Modelling groundwater recharge and discharge in Motueka catchment

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Groundwater protection relies on an adequate knowledge of geographical distribution of the aquifer, groundwater recharge, discharge, and groundwater quality. Conventional field approach is costly and time consumptive, however, numeric models provide a feasible tool to estimate the groundwater recharge and discharge characteristics, which are crucial for efficient development and management of groundwater resources. The objectives of this work are to spatially estimate the groundwater recharge and discharge in a series nested subcatchments in Motueka based on the practical modelling approach, and, evaluate the groundwater resource by different land covers.

Soil Water Assessment Tool (**SWAT**) is a continuous, physically based, parameter distributed catchment model that operates on a daily time-step. The hydrological processes of SWAT model include precipitation, surface runoff, soil and root zone infiltration, evapotranspiration and soil and snow evaporation, and groundwater flow. Surface runoff is estimated by Soil Conservation Service (SCS) curve number method. A storage routing technique is used to predict flow through each layer in the root zone as the percolation and lateral subsurface flow in the soil profile (0–2 m) is calculated simultaneously with percolation. The magnitudes of the vertical (percolation) and horizontal (lateral subsurface flow) components are determined by a simultaneous solution of the two governing equations. A shallow aquifer storage used by the model is recharged by the percolation from the bottom of the root zone.

The calibration of SWAT is primarily based on the relative contributions of baseflow and surface flow to the streamflow. An automated digital filter program is used to separate the measured daily streamflow into baseflow and storm flow. The heterogeneous groundwater contribution pattern found in different subcatchments in Motueka catchment (Table 1) is attributable to the land cover/land use, geology, soil, topography and climatic variability.

Table 1 The percentage of groundwater contribution to the streamflow in different subcatchment in Motueka catchment (Code and gage location are shown in brackets)

Subcatchments in Motueka	Percentage of baseflow (%)	Baseflow Days
Woodstock (57009)	23	47.5
Baton (Baton Flats, 57004)	53	28.5
Motueka (Gorge, 57008)	49	57.4
Motupiko (Christies Br, 57036)	29	47.6
Tadmor (Mudstone, 57024)	26	36.3
Waiwhero (Rosedale Weir, 57007)	26	36.2
Hope (Tadmor saddle, 57035)	66	43.9
Wangapeka (Walter Peak, 57025)	37	51.1

After the streamflow and the fraction the groundwater contribution to the streamflow are spatially calibrated based on actual measured streamflow and the separation technique, the simulated groundwater recharge and discharge by different land covers /land uses in different subcatchments are explored to addressing the groundwater recharge and discharge.

407 subbasins and 902 hydrological response units are delineated to spatially

represent the heterogeneity of the catchment on the soil, land cover variability. The daily output of the recharge and discharge of the groundwater over time indicates the groundwater dynamics under different land use scenarios and presents the particular spatial patterns throughout the catchment. The conclusion on groundwater recharge and discharge is drawn based on above analysis.