Natural Resources Management Plan 2015–2025

Have Your Say

for their future...

Discussion paper No 4: Wise and Productive Use of Water

This discussion paper is part of a series covering all of the 'Big Issues' raised by the community during meetings and workshops about the new Kangaroo Island NRM Plan. It provides a summary of the current state of knowledge about the issue, suggests courses of action and identifies who might work together with us in addressing it.

We now invite your comments, suggestions, criticisms and ideas.

Snapshot of the region

Approximately 5,700 km of watercourses transport surface water across Kangaroo Island, with the largest catchment in the region, Cygnet River, draining approximately 12% of KI's total surface area into Western Cove[1]. KI has some of the only catchments in South Australia that remain largely unaffected by European settlement, making them extremely significant in conservation and ecological values. The two most notable catchments are those of Rocky River and Breakneck River in Flinders Chase NP, which remain completely uncleared.

Watercourses of the larger catchments tend to terminate in estuaries at the coastline (e.g. Stun'sail-Boom, Middle and Cygnet Rivers) though some terminate at inland lakes or lagoons (e.g. Timber Creek). Many watercourses are ephemeral, with extensive sections of dry riverbed towards the end of summer, though some deep pools in shady areas of these watercourses remain permanently wet in most years. Some lakes and lagoons are permanently inundated while others hold water on a seasonal basis only. Swampy wetlands are found where upwelling groundwater saturates the soil, typically in the headwaters of catchments[1].


[1]Kangaroo Island Natural Resources Management Board. 2009. *Kangaroo Island Natural Resources Management Plan. Volume 1: State of the Region 2009.* Kangaroo Island Natural Resources Management Board, South Australia.

Surface water in streams and lagoons in the wetter west end of the island show a slight increase in salinity in the summer months but remain around or below 500mg/l (Peter Goonan, pers.com). Surface water in the east is generally more saline due to greater levels of vegetation clearance, lower rainfall and the inflow of shallow saline groundwater. Many of the wetlands that were previously seasonal have become more permanently inundated and more saline[1]. KI has 15 wetland systems[2] that are classified as nationally significant in the Directory of Important Wetlands in Australia[3]. They include four river systems, numerous lagoons and lakes, estuaries, bays and islets (e.g. Murray Lagoon, Pelican Lagoon and Cygnet River estuary).

Groundwater resources on KI are limited, with localised good quality groundwater available only in small supplies. Three quarters of all wells drilled on the island have a salinity of over 2000 mg/L Total Dissolved Salts (TDS) and 95% yield less than 1 L/s[4]. This is mainly because of unfavourable geology — the deep clay weathering zone of the Kanmantoo Group basement rocks has restricted recharge and contributes to high salinities. Groundwater potential exists in the alluvium and underlying Tertiary limestone in the Cygnet River area, and from aeolianite formations along the south coast, where groundwater quality is around 700 mg/L TDS. The unique shallow groundwater system across the region is highly susceptible to any human-induced contamination.

Management of Water on KI

The effective management of water is crucial as water is fundamental to life and most environmental, social and economic systems depend upon it. Regular water monitoring is necessary to avoid overuse and deterioration in quality, to anticipate significant changes in availability and to underpin sustainable development. The pressure to access new water resources will increase in future and the impacts of all water using activities, including land-use practices and changes, need to be assessed.

As water resources become increasingly stretched, we need to improve our understanding of all aspects of the water cycle and proactively manage it. Responsibility for the management of water resources in South Australia is co-ordinated across a range of institutions including NRM boards, Department of Environment, Water and Natural Resources (DEWNR), SA Water and the Environmental Protection Agency South Australia (EPA), as well as a number of private organisations representing industry. On Kangaroo Island the Kangaroo Island Natural Resources Management (KI NRM) Board is legislatively responsible for overseeing all water affecting activities and for developing suitable policies to ensure protection and wise use of this critical resource.

The level of farm dam development and large scale plantation forestry were identified in the KI NRM Plan (2009) as risks to water resources in some areas of the Island. These risks will increase due to predicted climate change over coming years. In response the Board adopted water management policies based on data that was available at the time and made a range of assumptions with the understanding that some of the data may not have been adequate or appropriate. During public consultation for the plan, it was clear that many in the KI community did not support the methods used to determine Water Use Limits (WUL) here. In particular, concerns were raised about the use of off-island data.

[2]Seaman, RL. 2002. *Wetland Inventory of Kangaroo Island*. Department for Environment and Heritage, South Australia.

[3]Department of the Environment. 2014. A *Directory of Important Wetlands in Australia.* Environment Australia, Canberra.

[4]Wen, L. 2005. *Water monitoring review for the Kangaroo Island Natural Resource Management Region.* DWLBC Report 2006/16, Government of South Australia, through Department of Water, Land and Biodiversity Conservation, Adelaide.

A Water Resources Management Taskforce (WRTF) was established to assess the scientific basis of the water policy and has taken a number of steps to facilitate the revision of WUL and associated policies. A technical report entitled *Hydrological investigations to inform surface water requirements for key ecological assets on Kangaroo Island*[5] has recently been delivered to the Board and a non-technical summary will shortly be available, together with a Q&A information sheet. As a result the new NRM plan will contain revised policies in relation to water resource management. The aim of the study was to validate WUL with local hydrological data. The report therefore represents a 'stepping stone' towards a system that balances social, environmental and economic needs for water.

Further work will be required to develop new water sharing rules. The timing of this work and the form it takes will depend on funding and the availability of water scientists. Such work will ideally lead to the development of 'Sustainable Extraction Limits' that meet 'Environmental Water Requirements'.

Regular water quality monitoring is undertaken by the KI NRM Board and the EPA. The EPA's 2013 Aquatic Ecosystems monitoring shows the impacts of clearing and land-use with a clear decline in aquatic system health from west to east (see figure 1 below) across the island.

Figure 1: Kangaroo Island Aquatic Health 2013

Pressures on Kangaroo Island aquatic ecosystems include:

- » Droughts reducing natural water flows and changing the intensity of rainfall events (reducing ecological integrity).
- » Altered flows in creeks resulting from catchment clearing or modification (reducing ecological integrity).
- » Extensive plantation forestry within some catchments leading to reduced base flows.
- » Limited vegetation adjacent to some creeks providing minimal buffer protection from catchment land-uses (reducing habitat quality).

[5]Whiting J and Green D. 2014. *Hydrological investigations to inform surface water use limits and generalised environmental water requirements for key ecological assets on Kangaroo Island*. DEWNR Technical Report 2015/07, Government of South Australia, through the Department of Environment, Water and Natural Resources, Adelaide

» Livestock directly accessing some creeks, causing erosion and adding excessive nutrients (which leads to increased turbidity, habitat disturbance, algal growth and aquatic weeds).
» Nutrient (including excessive amounts of nitrogen and phosphorous from cropping and grazing systems) and sediment inputs from diffuse sources in the catchment (leading to extensive growth of algae and aquatic weeds as well as increased turbidity and smothering of habitat).
» Pesticide/herbicide runoff (reducing ecological integrity and impacting biodiversity).
» Introduced weeds in the riparian zone (reducing habitat quality).
» Drainage from acid soils, including mobilised heavy metals (reducing ecological integrity).
» Runoff from unsealed roads during high rainfall periods leading to fine sediments discharging into creeks (increasing turbidity and smothering habitat).
» Saline groundwater inflows to creeks, wetlands and salt lakes (reducing ecological integrity, water quality for irrigation and water supply, the loss of amenity and aesthetic values).
» Bushfires causing erosion (habitat disturbance).
» Feral pigs causing sediment erosion and adding excessive nutrients (leading to habitat disturbance, algal growth and aquatic weeds).
» Introduced crayfish (marron) and trout potentially impacting on aquatic biodiversity.

Recent works such as wetland rehabilitation, fencing riparian vegetation and relocating stock watering points may have contributed to an improvement in water quality and aquatic ecosystem integrity in some areas, but much work is still needed to adequately address these pressures.

Further issues for consideration include equitable availability of water for development across properties and policies regarding the construction of farm dams. A diagram at the end of this paper shows factors that can lead to a decline in the condition of our freshwater resources, but gives examples of actions we can take to turn things around.

Consumptive Water Demand and Supply for KI

Kangaroo Island is heavily reliant on surface water captured through farm dams, and in many parts of the region rainwater is the main source of household drinking supplies. SA Water provides reticulated water within the bounds of the Middle River Water Supply System and from the Penneshaw Desalination Plant on Dudley Peninsula. Together they supply water to around half the population[6].

The main demands for potable water include the residential population (279 ML), non-residential uses (226 ML) and tourism (95 ML). Growth in residential water use will be driven by population growth, with flow-on impacts for non-residential uses. Following residential and non-residential demand, visitors to the Island are the major users of water, accounting for approximately 14% of yearly potable water demand[6].

Total potable water supplies currently available average 871 ML per annum, compared to average demand of approximately 670 ML. Hence there is an average annual surplus of approximately 202 ML of potable water. Due to anticipated growth in demand, the surplus is expected to decrease to around 22 ML by 2050[6]. Annual demands for non-potable water are driven by plantation forestry (23 GL), irrigated crops (2.3 GL), livestock (751 ML) and marron farming (undetermined). The current supply of surface water is estimated at 76.3 GL.

[6]Department of Environment, Water and Natural Resources. 2014. *Kangaroo Island Demand and Supply Statement*. A link will be placed here as soon as the report is cleared for publication.

In summary, in 2014 all supplies for potable water amounted to about 871 ML consisting of rainwater, desalinated water and water supplied from the Middle River Reservoir. This is expected to increase to 1114 ML in 2050 as rainwater collection increases. Potable water demand in 2014 amounted to 670 ML and is expected to increase to 1092 ML in 2050[6].

For both drinking and non-drinking quality water, sufficient supplies exist and no shortfalls are expected to occur before 2050[6].

Climate Change

DEWNR's *Impacts of Climate Change on Water Resources* (ICCWR) project[5] has investigated the potential impact of climate change on the surface water resources of KI. Annual and winter rainfall are projected to decrease, but if future global greenhouse emissions are higher than anticipated the reduction will be greater. Evapotranspiration (the sum of evaporation from surface water plus transpiration from plants) is projected to increase over time, but with greater increases and greater variability if future emissions are higher.

When these projected rainfall and evapotranspiration totals are fed into a rainfall-runoff model for Middle River, significant reductions are predicted in mean annual inflow to Middle River Reservoir. There will be fewer 'wet' years, and the maximum flow in wet years will be lower than in the past. There is a high degree of uncertainty involved in assessing future climate change impacts on water resources, but it is clear that we can expect flows in the Middle River catchment to reduce over time.

The Kangaroo Island Demand and Supply Statement (2014)[5] projected surface water supply to 2050 on the basis of two climate change scenarios for high and low greenhouse emissions. The scenarios deliver a wide range of possible outcomes, depending on the rate at which the global emissions of greenhouse gases are managed, from an increase to 82.6 GL or a decrease to 48.5 GL. Given a small projected growth in non-potable water use, the future annual surplus will range between 54 GL and 20 GL in 2050[2], indicating there is sufficient drinking and non-drinking quality water supplies on Kangaroo Island to satisfy demand until at least 2050.

According to Buying Time: A User's Manual for Building Resistance and Resilience to Climate Change in Natural Systems[7], freshwater ecosystems are sensitive not only to water temperature, volume and flow, but also to variability in these factors. Rivers, lakes and wetlands are therefore expected to respond in various ways to global climate change through changes in water temperature, quantity and quality, as well as in the timing and duration of flows. These changes impact the physiology and life histories of aquatic species and affect community composition and dynamics.

The likelihood that individual species or communities will be able to persist in the face of global climate change depends to a large degree on how resistant (able to withstand change) and resilient (able to recover from change) they are. Guiding principles for buffering aquatic ecosystems against growing climatic and likely water extraction pressures include[6]:

» Preserve a wide variety of habitats
» Protect physical features rather than individual species

[7]Hansen, LJ., Biringer, JL. and Hoffman, JR. eds. 2003. *Buying Time: A User's Manual to Building Resistance and Resilience to Climate Change in Natural Systems*, Chapter 7. WWF. www.assets.panda.org/downloads/buyingtime_unfe.pdf

- Preserve habitat connectivity to allow access to migration routes and refuges from higher temperatures
- Protect sites from human pressures and exotic species
- Manage entire watersheds and regulate extractive water use
- Restore degraded sites and consider performing active interventions in response to climate-induced threats
- Maintain an ability to change management strategies as circumstances change.

Strategies and priorities

It is important to note that the NRM plan is intended to guide and coordinate the efforts of all stakeholders in the region and responsibility for its implementation is a joint one.

- Define Sustainable Extraction Limits (SELs) for KI. This will require the determination of KI specific Environmental Water Requirements (EWRs) (the patterns of water flow required to maintain at a low level of risk the ecological values of water dependent ecosystems) and Environmental Water Provisions (EWPs) (those parts of the EWRs that can be met at any given time, determined by identifying a water regime that maintains the environment at an acceptable level of risk, therefore representing modifications to EWRs in response to social and economic demands on surface water resources, requiring an assessment of the risk level that society is willing to place on the ongoing health of KI ecosystems).
- The determination of EWRs for water-dependent fauna and flora on KI should be guided by local knowledge. There are still many gaps in the spatial distribution of ecological observations for KI. A firm understanding of local hydrology, ecology and geomorphology is therefore required to understand the impact of varying flow conditions on aquatic ecosystems. With only a small number of surface water flow monitoring gauges currently installed across KI, in the first instance eco-hydrological modelling to inform EWRs will need to be directed towards monitored zones.
- Establish additional gauging sites on the Harriet and Eleanor River catchments to improve the understanding of water resources on this part of the island in order to inform the determination of SELs.
- Take opportunistic readings at existing stream-flow gauges to reduce the uncertainties around medium-high flow estimation.
- Establish a coordinated, ongoing monitoring programme that builds upon historical ecological datasets for an improved understanding of the ecological assets of KI. A pragmatic approach guided by risk management and knowledge gaps will be needed to prioritise ongoing field investigations of KI catchments and wetlands. This should include investigations into the communities of the lagoon areas on the eastern side of KI in order to develop targeted management strategies. It should also include the further sampling of the estuarine areas of KI, which support a diverse range of fish species, in order to expand the understanding of the role of freshwater inflows to these areas with implications for management strategies for the surface water resources on KI.
- Continue to monitor water quality across KI, using this data to inform discussions with landholders and other interested stakeholders about how best to protect, manage and rehabilitate (where needed) this asset. Monitoring data should be used not just to track the overall condition of the asset but also to focus on assessing the implications/effectiveness of interventions to improve selected streams.
- Continue development of the Catchment to Coast nutrient and sediment model. Use this and other monitoring data to explore the potential to model estimated loads and sources as well as priority areas for on-ground works in other monitored and unmonitored watercourses.
- Establish seasonal water quality targets and trigger points or values for all monitored watercourses using available water quality monitoring data (KI NRM Board monthly monitoring, Catchment to Coast and Western Landcare Group data). Seasonal targets are needed to reflect the variations observed throughout the year.

- Continue to work with Council, landholders and industry to protect riparian vegetation, reduce point source and diffuse pollution impacts, maintain the integrity of aquatic ecosystems through excluding stock and relocating and reconstructing crossings, exclude and control weeds and feral animals, preserve habitat heterogeneity and increase the connectivity between ecosystems, and reduce the impact of runoff from unsealed roads.
- Projected reductions in rainfall together with increasing variability and increasing Potential Evapotranspiration (PET) means that more efficient use of water will be needed in the future. Attention needs to be given to ways of conserving water, increasing the efficiency of its use, and recycling opportunities across all sectors. Best practice needs to be implemented by all stakeholders. Innovation in water allocation, storage and management should be investigated and implemented.
- Maintain and enhance the appropriate connectivity of aquatic habitats and identify, plan for and protect aquatic refugia[8].

Partners

- Environmental Protection Agency South Australia
- Department of Environment, Water and Natural Resources
- Research Agencies
- Council
- Industry
- Community

What are your thoughts?

1. Have all the key issues relating to this **big issue** been adequately captured and understood?
2. Are there any gaps or misinterpretations?
3. What is the overall trend in relation to this issue — are matters improving or deteriorating, how fast and why?
4. In order to address this challenge, will the 'business as usual' approach work, or is adaptation (substantial change) or transformation (complete rethink of how we do business and how we tackle this issue) needed?
5. Do you agree with the strategies and priorities listed and/or do any need adding?
6. Who are the partners that need to collaborate to address this challenge?

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[8]Davis, J. 2014. *Australian rangelands and climate change — aquatic refugia*. Ninti One Limited and University of Canberra, Alice Springs.

Images: Irrigation, Farming First.

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Figure 2: Aquatic health regional conceptual model

SHOCKS

Disease
Natural disaster
Industrial disaster
Legislative changes

HIGH LEVEL DRIVERS

Climate change

Economic impacts
- Cost price squeeze (increasing costs, decreasing commodity prices, change crops (more pest/fertiliser), clear more land)

Land management and change
- Increasing demand for water
- Increasing intensity of agriculture/forestry

(+) MANAGEMENT RESPONSE

- Improve water use efficiency
- Manage surface water within Water Use Limits
- Improve riparian zones (weed management, revegetation, fencing)
- Improve land management to manage diffuse pollution
- Implement environmental flow programs downstream of reservoirs
- Improve water use efficiency

- Ensure new farm dams don't interrupt low flows
- Stop discharge of point source pollution
- Manage surface water within Water Use Limits
- Improve riparian zones (weed management, revegetation, fencing)
- Improve land management to manage diffuse pollution
- Stop discharge of point source pollution

1 DESIRED STATE

- Minor changes to ecological condition and function
- Healthy environment with a diversity of native animal and plant life
- Critical minimal flows maintained at refuge sites
- Good connections maintained between surface water and groundwater
- Macro invertebrate indicators show good diversity and at least some rare and sensitive species.
- Native vegetation remains (watercourse and riparian)
- Limited water quality parameters may be higher than would be expected based on the dominant land use in the catchment
- Well oxygenated and low in nutrients and turbidity
- At least one plant indicator may show signs of high nutrients, but the site is not dominated by excess plant growth (algae or in-stream vegetation)
- Native fish populations are stable and showing signs of being maintained (e.g. breeding, fish exist in all stages of lifecycle)
- An example of this state is Rocky River

2 TRANSITION STATE

- Moderate nutrient enrichment
- Changes to the rate, duration and frequency of flow between groundwater and surface water
- Macro invertebrate indicators show that generalist and tolerant species dominate, and rare and sensitive species are either not present or present in very low numbers
- Environmental flow requirements met sometimes, but unlikely to be met for low flow or base flow requirements
- Fair water quality, generally saturated dissolved oxygen (during the day)
- Nitrogen and/or phosphorus present at high concentration result in high algal and plant growth
- Fish populations are considered to be at risk (predation, competition, low numbers of native fish, declining refuge environments)
- An example of this state is Harriet River

3 POOR STATE

- Severely altered from natural state
- Gross nutrient enrichment
- Macro invertebrate indicators show that tolerant and generalist species dominate and there are usually high numbers of those species
- Environmental flow requirements are not met
- Poor water quality (increased salinity, metals sediment)
- High nitrogen and phosphorus concentrations cause excess algae or in stream vegetation most of the time
- Connection between groundwater and surface water is lost (land clearance decreased infiltrate to ground water, climate change, decreased river flow (not bores))
- Poor habitat structure and water flow
- Unhealthy fish populations with few species of native fish and reduced numbers, significant competition form introduced species and little recruitment
- Water may not be available for social and economic objectives
- Physical disturbances of substrates such as erosion and collapse
- An example of this state is Wilson and Timber Creeks.

CONTROLLING VARIABLES ↔

- Flow regime (volume, timing, duration)
- Water quality

The controlling variable is the particular aspect of a system that controls whether or not it will move towards or away from a threshold point

(-) REGIONAL THREATS

- Vegetation clearance
- Changes to runoff patterns
- Point source and diffuse pollution
- Increased water extraction
- Modified riparian zone (no effective filtering, e.g. stock watering points)
- Land use change
- Limited KI derived data – ecological and hydrological
- Competing water demands
- Aquatic and riparian weeds e.g. kikuyu, bridal creeper
- Increased salinization
- Soil acidification – metals increase erosion
- Changes to flow regimes
- Introduced fish species e.g. trout, marron, mosquito fish, redfin
- Dams obstructing movement
- No low flows bypasses on farm dams

- - - Thresholds exist between states. Specific thresholds relating to the controlling variable vary across the region.