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Recharge and discharge estimation in data poor areas of Australia

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Determination of an accurate groundwater balance for a region requires estimation of recharge and discharge rates and, where possible, knowledge of their spatial distribution. Where the value of the resource warrants it, detailed recharge and discharge studies are commissioned. These studies provide comprehensive empirical information on spatial and temporal variability of recharge, and the relationship between recharge rates and soil, regolith, landform and vegetation parameters. Where the value of the resource does not warrant detailed research, much cruder approaches (such as recharge is a simple percentage of rainfall or discharge is assumed to be non existent) are used. The aim of the project described here was to develop a nationally consistent approach to recharge and discharge estimation for data poor areas which is a half way house between using simple approximations and carrying out very detailed field and modelling studies.

This project involved two phases, the first of which compiled reviews of recharge and discharge studies that have been undertaken in Australia. It also involved preliminary identification of the parameters (climate, soils, regolith, near-surface geology, landforms, vegetation etc.) that determine recharge and discharge rates along with a review of the appropriate scale mapping approaches available for these parameters. The second phase of the project utilised empirical relationships derived from data collected in phase 1 of the project in a decision tree methodology that guides the user to the most appropriate estimate for recharge/discharge given the data availability. The decision tree has parallel pathways directing the user to estimates based on: (i) utilisation of statistically significant empirical relationships; and (ii) simple recharge and/or discharge estimation methods (e.g. chloride mass balance using groundwater samples). The decision-tree methodology is implemented in a Microsoft Excel spreadsheet which incorporates various parameters; for example mean annual rainfall, soil type, vegetation type, evapotranspiration and land use change. Other parameters considered include rainfall chloride flux, groundwater chloride concentration, watertable depth, surface soil and regolith type, and aquifer porosity. Where the user does not have access to these datasets, they are directed (wherever possible) to publically available GIS datasets. The Excel spreadsheet approach provides a single point estimate of recharge and discharge. The user is encouraged to divide the area of interest into sub-areas that have similar parameters pertaining to recharge and discharge. This ensures the true spatial variability is captured. National, regional and local datasets, used in conjunction with local hydrological knowledge, can be used to assist in the division of these sub-areas.