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1. Value and significance of wetlands in the South East

Background

The surface hydrology of the South East region of South Australia (SA) is the product of the interaction between the region's dominant limestone geology, remnant coastal geomorphology (consolidated stranded dune ranges and intervening stranded sea-beds), flat topography and temperate climate. Together these attributes combine to create a 400 km stretch of coastline (between the Murray and Glenelg Rivers) lacking a major natural defined waterway. Yet prior to European settlement, these characteristics also combined to make the region home to vast inland surface water resources; forming extensive, inter-connected floodplains, swamp systems and permanent pools that persisted within the landscape well into, and often through the drier summer season. The shallow falls (elevation gradients) that do exist in the region, resulted in the gradual natural movement of surface waters towards the west and north. Surface water features often directly interacted with, or were supplemented by, ground water aquifers, situated within the highly permeable limestone substrate that underlies the region.

These characteristics made the South East region one of the most diverse, geographically extensive and seasonally reliable areas for wetlands in Australia. The range of waterbirds, fish, frogs, reptiles, mammals, insects and plant life that are strongly associated with our wetlands are defining features that make the South East such a significant area for biological diversity (biodiversity).

Wetlands provide valuable cultural and economic services to the residents and visitors of the South East region. Depending on the type of wetland, its size and location, it may contribute to the cultural history of our Indigenous community as places for story-telling and centres for cultural activity. The graziers of the region see wetlands as important paddocks for summer 'green pick'. Other landholders see wetlands being useful for duck shooting, for catching yabbies, boating or angling. Some lakes in the region are important fish nursery for commercial fish stocks, and for water retention in a now drying system. Wetlands offer the broader landscape with a water filtering system and carbon sequestration sites, or they just might be a place for relaxation. In summary, most wetlands are important to multiple sectors of the community.

2. Impact that drains have had on South East wetlands

After European settlement in the 1840s, the first drains in the region were constructed in the 1860s. Various drainage programs (both private and government funded) have occurred semi-continuously ever since, with most major drainage works motivated by a desire to improve the region's agricultural productivity by reducing inundation. Hence the South East Natural Resources Management (NRM) region has undergone dramatic changes since European settlement, with 87% of the native vegetation cover cleared from the landscape, and over 90% of the region's wetlands drained for agricultural development.

The economic benefits of this development have now been enjoyed by the region's population and the State of South Australia over a long period of time; however signs of environmental stress are emerging – particularly in relation to water resources. This not only impacts upon the South East NRM Board's ability to protect and manage the remaining functional wetlands in the region, but also poses a threat to the

sustainability of economic activity that currently relies on reliable access to water resources within the shallow unconfined aquifer.

The issue is the product of a complex management history leading to competing land-uses, namely:

1. Most of the South East has been drained, and drained deeply (often intercepting groundwater in the process), to improve the viability of farming enterprises – usually to improve grazing in the first instance, but often leading to more intensive land-uses such as cropping.
2. The forest plantation industry has also expanded greatly in the region over several decades, including a recent more sudden expansion of blue gums. While it is now known that pines are particularly effective at reducing recharge to groundwater aquifers (through interception of rainfall), both pines and blue gums will also directly tap into groundwater resources when the water table is within 6m of the surface.
3. Finally, and at the same time as the more recent blue gum expansion, irrigated agriculture has undergone a vast expansion at key locations in the region where soil types and access to high quality groundwater are conducive.

During a period of reasonable rainfall in the 1990s, the signs of stress were not so apparent – but then during the prolonged below average rainfall period in the 2000's (the Millenium Drought), the impact of the above stresses (which also increase in intensity during dry times) became immediately apparent. Unprecedented declines in groundwater elevation, reducing spring discharges, the complete drying of permanent pools in creeks and drains for the first time in living memory (of region's the oldest farmers), and threatened species of fish pushed to the brink of extinction have all been signs of this trend.

Another way that this stress can be coarsely measured in biological terms includes the fact that many species of plants and animals specifically associated with wetlands in the South East are now considered threatened, with a significant number listed under national legislation (the *Environment Protection and Biodiversity Conservation Act 1999*). Those that require permanent inundation (such as native freshwater fish) are particularly susceptible to localised extinctions, as referred to above.

3. Modern significance of drains themselves in providing wetland habitat

Against the backdrop of these changes, and despite being the initial primary cause of reducing wetland extent and permanency in the South East, the artificial channels of the drainage system themselves now provide significant permanent pool habitat. In some years these are the only regional refuges for aquatic fauna during prolonged dry conditions, and are often representative of a direct interaction with groundwater. However, it is worth noting that currently only a fraction of (the over 2,500 km of government-managed) artificial drains in the South East, actually provide conditions conducive to aquatic animals that require drought refuge habitat.

Recent work completed by NGT over the past couple of years for the South East NRM Board, highlighted:

- the dramatic change to wetland extent and permanency after comprehensive drainage in the 1960s;
- the important environmental values associated with artificial drains, particularly permanent pools:
 - o thirteen species of fish (12 native, one exotic) were recorded across 15 sites surveyed, including the nationally threatened Yarra Pygmy Perch and Dwarf Galaxias;
 - o six species of frog were detected in the survey of 33 sites, with no frogs detected at 9 (more saline) sites, while the nationally vulnerable Southern Bell Frog was recorded at 10 sites – typically those with fresher water quality and higher levels of emergent aquatic vegetation;
 - o twenty-five different species of waterbirds at 31 survey sites; and,
 - o 130 species of flora, from 33 sites across a wide range of in-drain habitats.
- the relatively tiny area within the existing artificial drainage network that actually provides permanent refuge habitat for wetland species; and,
- the clear relationship between:
 1. permanent pools presence in drains through time **and** groundwater levels (i.e. shallow groundwater supports permanent pools);

2. biological diversity **and** drain salinity (i.e. fresher pools support more biodiversity).

These permanent pool refuge habitats have particularly high values worthy of specific management for nationally threatened species of fish and frogs; species that are particularly dependent on permanent pools habitats in drains for maintaining key populations across their range in the South East. High value sites for these species (16 of the total 37 sites surveyed) were predominantly concentrated in the Lower South East (where drains are fresher), along the lower reaches of Drain M, three sites on the Millicent District Flats, and at Katani Park on the Southern Bakers Range Drain, with the notable exception being an outlying (fresher spring-fed) site at Henry Creek in the Upper South East.

4. Opportunity to better manage the drainage network to help offset its environmental impact

Within the Network

Upon closer analysis, it turns out that many of the permanent pool refuge sites correspond to sections of the drainage network where weirs within the drains are now creating a weir pool – a section of permanently inundated drain upstream of the weir structure that directly influences the static level of drain water and adjacent groundwater at the same time. Some of these weir structures were actually constructed in the 1980s to address local farming concern about the impact of over-drainage on soil moisture and groundwater levels through the summer, but have had the unintended, but fortuitous, ecological benefit of providing key aquatic refuge sites for many important species of fish and frog.



A permanent weir pool in Drain M that supports one of five populations of the nationally threatened Yarra Pygmy Perch that remains in the wild in the South East, and a population of the nationally threatened Southern Bell Frog

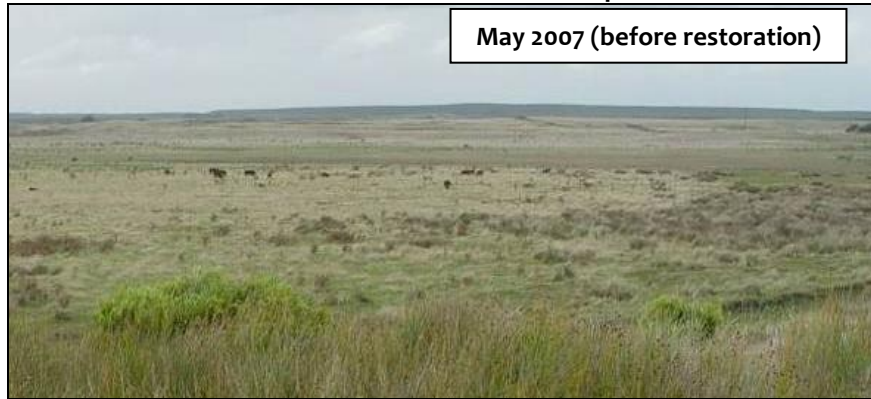
A key recommendation of the recent reports NGT has prepared for the South East NRM Board, is that the enhancement or creation of additional permanent pool habitat (to increase summer water retention capacity in drains) should be investigated, by identifying potential locations for the installation of strategically sited weir structures that don't compromise winter drainage functionality.

In the Wider Landscape

While measures to improve the ability of the drainage network itself to provide aquatic habitat and retain groundwater as previously described are critical, they do little to address the wider trend of wetland loss or regional-scale groundwater declines. Additionally, given that the trend of land-use intensification is here to stay, the clear challenge becomes how to cleverly design water recharge and conservation functionality back into more of the landscape, while remaining cognisant of the fact that the hydrological system has been permanently altered.

A rare example of this principle in practice can be seen at Pick Swamp, a 230 hectare addition to Piccaninnie Ponds Conservation Park (now an internationally recognised Ramsar site), that is now a demonstration site for sustainable wetland restoration and water management. The transformation below was made possible by decommissioning the network of drains that had been constructed on that property, and (importantly) is designed in a way that does not negatively impact neighbours.

The restoration of Pick Swamp



Aquatic habitat recovery – restoring permanent refuge habitat for wetland species, including a huge diversity of birds and two species of nationally threatened fish

Pick Swamp was converted from a cleared and developed cow paddock in 2007, to eventually being accepted within the National Reserve System and part of the Piccaninnie Ponds Karst Wetlands Ramsar site, as a wetland of international significance in 2012. The site boasts one of the largest bird lists of any reserve in the region, is home to recovered populations of fish and frogs, and is currently being used as a reintroduction site for the nationally threatened Yarra Pygmy Perch. This is a testament to the recovery

potential of wetlands, demonstrating what is possible when sites are strategically selected for wetland restoration.

5. Impediments to strategic environmental works associated with drains being implemented

In terms of off-setting the environmental impact of 150 years of drainage in the South East region, there are a number of practical constraints. For example, within the drainage network itself, retrospectively installed weirs (like the Drain M example) would have to be carefully located so as not to impede their winter drainage function upon the agricultural land serviced by the drain in question. Likewise, selecting sites for strategic wetland restoration, by entirely or partially removing the drainage function altogether from some sites (like the Pick Swamp example), is something that can only be considered at a limited number of sites; where the topography, cadastral boundaries, land use, water security and land tenure issues can all be adequately addressed.

Rationale for a Wetland Habitat Restoration Fund

Strategic works that undertake restoration within the drainage network or at priority wetlands within the region require a long-term vision and deliberate approach to funding. Despite the existing sympathetic charter of the South Eastern Water Conservation and Drainage Board, and the best intentions and goodwill of the Departmental staff that service the Board, the reality is that the existing State Government annual budget allocation does not currently permit the ideas presented in this submission to be practically implemented. Additionally, the priorities of state and federal competitive grant programs are broad in their reach and intent, and often do not neatly match the strategic priorities of individual regions, nor fit the required project timelines – like the very specific (and often expensive) activities suggested in this submission.

Hence, it is suggested that if a portion of any future funding model for the SE Drainage network were set aside each year, to contribute to an ever-growing balance within a legally constituted Public Fund, that this would address a major current policy gap in regional NRM. It would do so by permitting occasional investment into strategic, highly practical and targeted concepts that would directly address the types of water conservation and wetland ecology issues mentioned. A number of models for how the fund could be administered and implemented exist, and, in an era of declining internal government funding and capacity, could also include working in partnership with the expertise and support of a third party organisation.

6. Other management considerations

a. Importance of environmental monitoring

Monitoring is core activity of the South Eastern Water Conservation and Drainage Board (SEWCDB) to manage the drainage network, to better understand water quality and quantity, and the effects (positive or negative) on the landscape including the natural environment and agricultural activities. The geographical scope, complexity and highly modified nature of the wetland systems and drains in the South East, meant an Adaptive Flows Management approach was adopted by the SEWCDB to monitor key aquatic assets. In areas of strategic management interest, such as the Bakers Range Watercourse (REFLOWS) and South East Flows Restoration (SEFR) Project areas, an annual ecological monitoring program was recommended to collect sufficient knowledge about the ecological requirements of the wetland complexes within the project area and their response to the project's management actions. The information is critical to adequately inform decision making processes about future management actions and water regimes. The monitoring focus is placed on the response and requirements of the affected wetland systems, including their flora and fauna, in response to the source, timing, duration and frequency of watering events.

Since 1999, monitoring of the fish communities has occurred relatively regularly throughout the South East region, with over 600 temporally or spatially replicated sites. Irregular but targeted vegetation, frog and waterbird monitoring has also previously been undertaken. In 2011, DEWNR (formerly Department of Water) instigated a coordinated monitoring program to monitor the ecological (vegetation, frog and fish)

responses of wetlands across the South East region. This monitoring program was expanded in 2012 to include additional locations as well as documenting waterbirds. As we move forward, changes are still occurring in our drainage and wetland systems (including the proposed SEFRP with potentially new drains) that require monitoring to identify change and inform management actions. It is through understanding our system that critical biological indicators can be recognised and water flows can be delivered at appropriate times and qualities to prevent local aquatic extinctions. NGT strongly advocate the need for monitoring to inform management of the drainage network and to continue into the future, noting that this critical aspect of drain management under the current funding regime is **severely under-resourced**.

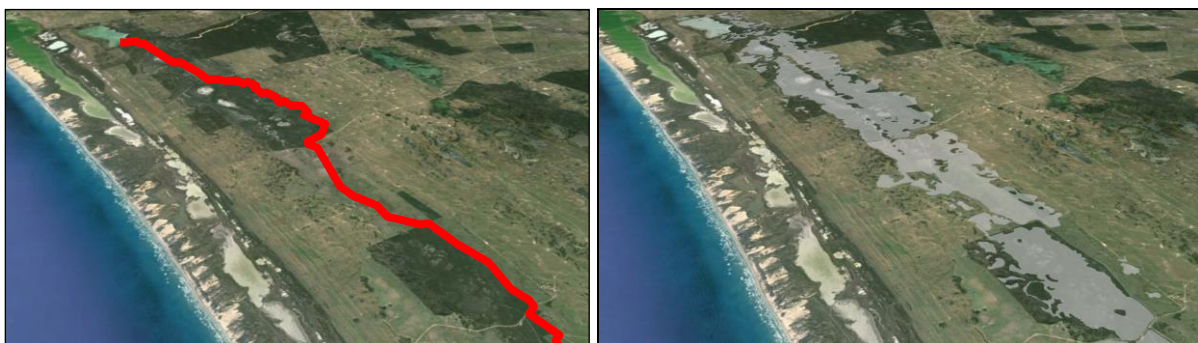
b. Using new investment to design low cost, ‘set and forget’ management solutions

Nature Glenelg Trust currently undertakes a wide range of wetland restoration works on private land, and wherever possible we adopt what we call a ‘set and forget’ philosophy for how our works are designed and implemented. Put simply, we don’t want over-engineered solutions or to be responsible for the ongoing operation of adjustable structures if this can be avoided through landholder agreement and sensible design. Where adjustable structures are necessary, having them set to a fixed position that meets the site environmental objective is our priority. Hence, irrespective of whether we have time to visit before the next rainfall event, the environmental objectives of these sites will automatically be met by this ‘set and forget’ philosophy.



Example NGT structure near Dunkeld, which sets a new restored “fixed” sill level (maximum retention height) for this substantial wetland (background), but maintains the existing artificial drain alignment.

This concept also has relevance at the present moment, with new investment about to occur in the region under the South East Flows Restoration (SEFR) Project aimed at delivering water to the Coorong South Lagoon, when and if required, from Blackford Drain near Kingston. The current design being promoted for the project involves widening existing groundwater drains the whole way to convey flows, with potential structures within the channel aimed to allow occasional “real-time” diversion to isolated wetlands *en route*. This approach is similar to that adopted by the Upper South East Program, which resulted in the construction of an abundance of complex structures and control points within, or associated with, a 650km network of constructed deep groundwater drains. Many of these structures are remotely located but often need to be managed in real-time to meet their management objectives.



The existing (drain only) proposal for the South East Flows Restoration Project (left), with the alternative NGT proposal of restoring overland flows using Tilley Swamp (right)

Consistent with the NGT philosophy, in December 2014 we proposed an alternative approach for the SEFR project that would simplify existing management in the project area and reduce the ongoing management and maintenance requirements of the SEWCDB upon project completion. Our suggestion is that the project be designed (where possible) to automatically meet the requirements of wetlands *en route*, by using the natural Tilley Swamp Watercourse to convey the last 35km of flows, rather than constructing a new (up to 40m wide) channel through the floodplain. To name just a few benefits, such an approach will significantly reduce the infrastructure footprint of the project, improve the quality of water available for release to the Coorong, re-invigorate a wetland system that has been starved of major reliable flows since the construction of Blackford Drain and create management flexibility (wetland storage capacity) in the system that is currently lacking. Minimising the number of control points that are required to manage flows is also a key to simplifying management (i.e. make it easy to do the right thing). For instance, the SEFR Project will require a control point at the Blackford Drain diversion point and where flows are released at Salt Creek. If regular management could be limited to these two locations, this would be a sensible design outcome.

Footnote: The alternative NGT proposed design for the SEFR Project has been formally reviewed (by an Ecological Working Group) in January 2015, and is currently being considered for more detailed investigation by the project.

7. Closing thoughts on a Wetland Habitat Restoration Fund

Why would one consider this approach?

Think about most government-managed levies that exist – and in many cases they end up supporting ‘day-to-day’ operational affairs, behind the scenes policy development or other regular business that is not highly visible to the public. The suggested allocation of a portion of any future funding model proposed for the SE Drainage Network to fund longer-term, more strategic activities, would demonstrate that – by design – this is a different kind of funding model that is also capable of investing in bigger-picture environmental priorities and lasting, practical results on the ground.

Why consider the fund sitting outside of government?

Water management and drainage issues have been divisive in recent years, and many landholders will resent paying yet another levy that may be perceived to support ‘regular’ government business. To establish a strategic fund that could sit outside of government and be used for the benefit of sustainable water and environmental management in the region would be a novel approach that may diffuse some of this criticism/tension. It would also help overcome some of the likely administrative hurdles that are likely to emerge if seeking a solution to “holding” funds within government across financial years.

What safeguards exist to protect a fund sitting outside of government?

Any duly constituted not-for-profit environmental organisation with a fund eligible to offer tax-deductible donations must be endorsed by the Australian Taxation Office and meet a set of stringent criteria set by the Register of Environmental Organisations, including an annual audit of all organisational accounts. The Public Fund must have a separately audited account to regular organisational accounts, and be overseen by a Committee of Management who are legally responsible for ensuring the proper administration of the Public Fund.

Finally - Why not?

NRM organisations need to find new and innovative ways to more effectively utilise resources and invest in long-term outcomes. In this case we also have the advantage that wetland restoration is different to revegetation on dry land – the pay-back time is much faster and the results are tangible - there for all in the community to see, experience and enjoy. However the tools required to make this happen, when a strategic opportunity presents itself, are not currently at our disposal.

The proposal outlined in this submission would create lasting and positive legacy for the regional community and wetlands in the South East region, by setting up a structured and reliable means of helping to offset, in a small but strategic way, some of the environmental impacts associated with the long history of the drainage network in the region. The community has certainly benefitted greatly from drainage since settlement and so we ask the Community Panel: *is now the time for us to consider setting up the mechanism that would enable us to invest in future strategic projects that 'give a little back'?*

8. Key points raised in this paper

1. Establishment of a mechanism capable of investing in long-term environmental (water conservation) projects would offset, in a strategic way, some of the impacts associated the drainage network;
2. Provision of sufficient funding for environmental monitoring within the drainage network is critical to inform wise future management decisions; and,
3. New projects in the SE drainage network should be implemented according to a philosophy that (wherever possible) minimises engineering, automates environmental outcomes, is low cost to maintain and works in conjunction with the characteristics of the natural landscape.

Relevant selected NGT reports suggested for further reading:

- Anderson, D., Farrington, L., Bachmann, M., Bouchier, J., Dean, C., & Thompson, J.R. (2013) Verification of Permanent Pools in Drains in the South East of South Australia. A report commissioned by the South East Natural Resources Management Board; NGT Consulting – Nature Glenelg Trust, Mount Gambier, South Australia.
- Bachmann, M. (2014) Discussion Paper – December 2014: Ensuring adequate provision of water for Upper South East Wetlands as part of the South East Flows Restoration Project. Nature Glenelg Trust, Mount Gambier, South Australia. Available on-line at: <http://natureglenelg.org.au/wp-content/uploads/2014/12/NGT-Discussion-Paper-Tilley-Swamp-and-SE-Flows.pdf>
- Bachmann, M., Whiterod N., Anderson, A., Farrington L. and Veale, L. (2014) Regional status update of the Dwarf Galaxias in the South East of South Australia – Spring 2012-14. Aquasave – Nature Glenelg Trust, Mount Gambier, South Australia.
- Dickson C., Whiterod N., Bachmann M., Haywood B., Farrington L. & Kivisalu, L. (2013) Ecological Monitoring of Wetlands in the South East of South Australia 2012. Report to the Department of Environment, Water and Natural Resources, Government of South Australia. Aquasave Consultants and NGT Consulting, Nature Glenelg Trust - Mount Gambier, South Australia.
- Farrington L., Dickson C., Bachmann, M., Whiterod N., Haywood B., and Kivisalu, L. (2014) Evaluation of Change and Survey of Environmental Values: Permanent Pools in Drains and Watercourses in the South East South Australia. Report to the South East NRM Board and DEWNR, Government of South Australia. NGT Consulting and Aquasave – Nature Glenelg Trust, Mount Gambier, South Australia.
- Veale, L., Whiterod N., & Bachmann, M. (2013) Reintroduction Feasibility Assessment and Action Plan for Yarra Pygmy Perch in the South East of South Australia. Report to the Department of Environment, Water and Natural Resources, Government of South Australia. Aquasave - Nature Glenelg Trust, Mount Gambier, South Australia.