Senate Select Committee into the Murray Darling Basin Plan

Submission from: Prof. Peter Gell (Federation University Australia)

There is clear evidence that the natural systems of the Murray Darling Basin have been impacted severely by the activities of European people. Few recognise that this impact has a long history with changes evident from the mid-late 19th century[1], but particularly from after the regulation of the river systems from the 1920-30s. It stands that few if any of the natural systems of the southern basin remain unimpacted by salinity, nutrients, sediments or flow changes.

Water resource development across the MDB has occurred in concert with a highly variably climate associated with the well known ENSO cycles, but also the multi-decadal cycles of flood and drought dominated regimes (FDR; DDR) associated with the Pacific Decadal Oscillation. Variability is the norm with floods occurring in DDRs and vice versa. Much of the water resource development across the Basin occurred during an FDR (1946-76) when water resources appeared unlimited[2]. A longer term understanding of variability may have lead to more conservative water impoundment development and allocations. Providing warmer climates do not interfere with ENSO and PDO circulations we can expect both wet and dry phases of these phenomena to continue into the future. However, the Southern Annular Mode, which describes the track of the winter westerlies, has been shifting for several centuries[3] and the southern growing season has become truncated as a result. So, on average the southern Basin is expected to dry. Given the increased energy in, and moisture holding capacity of, the atmosphere the amplitude of ongoing variability may increase.

A prominent measure, within the Basin Plan, to rehabilitate the natural systems was to return considerable volumes of water to the environment. A strong case was made for volumes to be directed to South Australia on the basis that the Lower Lakes were always fresh and that the State had an obligation to retain the natural ecological character as described in the 1985 Ramsar listing. In fact there is no such obligation with respect to the ecological character as nations can notify the Ramsar Secretariat of change in 'natural' character. Further, Ramsar is increasingly understanding the limitations of a static character description and is accommodating greater variation in the understanding of ecological character. Nations are expected to work towards retaining the listing *criteria* and so the management focus should be more on this than on a static baseline[4].

Historical and paleoecological evidence reveals that both the Coorong and Lake Alexandrina were tidal before regulation – with the influence of sea water attenuating away from the Murray Mouth. Given the high seasonal and interannual variability in rainfall and flow the natural condition of Lake Alexandrina is highly likely a fresh to tidal system with the effect of sea water greatest, and most extensive, in drought years and dry months. Further, the greater hydrological efficiency of the Goolwa channel means that, in average conditions, most freshwater flowed preferentially via that route, and so the influence of river water was

also spatially variable. That said, even the Goolwa Channel was unequivocally tidal before the barrages were commissioned.

The Coorong was also unequivocally tidal for its entire existence, but it was mostly subsaline[5]. That is, some freshwater inflow ensured the Coorong was a shandy of sea water and fresh. The absence of river plankton in the Coorong sediment record suggests that, historically, the Coorong was freshened by water from the Upper South East, rather than the River Murray, an observation reinforced by ethnohistoric evidence, but challenged by modelling. Extensive drainage of the Upper South East has now rid freshwater to the sea, and the quality of this is now compromised. The mis-identification of the natural character of the South Lagoon as saline to hypersaline under Ramsar lead to an embargo on releases from the Upper South East to this system, leaving it vulnerable to extreme salinity under drought. The recent coincidence of limited releases and drought has driven ecological shifts that may challenge the capacity of management to retain listing criteria. Nevertheless, the best prescription here is to engineer greater marine water inflow with river flow critical in maintaining an open mouth. The provision of freshwater to the Coorong remains a challenge due to the degraded quality from the Upper South East. River water could be considered but large flows may tend to exit the system directly rather than flowing down the lagoon, and even then sit above the denser saline layers.

The identification of the river volume necessary to restore critical aquatic ecosystems has posed considerable challenges. Monitoring of the ecological response from watering is being undertaken to demonstrate the benefits of the release of this water across the Basin. This represents a considerable investment utilising considerable national research capacity. The redemption of water for the environment, under the Plan, has however, created hardship for water users and related communities, perhaps sooner than expected. The existence of the Senate Select Committee is clear evidence of that. The legacy of historical ecosystem degradation, over allocation of the water resource and a variable, and drying, climate has inevitably conspired to create a management challenge as great as any confronted across the planet. A solution, or even a part solution that acknowledges some losses in ecosystem condition and water supply, requires a nuanced approach and not one so heavily focussed on volume.

A comprehensive analysis of wetland condition across the basin has shown the condition of productive wetlands to be compromised by the increased flux of sediments, salts and nutrients, in part carried by the rivers[6]. Importantly this has clear impacts on natural systems, not least through the impact on the light environment of the water body, which is important to promote diverse aquatic plant beds. Given the quality of the water source for environmental watering is compromised, a risk under the allocation of expensive and high contested water volumes under the Plan is that the ecological response is subdued. There is a well established tenet in river management in that it is best to tackle water quality before entering into a contest over volume. That said, it is clear that many elements of the natural

system require water of any quality. Given this a more nuanced approach to providing water for the natural environment would include analysis of both where water needs to be allocated but also what ecological benefit may be gained in a focus on the mitigation of the causes of water quality decline[7].

The Big Dry exposed the degree to which many communities within the Basin lacked sufficient adaptive capacity to climate variability and change. Without adaptive capacity the players have resorted to a contest over allocation and this appears to persist still. A process which pitches one community against another, or which subsidises the persistence of unsustainable practices, will not advance the case of improving adaptive capacity. Water price is one lever that may drive increased adaptive capacity but it does not quantify well the social costs of reduced economic activity in regional communities. The Basin could be better viewed as a social–ecological system whereby the Plan sets in place an adaptation pathway through the century where ecological benefits accrue from investment in both water quality and water volume, and regional industries and communities cede access to volume as water is released from the investment in water use and transfer efficiencies. Consequent changes in access to water of suitable quality for industry can be overcome by investment in infrastructure.

As with climate change adaptation, there are questions as to the justice of requiring this generation to bear all the costs for the remediation of impacts that have built up over more than a century. However, it stands that some natural ecosystems are under acute stress and need prompt remediation. An adaptation pathway for the Basin identifies priority interventions and develops a program of measures that allows for the sharing of the cost equitably. It allows communities to persist, adapt and thrive and retains, and perhaps even augments, the communities' commitment to maintaining the quality of the natural assets of the Basin, once their own futures are assured.

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