Groundwater and stream water interactions in Widden Brook, Upper Hunter Valley, N.S.W.

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Drought conditions related to El Nino episodes in the last two decades and unsustainable levels of groundwater extraction have significantly altered the hydrology of catchments in south-east Australia. Stream water and groundwater interactions play a vital role in the health of riverine ecosystems. These interactions occur in the hyporheic zone, which is the mixing zone between groundwater, shallow sandy aquifer water and stream water.

A study of groundwater-stream water interactions is being conducted in Widden Brook, which is a tributary of the Goulburn River in the south-west region of the upper Hunter Valley, New South Wales. A piezometer network has been installed along five sections of the catchment to assess the groundwater quality in the shallow alluvial aquifers. Five wells and five spear points access groundwater from variable depths for irrigation. A water quality survey of stream and groundwater was undertaken in Widden Brook in May 2005, November 2005 and March 2006.

Stream water chemistry results indicate increasing EC (150-580 µS/cm) and alkalinity along Widden Brook. Na is the major cation and increases in proportion to total cations (from ~ 50 to 90%) downstream. Groundwater chemistry is variable possibly reflecting different groundwater sources. Groundwater in the wells and piezometers situated on sodic floodplain terraces is oxidized and brackish (EC 1200-2400 µS/cm). Groundwater in the spear points and piezometers in the shallow alluvial aquifers is reduced though less brackish, with EC in the range of 500-900 µS/cm.

The bicarbonate/chloride ratio of both stream water and groundwater is generally > 1, suggesting the input of ions as a result of mineral weathering into the stream water and groundwater aquifers. Trace metal (Sr, Ba, Cr, Cu and Ni) concentrations in stream water are low, ~ 1-10 ppb, but approximately an order of magnitude higher in groundwater, consistent with groundwater-rock weathering reactions at variable depths in the regolith. Results suggest a Na-Mg-HCO_3-Cl groundwater-stream water system in the Widden Brook catchment which is a variation of other studies of water chemistry in the south-west upper Hunter Valley.