Regional scale modelling of the lower River Murray wetlands

A model for the assessment of nutrient retention of floodplain wetlands pre- and post-management

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Declaration

I declare that this thesis is my own work and to the best of my knowledge and belief, contains no material used for the award of another degree, or published or written by another person(s), except where appropriately referenced in the text. To the best of my knowledge and belief, this thesis contains no material previously published or written by another person, except where due reference has been made in the text.

I consent to a copy of my thesis, when deposited in the university Library, being made available for loan or photocopying.

Kjartan Tumi Bjornsson

Date 2007

Acknowledgements

This project used monitoring data from several sources. River flow data, which is collected at all locks, was obtained from the Murray Darling Basin Commission (MDBC). This flow data, which was included in the model, was collected at Locks 1 through to 8 (Figure 12 on page 65). The River Murray nutrient data was provided by the Department of Environment and Heritage of South Australia (DEH). This nutrient data was a collection of data originally sourced from the South Australian Environmental Protection Authority (EPA), the MDBC, and the South Australian Department of Water (SA Water). The river nutrient data monitoring points are at Lock 5, Mannum, and Murray Bridge. For simplicity in this report, all river data is referred to consistently as MDB river data. However, the contributions by the MDBC, DEH, EPA and SA water are gratefully acknowledged, as without their support this project would not have been possible.

Planning SA provided GIS data covering the wetlands (the South Australian Wetlands Atlas (Jensen *et al.* 1996)), Locks, and the River Murray. Wetland Care Australia provided the Wetlands Management Study report 1998 ((Nichols 1998)), which was used in obtaining wetland depth information. Solar radiation was obtained from the Bureau of Meteorology (BOM). Bartsch (1997) Marsh (1997) Wen (2002a) Wielen (nd) have collected a substantial quantity of water quality data for some wetlands of the lower River Murray, as well as irrigation drainage into affected wetlands and some river data at a site close to the wetlands for the same monitoring dates. Table 1 on page 64 describes the source and frequency of data collection. I thank them for their contribution of data.

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Abstract

Most of the lower River Murray and its floodplain wetlands are impacted upon by degradation caused by river regulation. Increasingly the restoration of these ecosystems and the river water quality has become a high priority for federal and state governments and associated departments and agencies. Public concern is adding to the pressures on these departments and agencies to restore these ecosystems and to sustainably maintain the river water quality.

The long term monitoring of floodplain wetlands has been limited, compounding the difficulties faced by managers and decision makers on assessing the potential outcome of restoration options. The role of this project in the broad scheme of restoration/rehabilitation is to contribute to the construction of a model capable of increasing managers and decision makers understanding, and build consensus of potential outcomes of management option. This model was to use available data.

The developed model, based on WETMOD developed by Cetin (2001), simulates wetland internal nutrient processes, phytoplankton, zooplankton and macrophyte biomass as well as the interaction (nutrient and phytoplankton exchange) between wetlands and the river. The model further simulates the potential impact management options have on the wetlands, and their nutrient retention capacity, and therefore their impact on the river nutrient load.

Due to the limitation of data, wetlands were considered in categories for which data was available. Of these two had sufficient data to develop, calibrate and validate the model. Management scenarios for these two wetlands were developed. These scenarios included, the impact of returning a degraded wetland in a turbid state to a rehabilitated clear state, and the impact the removal of nutrient from irrigation drainage inflows has on wetland nutrient retention, and consequent input to the river.

Scenarios of the cumulative impact of the management of multiple wetlands were developed based on using these two wetlands, for which adequate data was available, as “exemplar” wetlands, i.e. data from these wetlands were substituted for other similar wetlands (those identified as belonging to the same category). The model scenarios of these multiple wetlands provide some insight into the potential response

management may have on individual wetlands, the cumulative impact on river nutrient load and how wetland morphology may relate to management considerations.

The model is restricted by data availability and consequently the outputs. Further, some limitations identified during the development of the model need to be addressed before it can be applied for management purposes. However, the model and methods provide a guide by which monitoring efforts can assist in developing future modelling assessments and gain a greater insight not only at the monitoring site but also on a landscape scale.