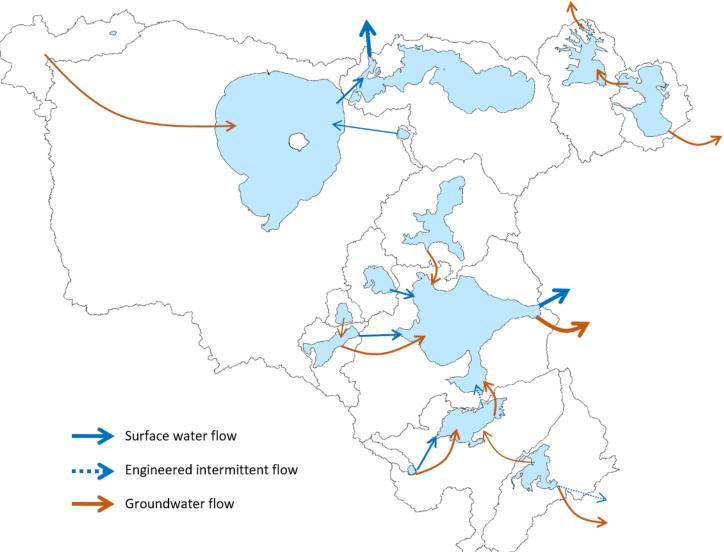
## Water quality modelling of Lake Okareka

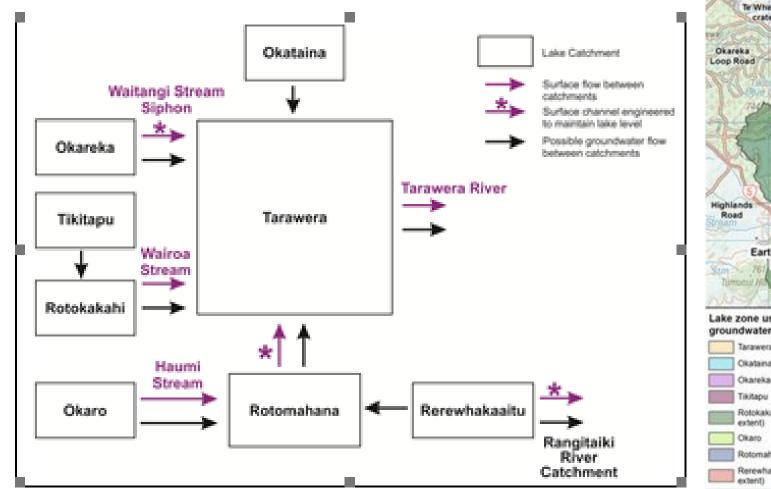
David Hamilton 19 April 2018

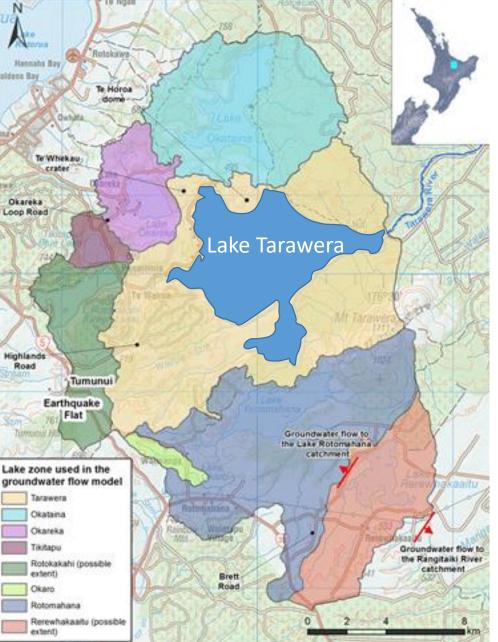


## A perspective on where the water goes in the Rotorua /Te Arawa lakes



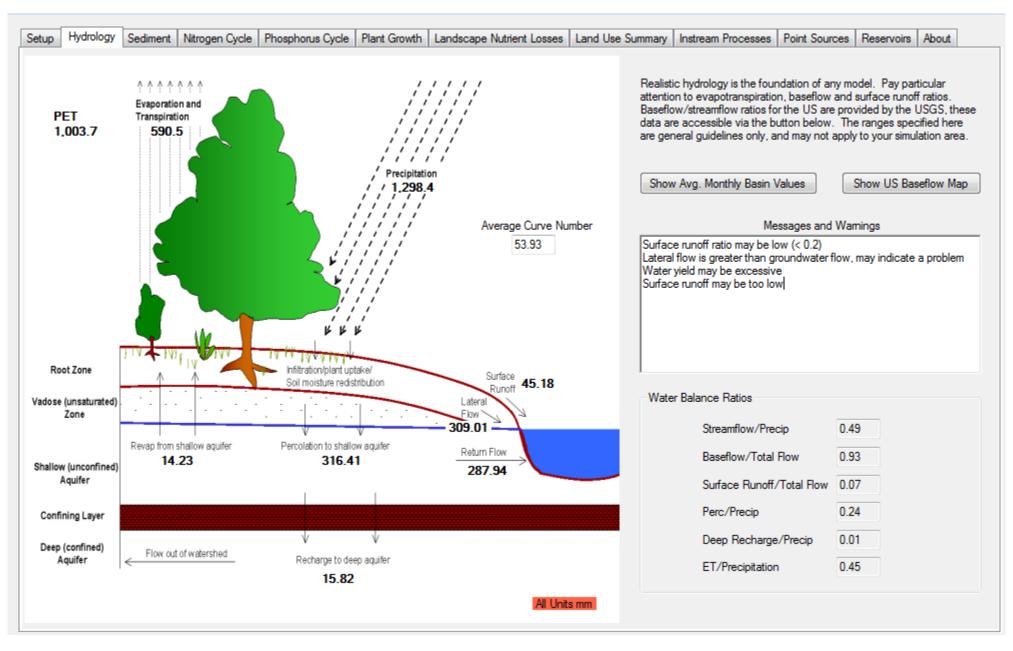
## Tarawera subcatchments and water balance



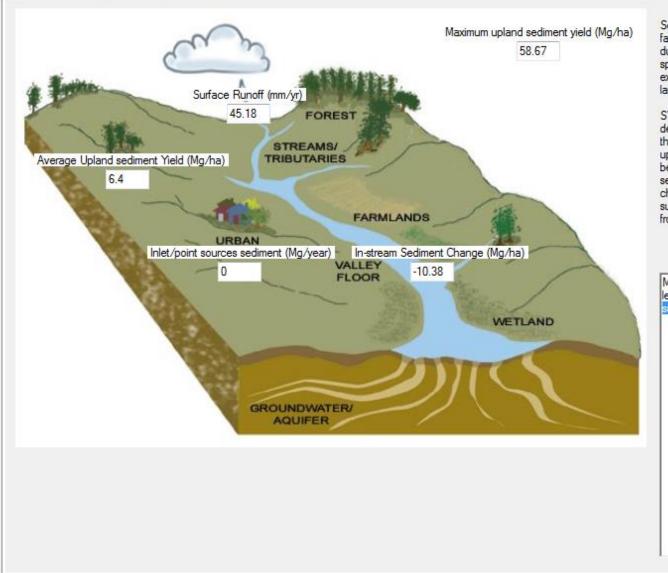


Paul White, GNS

## The Surface Water Assessment Tool (SWAT) Model – Water Balance



## The Surface Water Assessment Tool (SWAT) Model – Sources of water, sediment and nutrients



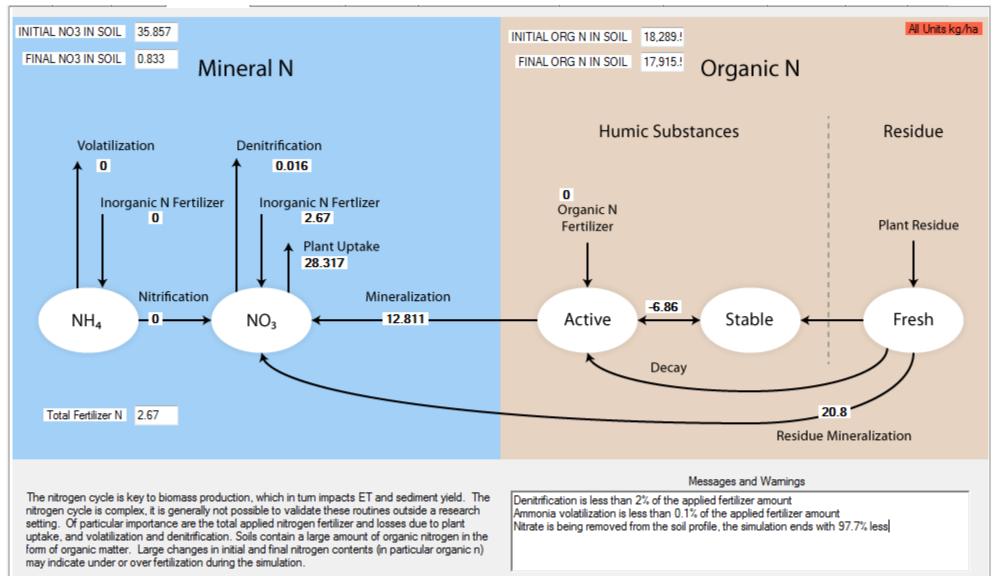
Sediment loss form the landscape is dependent upon many factors. Sediment overestimation in SWAT is most commonly due to inadequate biomass production. This often occurs on specific land uses. If your maximum upland sediment yield is excessive, use the landuse summary tab to identify the problem land use.

SWAT also modifies sediments to account for in-stream deposition and erosion of stream banks and channels. Often there is little or no measured data to differentiate between upland sediment and in-stream sediment changes. Streams may be either a net source of sediment, or a sink. In-stream sediment modification is impacted by physical channel characteristic's (slope, width, depth, channel cover, and substrate characteristics) and the quantity of sediment and flow from upstream.

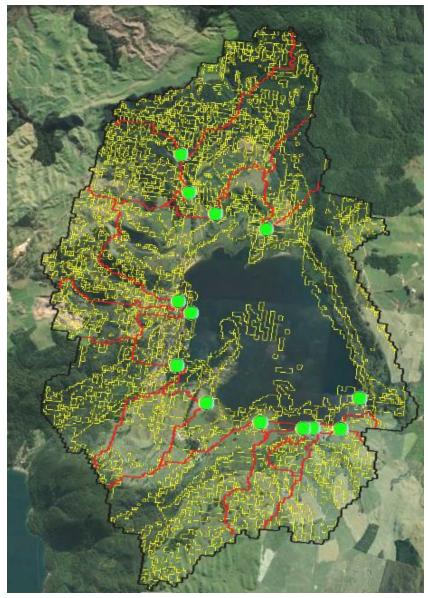
#### Messages and Warnings

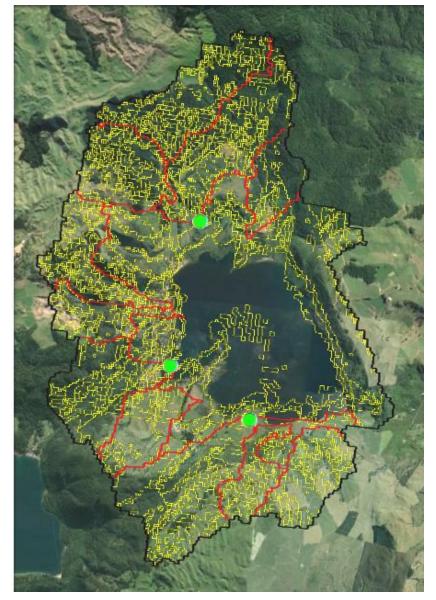
Max sediment yield is greater than 50 metric ton per ha in at least one HRU. The highest value is from HRU#: 254, subbasin#: 9, crop: PAST, soil: TeRangii

# The Surface Water Assessment Tool (SWAT) Model Nitrogen transformations

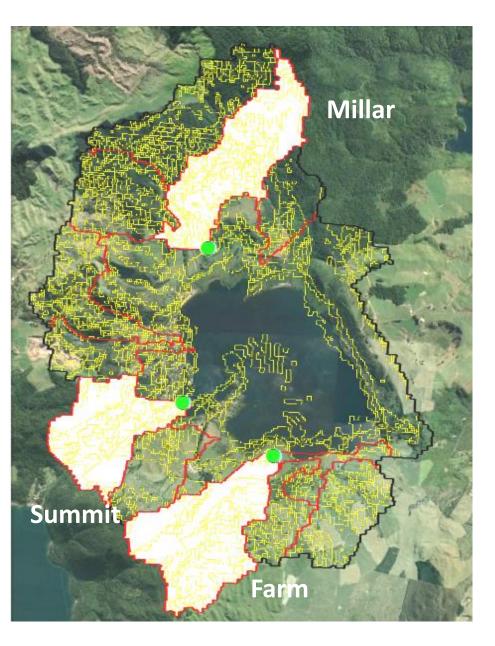


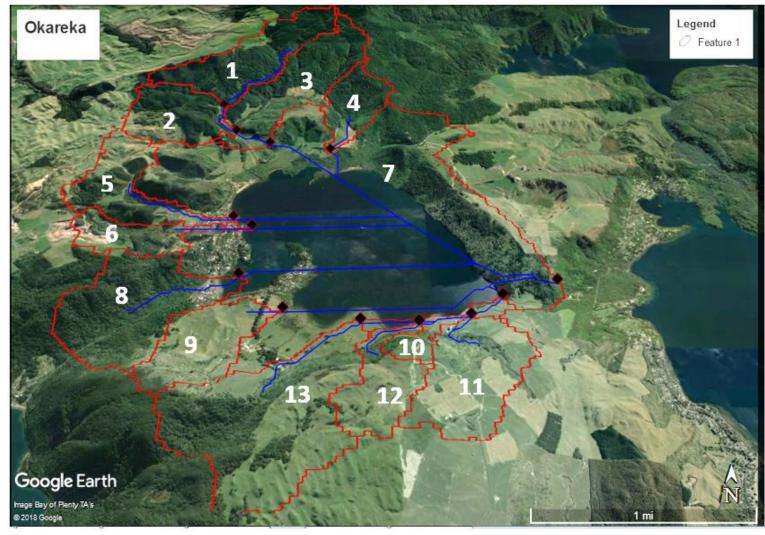
## Lake Okareka catchment showing 13 sub-catchments and 3 monitored streams (Millar, Summit and Farm)



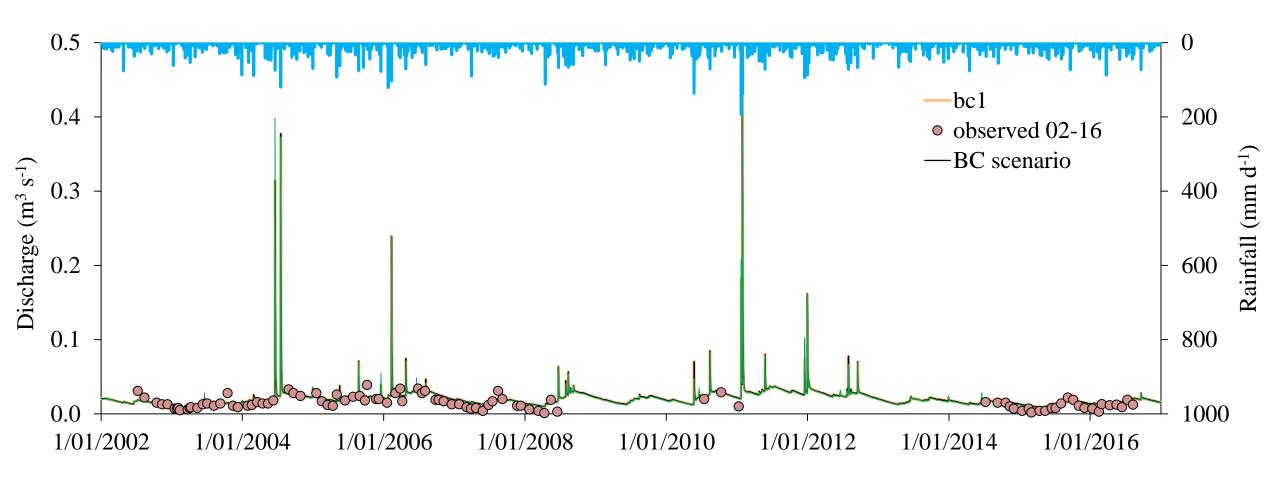


## Further delineation of Millar, Summit and Farm subcatchments

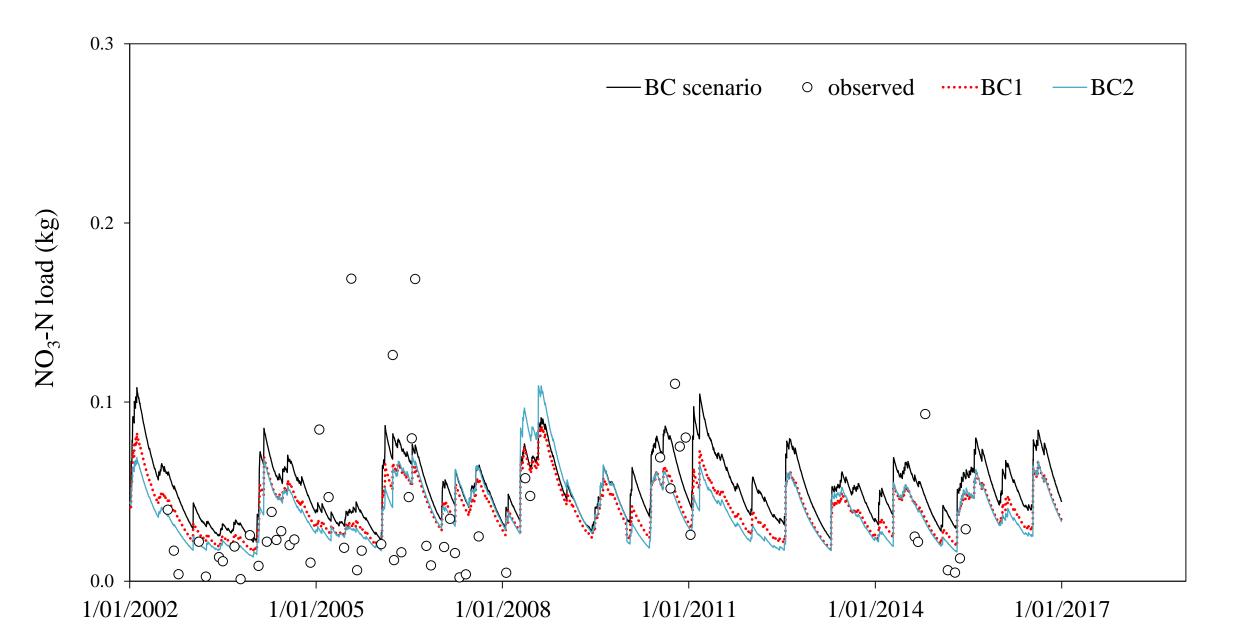




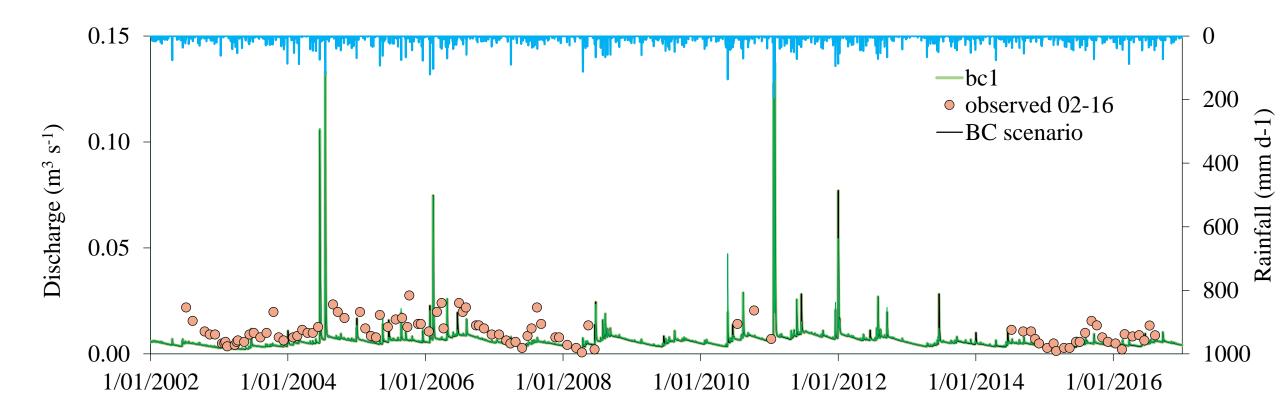
## Discharge (flow) at Millar and rainfall (Rotorua Airport)



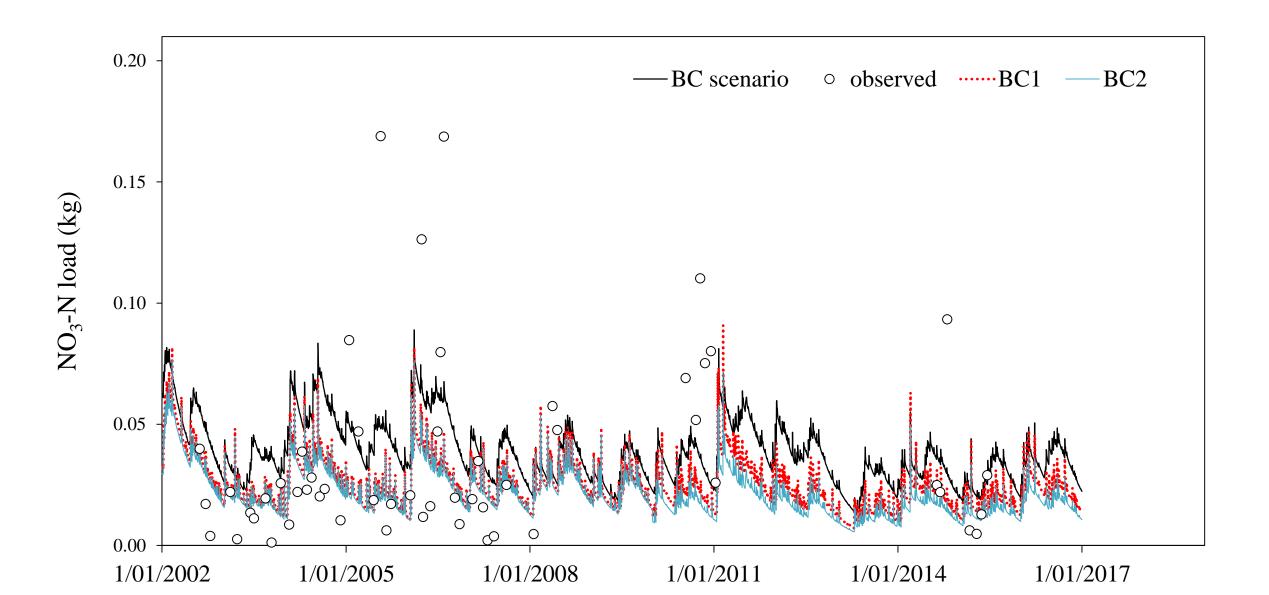
## Miller Stream nitrate load



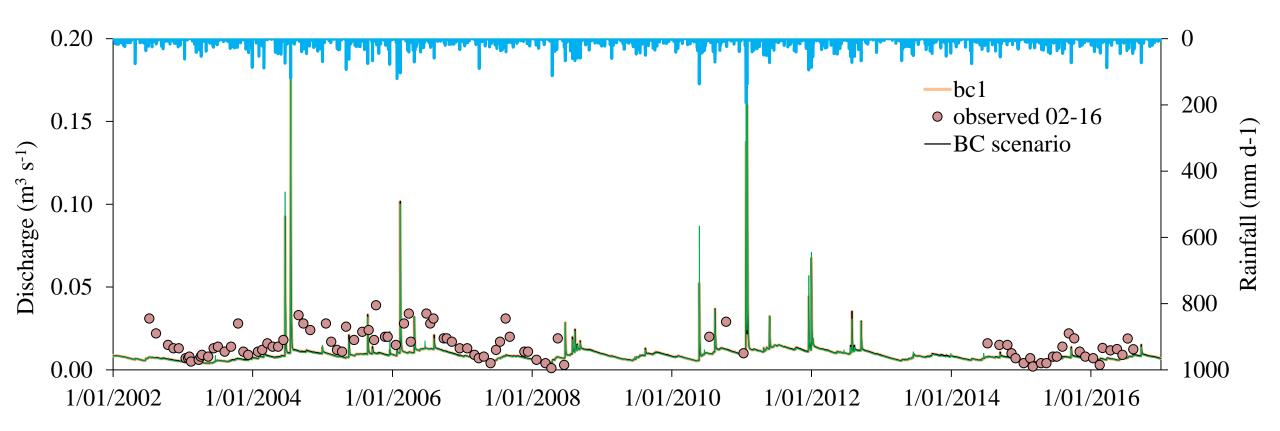
## Discharge (flow) at Summit and rainfall (Rotorua Airport)



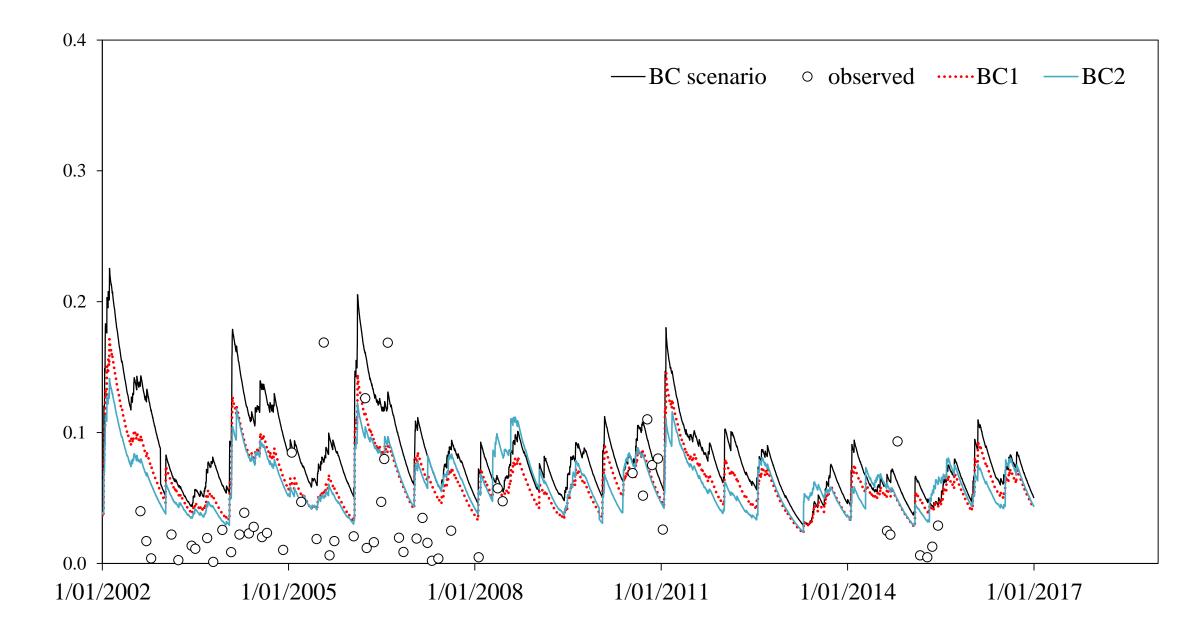
## Summit Stream nitrate load



## Discharge (flow) at Farm and rainfall (Rotorua Airport)

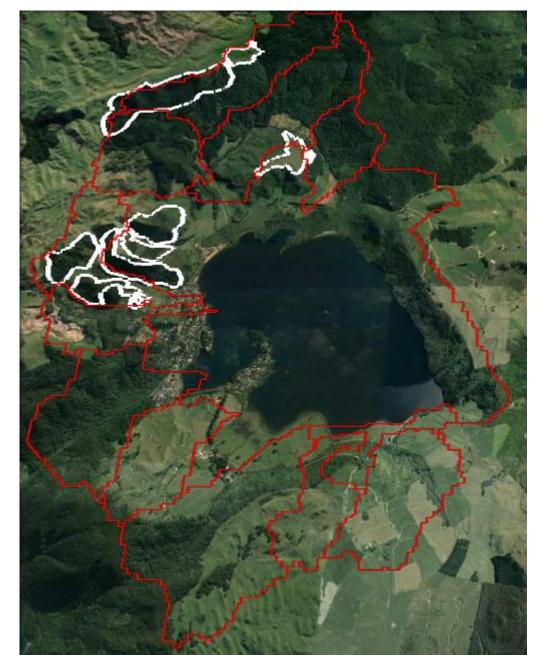


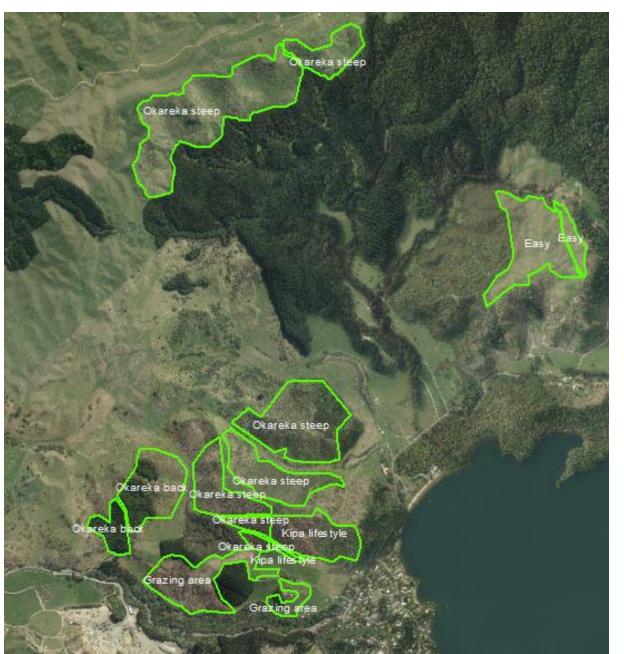
## Farm Dam nitrate load



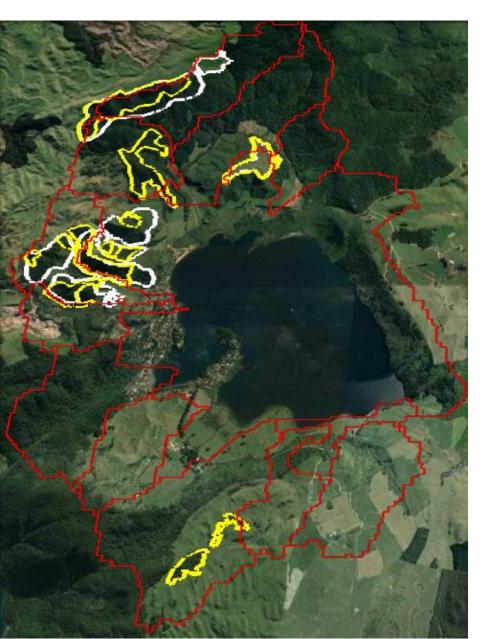
NO<sub>3</sub>-N load (kg)

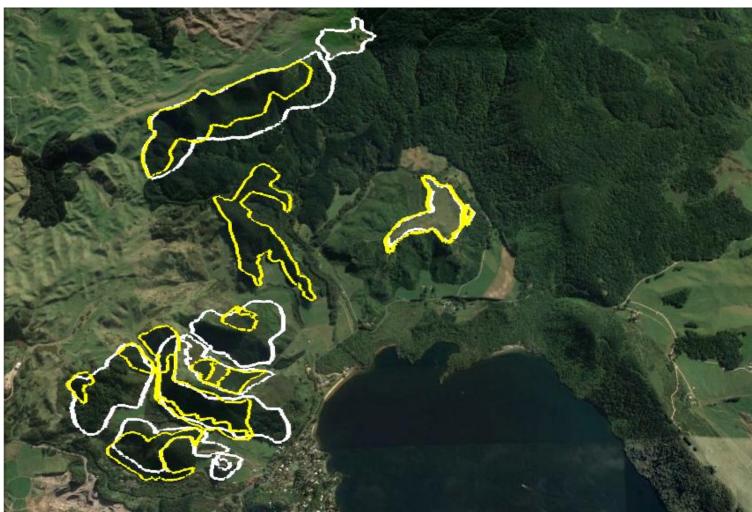
### Areas marked for pine plantation (white). Red polygons are subcatchments



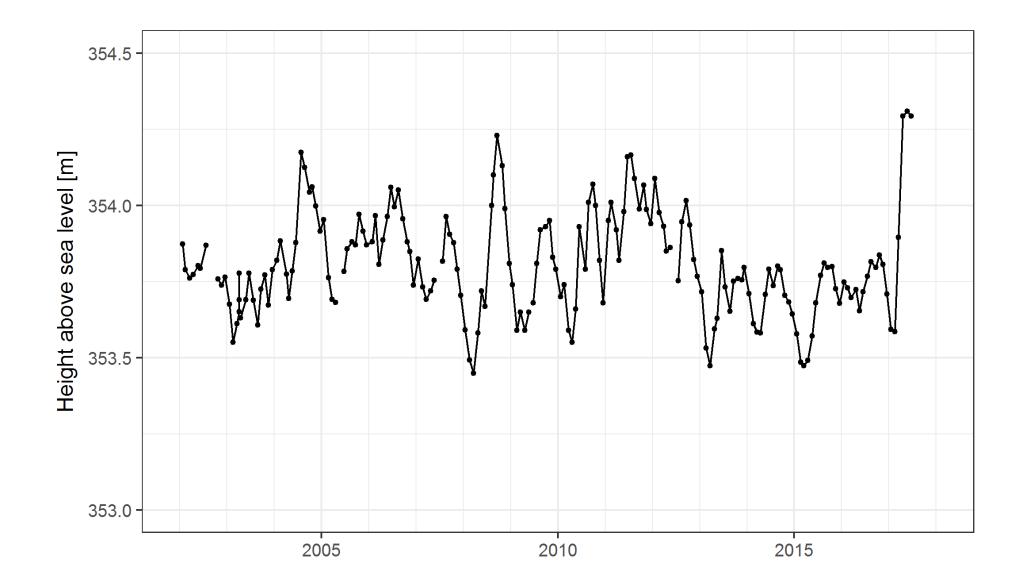


Actual (white) vs proposed (yellow) areas of pine plantation

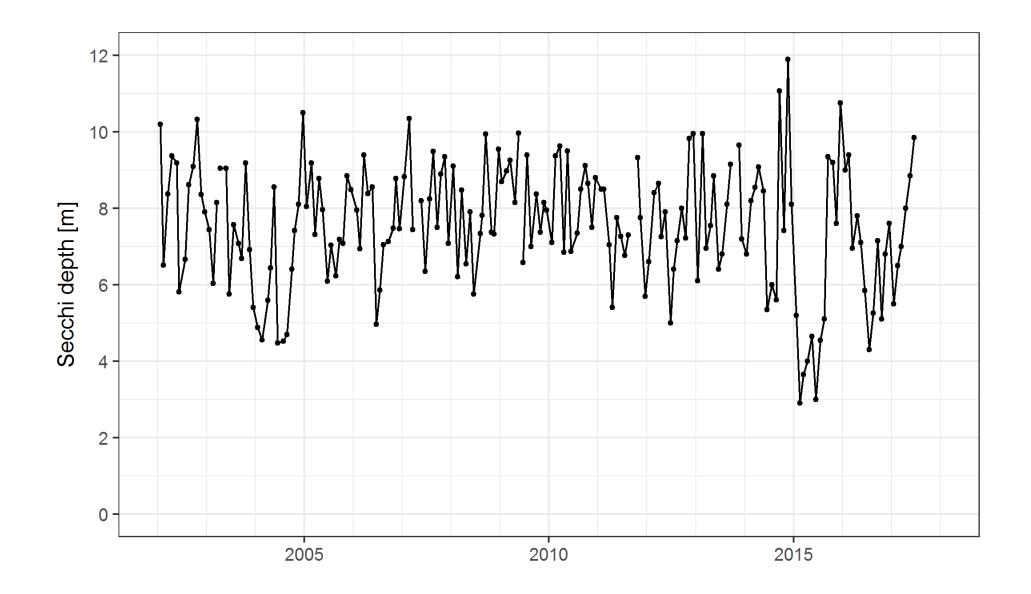




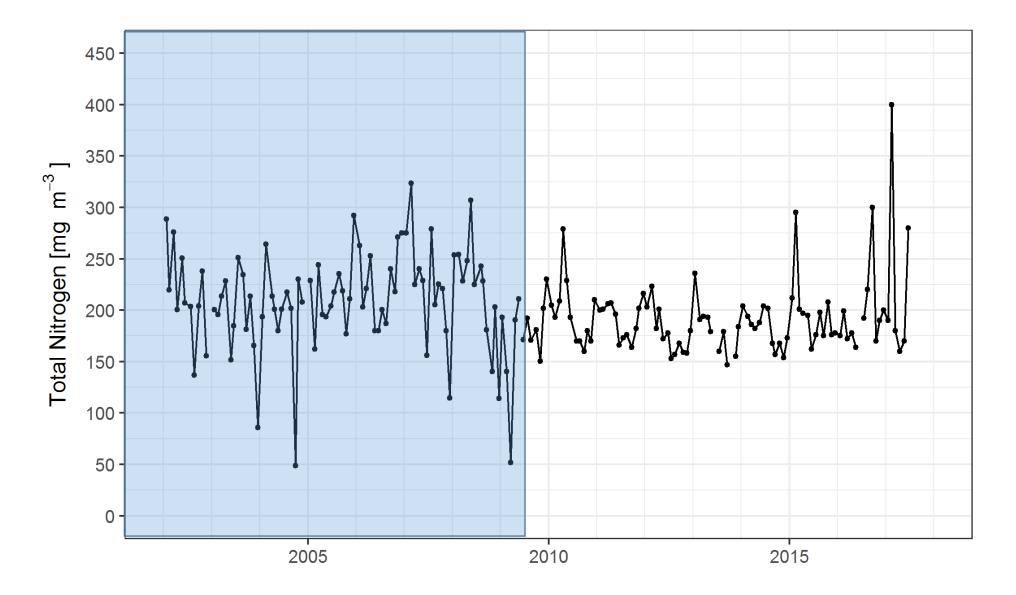
### Water elevation for Lake Okareka, 2002 to mid-2017



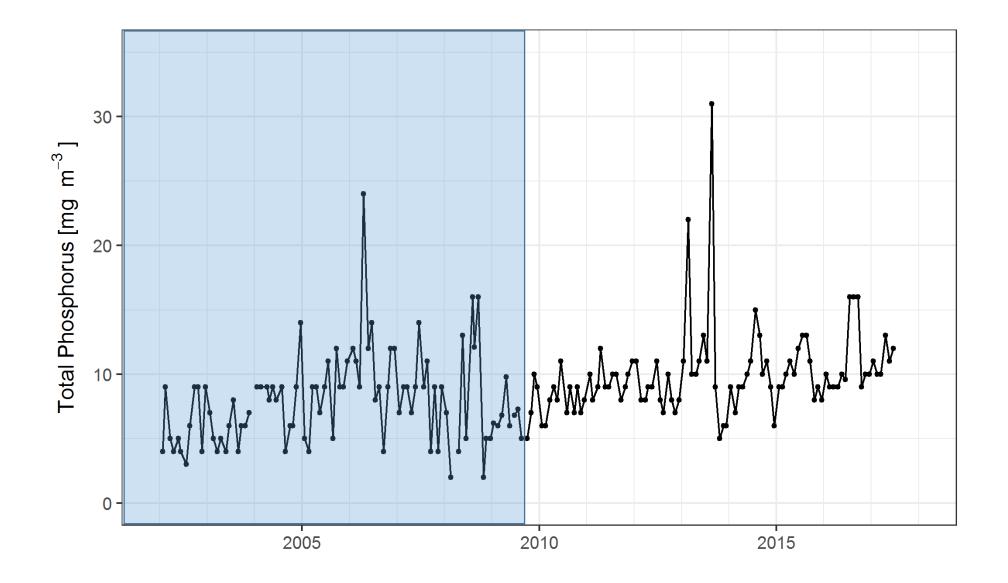
### Secchi depth (clarity) for Lake Okareka, 2002 to mid-2017



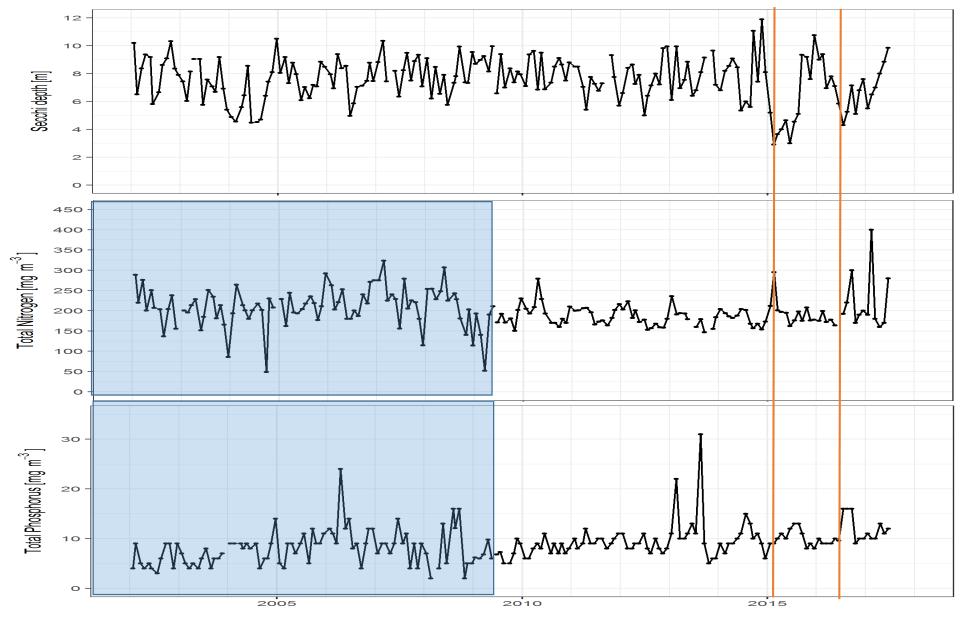
#### Total nitrogen for Lake Okareka, 2002 to mid-2017

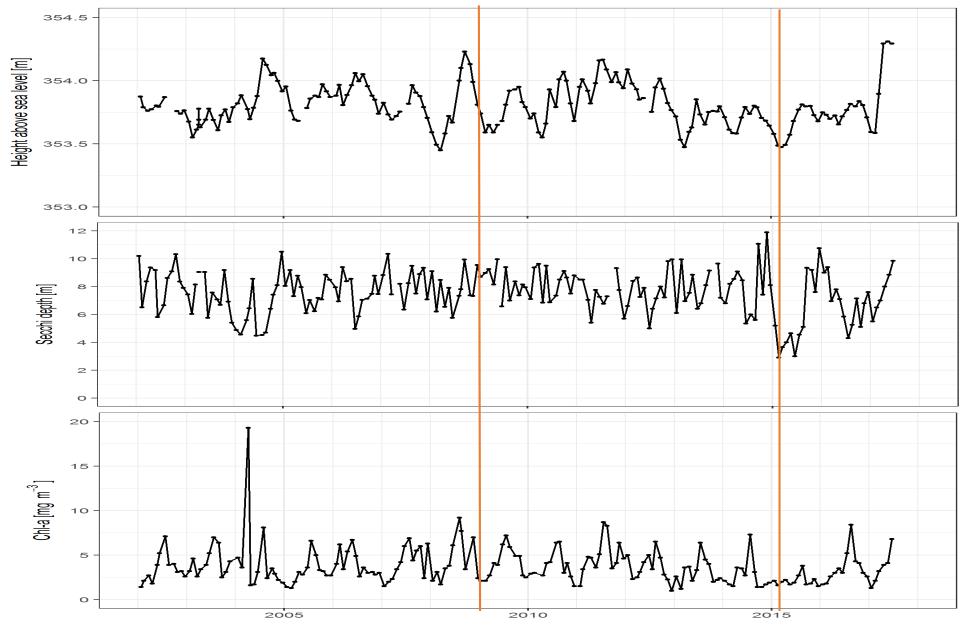


### Total phosphorus for Lake Okareka, 2002 to mid-2017



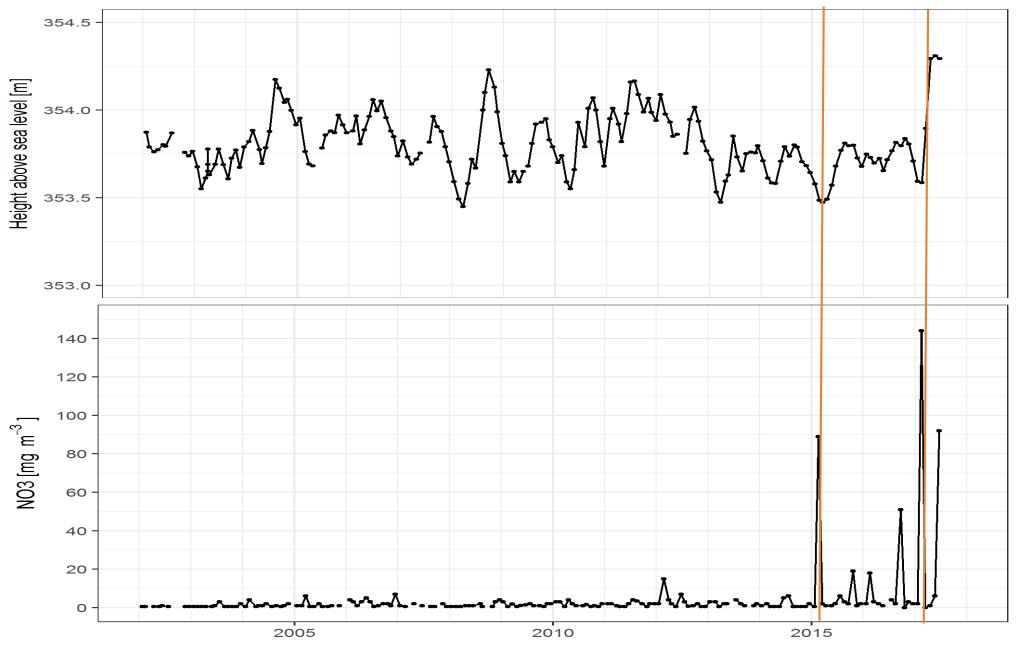
### Secchi depth, TN and TP for Lake Okareka, 2002 to mid-2017



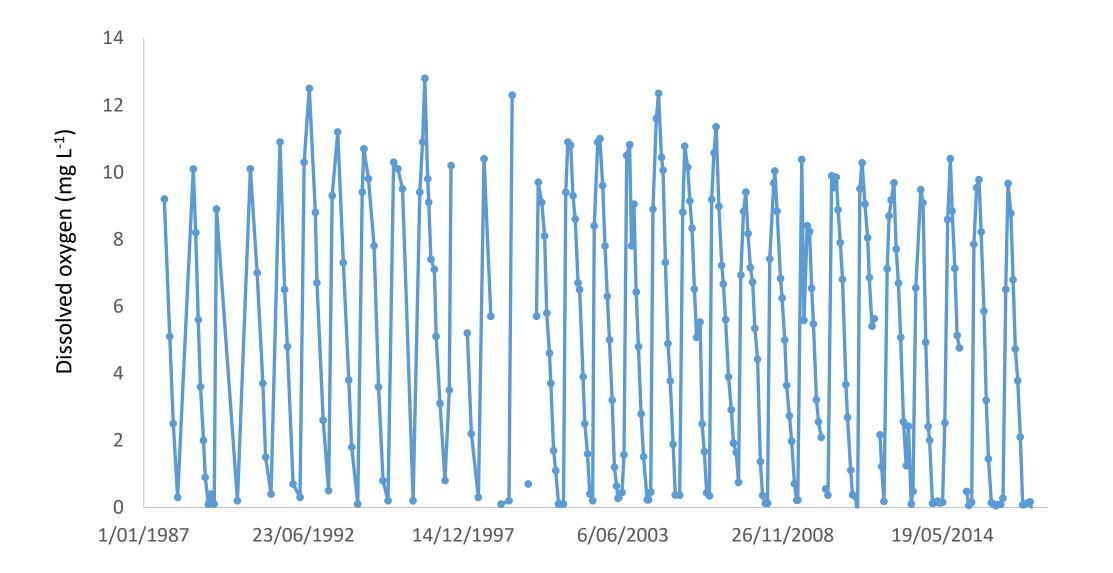


Water level, Secchi depth, chl a for Lake Okareka, 2002 to mid-2017

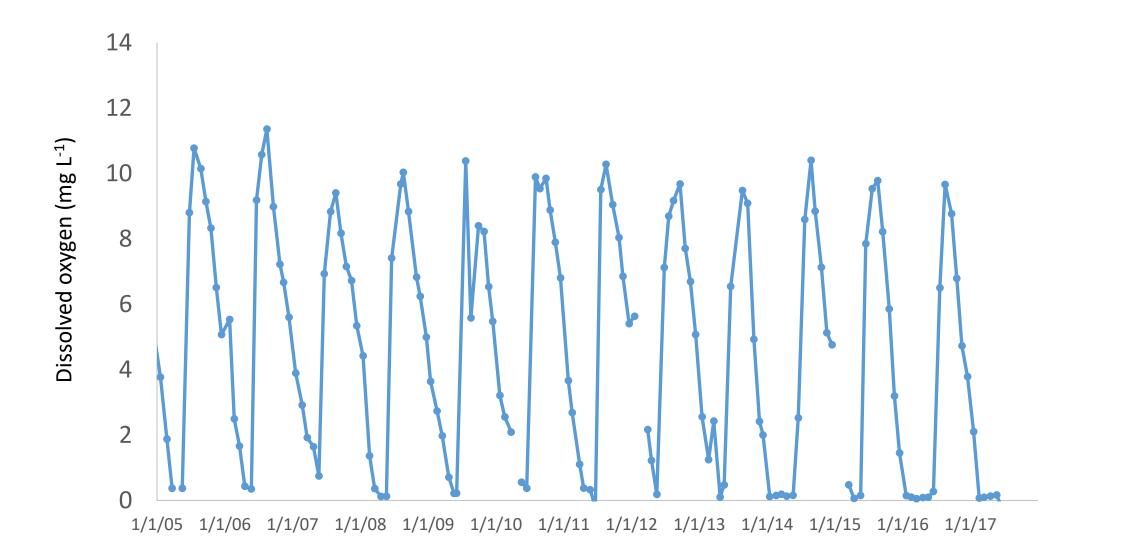
#### Water level and nitrate for Lake Okareka, 2002 to mid-2017



### Dissolved oxygen for Lake Okareka, 1987 to mid-2017



#### Dissolved oxygen for Lake Okareka, 2005 to mid-2017



## **Summary Discussion**

- Water levels appear to have a strong influence on water quality but a quantitative estimate is difficult to provide at this stage.
- Changes in land use to benefit the lake are likely to offset some of the water quality deterioration that we might expect with changes in climate (e.g., greater variability of rainfall, warmer temperatures).
- Dissolved oxygen (in bottom waters) is a cause for concern and requires a careful watching brief. This sort of change has potential to create a synergistic deterioration of water quality.
- Have not considered food chain (trophic) linkages affecting water quality.