Appendix 7

Estimated in-river N loadings under the agreed dairy growth scenario

A key question regarding the nitrogen load scenarios is which scenario best represents the most likely growth outcome, either with Rule 13-1 or without Rule 13-1? In both cases the answer is dependent on the level of intensification or otherwise in the catchment.

Neild and Rhodes (2010) outline dairy growth scenarios for Tararua, including the area of the upper Manawatu modelled for assessing the environmental benefits of Rule 13-1. The predicted area of dairy expansion for the Tararua area (10%) is lower than the range of 11-18% reported for elsewhere in the Region (see related sections above). The rise in per hectare production of milk solids of 483 kg MS/ha is in the middle of the range predicted Regionally (446 to 514 kg MS/ha). These figures can be incorporated with the work of Clothier *et al.* (2007) to determine predicted increases in N loading due to growth in the dairy sector.

Table 1: Growth scenarios for dairy in the Tararua District. *Sourced from Table 9 of Neild and Rhodes (2010).*

Tararua District	**Year 2010**	**Year 2030**	**% change**
Area (ha)	36,359	40,172	10%
Cows	99,273	138,822	40%
Cows/ha	2.73	3.45	26%
Milk Production m kg MS	32.1	54.8	70%
Kg MS/cow	323	395	22%
Kg MS/ha	882	1,365	55%

<u>Increased load due to increased milk solids per hectare</u>

The analysis of Clothier *et al.* (2007) showed raising production from 1,000 kg MS to 1,200 kg MS/ha increased leaching from 31 kg/ha/year to 49 kg/ha/year. The increase predicted by Neild and Rhodes (2010) for Tararua is 483 kg MS/ha to a total of 1,365 kg MS/ha. This is a greater overall level of increase in production than that modelled by Clothier *et al*. (2007). At the lower level of production increase modelled by Clothier *et al.* (2007) (1,200 kg MS/ha) the N loading rate for the current land area is predicted to increase the current load from 744 tonnes/year to 877 tonnes/year. Nutrient losses from a farm producing 1,365 kg MS/ha have not been modelled but are predicted to be higher than that of Clothier *et al.* 2007.

Increased production related to increased area in dairy

The growth predictions for the dairy sector are 10% more land in dairying for the Tararua District (Table 1) and 11 to 18% more land in dairying for the Region. The dairy expansion predictions used by Neild and Rhodes (2010) are lower than those modelled by Clothier *et al.* (2007), who showed for every hectare converted from sheep and beef to dairy farming the increase in N load in-river (after attenuation in the landscape) would be 11.5 kg/N/ha/yr. This assumed a dairy farm was leaching 31 kg N/ha/year compared to sheep and beef farms at 7.8 kg N/ha/year.

This analysis also needs to account for the increase in milk solids per hectare production as outlined above. At 1,200 kg MS/ha/year, Clothier *et al*. (2007) predicted leaching to increase to 49 kg/ha/year from dairy farming. Using the methods of Clothier *et al*. (2007) every hectare converted from sheep and beef to dairy would increase in-river N loads by 21 kg/ha/year (allowing for an attenuation factor of 0.5).

Clothier *et al.* (2007) used a land area currently in dairy farming of 20,534 ha. Increasing this area by the projected growth rate for Tararua (10%) to the predicted increase for the Region (18%) and accounting for production from this land being at the 1,200 kg MS/ha rate predicts the current state load of 744 tonnes/year will increase by between 43-78 tonnes/year. Adding the additional 43 to 78 tonnes from the extra land in dairying to the additional load predicted from production increases to 1,200 kg MS/ha/year (on existing dairy land), estimates a total in-river N load in the order of 920 to 950 tonnes/year.

If dairy sector growth continues at historic levels, as predicted by Neild and Rhodes (2010), nitrogen loads in the Upper Manawatu would rise to greater than 920 to 950 tonnes N/year. The 920 to 950 tonnes/year in-river estimate is conservative as it does not account for any increase in the sheep and beef sector, which has been growing at 1-4% per annum (Neild, 2005), and the prediction is based on a lower increase in milk production (ie. the 920 to 950 tonne estimate only accounted for a 200 kg increase to a total of 1,200 kg MS/ha rather than the increase to 1,365 kg MS/ha/year predicted Neild and Rhodes (2010) for Tararua). Clothier *et al.* (2007) show a strong linkage between increased milk production per ha and increased nutrient leaching losses (an increase from 1,000 to 1,200 kg MS/ha/year was predicted to increase nitrogen losses from 31 kg N/ha to 49 Kg N/ha).

Taking these factors into account, under the continued steady growth model at historic levels of growth, the likely loading will grow from the current state to greater than 920 to 950 tonnes by 2030. The no-limits allocation approach is predicted to increase loads from the current state scenario to greater than the 1,200 kg MS/ha load or LUC expansion load and may reach close to the 1,200 kg MS/ha load and LUC expansion load intensification scenario by 2030.