Hydrogeology of Noobijup Lake, Muir-Unicup Catchment, Western Australia: Implications for environmental water requirements

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26th October 2011
Abstract

The Muir-Unicup Natural Diversity Recovery Catchment is under threat from altered hydrology, in particular the biodiversity values are at risk. Previous studies in the catchment have identified differences between wetlands and have driven the need for understanding on a local wetland scale. Noobijup Lake is a peat wetland within the Muir-Unicup Catchment that supports a rich suite of flora and fauna. This study is a hydrogeological investigation of the Noobijup Lake wetland and has three major outcomes: quantification of Noobijup Lake hydrological stores and fluxes, assessment of the sensitivity of the wetland to declining rainfall trends and characterisation of the wetlands groundwater surface-water interactions. Methodology involved the development of a conceptual hydrogeologic and water balance model (including a sensitivity analysis) and then use of this model to simulate the lakes hydrology under a drying climate regime. Results from the model show precipitation comprises~95% of the Noobijup Lake water balance inputs and is the model parameter with the highest sensitivity rating. The models only output parameter is evapotranspiration and the contribution of groundwater and surface water to the balance is small; comprising 3.6% and 1.5% of total inputs respectively. Despite this, groundwater inflows maintain moisture in the peat during summer and reduce the potential oxidation of sediments. This has three benefits; firstly it reduces the conversion of potential acid sulfate soils to acid sulfate soils, secondly it reduces potential fire hazards and thirdly allows persistence of a moist habitat for hibernating fauna such as frogs. The groundwater surface-water interactions have been characterised as a flow-through regime for ten months of the modelled period, for the remaining two months the lake is characterised as a recharge regime. Drying climate water balance scenarios indicate the Noobijup Lake bed sediments are particularly vulnerable to drying out. This will be detrimental to the biodiversity of Noobijup Lake’s flora and fauna, particularly the sedge (Baumea articulata) that covers the lake bed and may have serious implications for wetland acidification impacts to resident and migratory flora and fauna. The hydrophobicity of blue gum topsoil is a major concern in the catchment and has the potential to affect rainfall-runoff regimes and groundwater recharge. Removal of the plantations will affect Noobijup Lake by reducing groundwater recharge and overland flow thresholds.