Nature Glenelg Trust
ABN: 23 917 949 584

Mr Mark Bachmann
Principal Ecologist
Nature Glenelg Trust
PO Box 2177
MT GAMBIER, SA 5290
08 8797 8181
0421 97 8181

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# DISCUSSION PAPER 2 – May 2015:
## *Exploring how wetlands of the Northern Bakers Range Watercourse can benefit the Coorong Ramsar site through the SE Flows Restoration Project*

By Mark Bachmann, Nature Glenelg Trust

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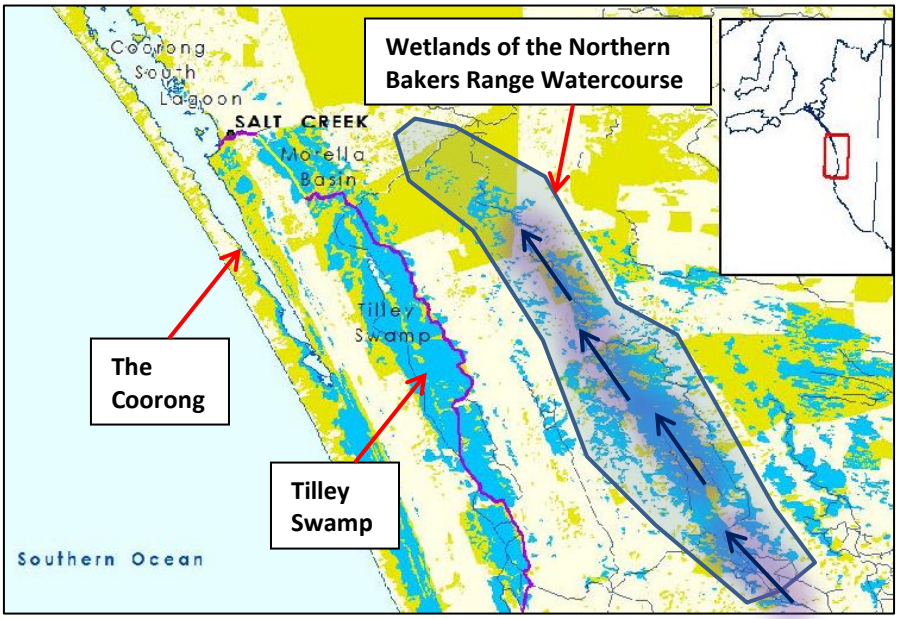
## INTRODUCTION

Since the public presentation and distribution of a discussion paper produced by Nature Glenelg Trust (NGT) in December 2014 (Bachmann, 2014), a number of important steps have been taken by the Department of Environment, Water and Natural Resources (DEWNR) in a bid to improve the SE Flows Restoration Project.

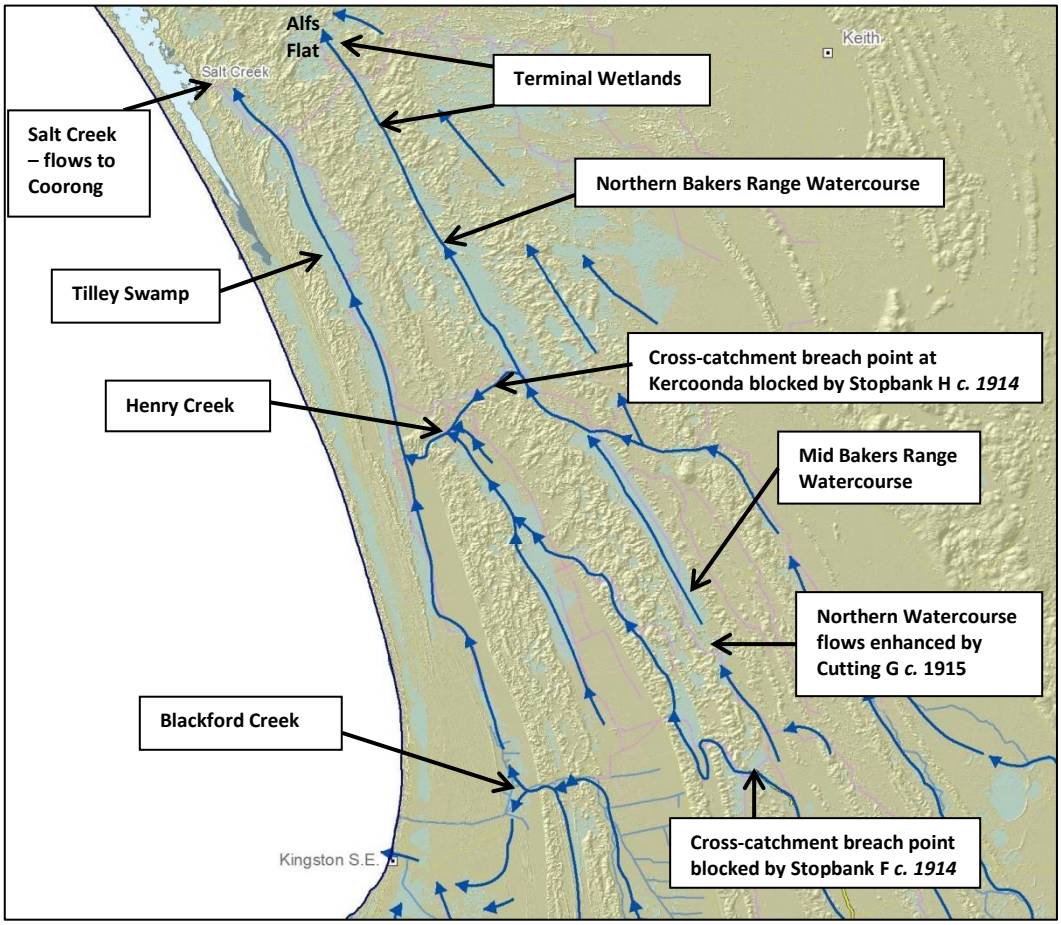
Firstly, a review in January 2015 by an ecological working group, consisting of both government and independent scientists, resulted in the NGT proposal (to restore flows to the Coorong via overland flows through Tilley Swamp, rather than the widening of a deep drain) being recommended for further investigation to assess its technical (hydraulic and hydrological) feasibility. This suggestion was endorsed by the Project Steering Committee and the technical feasibility work is currently underway.

A further key issue raised in the original discussion paper, also recommended by the ecological working group, was that parallel negotiations occur to modify project scope, in order to make it possible to reinstate currently compromised flows to the Northern Bakers Range Watercourse. Although supported by the Project Steering Committee, the progression of this concept within the context of the current project agreement is problematic. It does not appear to have been satisfactorily demonstrated how the terminal wetlands of the Northern Bakers Range Watercourse directly contribute to and benefit the Coorong and Lower Lakes Ramsar site.



# A BRIEF HISTORY OF NORTHERN BAKERS RANGE WATERCOURSE FLOWS

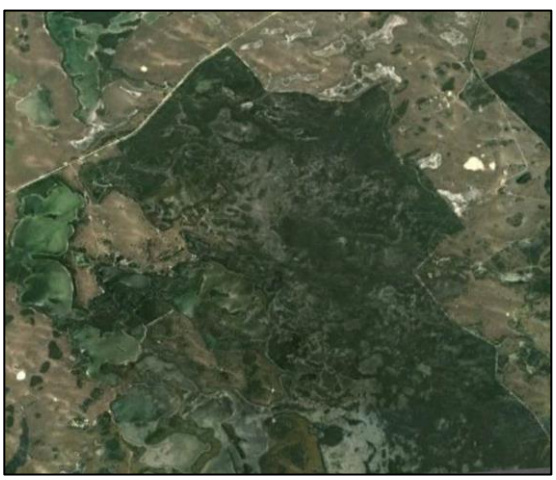
The only original overland connection of flows from the northern portion of the Bakers Range Watercourse to the Coorong was via Henry Creek and Tilley Swamp – see image below. Available evidence suggests that this regular, seasonal occurrence was caused by the back-water inundation impact of northern Bakers Range Watercourse wetlands beyond that point, and probably increasing substantially in volume on some occasions when the downstream terminal wetlands were full.




**Historic flow direction of surface water (dark blue arrows) in the Upper South East**

These terminal wetlands were permanently or semi-permanently inundated from the early 1900's (stopbank works in 1914/15 actually retaining all flows in the watercourse for decades – see above) until construction of Drain M and other Anderson Scheme Drains in the 1960's, which intercepted (and directed to the ocean) large volumes of fresh water from source catchment areas of the mid and lower South East.

**1956**



**Present**

**The wetlands in a portion of the Northern Bakers Range Watercourse (Cortina Lake – left of image)**

Although no direct surface hydrological connection existed between the far northern end of the Bakers Range Watercourse and the Coorong, a likely lateral contribution of groundwater towards the Coorong when these wetlands were fully inundated (consistent with the direction of regional groundwater flow), can be expected. The fact that these 'terminal' wetlands do not become salt pans when dry, often for very lengthy periods, indicates that export to groundwater exceeds evaporation.

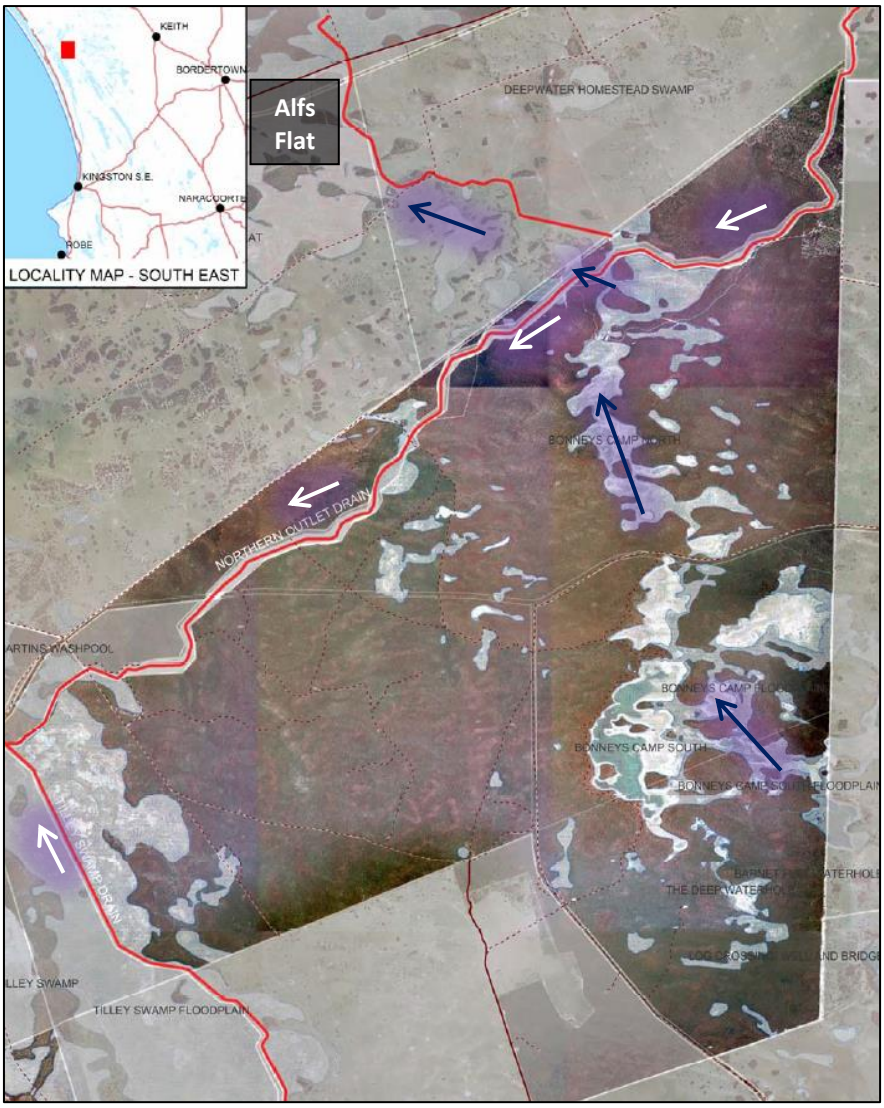
After many decades of private, ad hoc, but usually shallow, surface drainage works, the deep groundwater drains of the Upper South East Program (1997-2010) fundamentally altered hydrological patterns in the Upper South East. Although confounded by climatic factors (below average rainfall) for much of the time during and since construction, at the local scale the works have clearly contributed to altered inundation duration, frequency and water quality available to floodplains and wetlands. Key issues have been (a) the dewatering of the soil profile, reducing the ability of the landscape to produce and sustain fresh runoff, and (b) the quality of flows within many of the drains (that was anticipated would be available for diversion to wetlands) being tainted by saline groundwater and outside recommended thresholds.

At the regional scale, the program further engineered flow patterns, with cross-catchment deep groundwater drain cuttings constructed on the Fairview, Kercoonda S-Bend and Northern Outlet Drains. The Northern Outlet Drain is particularly relevant to this discussion paper, as it introduced a new hydrological connection between previously landlocked, terminal wetlands of the northern Bakers Range Watercourse and the Coorong, via Morella Basin and Salt Creek.

***RIGHT:***
**The Northern Outlet Drain through Bonneys Camp: a Wetlands and Wildlife property (White 2007)**

*This drain provides an outlet for saline groundwater flows for the northern (constructed) catchment of the Upper South East Program area (entering top right), but also bisects the northern, terminal end of the Bakers Range Watercourse, between the wetlands of Bonneys Camp and Alfs Flat (top left).*

*The watercourse flow direction is shown in dark blue, with direction of flow down the drains shown in white.*



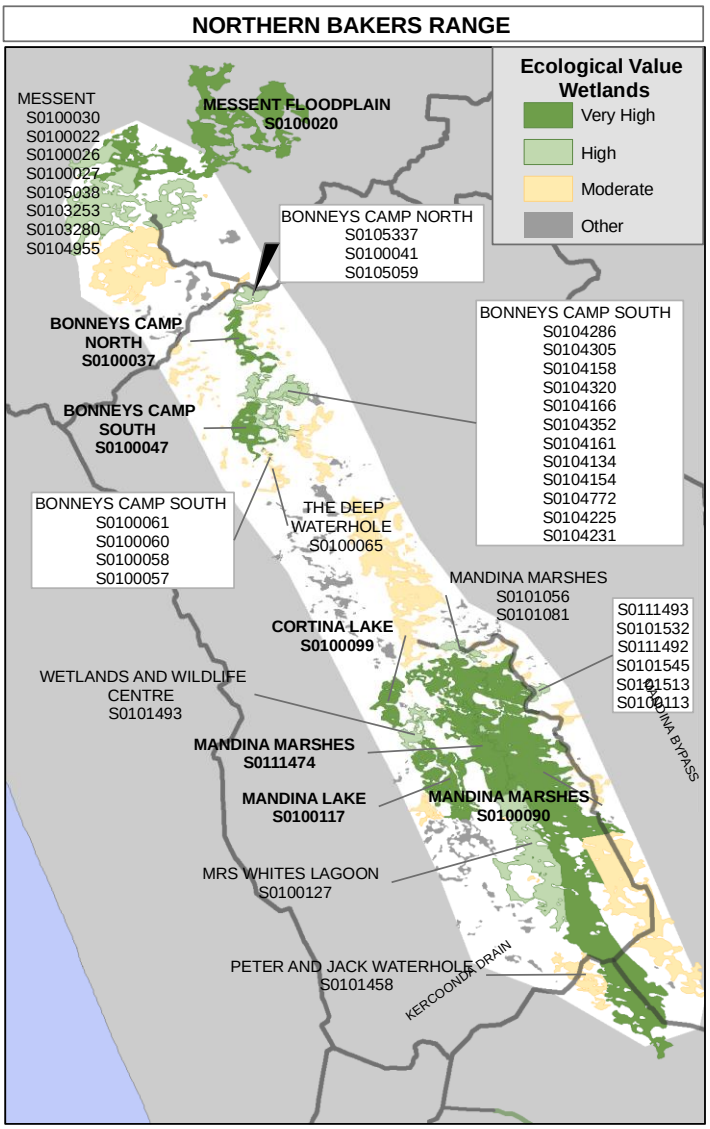

However, since the construction of the Northern Outlet Drain, these altered catchment characteristics and regular below average rainfall have meant that Bakers Range Watercourse flows have not been sufficient to fill the watercourse in the vicinity of these terminal wetlands for many years. Bonneys Camp wetlands last received significant inflows and filled to near capacity in the early 1990s, while significant flows have not completely filled Bonneys Camp and spilled into the terminal basins of Messent (Alfs Flat) since the floods of 1981 (Nitschke, 1982).

# THE RELATIONSHIP BETWEEN FLOWS AND WETLAND VALUES

Prior to the construction of the Fairview Drain in 1997/98, all central and southern Bakers Range Watercourse flows (at that time purely surface flows of generally very good quality) ultimately made a hydrological contribution to the chain of significant wetlands of the northern Bakers Range Watercourse (Mandina Marshes, Mandina Lakes, Cortina Lakes, Bonneys Camp, etc). A total of 290 wetlands covering 12,250 ha, many situated within privately owned Heritage Agreements, have been mapped in the Northern Bakers Range wetland complex (Harding 2007). These wetlands have been well studied now for over 20 years by a number of researchers, including Janice White (retired Research Associate, UniSA and Director of Wetlands and Wildlife) and her past students. The recorded diversity of habitats and ecological character make them some of the most important wetlands in the region.

For example, the semi-permanent lakes and inundated shrublands and sedgelands associated with the Northern Bakers Range provide significant refugia and breeding habitat for a large number of water dependent species. Seventy waterbird species have been recorded in this catchment, of which 24 are listed as threatened species under relevant legislation. Six species of frog and 6 species of native fish have also been recorded in this system, making the Northern Bakers Range catchment one the most diverse in the region, in terms of water dependent fauna recorded since 1980 (Harding, 2007).

However, with declining inflows and diminished water quality for the past 10-15 years, these values have been under significant threat. This is despite the completion of the REFLOWS floodway in 2010, a project with a specific aim of increasing freshwater flows along the Bakers Range Watercourse from the Lower South East, funded by the Australian Government, Water Smart Australia Program.




**The relative Ecological Value of Northern Bakers Range Wetlands based on SA Wetland Inventory Database data (from Harding, 2007)**

**The Mandina Marshes in November 2000 – a very high value wetland complex of the Northern Bakers Range (from Harding, 2007)**

Although influenced by the longer term climatic trend, there are operational limitations of the REFLOWS floodway near its junction with Fairview drain that have failed to deliver the maximum volume of potential flows to the Northern Bakers Range Watercourse since 2010. For example, in 2013 (the last reasonable year for flows) 3 GL of water flowed up the Bakers Range Watercourse floodway, but 1.3 GL of additional suitable flows were unable to be diverted from the Fairview Drain due to operational constraints and were therefore ultimately lost to the sea via the Blackford Drain.

The proposed upgrade of this portion of the Bakers Range Watercourse would remove the constraints that limit diversions of Fairview Drain flows to the watercourse, increasing the flexibility of diversion frequency and volume; noting that future agreed salinity thresholds will also be a key determinant of actual future diversion volumes. On the basis of the ecological values of these wetlands, upgrading the Northern Bakers Range Watercourse to maximise potential freshwater flows to this important wetland complex, and capitalise on previous Australian Government investments, is absolutely critical.

## DEFINING THE LINK BETWEEN UPPER SOUTH EAST WETLANDS AND THE COORONG – A FOCUS ON HYDROLOGY OR ECOLOGY?

### *Hydrology:*

To date, recent discussions within the South East Flows Restoration Project have focussed on the potential of developing a hydrological connection between the Northern Bakers Range wetlands and the Coorong, to justify the inclusion of this area in the project. However, as previously highlighted, this suggested connection is not representative of a historic flow path (unlike Tilley Swamp, which forms part of the source catchment for original overland flows through Salt Creek) and was not a recommendation of the ecological working group that convened in January 2015. Hydrological connection to the Coorong is only made possible by the presence of the Northern Outlet Drain, a deep artificial cutting (through a considerable dune formation) that crosses catchments through Bonneys Camp (a Wetlands and Wildlife property) before joining the Tilley Swamp drain near Morella Basin.

There are many obvious practical challenges with pursuing this concept further, that don't require detailed investigations to reveal, such as:

- The likely cost associated with any upgrade to the Northern Outlet Drain (should that be required), and the difficulty of achieving that outcome within the current fixed project budget;
- The storage capacity of wetlands in the northern Bakers Range is large, introducing operational and design complexities that would not be consistent with the current function of these wetlands as terminal storages that 'fill and spill' in response to varied available flow volumes;
- The problems associated with insisting on the ability to 'fast-track' flows would require modification to the watercourse, and is likely to compromise the hydrology, and hence ecological values, of these important wetlands in the process;
- The difficultly associated with negotiating a satisfactory outcome in Tilley Swamp, where landholder negotiations are unlikely to be resolved until the infrastructure upgrade, to fully restore flows to the northern Bakers Range Watercourse, occurs; and,
- The time delays to the overall project, but particularly to the commencement of construction for the primary route via Tilley Swamp, likely to be caused by introducing such a large and complex additional element to the project.

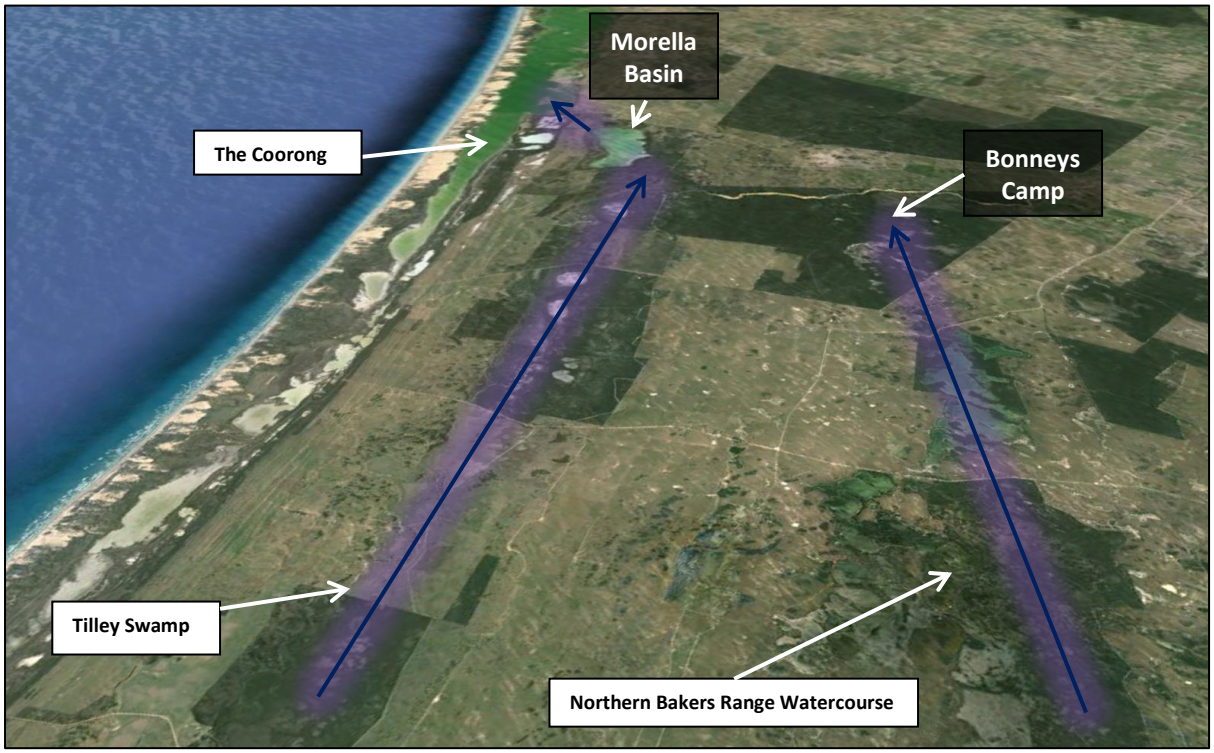
But what if the current focus on the potential for a direct hydrological connection, is missing the point?

### *Ecology:*

Although important for some aspects of aquatic ecology, watercourses and wetlands are not only 'linked' if they share a surface water catchment, or are physically connected by flows. A basic premise of modern ecology, and the theories that underpin this complex area of natural science, is that the function of an ecosystem and the species within it, is made up of a web of complex interactions at the landscape scale where the 'whole is greater than the sum of the parts'.

The very notion of an ecosystem is inherently 'conceptual', in that respective observers may legitimately define ecosystem boundaries and components differently. For instance, the Coorong and Lower Lakes Ramsar site is considered to be an 'ecosystem' in its own right, with a legally defined and agreed boundary.

However, in much the same way that Murray Darling Basin catchment flows which originate outside the Ramsar site, shape and define its ecological character, the ecology of neighbouring wetlands in the Upper South East also play a key role in supporting the ecological character of the Ramsar site, as a direct result of their proximity. In this way, the functional ecological boundary of the Ramsar site is clearly much broader than can be simply defined by a line on a map – with nearby wetlands playing a critical, complementary role in the ecosystem.




**Reinstating flows to both the Tilley Swamp (*en route* to the Coorong) & Northern Bakers Range Watercourses (as a terminal, stand-alone high value wetland system) – building resilience of the Coorong Ramsar site through the restoration of nearby breeding habitat for waterbirds**

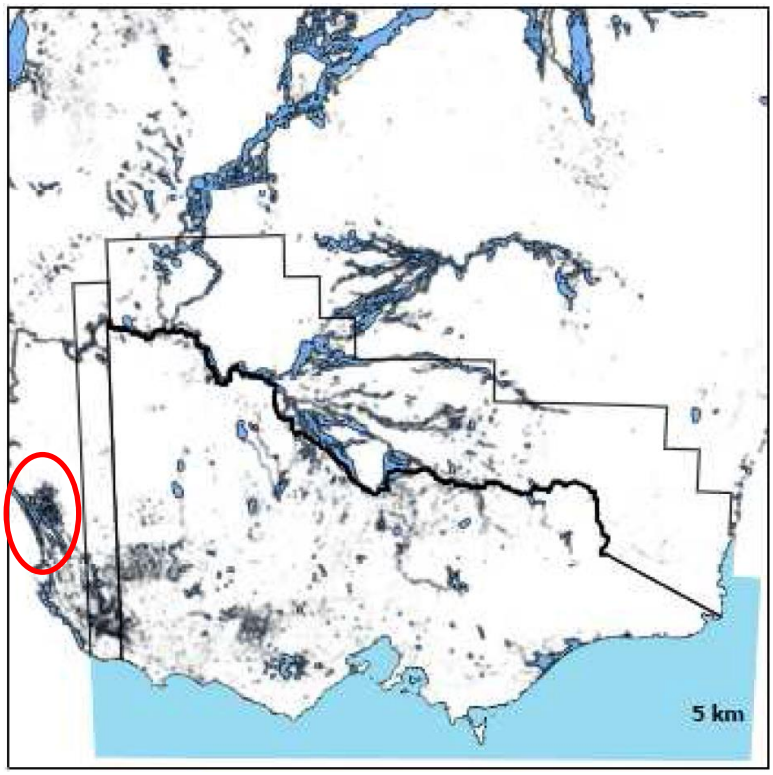
Although the Coorong and Lower Lakes meet most (8 of 9) criteria for listing under the Ramsar convention, the Coorong in particular is most often recognised for its value as a significant habitat for waterbirds, thanks in large part to the long-term monitoring program of Assoc. Professor David Paton (University of Adelaide). Seventy-one species of waterbirds were detected during regular monitoring over a 10 year period up to 2009, with 57 of these species considered to be regular users of the site (Paton, 2010). However, the primary value of the Coorong wetland habitat is as a summer or drought refuge, with very few species (only 5 summer breeders) recorded breeding within the site. It is in this context that the true value of nearby wetlands that offer a range of complementary habitats and resources, driven by a fresher, seasonal (typically winter/spring) hydrological regime becomes critical.

The wetlands of the Northern Bakers Range Watercourse are significant recorded breeding grounds in South Australia for a number of waterbirds, as well as a highly productive feeding ground for migratory waders. The requirements for breeding vary with species but the majority of waterbirds nest in emergent vegetation. Larger species such as cormorants, ibis, egrets, spoonbills and herons breed in colonies in relatively large, dense patches of trees or shrubs over water such as at Mandina Marshes. Ducks nest in tree hollows, tussocks, low shrubs or grassy margins or in dense reeds. Most rails, crakes and bitterns need a dense cover of sedges, rushes or similarly structured vegetation over or near shallow water to conceal their nests. Swans, blue-billed and musk ducks, grebes and coot need an abundance of submerged or emergent vegetation with which to build their platforms.

All of these conditions are found within the current mix of habitats available in the northern Bakers Range Watercourse but are largely absent from the Coorong. These Northern Bakers Range wetlands are not critical as nesting areas for nomadic duck species but they contribute significantly to the recruitment of ibis, egrets, herons, cormorants and spoonbills in South Australia. Parker *et al.* (1979) indicated that only three other recent breeding sites have been recorded for great egret, six sites for glossy ibis and nine for royal spoonbill within South Australia. The South East wetland survey in 1981 (Jaensch *et al.* 1989) indicated that, within the South East of South Australia, only Bool Lagoon has more colonial-nesting waterbirds than Mandina Marshes, one of the highest value wetland complexes in the Northern Bakers Range. It is also an important breeding area for musk duck and, in the past, great crested grebe. All of the key species mentioned utilise the Ramsar site, and form a significant component of its waterbird community, but none of them use the Coorong as breeding habitat. Additionally, until several years ago (when the impact of reduced flows became most severe), extensive areas of habitat suitable for breeding by crakes, rails and bitterns existed in the Northern Bakers Range Watercourse but, because of the cryptic nature of these birds, the extent of breeding is unknown (White, 2007). Given restoration of fresher, more frequent flows these habitats would rapidly re-establish.

Taking steps to better support and protect prime breeding habitat for a wide range of waterbirds situated so close (in a landscape context) to the Coorong, a high quality summer refuge habitat for waterbirds, makes perfect ecological sense. Even among the most mobile waterbirds, dispersal capacity becomes constrained during breeding and moulting. Despite their flying ability, clearly the less energy expended by post-reproductive adults and fledged young to travel to summer refuge habitat, the greater the probability of successful survival and/or recruitment. During these critical life stages the proximity of suitable foraging wetlands to breeding and moulting sites is likely to play an important role in the persistence of waterbird populations (Morris, 2012).

The image below was generated by Morris *et al.* (2012) in an attempt to better assess connectivity at an ecosystem level, despite it remaining one of the key challenges of landscape ecology. Of note, the model highlighted the importance of the cluster of wetlands in the Upper South East and Coorong for waterbirds (in the wider south-eastern Australian context), based on their proximity to each other and the habitats they provide.




**Model of wetland connectivity for waterbirds in south eastern Australia – with darkened areas highlighting sites with the greatest connectivity for waterbirds.**

*Upper SE Wetlands and the Coorong (circled) scored highly in this 5km proximity analysis* (from Morris, *et al.* 2012).

# SUMMARY

- The current investigation into the feasibility of re-instating watercourse flows, using Tilley Swamp as an extensive restored wetland habitat and storage area for managing releases, is consistent with the historic South East watercourse flows known to occur into the Coorong via Salt Creek.
- In contrast, the Northern Bakers Range Watercourse was originally a terminal wetland system that only generated sufficient surface water flows to reach Alfs Flat (Messent) occasionally, but never directly into the Coorong.
- Considering changes that would make the Northern Bakers Range Watercourse a more uniform, flow-through system, capable of delivering regular flows to the Coorong, runs the risk of altering the hydrology of an extensive area of highly important wetland habitat in its own right, and would introduce a range of unnecessary technical, practical and budgetary challenges, not to mention significantly delay overall project delivery.
- However, simply upgrading the capacity to deliver flows to Northern Bakers Range Watercourse, enabling its terminal wetlands to receive more reliable flows, will improve the ecology of these important wetlands, and by virtue of their location in the landscape, directly benefit the ecological character of the Coorong and Lower Lakes Ramsar site.
- While the Northern Bakers Range Watercourse wetlands (70 species of waterbirds recorded) and the Coorong (71 species of waterbirds recorded) host a similar suite of waterbirds, they provide very different habitats.
- However, these habitats have a highly complementary ecological function, given their close proximity in the landscape, with:
    (a) The Northern Bakers Range Watercourse providing key waterbird breeding habitat for a large proportion of the species that utilise the Coorong (but do not breed there);
    (b) The Coorong providing key summer and drought refuge waterbird feeding habitat; and,
    (c) The close proximity of the two areas providing an ecological synergy likely to improve waterbird breeding success and population viability.
- The proposed restoration of Tilley Swamp, utilising water from a different source (the Blackford Drain catchment), will further enhance this 'neighbourhood' ecological effect; improving the resilience, function and ecological character of the Coorong and Lower Lakes Ramsar site.

Nature Glenelg Trust is committed to making complex environmental science more accessible to decision makers and the general public; to improve on-ground environmental outcomes for our region. In this spirit of constructive dialogue, feedback or questions in relation to this discussion paper are most welcome.

You can contact Nature Glenelg Trust by emailing info@natureglenelg.org.au.

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