gidgee trees fill drainage lines, while Spinifex, grasses and herbs cover the valley floors between dunes. During dry periods, vegetation is extremely sparse and located only where water collects in drainage lines, soaks and in crevices in the gibber. During flood desert vegetation is firstly submerged in the floodplains which turn a rich green, followed by drying times where the colours of the desert return to their customary red and yellow sands and stones interspersed with dark and dusty green lines of trees and shrubs associated with drainage lines and floodplains.





Figure 6.3.3 The Cooper Creek in flood (2011) and recovery (2012): From top left, Cooper Creek at Innamincka, April 2011, Cooper Creek Floodplain west of Innamincka, April 2011, From bottom left, Coongie Lake Cooper Creek North West Branch inlet, September 2012, Lake Kopperamanna, September 2012.

### **General history and current aspects of occupation**

Despite being isolated and often inaccessible, the South Australian arid lands region has seen much European activity in the form of exploration, pastoralism and oil and gas production. The presence of reliable water from natural sources was the primary reason for the location of many homesteads and associated service infrastructure of the early settlers, followed by drilling of wells and bores from sub-artesian sources upon the arrival of new pastoral and mining technology.

The desert was the site of Burke and Wills ill-fated expedition, of missionary exploration and occupation of places where groups of Dieri, Yandruwandha and Yawarrawarrka people could be found, and of the beginning of Sir Sidney Kidman's pastoral empire the backdrop for the rise and fall of many pastoral properties. Tourists can visit the ruins of several outback stations and missions, including the Coongie and Lake Killalpaninna ruins. Aboriginal occupation, past and present is visible throughout the landscape, especially near waterholes, wetlands and lakes and their shorelines and associated dunes. Scatters of stone material indicate places of tool manufacture and middens of discarded shells tell of ceremonial and meeting sites occupied by great numbers of people over long time periods. Many wilderness camping sites have been home to campers over thousands of years.

Innamincka Regional Reserve is home to many tributes to Burke and Wills; Nappa Merrie and Bullah Bullah waterholes and the Dig Tree and the trail moving westerly along the Creek to witness their graves, King's Tree and the Alfred Howitt Memorial. As part of the Cooper Basin the area is the site of Australia's largest onshore petroleum production. Conservation activities now overlay existing pastoral leases as the region also contains the Innamincka Regional Reserve, the Ramsar nominated Coongie Lakes National Park and the Strzelecki Regional Reserve as part of the Desert Parks of South Australia system.

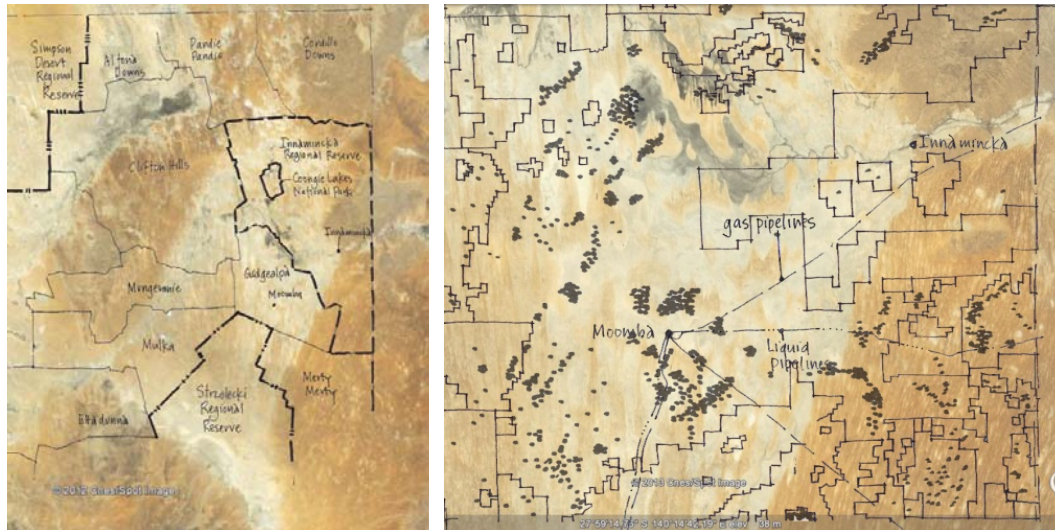


Figure 6.3.4 The Cooper Creek SA section pastoral boundaries on the left and mining tenements and well points on the right. Source: [www.earthgoogle.com](http://www.earthgoogle.com) retrieved 19/11/2011.

The contemporary landscape of the Cooper Creek region is a pattern of the overlays of boundary lines first established through pastoral leases and the vast runs of Innamincka, Gidgealpa, Merty Merty, Mungerannie, Mulka and Etadunna. Station tracks and waterpoints are the predominant markings on the landscape and these are widely dispersed. The advent of mining has brought an industrial landscape aesthetic to the arid lands through mining tenements now marked over the old pastoral boundaries. Alongside the visible presence of seismic lines, bore fields, borrow pits, dams, wells and pipelines, multiple service roads overlay the country on a huge scale, particularly in the areas to the west, south and north of Innamincka, to the east of Lake Hope, north to Tirrawarra Swamp and the Gidgealpa area and south along the Strzelecki Tracks to around Merty Merty and the Strzelecki Reserve.

## 6.4 Tracks and infrastructure

The noted heritage Birdsville and Strzelecki Tracks are the major north-south communication lines through the catchment and follow traditional pathways across the arid landscape. When pastoralism was first established in the region, the associated stock routes were the first line of travel building upon age-old Aboriginal routes across the desert in search of reliable water. Stock routes No. 2, 5 & 7 now form the basis for the Birdsville and Strzelecki Tracks, although the route of the Strzelecki has changed significantly since mining operations commenced due to the potential for the old track to be regularly inundated and therefore impassable.

Creek and drainage line crossings bisect the predominantly dirt, sand and gravel roads, with extensive floodplains to manoeuvre. The Cooper and Strzelecki Creeks and their floodplains provide the major crossing points for the Birdsville and Strzelecki Tracks respectively and can make the roads impassable for months during times of intense flooding. Pastoral tracks lead off the Birdsville Track to access the paddocks and associated bores, lakes and ephemeral waterholes and wetlands in the sand dune and stony plain country.

To the south the Strzelecki Track is also bisected by creek and river lines, but these drainage lines become more rare travelling southwards through the sandy deserts and areas



such as the hummocky dunescape of the Cobblers. Further north the Track traverses high sand dunes and interdune flats. Pastoral tracks also lead off the Strzelecki, with the increasingly numerous mining roads, the Moomba Complex and tracks with signs to oil and gas fields providing new networks across the once impassable landscape. The now diverted old Strzelecki Track is rarely traversed and is an indicator of the narrow track of the past that was not engineered for heavy vehicular traffic as today.



Figure 6.4.1 Tracks and infrastructure landscape overlay, Old and new Strzelecki Tracks, mining and pastoral tracks, major settlements. Source [www.googleearth.com](http://www.googleearth.com), retrieved 19/11/2011.

Secondary tracks such as 15 Mile Track follow the floodplains and water lines of the Cooper Creek and up to Coongie Lakes National Park, mirroring the routes taken by the Dieri, Yandruwandha & Yawarrawarrka and other local Aboriginal groups following water. In more recent history the explorers; Eyre 1839, Gregory 1850, Burke & Wills 1859-61, Stuart 1860-62 moved across the area primarily following the routes established by Aboriginal groups which closely aligned with available water points. These are the pastoral and tourist driven tracks of today, with rare use by mining interests.

The Cooper Creek South Australian study area contains a series of major and minor Aboriginal Dreaming, goods and trading routes, associated with water places and the wider landscape. The extensive networks and social alliances and their trade and ceremonial routes are mapped on the image above. Along each of these tracks, important ceremonial and spiritual sites are marked through oral history and the visible remains at midden, burial and other sites, usually located close to water sources. The cultural landscape is a network of noded linkages connected by the creation stories of the ancestral beings (McBryde, 1997). Lake Kopperamanna is marked as an important site of camping, exchange, meeting and ceremony.

The Cooper Creek South Australian study area contains a series of major and minor Aboriginal Dreaming, goods and trading routes, associated with water places and the wider landscape. The extensive networks and social alliances and their trade and ceremonial routes are mapped (refer Fig. 6.4.2). Along each of these tracks, important ceremonial and

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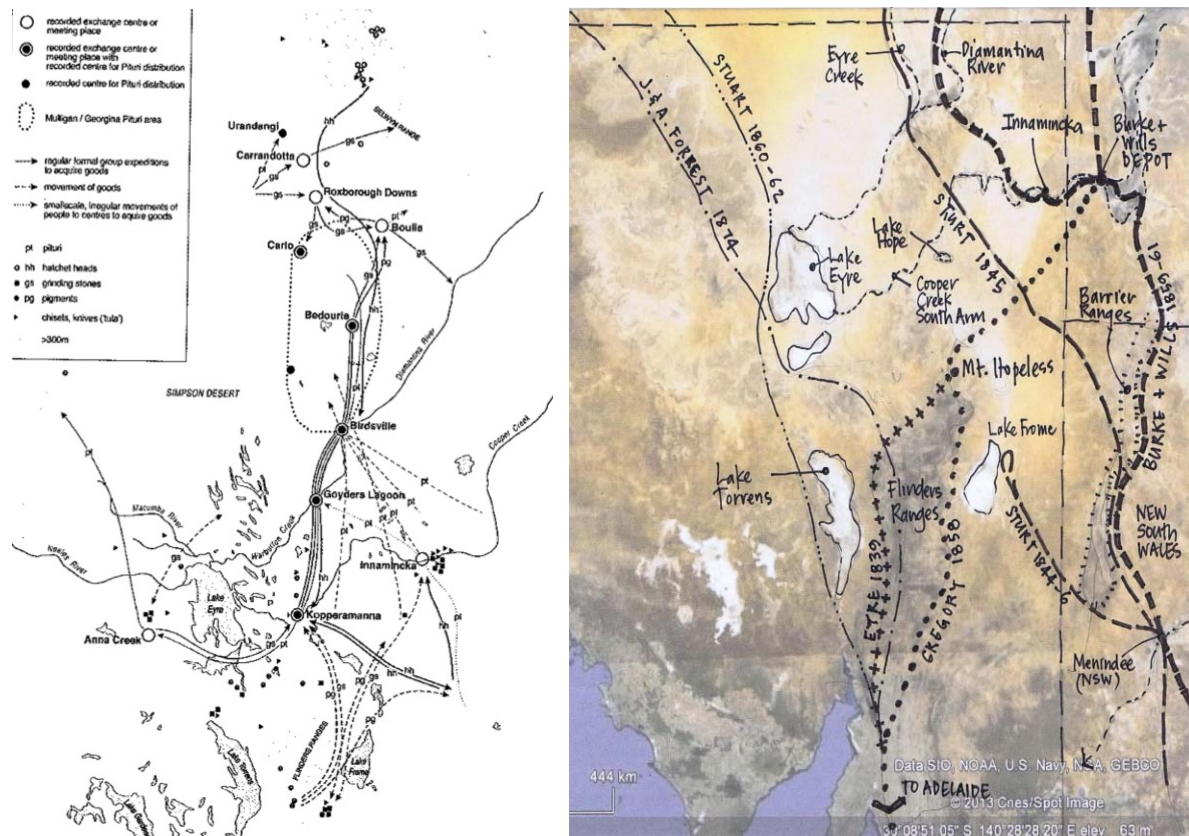


Figure 6.4.2 Aboriginal trading routes and explorer routes Image Source: McBryde, 1997 and [www.google.com](http://www.google.com) retrieved 19/11/2011



### 6.4.1 Strzelecki Track Overview

**Location:** Lyndhurst 138° 20' E 30° 17' S Elev: 57m to Innamincka 140° 44' E 27° 44' S Elev: 127m



Figure 6.4.1.1 The Strzelecki Track exploration and road corridors mapped in relation to settlements and water points and an overview of the Strzelecki Creek and track landscape. Source [www.earthgoogle.com](http://www.earthgoogle.com) retrieved 19/11/2010.

### General landscape character



Figure 6.4.1.2 Strzelecki Track and Strzelecki Creek April 2011

The 460 km sand and clay Strzelecki Track begins at Lyndhurst and travels across a variety of sand plains and dunefield landscapes, cut by several small tree lined creeks. The major named landscape features in the Strzelecki Regional Reserve through which it passes are Montecollina Bore and the Strzelecki Creek Crossing near the Yaningurie Waterhole further north. Occasionally stony rises give way to hummocky dune plains, gradually entering predominantly treeless red sand dune plains with low scrubby interdune flats and claypans around the Merty Merty pastoral lease and towards the Moomba gas and oil facility. The landscape rises to higher stony plains and occasional mesas on the approach to Innamincka township.



Figure 6.4.1.3 Strzelecki Track from south to north. General dirt road conditions with occasional bitumen through open grasslands plains to dune landscapes interspersed with mining infrastructure and worksites towards the settlements of Moomba and Innamincka



Figure 6.4.1.4 Old Strzelecki Track well infrastructure, signs and co-occupation of pastoralism and mining interests

### General history and current aspects of occupation

The Strzelecki Track encompasses a landscape of pastoral and mining activities. Occupied by Aboriginal people for thousands of years by Yandruwandha & Yawarrawarrka peoples, it crosses Aboriginal trading routes. The Track was first made by Harry Readford and is located on past Stock Route numbers 5 and 7 from Haddon to Farina via Innamincka (Yelland, 2002). During droving times numerous wells were sunk to support stock but the unreliability of these water points determined its demise and it was abandoned in 1952.

In 1963 when large gas deposits were found in the Cooper Basin at Gidgealpa west of Innamincka the track was re-established in its present form to facilitate mining activities. Moomba and its associated oil and gas plants of Big Lake Gas Field and Moomba Gas Field are located on the Strzelecki Track, approximately 150km from Innamincka in a sand dune landscape. The almost abandoned Old Strzelecki Track commences at the Merty Merty Station turn off, reconnecting with the new Strzelecki Track east of Moomba. Although predominantly re-established for mining purposes the new Strzelecki is a popular outback drive and is subject to high tourist visitation as part of the Outback Loop linking Lyndhurst, Innamincka, Birdsville and Marree, and the destinations of the waterholes and wetlands of the Cooper Creek.



### 6.4.2 Montecollina Bore

**Location:** 139° 58' E 29° 24' S Elev 9m

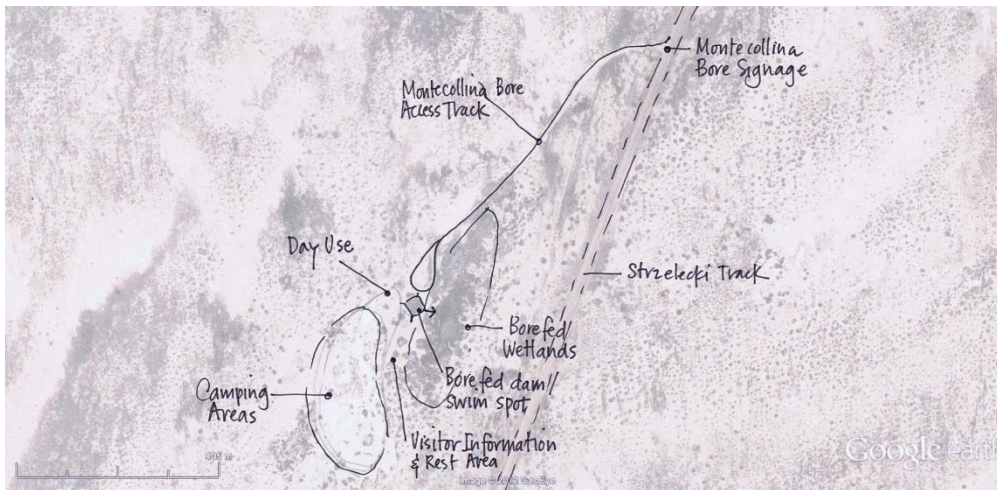


Figure 6.4.2.1 Montecollina Bore. Image February 2011. Source [www.earthgoogle.com](http://www.earthgoogle.com) retrieved 19/7/2012.

#### **General landscape character**

Montecollina Bore is located just off the Strzelecki Track in the Cobblers hummocky white sand dune area. The pastoral bore spills initially into an open dam on high ground and then via another pipe system into an enclosed and extensive artificial wetland to the west of the Track. The wetland supports a diverse community of saline marsh plants and shrubs on its outer margins. It is an oasis for birdlife, saline aquatic and riparian plants and human travellers alike.



Figure 6.4.2.2 Montecollina Bore Wetlands April 2012



Figure 6.4.2.3 Montecollina Bore dam and bore infrastructure April 2012







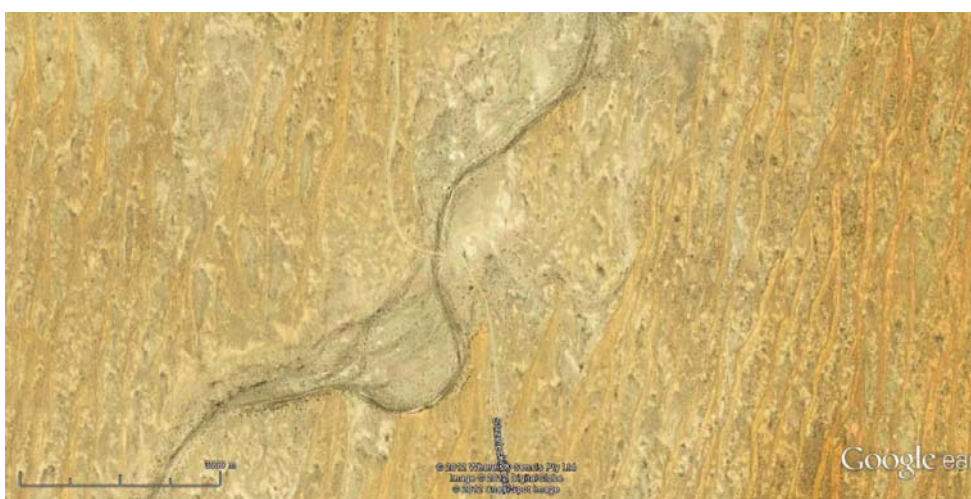
Figure 6.4.2.4 Montecollina Bore dune camping area, walking tracks and shelter September 2012

### General history and current aspects of occupation

Montecollina Bore was one of only two government bores sunk on the Strzelecki Track stock route (Yelland, 2002). Located in the Strzelecki Regional Reserve, which was once a pastoral lease, it is popular with tourists as it combines a bore-fed dam where the warm waters are inviting after a day on the road with the added feature of a lush wetland with plentiful birdlife. An uncommon sight in the arid landscape, the Bore is a bird watching place alongside a camping ground set amongst the dune array known as the Cobblers. The spatial layout of sites between the dunes is an excellent example of successful planning for diverse groups, however this is most probably at the expense of dune ecology. Intimate separate campsites offer protection from the otherwise open environment. A small, sheltering interpretive structure with seating and water tanks further supports day-trippers and campers. Bollards have been placed over tracks made between the dunes to prevent vehicles driving across fragile claypans.

### 6.3.3 Strzelecki Crossing

**Location:** 140° 06' E 28° 56' S Elevation: 29m





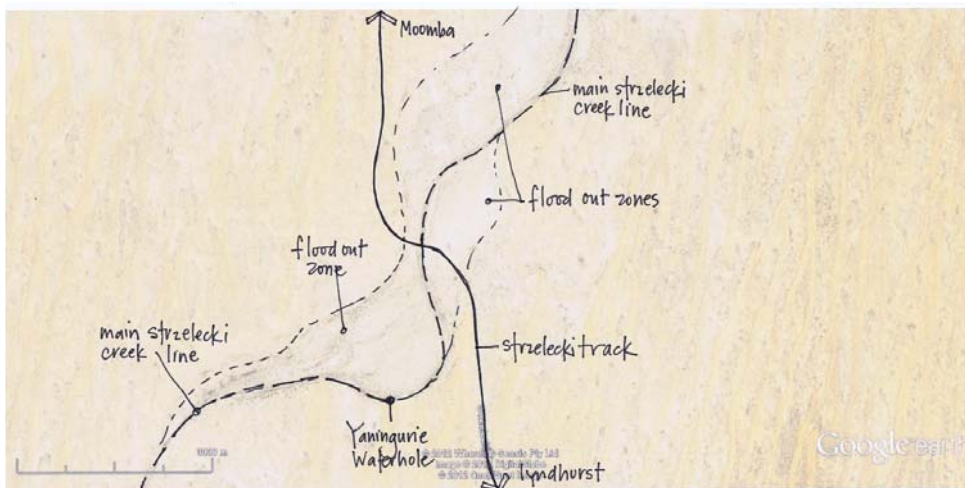


Figure 6.3.3.1 Strzelecki Crossing and Yanningurie Waterhole. Image February 2007. Source [www.earthgoogle.com](http://www.earthgoogle.com) retrieved 19/7/2012.

### General landscape character

The Strzelecki Crossing is located 50km north of Montecollina Bore on the Strzelecki Track within the Strzelecki Regional Reserve. The private Yanningurie Waterhole is nearby. At this point the Track crosses a bridge over the narrowed stony channel of the intermittent Strzelecki Creek. The channel is cut low on the east and west, yet with quite different character attributes on either side of the bridge. To the east the channel is heavily vegetated, while the western channels opens up into a wider floodplain with ephemeral pool and higher flat areas associated with an open woodland riparian zone.



Figure 6.3.3.2 Strzelecki Crossing road and eastern landscape character above and below bridge infrastructure and debris and campsites on the higher northern floodplain.

### General history and current aspects of occupation

A rest area is established at the site and access is directly off the northwestern side of the Strzelecki Crossing via a pastoral track. It is popular with tourists looking for a camping site near water as evidenced by fire remnants. It is a popular spot with tourists looking for a camping site on the side of the track and this is evidenced by fire remnants. There is a story of a UFO sighting at this location a couple of years ago.

### 6.3.4 Moomba Oil and Gas Depot

**Location:** 140° 12' E 28° 06' S Elev: 37m

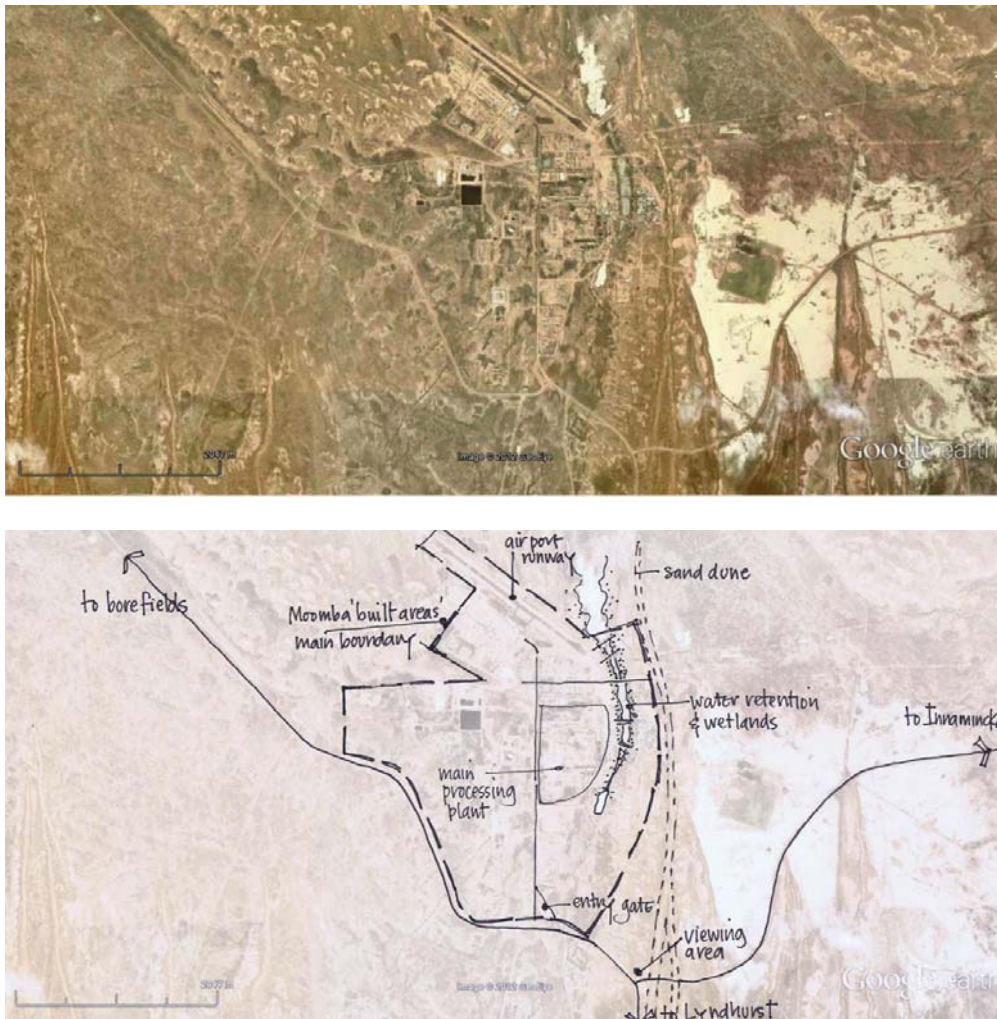


Figure 6.3.4.1 Moomba Oil and Gas Depot, roads, wetlands and associated dune. Image February 2011. Source [www.earthgoogle.com](http://www.earthgoogle.com) retrieved 19/7/2012.

### General landscape character

Moomba is located 150km south of Innamincka on the Strzelecki Track sited on the red sand plains and claypans adjacent a major north south dune to the east. This industrial facility is a long low sequence of buildings, chimneys and tanks, which spreads across the plains. Its planning is structured to suit the works of the refinery and storage facility. Drawing water from the nearby Gidgealpa bore; the establishment of a wetland used for water retention and control also sustains the plant and its landscape.

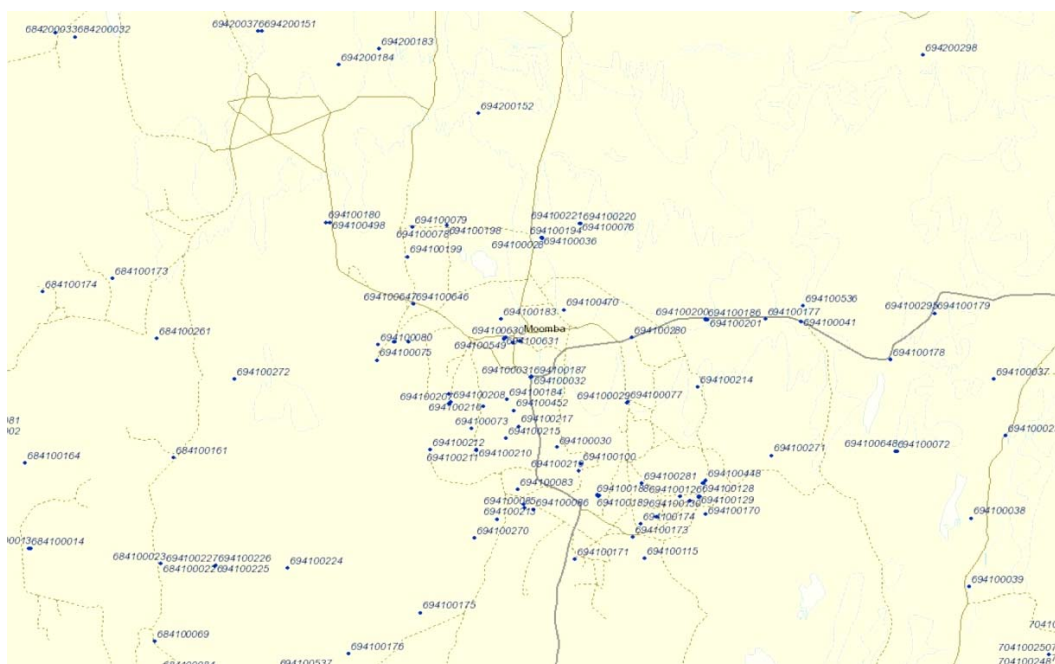




Figure 6.3.4.2 Moomba Oil and Gas Depot on the sand plains – view from the information bay



Figure 6.3.4.3 Moomba wetlands at the facility, and associated infrastructure on the roads to Gidgealpa: borrow pit as dam, associated mine and well installations nestled behind dunes.



### General history and current aspects of occupation

The Moomba gas and oil facility was established after the discovery of gas at Gidgealpa in 1963. It is an extensive industrial centre for the collection, production and distribution of gas and oil drawn from surrounding fields in all directions. The location of water wells above is an indicator of the density of exploration and extraction. The commercial facility is not open for tourist visitation, however Moomba does supply emergency medical assistance. On the dune east of Moomba an interpretive and rest area has been established over-looking the facility in the distance with panels showing the processes of mining operations in the context of the geology of the landscape. The constant movement of trucks on dirt roads raises dust and requires ongoing maintenance of road surfaces requiring substantial amounts of water drawn from local sources.

### 6.3.5 Birdsville Track: landscape characteristics

**Location:** From Marree 138° 04' E 29° 39' S Elev: 44m to  
Mungerannie 138° 39' E 28° 01' S Elev 59m (extent of roads travelled for this study)

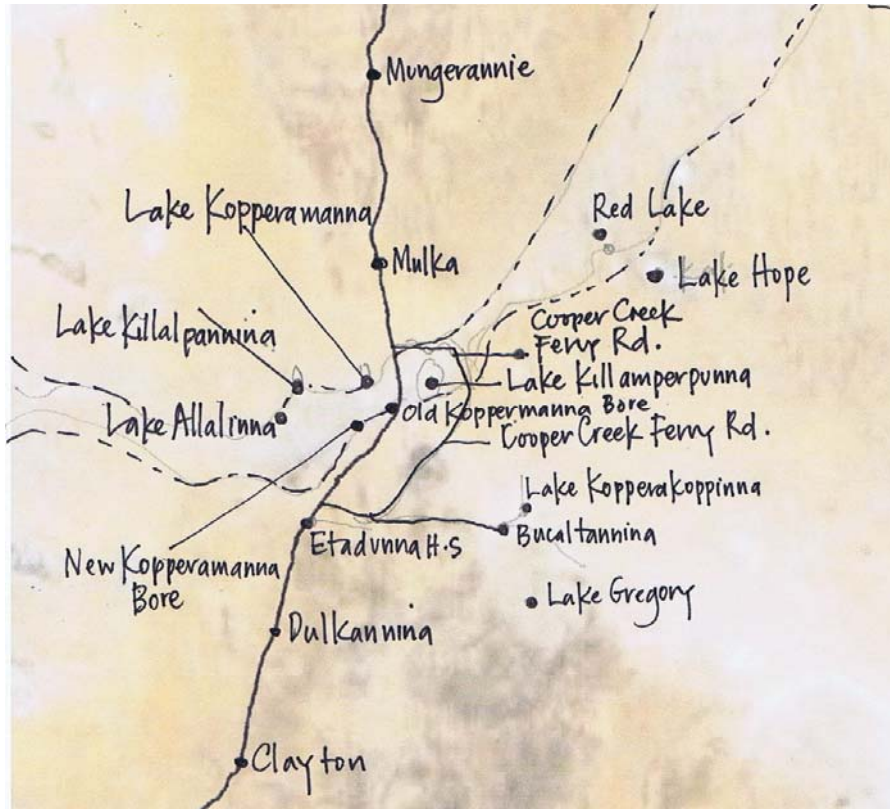


Figure 6.3.5.1 Birdsville Track. Image February 2011. Source [www.earthgoogle.com](http://www.earthgoogle.com) retrieved 19/7/2012.

#### General landscape character

The Birdsville Track begins at Maree and traverses a variety of arid landscapes including undulating gibber stony plains and isolated mesas, ephemeral lakes, sand dunes and the Cooper Creek and its extensive floodplain. The predominantly treeless plains are only relieved by the often-dense woodlands at the riparian edges of the rare creek lines.









Figure 6.3.5.2 Birdsville Track Lake Harry to Etadunna Station and the Cooper Creek floodplain campsite

### **General history and current aspects of occupation**

This study concentrates on the lower section of the Birdsville Track between Marree and the Cooper Creek Crossing approximately 20km north of Etadunna Station homestead. The Dieri people have and continue to occupy this landscape over long periods and have invited many other people on this landscape for formal expeditions to acquire goods, trade and ceremony on the lakes associated with the expansive and fertile floodplain. The area has also been the site of missionary expeditions and settlement on the margins of the associated ephemeral salt lakes.

More recently the floodplains have been the sources for extensive pastoral production through the leases of Dulkaninna, Clayton and Etadunna Stations. According to the 1905 stock routes map the track is on Stock Route 2: Hergott to Birdsville. It was the major route for cattle movement from Kidman properties to north and from Queensland (Yelland, 2002). Today the Track traverses primarily a pastoral landscape and is regarded by tourists as one of the major heritage roads linking the towns of central South Australia. A campsite with minimum services including toilet, fire rings and campsites under Coolibahs is situated in the floodplain towards the north of the road crossing.



### 6.3.6 Cooper Creek Crossing: Road and Ferry

**Location:** 28° 36' S 138° 42' E Elev 10 m

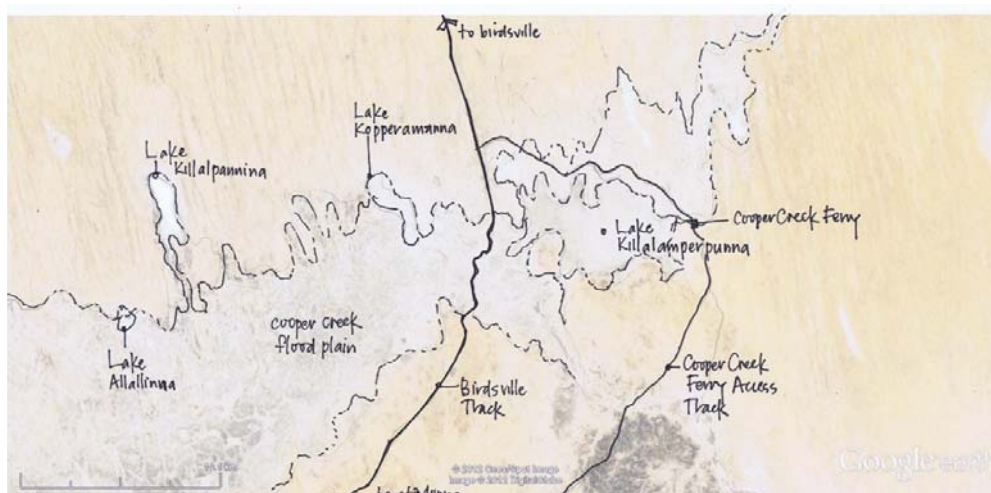
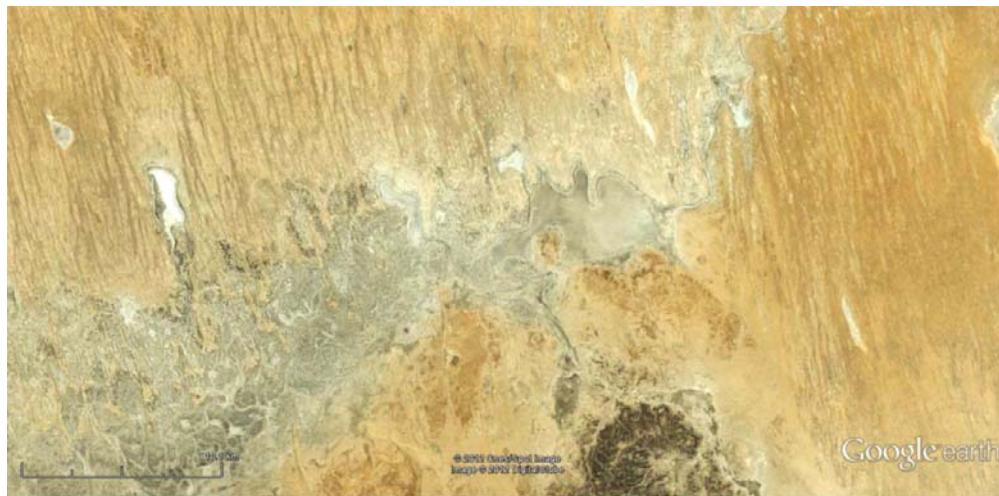


Figure 6.3.6.1 Cooper Creek Ferry. Image February 2011. Source [www.earthgoogle.com](http://www.earthgoogle.com) retrieved 19/7/2012.

#### **General landscape character feature**

The Cooper Creek road Crossing tracks across the 5km wide floodplain and has been relocated further west over time as evident in the aerial photographs. When the road crossing is impassable a track to the east of the Cooper Creek ferry is taken; from the north off the Birdsville Track, and from the south access from Etadunna Station. The access track passes through sand dunes, flood outs, gibber plains and mesas to terminate at a sandy creek edge of red dune margins with very sparse vegetation.





Figure 6.3.6.2 Cooper Creek and Birdsville Track across the floodplains September 2012, April 2011



Figure 6.3.6.3 Cooper Creek Ferry Crossing April 2012





Figure 6.3.6.4 Birdsville Track Road Closed to Ferry Crossing and MV Tom Brennan punt September 2012

### General history and current aspects of occupation

Long an aspect of some complaint, the Cooper Creek Ferry crosses the channel at a narrow point just west of Lake Killamperpunna. Tributes to earlier ferries are marked at a memorial site on the Birdsville track with the display of the earlier punt the MV

## 6.5 Cooper Creek Complex: Innamincka overview

Location 27° 47' S to 27° 41' S and 140° 37' E to 140° 55' E

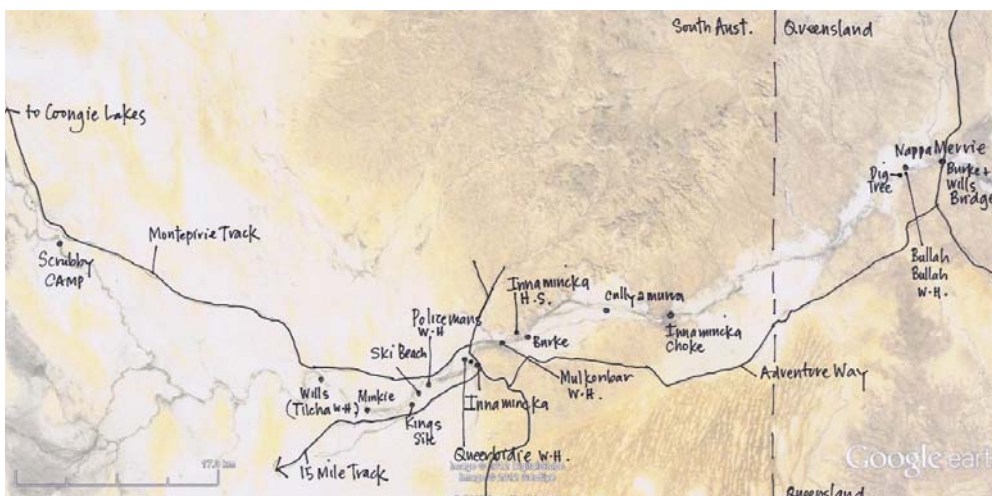
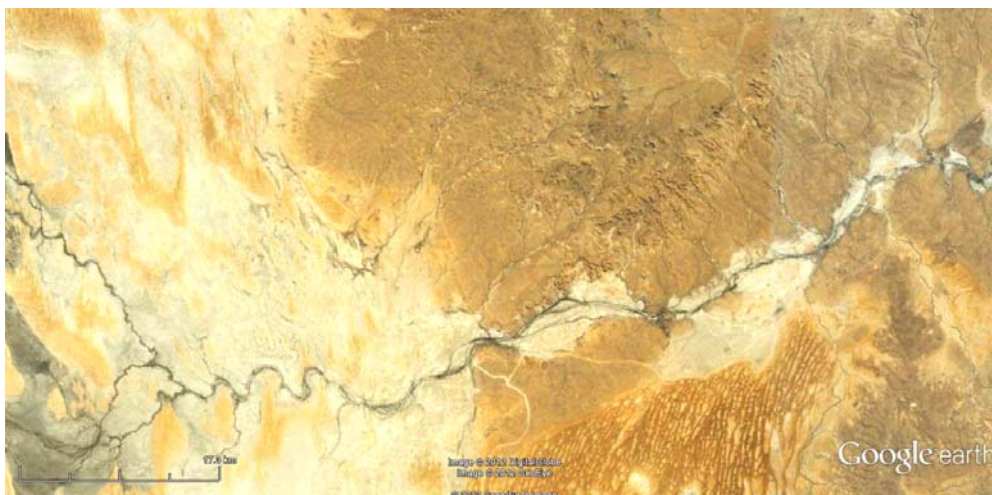


Figure 6.5.1 Waterholes, road and tracks around the Innamincka Complex and Township Image: August 2011  
Source: [www.googleearth.com](http://www.googleearth.com) Retrieved 10/11/2011



## Form

The unique geological and landscape conditions of the Cooper Creek at Innamincka form the sequence of waterholes within the braided channels characteristic of the area. Stretching from the narrow rocky Innamincka Choke in the east which gives rise to the deeply scoured Cullyamurra Waterhole, to the Tilcha Waterhole to the west, the creek and its extensive floodplain exhibit a series of channel conditions which give each of the eight waterholes their distinctive spatial appearance. The inundation map below reveals the raised form of the Innamincka Dome to the east and the flatter Innamincka Fan to the west where floodwaters flow across the floodplains and dune formations of the sandy deserts. The generally contained Cooper Creek channel branches into the less defined Strzelecki Creek channel just south of Innamincka.

East of Innamincka, the channel broadens into the wide Cullyamurra and Mulkonbar Waterholes with flatter more expansive floodplains to the south and rocky hills to the north. At Innamincka, the channel narrows and the sequence of waterholes stretch for 10 kilometres; Queerbidie, Policemans, Ski Beach, King, Minkie and Tilcha each are fringed within relatively dense woodland riparian edges and a range of bank conditions. During the time of this survey, flood conditions in 2011 displayed a single, continuous river system framed by vegetation with lines of mature trees at the usual riparian edge semi-submerged in water. In September 2012, with waters reduced, the main channel and small floodouts were revealed with the waterholes and their wide bank margins becoming more distinct.

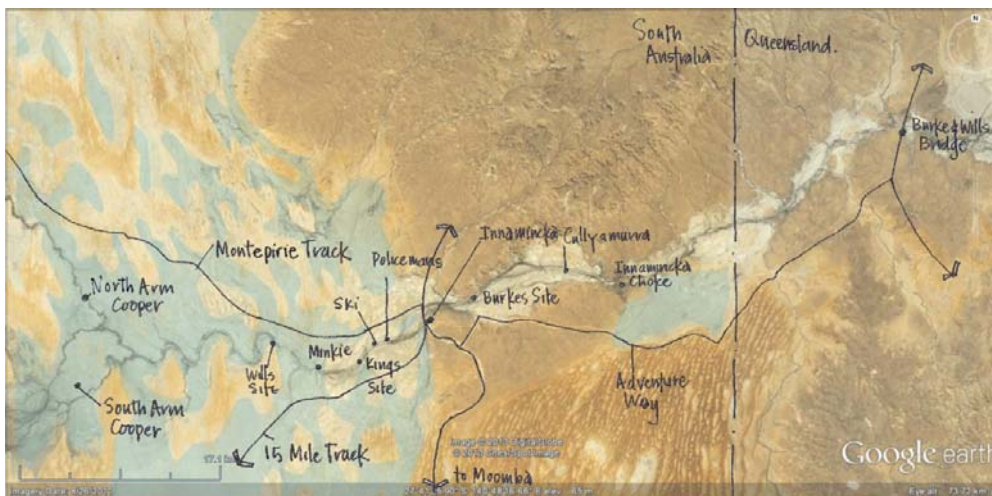


Figure 6.5.2 Overview of inundation zones mapped by RPS Aquaterra 14/02/2012

Source: [www.earthgoogle.com](http://www.earthgoogle.com) Retrieved 10/7/2012.

## Water feature



Figure 6.5.3. Innamincka Complex Western Waterholes in flood April 2011 and recovery September 2012. Google Earth image August 2011 Source: [www.earthgoogle.com](http://www.earthgoogle.com) Retrieved 10/7/2012.

The inland river system comprises a visible vegetated line across the otherwise sparsely vegetated rolling hills and sand plains. A rare sight in the arid landscape the presence of water from the deeper green of swiftly flowing flood waters, to the brownish gently flowing waters of the drying river provides a view of one of Australia's great rivers under the characteristic changing conditions of the system.



Figure 6.5.4 The Innamincka Causeway submerged in flood April 2012, revealed in recovery September 2012

## Occupation

The Innamincka complex is an evolved landscape with an overlay of conservation, production and storied cultural themes. Charles Sturt was the first explorer to navigate the Cooper Creek and named it in 1844 during a time of drought when the channel had been reduced to the sequence of waterholes. It was felt that the water system carried insufficient water to name it a river. In 1860 Burke and Wills perished here on their return from the Gulf of Carpentaria this providing for tourist visitation to the waterholes that celebrate their demise ever since. By the 1880s the watercourse was established as a route for drovers and travellers.

Home to the Yandruwandha and Yawarrawarrka peoples, who feature as hospitable to the explorers before their resources and waterholes were overtaken, Innamincka is a corruption of the Aboriginal word meaning 'deep dark hole' or perhaps 'meeting place'. J. Becker established the 'Innamincka Run' as lease no. 2407 in 1874. The town of Innamincka, some 900 km northeast of Adelaide was proclaimed as 'Hopetoun' on 17 April 1890, taking its present name on 28 January 1892. By 1900 the first pastoral stations had been established at Coongie and Innamincka, later combining to form the Kidman Pastoral Company, which still holds the leases. The Innamincka Regional Reserve, established in 1988, includes Innamincka as well as the world-renowned wetlands of the Coongie Lakes system. The Elizabeth Symon Nursing Home in the Innamincka Township operated as an Australian Inland Mission from 1928 to 1951. It is now home to the National Park and Wildlife Service Reserve headquarters and information centre and forms the northern edge to the township, which also comprises the Innamincka Hotel, the Trading Post and tourist ablution facilities around a wide, open dusty town square. A number of houses and permanent residents are located on the town road grid system with SA Government buildings on the rise adjacent the airport overlooking the Cooper Creek. The Town Common is the associated, locally serviced camping area to the west of the town on the banks of the Cooper Creek at Queerbidie Waterhole. Managed by the Innamincka Progress Association and supported by the Friends of Innamincka Group, the Common is a critical component in housing the transient tourist population, and is subject to high levels of visitation.

The 354,506 hectare Innamincka Regional Reserve operates under co-management arrangements through pastoral, SA government conservation and Yandruwandha and Yawarrawarrka interests. The park and its water systems are magnets for tourists and the mining workers for 4WD, camping, fishing and boating along the watercourse when the water level permits. The story of people travelling long distances to meet, fish and tell stories is a practice that has endured at the waterholes over millennia. Described in the tourist literature as an oasis of striking contrasts; as a place of natural beauty with many waterholes surrounded by vast expanses of sandy desert and arid plains, it is also important as a location connected to inland Australia's founding exploration and pastoral history and rich in its natural and cultural features and values.





Figure 6.5.5 Town Square character of Innamincka; tourist facilities, parking and the pub.



Figure 6.5.6 Landscape character of Innamincka, Town Common & Queerbidie Waterhole September 2012

## Access



Figure 6.5.7 Cooper Creek Crossing at Innamincka causeway looking south; tracks along the floodplain and stony plains beyond

Innamincka and the complex of waterholes are accessed by the Strzelecki Track from Adelaide and Port Augusta to the south to Birdsville in the north. The causeway crossing at Innamincka can be closed for months due to floodwaters. The Adventure Way connects the township and environs to Queensland and the Burke and Wills Dig Tree at the Bullah Bullah waterhole on Nappa Merrie Station. The predominantly dirt roads are subject to major mining traffic and secondary pastoral and tourist travel. Often becoming impassable after local rains, road maintenance is an ongoing issue with regard to water extraction and the safety of the travelling public. Innamincka is the centre of information for outback weather, road and tourist information and is the location of the only public telephone and internet facilities in the area.



### 6.5.1 Cullyamurra Waterhole

Location: 27° 42' S 140° 50' E

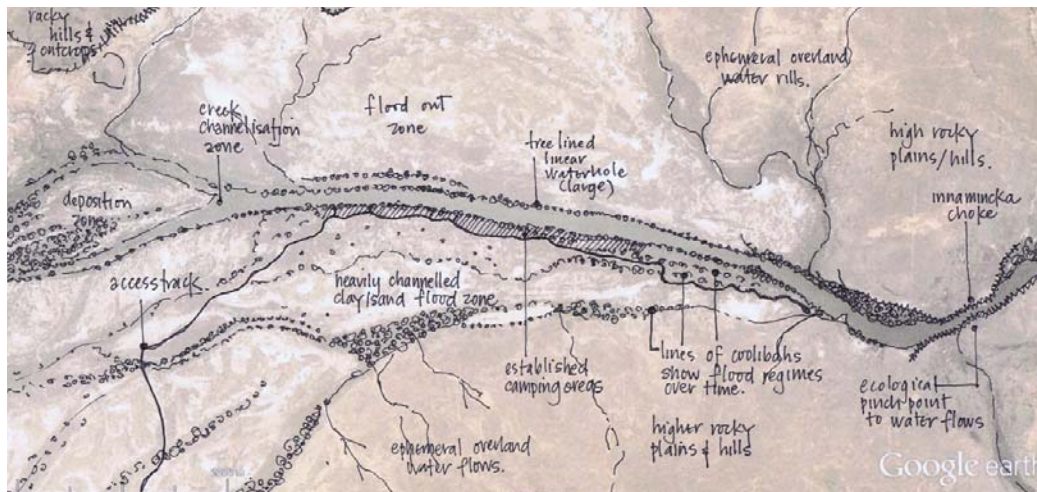


Figure 6.5.1.1 Landscape form of Cullyamurra Waterhole Image: August 2011 Source: [www.earthgoogle.com](http://www.earthgoogle.com) Retrieved 10/7/2012.

#### Form

This linear tree-lined permanent waterhole, recorded with a depth of up to 28 metres, lies in the Cooper Creek floodplain some 15 kilometres north east of the Innamincka township. It extends approximately 8 kilometres west from the Innamincka Choke. From an aerial perspective, the geomorphology of Cullyamurra is clearly visible: the channel is constrained at the rocky pinch of the elevated choke and opens to a wide floodplain on the Innamincka fan. To either side the landscape rises moderately to rocky hillslopes. The extent of the lines of Coolibahs across the floodplain indicates previous flood regimes. Extensive intermittent drainage channels extend throughout the floodplain to either side of the waterhole. The waterhole branches below Cullyamurra and a sandy deposition zone interrupts the single channel form that characterises the waterhole.





Figure 6.5.1.2 Innamincka Choke in flood April 2012, main channel and western branching and deposition zone in recovery September 2012



Figure 6.5.1.3 Cullyamurra Waterhole looking towards the eastern reaches, note the long curving form, September 2012

### Riparian Zone

The riparian zone exhibits a mix of grey brown clay soils, with low to high steep banks to either side as the waterhole progresses from the east to the western reaches. The clay and sand floodplain margins give way to stony rises to the north and south. These fertile soils together with less saline water quality support River Red Gum at the bank edge and Coolibah from bank to floodplain with well-established understoreys of dense Lignum lining and supporting the banks and limiting erosion from high flows. Access to banks is limited by NPWS control measures. Vegetation regeneration programs for the riparian plain are



occurring. Access to the waterhole is gained via vertical erosion gullies in drainage lines along the bank.

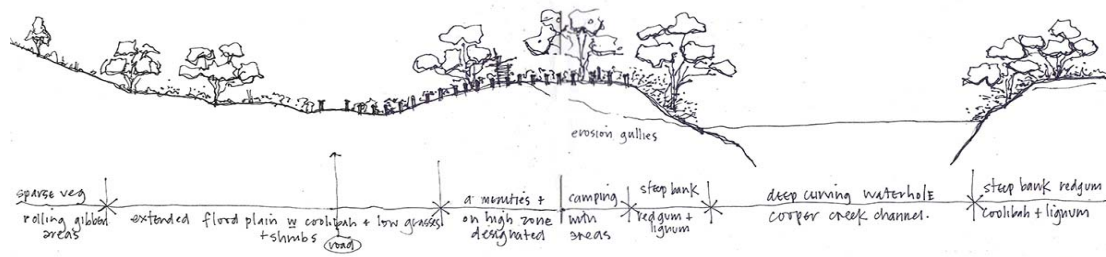


Figure 6.5.1.4 Section of Cullyamurra waterhole at main camping area



Figure 6.5.1.5 Steeply sloping Lignum lined banks in flood April 2012 and September 2012

## Views

There are clear internal views along and across the waterhole except where areas of dense vegetation can interrupt access to the water's edge. Overhanging lines of mature Coolibahs and River Red Gums provide picturesque reflections along both riparian edges. Dense vegetation and high banks between the road, floodplain and water obscure views from beyond the bank edge.



6.5.1.6 Views are possible along the waterhole and across



6.5.1.7 Views are framed along banks due to dense vegetation and ephemeral flood sponsored water plants April 2012

### Water feature

Cullyamurra Waterhole is a rare and extensive permanent waterhole with a river-like appearance in a dry landscape. Well-defined heavily treed banks within the larger floodplain, mature trees and regeneration of the waterhole riparian plains provide a sense of refuge from the surrounding stony treeless landscape.



Figure 6.5.1.8 Cullyamurra Waterhole in flood April 2012 and in recovery September 2012. Note the change in water colour and turbidity and bank access

### Vegetation

This Cooper Creek waterhole is lined with mature River Red Gum (*Eucalyptus camaldulensis*), and further into the sandy bank and plains, Coolibah (*Eucalyptus coolabah*), the occasional Queensland Bean Tree (*Bauhinia gilva*), and Lignum (*Muehlenbeckia florulenta*). During flood time numerous grasses and water plants invade the riparian edge. Further into the floodplain, drought tolerant Acacia (Shoestring Acacia, *Acacia stenophylla*) and Cooba (*Acacia salicina*), samphire (Ruby Saltbush, *Enchylaena tomentosa* and Climbing salt bush (*Einadia nutans*) and native grasses take over.





Figure 6.5.1.9 Vegetation at Cullyamurra Waterhole, bankside understorey at the main camp area April 2012

### Occupation

This is an evolved landscape that exhibits conservation, storied and productive cultural landscape themes. Evidence of recent and past Aboriginal occupation is present in the significant Yandruwandha and Yawarrawarrka men's and women's sites along the waterhole and across the immediate landscape. When Howitt camped here in 1861 (where a memorial now stands on the north bank) he named it from the Aboriginal name 'Kaliumaru' or 'wide lake' subsequently it has morphed through 'Callieumaarou', 'Culemuray', 'Coolumuray', 'Callamurra' and 'Cullymurra' to Cullyamurra as it is known today (Murgatroyd 2002, Silcock 2009, Tolcher 1986). Explorers and pastoralists relied on the permanent waters to the extent that in the 19<sup>th</sup> century both the Church of England and Moravian Missionaries planned but never executed permanent missions at Cullyamurra.

Now located wholly within the Innamincka Regional Reserve and the Innamincka Station pastoral lease, this once wild camping area is loved and highly used by tourist campers using the Adventure Way, Strzelecki Track and the Outback Loop routes. It is also used by pastoralists and continues to be visited by the Yandruwandha and Yawarrawarrka and other local Aboriginal groups. Day areas and camping areas are now managed by NPWS rangers and are provided with amenities, and new access roads and parking areas with bollards are intended to protect fragile areas. Numerous camping areas are lined along high banks of the waterhole with varying distances between clearings that allow for various group sizes, their vehicles and camping equipment. Return visitors stake out their favourite campsites and the closer sites to the road entry, which are serviced by long drop toilets appear to be the most popular.

Discussions with stakeholders occurred regularly around the Cullyamurra campsite being regarded as a sacrificial area of high visitation to take the impact off other areas. Continuing restrictions to only the accessible southern banks and the idea of spelling certain campsites have been raised in relation to high use after flood and before the dry sets in. Activities generally include swimming, paddling, walking, boating and fishing.



Figure 6.5.1.10 Overnight camping clearings among the Coolibahs are located on the high clay banks. Amenities, bollards and defined tracks, ensure visitors remain in dedicated areas, access for water craft is available directly from the banks of Cullyamurra down cleared vertical paths which often become erosion gullies.



Figure 6.5.1.11 Steeply sloping clay banks with access points in erosion gullies between dedicated camping areas. Soil profiles sampled from Cullyamurra banks and riparian zones.



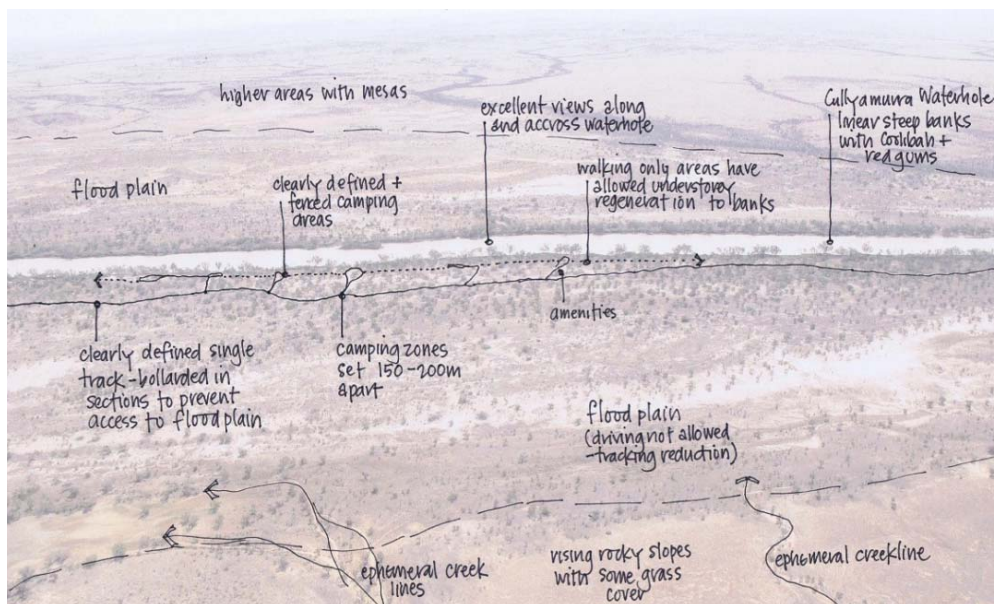


Figure 6.5.1.12 Cullyamurra Waterhole overnight camping areas, access and walking tracks on floodplain, occupation characteristics overview. Image September 2012

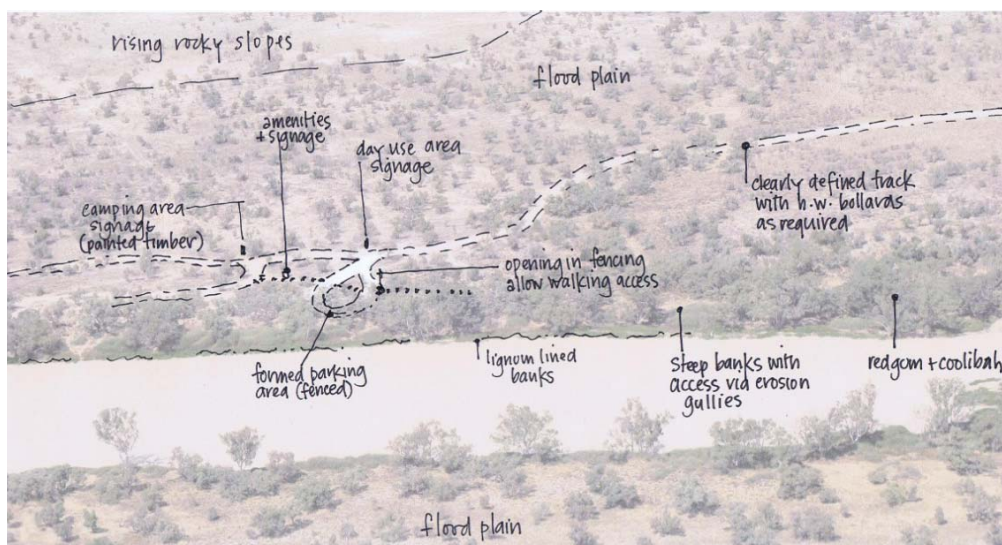


Figure 6.5.1.13 Cullyamurra overnight camping at first camp and day carpark from main road showing new road alignment and vehicle turn around and patterns of use. Image September 2012

## Access

Cullyamurra Waterhole is easily accessed via the Adventure Way and a clearly marked access road/track, adjacent a feature stony plains mesa. The entry track winds through the changing plains to floodplain landscapes and vegetation assemblies gradually becoming denser as the waterhole is approached.



Figure 6.5.1.14 Cullyamurra & Burke Waterhole track into waterhole, entry point Adventure Way, and entry track showing road conditions



Figure 6.5.1.15 Cullyamurra floodplain access track with bollards to either side & overview of camping and access tracks to southern waterhole bank Images: G Lee September 2012

Visitors access the southern bank through newly made post flood tracks that parallel the creek along the riparian floodplain and away from the banks. Tracks lead to unmarked camping clearings. The main parking area is fenced using hardwood bollards and a single stainless steel wire to prevent access to the surrounding floodplain.



NPWS rangers and managers have limited the extent of visitation along the southern waterhole margins and access along the banks and into the riparian landscape is by walking only generally through desire lines made by visitors from camp to camp, along erosion gullies and directly down to the water at gaps in the dense Lignum.

## Interpretation

Signs are provided by a number of sources including SA Roads directional and road condition signage, with information and interpretation provided by NPWS, Santos and the SA Government, Pastoralists, South Australian Fisheries and memorial plaques by visitors. NPWS interpretive signage, consistent with existing Innamincka Regional Reserve graphics, are planned. The increasing appearance of blogs and internet sites posted by tourists provides social media research to guide tourists to the best places and illustrated accounts of traveller's tales and experiences abound on various websites.



Figure 6.5.1.16 Various information, interpretation and memorial signs at Cullyamurra

### Issues requiring management approaches

- The Innamincka Choke southern and northern banks are places of great cultural importance to the Yandruwandha and Yawarrawarrka. Visitors interested in geology and the Aboriginal story of the area enjoy the walk to the Choke as a rare walking trail in the area, without understanding the cultural significance and need to avoid certain areas. The desires of locals and visitors will need information, negotiation and a management plan in order to establish protocols for visitation or closure.
- Interpretative signage and expanded information through an Innamincka Complex App for mobile technologies will assist to explain the various ecological and cultural heritage aspects and dynamics of the Cullyamurra Waterhole landscape.
- In co-operation with local Aboriginal knowledge, consider education programs regarding recognition and interpretation of the range of important cultural sites and their landscape appearance. Visitor and local management recognition understanding of both small and large landscape features, such as groups of rocks, will assist their protection and confirming community values of the broader areas.
- Good approach to traffic and camping management also requires a review of the spaces allowed for multiple visitor groups and the scope and scale of camping equipment including turning circles and parking areas.
- A system of walking tracks and trails would enable management of the riparian edge from clearance and erosion through foot traffic and open up the waterhole experience for interpretation.
- Fire management and tree cutting remains an issue across the range of campsites.

### 6.5.2 Burke's Grave, Innamincka Station and Mulkonbar Waterhole

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**Location:** 27°43'S 140°46'E





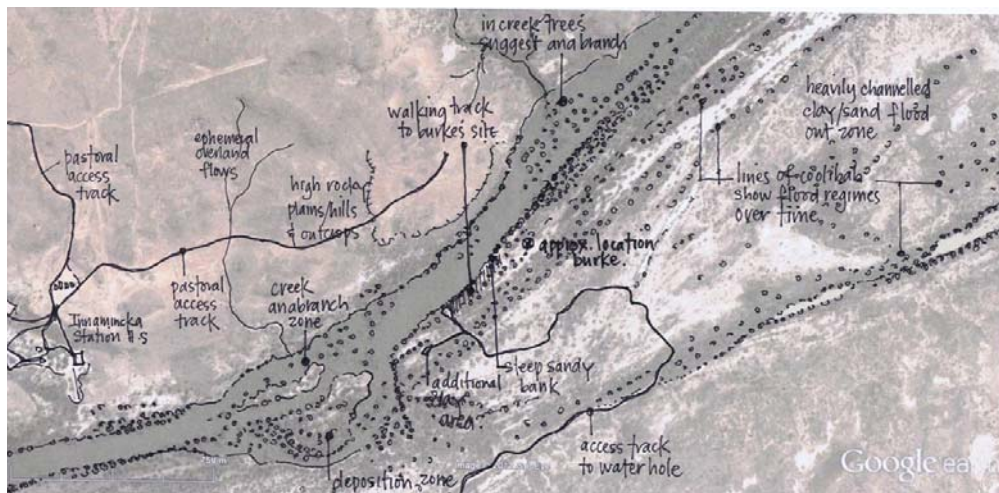


Fig 6.5.2.1 Mulkonbar Waterhole: Innaminka Station on north, Burke's Grave on south bank. Source: [www.googleearth.com](http://www.googleearth.com) retrieved 11/7/2012

### Form

Mulkonbar Waterhole is a large longitudinal semi permanent waterhole south of Cullyamurra Waterhole in a sand deposition zone. The southern side's steep sandy banks from the carpark to Burke's Grave extend back towards the floodplain for 60-200m with the north exhibiting a narrow treed bank edge zone, gently rising stony and clay banks to the red clay plains beyond. The flatter southern floodplain is deeply channelled with a substantial drainage line flowing south at the western margins. The waterhole is contained by small anabranching, treed sections to the east and west which define the specific confined form of this waterhole.



Fig 6.5.2.2 Mulkonbar Waterhole from the east in recovery & from west in flood, September 2012 & April 2011

### Riparian Zone

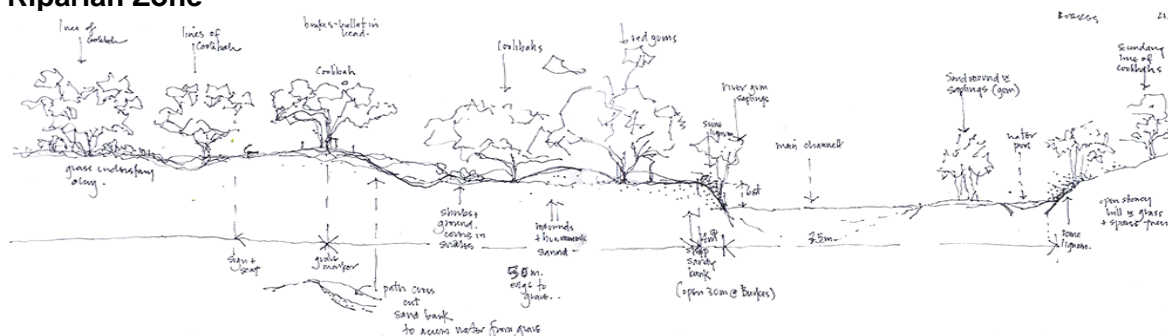


Fig 6.5.2.3 Cross-section of Mulkonbar Waterhole and Burke's Grave site including high floodplain and steep sandy southern bank

The sandy riparian zone extends into grey and brown clay soils in the floodplain to the south. The riparian zone after flood is richly vegetated with dense low shrubs and ground covers under mature Coolibahs. Mature River Red Gums line the lower banks with sparse understorey and less extensive Lignum on the more easterly margins.



Fig 6.5.2.4 Mulkonbar Waterhole from the west looking east, in recovery and overview in flood indicating the large sand bank where Burke's Grave is located, September 2012 and April 2011



Fig 6.5.2.5 Mulkonbar Waterhole sandy riparian edge looking east, in recovery and overview in flood indicating an area of dense Lignum on the south bank and a more open understorey on the rockier north bank, September 2012 and April 2011

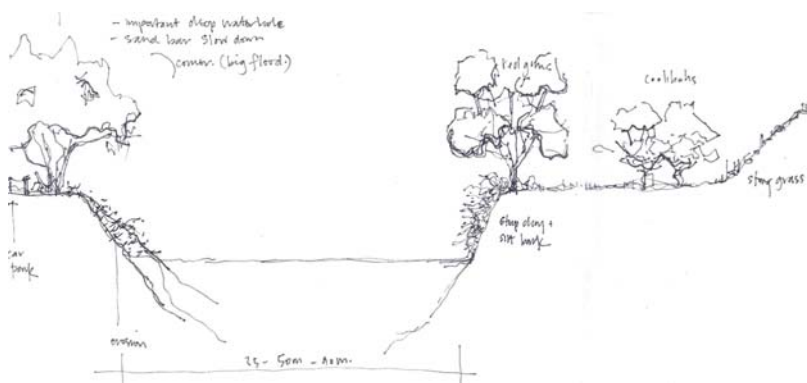


Fig 6.5.2.6 Cross-section of Mulkonbar waterhole at the designated parking area





Fig 6.5.2.7 Mulkonbar Waterhole at the designated parking area

At the southern most reaches of the water hole the sandy banks give way to very steep clay-lined banks with fringing River Red Gums with a dense Lignum lining the banks, extending out to Coolibah open woodland floodplain assemblies.

### Views

Breaks in dense bank vegetation offer excellent cross views, and where access can be gained to the water edge clear views are possible along the waterhole in both directions. This picturesque waterhole gives the impression of a natural contained water landscape. As the landscape dries the sandy bars on the waterhole margins become more pronounced.





Fig 6.5.2.8 Clear cross waterhole views can be found in vegetation breaks and at sand deposition area adjacent the Burke's grave area, in flood April 2012 top 3 images and in recovery September 2012 bottom 3 images

### Water Feature

This semi permanent waterhole in the Cooper Creek system is a more contained waterhole than Cullyamurra waterhole. Mature trees and open undergrowth on the sandy banks provide dappled sunlit walks and a sense of refuge. As the banks are revealed during drying conditions, the sandy nature of the creek bed becomes more pronounced.



Fig 6.5.2.9 Mulkonbar Waterhole features a contained expanse of water with anabranches to each end

### Vegetation

The characteristic upper Cooper Creek bank vegetation of mature River Red Gum (*Eucalyptus camaldulensis*) and Lignum (*Muehlenbeckia florulenta*) is abundant. Further into the sandy bank and plains, Coolibah (*Eucalyptus coolabah*) and the occasional Queensland



Bean Tree (*Bauhinia gilva*) have dense understoreys of flowering shrubs and forbs. During flood time numerous grasses and water plants also invade the riparian edge. Further into the floodplain, drought tolerant Acacia, Shoestring Acacia (*Acacia stenophylla*) and Cooba (*Acacia salicina*) join the Coolibahs under-planted with samphires (Ruby Saltbush, *Enchylaena tomentosa* and Climbing salt bush (*Einadia nutans*) and native grasses.



Fig 6.5.2.10 Mulkonbar Waterhole at Burke's Grave in spring recovery

### Occupation

This associative landscape exhibits storied and conservation cultural themes. Records of events of Burke and Wills last days in the area attest to the long occupation of the Yandruwandha and Yawarrawarrka in this area. Best known to the public as the site where Burke perished this account recalls the co-occupation of this place. 'King recalled, they [the Yandruwandha] were very anxious ... to know where Mr. Burke lay, and one day ... I took them to the spot. On seeing his remains, the whole party wept bitterly, and covered them with bushes' (King's narrative, #255110, Box FB33, MS13071, State Library of Victoria). This description inspired Charles Summers to use it as the theme for one of the four bas-reliefs on his statue.



Fig 6.5.2.11 ***Finding Burke dead*** by Charles Summers, 1865. 'One of four bas-reliefs at the base of 1865 Melbourne statue to Burke and Wills.' <http://burkeandwills.slv.vic.gov.au/ask-an-expert/yandruwandha-yawarrawarrka-cooper-creek>

Today Mulkonbar or Burke Waterhole has high tourist visitation on its southern banks as the site at which Burke reportedly died and where Howitt buried his remains and marked a tree. In order to defend the site from overuse only day parking and visitation is permitted. NPWS provide access tracks fenced off from the surrounding landscape day parking facilities and amenities. A naturally defined, meandering walking path is provided to Burke's Grave site with extensive static interpretation lining the track.

As one of the few designated heritage walks in the area, the Burke's Grave site is also well-used by birdwatchers and passive recreationalists. Boating and swimming do not occur, possibly due to the steepness of the southern banks. Adjacent the Innamincka Homestead on the north bank, the waterhole is important as the source of both water and respite for the station people and it is a favourite recreational and relaxing space for locals after a hard day. The location of station houses in close proximity to major waterholes is a typical response in establishing pastoral facilities on the Cooper Creek, where the compounds are usually located on high ground, well away from floodplains and the possibility of being flooded out.







Fig 6.5.2.12 Burke's Grave & Mulkonbar Waterhole Overview of walk to grave



Fig 6.5.2.13 Burke's Grave & Mulkonbar Waterhole bird watching and river monitoring

The day use carpark is a gathering area for groups, and the designed gateway and sign and fencing only permit walkers to proceed to the gravesite. The new road making after the floods needs time to bed down into the landscape as it is a very bright incursion into the natural landscape. The scale of the clearings for parking and along the walking track are appropriate to the riverine setting and are an exemplar for providing enough room and variation in the relationship between a 'natural' place and an overly managed place.

Many people spoken to in the course of travelling along the Cooper Creek complex of waterholes at Innamincka regard the scenic qualities of Burke's site along with the combined histories of Aboriginal and explorer lives a highlight of the area. For others it is a very managed site, particularly at the entry and they would prefer it to be more open for camping. Nonetheless this place and its landscape treatment should be regarded as an exemplar as

both a naturally beautiful place and as a site that conveys an effective management approach.

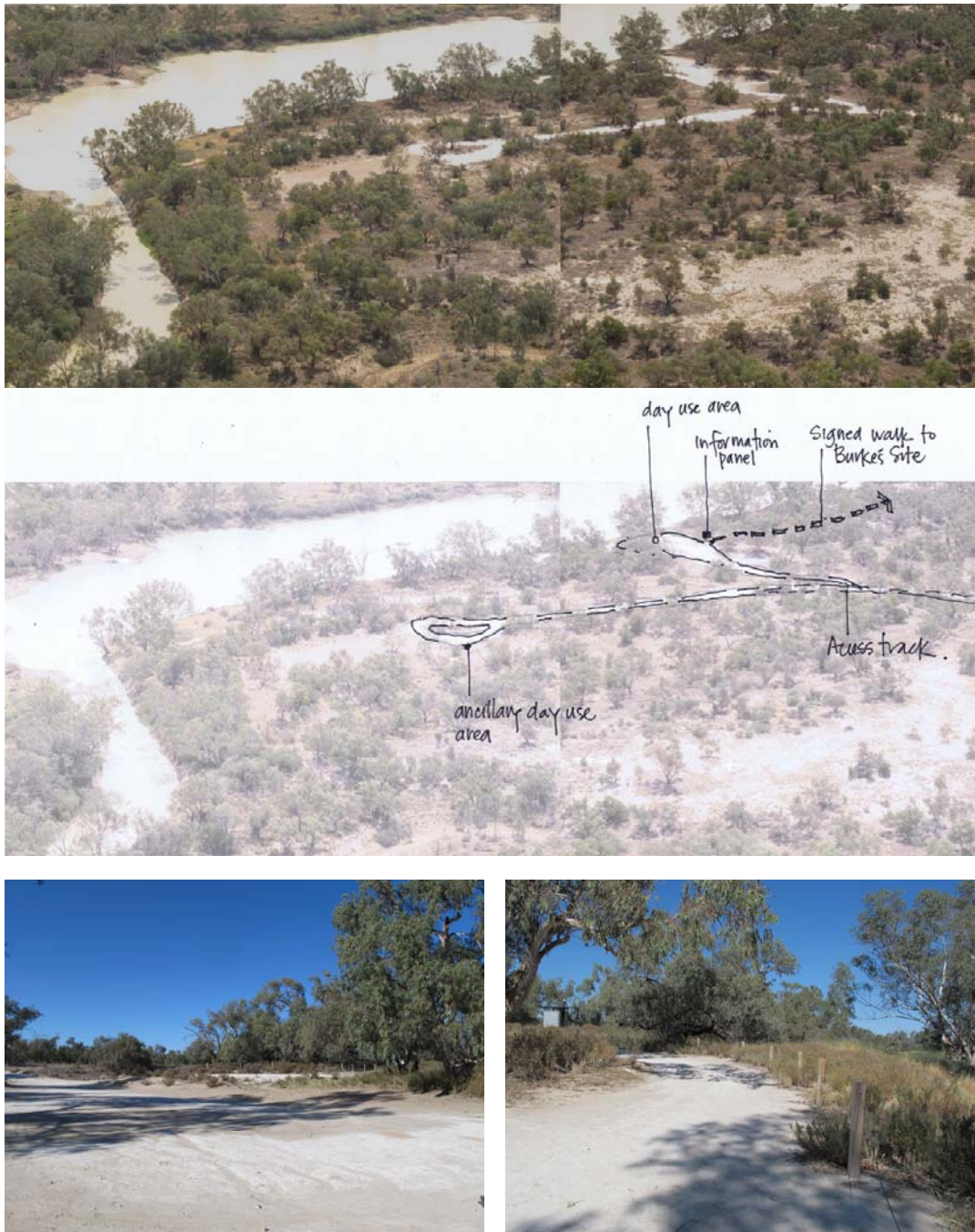


Fig 6.5.2.14 Burke's Grave & Mulkonbar Waterhole over view of day parking area car parking, access track and entry to walk to Burke's memorial gravesite September 2012

### Access

Entry tracks off the Adventure Way east of Innamincka and from the Cullyamurra track are clearly defined and signed in NPWS style for access across the floodplains and claypan to the Burke's Grave site. This day use area has provision for parking only, sufficient for cars with trailers if the site is not too heavily visited and there is a shaded overflow area if necessary. The entry track is fenced to prohibit vehicular access to the site or floodplain. The walking track is clearly marked and easy to access via an opening in the specially



designed fencing. People are kept some 5 to 10 metres away from the steep banks and accessing the waterhole through careful path planning and vegetation clearing.



Fig 6.5.2.15 Burke's Grave car parking, access track and entry to walk to Burke's memorial gravesite

### Interpretation

In keeping with the NPWS Innamincka Regional Reserve interpretive signage system, standard park directional signage and purpose designed steel, hardwood and aluminium interpretive signage is provided. The entry and walking track to Burke's Grave site has a series of interpretive signs along a meandering walk. These signs provide information on a variety of topics including; Aboriginal occupation, lifestyles, food sources, explorers, plants and animals that are local to the area and the region. This site has the most extensive interpretive material in the Innamincka Cooper Creek group of waterholes.

A great deal of interpretive material regarding the history of the site is available on the web and through blogs, however the landscape aspects and other heritage of Aboriginal stories are less covered.



Fig 6.5.2.16 Burke's Grave & Mulkonbar Waterhole interpretive sign suite and Burke's Grave marker

### Issues confirming management approaches

- The management of the Burke's Grave southern banks of the waterhole is very successfully planned and executed regarding traffic, foot and camping management. Alongside the high aesthetic and ecological quality of the waterhole walk to Burke's Grave, the spatial experience of walking along the sandy tracks through the cleared bushes is as close to a natural experience as possible. The carpark has enough space for groups without appearing too overly planned. There are some key spatial and material design exemplars at Burke's to serve as a model for walking and traffic management at other water places.
- Co-management negotiations regarding the interpretation of the Burke's Grave site and waterhole have produced very informative information for tourists. Consideration of web-based or mobile application extensions to the information system would benefit tourists and locals alike in expanding the stories that abound, including cultural stories and identifying other tales of exploration and pastoral life.
- Expanded interpretation of the ecological systems and dynamics of the system could supplement the existing signs, including mobile app development for the entire Cooper Creek complex.



### 6.5.3 Innamincka Town Common and Queerbidie Waterhole

Location: 27° 44' S 140° 43' E

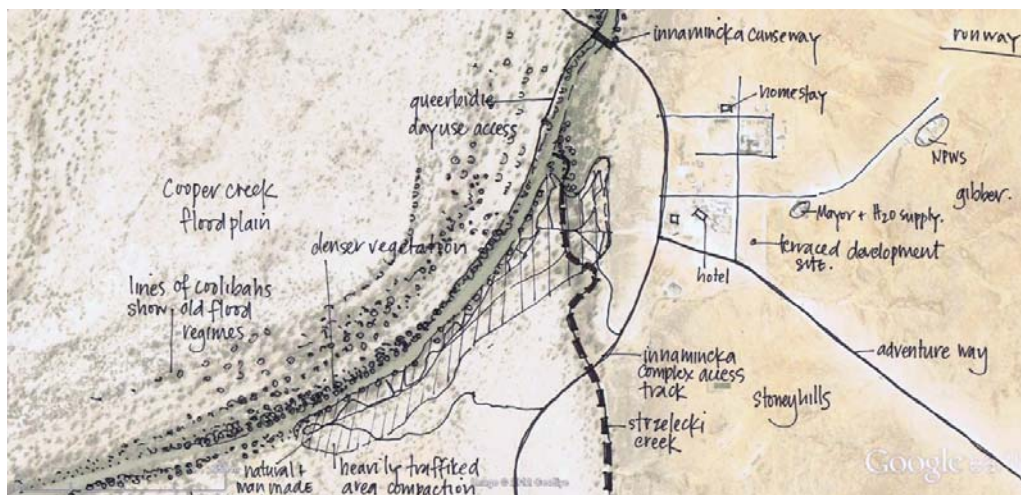


Figure 6.5.3.1 Landscape character of Innamincka Town Common & Queerbidie Waterhole in drought  
Image: 2009 Source: [www.earthgoogle.com](http://www.earthgoogle.com) Retrieved 10/7/2012.





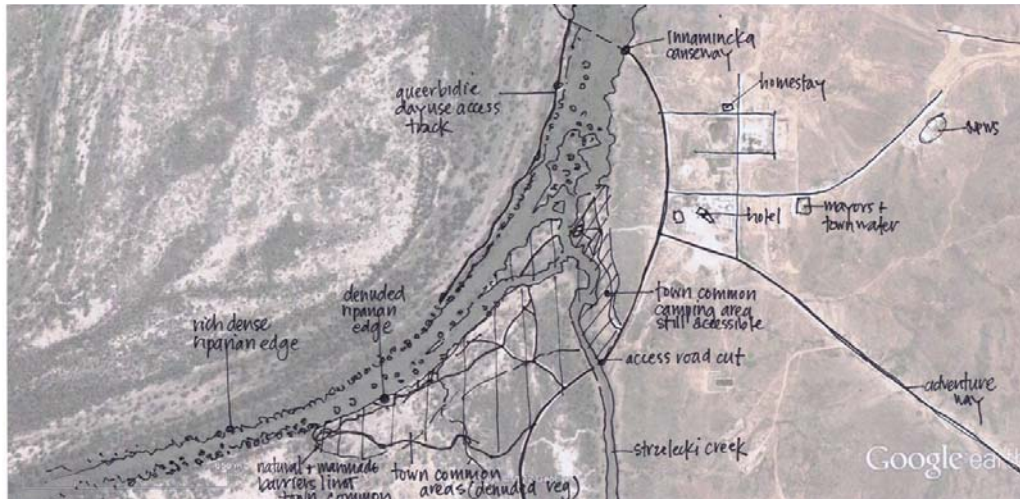


Figure 6.5.3.2 Landscape character of Innamincka Town Common & Queerbidie Waterhole in flood indicating flows down the Strzelecki Creek, the flooded causeway and the expanse of water in the floodplains and over the Town Common Image: 2011 Source: [www.earthgoogle.com](http://www.earthgoogle.com) Retrieved 10/7/2012.



Figure 6.5.3.3 Innamincka Town Common & Queerbidie Waterhole in flood. The central land spur is the access road to Queerbidie north on the Innamincka Regional Reserve and the Waterhole is located in the southern channel. The 15 Mile track is cut by the Strzelecki Creek top left of image. Image: April 2011

## Form

Queerbidie Waterhole is a long curving waterhole south of the Innamincka Causeway and adjacent the Innamincka Township and Town Common. In extreme flood events it is south of Queerbidie where swelling floodwaters can make their way down the ephemeral Strzelecki Creek. The main channel narrows at Innamincka as the floodplain expands across low riparian banks. The bowl like form of the Town Common riparian plain dotted with shade trees and low vegetation is a perfect spatial form for gatherings and group camping. Further away from the central entry and along the creek bank, the bank narrows to provide more linear and self-contained spaces.





Figure 6.5.3.4 Overall landscape character of the Town Common and Queerbidie Waterhole in recovery showing tracking and re-establishment of the camp ground after flood and the important riparian planting adjacent the inlet bar of the Strzelecki Creek September 2012

### Riparian Zone

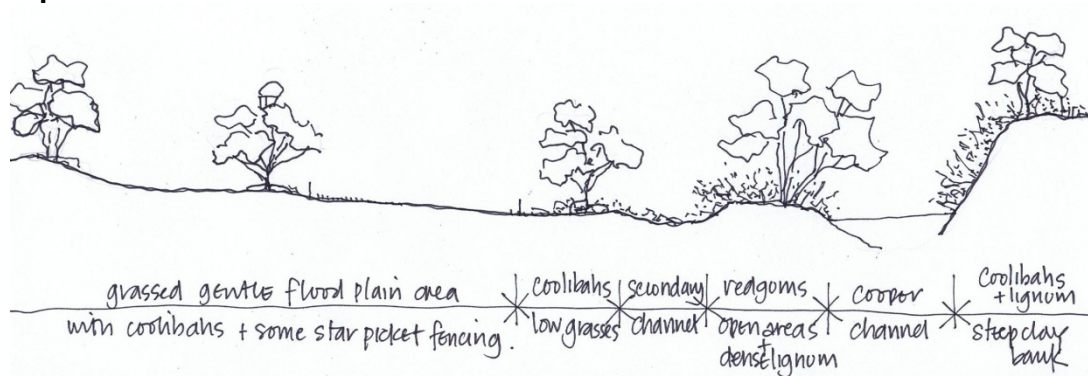


Figure 6.5.3.5 Section through Town Common and Queerbidie Waterhole

The riparian zone is typified by clay/silt soils with low banks on the southern Town Camp side and moderate to steep banks on the northern Queerbidie side. River Red Gums line the waterhole banks giving over to an open woodland of Coolibah on the southern banks. The northern banks are more densely vegetated with Lignum along the entire length of the waterhole. To the Town Common dense Lignum extends from the channel banks over the riparian flats around the Strzelecki Creek inlet as a very important stabilising plant for this fragile area, essential to the hydrology of the entire system. This open woodland zone supports native grasses and Nardoo in wet times. The northern area extends to open woodland with samphire associations giving over to Acacia dotted grassy plains with occasional Coolibah beyond.



Figure 6.5.3.6 View of Town Common over Queerbidie Waterhole from the north bank indicating the cleared banks associated with the camping and fishing area. September 2012

## Views

Views along the waterhole and over the camping area are available to the town common side of the waterhole in both directions, except where dense Lignum on the western end reaches down to the water. The Innamincka Regional Reserve day use area to the northern side provides dedicated viewing areas in controlled zones once the riparian vegetation is crossed.



Figure 6.5.3.7 View to the west along Queerbidie Waterhole towards the causeway September 2012

## Water Feature

The nearly permanent Queerbidie Waterhole has a river-like appearance, which is of great benefit to the Innamincka settlement. It is a feature of the town that water, birdlife and recreation associated with water is available. The waterhole being so close to town increases the oasis-like character of the area and the muddy aspect of the water in recovery and drought times confirms the outback appearance of dryland creeks.



Figure 6.5.3.8 Queerbidie Waterhole at the Town Common water feature looking west and east September 2102

## Vegetation

Vegetation types and densities vary on either bank and along the waterhole. River Red Gums (*Eucalyptus camaldulensis*) persist along the waterhole becoming denser further west where less camping on the banks occurs. Lignum (*Muehlenbeckia florulenta*) is also present at varying densities and in the swampy area adjacent the Strzelecki Creek entry and on the swampy margins, Nardoo and water plants are flourishing in this time of recovery. The Town Camp floodplain is generally an open Coolibah (*Eucalyptus coolabah*), woodland with low grasses.



## Occupation

Queerbidie Waterhole and its associated campgrounds are an evolved landscape with cultural themes drawing upon productive, conservation and storied activities. The waterhole and its environs are located within the Innamincka Town Common to the west of town and the Innamincka Regional Reserve and Innamincka Pastoral Station to the north. The southern Town Common side is managed by the Innamincka community and has very cost effective tariffs, whereas the Queerbidie campsite on the northern riparian flats is NPWS managed with a substantially increased fee. The more contained northern side is more secluded than the busy Town Common and is inaccessible when the river is in flood and the causeway closed.

Queerbidie Waterhole's name is derived from the Aboriginal 'Quia-pidrie' meaning 'origin of fishes' (Tolcher, 1986). It is essentially the town waterhole and as such its appearance and use is more in line with a country urban beach experience than with the further waterholes that provide 'wilderness' camping. Long drop toilets are available on site and showers are nearby in the Town Square. Because of its size and relatively flat topography it is able to accommodate large groups where 300 people or more can be separated from individual campers. Activities on both banks include, camping, fishing, walking, bird watching and boating. It was noted on the September 2012 field trip by researchers familiar with the area over the past 30 or so years that the condition of the riparian zone on the Town Common side was in much better condition than expected as previously there had been a great deal of rubbish, trees cut for firewood and compaction in the area. Comments as to the cleansing action of the flood were put forward as explanation along with good local management regimes.





Figure 6.5.3.10 Landscape character of Innamincka Town Common central campsite under shady Coolibahs. September 2012



Figure 6.5.3.11 Various camping and recreational positions on the creek bank, under shade and close to the water for relaxing and fishing. September 2012



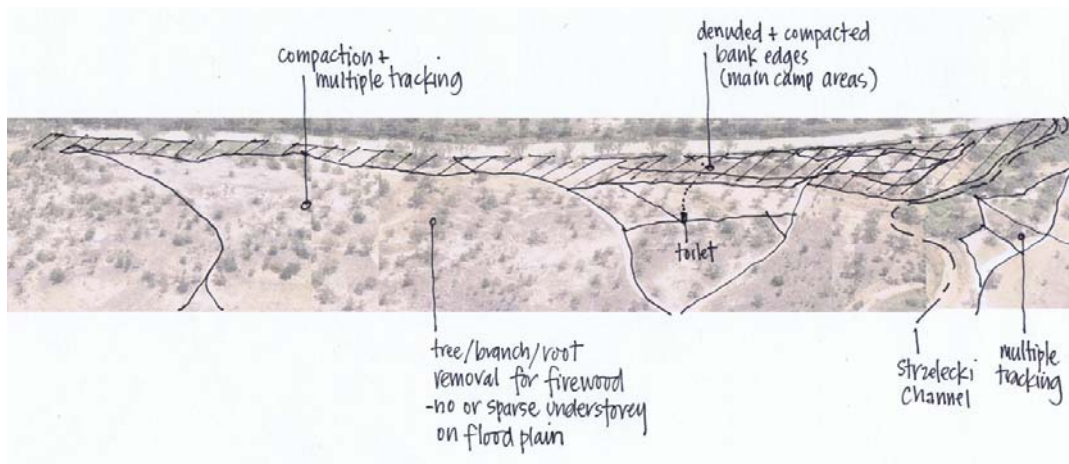


Figure 6.5.3.12 Areas of impact upon the riparian zone and its vegetation

Impacts upon the riparian floodplain include compaction from camping under mature Coolibahs, multiple tracking across the floodplain, damage to tree roots and trees from illegal wood removal for camp fires, many individual campfires dotted around associated with ephemeral campsites and fires set too close to trees and vegetation.

### Access

There is clear defined access to the Town Common via 15 Mile Track, just past the Strzelecki Creek crossing. Tracks and trails on the town common have not been 'designed' rather they are the result of desire lines of visitor travel over considerable time. Some access control to floodplain areas is implemented using steel star posts. The Innamincka Regional Reserve northern banks are accessed via the Innamincka Causeway north of Innamincka with a clearly defined turn off and fenced access track, day use stopping areas and turn around bay.



Figure 6.5.3.13 Entry to Queerbidie Waterhole and overview of Town Common Tracking September 2012

## Interpretation

Queerbidie waterhole camping area fenced tracks, directional and interpretive signage is provided by NPWS consistent with the Innamincka Regional Reserve graphic system. The southern bank Town Common directional and information signage and fencing are provided by the Innamincka Progress Association, which includes an honour box for camping fees.



Figure 6.5.3.14 Entry interpretation into Queerbidie by NPWS, on the town margins and information signs at the Town Common September 2012

## Issues requiring management approaches

While the Town Common is well managed by the local Innamincka group there are some issues that require management for the long-term health of the riparian zone and its mature trees.

- In line with the recommendation that a town plan be developed, the Town Common should equally undergo a planning exercise to enable rationalisation of tracks and camping areas and the protection of trees and their root systems.
- A system for fire management and timber supply can prevent issues with harvesting tree parts for campfires including firepit to limit the size and location of fires. Careful planning and detailing is required so that the intrinsic character of the Town Common is not overly designed in relation to the successful spatial layout that currently exists.
- The current disconnection between the Cooper Creek channel and the Strzelecki Creek channel is an essential component of the fluvial and ecological systems downstream. The existing sand bar and dense Lignum on the riparian edge is



necessary to ensure that the Strzelecki Creek only floods intermittently and that flows are not diverted away from the larger downstream Cooper Creek systems.

- Negotiation between the Innamincka community and NPWS regimes and the co-management wishes of the Yandruwandha and Yawarrawarrka people for careful and consistent management of the Queerbidie Waterhole and its two distinct bank environments is recommended in line with the proposal to undertake a town plan project.
- Expanded interpretation of the ecologies and dynamics of the system could supplement the existing signs, including mobile app development for the entire Cooper Creek complex.

#### 6.5.4 Policemans Waterhole

Location 27° 45' S 140° 42' E

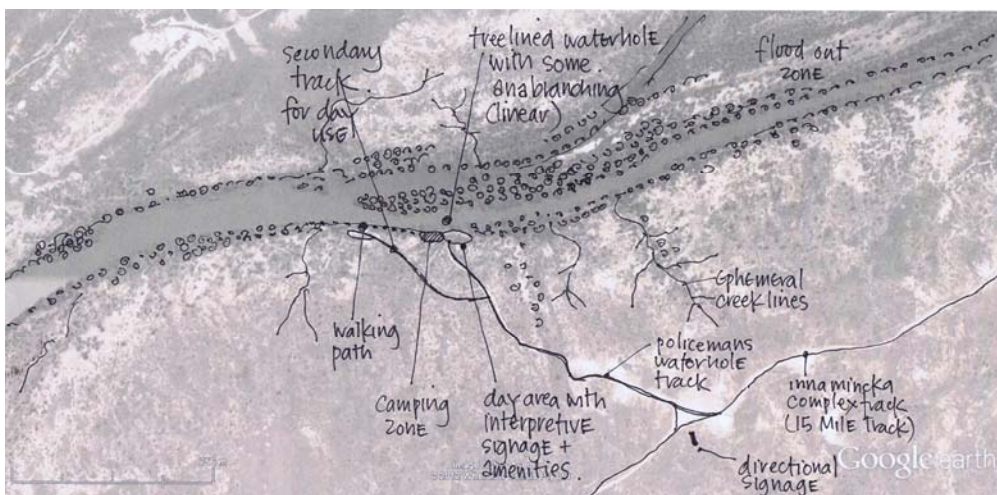


Figure 6.5.4.1 Landscape character of Policemans Waterhole Image: 2011 Source: [www.earthgoogle.com](http://www.earthgoogle.com) Retrieved 10/7/2012.

## Form

This linear, slightly arcing semi permanent waterhole features a narrow southern channel, a mid channel deposition zone and long distributary channel to the north. Located at the end of a braided section of the Creek the waterhole widens to an open expanse of channel to the west. Numerous small treed drainage channels and erosion gullies line the southern floodplains. Slightly graded extended bank systems allow for good access to the water over some 500 metres.

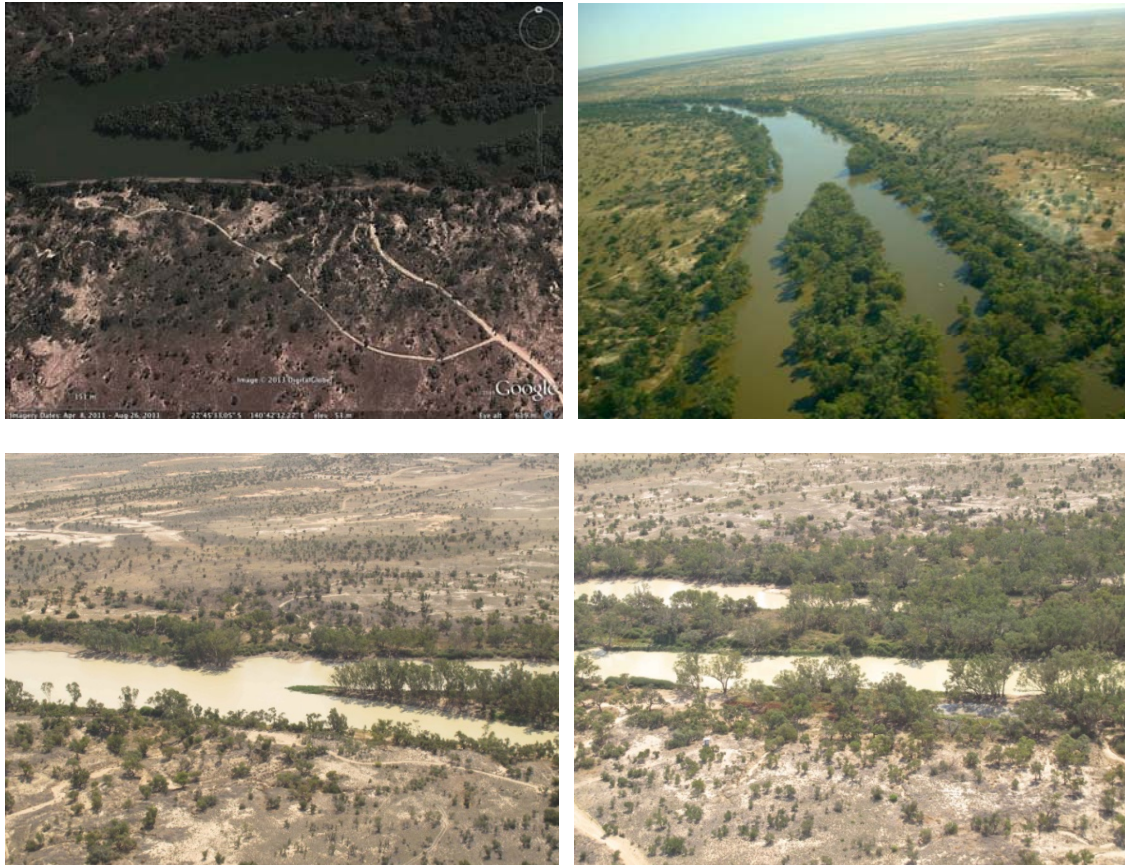


Figure 6.5.4.2 Landscape form of Policemans Waterhole: April 2011 in flood and recovery September 2012  
Source: [www.earthgoogle.com](http://www.earthgoogle.com) Retrieved 10/7/2012.

## Riparian Zone

The riparian zone consists of brown/grey clay silty soils and gentle sloping ground to the immediate south bank moving to steep bank 20 – 30m back from the waterhole edge. The northern bank has medium to steep clay banks with typical River Red Gum lined banks grading to Coolibah open woodland on the higher banks and into the floodplains. A dense Lignum understorey on the northern bank is also in areas on the south away from the camping area.



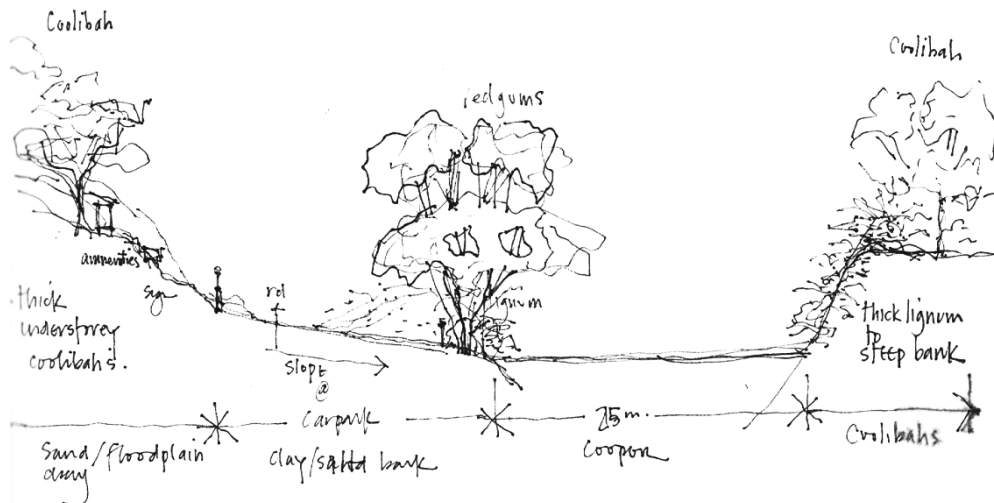


Figure 6.5.4.3 Cross-section at Policemans Waterhole eastern campsite



Figure 6.5.4.4 Riparian edge at Policemans Waterhole camping area September 2012

## Views

Policemans exhibits contained views along the main channel at the eastern end opening up to more extensive views both across the wider channel to the west. Mature River Red Gums overhang and frame the waterhole and emphasise the two forms of the channel.





Figure 6.5.4.5 Contained and open views at Policemans Waterhole September 2012 above and April 2012 below

### Water Feature

The semi-permanent Policemans Waterhole features a contained southern river channel that provides a peaceful and secluded perspective of the Cooper Creek at one of its narrower points. Alongside its channel the distinctive spit in the centre of the channel is one of its defining features.



Figure 6.5.4.5 the contained channel of Policemans Waterhole September 2012

### Vegetation

Policemans Waterhole is lined with mature River Red Gum (*Eucalyptus camaldulensis*) and Lignum (*Muehlenbeckia florulenta*) with some grasses and water plants at the water line, with Coolibah (*Eucalyptus coolabah*) further up the clay bank.



Figure 6.5.4.6 Typical riparian vegetation at Policemans Waterhole April 2012

### Occupation

An evolved landscape evoking conservation, pastoral and storied cultural themes, Policemans Waterhole is located within the Innamincka Regional Reserve and Innamincka Station pastoral station lease and managed by NPWS rangers. It is a popular campsite with locals and tourists combining a day area with; amenities and interpretive signage to the east, a small camping area to the west of the central clearing, and further west off a small track a



day area of fishing opposite the end of the spit. A private, pastoral camp occupies the northern bank just west of the spit. NPWS provide a clearly marked single access track off the 15 Mile Track that is partially fenced on the floodplain and entirely at the parking and camping areas. West of the camping area an opening in the fence provides walking access to the floodplain and to the banks' openings providing direct access to the waterhole as well as a dinghy/canoe launching area. The spatial form of the contained camping zone is very suitable for small groups of campers who can occupy the entire riparian bank area between the lower water level and the steeper banks adjacent the floodplain. A number of tourists confirmed Policemans as their favourite campsite due to its raised position off the water level, its sense of privacy and scale, access for small boats and its proximity to ablution facilities.

Figure 6.5.4.7 Spatial layout of camping zone and traffic management at Policemans Waterhole typical of the elements installed by NPWS at all the Innamincka Complex waterholes





Figure 6.5.4.8 The contained landscape character of the occupiable bank zone at Policemans Waterhole from the banks and from the water September 2012

### Access

Policemans Waterhole is accessed directly off the 15 Mile Track 2 km from Innamincka via a single track that terminates in a car park and camping area. 500 metres from the main camp the day and fishing area track forks to the left to a disused camping area planned for future closure from public use by NPWS management. Directional signage is provided by NPWS in keeping with the Innamincka Regional Reserve system. Some day parking is available and the banks allow fishing and resting under shade.



Figure 6.5.4.9 Defined access roads at Policemans Waterhole opening to eastern day parking and western camping areas September 2012





Figure 6.5.4.10 15 Mile Track entry and preventative bollards in camping zone adjacent riparian edge April 2012

### Interpretation

Directional and interpretive signage is provided by NPWS at the 15 Mile Track turn off and at the Waterhole. A single interpretive signage unit located on higher ground amongst the trees provides information on birds as local insect controllers and on camp courtesy. A tree sign indicating the 2010 flood level is adjacent the bank.



Figure 6.5.4.11 Interpretive sign at Policemans Waterhole

### Issues requiring management approaches

- NPWS management is undertaking effective protection of the bank edge and the planning for appropriate camping sites with confined space still enables the 'facilitated wild' camping to be experienced.
- Review of the extent of protection and rehabilitation programs and resting of some areas will protect the secluded and spatial scale character of Policemans Waterhole.
- Expanded interpretation of the ecologies and dynamics of the system could supplement the existing signs, including mobile app development for the entire Cooper Creek complex.

### 6.5.5 Ski Beach

Location 27° 45' S 140° 41' E

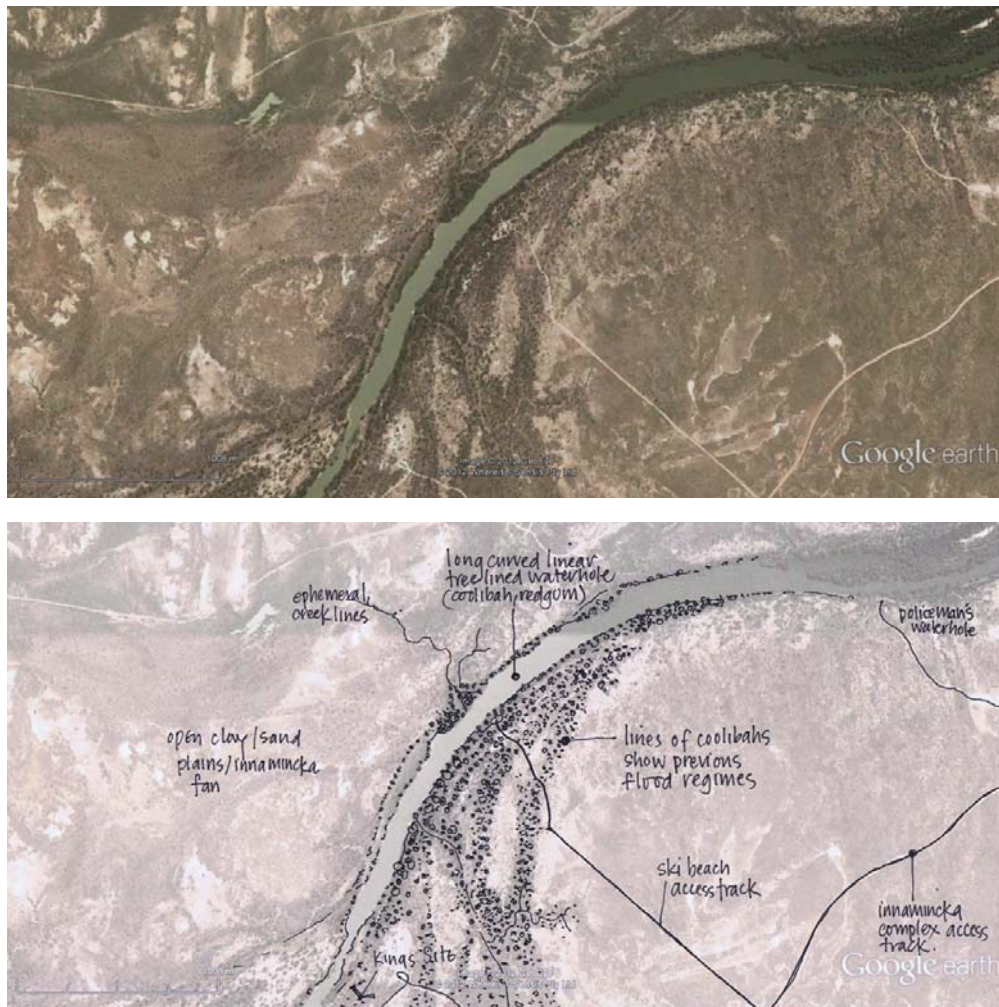


Figure 6.5.5.1 Landscape character of Ski Beach waterhole Image: 2011 Source: [www.earthgoogle.com](http://www.earthgoogle.com) Retrieved 10/7/2012.

#### Form

Ski Beach is an extensive curved semi-permanent waterhole approximately 2.5 km long with low gently sloping banks to the waterhole edge, grading to medium steepness to the higher plains and claypans of the adjacent landscape. The waterhole narrows to a constrained channel to the west. Numerous mature trees line the minor drainage lines on the floodplains beyond. A substantial drainage channel to the north supplements the densely treed zone framing the waterhole.



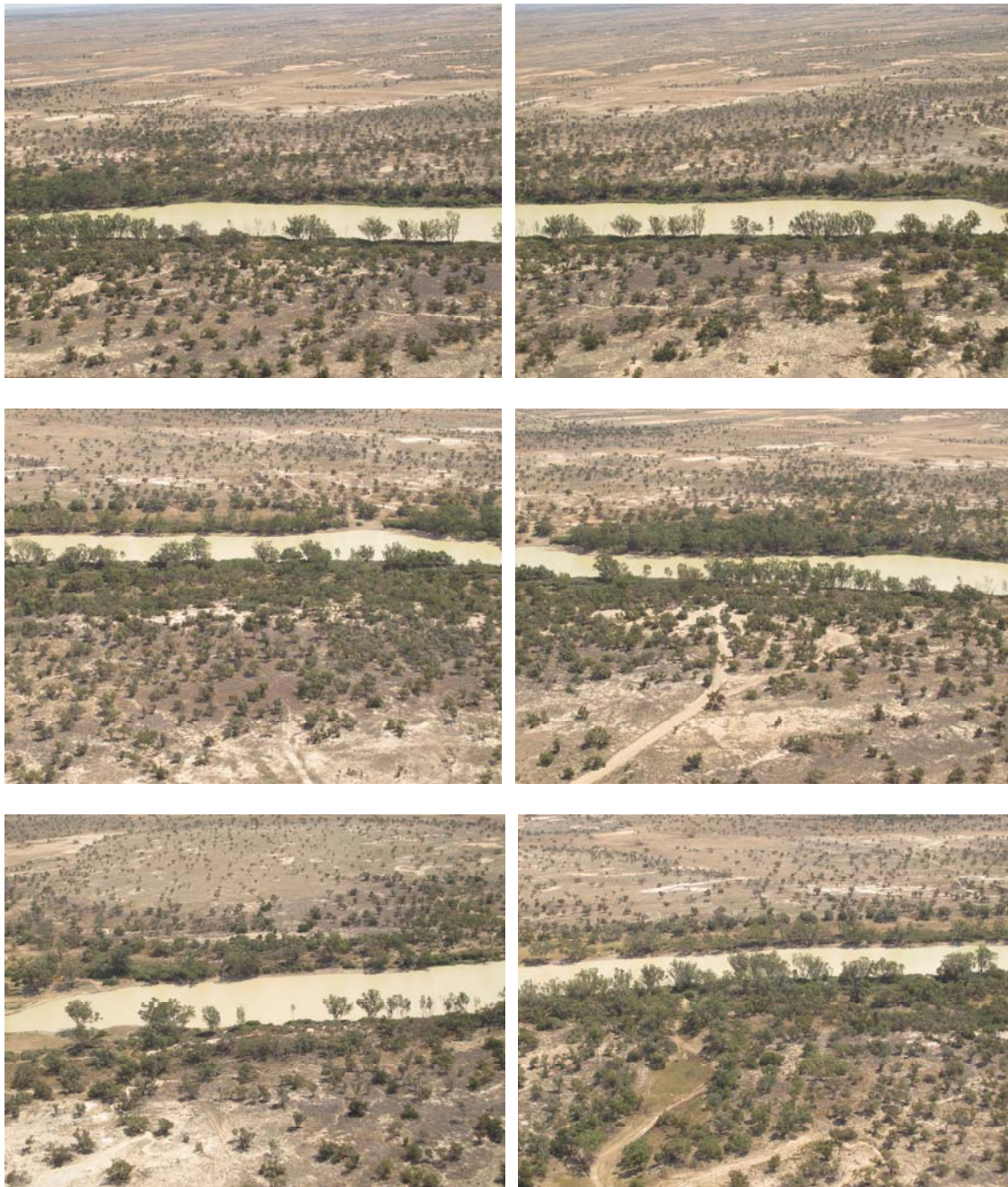


Figure 6.5.5.2 The extent of the long Ski Beach Waterhole from the east top right to the western narrows bottom left Image: August 2011 Source: [www.earthgoogle.com](http://www.earthgoogle.com) Retrieved 10/7/2012 and September 2012

### Riparian Zone

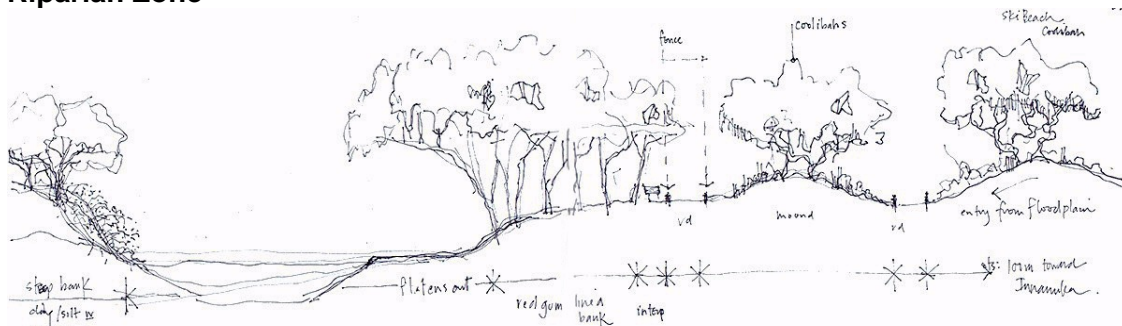


Figure 6.5.5.3 Cross-section of main channel and gently sloping riparian zone at Ski Beach Waterhole



The immediate riparian zone has sandy soils on gently sloping tree lined banks adjacent the waterhole moving to clay/silt/sand on the floodplain beyond. To the south these rise to a floodplain supporting Coolibahs across to its margins as signs of the expanse of previous flood events. To the northern bank mature trees line the waterhole but are sparser along the waterhole length in comparison to the southern bank. Ski Beach Waterhole exhibits typical River Red Gum lined banks with Lignum understorey.



Figure 6.5.5.4 Riparian edge with open sloping banks to waterline and overhanging dense River Red Gums and sparse understorey planting near camping area April 2012

### Views

The trees and saplings lining the bank frame clear views of the extensive waterhole. The shade and dappled light of the mature tree canopies hanging over the waterhole edges and the slow moving waters offer high landscape quality.



Figure 6.5.5.5 Views to the east and to the west from camping area April 2012



### Water Feature

The length of the waterbody and its defined channel is the characteristic feature of Ski Beach Waterhole. It has well defined banks with a sandy margin at waterhole edges providing good access under shady trees. It is a secluded environment protected from the south by gently sloping banks onto the floodplain. The area of dense trees at approximately the centre of the waterhole is a visual marker and spatial refuge from the open plains beyond.



Figure 6.5.5.6 Ski Beach Waterhole concentration of mature trees September 2012

### Vegetation

Ski Beach Waterhole is lined with mature River Red Gum (*Eucalyptus camaldulensis*) and Lignum (*Muehlenbeckia florulenta*) with some grasses and water plants at the water line, with Coolibah (*Eucalyptus coolabah*) further up the clay bank. During late flood and recovery water plants flourish in the slowly moving waters.



Figure 6.5.5.7 Vegetation comprises areas of clear banks and mature River red Gums contrasting with dense Lignum under mature and young Eucalypts at the margins of camping areas. April 2012

### Occupation

Ski Beach is an evolved landscape evoking conservation, pastoral and contemporary storied cultural themes, and is located within the Innamincka Regional Reserve and Innamincka



Station pastoral station lease, managed by NPWS rangers. It is a popular small campsite for locals and tourists. NPWS have limited the extent of visitation and camping areas along the waterhole margins, with campsites clearly defined and amenities provided. Access to the surrounding landscape is by walking only. Activities generally include swimming, paddling, walking, boating, bird watching and bank fishing. West of the camping area an opening in the bollarded fence provides walking access along the banks and across to the floodplain. The bank openings provide direct access to the waterhole as well as opportunities for canoe launching. The presence of numerous open campfire remains in the sandy margins of the raised bank edge indicates heavy use of firewood, often set quite close to trees.



Figure 6.5.5.8 Scale of the Ski Beach camping site and road access



### Access

The waterhole is accessed via the 15mile track 4 kilometres from Innamincka via a single track over the floodplain. A pastoral fence system retains the road to the eastern side and a long dune to the west. Closer to the waterhole the track branches and terminates in a car park and camping area, where NPWS have employed fencing to limit access to the floodplain margins and to contain visitor activities. Directional signage to Ski Beach Waterhole is provided by NPWS in keeping with Innamincka Regional Reserve system.



Figure 6.5.5.9 Entry road sequence into Ski Beach

### Interpretation

Directional and interpretive signage is provided at the 15 Mile Track turn off and at Ski Beach waterhole. A single interpretive sign provides information on birds as local insect controllers and on camp courtesy. The amenities block has fisheries control information signage and a small sign indicating the level of the 2010 flood.



Figure 6.5.5.10 Interpretive and information signs at day park area

### Issues requiring management approaches

- NPWS management is undertaking effective protection of the bank edge and the planning for appropriate camping sites with confined space still enables the 'facilitated wild' camping to be experienced.
- Expanded interpretation of the ecologies and dynamics of the system could supplement the existing signs, including mobile app development for the entire Cooper Creek complex.

### 6.5.6 King's Marker

**Location:** 27°46'S 140°40'E



Figure 6.5.6.1 Landscape character of King's Marker & Waterhole Figure Image: 2011  
Source: [www.earthgoogle.com](http://www.earthgoogle.com) Retrieved 10/7/2012.

#### Form

The waterhole at King's Marker is a medium to narrow straight tree lined semi permanent waterhole approximately 8 kilometres from Innamincka and directly south-west of Ski Beach. It is a long, complex waterhole with many sand bars and distributary channels feeding into the main anastomosing channel at its western margins. To the east of King's Marker an area of flat riverine banks from the waterhole edge move up to steeper banks on the higher floodplains and older channels. The western end of the channel narrows to a sand bar and large distributary channel to the south rising to very steep and inaccessible banks at the water's edge.





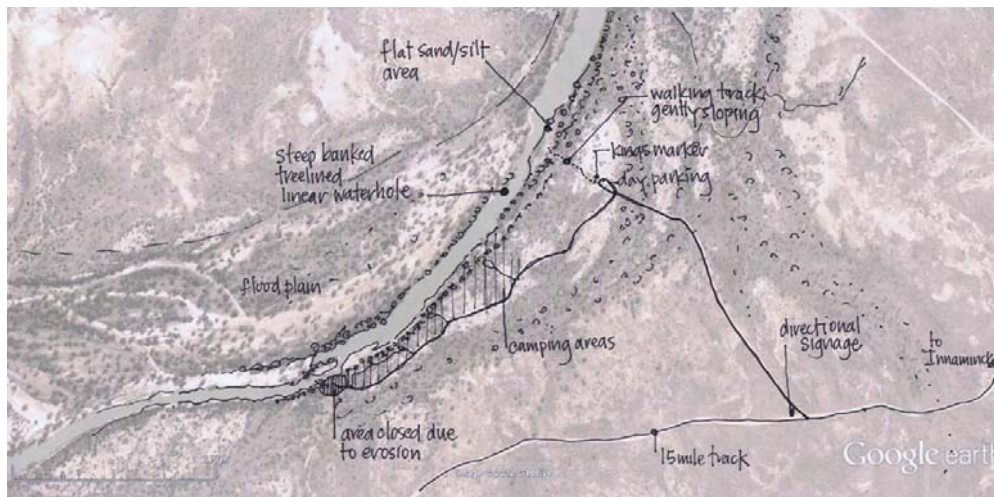


Figure 6.5.6.2 Landscape character of King's Marker Waterhole monument site and camping area Image: 2011  
Source: [www.earthgoogle.com](http://www.earthgoogle.com) Retrieved 10/7/2012.

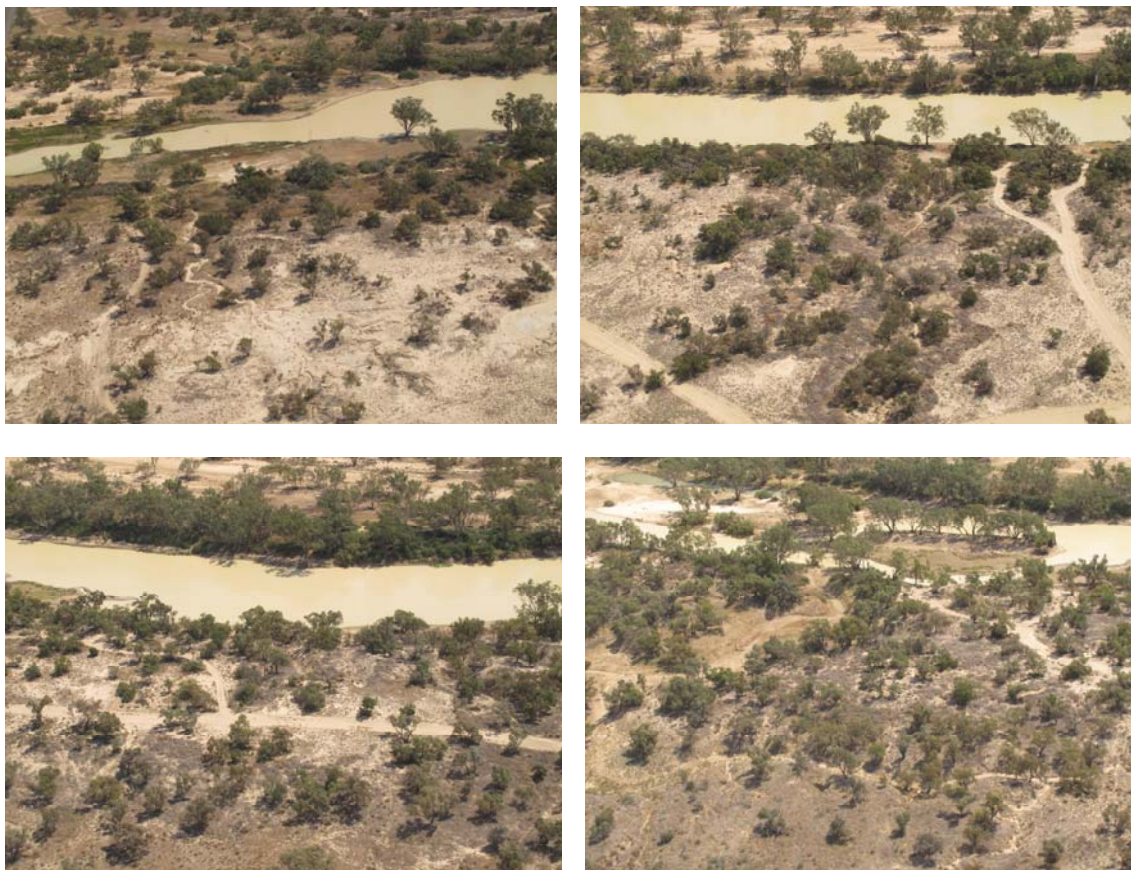


Figure 6.5.6.3 Landscape character of King's Marker Waterhole east to west including day park and campsite zones top left to bottom right September 2012

### Riparian Zone

The riparian zone at the eastern King's Marker and western campsites sequence displays a variety of conditions. At the eastern waterhole edge in the deposition zone sand/clay soils on the wide flat banks are dotted with occasional River Red Gum near the main channel; these are replaced with Coolibah and Lignum lined higher banks on the south. To the west camping area the banks are very steep and rise to a high floodplain supporting Coolibah on the top banks of the deep channel. On the northern bank mature River Red Gum and



Coolibah line the waterhole with dense grasses under flood conditions. The open woodland hummocky floodplain supports low shrubs in the more saline zone.

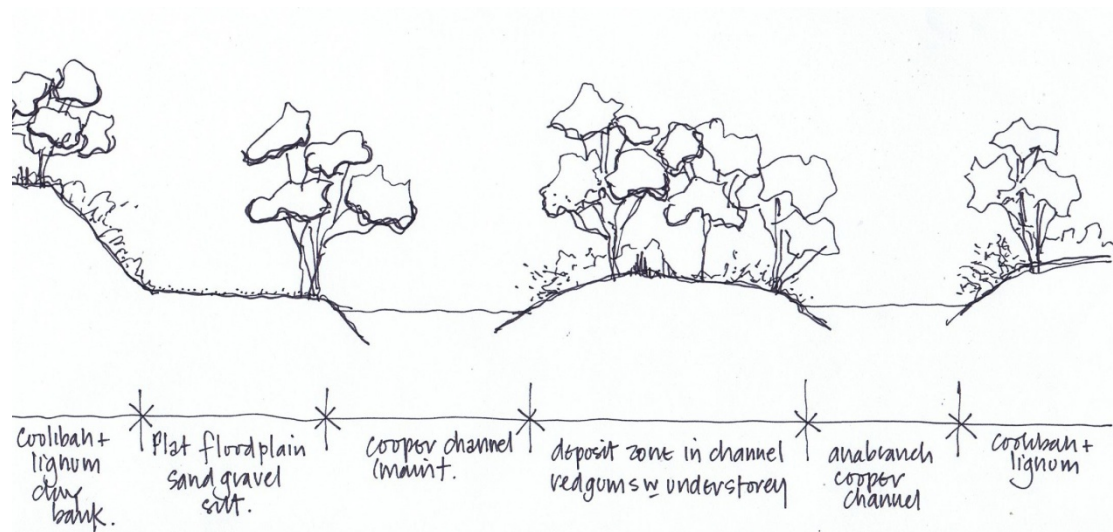


Figure 6.5.6.4 Western waterhole bank edge conditions in flood April 2012







Figure 6.5.6.5 Riparian plain at King's Marker, top, bank edge further downstream leading into narrower channel, middle, and hummocky floodplain, bottom September 2012

### Views

Extensive cross and long waterhole views with a variety of spatial characters are possible at King Waterhole. Views from the western end of the camping site over the contained channel are framed by mature trees and steep banks. The walking track from the eastern day parking area to the waterhole offers vistas of open floodplain and channel areas sloping towards the expansive waterhole, ringed by mature trees. As the water level drops the appearance of sand banks and widening riparian zones alters the scale of the view.







Figure 6.5.6.6 Views over King's western waterhole April 2012 and a panorama from the eastern beach September 2012

### Water Feature

Distinctive characteristics at King Waterhole includes an upstream expansive waterhole and a narrower channel and anastomosing drainage channels downstream. Its well-defined banks during flood are revealed as wide beaches during recovery and drying to result in a narrowed central channel, remnant pools and extensive sand bars.



Figure 6.5.6.7 King western waterhole in flood April 2012 and recovery September 2012



## Vegetation

Vegetation types and densities vary on either bank and along the waterhole. River Red Gums (*Eucalyptus camaldulensis*) persist along the central channel. Coolibah (*Eucalyptus coolabah*) and dense Lignum (*Muehlenbeckia florulenta*), the occasional Queensland Bean Tree (*Bauhinia gilva*), shrub and grass understorey on the riparian banks give way to open Coolibah woodland of low salt tolerant shrubs and grasses.



Figure 6.5.6.8 Landscape character of riparian vegetation at King's Marker waterhole April 2012

## Occupation

King's Marker waterhole is an associative landscape exhibiting storied, conservation and productive cultural themes. Popular with campers and day visitors seeking an historical experience, it is famous for being on the explorer trail and the site where Edwin Welch (Howitt's surveyor) discovered John King, the last survivor of the Burke & Wills expedition living with the Yandruwandha in 1861. Located on the Innamincka Regional Reserve and the Innamincka Pastoral Station, it is managed by the NPWS to limit intensive day traffic to the historic site and adjacent waterhole margins, which are subject to gully erosion from multiple foot tracking. Up to 4 discrete camping areas line the increasingly steep banks along the waterhole margins, with campsite clearing clearly defined and limited amenities provided. Gully erosion, particularly at the western southern bank area where camping has been possible close to the bank edge is now subject to fencing and exclusion to reduce human induced erosion. Access to the waterhole and riparian zone is restricted to walking. Activities generally include visiting King's site, swimming, walking, boating, bird watching and fishing. King Waterhole is the furthest accessible beach downstream for river cruises from Innamincka.



Figure 6.5.6.9 River cruises dock at King's Marker and waterhole during recovery September 2012



Figure 6.5.6.10 Amenities, bank protection and pathway erosion at King's west camping areas.

### Access

The waterhole is accessed via the 15 Mile Track and its turn off is 8 kilometres from Innamincka. Access to the monument and camping area is via a single dirt track for 1.5 kilometres over the floodplain, which terminates in a day visitors area with recently installed parking area and fencing. A track from this turnoff to the west provides access to the King's Site camping areas, of which up to three camp areas terminate in discrete clearings on the bank edge. The most western camp terminates overlooking a steep bank, the main channel and a large distributary channel to the south. NPWS have employed fencing to limit access to the floodplain margins and to contain visitor activities. Clear directional signage to King's Site and camping zones is provided in keeping with the standard Innamincka Regional Reserve system.







Figure 6.5.6.11 Entry from the 15 Mile Track, road and parking conditions through open woodland

## Interpretation

In keeping with the NPWS Innamincka Regional Reserve interpretive signage system, galvanised steel hardwood timber aluminium interpretive signage is provided. The walking track to King's Marker Site has a series of interpretive signs and part of a tree marked by Alf Towner in 1947, including steel copper capped post and stone cairns commemorating the site. Mack and Loeffler installed a cairn and plaque in 1973. This site is interpreted as part of the Burke and Wills expedition story and the NPWS interpretive signs provide information on a variety of topics including Boom or Bust Country, King's Story of his survival and respect for Indigenous people, Living with country and Indigenous peoples relationship with the land, a description of Alf Towner's tree known as King's Blaze.







Figure 6.5.6.12 The diverse interpretation at King's Marker installed over the years by various people.

### Issues requiring management approaches

- The planning and installation of roads, day parking and turn around areas is consistent with other waterhole management along the Cooper Creek Complex. This necessary and appropriate management to prevent vehicular traffic too close to the riparian edge nonetheless requires review in the relation to the size of turn around and parking zones and the scale of vehicles and their trailers.
- The severe erosion adjacent banks in the western camping zone and in association with walking trails is being managed through fencing and marked off areas. Further attention to the spatial distribution of campsites and proximity to banks may be warranted. A system for managing multiple foot traffic along fragile edges and in gullies is recommended.
- Expanded interpretation of the ecologies and dynamics of the system could supplement the existing signs, including mobile app development for the entire Cooper Creek complex.

### 6.5.7 Minkie Waterhole

**Location:** 27° 46' S 140° 38' E



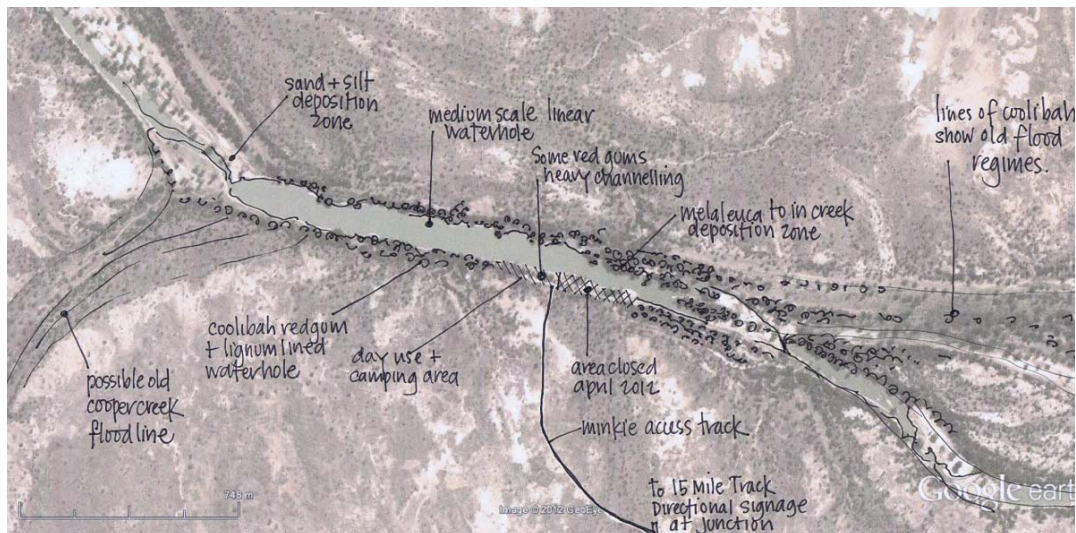


Figure 6.5.7.1 Landscape character of Minkie Waterhole Image: 2011 Source: [www.earthgoogle.com](http://www.earthgoogle.com) Retrieved 10/7/2012.

### Form

Minkie Waterhole is a linear semi- to nearly-permanent waterhole of high aesthetic beauty, approximately 1.5 kilometres long. Upstream anabranching and central and southern bank sand bars provide a complex eastern formation, which flows unobstructed until narrowing to a smaller channel at the western end. In floods access to the lower riparian banks of the waterhole are constrained by the steep banks on the south but flow over the northern banks to develop into a very wide waterhole. The Ooranie Creek flows south from the western end of the channel and this area of the Cooper Creek has less channelization of the immediate floodplain than further upstream. The wide southern bank sand bar revealed after flood provides easier access to the water than the generally steep banks lining the more westerly south bank riparian edge.







Figure 6.5.7.2 Minkie Waterhole in flood April 2011 and central and eastern parts in recovery September 2012

### Riparian Zone

The riparian zone at Minkie Waterhole is typified by grey brown silty soils with a medium tree cover located closer to the waterhole becoming sparser across the floodplain than observed at other waterholes on this section of the Cooper Creek. River Red Gums and Coolibah are the dominant tree species lining the waterhole. The banks are gently sloping to moderately steep rising up to relatively flat plains beyond.

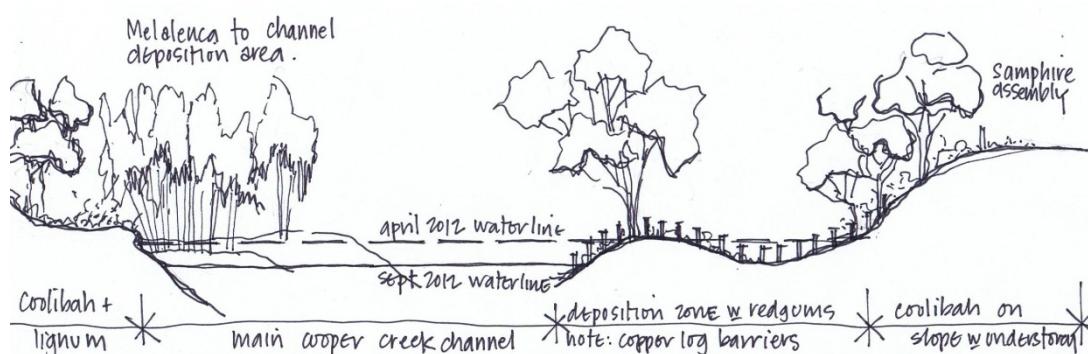


Figure 6.5.7.3 Cross section at the camping area of Minkie Waterhole





Figure 6.5.7.4 Riparian Zone at Minkie Waterhole from low banks to high riparian edge April 2012

### Views

Extensive cross and along waterhole views are possible at Minkie Waterhole, particularly on the channelled floodouts adjacent the waterhole. During flood time extensive bank-to-bank water views, reflections and drowned trees provide enclosed views along flooded sand bars.

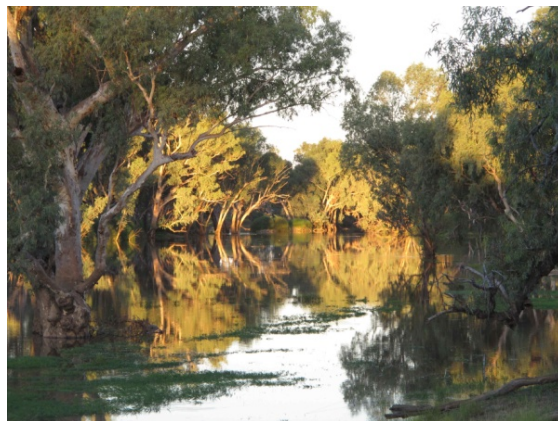






Figure 6.5.7.5 Views across and along Minkie Waterhole in flood April 2012 and recovery June 2013

### Water Feature

Minkie displays panoramic expanses of water within densely vegetated river margins within a narrow floodplain. The waterhole's distinctive characteristics include a wide waterhole at its centre narrowing to the east upstream into complex channelling and sand bars. Its curving northern banks provide picturesque copses of dense vegetation and flooded River Red Gums when the water is high.



Figure 6.5.7.6 The flooded landscape of Minkie Waterhole

### Vegetation

Vegetation types and densities vary on either bank and along the waterhole. River Red Gums (*Eucalyptus camaldulensis*) persist along the central channel. Coolibah (*Eucalyptus coolabah*) and dense Lignum (*Muehlenbeckia florulenta*), the occasional Queensland Bean Tree (*Bauhinia gilva*), shrub and grass understorey on the riparian banks give way to open Coolibah woodland of low salt tolerant shrubs and grasses.



Figure 6.5.7.7 Vegetation of Minkie Waterhole including riparian banks and waterplants

### Occupation

Minkie Waterhole is an associative landscape exhibiting storied, conservation and productive cultural themes. Minkie (pronounced mink-kai-yee) and is derived from local



Aboriginal language meaning ‘at hole’ *minka* – hole, *yi* – at as noted on the onsite interpretive sign adjacent the day carpark. Historical records document the use of this dried out waterhole by the Burke and Wills expedition including the demise of a camel, Landa, who became bogged in April 1861. The remnants of pastoral fences, gates and access into the waterhole via an easterly track leading down to the water indicate the shared history of this highly aesthetic waterhole. This access was closed during flood time but since reopened in June 2013. It has a small camping area without facilities confined to a western clearing and dirt track on the riparian bank to the west of the day park area. Activities generally include camping, swimming, walking, boating, bird watching and fishing.







Figure 6.5.7.8 Minkie occupation overview Image: 2011 Source: [www.earthgoogle.com](http://www.earthgoogle.com) Retrieved 10/7/2012, Remnant pastoral and boating access, gently sloping banks allow close access water on the eastern margins, April 2012, camping area and walking track along exposed western banks June 2013, old stockyards and fencing of riparian edge near access track April 2012

### Access

The waterhole is accessed via the 15 Mile Track 9 kilometres from Innamincka via a single track over the floodplain arriving at a t-junction and a day visitors' area. A track west from this point accesses the camping area, and to the east boat launching zones and past pastoral access adjacent the waterhole. The NPWS has employed fencing to limit access to the floodplain margins and to contain visitor activities. Directional and information signage to Minkie and camping zones is provided in keeping with the IRR system. At the Minkie turn-off there is a PAR sign for further travel west along the 15 Mile Track, indicating appropriate vehicle rules and suggested safety measures and etiquette required by the Pastoral Board.



Figure 6.5.7.9 Access roads and directional signs into Minkie Waterhole April 2012, June 2013

## Interpretation

Located with a high view over the waterhole in the day park, a single interpretive sign provides information on the topics 'Our Country', which covers both pastoral and Aboriginal histories, occupation of and protocols for the general area. It also repeats Camp Courtesy information and describes the qualities of waterholes along this section of the Cooper as 'family homes'. A small sign indicating the 2010 flood level is nailed on a nearby River Red Gum.



Figure 6.5.7.10 Interpretive signs at Minkie Waterhole

## Issues requiring management approaches

- Necessary fencing for management of vehicular traffic needs to be planned in relation to the 'natural' landscape qualities of this important cultural area. Final positioning and materials to provide protection and to maintain the aesthetic qualities of the riparian edge requires review.
- The severe erosion adjacent banks in the western camping zone and in association with walking trails is being managed through fencing and marked off areas, however vertical foot access down to the waterhole is causing further small gully erosion
- Expanded interpretation of the ecologies and dynamics of the system could supplement the existing signs, including mobile app development for the entire Cooper Creek complex.



### 6.5.8 Tilcha Waterhole & Wills Grave Site

Location: 27°45'S 140°35'E

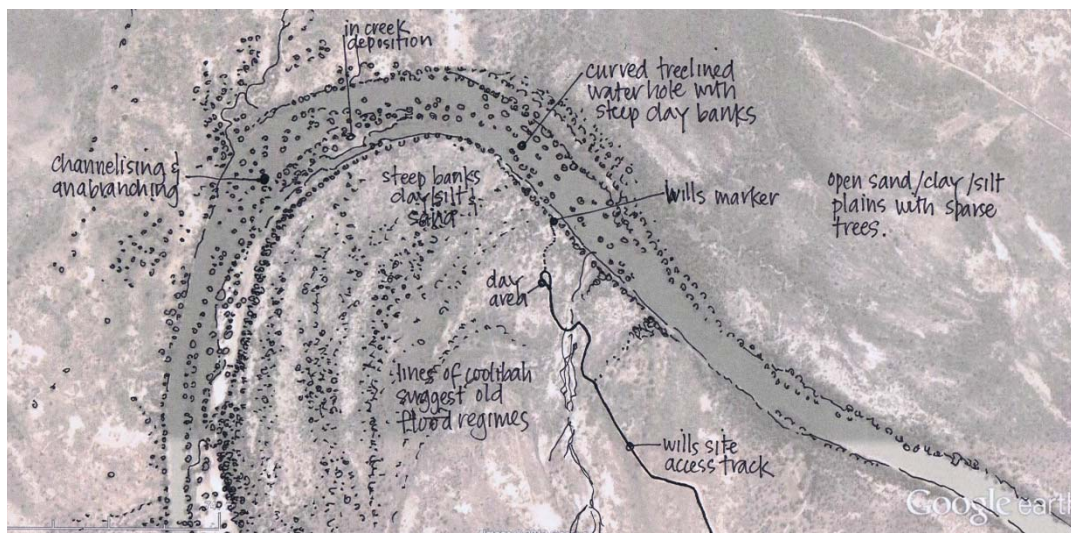
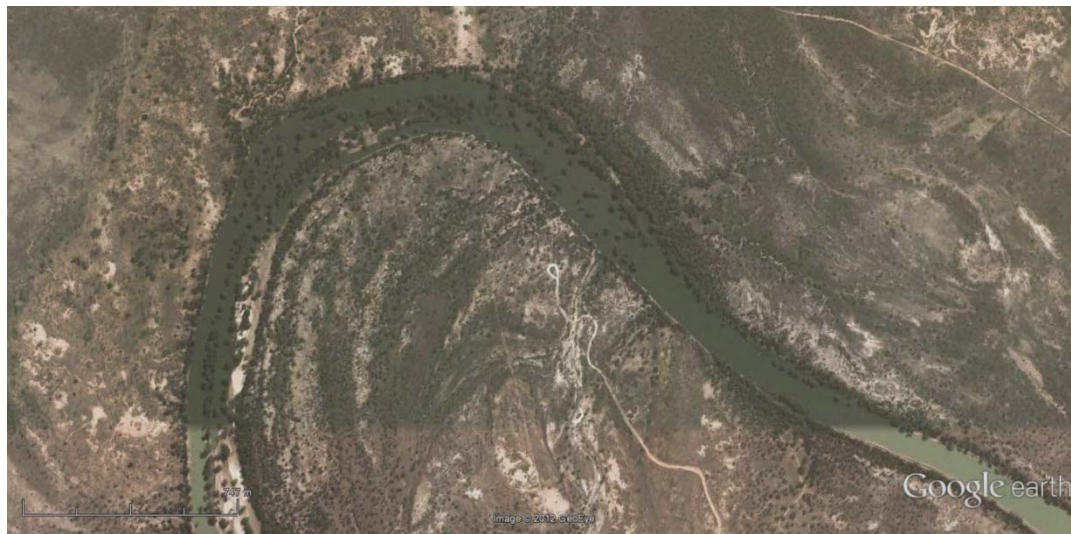


Figure 6.5.8.1 Overview of Wills Grave Site and Tilcha Waterhole to the south Image: 2011 Source: [www.earthgoogle.com](http://www.earthgoogle.com) Retrieved 10/7/2012.

#### Form

Tilcha Waterhole is a long semi-permanent waterhole east of Wills Grave site, which is located on the western margins of the deeper Cooper Creek channel 20 kilometres west of Innamincka. An area of very steep banks above the waterhole and heavily channelized creek bed, moving up to a high relatively level floodplain to the south. The characteristic sandy desert north south sand dunes become more prominent as Cooper Creek flows westwards to the margins of the Innamincka waterhole complex.





Figure 6.5.8.2 Landscape character of Tilcha Waterhole and Wills Grave Site area in flood April 2011 and below looking across the increasing dune landscape and meandering defined Cooper Creek channel September 2012

### Riparian Zone

The riparian zone at the western Tilcha Waterhole at Wills Grave site comprises very steep banks on the southern side grading to a lower floodplain on the north. In the central sand bars River Red Gums form vegetated islands in the Creek channel. Coolibah and Lignum line the higher banks on the south. On the northern bank mature River Red Gum and Coolibah line the waterhole with dense grasses under flood conditions.

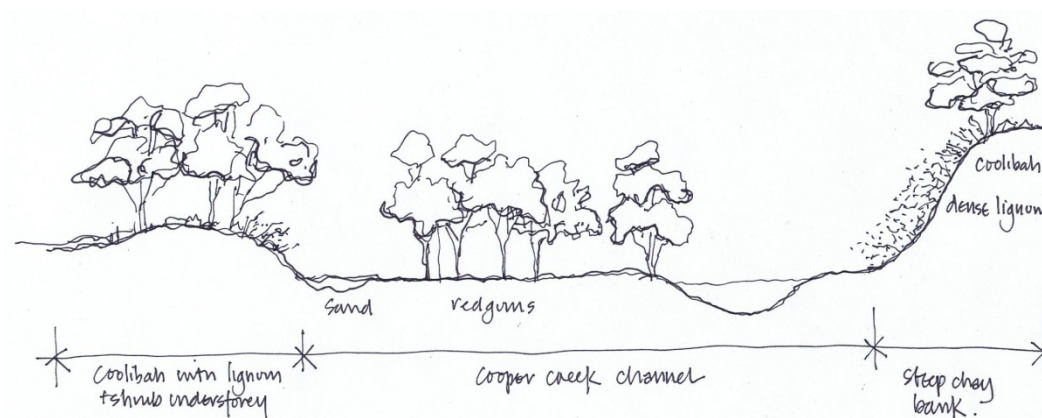


Figure 6.5.8.3 Cross-section of Tilcha Waterhole at Wills Grave Site



Figure 6.5.8.4 Western and eastern riparian zones in flood April 2012 above and recovery September 2012 at Tilcha Waterhole west in the Wills Grave area.

### Views

Views along Tilcha Waterhole at Wills site are obscured until the lower banks are accessed due to dense tree and understorey vegetation lining the banks. The high banks give excellent vistas both across and along the waterhole however this requires some scrambling down steep banks to access. In recovery and dry times access to the lower banks allows for more extensive views along the channel. The walking track from the day parking area also affords views of typical Cooper Creek floodplain and dune country.







Figure 6.5.8.5 Late afternoon views up and downstream at Tilcha Waterhole and Wills Grave Site April 2012 and September 2012

### Water Feature

Tilcha Waterhole west exhibits extensive in-creek channeling across a wide section of the Cooper Creek main branch. Well-defined very steep banks during flood time are exposed as the waters recede to a sequence of pools and treed islands. Under flood conditions the western waterhole is an expansive sheet of water flowing under mature trees. In recovery and dry times it is possible to walk along the channels and sand bars of the waterhole and cross to the northern banks.



Figure 6.5.8.6 Water character of Tilcha Waterhole and Wills Grave Site in flood April 2012 and recovery in September 2012

### Vegetation

Vegetation types and densities vary on either bank and along the waterhole. River Red Gums (*Eucalyptus camaldulensis*) persist along the central channel. Coolibah (*Eucalyptus coolabah*) and dense Lignum (*Muehlenbeckia florulenta*), the occasional Queensland Bean Tree (*Bauhinia gilva*), shrub and grass understorey on the riparian banks give way to open Coolibah woodland of low salt tolerant shrubs and grasses.





Figure 6.5.8.7 Vegetation of the riparian banks and southern riparian plains of Tilcha Waterhole west

### Occupation

Wills Gravesite and waterhole is an associative landscape exhibiting storied, conservation and productive cultural themes. Popular with day visitors seeking an historical experience, it is famous for Alf Towner's 1948 steel post and piled rock monument to mark Wills grave. Mike Steel and Red Rover Tours erected a monument and plaque at the site in 1973. The original tree that Howitt marked at Wills grave on 18 September 1861 has disappeared, its location is unknown and there are no known photographs or images of the tree. Howitt's field notes have been replotted to indicate that Wills was buried about 2.5 kilometres away from Towner's and Steel's memorials. Aboriginal access to the place is confirmed by the remnant blaze on a Coolibah adjacent the walking track. Located on the Innamincka Regional Reserve and the Innamincka Pastoral Station, it is managed by the NPWS to limit intensive day traffic to the historic site and adjacent waterhole margins, which are subject to gully erosion from multiple foot tracking. Access to the waterhole and riparian zone is restricted to walking and recent track; turning bay and parking have been refurbished post flood. Activities generally include visiting Wills site, walking, bird watching and fishing.



Figure 6.5.8.8 track and parking area, walking path to Wills Grave monuments and access to Tilcha Waterhole  
Image: 2011 Source: [www.earthgoogle.com](http://www.earthgoogle.com) Retrieved 10/7/2012.



Figure 6.5.8.9 Aboriginal blaze tree, walking track along Tilcha Waterhole, Wills markers by Steel and Towner September 2012

### Access

The waterhole is accessed via the 15 Mile Track via a single road over the floodplain, which terminates at a day visitors area with parking and fencing. Innamincka Regional Reserve have employed fencing and parking to limit access to the floodplain margins and to contain visitor activities to day visitation and no camping. Directional signs to Wills Site walking trail is provided by NPWS in keeping with the Innamincka Regional Reserve system.







Figure 6.5.8.10 Access from 15 Mile Track to parking and walking track into Wills Grave Site September 2012

### Interpretation

In keeping with the Innamincka Regional Reserve interpretive signage system, galvanised steel hardwood timber aluminium interpretive signage is provided. The walking track to Wills Grave site has a series of NPWS and Santos interpretive signs alongside Towner's and Steel's markers. The Innamincka Regional Reserve interpretive signs provide information on a variety of historical, cultural and ecological topics including, 'Wills ultimate sacrifice', 'Strangers exploring country' and 'Life Beneath the Surface'. As with King & Burke sites this site contains more interpretive material than the other Cooper Creek waterholes in line with its explorer historical importance.







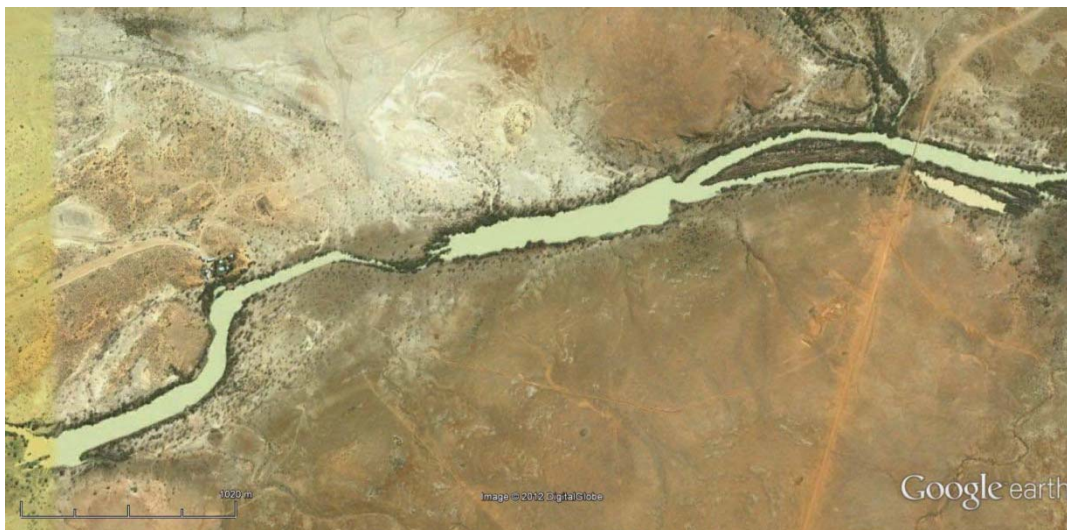
Figure 6.5.8.11 Interpretive signs at Wills Grave site

### Issues requiring management approaches

- The planning and installation of roads, day parking and turn around areas is consistent with other waterhole management along the Cooper Creek Complex. This necessary and appropriate management for vehicular traffic to protect the monuments requires review due to the observed damage to relatively new infrastructure. The scale of turn around and parking zones appears undersized in relation to the size of vehicles and their trailers.
- Methods for interpretation and protection of Aboriginal cultural sites should be considered.
- Expanded interpretation of the ecologies and dynamics of the system could supplement the existing signs, including mobile app development for the entire Cooper Creek complex.

### 6.5.9 Nappa Merrie and Bullah Bullah Waterholes (Queensland)

**Location:** 27°37'S 141°04'E



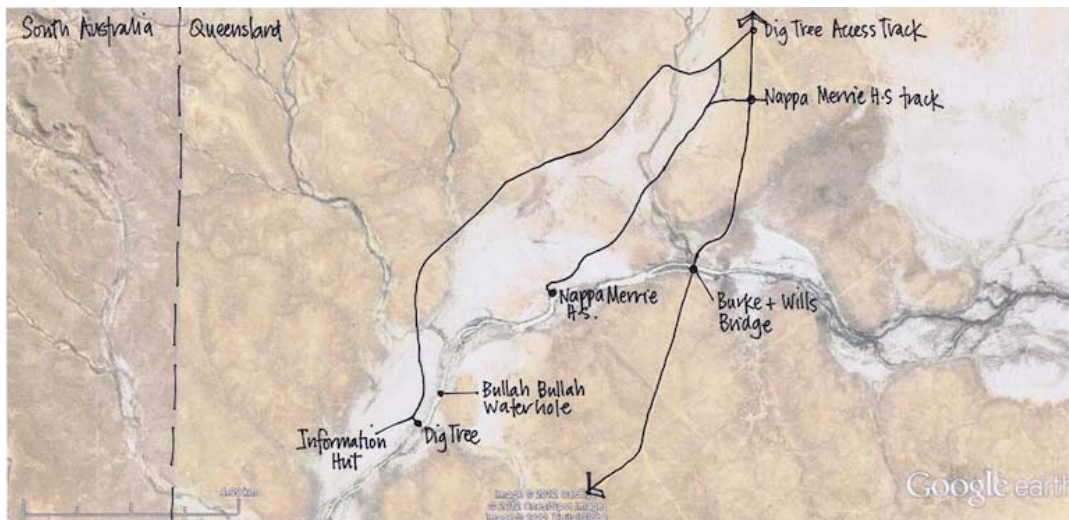


Figure 6.5.9.1 Overview of Nappa Merrie and Bullah Bullah Waterholes, Nappa Merrie HS to the northeast and access roads and tracks and Image: April 2006 Source: [www.earthgoogle.com](http://www.earthgoogle.com) Retrieved 10/7/2012.

### Form

Nappa Merrie and Bullah Bullah waterholes are a sequence of permanent to semi permanent elongated waterbodies within a single channel section of the Cooper Creek System in Queensland northeast of the Innamincka Complex in South Australia. This waterhole and channel complex on the Nappa Merrie pastoral lease is situated within the Innamincka Dome geological formation and is characterised by a narrow floodplain bordered by stony plains to the south and north. At the southern end of Bullah Bullah the channel diverges into a braided channel area and the upstream widening of the waterhole. The wider northern floodplain provides good amenity for human use adjacent the waterbody. The primary focus of this assessment is Bullah Bullah Waterhole as the location of the major Burke and Wills tourist interpretation site and camping area.



Figure 6.5.9.2 Bullah Bullah Waterhole, Dig Tree & camping areas landscape overview Image: August 2006 Source: [www.earthgoogle.com](http://www.earthgoogle.com) Retrieved 10/7/2012.

### Riparian Zone

The sandy/brown clay riparian zone exhibits a combination of dense Lignum and cleared areas on generally low waterhole banks lined with mature Coolibah and Queensland Bean Trees with Coolibah dotted throughout the floodplains. Riparian vegetation is denser on the southern margins with less clearing and roads and campsites for tourist access.





Figure 6.5.9.3 Bullah Bullah Waterhole north bank camping areas riparian edges Image: April 2012

### Views

Clear views are possible along the Bullah Bullah waterhole in both directions. This picturesque waterhole is an oasis in the surrounding bare plains and the more occupied southern floodplain gently slopes away from the creek line to provide an open park like experience framed by Lignum and tree canopies at the creek edge.



Figure 6.5.9.4 Bullah Bullah Waterhole views to the south and the north during flood Image: April 2012

### Water Feature

Mature trees and open undergrowth on the sandy banks provide a sheltered aspect to the wide channel. Under flood conditions the main channel and distributary channels expand provide extensive water experiences and clues as to the more usual extent of the waterhole due to the appearance of partially submerged Coolibahs adjacent the Dig Tree area.







Figure 6.5.9.5 Bullah Bullah upstream open channel and flood adjacent floodplain, expanded waterhole at the Dig Tree under flood Image: April 2012

### Vegetation

The characteristic upper Cooper Creek bank vegetation of mature Coolibah (*Eucalyptus coolabah*), the occasional Queensland Bean Tree (*Bauhinia gilva*), and Lignum (*Muehlenbeckia florulenta*) is abundant. Beyond the sandy bank and plains, Coolibah are under planted with low understoreys of flowering shrubs, grasses and other herbs. During flood time water plants also invade the riparian edge.



Figure 6.5.9.6 Bullah Bullah vegetation at riparian edge on southern banks during flood Image: April 2012

### Occupation

This associative landscape exhibits storied and productive cultural themes. The general area around Nappa Merrie Waterhole and the pastoral station and homestead, which bears its name may have been derived the 'Wongkumara words ngappa = water and merrie = sandhill (Silcock 2009, p.65 paraphrasing Historical Research et al 2002). As one of the most prominent historical sites in outback Australia, the Bullah Bullah Waterhole is the site of the Camp LXV or 65 Depot where the Dig Tree site of the Burke & Wills expedition and the subsequent 'face' tree are enshrined adjacent the Cooper Creek. The blaze tree showing B-LXV (Burke, Camp 65) is still visible due to management of undergrowth - as a significant site for the Burke & Wills exploration it undergoes high tourist visitation. The surrounding plains are still utilised for pastoral use through cattle grazing with mining exploration and extraction in the general area, however not yet in the proximity of this major heritage area, although the existing road system can be shared across competing uses.

An extensive linear camping area of over 2km has been set aside and is managed by the owners of Nappa Merrie Station, S. Kidman & Co. along the banks of the creek on the flood zone directly adjacent the water. The interpretation and management approach has a local and pastoral ‘feel’ rather than the systematic design of the NPWS Innamincka Regional Reserve waterholes in South Australia. Management of the root zone around the important carved and marked trees, parking and interpretation through board walks, chain fencing and farm-type shelters is in keeping with the unique and individual qualities of the place. The camping area allows for larger groups in a free camping manner, with preference for the more remote sites as close as possible to the water, confirmed through the numerous internet sites carrying outback travel blogs. Tourist use includes walking the banks, bird watching and timber gathering as evidenced from site inspections and confirmed on tourist blogs.



Figure 6.5.9.7 Bullah Bullah bankside camping areas adjacent trees, evidence of campfires, sign to camping area and typical group camping arrangement under trees adjacent waterhole Image: April 2012







Figure 6.5.9.8 Bullah Bullah Dig Tree, Face Tree and Burke and Wills site interpretation and entry shed, marker, tree protection and car parking management Image: April 2012

### Access

Access to the Dig Tree & Waterhole is via the Adventure Way and private pastoral tracks on the Nappa Merrie Station pastoral lease. The road travels across stony plains with numerous small dry creek crossings, which are made impassable during wet times, sometimes for extended time periods – it is necessary to cross Cooper Creek over an area of anabranching and floodplains to access the northern side from the southern main road. No access to Nappa Merrie Station is available to tourists and there is a nearby airstrip for tourist flights wishing to access the Dig Tree. An interpretation station with pit toilet and entry fence maintain access into the heritage site and a fee is necessary for visitation and camping.







Figure 6.5.9.10 Entry to Nappa Merrie and Dig Tree heritage site and camping area including road conditions into the site from Adventure Way rerouted due to flood conditions over 2010 to 2012 Image: April 2012

### Interpretation

On-site interpretive signage systems are provided by S. Kidman & Co and Nappa Merrie Station supplemented by extensive historical and access information provided by private tour companies and historical public and private accounts via official websites and blogs due to the intense interest in the Burke and Wills story about this site and as a link to other sites across central Australia. This is very much part of the Cooper Creek waterhole and historic campsite knowledge of the Australian outback. At the Dig Tree site a contemporary monument and interpretive shelter marks the spot. The information contained in the entry shelter is extensive and covers Aboriginal, geological and historical information including maps and photographs. A local gentleman with great knowledge of the area is sometimes there.



Figure 6.5.9.11 Entry to Nappa Merrie and Dig Tree heritage site and camping area and marker at the site on Cooper Creek Image: April 2012

### Issues requiring management approaches

- Any comments are assumed to require negotiation between pastoral management and government agencies to ensure the longevity of the heritage site in relation to ecological health of the banks and floodplains locally.
- Ensuring the compatibility of pastoral, current and future mining and long-term tourist activity.
- The Nappa Merrie and Bullah Bullah Waterholes are at the top of the upstream reaches of the Innamincka complex of channels and waterholes and are a primary management point for the prevention of cane toad access into the South Australian system, particularly as the local geomorphology provides for choke points and the relatively narrow floodplains reduce cane toad habitat and movement opportunities.

- The individual management approach expresses a charming outback personality beyond more corporate NPWS responses, however some tourist responses suggest management by NPWS may be considered.
- Extensive visitation during post-flood and recovery times along the outback heritage trail impacts upon access tracks and riparian zones through compaction, tracking and removal of fallen timber.
- Capturing and expanding highly interesting and informed local knowledge on site to supplement existing static interpretation.

## 6.6 Cooper Creek North West Branch and Montepirie Track



Figure 6.6.1 Landscape character overview of the North West Branch to Coongie Lakes including key sites.  
Source [www.earth.google.com](http://www.earth.google.com) retrieved 19/7/2012.

### General landscape character features

The junction of the main branch of the Cooper Creek and the North West Channel lies approximately 30 kilometres to the west of Innamincka where it splits and flows over some 140 kilometres to terminate in Coongie Lake. There are a number of important and extensive semi-permanent refuge waterholes along the length of the branch including Scrubby Camp, the four waterholes at Kudriemitchie and the terminating Coongie Lake waterhole adjacent the expansive Coongie Lakes to the east.



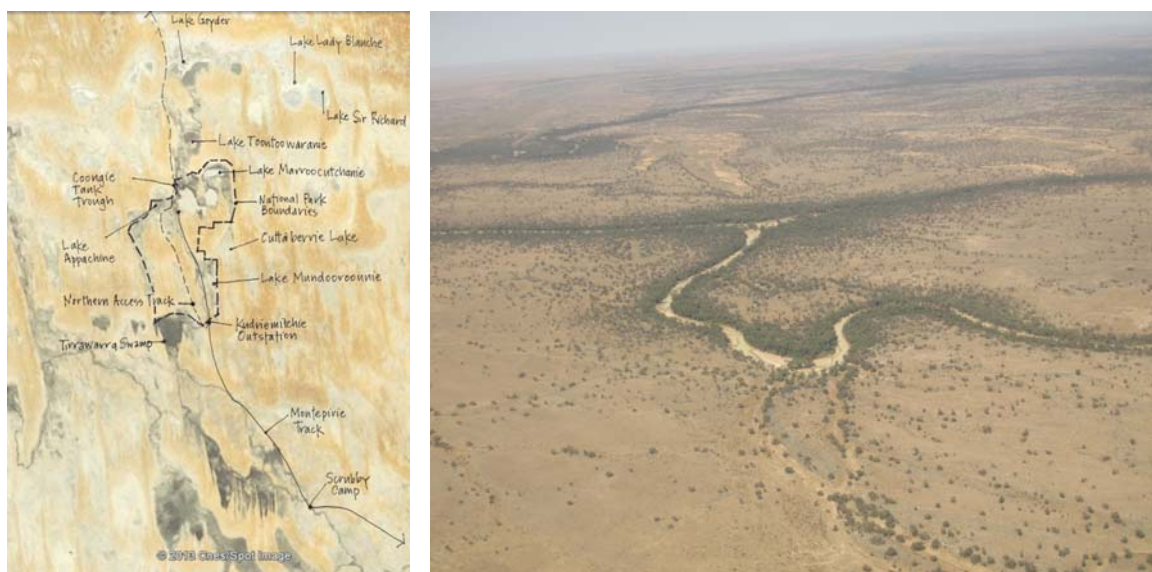


Figure 6.6.2 North West Branch and main channel divergence and waterhole site locations along the Montepine Track Source [www.earthgoogle.com](http://www.earthgoogle.com) retrieved 19/7/2012.and Image: September 2012

The channel traverses a diverse range of landscape types including generally longitudinal dunefields, swamps and floodplains with the underlying characteristic of a very low relief landform that supports slow and expansive drainage during flood. The North West Branch channel is heavily treed along its length with an associated dense understorey along the riparian zone supported by riverine silty clay loam soils. In contrast, the associated floodplains are relatively sparsely tree covered. The following overview sequence documents the general range of character types associated with the North West Branch from south to north embracing the main channel and floodplain, western longitudinal dune plains and interdune floodouts in recovery flood mode associated with the Embarka Swamp and the main channel dispersal, the mid-channel and major distributary channels, Tirrawarra Swamp to the west and the North West Branch channel entry into Coongie Lake.







Figure 6.6.3 General landscape character types of the North West Branch from the air from south to north during recovery terminating in Coongie Lake Images: September 2012

### **General history and current aspects of occupation**

An overview of this evolved and associative landscape demonstrates all cultural themes along the North West Branch channel length and over adjacent landscapes: industrial, conservation, storied and productive. Due to the diversity of landscape types this area is regarded as high conservation and aesthetic value to the broader community evidenced by the declaration of the entire area as falling within the designated Ramsar Convention list of Wetlands of International Importance (June 15, 1987); (DEHAA, 1999).

Occupation by the pastoral industry is evident in the appearance of historic and contemporary stockyards, fencing, windmills and associated tracks and other infrastructure and outstation buildings such as at Kudriemitchie. Establishment of the pastoral industry around the end of the 19<sup>th</sup> century saw Coongie (1902) and Innamincka (1980) Stations established in the early years of the 20<sup>th</sup> century. The fencing of Coongie Lakes (1996) and the management regime of the Coongie Lakes National Park (2005) require that cattle and mining and exploration be excluded from the proclaimed areas. Long-term pastoral management regimes include careful attention to paddock rotation and wise use of water resources to cope with both wet and dry times, honed by long association with the land and through negotiation across the multiple users of the landscape. The importance of gaining local pastoral knowledge and expertise in the management of the area is critical to future conservation and production (Pers comm. M Morton, 2013).

Oil and gas exploration and extraction commenced in 1963 and now are evidenced through extensive infrastructure development in the swampy areas to the west of the North West Branch including the Tirrawarra Oil and Gas facility at Embarka Swamp. Improvements to the once pastoral Montepirie Track from Innamincka to just south of Coongie Lakes is provided by mining operations requiring reliable access to the Moomba refinery. Numerous private mining tracks head westerly to various mining and extraction sites and signs indicating underground pipelines criss-cross the country.

Conservation priorities are undertaken by National Parks and Wildlife South Australia through co-management of high value conservation zones and waterholes. Tourist management and oversight of remote campsites and regulation of public use is undertaken under the guidelines established for the Innamincka Regional Reserve. Additionally a number of friends groups are involved in the conservation and management of historic sites alongside their recreational interests.



Figure 6.6.4 Signs of occupation along the North West Branch from the air including the Montepirie Track, mining exploration and installation lines Images: September 2012

Aboriginal occupation over long time periods is widespread, confirmed through the abundance of cultural sites associated with waterbodies and landscape features and through the stories of the Dieri, Yandruwandha, Yawarrawarrka, Wangkangurru and Wangkumara peoples. In March 2010 Native Title was determined over the Coongie Lakes National Park in favour of the Yandruwandha Yawarrawarrka Traditional Land Owners (Aboriginal Corporation) which establishes the right to negotiate over certain acts or activities which may cause disturbance to land or subsoil underneath waters, tourism operations or conservation processes. The co-management of the area, which lies under the Innamincka Regional Reserve jurisdiction, the pastoral operations of Innamincka Station operated by S. Kidman & Co and various mining operations, is subject to an agreed management plan for the Innamincka Regional Reserve and Coongie Lakes National Park (NNTT ILUA, 2010).h



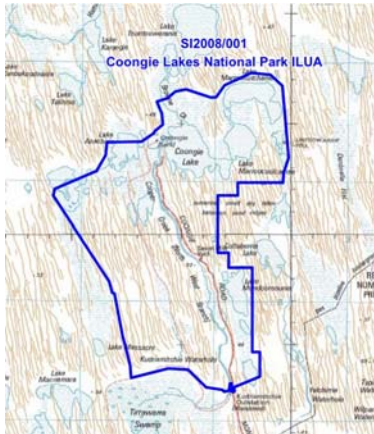


Figure 6.6.5 Extent of ILUA boundary from Kudriemitchie to Coongie Lakes Source: NNTT SI2008\_001 Image: September 2012

### 6.6.1 Scrubby Camp

Location: 27° 38'S 140° 22'E

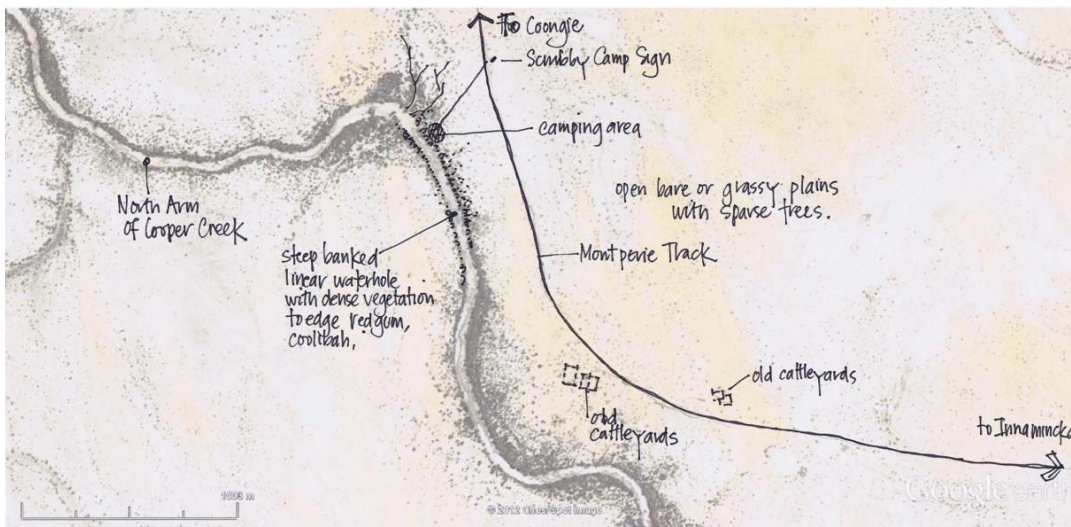


Figure 6.6.1.1 Overview of Scrubby Camp channel and waterhole and associated pastoral sites Image: 2010 Source: [www.earthgoogle.com](http://www.earthgoogle.com) Retrieved 10/7/2012.



### Form

Scrubby Camp is a narrow, linear tree lined semi-permanent 5 to 6 metre deep waterhole on the North West Branch of the Cooper Creek. It occurs between two bends in the relatively consistently 40 metre wide main channel, stretches more than a kilometre and exhibits a narrow riparian zone and floodplain on both sides within a landscape of longitudinal north south dunes. It has very steep banks to the waterhole edge moving up to a high relatively level floodplain in the adjacent landscape. The narrow riparian vegetation expands where the channel curves and water concentrates during flood.



Figure 6.6.1.2 Landscape character of Scrubby Camp and waterhole. Image: September 2012

### Riparian Zone

Mature trees and dense Lignum closely line the steep banks of the waterhole, only cleared where drainage gullies provide access for cattle. The surrounding landscape is typified by clay/sand/silt floodplains with intersecting sand dunes and three distinct vegetation associations occur from bank to riparian edge to floodplain including Coolibah, sparse River Red Gum, Acacia species and Queensland Bean Tree.

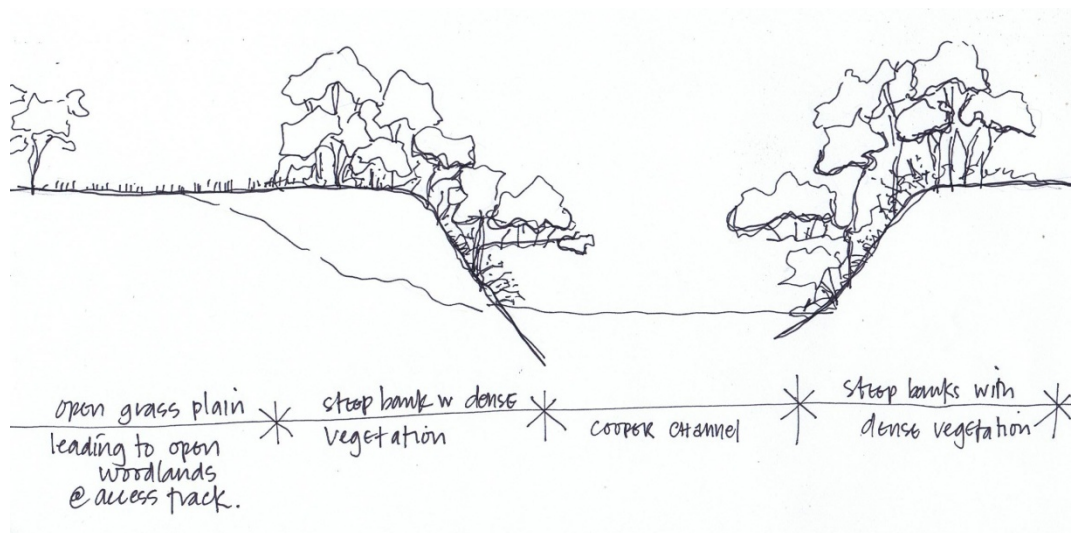


Figure 6.6.1.3 Cross section of riparian edge zone at Scrubby Camp camping area Image: April 2012

### Views

Dense trees and vegetation obscure views along the waterhole from the top of the banks. However, framed cross views provide for a secluded and contained landscape character experience. Views along the waterhole are possible from the lower banks but these are not accessible during flood whereas the waterhole opens up as the waters drop to enable views along the channel. The still waters are highly reflective and make this a most scenic small waterhole.







Figure 6.6.1.4 Contained views at Scrubby Camp waterhole during flood April 2012 and from the banks during recovery June 2013

### Water Feature

Scrubby Camp's contained channel provides a real oasis quality hidden behind high banks and dense vegetation. During flood, water and vegetation meet and the banks disappear from view, whereas during recovery the river-like appearance reduces into a more dispersed waterhole and dry channel appearance evident in the historic Google imagery. The picturesque qualities of this intimate waterhole are consistent with the refuge nature of the smaller waterholes in narrower creek channels in the catchment where abundant birdlife is ever present.



Figure 6.6.1.5 Views across Scrubby Camp waterhole in flood April 2012 and in recovery June 2013



## Vegetation

Vegetation types and densities are consistent across the banks and along the waterhole forming a very continuous covering of trees and dense undergrowth along the riparian edge. River Red Gums (*Eucalyptus camaldulensis*) and Coolibah (*Eucalyptus coolabah*) with dense Lignum (*Muehlenbeckia florulenta*) understorey characterise the banks. On the upper banks Acacia species such as *A. salicina* and *A. stenophylla*, the occasional Queensland Bean Tree (*Bauhinia gilva*), Whitewood (*Atalaya hemiglauca*) and a copse of Beefwood (*Grevillea striata*) make this a very floristically interesting waterhole displaying unusual species on a contained site. The associated floodplain is more sparsely populated with open Coolibah woodland with low salt tolerant shrubs such as Ruby saltbush (*Enchylaena tomentosa*), other chenopods and grasses.



Figure 6.6.1.6 vegetation types at Scrubby Camp, riparian edge and banks and floodplain Image: June 2013

## Occupation

Scrubby Camp is both an evolved and an associative landscape with predominantly productive, conservation and storied cultural themes. This is a popular stock camp and watering point for Innamincka Station pastoral property. Long evidence of pastoral use is seen in the stock yards, both in use and abandoned, bore and windmill and various fencing and tracks off the Montepirie Track. It is now co-managed by S. Kidman & Co and under the Innamincka Regional Reserve management regime and lies within the designated Ramsar Wetlands zone. Until recently it has been used by tourists as a secluded stop off on the way to Coongie Lakes and for camping, swimming, paddling, walking, bird watching and fishing, however NPWS management and the station managers have now closed the road and restricted camping. The waterhole and the surrounding floodplains evidence the vital importance of waterholes to the cattle industry and the appearance of multiple tracking and

gully use confirms that this paddock is in current use. Innamincka Station management plans include careful management and rotation of the various paddocks and their waterholes and waterpoints to protect riparian zones and associated floodplains (M. Morton pers comm. 2013).

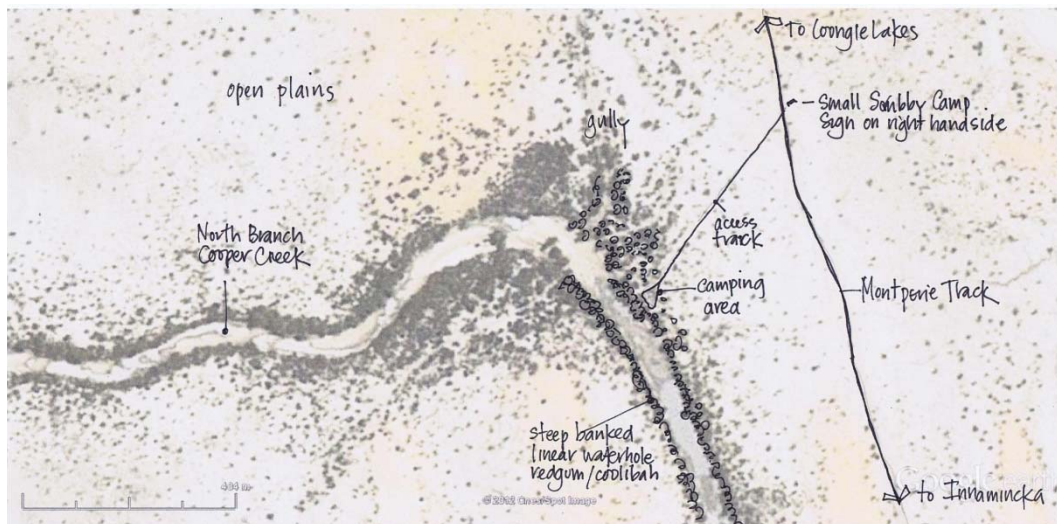


Figure 6.6.1.7 Occupation sites at Scrubby Camp Image: 2010 Source: [www.earthgoogle.com](http://www.earthgoogle.com) Retrieved 10/7/2012.







Figure 6.6.1.8 Camping ground adjacent riparian banks, historic and abandoned stockyards and evidence of pastoral operations in the area of Scrubby Camp. Images: April 2012

### Access

The waterhole is accessed via the Montepirie Track 38 kilometres north west of Innamincka via a single pastoral road that runs parallel to the Creek towards Coongie Lakes. The turn off to the camping has an obscure signpost leading across the floodplain to a large circular drive from which free camping is available adjacent a gully, providing easy access into the waterhole for both stock and people. The NPWS and station managers have employed fencing to limit access to the floodplain margins and to contain visitor activities. A number of tracks along its length lead into pastoral sites. Cattle tracking from the east is evident including pathways across the creek for access to the west during times of low water levels.



Figure 6.6.1.9 Montepirie Track, access tracks and the main North West Channel at Scrubby Camp. Images: September 2012, April 2012



Figure 6.6.1.10 Stock movement utilising gullies and bank sides at Scrubby Camp. Images: June 2013



## Interpretation

Directional signage is provided by NPWS and some no public access signage is now installed. This camp largely remains for pastoral use and is only occasionally described through social media and website reporting.



Figure 6.6.1.11 Limited signage and no interpretation at Scrubby Camp

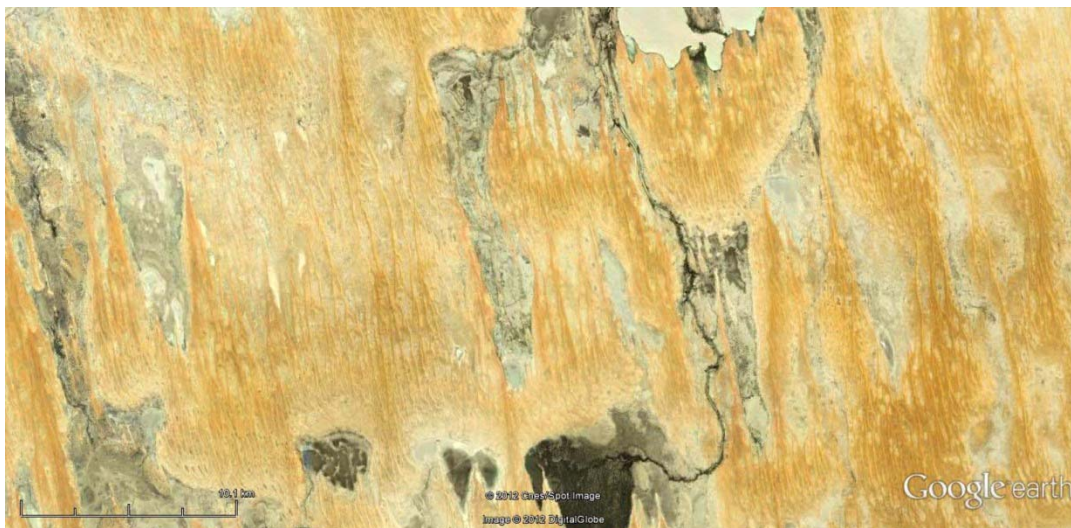
## Issues requiring management approaches

- NPWS and Station management and reduction of tourist visitation and camping will need to be maintained to prevent overuse and compaction of the camping area adjacent the erosion gully
- Bank and gully erosion due to ease of stock access into the waterhole at the camping area requires attention for rehabilitation of the drainage gully, especially in the transition from flood to drier conditions.

## 6.7 Kudriemitchie Waterhole

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**Location:** 27° 22'S 140° 12'E



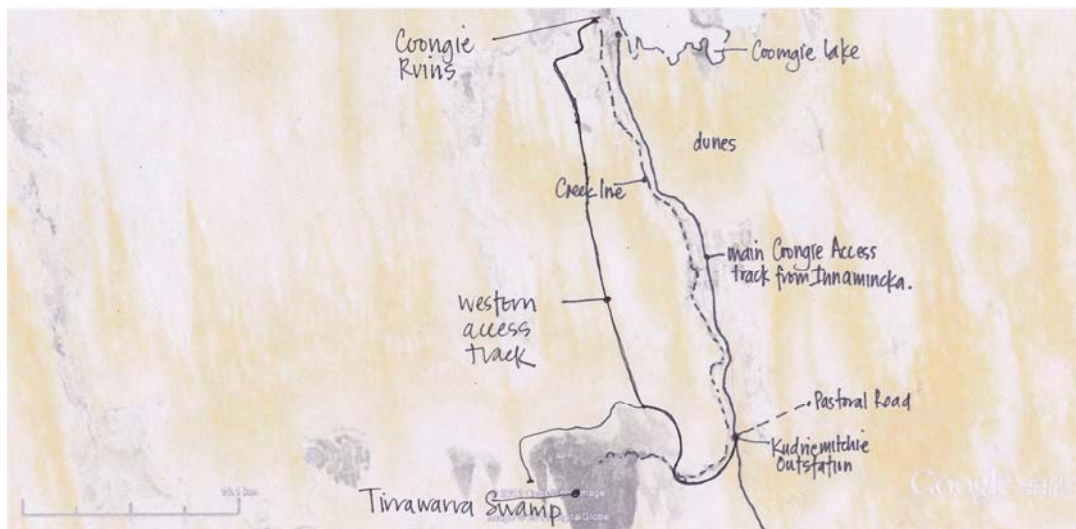
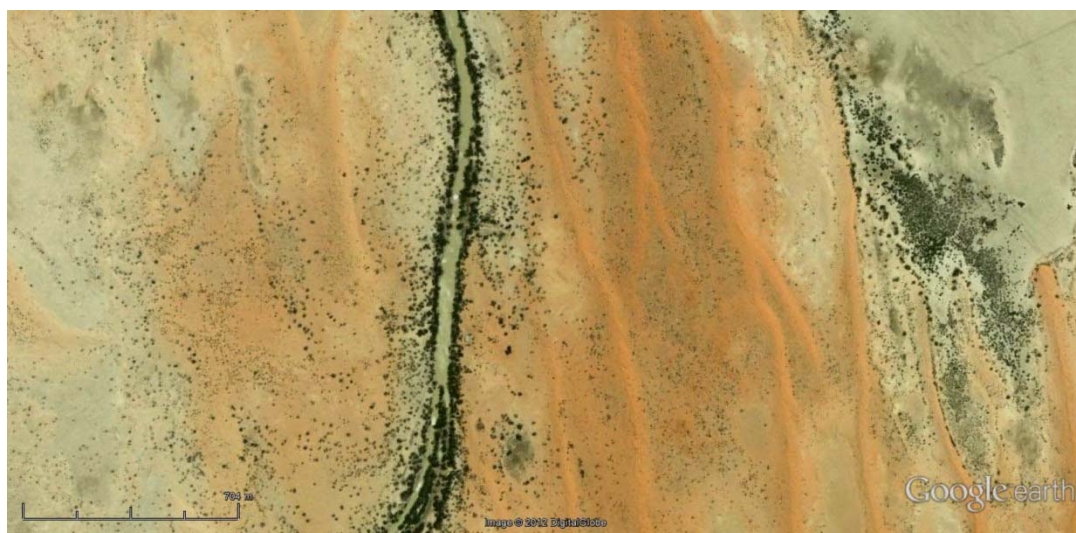


Figure 6.7.1 Overview of Kudriemitchie Outstation to Coongie Lakes Montepirie Track landscape type. Image: 2006 Source: [www.earthgoogle.com](http://www.earthgoogle.com) Retrieved 10/7/2012

### Form

Kudriemitchie is a very long waterhole running south to the north with a defined 50 metre main channel with a southern local anabranch adjacent the Outstation, and a sequence of in-stream islands and outtakes further north providing access at low banks particularly to the east. Just south of Kudriemitchie the dispersed North West Branch channel emerges from the Tirrawarra Swamp to form a defined channel flowing to the north. Kudriemitchie exhibits a narrow riparian zone and floodplain contained on both sides by longitudinal north south dunes. A series of claypans and interdune swampy areas that are noted as land subject to inundation are present in the western floodplain. The narrow yet dense riparian vegetation cover expands where the main channel diverges around the localised islands and off-takes at the channel margins. During flood the low banks are overrun and the plains flood into the lower pans and interdune zones. Kudriemitchie Outstation is located on a higher point on the eastern bank at the lower reaches of the waterhole.





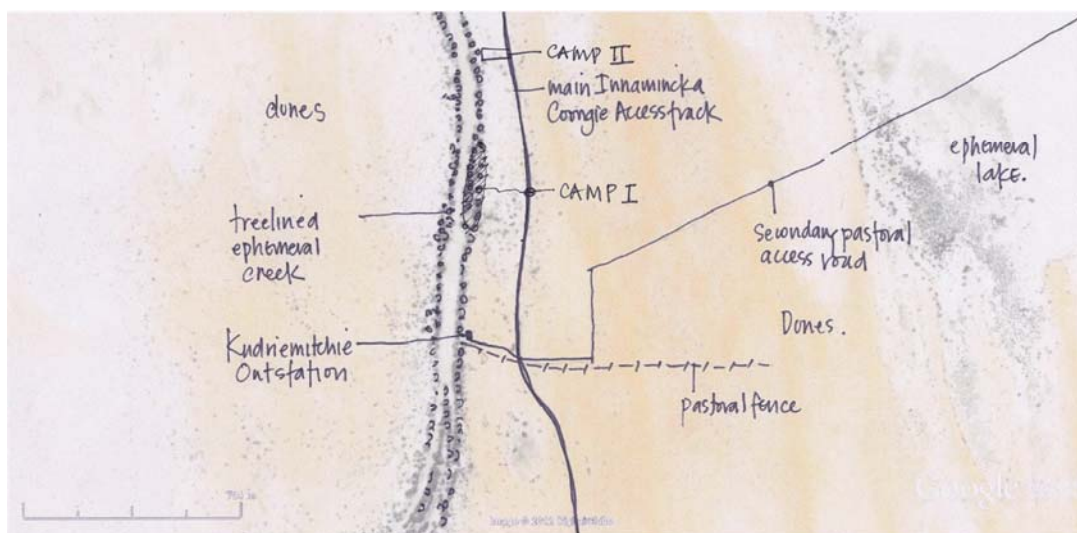


Figure 6.7.2 Kudriemitchie waterholes on the North West Branch in drought and in flood and general location of the Outstation and tourist camps Image: 2006, 2010 Source: [www.earthgoogle.com](http://www.earthgoogle.com) Retrieved 10/7/2012

### Riparian Zone

The form and scale of the riparian zones vary along the length of the waterhole from higher banks with steeper sides to very flat extended bank and channel areas adjacent the floodplains. Generally the vegetation consists of very mature River Red Gums, particularly on the in-stream channels, with Coolibah, Queensland Bean Tree and Acacia species, dense Lignum and grasses on the riparian margins dispersing into sparsely covered floodplains with Coolibah, chenopod and samphire species and grasses. The surrounding landscape is typified by clay/sand/silt floodplains with intersecting sand dunes and interdune sand plains.



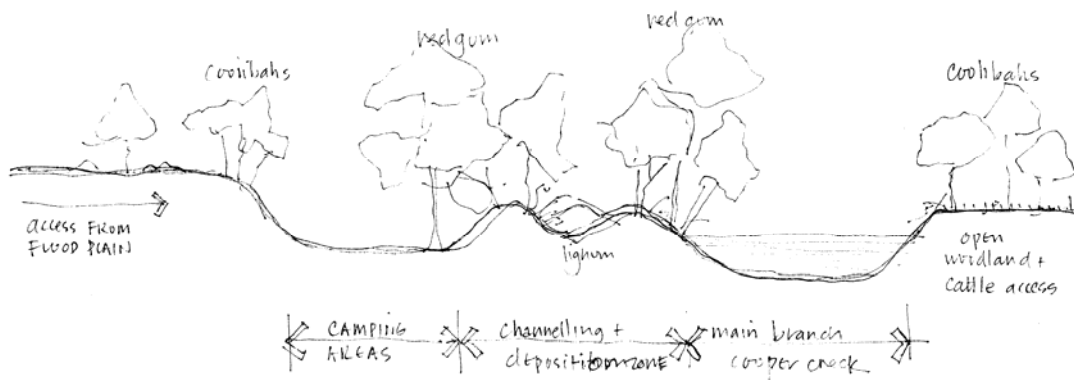


Figure 6.7.3 Kudriemitchie section at Campground 1 indicating channelized areas and island



Figure 6.7.4 Top to bottom: Riparian zone on east bank at Kudriemitchie Outstation, Kudriemitchie Campground 1 and Kudriemitchie Campground 3. Images: June 2013



## Views

Dense trees and vegetation obscure views along the waterhole from the top of the banks. However, views along the waterhole are possible from the lower banks along expansive sections of the slow flowing channel, particularly in the open channel adjacent Kudriemitchie Outstation. The lower and wider banks at the two campgrounds provide for framed views of the water beyond after passing down a gently sloping bank, which sets up the cross-bank experience of glimpses of the channel beyond prior to moving down towards the water's edge.



Figure 6.7.5 Top to bottom: Views from the east bank at Kudriemitchie Outstation, Kudriemitchie Campground 1 and Kudriemitchie Campground 3. Images: June 2013

## Water Feature

Kudriemitchie Waterhole is a nearly permanent water body featuring the typical arid country brown green turbid slow moving water lined with densely overhanging mature trees. The picturesque qualities of this creek channel do not immediately suggest its waterhole qualities

under times of flood and recovery. In June 2013 the drying creek revealed a number of intimate and contained small bankside channels and low sandy beaches, which provide refuge for birdlife and access for stock alongside places to camp and recreate with easy access to the water. The variety of water experiences is a feature of this section of the North West Branch landscape.



Figure 6.7.6 The range of water features from top to bottom and left to right Kudriemitchie Outstation and Campgrounds 1, 2 and 3 Images: June 2013

### Vegetation

Vegetation types and densities are consistent across the banks and along the waterhole forming a very continuous covering of trees and dense undergrowth along the riparian edge. River Red Gums (*Eucalyptus camaldulensis*) and Coolibah (*Eucalyptus coolabah*) with dense Lignum (*Muehlenbeckia florulenta*) understorey characterise the banks. On the upper banks Acacia species such as *A. salicina* and *A. stenophylla*, the occasional Queensland Bean Tree (*Bauhinia gilva*) and Coolibah are present. The sandy floodplain rising to low dunes is more sparsely populated with open Coolibah and Acacia species woodland, occasional Needlewood (*Hakea leucoptera*), low salt tolerant shrubs such as Ruby saltbush (*Enchylaena tomentosa*), herbs and grasses. The noxious weed Buffel Grass and various thorn bushes are also present in this area.





Figure 6.7.7 vegetation types at Kudriemitchie, sandy floodplain, riparian edge and banks and channel Image: June 2013

### Occupation

Kudriemitchie Outstation and waterhole is both an evolved and an associative landscape with predominantly productive, conservation and storied cultural themes. This heritage listed former Innamincka Station pastoral outstation is now co-managed by S. Kidman & Co and the South Australian Government NPWS under the Innamincka Regional Reserve management regime and lies within the designated Ramsar Wetlands zone. Further north the three discrete and picturesque Kudriemitchie unserviced bush camping sites on the lower banks of the main channel just before the formal entry into the Coongie Lakes National Park are popular with Coongie-bound tourists. The route of Burke and Wills 1860-61 exploration to the north is marked as crossing nearby Kudriemitchie and following the channel northwards towards Lake Apachirie.

An extensive use of the waterhole by the early pastoral managers in line with Sir Sidney Kidman's strategy to secure the waterholes, creeks and floodplains saw the development of the outstation complex until its eventual abandonment in the later 20<sup>th</sup> century as roads and communication improved. Since 1995 volunteers from the Toyota Landcruiser Club (TLCC) have regularly undertaken working bees to renovate and secure the relocated 1970's oil and gas rig site building and subsequently abandoned outstation buildings. These include a bunkhouse and kitchen building, outside toilet and unusual meat house and water tank in return for the right to camp and recreate in the area. It is noted as being available as a base for park management and scientific research. The Tirrawarra Swamp and intensive mining operations to the west and south do not visibly impact upon the area, however mining interests and infrastructure together with tourism visitation on the northward trip to Coongie Lakes assist in the maintenance of roads and the intensity of seasonal use. During the 2010

to 2012 floods the Montepirie Track was closed and the area cut off from tourist, pastoral and mining activity in the extensive floodplains and interdune areas.

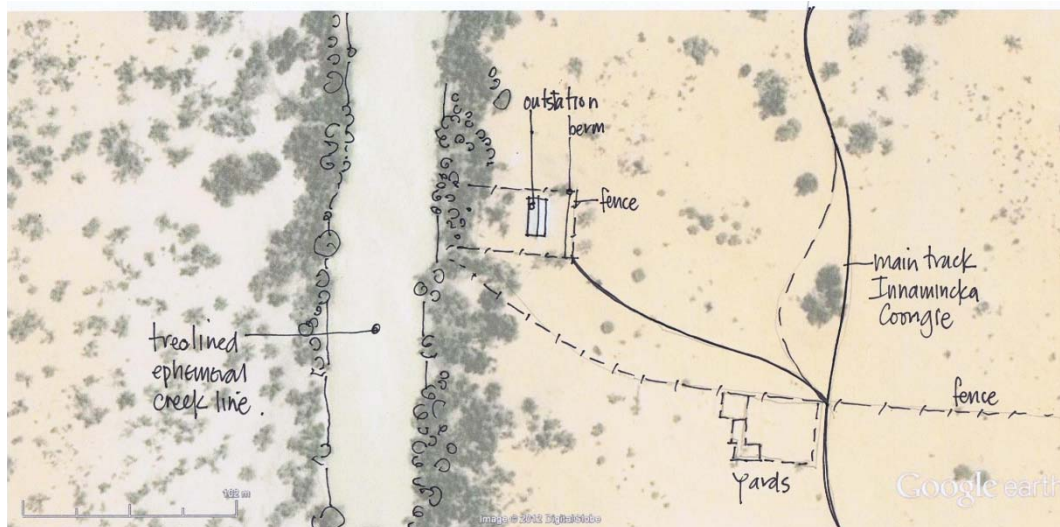


Figure 6.7.8 Kudriemitchie Outstation and pastoral infrastructure on the Montepirie Track Image: 2006 Source: [www.earthgoogle.com](http://www.earthgoogle.com) Retrieved 10/7/2012

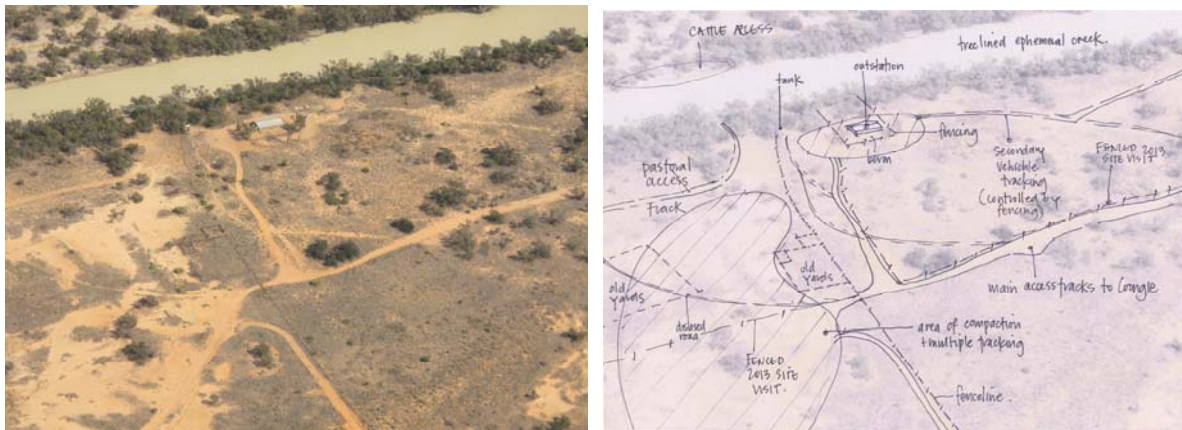


Figure 6.7.9 Kudriemitchie Outstation occupation and use indicating historic pastoral infrastructure now utilised for bush camping and tourist visitation. Image: September 2012



Figure 6.7.10 Kudriemitchie Outstation: stockyards at entry, outstation bunkhouse, meat safe and tank, track to waterhole and channel, Cooper Creek north West branch main channel. Images: June 2013



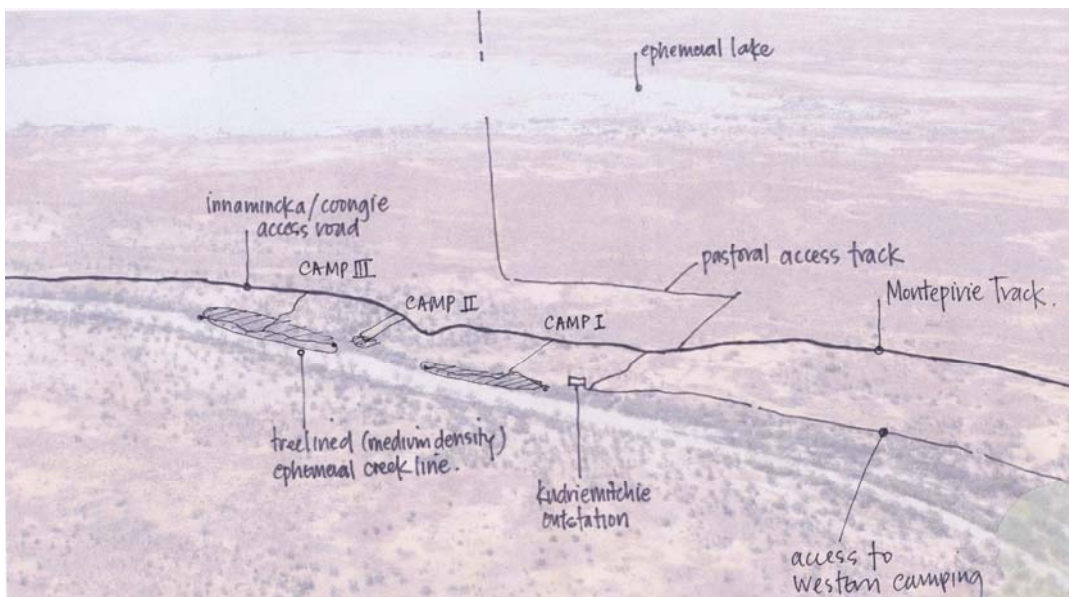


Figure 6.7.11 Kudriemitchie Outstation overview of site and camping grounds in recovery just prior to the road opening after the floods Image: September 2012







Figure 6.7.12 Top to bottom Kudriemitchie Campgrounds 1, 2 and 3 general access conditions and landscape character of the campgrounds

The three Kudriemitchie campgrounds have distinct characteristics although they occupy the same stretch of the main channel. Campground 1 is a secluded swampy/sandy zone stretching for some 400 metres along the main channel and separated by a treed sand bar, Campground 2 is more of a parking area on the top of the bank more separated from the water and located in the riparian edge of the floodplain, whereas Campground 3 is another elongated bankside area where campers can locate their campsites adjacent the water with sufficient separation from other groups. It is possible to walk alongside the channel to view birdlife and water activities along unmade paths under the mature River Red Gums.

### **Access**

The Outstation buildings and waterhole campsites are accessed via the Montepirie Track 85 kilometres north west of Innamincka. It is accessed via a single pastoral road that runs parallel to the Creek towards Coongie Lakes. The turn off to the Outstation and camping areas are well signposted through the NPWS system. Access to the waterhole at the outstation is only via walking tracks from the Outstation facility, however the campsites generally provide for vehicular access straight down the riparian bank and onto the creek bed with space for groups and larger vehicles when water levels allow. Turning circles are somewhat limited in the linear campgrounds.



Figure 6.7.13 Kudriemitchie Outstation access from Track and access to waterhole Images: June 2013

### Interpretation

Minimal interpretation signs have been installed at the Outstation as a joint project between the then DENR and NPWS, indicating the history, management and association of Kidman Pastoral Company and the TLCC for the sites provision and its restoration. There is some further information provided by the TLCC on their website regarding access and use. The camping areas are noted on State Government information brochures.



Figure 6.7.14 Kudriemitchie Outstation interpretation Images: June 2013

### Issues requiring management approaches

- NPWS, Innamincka Station and TLCC management is enabling the restoration and protection of the historic outstation. Further interpretation and information regarding the ecology and use of the associated campgrounds is warranted.
- Bank erosion at the campsites due to vehicular and camping traffic including compaction near mature trees and clearing of Lignum by tourists requires attention.
- Firewood management is also necessary as many bush fireplaces close to vegetation were observed with large fallen/sawn trees being gathered in evidence.



## 6.8 Coongie Lakes

**Location:** 27° 27' S 140° 00'E

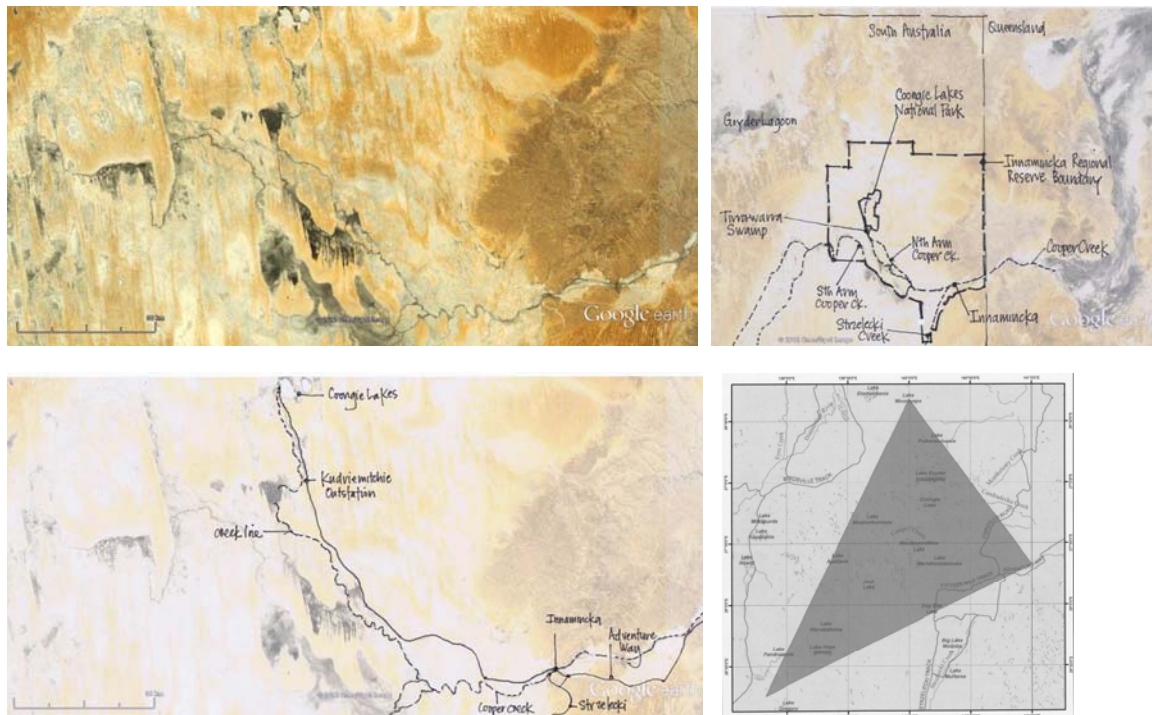


Figure 6.8.1 Coongie Lakes access from Innamincka, National Park, Ramsar location Image: 2006 Source: [www.earthgoogle.com](http://www.earthgoogle.com) Retrieved 19/7/2012

### General landscape character features

The Coongie Lakes system lies in the northernmost floodplains of the Cooper Creek and is regarded as one of the last unregulated natural freshwater system wetlands in the world. The wetlands are a series of interconnected ephemeral, semi-permanent and permanent waterbodies comprised of river and creek channels, waterholes, freshwater and saline lakes, internal deltas and numerous shallow floodout plains, interdune corridors and swamps. While the larger lakes may be regarded as permanent (except after long periods of extreme drought), the wetlands surrounding them are ephemeral until floodwaters from local rains, and from floodwater pulses from the Cooper Creek from Queensland, replenish the system often over yearly and longer timeframes. To the south Tirrawarra Swamp is connected to Coongie Lakes via the North West Branch of Cooper Creek. The lakes in the system are Lake Coongie, Lake Apachirie, Lake Marroocoolcannie, Lake Marroocutchanie, Lake Toontoowaranie, Lake Warra Warreenie, Lake Goyder, and Stuart Ponds, Emu Flat and Tirrawarra Waterhole. This is a landscape of high biodiversity where sixty wetland habitats have been described within its system (DEHAA, 1999).

Low gradients, the shallow relief of the surrounding country and the longitudinal dunes juxtaposed with floodplains enable floodwaters to slowly spread across the landscape for vast areas, thus replenishing the floodplains as the lakes sequentially fill (to approximately 1.5m) and overflow into the next waterbody. During flood periods creek lines, channels and drainage lines maybe come indistinguishable from the single defined channels to multiple branching elements obvious in dry times. The water habitats of the system are characterised



locally around particular water bodies including: deep, open waters, inundated lake margins, minor channels and shallow rain-fed pans. Terrestrial habitats include riparian woodlands (River Red Gum, Coolibah and Lignum), treeless floodplains and sand dunes (Reid & Puckridge, 1990). The climatic and wind conditions vary widely from the exposed lakes to the more protected river channels.



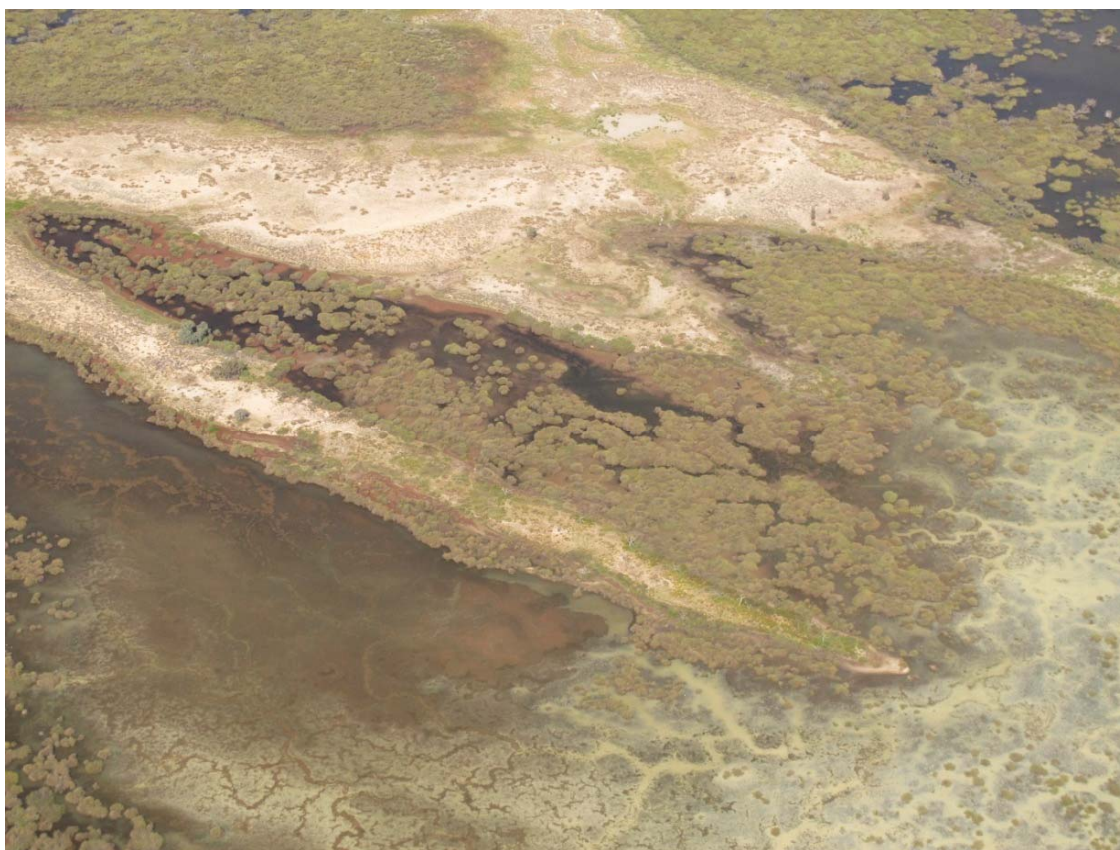


Figure 6.8.2 Overview of Coongie Lakes Wetlands in flood recovery indicating the relative locations of the major lakes, the termination of the North West Branch into Coongie Lake, and the sequence of landscape character types including lakes, wetlands, dunes and interdune corridors and swamps. Images: September 2012

### **General history and current aspects of occupation**

The Coongie Lakes are about 100 kilometres northwest of Innamincka and lies within the designated Ramsar Wetlands zone, the Coongie Lakes National Parks and the Innamincka Regional Reserve. The Coongie Lakes Ramsar site has an area of 19,800 km<sup>2</sup> and the Coongie Lakes National Park is 279 km<sup>2</sup>. The Coongie Lakes lie within the traditional lands of the Yandruwandha, Yawarrawarrka, and Dieri people who are able to confirm ongoing occupation for thousands of years, through the stories that have been handed down and the numerous cultural sites that surround the Lakes and river channels. The area displays all the cultural landscape themes of industrial, conservation, production, and storied through the mix of land tenure and land use. The area is designated variously as crown land, pastoral lease (cattle grazing) and national park (conservation, Aboriginal cultural occupation, tourism) and the wider area has extensive oil and gas production and associated infrastructure. Due to its high biodiversity the National Park is a haven for nature lovers seeking an outback experience in a wilderness setting including bird watching for local and migratory birds, low impact water sport and exploration, photography, camping and bushwalking.

Passing from its historical association with the pastoral industry and the early establishment of Coongie and Innamincka Stations, as stock are now excluded from the fenced Coongie Lakes, the strategic management of the Park is undertaken through shared responsibility and co-management partnerships between the traditional owners, the Yandruwandha and Yawarrawarrka people and the South Australian Government. There are various natural

sites listed on the Register of the National Estate and the South Australian State Heritage Register.

A 'Plan for Wise Use' was tabled for public consultation (DEHAA, 1999) and although somewhat dated in 2013, it contains a number of principles for the wise use and planning of Coongie Lakes, in accordance with Ramsar international guidelines summarised below. The five key points include:

- Continuation of the hydrological diversity of the naturally flowing Cooper Creek
- To define an ecological and hydrological boundary to the wetlands that promotes wise use of resources according to the core or frequently flooded wetland, the greater wetland system and the non-wetland area.
- Promote maintenance of the natural systems biodiversity and the heritage cultural landscapes including the enhancement of the living culture of the wetlands.
- To support expanding the knowledge of wetland functions and
- To promote activities that enable people to work together to achieve community support for wetland management.



### 6.8.1 Coongie Lake

**Location:** E 27° 11' S 140° 10'E

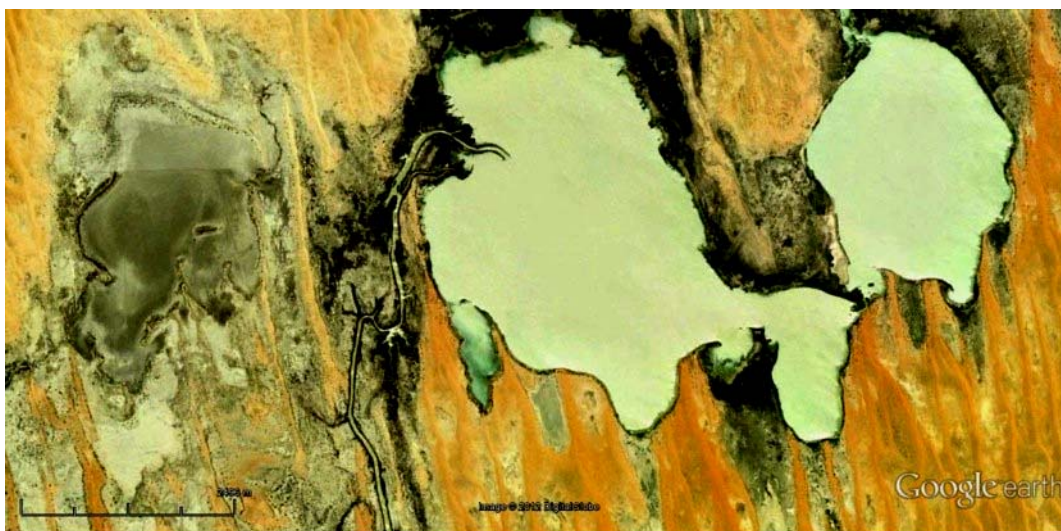
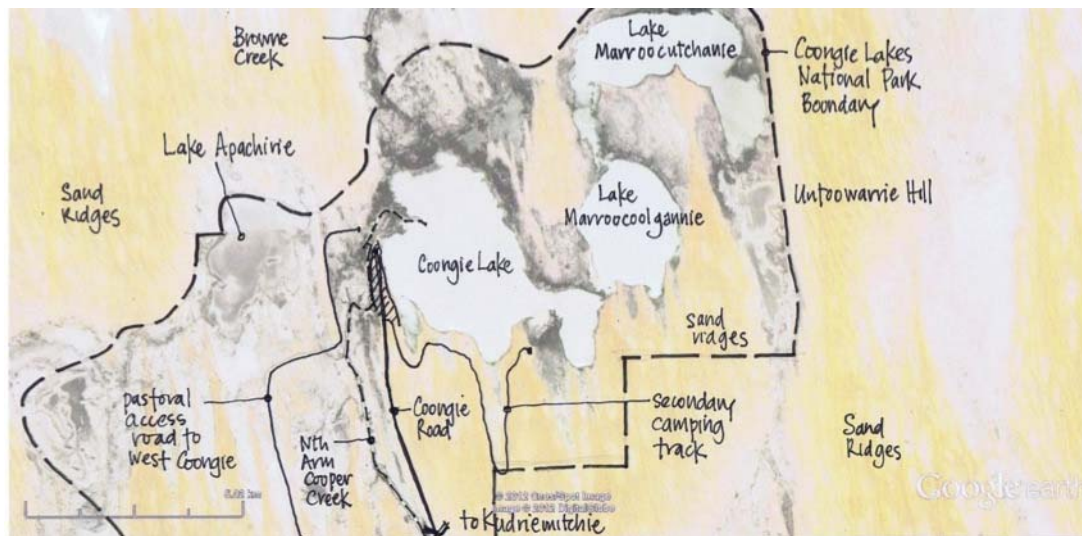


Figure 6.8.1.1 Coongie Lake, the National Park boundary and general Coongie Lake access, general landscape types including permanent lakes, ephemeral lake, dune extent and structure, North West Branch channels and wetlands on the large margins during the dry. Image: 2006 Source: [www.earthgoogle.com](http://www.earthgoogle.com) Retrieved 19/7/2012

#### Form

The expansive Coongie Lake is a permanent and central feature of this important wetland landscape. It is some 3.5 kilometres wide and 5 kilometres long at the central east-west-north /south across its centre fed by the North West Branch of the Cooper Creek channel which terminates on its northwest margin. To the north low treed swampland surrounds the upper Lake margins, whereas the north-south dunefields terminate along the southern and eastern margins. The extremely shallow gradient of the surrounding landscape forms the Lake - which is at most less than 2 metres deep - and the adjacent lakes that range from fresh to salty depending upon the proximity of floodwaters and the degree of drying during recovery and drought. The North West Branch adjacent the Lake is confined by dunes and exhibits a narrow floodplain, small distributary channels and flood outs, and densely treed

riparian edges especially where the channel splits at its termination into Coongie Lake. The dune margins are sparsely treed and are characterised by interdune plains, which may remain flooded for some months or years after inundation. As the creek channel enters the lake is diverges into two channels that finally flow beyond the lake margins forming a small delta of deposited sediment and a constrained floodplain just to the south, which forms a natural area for sheltered occupation and use.



Figure 6.8.1.2 The attributes of the complex and extensive ephemeral and semi-permanent freshwater wetland system at Coongie Lake, Lake Marroocoolcannie above and Lake Apachirie below; the North West Branch channels and deep treed waterhole and localised floodplain and swampy land (above) and the sparsely treed and inundated southern dunefield, shallow floodout plains and interdune plains (below). Images: September 2012



### Riparian Zone

There are three distinct riparian zone character types at the Coongie Lake western margins that support both aquatic and terrestrial species. The North West Branch channel exhibits the typical river channel conditions with generally low banks with Coolibah, very mature River Red Gum on the creek shorelines, Acacia species, dense Lignum and grasses on the riparian margins. The white sand/sediment and very shallow floodplains are more sparsely covered with Coolibah, chenopod and samphire species and perennial flowering shrubs. As the channel enters the Lake the low plain is typified by clay, sand and silty soils providing rich habitat for aquatic fauna and vegetation. Where the pale sandy dunes intersect the Lake to the south the trees thin out to generally line the shoreline margins, with some zones of Coolibah, grasses and rushes transitioning to Whitewood, Sandhill Wattle and Sandhill Canegrass. The dunes intersect the Lake with varying scales of dune elevation with accompanying various vegetation types depending upon top of dune or dune plain inundation.



Figure 6.8.1.3 Coongie Lake riparian zone at North West Branch channel (above) and looking from the creek channel towards the lake (below). Images: June 2013





Figure 6.8.1.4 Coongie Lake white sand beach riparian zone on the western margins adjacent the creek (above) and the pale red and yellow sand southern margins at the shoreline and overlooking the interdune floodplains (below) Images: June 2013



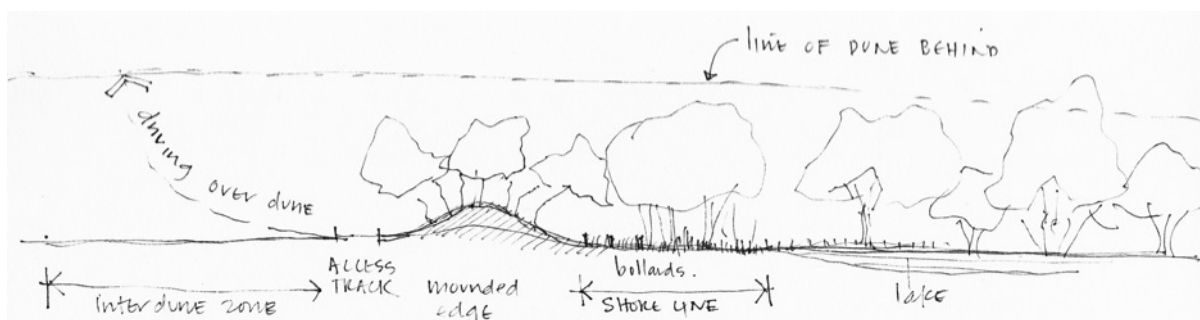


Figure 6.8.1.5 Coongie Lake riparian sections for two character types along the southern margins; the top of dune as it intersects the lake to the south (above), interdune floodplain of very low gradient at lake edge.

## Views

Dense trees and vegetation generally obscure views along the channel from the top of the banks. The exception is near the camping ground where cleared access to the creek banks allows picturesque sights across the broad expanse of the creek formed by the divergence of the single channel and framed by large River Red Gums and the dense bank vegetation typical of the North West branch creek. To the east the lake affords more highly picturesque views especially at dawn and dusk as the sun raises and sets over the Lake. Good access to the Lake edge, sufficient water in times of flood and recovery, sandy beaches in colours ranging from white to deep ochre and pink, and some signature trees and understorey planting all enable both open and framed views of the Lake margins alongside expansive views across the Lake in all directions. Views across the dune plains to the south alongside really breathtaking views across the Lake make this one of the most scenic experiences on the Cooper Creek catchment.



Figure 6.8.1.6 Two distinct view types; overlooking the channel as it makes its way to Coongie Lake (above) and across the Lake from atop the large dune at the furthest designated southern campsite (below) Images: June 2013



### Water Feature

The three distinct character types emerge from the intersection of the inland river system and the inland lake and its surrounding dunefields. The deeper channel that forms a linear and flowing expression of outback waters, the shallow floodplain lake that is affected by the silting and flooding regimes of the channel systems and thirdly, the sandy lake defined by its intersecting dunes and dune plains. The quality, colour and dynamics of the waters in these three conditions provide a very diverse aquatic and riparian experience.



Figure 6.8.1.7 Three distinct water feature types; the typical inland river channel (above), the western lake white/grey shoreline adjacent the channel floodplain (middle) and the southern ochre/pink dunefield margins (below) Images: June 2013



## Vegetation

Reid and Puckridge identify five distinct vegetation assemblages and associations for the Coongie Lake area: woodland complex (including riverine areas), interdune low floodplain complex, sand dune crest complex, sandy dune slope – interdune complex and claypans (which are generally designated as barren) (Reid & Puckridge, 1990 p122). Vegetation types and densities along the creek riparian zone are consistent along and across the banks forming a very continuous covering of trees and dense undergrowth along the riparian edge as in the lower reaches of the channel. The northern limit of the Eucalyptus woodland typology of River Red Gums (*Eucalyptus camaldulensis*), Coolibah (*Eucalyptus coolabah*) with dense Lignum (*Muehlenbeckia florulenta*) with occasional River emu bush (*Eremophila bignoniiflora*) understorey characterise the banks and immediate riparian zones. On the upper bank and floodplains Broughton Willow (*Acacia salicina*) and River Cooba (*Acacia stenophylla*), and Coolibah are present. The sandy floodplain rising to low dunes is more sparsely populated with open Coolibah and Acacia species woodland, occasional low salt tolerant shrubs such as Ruby saltbush (*Enchylaena tomentosa*), herbs and grasses. The southerly sand dunes and lake margins display similar tree species more sparsely located around the lake margins and adjacent dune floodplains. Typical Sandhill Cane-grass (*Zygochlea paradoxa*) dune vegetation with ephemeral species of grasses and perennial flower plants occur in relation to seasonal conditions.



Figure 6.8.1.8 The variety of vegetation types from creek, floodplain and sand dune margins Images: June 2013

## Occupation

Coongie Lake is both an evolved and an associative landscape with predominantly conservation and storied cultural themes being practiced and the once lucrative pastoral productive use now confined to history due to the designation of the Coongie Lakes National Park and the application of Ramsar wetlands and co-management regimes. Evidence of long-term occupation of the area by the traditional owners, the Yandruwandha and Yawarrawarrka and other clans such as the Dieri, Wangkangurru and Wangkumara peoples, is found in the shell middens visible over great areas of the adjacent floodplains and dunes. The location and extent of these middens provide rich source material for the confirmation and development of the storied landscape. The ongoing cultural occupation of this landscape for food and shelter in a landscape that supports both desert terrestrial and wetland aquatic occupation is important for both historic and contemporary cultural landscape understanding and future development. Coongie Lakes is also the premier

conservation site of the Cooper Creek catchment, which is an attractor to ecologically minded tourists, artists and locals.

The major occupation site for tourists and research and conservation activities is located at the confluence of the Cooper Creek North West Branch channel as it enters Coongie Lake. This small campground is contained by the creek riparian edge to the west and the floodplains and lake margins to the east. Its scale and shape naturally limits the extent of groups in large vehicles and trailers being able to experience the site, however it does provide ablution facilities. The contrasting riverine and lake landscapes are a feature of the main campsite, where a major attraction for visitors are the numerous birds and nesting sites as evidence of the landscape's rich biodiversity. Dingoes, small reptiles and mammals are obvious from tracks on the sand dunes and night cries of the roaming dogs. Walking tracks around the lake alongside other water derived recreation activities, including creative pursuits such as photography, are also popular with campers. As a Ramsar wetland the site is also the destination and departure points for ecological surveys and is the focus for current and future cultural management by traditional owners and their families.

The alternative Lake Drive southern campsites line the lakeside in a variety of low white sandy beach and swampy wetlands and the higher ochre/pink sand dunes further to the east provide more secluded lakeside wild camping with no facilities. Many of these are located in close proximity or on midden sites. The preference for campers to park their vehicles on riverbank edges close to lake margins is evident, as are the remains of campfires despite these being prohibited. These camping areas become impassable during times of flood and the access road across the dunes is washed away. Despite the park map designating three camping areas on the lake drive, up to six or seven camping areas were recorded in clearings at the lake margins ranging from top of dune to swamp flat, with varying degrees of access. Dependant upon the frequency of flood and inundation, these areas are able to be naturally spelled and rejuvenated in terms of their biodiversity however the management of cultural sites requires identification and careful management of tourism infrastructure and access.



Figure 6.8.1.9 The Coongie main eastern campsite area at the extreme north of the image and the western camp that is little used on the western side during the time when floods had reduced access for some years. Image: September 2012



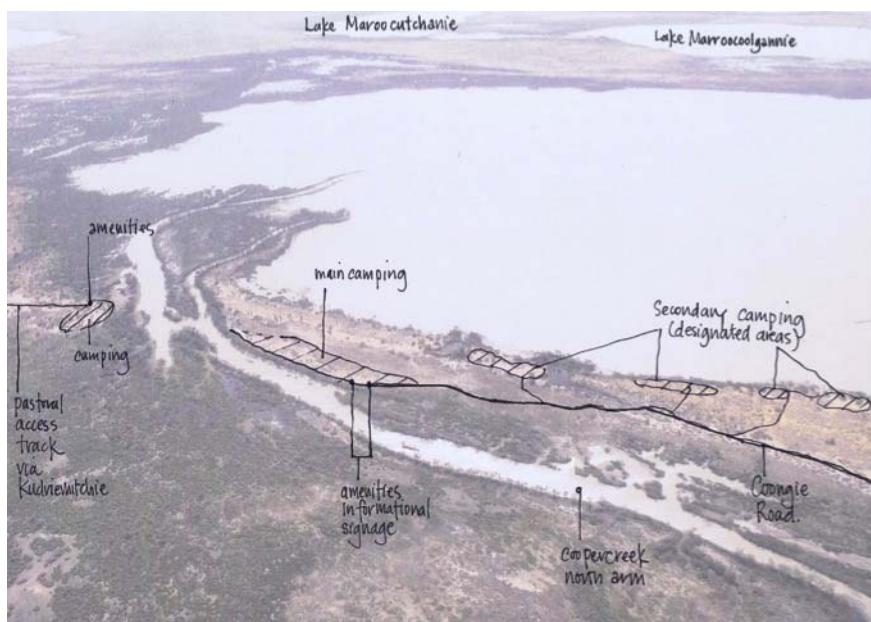


Figure 6.8.1.10 The Coongie main eastern campsite area on the channel and lakeside 'wild' campsites when the site was still cut off from access due to flooding Image: September 2012







Figure 6.8.1.11 The Coongie main eastern campsite area indicating the camp entry, ablutions location in Aboriginal midden at the site entry, general location of camping preferences for vehicles and trailers, and impacts of camping on the riparian edge, including tracking. Images: June 2013

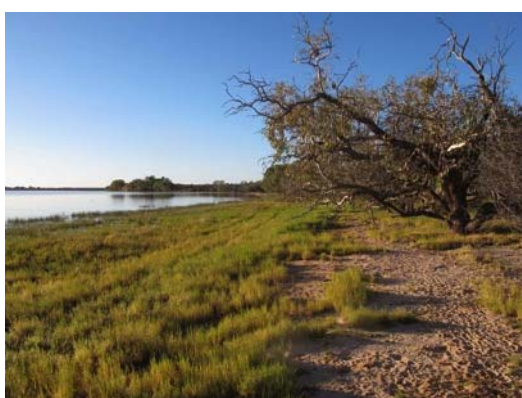




Figure 6.8.1.12 Five typical Lake Side Drive campsites from the furthest site located on a high sand dune to increasingly lower camping on the lake margins in the interdune floodplains closer to the entry road. Images: June 2013



Figure 6.8.1.13 Cultural occupation sites along the dunes and at the channel campsite indicating shell midden remains and grinding stone, foot traffic and old (banned) campfires. Images: June 2013

### Access

Access to Coongie Lake, some 106 kilometres northwest of Innamincka is only possible along the Montepirie, or the Coongie Track as it is most usually named, and requires a permit. No fires, pets, fishing, generators or powerboats are allowed and the road and Park entries are clearly signposted with standard Innamincka Regional Reserve NPWS infrastructure, signage and interpretation. The unregulated nature of vehicular traffic means that tracks and turning areas frequently impact upon visible shell middens, which ring the lake's edge. Orange track markers provide guidance but no protection and tracking is also present on the sandy/swampy beach zones. Lakeside camping is limited to 5 kilometres from the main entry, however the lake access track continues to wind its way along the dunes.



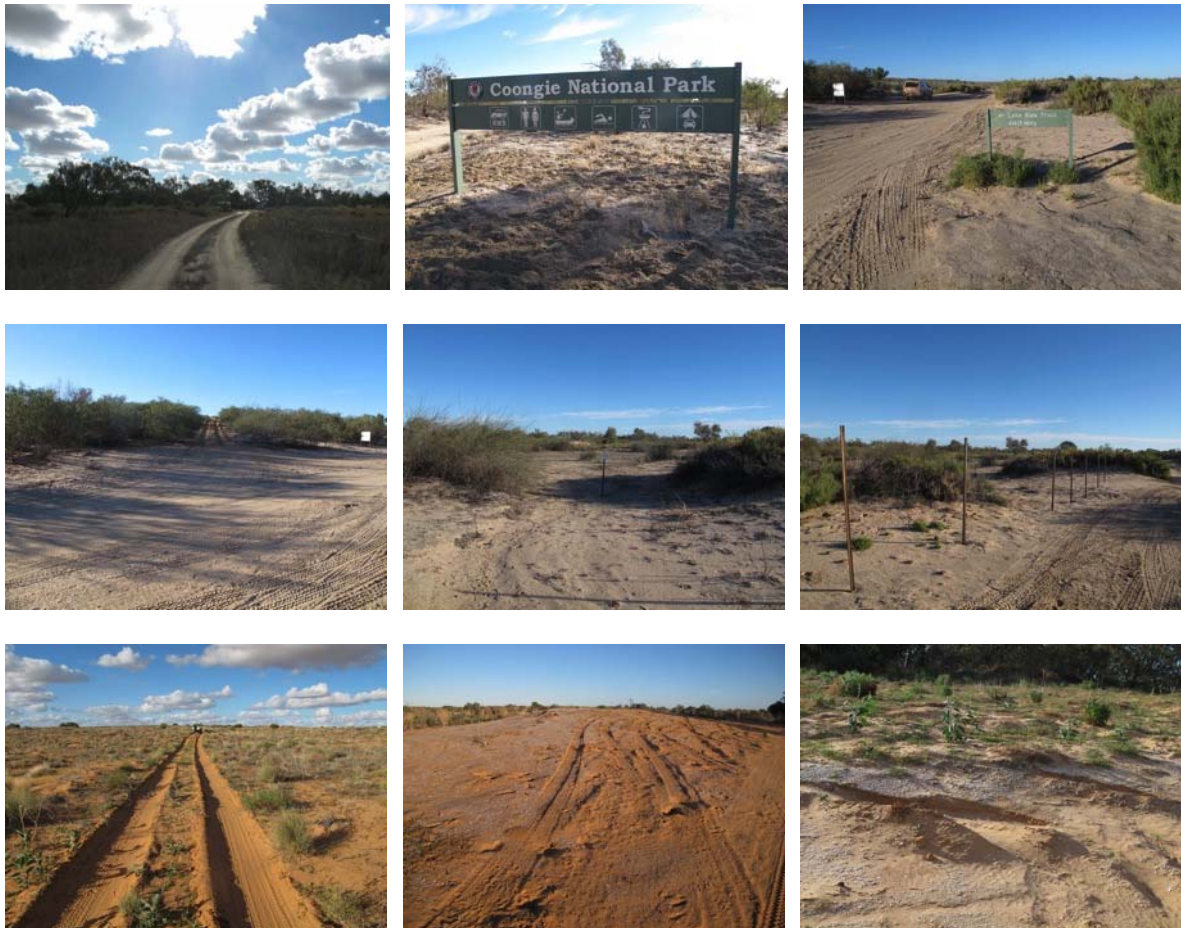


Figure 6.8.1.14 Access tracks from the Coongie Track the camping area entry, entry to Lake Drive, various traffic management methods for the conservation zone, sand dune track and midden tracking. Images: June 2013

### Interpretation

A range of shelters and regulation and interpretive signage as for the Innamincka Regional Reserve, marks the limits of the formal camping and interpretation area at Coongie Lake, located adjacent the channel on the main entry track. The interpretative signage shelter and first toilet is well sited away from the main campsite and key landscape features.



Figure 6.8.1.15 Coongie Lakes interpretation. Images: June 2013

### Issues requiring management approaches

- As the iconic recognised wetlands in central Australia, Coongie Lakes, has Ramsar recognition and National Park status, therefore the importance of wise water management is imperative. The maintenance of upstream flows and for the Cooper



Creek system to remain unregulated is vital to the ongoing health of the system. This is an intergovernmental and national policy agenda that requires legislated management for the ecological and cultural benefit of the Coongie Lakes.

- Installation of upstream infrastructure associated with industrial development must not impede seasonal and ephemeral flows to sustain the health of the system.
- Wild camping and management of riparian zones requires review in terms of shoreline access, however the wild camping experience should not be overly prescribed in terms of car parking, bollards and other NPWS standards, and rather in relation to landscape qualities and appropriate spatial and detail design.
- Access to Aboriginal sites, installation of infrastructure and traffic management is necessary in coordination with Aboriginal cultural management regimes.
- In co-operation with local Aboriginal knowledge, consider education programs regarding recognition and interpretation of the range of important cultural sites and their landscape appearance. Visitor and local management recognition understanding of both small and large landscape features, such as groups of rocks or dune middens, will assist their protection and confirming community values of the broader areas.

## 6.9 Gidgealpa Waterhole

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**Location:** 140°09' E, 27°49' S

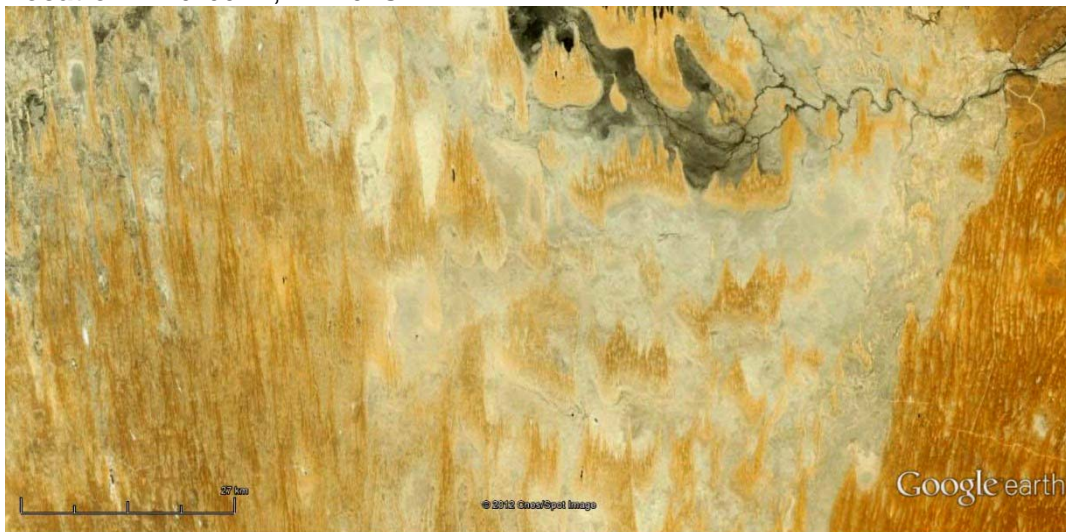
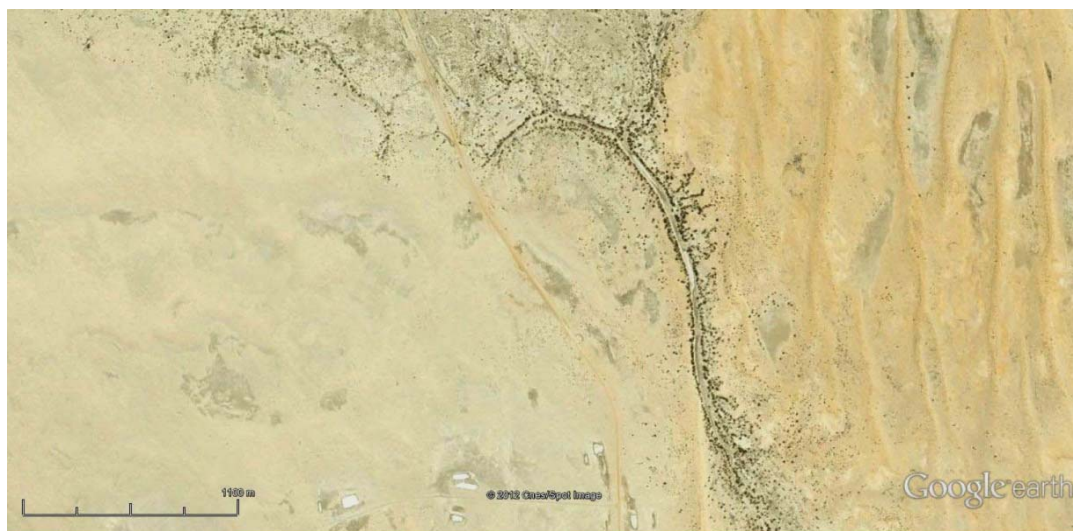




Figure 6.9.1 Gidgealpa Waterhole general landscape overview and location. Image: February 2007. Source [www.earthgoogle.com](http://www.earthgoogle.com) retrieved 19/7/2012.

### Form

Gidgealpa Waterhole is an ephemeral waterhole approximately 1.5 kilometres long and 20 metres wide located in the interdune corridor of the high north south dune system of the main Cooper Creek flow path at the edge of the Innamincka Fan. The waterhole has co-evolved with the dunes formed through erosion due to the concentration of flooding flows in the interdune corridor over long time periods. To the west the dunes give way to rolling low dune plains, whereas to the east and north the dune plain is contained by the swampy plains of the Cooper Creek main branch floodplains. The waterhole is also characterised by wide clay banks to the south until the western dune intersects the sandy channel to the north. Erosion gullies are prominent, both from the top of the dune to the margins of the waterhole and along the banks in one area forming a silty fan. The tree-lined creek eventually curves westward at its northern reach and appears to reduce to a large dry drainage channel and small floodplain.





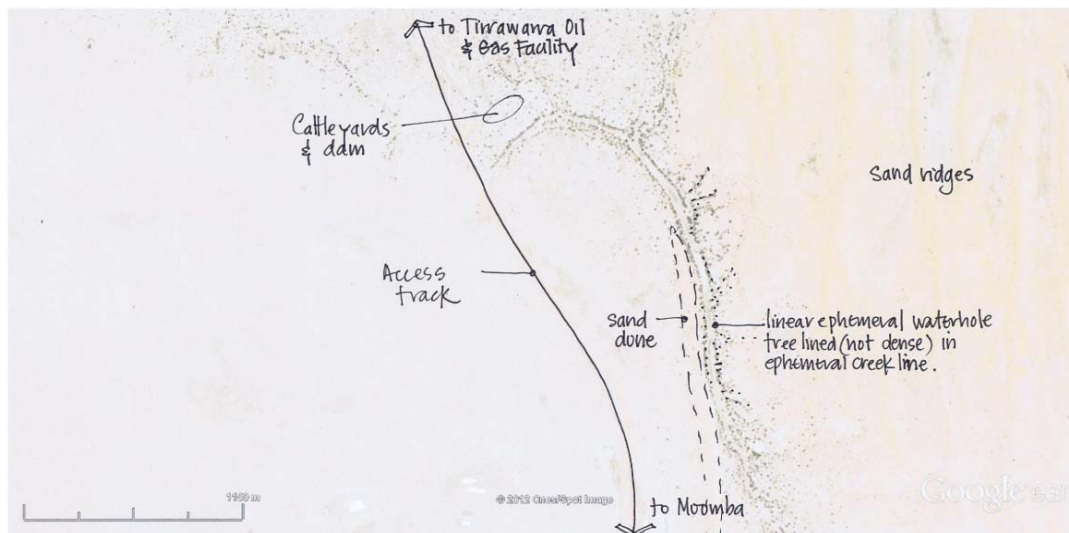


Figure 6.9.2 Gidgealpa Waterhole form and general landscape characteristics. Image: February 2007. Source [www.earthgoogle.com](http://www.earthgoogle.com) retrieved 19/7/2012.

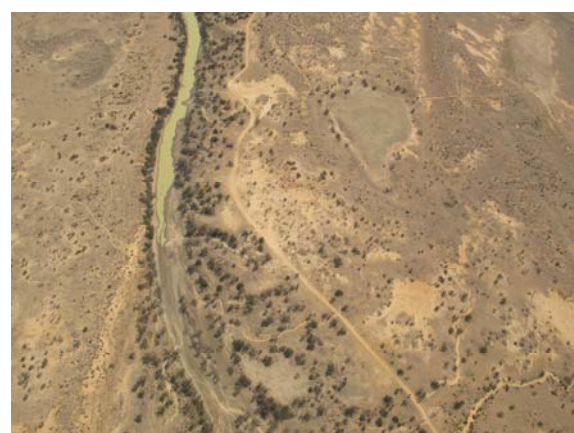
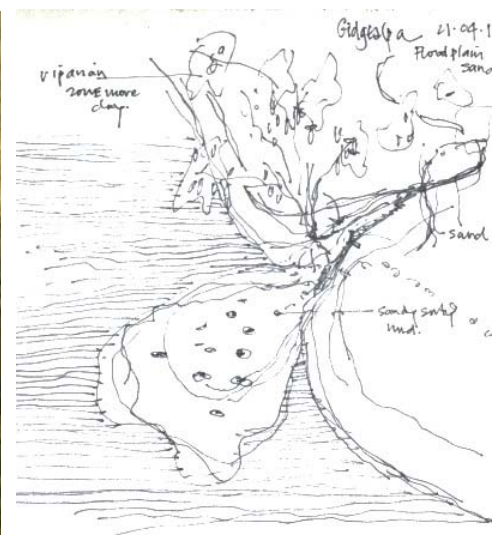


Figure 6.9.3 Landscape character of Gidgealpa Waterhole environs and schematic of the erosion silty fan as the waterhole bank. Images: April 2011 in flood, September 2012 in recovery showing the drying regime





Figure 6.9.4 Landscape form of Gidgealpa Waterhole at the base of dune to the right and floodplain to the left (upper image) and from the top of the western dune looking upstream and downstream. Images: April 2012

### Riparian zone

The distinctive riparian zone character types at Gidgealpa include the Coolibah woodland on the bank margins, confined by the high western dune and spreading into the eastern sand and clay floodplain. The dune slopes display typical *Acacia* species, Sandhill Canegrass, perennials and grasses. Both the dune slopes and the creek banks are prone to erosion and gullyng caused by stock accessing the waterways and crossing the channel to travel across grazing country. During the April 2012 visit, the riparian zone was in recovery phase from the 2010-2011 flooding displaying relatively lush and diverse vegetation and ground cover atypical of the predominantly drier conditions of the area.

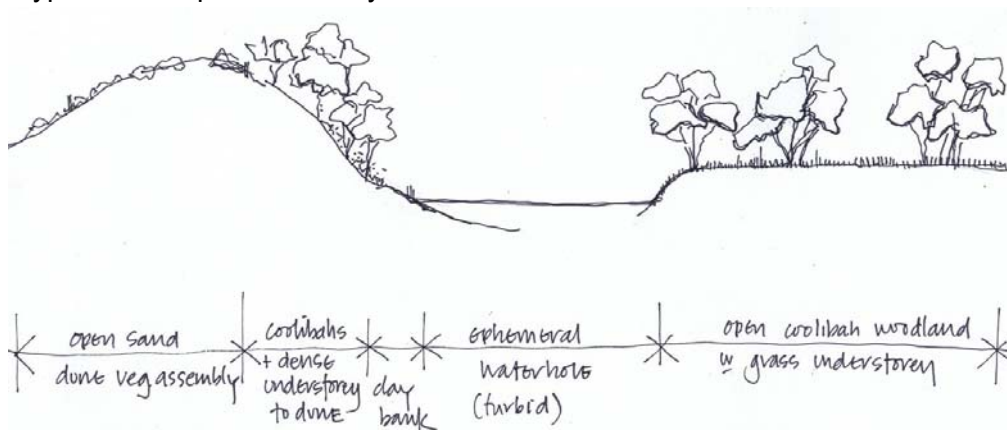




Figure 6.9.5 Western bank riparian conditions and sandy/silty fan at a small erosion gully, with aged Coolibah and exposed root systems. Image: April 2012

### Views

Extensive views across and along Gidgealpa Waterhole are facilitated by the high sand dune to the west. From the top of the western dune very panoramic views towards the east open up to the floodplains and low dune scapes beyond. Views along the waterhole to the north indicate a long and visually enclosed channel lined with mature Coolibah.



Figure 6.9.6 Gidgealpa Waterhole views along the channel from bankside and over the eastern floodplain to the east. Images: April 2012

### Water feature

This ephemeral creek and waterhole is a dryland feature in otherwise waterless sand dune and claypan areas west of the Main Cooper Creek channel. Its very distinctive form defined by the large dune to the west and the expansive eastern floodplain provides a scenic interlude with views over the turbid tree-lined waterhole, populated with flocks of Corella at the time of visiting. In-channel sand bars provide for semi-submerged trees and diversity of features along the single channel, where, over time its slow moving water which turns from brown to greenish brown as the waterhole dries.



Figure 6.9.7 Inland ephemeral water feature with expansive views over the floodplain enabled by the high western dune. Images: April 2012



## Vegetation

The absence of River Red Gums (*Eucalyptus camaldulensis*) indicates saline and arid conditions in this Coolibah (*Eucalyptus coolabah*) woodland, with the occasional Queensland Bean Tree (*Bauhinia gilva*), Lignum (*Muehlenbeckia florulenta*) and a grassy and perennial understorey. Typical Sandhill Cane-grass (*Zygochlea paradoxa*) dune vegetation with ephemeral grasses and perennial flower plants occur on the dune ridge in association with Marpoo (*Acacia ligulata*), Nitre Bush (*Chenopodium nitriaceum*) and various Atriplex, Chenopodia and saltbush species.



Figure 6.9.8 Dune vegetation and creek bank and floodplain vegetation at Gidgealpa Waterhole

## Occupation

The private Gidgealpa Waterhole is located in an evolved landscape with predominantly production and industrial cultural themes evident with some evidence of conservation landscape interests present. Gidgealpa Station is a commercially operated pastoral lease and the location of extensive oil and gas exploration and extraction in the swampy land to the west of the Cooper Creek main channel. The Moomba facility is located to the south and its lights can be seen at night from the dune that borders the waterhole. Numerous borrow pits line the adjacent road yet the waterhole is not central to any mining operations. The waterhole is used primarily for cattle watering as it is an unreliable water source, not even noted on the pastoral map. Extensive cattle tracking along the riparian banks and numerous tracks down the dunes and across the floodplains are resulting in erosion gullies on both the dune and channel. A sediment fan at the end of an erosion gully on the southwestern side has resulted in a silty stock pad flowing into the waterhole.

Further north from the deepest water adjacent where the channel crosses the road a pastoral dam, cattle yards attest to the mustering of cattle and water storage in dry times. The original Gidgealpa homestead slab hut is in the vicinity, south of the old cattle yards (Jason Barnes pers comm. April 2012). The relatively new campsite has been established as a result of research activity in relation to bird studies, marked by a visible toilet pit and use of the temporary camping area on the dune ridge. This campsite is both protected and affording fine views over the area and could encourage tourist use if the track and site are not managed for only private use.





Figure 6.9.9 Gidgealpa Waterhole cattle watering along the riparian edge and floodplain, dune fauna tracking, temporary camp occupation and dune erosion Images: April 2012

### **Access**

The Waterhole campsite is accessed via the Gidgealpa Homestead Road via an unmarked track leading to the high western dune, however it is not open to the public. Foot access to the waterhole, which is obscured from the road, is via unmade pathways down the steep western dune.



Figure 6.9.10 Access track to the waterhole from the Gidgealpa homestead road, dune access along erosion gully Images: April 2012

### Interpretation

No interpretive material is at this site.

### Issues requiring Management Approaches

- The combination of wind and pastoral use is resulting in both dune and riparian edge erosion and silting of the waterhole. Consider cattle management regimes during recovery events where Gidgealpa Waterhole is an important water source to manage erosion.
- The necessity to keep the waterhole a private camping zone will assist protecting the dune ecology and stability.

## 6.10 Embarka Waterhole at Gidgealpa Homestead

**Location:** 140°11' E 27°40' S

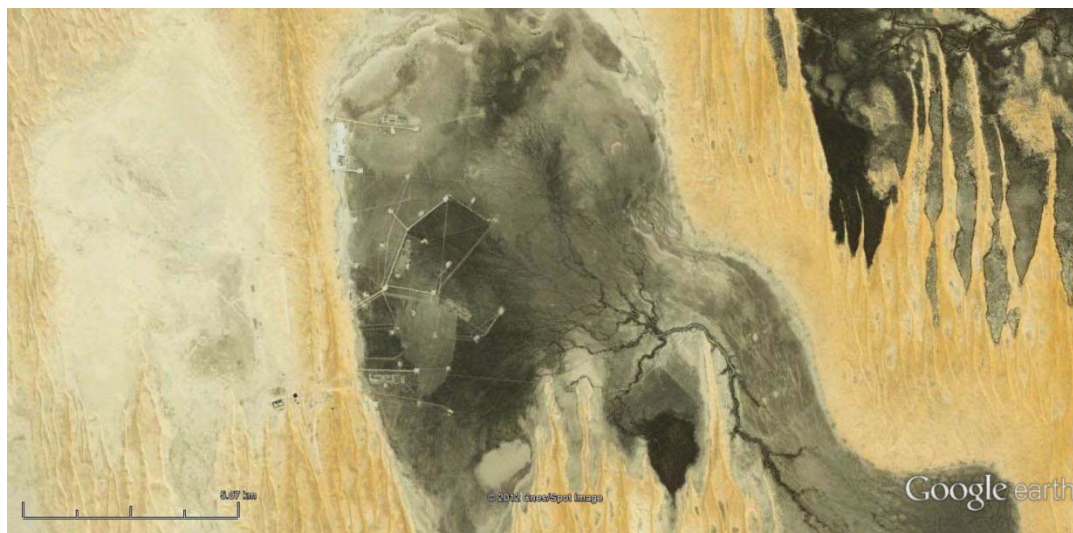






Figure 6.10.1 Embarka Waterhole general landscape overview and location. Image: February 2007. Source [www.earthgoogle.com](http://www.earthgoogle.com) retrieved 19/7/2012.

### Form

Embarka Waterhole is a large permanent waterhole located in the larger flood/swamp plain of the Cooper Creek. Approximately 2.5 kilometres long by 50 metres wide it arcs north to west forming a distinctive landscape element in the dune corridors and the Tirrawarra lakes and swamps at the far perimeter of the Innamincka Fan. It is further delineated by its narrow tree-lined margins and a number of offtake channels. A high, flattened north south dune benches above the surrounding floodplain and swampland and terminates from the south at Embarka Waterhole. To the west the waterhole diverges into numerous channels while to the south east the single channel retains its form until dispersing into the expansive floodplain some 5 or so kilometres upstream





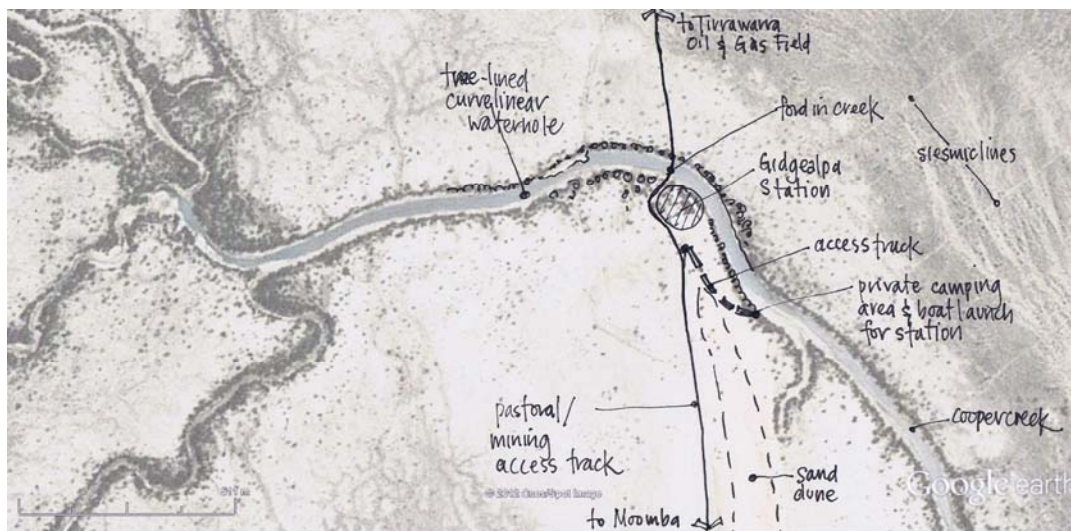


Figure 6.10.2 Embarka Waterhole form and general landscape characteristics. Image: February 2007. Source [www.earthgoogle.com](http://www.earthgoogle.com) retrieved 19/7/2012.



Figure 6.10.3 Embarka Waterhole form in recovery (above) and flood (below) Images: September 2012, April 2011

### Riparian Zone

The riparian zone at Embarka Waterhole is indicative of the changing nature of the Cooper Creek main branch as it flows westwards into dryer areas, however proximity to the swampy

and low gradient Tirrawarra area provides for a fertile if relatively narrow riparian edge prior to merging into the expansive floodplains. The large sand dune to the west confines floodwater into the silty/clay relatively shallow bank zone that slope gently into the waterhole during high water events. During the 2010/2011 floods water lapped the homestead garden and the private campsite area, inundating the riparian vegetation and reducing access to the waterhole (Jason Barnes, pers comm., 2012). By the 2012 field trip the water level was still high however this was due to local rainfall runoff and water flowing from the Tirrawarra swamp rather than recent overland flood pulses.

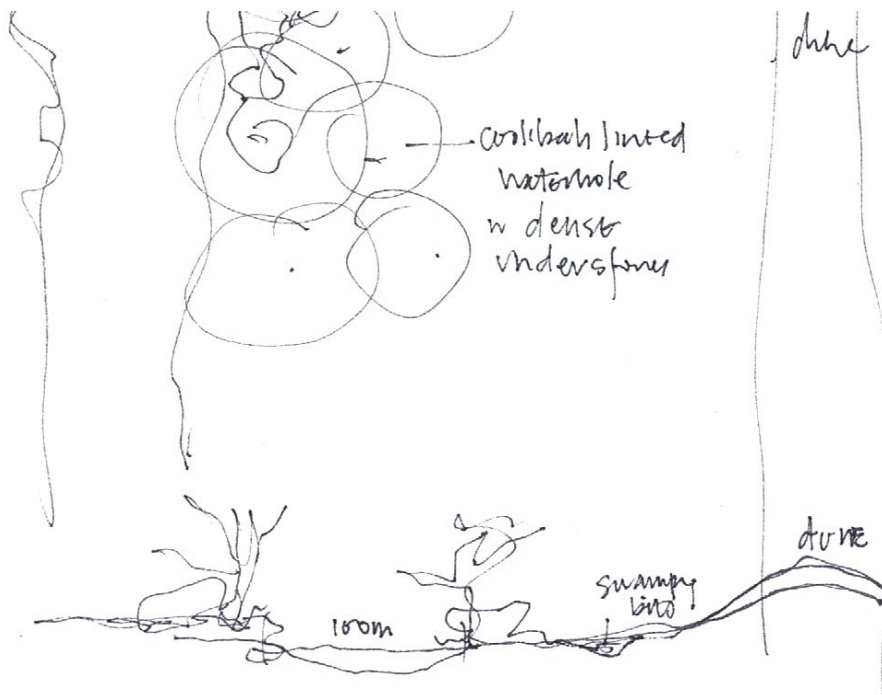


Figure 6.10.4 Embarka Waterhole riparian plan, section and edge vegetation at the campsite Images: April 2012

### Views

During the field trip, the water level and the dense riparian vegetation prevented clear views along the waterhole, however at the station campsite approximately 500m to the south of the homestead cross views are possible through the cleared undergrowth. The sheltered and framed views of the water from the western banks provide an intimate, shady refugial landscape character over the slow moving water.





Figure 6.10.5 Embarka Waterhole western bank views framed by riparian vegetation Images: April 2012

### Water feature

As the last permanent waterhole on the southwest branch of the Cooper Creek, Embarka Waterhole's unique form is an obvious marker of the Gidgealpa Homestead high plain, in flood or in recovery, as evident in Figure 6.10.3. Its distinctive single channel and wide curve makes it an important feature synonymous with the provision of water as a magnet for settlement in dry country. The contrast between the channel and its extensive floodplains and surrounding swamps make this a highly picturesque landscape feature from above.



Figure 6.10.6 Embarka Waterhole overview in flood looking east and in recovery looking west Images: April 2011, September 2012

### Vegetation

This predominantly Coolibah (*Eucalyptus coolabah*) woodland exhibits the occasional Queensland Bean Tree (*Bauhinia gilva*), but is characterised by dense Lignum (*Muehlenbeckia florulenta*) with Broughton Willow (*Acacia salicina*) and River Cooba (*Acacia stenophylla*) on the riparian banks. The interdunal corridor vegetation is sparser with *Chenopodium* species and dotted Coolibah predominating before the typical dune grasses and forbs take over on the dune margins.





Figure 6.10.7 Embarka Waterhole riparian and floodplain/dune vegetation Images: April 2012

### Occupation

Embarka Waterhole and the surrounding area is a designed and evolved landscape with production, industrial and storied cultural themes evident. The occupation of this permanent waterhole on Gidgealpa Station is typical of the early settlement location of homesteads on high ground near reliable water. Due to intensive mining and pastoral activities public access is not encouraged and tourism visitation is low, particularly as the Walkers Crossing PAR has been closed for a number of years. Embarka is noted on the pastoral map as a substantial waterhole and is used for watering cattle and private activities such as water skiing and tubing. 500 metres to the south of the homestead a private and long-used camping site has been developed with a very domestic and enclosed character, including bush fire places, sleeping spaces and memorial plaques. The evidence of Aboriginal occupation has not been recorded for this site in the context of this report.

The watering activities of cattle and their access to waterholes has changed markedly since the developments of roadside borrow pits and dams for mining (and some recreational) activities. The increasing number of permanent and ephemeral waterpoints results in greater dispersal of stock over wider areas as they follow the water. During 2012 no cattle were watered at Embarka due to substantial water lying in mining infrastructure ponds (Jason Barnes, pers comm.). Another critical issue for the broader area is the management of large mining and other seismic exploration programs to ensure the Lignum swamps have minimal environmental disturbance. A range of vegetation avoidance and sensitive clearance methods are under development by the big companies such as Santos and Beach Energy.





Figure 6.10.8 Embarka Waterhole occupation sites including mining extraction, pastoral station site and infrastructure, private camping site and temporary camping facilities Images: April 2012

### Access

Access to Gidgealpa Homestead and Embarka Waterhole is via the well-maintained pastoral/mining roads through the dune plains from Moomba or via the Walkers Crossing PAR, which is in poor condition. It can be accessed from the north by a road through the swamp and in wet times the 'flood track' comes through the dunes to the south. Public access is not encouraged at the waterhole or the surrounding pastoral landscape. The closure of the PAR has reduced the amount of through traffic heading towards the Birdsville Track or down south. Intensive mining traffic and heavy vehicle access has resulted in major road building and maintenance regimes and associated water infrastructure. There is ongoing need for water to maintain these roads to high quality.



Figure 6.10.9 Pastoral/mining road and farm track to the waterhole camp zone, public directional signage, both official and non-official in times of flood Images: April 2012



### Interpretation

No interpretation beyond mining warning messages and Station temporary signs.

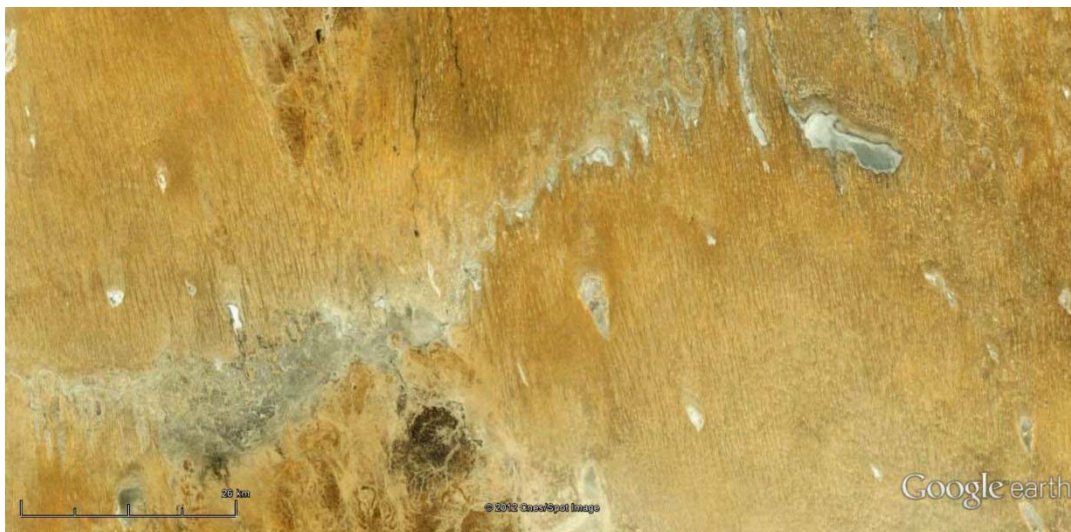
### Issues requiring management approaches

- Water management regimes and water extraction and management for mining activities to be reviewed in relation to water extraction from both surface and ground water resources.
- If increased tourism seeks access and 'free' camping outside of the Innamincka Regional Reserve, then a tourism management plan in relation to pastoral, mining and conservation activities is recommended.
- Aboriginal knowledge of the water hole and its dynamics over time is possible to record within the cultural clearance requirements for new mining sites and exploration.

## 6.11 Lake Hope (Pando Penunie), Lake Walpayapeninna (Red Lake)

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**Location:** 139°17' E 28°23' S





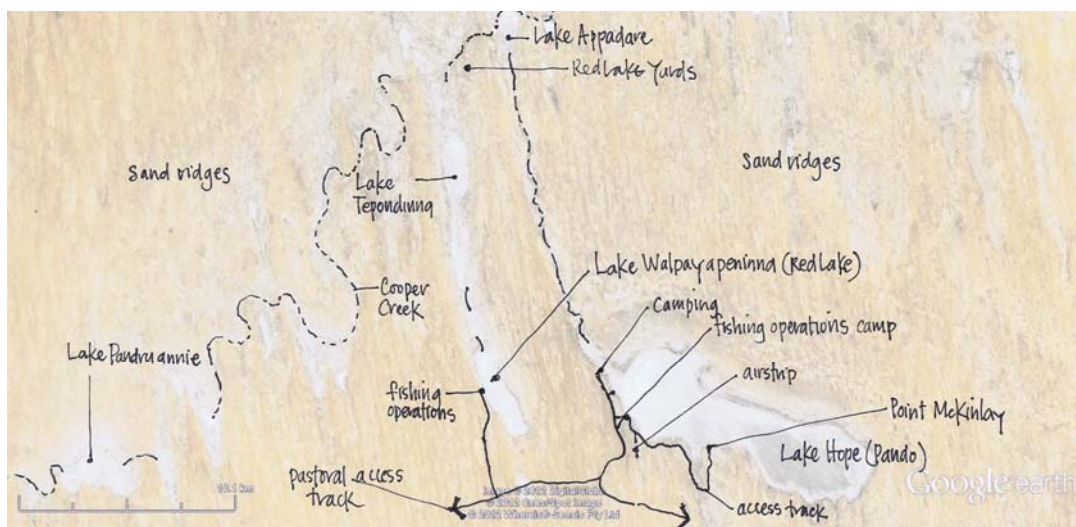
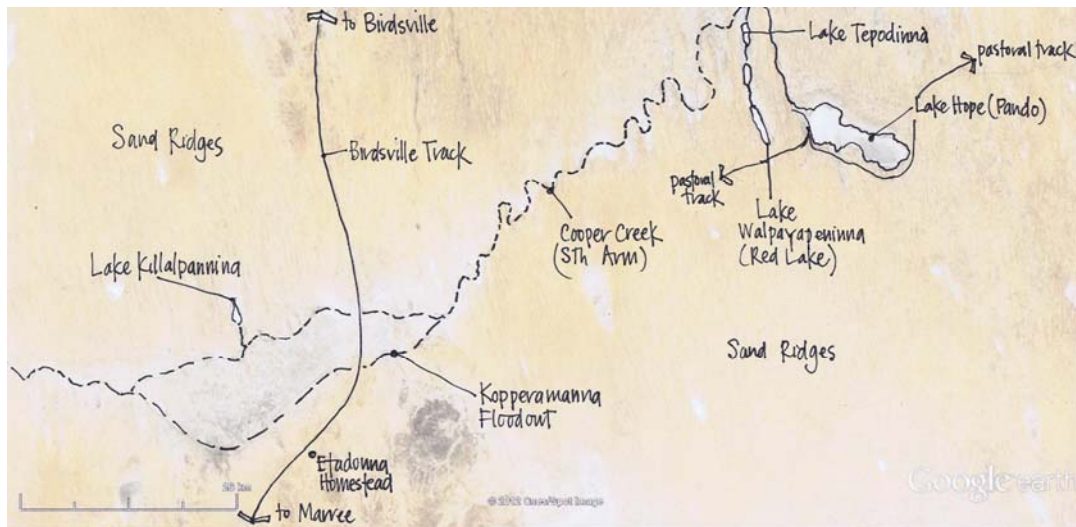


Figure 6.11.1 Lake Hope (Pando Penuni) & Lake Walpayapeninna (Red Lake) general landscape overview and location. Image: February 2007. Source [www.earthgoogle.com](http://www.earthgoogle.com) retrieved 19/7/2012.

### Form

Lake Hope (Pando Penuni) is a broad and relatively shallow terminal freshwater lake (Reid, 2012) fed via a single channel during large scale flooding of the main branch of the Cooper Creek, although these Lakes lie outside the Cooper Creek floodplain system. The smaller Lake Walpayapeninna (Red Lake) is formed and fed through a similar system and is not connected hydrologically to Lake Hope. Lake Hope is located in the expansive plains of the Strzelecki Dunefields and is approximately 12 kilometres long and 5 kilometres wide. Its distinctive form resembles a figure of eight due to the southern and northern expanses separated by encroaching dunes that narrow the Lake at its centre to just a kilometre or two. During flood both lakes expand to enable large quantities of water to flow southwards, followed by the reduction of water flowing from the channels to nothing during the dry. These lakes are then disconnected from the main Cooper Channel and it is this sequence of systems, which allow the lake to fill, trap fish and provide a rich environment for birds and fishers alike. The surrounding north south dunefield accentuate the riparian margins and the characteristic colours of red to ochre sand and blue-green water fading to white salt pans that develop during drought.

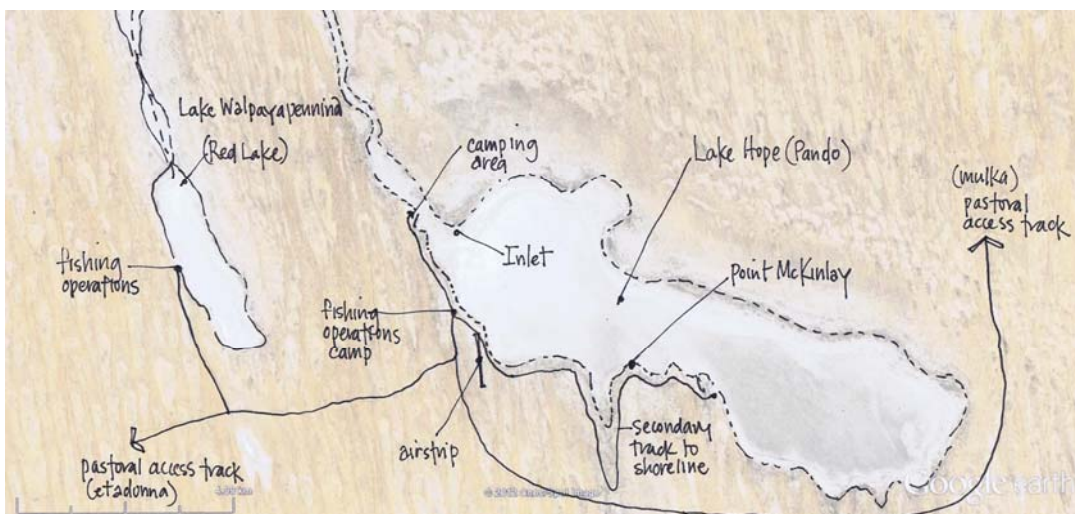
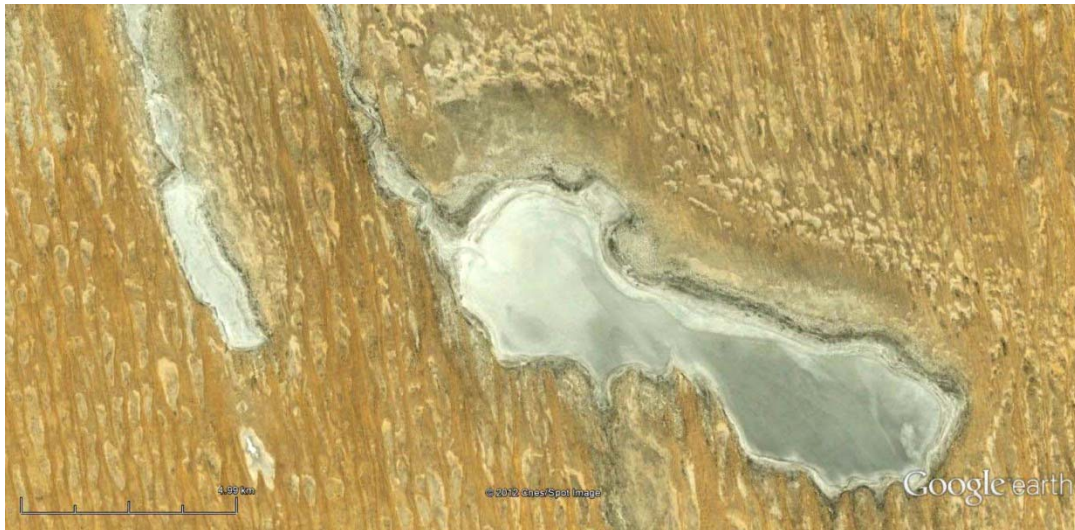


Figure 6.11.2 Lake Hope (Pando Penuni) & Lake Walpayapenninna (Red Lake) form and general landscape characteristics. Image: February 2007. Source [www.earthgoogle.com](http://www.earthgoogle.com) retrieved 19/7/2012.



Figure 6.11.3 Lake Hope (Pando Penuni) in flood (top Left) and in recovery Images: April 2011, September 2012

### Riparian zone

The gently sloping sandy margins of Lake Hope are interspersed with low encroaching dunes with associated lake edge vegetative assemblies. The expansive perimeter beach zone indicates periods of both wet and dry evidenced by the dried skeletons of shoreline plants. Further into the dune country, typical dune vegetation and interdune grasslands and small trees are observed. Only Coolibah and few other trees, due to local environmental



salinity, alkalinity and seasonal water, sparsely populate Lake Hope's riparian zone. It was noted during fieldwork that water levels at Lake Hope were higher in September 2012 than compared to April 2012 due to low gradients and slow drainage over the floodplain.



Figure 6.11.4 Lake Hope (Pando Penuni) western riparian beach zone sectional perspective and vegetation assemblies at fishing camp site Images: April 2012

### Views

Lake Hope is situated in a bowl framed by surrounding sand dunes from which it is possible to view over the expanse of water. However the best overviews can be experienced from the air, where the huge scale of the waterbody and its connectivity into the Cooper Creek channels can be traced. In the final approach to the Lake the view is obscured by large sand dunes until the immediate view opens up close to the water's edge as one emerges from the dunes. Lake Hope exhibits high landscape quality characteristics from the shoreline, particularly at sunset and sunrise. There are clear views across and around the water feature which can be easily traversed on foot if not by vehicle.







Figure 6.11.5 Lake Hope (Pando Penuni) above and Lake Walpayapeninna (Red Lake) below views at sunset and early morning from the northern campsite; from the air indicating dune movement in relation to the lake edge, and view from the road over Lake Hope Images: September 2012

### Water feature

During flood and recovery times until this ephemeral system dries to form a salt pan, Lake Hope's extensive bowl is not only a large water feature within the dry landscape but is also home to countless migrating and local birds. It is nominated as one of the Important Bird Areas (IBA) of the Strzelecki Desert Lakes complex and one of the largest freshwater lakes on the southwest branch of the Cooper. Where dunes are directly adjacent the lake, banks are more defined and show erosion of margins, with undulating dune and claypan systems alternatively reaching the lake margins along its north and south boundaries. Red Lake is a much smaller freshwater lake west of Lake Hope and is shallower and therefore dries more quickly.



Figure 6.11.6 Lake Hope (Pando Penuni) above and Lake Walpayapeninna (Red Lake) below dry landscape water feature within sand dunes, and an attractor for birds Images: September 2012



## Vegetation

Although structurally very sparse with only a single dominant tree species Coolibah, (*Eucalyptus coolabah*) and a complete absence of the upstream Cooper Creek vegetation, nonetheless at the time of visitation in April and September 2012, the dunes and surrounding riparian lake edges were floristically very rich. A number of Bluebush and other species were interspersed with herbs such as Red Spinach (*Trianthema triquetra*), Sida species, rushes and grasses



Figure 6.11.7 Lake Hope (Pando Penuni) top left and Lake Walpayapeninna (Red Lake) top right lake margins indicating the ephemeral nature of the lake waters and the effect on vegetation; dune vegetation progressively moving away from the lake and up into the dunes below 4 images. Images: September 2012

## Occupation

This is an associative landscape with production, conservation and storied cultural themes evident particularly in relation to Aboriginal occupation and historic missionary and pastoral

settlement. Stories of the significant Dieri sites spread around the lake and across the surrounding landscape including accounts of continuous use for thousands of years in relation to national and local Aboriginal trade routes and creation stories. Pando Penunie means great lake in Dieri language but the Stuckeys who 'discovered' the lake in 1859 named it according to the hope for their fortunes to improve in the future. In recent European history it was a police outpost in 1865, and ruins are marked on local maps near the western channel inlet although many who have tried to locate them have failed. In 1867 the Moravian church considered establishing a mission at Lake Hope on the then Lake Hope Station pastoral lease, but were persuaded to move to Lake Kopperamanna relatively near to the Lutheran missionaries who had already established a mission at Lake Killalpaninna. The detailed historical accounts of the development of this area document the clear links between the pastoral concerns at Lake Hope, the missionaries at Lakes Killalpaninna and Kopperamanna and the ongoing need for the Dieri and others to maintain their presence and access to their traditional lands.

Today it is located on Mulka Station some 30 or so kilometres across the sand dunes from Etadunna Station on the Birdsville Track. The area is broadly used for pastoral activities and there is evidence of water infrastructure in the dune plains along the track. Aquatic ecology research is carried out in relation to the commercial fishery that operates when seasonal flooding followed by channel disconnection provides sufficient fish stocks for permission by the South Australian Government to be given for commercial fishing. Lake Eyre Basin Golden Perch or Callop is fished, transported by road and sold in Adelaide for the domestic market. The abundance of fish after flood brings noted variety of birds to this secluded and peaceful lake, but it remains logistically difficult for tourists to access these sites. The Lake Eyre Basin Yacht Club has used the Lake for sailing including an alternative camping area south of the fishing camp (pers comm. Bob Backway, 2013).

Two discrete camping areas are located on the western margins of the Lake; the commercial fishery temporary camp, which pastoral uses are now revealed in the remnant fencing, and the caravans, tents and infrastructure to support the self-sufficient fishery. All equipment has been brought in as a mobile camp and dispersed along the top of the primary dune and in association with a rare copse of Coolibah in this dry and saline environment. Further north a bush camping spot adjacent the inlet allows for lakeside camping protected by low dunes under the shade of sparse old Coolibah. This private campsite makes use of a naturally cleared and flat area for small groups and individuals and affords good views over the mouth and up and down the extent of the lake. There are no facilities here. Lake Hope is extremely remote from major tracks and roads and is on private pastoral lease. Due to its remoteness and the ongoing commercial nature of the fishery, it is not regarded as a site for tourist visitation, beyond air sightseeing.



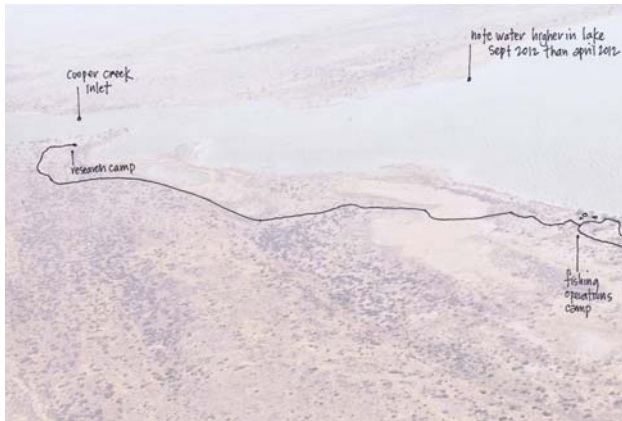


Figure 6.11.8 Lake Hope (Pando Penuni) overview of the fishery camp on the western margins of Lake Hope, overview of the bush camp and the spatial arrangements of the camp living and processing area Image: April 2012



### Access

Lake Hope and Red Lake can be accessed via stony and sand dune infested station tracks from Etadunna Station to the west and or the rarely used Mungerannie, Mulka and the Innamincka Regional Reserve track across the mining landscape to the east. Neither permits public access without prior arrangement due to the remote nature of the place, the difficulty with orientation and access due to there being no signs along the route and the possibility to take a variety of tracks. Track traffic is intensified when the fishery is operating and the single dune roads become quite difficult to access. The road passes through a variety of arid landscapes from gibber plains and mesas to sand dune and clay pans and it is necessary to be able to drive all these road conditions. Lake Hope is approximately 2 hours drive from the homestead, and there is no service for breakdowns.



Figure 6.11.9 Access road typology from the gibber plains adjacent Etadunna (above), major dunes, lake side road and pastoral dam in interdune plain Image: April 2012

### Interpretation

There is no interpretation at this site, although there are a number of web published reports on Lake Hope and its commercial fishery and history.

**Issues requiring management approaches**

- Operational requirements for the fishery and access roads including clear management guidelines to support ecological resilience to be resolved and open to public comment.
- Aboriginal and non-Aboriginal histories and stories make this an important storied landscape, which would benefit from sustained research and development of web-based information around the ecology and culture of this unique environment.



## 6.12 Lake Killalpaninna and Mission

**Location:** 138°33' E, 28°35' S

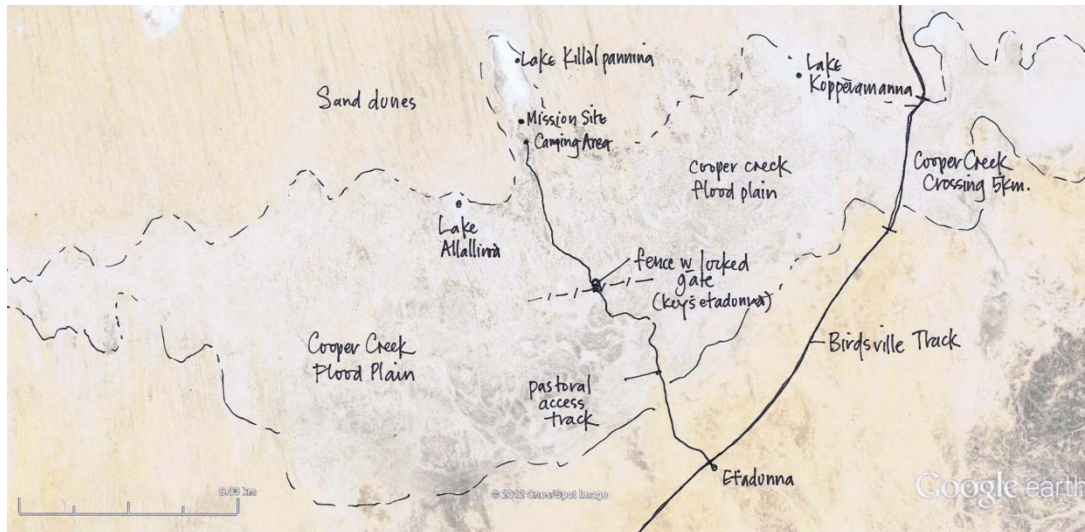


Figure 6.12.1 Lake Allallinna in foreground and Lake Killalpaninna in the distance general landscape overview and location. Image: February 2007. Source [www.earthgoogle.com](http://www.earthgoogle.com) retrieved 19/7/2012. Aerial image: September 2012

### Form

Lake Killalpaninna is a medium sized terminal lake feeding off the southern reaches of the Cooper Creek main channel and downstream of the much larger Lake Killamperpunna. This southeasterly section of the Cooper disperses into the expansive floodplains west of the Birdsville Track. Interestingly, the locals regard this lake as part of a sequence of three terminal lakes located in the Kopperamanna Floodout - including Lake Kopperamanna to its east and Lake Allallinna to the southwest - due to their interconnectivity in terms of relative drying times after flood. Lake Killalpaninna comprises a channelled section to the south opening into a long and relatively narrow expanded channel framed by long and wide north

south dunes and interdune plains, until it opens out after 1.5 kilometres to a wide and shallower bowl formation stretching some 3 kilometres to the north. A dune spit pushes northwards into the lake forming a wide flat and raised area, which provide the necessary height for surveillance and separation from floodwaters for the location for the Mission settlement. The narrow western channel is around 200 metres across with the northern lake at around 1 kilometre at its widest. The sparsely treed plains give way to relatively dense lake side vegetation becoming more open with elevation onto the dunes and further from the silty clays and sand at the lakeside.



Figure 6.12.2 Lake Killalpaninna in flood from the south and in recovery, from the north. Images: April 2011 September 2012

### Riparian zone

Lake Killalpaninna's riparian edge varies whether in association with the channel section or in proximity to the wider lake area. Coolibah is the main structural tree with an understorey of Lignum, Acacia and various grasses, reeds and chenopods. Banks generally slope gently into the lake with steeper banks on the western margins and associated with the dune spit. To the east, the interdune plain is very shallow and forms an extension to the lake in the wettest flood times. The drying and flooding regime is evident in the bank/water zone where dead shrubs line the margins between water and sandy beach.



Figure 6.12.3 Typical riparian edge at the south western channel near Dead Man's Hole and adjacent the Mission on the east side of the channel. Images: April 2012





Figure 6.12.4 Various riparian edge conditions at the south western channel beach between Dead Man's Hole and the Mission site. Changing water conditions and beach exposure during recovery, top September 2012 drying and below in April 2012

### Views

Killalpaninna is not obvious from the pastoral track that leads to the Mission site and elevated dune area. A 270-degree vista of the Lake and surrounding landscape opens up from the highest point of the dune, but the first overview is obtained at the carpark and site fence. At Dead Man's Hole, the views of the contained channel are revealed upon approach to the sandy beaches framed by vegetation. Once on the beach it is possible to walk along the beach side to view the channel and its bird and water life at close range.







Figure 6.12.5 Views from the highest house site to the south west and the north west, with good surveillance over the expanded lake and late afternoon beach views Images: September 2013

### Water feature

The story of Lake Killalpaninna as a water feature is a regional one, which involves the connection of water bodies to Aboriginal sustenance during seasonal change. The lakes, which are all located on the northern fringe of the Cooper Creek floodplain, are critical to sustaining life through their combination of deep channel and shallow lake features and their accessibility over the sand dunes. We were told that after floods the Dieri would settle first at the westerly Lake Allallinna until it dried, then moving to Killalpaninna until it too dried and then moving to Lake Kopperamanna (pers comm. September 2012). Lake Killalpaninna has the advantage of high dunes and accessible sandy banks with some tree cover for shelter, and the still waters and relatively narrow habitable channel provided rich plant and aquatic food supplies. Additionally, the Lake at later afternoon and morning provides wonderful opportunity for viewing waterbirds, reflections and inland water quality of high aesthetic value.



Figure 6.12.6 The map of the journey from lake to lake following the water during drying times, and the aesthetic quality of the late afternoon experience of Killalpaninna Images: September 2013

## Vegetation

This predominantly Coolibah (*Eucalyptus coolabah*) woodland is characterised by open grasslands over sandy and/or clay soils over the floodplains. Closer to the more permanent water sources of Lake Killalpaninna and its feeder channel from the floodplain, the vegetation becomes more dense with Broughton Willow (*Acacia salicina*) and a range of forbs and grasses on the dunes, interdune plains and on the riparian banks with *Chenopodium* species such as Ruby Saltbush (*Enchylaena tomentosa*), perennial herbs such as Bluerod (*Stemodia florulenta*) predominant. Curiously for a place where a mission settlement had been occupied for many years, there was no evidence of exotic food or decorative plantings still extant.



Figure 6.12.7 Collected species from the April 2012 field trip and typical vegetation assemblies in the floodplain and high dunes surrounding the mission site Images: April 2013



## Occupation

This is an associative and designed landscape with production, conservation and storied cultural themes evident particularly in relation to Dieri Aboriginal occupation and historic missionary settlement. It is located within the Etadunna Pastoral lease approximately 20 kilometres northwest of the Etadunna Homestead to the west of the Birdsville Track which is some 130 kilometres north of Maree just south of the Cooper Creek crossing. Etadunna derives from Dieri Aboriginal language 'Ethaduna' – 'turn back'.

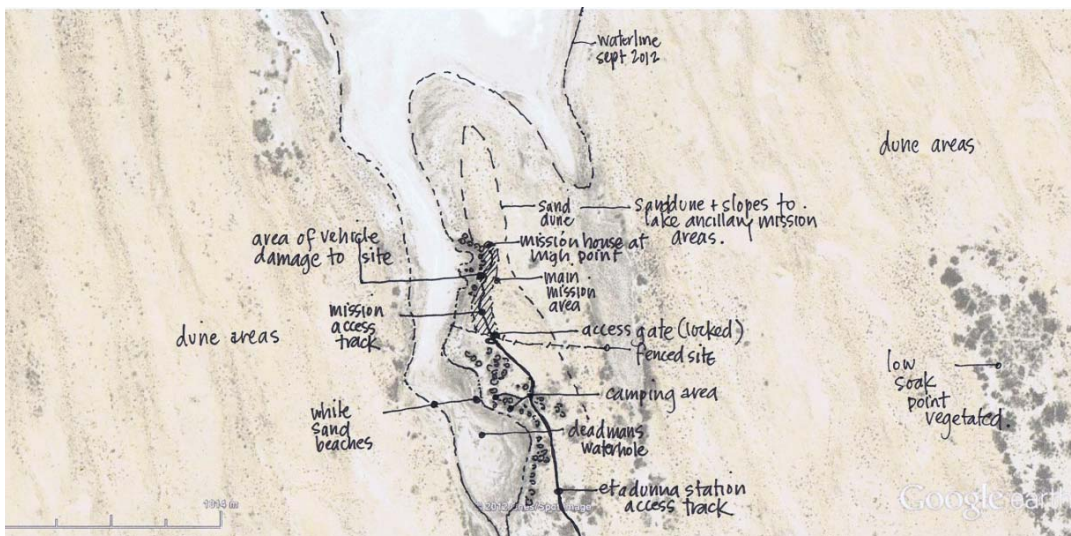


Figure 6.12.8 Lake Killalpaninna general site overview and location of ruins and Dead Man's Hole. Image: February 2007. Source [www.earthgoogle.com](http://www.earthgoogle.com) retrieved 19/7/2012.

Lake Killalpaninna is the site of the significant Bethesda Mission site established in 1867 by the Lutheran missionaries Gossling, Homann, Jacob and Vogelsang due to its safety from Aboriginal attack and the initial support of the local Dieri. By the mid 1880's the sandhills of the dune spit were home to twenty-one buildings including Church and school and dormitories. Mission outstations were also established at Kopperamanna and Etadunna. The work of the missionaries Carl Strehlow and J.C. Reuter were instrumental in recording Aboriginal place names and local languages, including the translation of the Old and New Testament into Dieri language. Mission history records tales of development and abandonment due to local politics, drought and sickness of its leaders until its final closure in



1915. The place is significant for Dieri people as many of their forbears were brought to the mission, were born, lived, educated and died at the Mission which was also an important place of respite and support during drought. Additionally, there is evidence of ancient occupation of the shoreline with the presence of fossilised material in the sand adjacent Dead Man's Hole.

Today Killalpaninna is used for pastoral, intermittent water sports and sailing, Dieri cultural and tourism activities. The Mission ruins consist of a large fenced off area from the Lake to the west, to the eastern and northern perimeters of the original settlement, and its surrounding grounds. The ruins are now confined to remnant footings and some building footprints of the Reuther House and the Church, the Lutheran and Aboriginal cemeteries, an old timber buggy house structure and the detritus of rusted metal and ceramic chips that tell of the patterns of occupation. Day visitors to the site must park outside the fence in an open unstructured carpark area and gain permission to access the site. Camping is permitted at the nearby Dead Man's Hole about 2 kilometres south of the Mission site on the eastern side of the inlet channel. The extreme fragility of the ruins remains and the importance of the wider landscape - including the interdune corridor to the east as a place where Dieri camped outside the confines of the mission – make the continuing management of the Killalpaninna Mission an important project for protection of both the natural ecology and the cultural fragments of past co-existence.

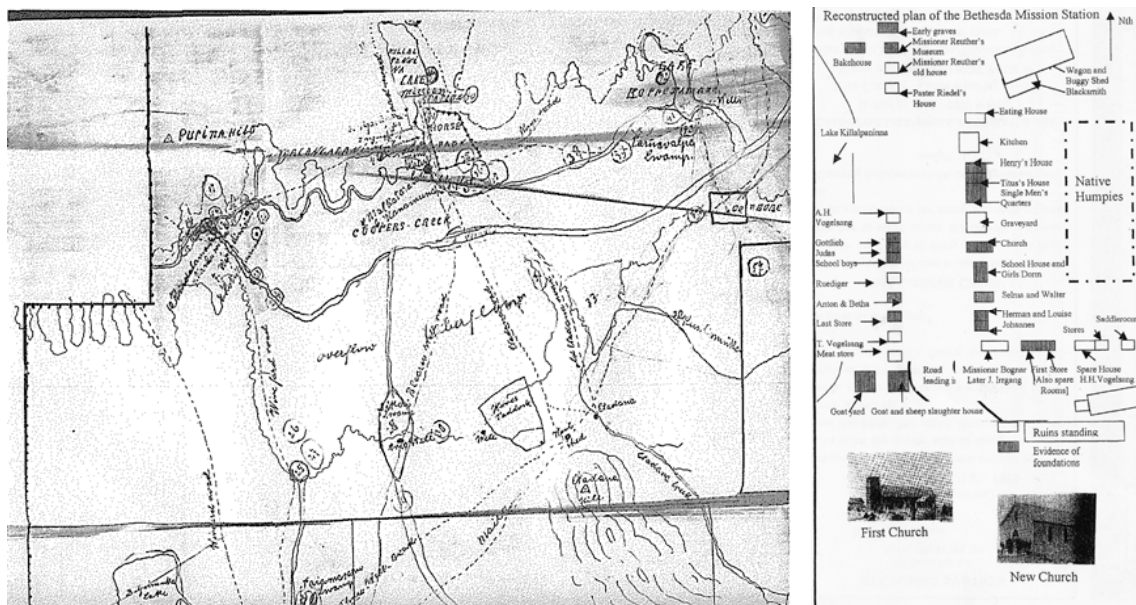


Figure 6.12.9 Gason's map of the Killalpaninna 'mission block', c. 1870 (Jones, p 191) and the 'mud map' of the original mission settlement provided by the Etadunna Station tourist guide









Figure 6.12.10 Bethesda Mission site building remnants, gravestones, rusting machinery and ruins of the buggy house and general rusted detritus and glass/ceramic shards indicating the spatial layout and living environments of the Mission's residents. Images: September 2012



Figure 6.12.11 Bethesda Mission site sandhill landscape character and relationship of the ruin site to graveyard and car parking on site including road and vehicular tracking Images: September 2012



## Access

Access to Lake Killalpaninna is directly off the western side of the Birdsville Track opposite Etadunna Station homestead. The pastoral track has a locked gate and keys may be obtained from the manager at Etadunna Station for a small fee, which includes a black and white printed brochure with a map and some basic information produced by the Station. The access track passes across dunes and floodplains, with the workings of the pastoral property in evidence through stockyards and fencing. The track terminates at the carpark and camping is permitted at Dead Man's Waterhole. The Mission ruins fence has a locked gate to prevent extensive damage caused by vehicles driving on the heritage site and fragile dune system. There is evidence of tourist tree cutting along the track for firewood.



Figure 6.12.12 Bethesda Mission site, access track and extent of fencing of the greater site Images: September 2012

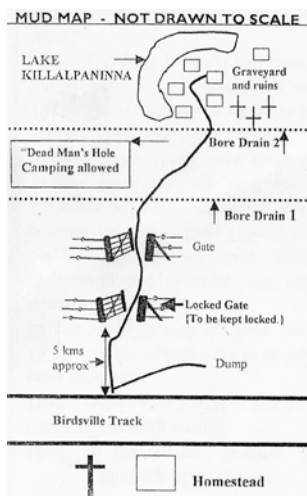


Figure 6.12.13 Access track from the Birdsville Track across the dune plains and the Cooper Creek floodplain Images: September 2012





Figure 6.12.14 Evidence of vehicular tracking across the Mission sandhills and the Lake beachfront, fencing into the Lake is necessary to prevent vehicular access into the Mission site. Images: September 2012

### Interpretation

Interpretation onsite is limited to the information brochure provided by Etadunna and a single monument and plaque erected by the Lutheran Church on September 23 1983. Historical researchers publish extensive information on the history of the site and the Lutheran Church both in books and journals and on websites such as prepared by AIATSIS and Flinders Ranges Research, as well as various tourist blogs



Figure 6.12.15 Onsite commemoration of the Bethesda Lutheran Mission Images: September 2012

### Issues requiring management approaches

- Ongoing management, protection and interpretation of the historic site and the Dieri cultural association with the Lake and the Mission is essential from a co-

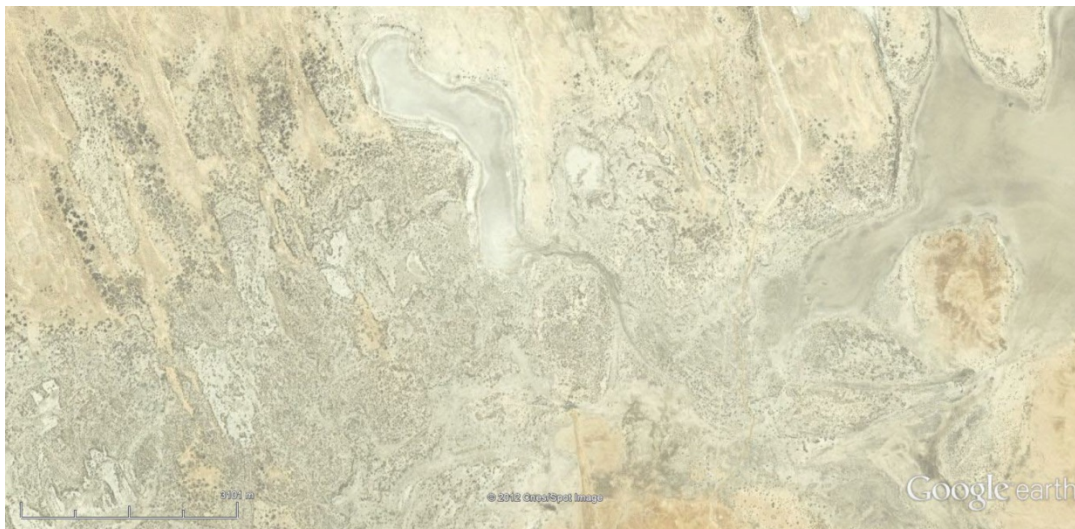
management perspective between Dieri, the Pastoral Leaseholders and the State Government

- Tourist access and management of fragile Lake Killalpaninna ecology at bush camping sites is essential including rubbish management, prevention of driving along the beach shoreline and monitoring and prevention of tree cutting for firewood along the track.
- A whole of Mission site survey and development of visitation and interpretation material for the Killalpaninna historic site and environs is recommended, including negotiation regarding fenced boundaries to include important Aboriginal cultural sites beyond the immediate confines of the Mission site.
- In co-operation with local Aboriginal knowledge, consider education programs regarding recognition and interpretation of the range of important cultural sites and their landscape appearance. Visitor and local management recognition understanding of both small and large landscape features, such as groups of rocks, will assist their protection and affirming community values of the broader areas.
- Ensure the bush camping, ecological and cultural experience is managed sensitively and designed to ensure that the unique qualities of this remote place are not overly influenced by generic design and traffic management solutions.

### 6.13 Lake Kopperamanna

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**Location:** 138°40' E, 28°34' S





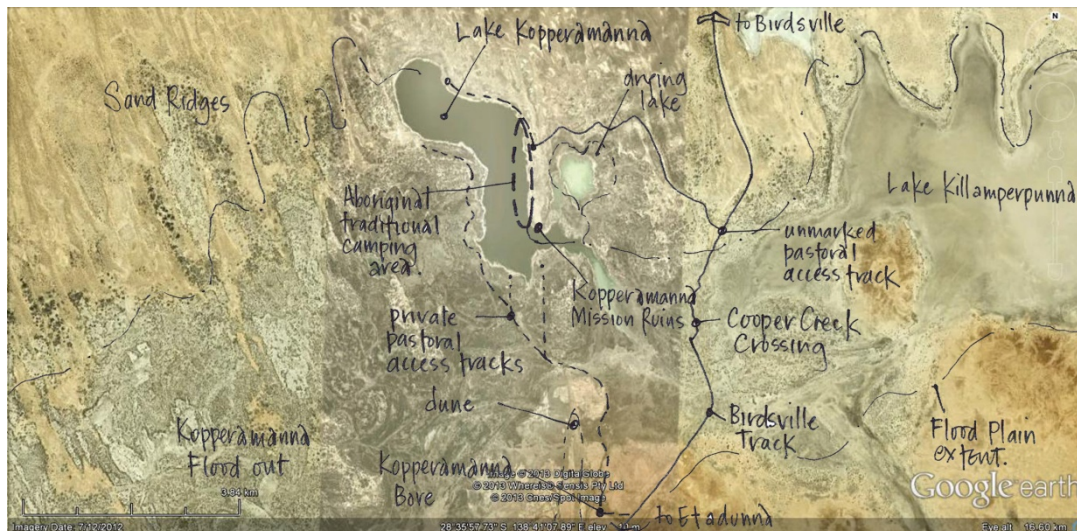


Figure 6.13.1 Lake Kopperamanna general place overview and location. Image: March 2012. Source [www.earthgoogle.com](http://www.earthgoogle.com) retrieved 19/7/2012.

### Form

Lake Kopperamanna is a medium sized terminal lake feeding off the southern reaches of the Cooper Creek main channel and downstream of the much larger Lake Killamperpunna. This southeasterly section of the Cooper disperses into the expansive floodplains west of the Birdsville Track. The locals regard this lake as part of a sequence of three terminal lakes located in the Kopperamanna Floodout - including Lakes Killalpaninna and Allallinna to the west - due to their interconnectivity in terms of relative drying times after flood. Lake Kopperamanna comprises a channelled section to the south opening into a long and irregularly shaped lake approximately 4.5 kilometres long by 800 to 1000 metres wide that widens to fill a secondary lake to the east in times of extensive flooding. The narrow channel converges at a neck to the south before dispersing into the floodplain. The sparsely treed plains give way to open lakeside vegetation on sandy dunes with few trees around the larger lake margins. The secondary lake to the east is populated by a Coolibah woodland, many of which in the lake margins have succumbed to flooding and salinity.



Figure 6.13.2 Lake Kopperamanna overview in the wet indicating the expanded lake to the east and in recovery revealing the drying eastern lake and the now visible beach Images: April 2011, September 2012





Figure 6.13.3 Lake Kopperamanna over view in times of drought and recovery. Image: February 2007, March 2012 Source [www.earthgoogle.com](http://www.earthgoogle.com) retrieved 19/7/2012.



Figure 6.13.4 Landscape change at Lake Kopperamanna, panoramic views indication water level, form and vegetation in April 2012 and 5 months later in September 2012.

### Riparian zone

Lake Kopperamanna's riparian edge is a low, wide and white sand plain populated with saline tolerant plants, with a medium height dune to the east that separates the lower lake systems. Coolibah is the main structural tree with an understorey of Acacia and various



grasses and shrubs, however this is confined to the interdune plain and the secondary lake to the east. Banks generally slope gently into the lake with a very wide and flat beach front around its entire perimeter populated by dead Acacia, reeds, chenopods and grasses. The drying and flooding regime is evident in the bank/water zone where dead shrubs line the margins between water and sandy beach. By contrast the secondary lake is based upon more clay silt and sand soils and conveys a distinctly swampy riparian condition.

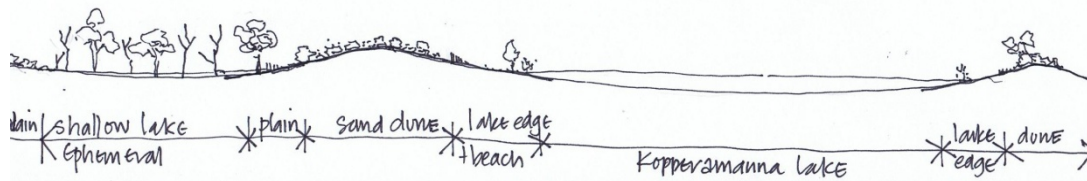


Figure 6.13.5 Section across the main lake, dune and interdune plain and the secondary eastern lake, views across the drying sandy beach and the dunescape to the east of the main lake, secondary lake swampy riparian conditions Images: April 2012

## Views

Kopperamanna lies at the end of an unmade and hard to access track. The first overview of the main lake is obtained by passing the dryer secondary lake and open woodland and crossing over a medium sized dune to reveal the expanse of lake beyond. It is truly an exciting find once the panorama is revealed. Extensive across and along views over the water and pristine sandy white beaches abound and from the beach it is possible to walk along the beach side to view the lake and its bird and water life at close range.



Figure 6.13.6 Views across the water and along the main lake, dune and interdune plain Images: April 2012

### **Water feature**

The story of Lake Kopperamanna as a water feature is a regional one, which involves the connection of water bodies to Aboriginal sustenance during seasonal change. The lakes, which are all located on the northern fringe of the Cooper Creek floodplain, are critical to sustaining life through their combination of deep channel and shallow lake features and their accessibility over the sand dunes. See section 6.12 Lake Killalpaninna Water Feature for the detail of this discussion. Lake Kopperamanna has the advantage of low, flat dunes and accessible sandy banks, and the still waters and wide beach provide rich plant and aquatic food supplies for the numerous birds that inhabit the lake to feed upon the fish in good times. This remote lake exhibits high scenic and aesthetic value of its expanse of water and the surrounding riparian zone and dunescape.





Figure 6.13.6 Featuring expansive open water emerging from a white sand dune landscape adjacent the vast lower Cooper Creek floodplain, Lake Kopperamanna also exhibits a fascinating shoreline zone, including a late season fish kill below, as the water turns saline during drying Images: April 2012, September 2012



Figure 6.13.7 The secondary drying lake to the east with a distinctly different landscape character to the main Lake Kopperamanna Images: April 2012

### Vegetation

The Coolibah (*Eucalyptus coolabah*) woodland beyond the riparian dune is characterised by open grasslands over sandy and/or clay soils over the floodplains. Closer to the water sources of Lake Kopperamanna the vegetation becomes sparser with Broughton Willow (*Acacia salicina*) and a range of forbs and grasses on the dunes, interdune plains and on the riparian banks with Chenopodium species such as Ruby Saltbush (*Enchylaena tomentosa*) and perennial herbs such as Bluerod (*Stemodia florulenta*) predominant.



Figure 6.13.8 Vegetation assemblies of the sand dunes at lake edge (left) and the woodland adjacent the secondary lake (right) Image: April 2012

### Occupation

This is an associative landscape with production, conservation and storied cultural themes evident particularly in relation to Dieri Aboriginal occupation and historic missionary settlement. It is located within the Etadunna Pastoral lease approximately 10 kilometres northwest of the Etadunna Homestead and 6 kilometres to the west of the Birdsville Track which is some 130 kilometres north of Maree, just south of the Cooper Creek crossing. Lake Kopperamanna derives from the Dieri language, Kopperamanna (properly Koppara Murra - *koppara*, "root" *murra*, "hand") (State Library of South Australia Place Names, 2013). As a great regional and national trading centre all tracks lead to and through the lake where evidence of long association is present in the shoreline dunes, including ancient fireplaces, middens and where it is possible to witness stone tools lying on the beach as waters subside.



In more recent history a small Moravian and then Lutheran Mission site was established in 1867. In 1880 100 people lived in the area of Lake Kopperamanna (Silcock 2009 paraphrasing Watson 1998). Today it is used for pastoral, research, intermittent water sports and Dieri cultural activities. The Mission ruins are located near the lake inlet on high ground with 360 degree views over the lake and surrounding country, a necessary location for surveillance and cooling breezes. Only the timber frames of small huts survive alongside the footings and cleared spaces for the various mission activities. Due to Lake Kopperamanna's continuing Aboriginal significance alongside the fragile remains of the Mission settlement this site remains in private co-management by the Dieri Aboriginal Corporation and the management of Etadunna Station.



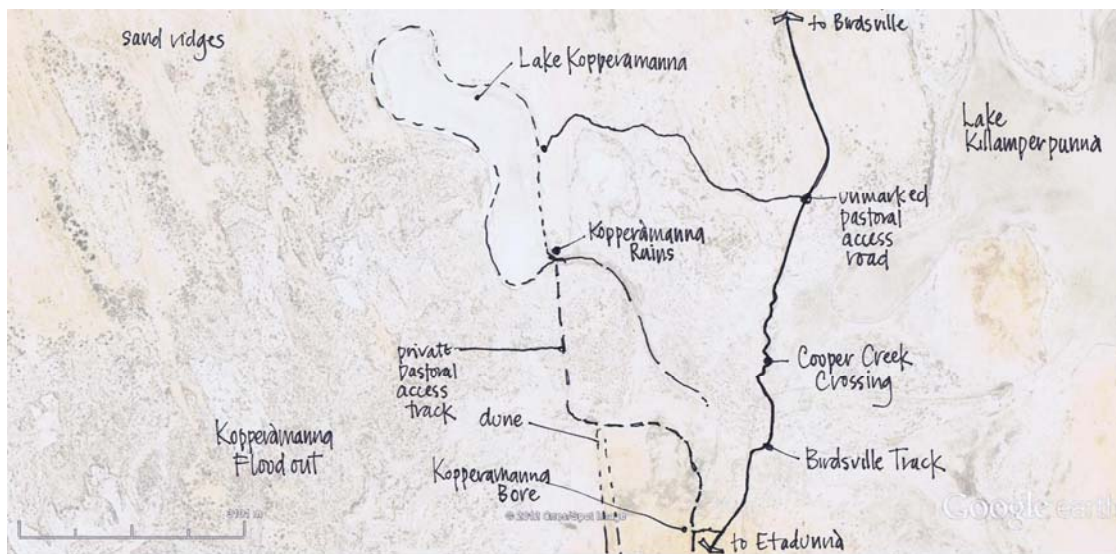
Figure 6.13.9 Ruins of the Moravian Missionary at the south eastern margins of the main lake overlooking the surrounding country, dune margins onto the sandy beach where evidence of Aboriginal occupation over time is revealed through stone tools and bone middens Images: September 2012



Figure 6.13.10 Lake ecology including abundant bird and fish life during flood and recovery Images: September 2012

### Access

Access to Lake Kopperamanna is via private pastoral access roads to Kopperamanna Bore and an unmarked track directly off the western side of the Birdsville Track where it crosses the Cooper Creek. Both tracks have fences and locked gates. These pastoral tracks become unusable after long periods of flooding and are not currently suitable for tourist visitation. Etadunna Station pastoral signs indicate that no entry is permitted without prior permission at the locked entry gates, no signage on track denotes the lake's presence; however, it is noted on topographic maps and will be visible in satellite mapping systems as a large water body.





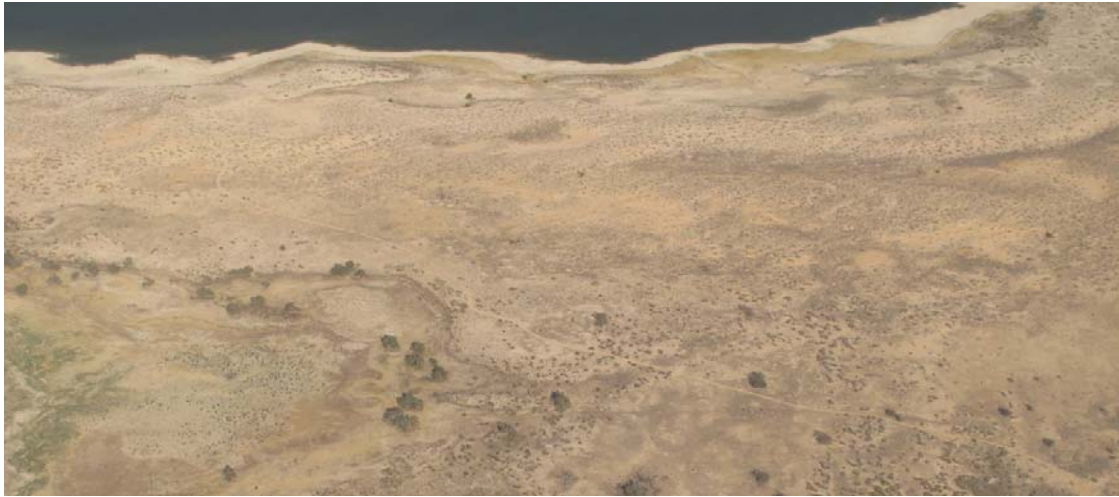


Figure 6.13.11 Overview of pastoral access track to Lake Kopperamanna from Birdsville Track, tracks across the dunes overlooking the secondary lake and woodland and evidence of an old road tracking along the beach  
Images: September 2012, April 2012

### **Interpretation**

None at the site or entry. Historical researchers publish extensive information on the history of the site and the Lutheran Church both in books and journals and on websites such as prepared by AIATSIS and Flinders Ranges Research. Extensive literature on the location and importance of Kopperamanna as a site for past and present Dieri and visiting group occupation is available.

### **Issues requiring management approaches**

- Ongoing management, protection and interpretation of the historic site and the Dieri cultural association with the Lake is essential from a co-management perspective between Dieri, the Pastoral Leaseholders and the State Government
- A tourist access and management plan should be considered should tourism be deemed appropriate in the future. The current private management and restricted access to the site is assisting in maintaining the authenticity and intactness of the landscape and the artefacts to be found there.
- In co-operation with local Aboriginal knowledge, consider education programs regarding recognition and interpretation of the range of important cultural sites and their landscape appearance. Visitor and local management recognition understanding of both small and large landscape features, such as groups of rocks,

will assist their protection and developing or affirming community values of the broader areas.

- Ensure that pastoral management regimes are cognisant of the importance of the lakeshore ecology and cultural significance, including protection of the extant Moravian Mission site.



## 7 MANAGEMENT AND COMMUNITY ENGAGEMENT BY DESIGN

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### 7.1 Interpretation: tourism, ecology, community

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Figure 7.1.1 The suite of signs at waterholes NPWS, Santos and NRM in partnership

The importance of good interpretation and communication of outback protocols at key waterholes and other tourist sites is confirmed by the recent installation of a range of signs at key places within the Innaminka regional reserve. Information kiosks and shelters herald entries to important sites and to the Reserve and provide general information regarding the environment and its landscape types, the cultural life of the area and regulations and guidance for use.

Specific information regarding the site and its history, principally explorer and Yandruwandha and Yawarrawarrka knowledge, and some ecological information are contained on stand alone signs adjacent parking areas and tracks into waterholes. Where they exist, a range of markers and other artefacts are situated at entries or at the sites where particular situations occurred as memorials or commemorative plaques. The placement of flood markers on trees is also a fascinating record and reminder of the space that floods take up and their effect upon the occupation of the waterholes and creeks.

The need for more detailed information that can be placed on physical signs, which are subject to potential flood damage, is possible through mobile digital technologies such as

computer based applications, able to be downloaded in phones or tablets prior to travel or downloaded at the NPWS office at Innamincka. It is recommended that a program for digital information for both the region and local places be investigated. During conversations with a range of stakeholders the use of technologically based information systems that operate alongside more permanent markers was enthusiastically received.



Figure 7.1.2 Pastoral industry signs at Innamincka and the Nappa Merrie Kiosk

Private signage and information kiosks have been installed by the pastoral industry in public areas and at the entry to the Burke and Wills site at Nappa Merrie. These systems are not seen as a component of a system approach to information, which confirms the identity of a sequence of places by accessing typical information each time as in the Innamincka Regional Reserve. The kiosk at Nappa Merrie displays a range of handmade information and collections of the entire region and is a place to spend time at, sifting through the variety of knowledge built up over the years.

Such local knowledge tells the layered stories of places and is a good model for site-specific development of material that could be digitised and support mobile applications. There is little evidence of information regarding contemporary mining industry information beyond the joint sponsorship of interpretation signs. It is recommended that a whole of region approach to interpretative information about the cultural landscape be adopted including: ecological systems, landscape and geomorphological systems, fish, birds and plant species, cultural stories and sites, and pastoral and mining industry histories and operations. A combination of designs that allow for both corporate systems and local materials and simple robust design forms will assist in confirming the special local character of the region.



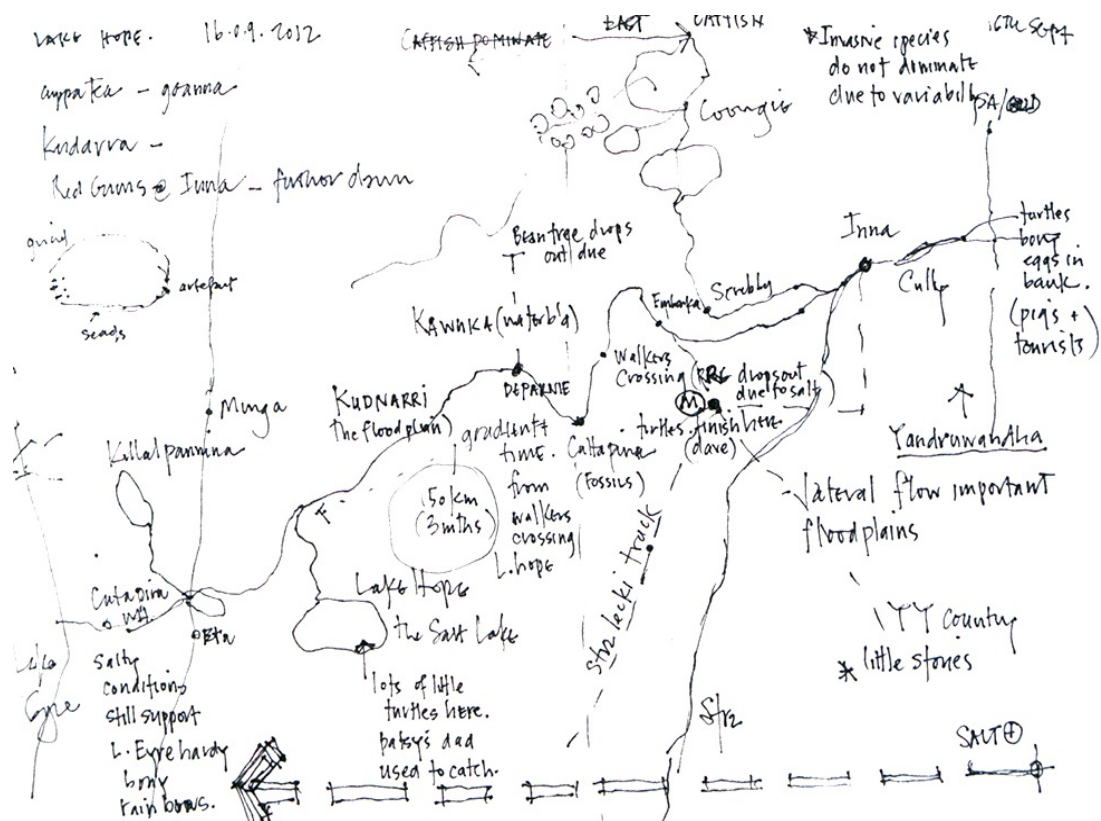


Figure 7.1.3 The importance of good planning and a whole of area approach involving the community. A spatial map of the Cooper Creek system produced at Lake Hope Camp site marking down the knowledge of local people alongside research findings and Aboriginal understanding. Image: Brooke Madill 2012

## 7.2 Infrastructure: tourism, pastoral, mining, community



Figure 7.2.1 Innamincka Township and Cooper Creek Floodplains



Figure 7.2.2 Innamincka Homestead and Mulkonbar Waterhole

The Innamincka Township is the community hub of the entire north east of the region and is the social magnet for all local and visitor activity, supplemented by the Moomba complex 90 kilometres to the south. As Moomba is not open to the public, and is accessible for medical and other emergencies only, the Innamincka community provides all services and communication outlets for tourists, locals and government providers such as the National Parks and Wildlife Service. Management of the Town Common is undertaken by the local community, who also has oversight and knowledge of the local environmental conditions in the Innamincka Regional Reserve, as a service for visitors. Innamincka Homestead located across Cooper Creek and adjacent the Cullyamurra and Burke's Grave waterholes, is the pastoral complex for the Innamincka Regional Reserve pastoral operations.



Figure 7.2.3 Innamincka public facilities and telephone, camping ground protocols

The town and its environs, including the Cooper Creek Crossing at the east to the margins of the Town Camp to the west, are the meeting place for various users and their vehicles from cars and 4WD commuters, a range of camping groups and their equipment, to large transports, all who park in the open area in front of the hotel. Dust and traffic management can be an issue in busy times. The relationship between the town square and the town common is an important landscape and cultural aspect of Innamincka. It is recommended that a town square and common plan be undertaken to assist with managing the environmental, traffic and outback town qualities of Innamincka, while ensuring that its current spatial character is retained.





Figure 7.2.4 Road, track and bridge infrastructure in flood and dune plains

Roads network the landscape and tracks first introduced by pastoralism and now are supplemented and under development by the networks of processing routes to mine sites across dune and floodplains. It is critical that the development of bridge and road infrastructure is planned and constructed in accordance with hydrological and geomorphological knowledge of slow flow patterns across the plains in order to allow natural flows to be maintained for the health of the systems both local to operations and downstream.

## 7.3 Landscape Character Zones for the Cooper Creek Catchment Key Sites

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### Cullyamurra Waterhole and Innamincka Complex:



Figure 7.3.1 Cullyamurra Waterhole line of campsites along the southern edge of the waterhole. September 2013

The deep Cooper Creek channel at Cullyamurra, with its line of mature River Red Gums, Coolibahs and Lignum bushes on the banks, provides easy access to this iconic waterhole, for campers and day-trippers. Extensive Coolibah dotted floodplains on either side are confined by low tableland hills and mesas in an area subject to both pastoral use – on the north bank – and tourism. Generally confined to the south bank, tourists traverse the 2km access road to find managed semi-wild camping areas on the sandy banks under the trees. These regularly spaced campsites provide sufficient room for up to three cars and their trailers. Larger groups occupy adjacent areas and have developed tracks parallel to the waterhole bank that cross local drainage lines and a number of vertical tracks down to the water's edge. Erosion is occurring at the riparian edge from foot traffic.



Figure 7.3.2 Cullyamurra Waterhole day park, access roads and campsites. September 2013

Extensive access road works, designated day parking and campsites, signage and bollard protection from cars travelling over the riparian edge and floodplain have provided good traffic management. The location of specific campsites has increased the use of the bank



zone, particularly to close-by toilets. To prevent erosion to the bank edges and the removal of Lignum, planning for walking tracks, gully crossings and oblique rather than vertical tracks to the waterhole edge is required. The potential for larger camping areas for bigger groups moving further away from the bank edge should be considered.

The walking track system can link the entire length of the Cullyamurra Waterhole Complex towards the Innamincka Choke. Due to Yandruwandha and Yawarrawarrka peoples' sensitivity to the cultural area around the Choke as against the importance of the area as a geological and ecological place of great interest, a negotiated program for walks and interpretation is recommended. A number of strategies will need to be put forward as visitor interest in the Choke will remain even if the area is closed off to walkers. For some it is an important aspect of their tour to make the walk to view the waterhole and landscape, beyond understanding the cultural significance of the site.

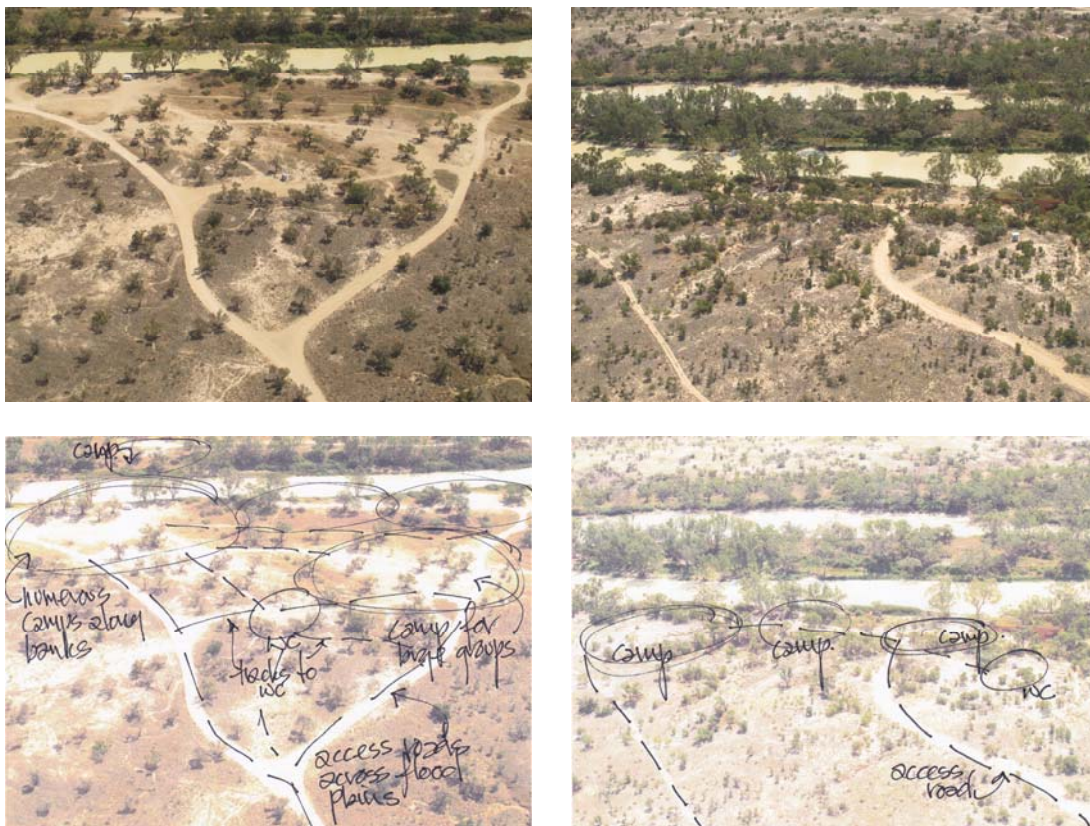


Figure 7.3.3 Town Common and Policemans Waterhole day park, access roads and campsites. September 2013

The Town Common camping area located on the broad southern floodplain adjacent the Cooper Creek at Innamincka is regarded as the town's beach area. It is heavily used by larger groups of tourists due to its proximity to town and services and the relatively shallow bank area. Extensive tracking across the floodplain and riparian edge and banks from cars and walkers poses a threat to vegetation and creek stability. Campers can park and fish on the creek edge causing compaction to the mature Red Gum and Coolibah root systems.

The character of the Town Camp is appropriate to the town's character, but does require rationalisation of the roads and tracks, and some exclusion areas to allow vegetation to recover. The necessity for space for large groups should be maintained to reduce pressure in other areas. The area close to the Strzelecki Creek channel requires maintaining its

existing form, and no camping or tracking should be allowed in this area, due to its important geomorphology and hydrological function in the flood management of the two creeks.

Policemans Waterhole situated at driving distance from Innamincka is a managed semi-wild waterhole of more intimate scale allowing for individual and small group camping in two to three designated clearings. In comparison with the town camp, the area has minimal road access intervention and car management confined to a single sandy track edged by bollards. The banks are relatively steep and bollards confine the extent to which cars can access the bank and the riparian edge and vegetation. This is a successful approach to maintaining the bush camping character of the area due to the relatively confined scale of the clearings and minimal intervention. Evidence of past occupation through fire charcoal dotted on the ground could be further confined through locating designated fire pits, as some fire pits appear dangerously close to trees and bank vegetation, and have been of large scale.

### Lake Hope



Figure 7.3.4 Lake Hope western margins, fishery and private camping. September 2013

Lake Hope is one of a sequence of terminal lakes in the middle reaches of the Cooper Creek situated within the expanse of north south dunes and interdune plains of the Strzelecki Dunefields. Its scale and articulated margins make it a lake of high scenic beauty combined with a rich history of occupation and use over time by Aboriginal groups and non-Aboriginal pioneers and missionaries. The current seasonal fishery operation is both unique in the area and an intriguing example of making use of the productive landscape of the catchment.

The riparian zone, dunes and sand flats that ring the lake provide useful camping spots under the shade of sparse old coolibahs. The mobile fishing camp reflects the self-sufficiency required to operate where the fish are running. The private campsite makes use of a naturally cleared and flat area adjacent the channel into the lake, and affords good views over the mouth and up and down the extent of the lake. Access tracks are made over the dunes linking back to Etadunna and the Birdsville Track to the west. A track across the pastoral lands to join mining tracks to the east is rarely used.

Lake Hope is extremely remote from major tracks and roads and is on private pastoral lease. Due to its remoteness and the ongoing commercial nature of the fishery, it is not regarded as a site for tourist visitation, beyond air sightseeing and rather is ripe for a web-based interpretation project into the ingenuity of outback endeavours.



### Coongie Lake and Kudriemitchie Outstation:



Figure 7.3.5 Coongie Lakes main camp and lake drive camps September 2013

Located at the confluence of the Cooper Creek North West Branch channel as it enters Coongie Lake the campground is contained by the creek riparian edge to the west and the floodplains and lake margins to the east. The low swampy landscape is framed by River Red Gums and Lignum riparian edge on the creek channel and the Coolibah woodland and wetlands of the shallow lake. The contrasting riverine and lake landscapes are a feature of the main campsite, alongside numerous waterbirds and nesting sites, evidence of the landscape's rich biodiversity.

Park infrastructure, signage and interpretation are of the same family as across the Innamincka Regional Reserve. The road system has been simplified to a single lane. Poorly sited toilets and roadways impact upon evidence of Dieri occupation in the numerous shell middens. A small camp area in a bowl at the end of the access track allows some camping for large vehicles with campers and trailers. This is a group camping area affording little privacy. Interpretative signage, shelter and toilet is well sited away from the main campsite and key landscape features.

The Lake Drive landscape character changes to dunes, interdune flats and red sandy beaches grading to white sand towards the west where swampy conditions take over. These camping areas become impassable during times of flood and the access road across the dunes is washed away. Despite the park map designating three camping areas on the lake drive, up to six or seven camping areas were recorded in clearings at the lake margins ranging from top of dune to swamp flat, with varying degrees of access. The unregulated nature of vehicular traffic means that tracks and turning areas frequently impact upon visible shell middens, which ring the lake's edge. Orange track markers provide guidance but no protection from the important cultural array of almost continuous middens in the dunes. Tracking is also present on the sandy/swampy beach zones and evidence of recent campfires despite the prohibition on fires.

Management of the landscape as a cultural site alongside its importance as an arid lands wetlands biodiversity exemplar is a critical aspect of the Coongie Lakes campground. Co-management or the development of protocols, interpretation and track and walking trail maintenance to avoid the midden landscape is essential.

## Lake Killalpaninna and Lake Kopperamanna:

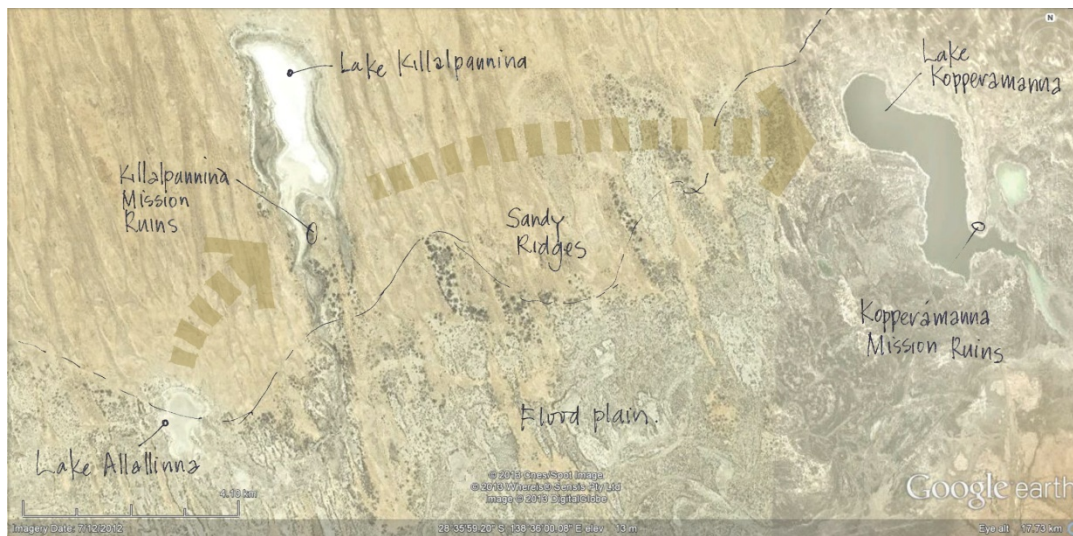


Figure 7.3.6 The linked lakes of Dieri country: Following the creek margins from Lake Allallinna to Lake Killalpaninna and to Lake Kopperamanna as they dry

The terminal playa lakes area in the Cooper Creek floodplain to the west of the Birdsville Track is often described through the features associated with each lake according to the European settlement and associated contact with the Dieri people and other local Aboriginal clans. It is a compellingly beautiful landscape of lakes, low sandy coloured dunes, low woodlands and interspersed clay and saltpans. The long shallow lakes are ringed by sandy beaches and form irregular shapes according to dune and drainage systems. Until the last century groups of Dieri would cross the sandy dune and floodplain landscapes, following the creek line after times of flood from Lake Allallinna, which was the first lake to dry. They then would settle around Lake Killalpaninna until it too dried, before moving to Lake Kopperamanna, an important place on the extensive Aboriginal trade routes across country. Pastoral infrastructure such as bores, fence lines, tracks, old yards and mobs of cattle typify the current occupation of the lakes on Etadunna Station.







Figure 7.3.7 Lake Killalpaninna overview of important places and detail as areas for design.

The Lake Killalpaninna site is a more complex place than the focus on the important and fenced in Bethesda Mission Station heritage site suggests. Any comprehensive program for managing the site needs an overall strategy for the range of sites and experiences based upon Dieri traditional owner, pastoral and tourist requirements. Additionally, as the site is predominantly on an impermanent dune system, the dynamics of wind, and water on dune movement requires flexible planning and infrastructure. It is reported by locals that more archaeological artefacts may lie under the sandy rise than are visibly evident. The development of interpretation materials including a computer based application for the many layers of historical information and orientation around the site could supplement the need for extensive physical signage.

As an overview there are at a minimum, six key places that require description and design strategies, even if the strategy is to do as little as possible:

#### **Site 1: Dead Man's Hole Camping place**

Informal camping area at an appropriate distance from the ruins and gravesites, sheltered and providing some shade and two discrete areas with some views to the lake and access to the beach. Lush lake ecology, including fossils and evidence of past dry times exist on the beach, which requires protection from campers and walkers. The recorded history of the death at the site is worthy of interpretation. An important place for Dieri to camp when visiting the site and for managed tourist visitation.

A potentially appropriate place for siting general information and protocols away from the view of the ruin site – similar to the siting of the information sign at Coongie. Trial a different design so that Lake Killalpaninna design does not refer to the public park system and rather to a pastoral or contemporary historical style.

#### **Site 2: Access Road and day parking**

The open parking area is part of the visual approach to the ruins and should retain a very simple and unstructured form. As Etadunna Station manages visitation, the requirement for organised parking should be low. The lake walk to the ruins is also an important way to access the site. Develop a new pastoral type fence system, including gate security to be negotiated with the Dieri. Negotiate the preferred location of the fence in relation to Dieri cultural practices.

**Site 3: Road up to the ruins, graveyard and ancillary buildings and equipment**

Refer to original road alignments if available and map the road, lane and track system throughout the ruin complex. Provide local materials, such as timber, stone or brush edges, to mark the pathways with the effect of keeping people from walking all over the site. Corners of sites and places to be simply pegged to define the original location and extent of buildings now vanished. Review the existing vegetation in line with building markings, removing vegetation from the footprints of structures, but leaving vegetation where it has grown elsewhere

**Site 4: Bethesda Mission Station Ruins area on dune ridge**

Continue the pathway and building marking system around the area where visible building foundations are extant. Provide discrete sign markers to support the Etadunna Tourist Map layouts.

**Site 5: Interdunal area where service infrastructure, gardens and Aboriginal camps were located**

Continue the pathway and building marking system around the area where visible, and discrete vegetation clearing to allow for clear pathways in the sand. Mark out general areas where temporary structures and camps were located to confirm the size of both permanent and ephemeral settlement.

**Site 6: The expanded area of Dieri occupation pre-European settlement**

Work with Dieri people to map out the extent of the original occupation of the lake area including campsites, middens and ceremonial sites if known. The expanded site will indicate the more expanded story of the intersection between Dieri life and that of the missionaries and pastoralists who came later.

This approach to clearing pathways and marking sites can also be applied to the equally as significant Lake Kopperamanna site should there be support to make visitation more public. As these are important cultural places for Dieri, the mapping and marking project could be funded to support Aboriginal co-management.



## 8 KEY FINDINGS

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The intent of the Cultural Landscape Assessment project is to contribute to a draft management strategy for waterbodies in the Cooper Creek Catchment, in particular The Innamincka Complex of waterholes, Coongie Lakes, Lake Hope and Lakes Killalpaninna and Kopperamanna. These findings are thus framed to underpin management strategies for priority on-the-ground projects to spatially manage key areas from a landscape design perspective. The multidisciplinary nature of the research assists in developing a balanced perspective on relevant and achievable management approaches informed by geomorphology, ecological, aquatic, hydrological and landscape quality conditions alongside Indigenous, pastoral, tourism and other community and commercial interests.

The Cooper Creek Catchment is a complex cultural landscape exhibiting rich historical and geological data alongside an arid lands ecological record that is nationally and globally, unique in its diversity and relevance at the intersections of contemporary society, economic development and environmental change and conservation.

The following key aspects contribute to the findings of this cultural landscape assessment and design research:

### 8.1 Waterbody typologies and landscape assessment

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This survey was undertaken over two years, from the floods of April 2011, during the recovery time of 2012, where floodwaters were still pulsing down the system with a final North West Branch review in June 2013. To undertake a complete landscape assessment would require returning after some years of dry times to compare conditions. The natural and cultural landscape character of the Cooper Creek study area exhibits the following features:

- The major Cooper Creek ephemeral river systems flow generally towards Lake Eyre through extensive braided streams and floodplains, shallow wetlands, flood-outs and longitudinal dunes, tablelands and gibber plains interspersed with playa lakes and sand plains. The North West Branch diverges to the north below Innamincka to replenish the Coongie Lakes wetlands system, while the ephemeral Strzelecki Creek rises at Innamincka to flow southerly towards Lake Callabonna and Lake Frome.
- Aquatic environments of the Cooper Creek Catchment are places of intense ecological activity overlain with tourism, mining and pastoral pursuits. The visible impacts of natural and human induced use upon fragile riverine ecologies and historic sites are evident after periods of fine weather and drought following floods.
- The high conservation value of the Cooper Creek system is recognized through the Ramsar Convention recognition of a large portion of the Cooper Creek reach; in the SA Section stretching from the Queensland border to Lake Hope in the southwest, to above the Coongie Lakes in the north. The specific requirements associated with managing high ecological value landscapes across an area where pastoral, Aboriginal cultural,

conservation and mining activities coexist is an example of co-management principles in practice.

- Wide floodplains, swamps, wetlands and the surrounding tablelands in the Upper Cooper area of the Channel Country are the backbone of the pastoral industry. The landscape comprises outback dirt roads and rare creek crossings, scattered pastoral settlements and farm infrastructure such as fences, windmills and bores and stockyards.
- Stony tablelands with occasional red and yellow mesas rising above the rolling plains. Tree-lined creek lines cut across the lower slopes and red treeless gilgai pavements shine into the distance. After wet years the plains are covered with golden, waving Mitchell Grass, cut only by dirt roads and now the occasional mobile camp of caravan and heavy equipment to support mining exploration.
- Tree-lined creeks and small channels, predominantly *Eucalyptus coolabah* (Coolibah) and *Eucalyptus camaldulensis* (River Red Gum), with often dense understorey *Acacia* species and *Lignum* in riparian zones, snake across expansive floodplains and dunescapes, towards the rocky gibber plains and desert ground scapes to the west; evidence of intensive Aboriginal and sparse non-Aboriginal occupation at waterholes and ephemeral lakes, seen in the detritus left on the ground, or on tracks and clearings in riparian zones.
- Ephemeral lakes nestled in the vast dune plains, come across after following floodplains and dunes along farm roads and past stock yards and the occasional dam or bore. Wide open expanses of water after the flood times drying to sandy and salty margins where dead shrubs and the presence of birds and ruins of past human occupation sometimes endure.

## 8.2 Co-existence, connectivity and change in the Cooper Creek catchment

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Focusing on the four distinct cultural landscape character types studied in the South Australian section of the Cooper Creek it is possible to extrapolate across a range of landscapes to record the patterns of connectivity. The main structural characteristics of the relationships between aquatic ecosystems and their waterbodies, and human use lies in:

- the connectivity along the river and creek channels for pastoralism, tourism and Aboriginal cultural activities. People follow the presence of water according to seasonal conditions, arriving at the permanent waterholes and lakes when other ephemeral systems dry up.
- the networks established across the landscapes of dune, floodplains and swamps in association with mining enterprises and artesian water extraction to support human and pastoral existence. The presence of reliable water linked to geology provides an alternative map of the landscape that is less reliant on surface water to structure movement.



### 8.3 Landscape values, themes and implications for management

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The multilayered landscape comprises distinctly varying bioregional landscapes along the length of the Cooper Creek, each area subject to a range of uses dependent upon the presence of the creek channel and its associated waterbodies and floodplains and the underlying geological riches of oil and gas deposits. The landscape values of the region is dependent upon the natural resources of the area for the range of stakeholders; including pastoralist, Aboriginal, mining, tourism, scientific, government and local communities and their service sectors.

The four culturally derived themes used to define the layered qualities of places according to cultural, social and economic conditions and values evident in the landscape assessment are:

- **Industrial landscapes:** where large scale infrastructure and permanent or mobile settlements are arranged over wide areas of plains and/or wetlands and swamps are components of the landscape of mining exploration and extraction.
- **Conservation landscapes:** of critical importance to the ecological and cultural health of arid landscapes and their waterbodies characterise conservation landscapes.
- **Productive landscapes:** where the production of food and resources over time has been established, including both natural and social/economic systems.
- **Storied landscapes:** where occupation of landscapes over time result in stories about places and its people and their experiences being written down, recorded through maps and imagery or handed down through oral history.

Four key waterbodies with high landscape quality, Indigenous and pastoral heritage, and intensity of use from a number of contemporary stakeholders, have been identified as areas for landscape assessment and possible management strategies:

- The Upper Cooper Creek complex including Cullyamurra Waterhole and Choke and Burke's Grave to the east, and the Innamincka Complex of waterholes including the Town Common and to Tilcha Waterhole or Wills Grave Site to the south west.
- Coongie Lakes and Kudriemitchie Waterhole tourist and conservation sites along the Cooper Creek North West Branch pastoral, mining and designated conservation wetlands country.
- The Lake Hope historic mission site and contemporary fishery on pastoral country.
- Lakes Killalpaninna and Kopperamanna playa lakes to the west of the Birdsville Track as important Aboriginal cultural places, the site of early missionary settlement and the development of the pastoral industry.

Landscape values associated with landscape quality are formed through associations to water systems as the magnet for aesthetic, cultural and sustenance qualities in the otherwise harsh arid environment; places now subject to ongoing issues of climatic change and the potential for flow regulation change upstream in Queensland. Management approaches drawn from the cultural landscape themes can be informed by identification of the variety of practices undertaken at key aquatic environments. Framed to identify partner stakeholders, the themes are a mechanism aimed at opening up dialogue across the range

of people occupying the same site for diverse purposes and outcomes, in order to gain negotiated knowledge and communication to support flexible management regimes.

## **8.4 Information, education and interpretation**

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### **Directional and access information**

- The minimum necessary physical directional and access signs are currently installed along major roads and river crossings. They are subject to damage and disappearance in some cases from adverse weather conditions and human intervention. Sufficient information on distances to water points and other facilities is lacking in public access areas but is now available through car mounted GPS systems.
- Increased access to information websites where waterbodies can be located with GPS technologies, require management strategies for managing access that can interact with stock and private infrastructure, and Indigenous cultural sensitivities to remote sites; and potentially limit the availability of such places on pastoral and Aboriginal lands.
- New easily accessed mining generated roads provide greater ease of access for tourists although private access is regulated through signs at track junctions. Management approaches for access to waterbodies and cultural sites must include a coordinated effort to provide accurate positioning information, and include guidance for the appropriate use of water landscapes and environs.

### **Educational programs**

- Community participation in the development and delivery of educational programs for groups such as schools, tourist groups, individual tourists and other commercial concerns can operate at a number of levels: for community capacity building when the knowledge of on-the-ground research can be disseminated locally; and for the education of the broader visiting public and new operators of pastoral and mining programs.
- Illustrated print materials alongside web-based materials and mobile applications ensure that information is both accessible and portable for a range of users from many cultures and ages.
- Mining company environmental impact statements and published protocols for the management of cultural materials and landscapes is supplemented through cultural programs for mine workers and sub-contractors trained in working sensitively with the cultural landscape. Many of these protocols are freely available on the web.

### **Interpretation**

- The interpretation signs installed at the key NPWS sites around the Innamincka complex of waterholes on Cooper Creek are graphically informative as an introduction to the history and culture of Aboriginal and non-Aboriginal lives in the area.
- Aboriginal knowledge and interpretation of culturally important sites is not widely available beyond formal camping sites along the Cooper Creek at Innamincka, either on signage, websites or through personal communication by tourist guides or publications.
- Appropriate information on important ecological and landscape systems operating around popular waterholes, and their relative fragility to human generated impacts, will



assist with management of key sites and tourist preparation for visiting remote outback sites.

- Adopt a whole of region approach to interpretative information about the cultural landscape including: ecological systems, landscape and geomorphological systems, fish, birds and plant species, cultural stories and sites, and pastoral and mining industry histories and operations.

#### **Internet, global positioning and mobile application information systems**

- The collection and collation of various landscape and ecologically based data through digital information systems is transforming the depth of knowledge and understanding of the Cooper Creek Catchment. Environmental systems and flows are modelled and transmitted as useful data instantaneously, opening up communication systems and providing necessary databases that support management approaches to waterholes, their communities and the regional landscape.
- It is important to note that areas identified through topographical, historical and pastoral maps and on-the-ground surveys and visitation are supplemented by aerial surveys and personal communication. Through these methods it is possible to limit knowledge of and access to places.
- Increasingly, free to all website postings, social networking Internet sites, Google Earth, GPS and mobile apps daily expand the amount of information available.
- While well-developed and informative guidelines for wise use apply in the Innamincka Regional Reserve sites, other areas are left up to local pastoral managers to guide and protect sites. Mapping technologies are sometimes out of date and not attuned to road and track changes due to mining infrastructure and weather conditions. The local community increasingly has to manage unprepared visitation informed through GPS readings and travellers' tales.

#### **Landscape management and spatial design approaches**

- Building upon on-the-ground experience, management approaches to ecologically and culturally sensitive landscapes subject to public visitation require landscape design strategies to direct visitors across landscapes and heritage areas in a coordinated way. Issues such as protection and improved visitation experiences require appropriately scaled and managed pathways, roads and tracks, barriers and infrastructure to aid visitor movement and accommodation.

### **8.5 Community and landscape generated projects**

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The importance of volunteer friend's groups cannot be underestimated in the ongoing management of remote places and under regimes of diminishing budgets. A number of groups visit the area regionally such as the Friends of Innamincka and the Toyota 4WD group. Each group combines an outback holiday with very useful work on key sites requiring maintenance or building projects that could not be otherwise achieved.

The Yandruwandha and Yawarrawarrka and Dieri communities' knowledge and traditional cultural association with the landscapes of the Cooper Creek are available when walking the creeks and travelling across country. A program to document and tell such knowledge in appropriate information systems for mobile application connected to places will assist in both

future planning of sites for visitation, or for protection from visitation, and ensuring culturally important material about the landscape and its people is kept.

- A register of friends groups and their interests could be developed for the region to include their focus on particular places.
- Include monitoring of ecological and landscape conditions in the range of work that friends groups undertake to contribute to other monitoring projects.
- The Killalpaninna Lake and Bethesda Mission Station Ruins interpretation and landscape management project is a possible collaborative project between Dieri, pastoral managers and the State Government, with the possible inclusion of a friend's group to be established.
- Provide a forum for landscape managers across the region drawn from key stakeholders to identify local projects for managing places where high value aquatic ecosystems beyond NPWS management may be at risk.
- Undertake a series of Deep Mapping projects for selected aquatic ecosystems and cultural landscapes in collaboration with all identified stakeholders for each place.



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