Progress of Discovery Bay wetland restoration works and how they interact with the Glenelg River

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Introduction

Discovery Bay, a vast stretch of mostly sandy coast that straddles the state border between Victoria and South Australia, was named by explorer Thomas Mitchell after travelling down the Glenelg River in 1836.

The township of Nelson is situated at a key location – something of a ‘hub’ – within Discovery Bay. Not only does it mark the location where the Glenelg River meets the sea, but it is also the original confluence point for freshwater flows that used to enter the estuary near the river mouth from the coastal wetlands either side.

On the Victorian side of the river was Eel Creek, discharging into Oxbow Lake and fed by rainfall and spring flows originating from as far as 15 km away at Lake Moniboeng. On the South Australian side, the high volume freshwater flows from Piccaninnie Ponds and the springs beyond (up to 12 km away), all converged into a single channel known as Freshwater Creek, that permanently flowed into the river near its mouth.

However, since European settlement and development of the Discovery Bay coast, many changes have occurred, particularly to the way water flows. These changes have altered the character and condition of these waterways and the wetlands that feed them.

Thanks to strong local interest over the past 15 years and the crucial support of governments agencies in both South Australia and Victoria, a number of projects have been initiated over recent times to improve water management and wetland condition in Discovery Bay.

These projects, including wetland restoration works at Piccaninnie Ponds, Pick Swamp and Long Swamp, are briefly summarised over the following pages.
Part 1: Piccaninnie Ponds CP, South Australia (DEWNR, 2006 & 2013)

Piccaninnie Ponds Conservation Park is situated several kilometres west of Nelson, in South Australia. For 15-20 years after the park was proclaimed in 1969, there was considerable local interest in trying to address previous changes that had been made to the hydrology of the wetland system. Although it was protected, reserved and supporting a diverse suite of habitats and range of resident threatened species, Piccaninnnie Ponds was far from intact from a hydrological perspective.

Prior to European settlement, water that discharged from the karst, rising-spring wetlands in the system flowed eastward across the State border into the Glenelg River Estuary, along a watercourse between the dunes called Freshwater Creek near what is now the township of Nelson, in far South West Victoria.

![The Piccaninnie Ponds Wetland System when first mapped by William Blandowski (1851), showing the original course of Freshwater Creek. The red line shows the boundary between the colonies of South Australia and Victoria.]

This is how the system remained until 1906, when the first of several attempts to drain the wetlands of Piccaninnie Ponds directly to the sea occurred. However, rather than being the beginning of comprehensive drainage, what ensued was a turbulent nine year period during which the community, led by local fisherman in both states, lobbied governments in both South Australia and Victoria in an attempt to have the creek re-directed to the Glenelg River. It seems that the often estuarine lower reach of the Glenelg River was a hot-spot for fishing, and the locals had noticed a dramatic decline in their catch since the permanent freshwater flows from Piccaninnie Ponds were lost.

This early form of environmental activism was rewarded in 1915, when the state governments agreed to share the cost of damming the new outlet through the dunes and constructed an alternative channel to the Glenelg River. This was necessary because the original flowpath between the dunes had been lost to drifting sand.

![The 1915 ‘damming’ of Freshwater Creek at the 1906 artificial outlet location to the sea]
It was not long before the new flowpath caused controversy however, with landowners at the western end of the system complaining that the water level was now higher than prior to 1906, and was impacting on the viability of their grazing enterprises. By 1917, with water levels high and the dunes still unstable, another suspected act of sabotage led to a new outlet being cut near the state border.

*RIGHT: The new 1917 artificial outlet of Freshwater Creek. Note the stranded aquatic plants in the foreground, indicating a rapid water level drop as the cutting eroded to sea level.*

The difficulties encountered in such an unstable coastal environment, and problems in getting interstate cooperation to meet the costs, then led both governments to abandon any further plans for flowpath restoration, enabling the ad hoc drainage and development of portions of the wetland system to commence by private owners or lessees.

At the time the Park was proclaimed in 1969, a new main artificial outlet was draining the ponds directly to the sea. Both the South East Association of Field Naturalists and local ranger staff took an active interest in the hydrology of the area, by advocating for the restoration of flows to the Glenelg River. However, the final filed correspondence on the matter from the 1980s shows that scientific officers based in Adelaide refused to support the proposals on the grounds that a change to hydrology may cause disturbance to terrestrial vegetation in the Park. The concept was shelved, until revived through a series of steps undertaken to achieve hydrological restoration from 2002.

The first of these steps, the stage 1 weir and fishway constructed in 2006 at Piccaninnie Ponds, halted a long-term (several decades) drying trend in the Park, by regulating outflows on the artificial outlet for the first time.

*RIGHT: Stage 1 weir and fishway under construction in 2006.*

It also had the effect of increasing inundation in a small area immediately upstream of the structure, under the direct influence of the weir pool created by the new structure.

*The upstream inundation impact and habitat change caused by the stage 1 weir, showing habitat change 2006–2012.*
The subsequent stage 2 weir and fishway upgrade, completed in 2013, resulted in the structure height being lifted to increase future management flexibility. This includes the future ability to completely block outflows, should the option of re-instating flows to the Glenelg River one day become a reality.

The lifted & redesigned stage 2 weir and fishway on the main artificial outlet at Piccaninnie Ponds, completed in 2013.

The stage 2 upgrade was completed at the same time as providing a new flow path to physically reconnect the isolated eastern and western basins at Piccaninnie Ponds. These wetlands had been separated for several decades by a combination of lower water levels, sand drift and, to a lesser extent, the impact of the Piccaninnie Ponds Road. An aerial photographic view of the new flow path is shown below.

Aerial imagery showing the reconstructed flow path and culvert location under the Piccaninnie Ponds Road. Construction occurred in 2013.

The main Piccaninnie Ponds (western wetland) are in the top left of each image, while Hammerhead Pond (eastern wetland) is in the bottom right corner of each image. Also note the increase in open water habitat to the south of the main Ponds, associated with the installation of the stage 1 and stage 2 weir structures.


These works within the original Conservation Park have occurred in a complementary way with those that have occurred in the neighbouring, newly reserved area at Pick Swamp, each contributing to the wider vision for restoration of this wetland complex.
Part 2: Pick Swamp, Piccaninnie Ponds CP, South Australia (DEWNR, 2007-09)

Pick Swamp was first identified and recommended for protection as a result of its biological values in a 1964 submission by the Field Naturalists’ Society of SA to the SA Government, which led to the creation of the Piccaninnie Ponds Conservation Park. However, Pick Swamp was ultimately not included, as a compromise during the landholder negotiations required to secure the new reserve. Pick Swamp remained largely intact until the early 1970s, when the property changed hands and was progressively drained and developed for agriculture.

By the time the property was first offered for resale, approximately 30 years later in 2002, the bulk of it had been modified (drained, cleared and grazed by cattle), with the exception of the now isolated Crescent Pond (a significant spring feature) and a surrounding 40 hectare area of saturated (groundwater fed) peat fen supporting Silky Tea-tree shrubland. Despite several attempts, this remnant area was never effectively drained or cleared, but was being negatively impacted by drainage of the surrounding land. After a protracted and complex negotiation process that involved 2 different owners over a period of 3 years, the 230 ha property was eventually purchased by the SA Government in 2005 for future restoration and eventual inclusion in the adjacent Conservation Park. A plan (written by Steve Clarke of DEWNR in 2007) was implemented in stages from 2007 to restore the property, primarily through reversal of artificial drainage and supplementary revegetation of the wetland fringe, beginning a process of spectacular natural aquatic habitat recovery.

The restoration of Pick Swamp has resulted in approximately 130 ha of land being permanently re-inundated, and the aquatic component has recovered spectacularly with minimal subsequent management intervention. This recovery was aided by the fact that Pick Swamp was strategically selected for its restoration potential; being adjacent to an existing Conservation Park and having excellent prospects for natural regeneration. As well as hosting a wide range of different vegetation types, Pick Swamp has become a stronghold for the nationally threatened Australasian bittern and dwarf galaxias, and the site has become a key drought refuge habitat capable of hosting thousands of waterbirds. Just five years after restoration works commenced in 2007, the site was included in the Piccaninnie Ponds Karst Wetlands Ramsar site listing at the end of 2012 – a testament to successful habitat recovery.

A further demonstration of the success of this ongoing restoration project has been the recent reintroductions of two nationally listed threatened species, each with very specific habitat requirements, the Yarra pygmy perch and the swamp greenhood (both of which are listed as vulnerable).

**RIGHT: The Swamp Greenhood (Pterostylis tenuissima)**

**Oblique image looking east over Pick Swamp before and after restoration; Jan 2003 (left) – Jan 2014 (right)**
The Restoration of Pick Swamp: 2007 - 2012

May 2007 (before restoration)

July 2007 (several weeks after restoration commenced)

June 2012 (5 years post-restoration – note the natural recovery of aquatic plants)

Long Swamp is a 15 km long coastal freshwater wetland complex within Discovery Bay Coastal Park, located immediately behind the coastal dunes, east of Nelson. The wetland system supports a diverse suite of nationally threatened species and is currently undergoing a Ramsar nomination process. Despite its size, reserved status and impressive biodiversity values, including recognition on the Directory of Important Wetlands in Australia, the local community in Nelson had expressed concern for over a decade about the impact that two artificial outlets to the ocean were having on wetland condition. The outlets were cut during an era when the swamp was grazed, many decades before being dedicated as a conservation reserve in the 1970s.

While the wetland originally discharged into the ocean via Oxbow Lake and the Glenelg River mouth at Nelson, these changes to hydrology caused an interruption of flows, contributing to a long-term drying trend within the wetland complex. This situation highlights a dilemma with altered wetlands in protected areas where, unlike modified wetlands on cleared farmland, rapid native vegetation change can mask the degree and extent of modification that has occurred or may be underway. As a relatively flat, extensive, coastal freshwater wetland ecosystem becomes drier, open water aquatic habitats are initially replaced by dense stands of reeds and sedges, and with sufficient drying can even transition to being invaded by encroaching shrubs. The wetland margin is invaded and sometimes totally displaced by true terrestrial (or dryland) species, such as coastal wattle and coastal bearded heath, as all the communities move ‘downslope’ in response to the change. As a result of this gradual process, which has accelerated since the exclusion of grazing, the site has been the subject of some long-running community debate about water management; because in its modern, modified condition, and despite strong observational information about the physical changes underway, it continued to support a wide range of valuable wetland habitats and a host of associated threatened species.

In 2012, Nature Glenelg Trust became actively involved in Long Swamp, working closely with Parks Victoria, the Nelson Coast Care Group, and the Glenelg Hopkins CMA; initially to undertake a scientific review of the aquatic ecological values that might be impacted by the ecological shifts anecdotally observed to be underway. This early work identified that the more remote artificial outlet to the sea (White Sands) had in fact naturally closed, with a dune forming in front of the former channel several years earlier during the Millennium Drought (c. 2005).

White Sands: LEFT, showing the artificial outlet in 2002, and RIGHT, the same area in 2014, years after natural closure

The ecological benefits observed from the natural closure of the artificial outlet at White Sands included the recreation of an area of aquatic habitat immediately upstream of the former outlet that is now home to a
diverse native freshwater fish community, including two nationally threatened fish species, the Yarra pygmy perch (*Nannoperca obscura*) and dwarf galaxias (*Galaxiella pusilla*). This work and other investigations led to the planning of a restoration trial aimed at regulating or possibly blocking the second and final artificial outlet at Nobles Rocks.

Overall objectives of this restoration project are to increase the availability, diversity and connectivity of aquatic habitats throughout Long Swamp, in order to benefit a wide range of wetland dependent species. As well as undertaking basic monitoring across a broad range of taxonomic groups (birds, vegetation, frogs), the project has a particular emphasis on native freshwater fish populations (being a key conservation asset that is most sensitive to hydrological change) as a primary indicator of project success.

The restoration trial has progressed in three stages over the past two years, enabling NGT to progressively record and measure the impacts of hydrological restoration in real time, and provide the information necessary for determining a future permanent solution.

A series of gauge boards with water depth data loggers were also placed at key locations in the outlet channel and upstream into Long Swamp proper, to monitor the change in water levels throughout each stage of restoration and into the future.

The first two stages of the restoration trial in May and July 2014 involved 56 volunteers from the community working together to construct low-level temporary sandbag structures, initially at the most accessible and technically feasible sections of drain under flowing conditions. Tackling the project in stages enabled us to learn sufficient information about the hydrological conditions at the site in 2014, before commencing the third and final stage of the trial in March 2015. On the 27th April 2015, the main structure was completed, following two days of preparation and nine days of sandbagging (using about 6,600 sandbags), which were put in place with the dedicated help of over 30 volunteers (many of whom attended over several days). To achieve our target operating height, the structure was raised by a further 30 cm in August 2015, using a further 400 sandbags, meaning a grand total of 7000 were used in phase 3!

Water levels in the swamp immediately upstream of the final structure increased, in the deepest portion of Long Swamp, from 34 cm (in April 2015) to 116 cm (in early Sept 2015).

**RIGHT: Aerial view of Nobles Rocks artificial outlet, detailing the location of the three trial sandbag structures.**

**Phase 1** – May 2014

**Phase 2** – July 2014

**Phase 3** – April 2015

**LONG SWAMP**

**NOBLES ROCKS**

**RIGHT: Celebrating the completion of the third and final sandbag structure with some of the many dedicated volunteers from the local community.**
Further upstream, in a shallower zone more representative of the impact on wider portions of Long Swamp, levels increased from being dry in April 2015, 14 cm deep in May, through to 43 cm deep in early September 2015, as shown below. This is a zone where the shrub invasion is typical of the drying trend being observed in Long Swamp, and hence will be an important long-term monitoring location.

_Further inland in the swamp after the Phase 3 structure was complete, shown above in May 2015 (14 cm deep); and below, 4 months later in September 2015 (43 cm)._  

The body of deeper fresh water first observed and mapped at Nobles Rocks in 1850 has reformed. As anticipated, parts of this newly inundated area have undergone an obvious immediate shift; from supporting a drying plant community to true aquatic flora. An example of this (aquatic reed beds) is shown below.

_The Long Swamp Restoration Trial: 2015 - 2016_

_March 2015 – Before the final phase commenced_

_Winter 2015 – Phase 3 structure operational_

_Spring 2015 – Peak levels achieved in 2015_

_March 2016 – What a difference a year makes!_
Oblique view over Long Swamp, in the area of restored wetland habitat inland from Nobles Rocks, as its appearance has changed during the implementation of the trial. The restored outflows will improve downstream wetlands in Long Swamp, resulting in increased flows towards the Glenelg River, into Oxbow Lake at Nelson.

Meaningful community participation has been one of the most critical ingredients in the success of this project so far, leading to a strong sense of shared achievement for all involved. Monitoring will continue to guide the next steps of the project, with the ultimate aim of informing a consensus view (among those with shared interest in the project) for eventually converting the trial structure to a permanent solution.

For more information on the future progress of the Long Swamp Restoration Project or our other work, please visit the NGT website: www.natureglenelg.org.au, or contact us by emailing info@natureglenelg.org.au.

Major supporters of the restoration of Discovery Bay wetlands presented in this summary: