ACTIVE WATER MANAGEMENT TRIALS FOR THE REMEDIATION OF ACID SULFATE SOILS BACKSWAMPS, KINCHELA CREEK, NEW SOUTH WALES, AUSTRALIA.

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BACKGROUND

Backswamp wetlands of reeds and sedges once covered large areas of the Macleay River floodplain (Hodgkinson 1844). In the early 1960s the CSIRO discovered that these backswamps were underlain by acid sulfate soils (ASS) (Walker 1961, 1963), advised that "*It is doubtful whether reclamation ... is feasible…the maintenance of a low water-table would aggravate the acid condition of some swampland soils…"* (Walker 1963). Nevertheless, an extensive system of drains, levees and flood control structures was constructed in the 1960s and 1970s. Although frequently justified on flood mitigation grounds, an additional, and often primary, motive for these works was the 'reclamation' of dry land, often by the drainage of backswamps (Tulau in press). The Macleay flood mitigation system now includes 138 km of drains, 180 flood control structures and 352 floodgates (Henderson 2001). This has caused the oxidation of sulfidic estuarine clays and the export of acid and metal by-products to receiving waters. The legacy of this over-drainage has included: poor water quality; fish kills; loss of aquatic habitat; major changes in wetland vegetation; extensive acid scalding; increased soil salinity; land slumping; and wind erosion.

Changes in community values and farming practices have resulted in a critical examination of the flood mitigation and drainage scheme, including of the environmental and social impacts. It is now recognised that many of the swamps have been over-drained - that there is a need to "keep the wetlands wetter" (Dutton 1998).

SITE DETAILS

The Kinchela backswamp is part of a larger contiguous backswamp basin encompassing most of the floodplain south of the Macleay (Figure 1). The Kinchela backswamp comprises 2, 671 ha, with elevations 0 - 2 m AHD (Tulau & Naylor 1999). The swamp has been listed in the Directory of Important Wetlands in Australia (ANCA 1996), and a large area centred on Swan Pool is SEPP 14 Coastal Wetland No. 458. Most of the backswamp is privately owned. The backswamp has also been classified as 'ASS 'hot spot' (Tulau & Naylor 1999).

The swamps are replenished by the distributary streams Belmore River and Kinchela Creek during flood events. Controlled discharge into the backswamps occurs through flood control structures - the swamps are used as flood storage basins which sacrifices poor agricultural land to protect more valuable upper levee land (Dutton 1998). Waters in the backswamps are then drained back into the Belmore River and Kinchela Creek via the drains and floodgates (Dutton 1998). Some drains are owned and managed by Kempsey Shire Council, some by Drainage Boards, and some by individual landholders (Tulau & Naylor 1999).

The Belmore River and Kinchela Creek both have a history of fish kills and periodic poor water quality including black water, low dissolved oxygen, low pH, and elevated levels of aluminium and iron (Walker 1961, Tulau & Naylor 1999).

REMEDIATION STRATEGY

The most appropriate remediation strategy is containment by fresh water ponding. Waters are contained by in-drain structures (low weirs) which raise drain water levels, minimise the drying of the sulfidic/sulfuric layers, and reduce or eliminate ground water flow from the soil to the drain (effluent flow). Water can be decanted from the river to top up the wetlands, particularly from September to February. Water is lost from the site primarily by evapotranspiration.

Funded by the ASS Program (ASSPRO), the Macleay ASS Local Action Group (MASSLAG), comprising landholders, fishers, local and State government, and environmental representatives, are trialing simple floodgate modifications to allow active water management involving on-site broadacre water retention to 600 ha of wetland (Henderson 2001). The project aims include: improved water quality; reinstatement of wetland values; and landholder participation in ASS management.

Current projects are: the installation of a floodgate lifting crane and winch, an in-gate adjustable window, and a drop-board weir at Wilsons Drain; installation of drop-boards on Council Drain; installation of lifting devices on floodgates and bucket weirs on Irwins Drain; and installation of a lifting device on one floodgate on Bradleys Drain.

OUTCOMES

Weirs have been set and water ponded to a maximum depth of 0.5 m in the lowest parts of the wetlands. After ponding, an ASS scald that was producing run-off water with pH 3-4 is now revegetated and producing typical water quality of pH 5-6.5. Generally, surface ponded waters are not acid, as they do not mix with acid ground waters. Sulfide reduction may also occur in soils due to anaerobic/organic conditions. Although drain waters are generally acid, displacement of these waters will only occur in diluted form.

The projects have cost $4 300 (ASSPRO) plus an additional $1900 to date. This has funded the manufacture and installation of modifications to four existing floodgate structures. Modifications were designed, manufactured and installed by landholders. Advantages of these techniques are that they: are cheap; require limited management and maintenance; can be transferred to other broad-acre operations; reduce poor quality water discharges; provide valuable pastures; and reinstate wetland values.

MONITORING

Kempsey Council operates continuous real-time dataloggers. MASSLAG carries out event-based water quality testing, and monitors the movement and ponding of water in response to active water management, climatic and tidal influences. Native vegetation and introduced pasture species will also be monitored. Responses in the severity of episodic events may not be apparent short term.

LIMITATIONS

Some limitations to success have included the following: sites are susceptible to evaporation and oxidation of monosulfides during drought; concerns that high rainfall may displace acid water; delays associated with approval processes; resistance to changes in land use practices; and resistance to enter into formal management agreements. Concerns have also been raised amongst some landholders that the weirs reduce the flood mitigation function of the drains, although this is not the case. It is also noted that certain hydrologic and chemical processes associated with ponding are not fully understood.

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Figure 1. Project site location.