

Hydrology, Water Quality and Management Strategies
of a Coastal Floodplain Wetland,
New South Wales, Australia



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Abstract

Many coastal floodplain wetlands in northern NSW have been drained and fitted with one-way floodgates. These wetlands are often underlain by acid sulfate soils (ASS) that can release acidic by-products into the groundwater and surface water if oxidised. Little Broadwater, on the Clarence River, is typical of these altered wetlands. An ongoing restoration trial focussing on increased tidal exchange, initiated in June 2003, provided the opportunity to study the rehabilitation process taking place within the wetland. This study aimed to investigate the hydrology and changes in water quality characteristics during the re-establishment of tidal exchange at Little Broadwater.

Discharge water quality (pH, electrical conductivity (EC) and dissolved oxygen (DO)) were compared pre- and post-rehabilitation to determine if restoring tidal exchange improved discharge water quality. Monitoring of surface water and groundwater quality (pH, EC, DO, temperature, acidic cations, basic anions, total nitrogen and total phosphorus) was conducted over a 28-month period. Short-term monitoring was also conducted at two reference wetlands to compare spatial patterns and factors that affected water quality. The results of this study were used to develop a conceptual model of coastal floodplain wetland functioning, with particular reference given to Little Broadwater.

Restoring tidal exchange resulted in a substantial reduction in the duration, severity and frequency of acidic discharge. This was primarily due to reduced oxidation of ASS and dilution of drainage waters through inundation of ASS and increased exchange. However, there were still regions within Little Broadwater which were acidic for the majority of the study, and poor circulation within the wetland resulted in these acidic waters remaining ponded. Statistical analysis revealed significant spatial zonation of water quality within the wetland, which was primarily due to variation in salts, followed by ASS products and then nutrients. Poor circulation within the wetland was the major factor accounting for this spatial variation.

Although reflooding the wetland raised the watertable above the ASS layer, very acidic (average pH < 4) deep groundwater with very high concentrations of aluminium and iron was observed along the eastern boundary of the wetland. However, the presence of a semi-confining layer indicated that this deeper groundwater did not influence surface water quality

within the wetland. Rather, the shallow groundwater and sediments above the semi-confining layer influenced wetland water quality through direct exchange and the dissolution of acidic salts (on the sediment surface) by rainfall.

The conceptual model developed for Little Broadwater simplified the complexity of interactions between ecosystem components, indicating the implications of changing one or a number of components for future management. While the model was developed for ongoing management of Little Broadwater, observations of similar patterns in water quality in other coastal floodplain wetlands indicated the broader applicability of the model. Furthermore, the nature of the model allows for comparisons of processes within individual zones of the wetland. Management recommendations are made based on the outcomes of the rehabilitation trial, water quality and hydrology results, and the conceptual model. However, the characteristics of the wetland system, along with the current flood mitigation structures and land use, prevent Little Broadwater from being returned to an entirely natural condition.

Declaration

I certify that the substance of this thesis has not already been submitted for any degree and is not currently being submitted for any other degree or qualification.

I certify that any help received in preparing this thesis, and all sources used, have been acknowledged in this thesis.

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Signature

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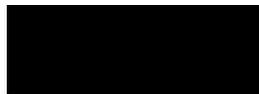
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