SUMMARY OF EVIDENCE OF JAMES MITCHELL BLYTH

1 My summary evidence addresses the following information from Williamson Water & Land Advisory (WWLA), relied on by all applicants:

- A detailed review of the '**Kaimaumau Wetland Modelling Report_rev3'** (here after referred to as the 'modelling report')

Review Summary of WWLA 'Modelling Report'

2 The water balance model conceptualisation (and subsequent numerical modelling that follows) lacks the inclusion of groundwater inputs, and assumes the wetland is entirely rainfed.

3 This means the model calibration process also doesn't evaluate whether any groundwater inputs could be present.

4 To assess this properly, groundwater input could be simulated in the water balance model. Re-calibration could modify other parameters such as the catchment area, evaporation canopy losses, maximum level for open water evaporation (currently set at 1.4 mRL) and seepage rate versus water levels. This may show whether a calibration is still possible with groundwater inputs occurring.

Analysis

5 The model simulates a large wetland catchment (3,416 ha), overestimating the water balance inputs and outputs (see Figure 1 in my full evidence). Calibration and verification occurred at a cluster of water level sites within the scientific reserve (~955 ha), despite a large portion of the catchment being downgradient of these sites and the wetland extending over 9 km to the east (where it may be hydrologically disconnected from the calibration area).

6 Figures 8, 9 and 11 of the modelling report do indicate an accurate simulation of the receding water levels over summer, particularly for the January – April 2020 periods, when compared to observed data. This is relevant for sites KM7, WWLA, Wetland North and Wetland South.

7 However in February 2020, Wetland North (an area of standing water) appears to diverge from the observed and modelled water level recession occurring at sites WWLA and Wetland South (see Figure 2 in my full evidence), with the water level gradient also appearing to reverse. The higher water level inland from WWLA (at Wetland North) during the peak of the 2020 drought, highlights that this area of the wetland may have a different hydrological conceptualisation than the water balance model, may have additional groundwater inputs, or lower seepage rates that offset the higher evaporation that would be occurring in an open water environment.

8 In my view, the model simulation at sites KM3 and KM4 is generally poor (see Figure 3 in my full evidence). These sites (and KM2) were installed by the Department of Conservation in 2017 due to their

unique hydrology and possible connection with the large standing water body to the east (i.e. Wetland North).

9 The applicant indicated the poor calibration at these sites was likely due to the drains/streams maintaining water levels. However, Figure 20 on page 257 of the REQ.596300 S42A Hearings Report, shows drain water levels at KM2 (drain logger) are between 0.4 and 0.6 m below KM3 throughout the majority of the year (including summer), indicating that the drain does not maintain water levels at these sites.

10 In addition, KM3 water levels plateau in March 2020 (see Figure 4 of my full evidence) while simulated levels continue to decline. This may be due to transducer depth, however data from both KM3 and KM4 should be further examined to verify the divergence from the model.

11 A large part of the water balance outputs is from evaporation (both open water and canopy transpiration), accounting for an estimated ~78% of losses. An important model parameter is the assumption that at a water level of 1.4 m, any water above this level is considered ponded and subject to higher open water evaporation rates. No sensitivity analysis was conducted on this parameter.

12 The modelling report considers the pumping effects on water levels and the water balance of Kaimaumau Wetland. This utilises the Aupouri Aquifer Groundwater Model (AAGWM), which is presumed to have a similar conceptualisation of the wetland as being rainfall fed.

13 Pumping losses are an average across the entire wetlands spatial extent,and appear to be relatively small when compared to the average daily rainfall and evaporation. Revision of the modelled catchment area (to make it smaller) if a recalibration was undertaken, would also proportionately reduce average pumping losses.

14 However, if groundwater was contributing to the wetland near the ‘Wetland North’ or KM3/KM4 monitoring sites (or other locations around Kaimaumau to the east that have little monitoring data), pumping may have a greater influence on water level drawdown at localised areas than what has been considered in the AAGWM and Water Balance model.