Comparing official modelling of the impacts of the Action for healthy waterways package and DairyNZ's modelling

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	Action sought:	Response by:
To: Hon David Parker, Minister for the Environment	Note the contents of this paper	
Forward: Hon Damien O'Connor		

Actions for Minister's Office Staff	**Forward** this report to Hon Damien O'Connor **Return** the signed report to MfE.
Number of appendices and attachments	Nil

Ministry for the Environment contacts

Position	Name	Cell phone	1st contact
Principal Author	s 9(2)(a)	s 9(2)(g)(ii)	✓
Responsible Manager	s 9(2)(a)	s 9(2)(g)(ii)	
Director	s 9(2)(a)	s 9(2)(g)(ii)	

Comparing official modelling of the impacts of the Action for healthy waterways package and DairyNZ's modelling

Key Messages

1. The purpose of this memo is to outline why the economic impacts on the rural sector reported by DairyNZ exceed those estimated by officials.
2. Officials estimate reduced profits in the agricultural sector from the Action for healthy waterways (AHW) package at $114 million while DairyNZ's estimate is $984 million for the dairy sector alone.
3. Two quantifiable assumptions explain half the difference:
    - DairyNZ assume the current NPS-FM would have no impact; and
    - DairyNZ were modelling a previous proposal for stock exclusion.
4. There are also important unquantifiable assumptions which we think contribute to the difference in the officials estimate and DairyNZ's estimate:
    - DairyNZ's model assumes that any land that changes from dairy to another use generates no profit;
    - DairyNZ uses a complex dynamic model which involves making numerous calls on future states and can compound the effects of these assumptions; and
    - DairyNZ used data sets that they have not made public or allowed us to access.
5. We are confident that the modelling approach officials have taken is appropriate and it has been peer reviewed by Sense Partners and Infometrics.
6. Once decisions on the package have been announced, the information relied on for the economic impact analysis will be released to all stakeholders simultaneously on the Ministry for the Environment's website.
7. MfE are prepared to meet with any organisation that has conducted modelling (including DairyNZ) to discuss the modelling approaches taken, after reports have been publicly released.

Recommendations

8. We recommend that you:

    a. **Note** that the key messages provide information to support discussions with your colleagues

    b. **Note** that MPI has provided separate advice to Minister O'Connor on this topic, including a recommendation that officials meet with DairyNZ in week of 4 May to discuss the modelling that underpins the Cabinet paper in advance of decisions being made

    c. **Refer** this paper to Hon Damien O'Connor for information

Yes/No

Signature

Martin Workman
Acting Deputy Secretary – Water and Climate
Ministry for the Environment

Hon David Parker
Minister for the Environment **Date**

Differences between official modelling of the Action for healthy waterways package and DairyNZ's modelling

Purpose

1. The purpose of this memo is to outline why the economic impacts on the rural sector reported by DairyNZ are different to those estimated by officials.

Context

2. We are confident that the modelling approach we have taken is appropriate and it has been peer reviewed by Sense Partners and Infometrics.
3. A number of organisations have provided their own modelling of the impact of the Action on healthy waterways (AHW) package. This briefing note compares results for the cost of the package provided to officials by DairyNZ on 6 March 2020 and the analysis relied on by officials as outlined in the recent Cabinet Paper.[1]
4. The headline difference between these two estimates is $870m per annum assuming full compliance with the AHW package, with the official estimate of reduced profits in the agricultural sector being $114 million and DairyNZ's estimate being $984 million for the dairy sector alone.
5. One obvious difference is that DairyNZ's modelling only covered the effects on the Dairy sector, whereas the estimates in the Cabinet paper reflect the impact on the agricultural sector. The factors outlined in this paper provide an explanation of the $870 million difference. It is possible to identify differences in two key assumptions that, together, explain half of the $870 million difference. The balance of difference, as far as it is possible to tell, reflects structural differences in the models and associated assumptions made in the complex modelling used by DairyNZ.

Analysis and Advice

Two assumptions explain half the difference

6. Two assumptions are estimated to explain half the difference. These relate to:
    - the impact of the current NPS-FM on dairy farms. DairyNZ assumed no impact on dairy farm production or profit from the 2017 NPS-FM, whereas officials assumed a $394 million per annum impact. While there is a degree of flexibility that councils could take to the implementation of the 2017 NPS-FM we do not consider DairyNZ's interpretation that there would be no impact to be tenable. The approach taken by officials was peer reviewed by NIWA who found that the approach taken by officials was the best available tool for estimating nitrogen reductions to achieve the requirements of the 2017 NPS-FM periphyton bottom line at the national scale.
    - the stock exclusion policy. DairyNZ assumed existing fences would be moved, the setback would be 5m and small streams would be fenced. Officials estimate this could contribute at least $50 million to the difference.

[1] DairyNZ (2020). Economic assessment of alternate nitrogen and phosphorus limits in the Essential Freshwater Package 6 March 2020.

Implications of land use change

7. In the modelling relied on by officials, land use change occurred when on-farm mitigation could not deliver the pollution load reductions required. The new land use was assumed to generate profits (albeit less than those in the prior land use). The profit estimates of the new land use were based on publicly available data.

8. In contrast, DairyNZ appears to have assumed that when land use change occurs the land is unable to generate any new profit flow at all. This approach would tend to increase the impact estimate.

Fundamentally different models

9. The models relied on by officials were constructed solely for the purpose of estimating the marginal impact of the AHW package. Reflecting this purpose and inherent limits to environmental modelling, the models relied on by officials were simple and 'static' – essentially providing before and after comparisons assuming full compliance.

10. A key driver of the static approach relied on by officials was the environmental modelling which underpinned the economic impact modelling. NIWA's scientists advised that it is not possible to credibly project future pollution loads assuming no policy intervention. This means using static environmental modelling, and this meant the economic impact analysis had to be static too.

11. Outputs of the environmental modelling show how much today's pollution loads have to reduce by and the economic analysis estimated a profit impact associated with that. These costs included mitigation costs and new profit flows as a result of land use change. In other words, impacts on farm profits and land use change were the only 'endogenous' variables in the modelling. Once these impacts were estimated, NZIER's computable general equilibrium (CGE) model received this set of impacts as a one-off shock to the agricultural sector and estimated the wider regional and national economic impacts, again in a before-and-after way (ie, the CGE model is a static model).

12. DairyNZ used a complex model which means a relatively large number of variables are determined within the model ('endogenous' variables), as opposed to being taken as given ('exogenous'). The endogenous variables influence each other (meaning the model is 'dynamic' rather than static). The need to inform organisational functions and answer potentially detailed questions from management in an internally consistent way, justifies organisations like DairyNZ using complex models.

13. DairyNZ's model appears to have numerous endogenous variables - including production, asset values, debt levels and the milk price. Interactions between these variables will influence the results. For example, DairyNZ reports that their estimate of insolvencies reflects not only mitigation costs but also asset values and debt levels (and insolvencies will impact on production and hence profit). The relative importance of these factors in driving the $984 million impact is not clear from their reporting as no attribution analysis was provided.

14. It would be wrong to assume complex models are necessarily – or even often – more accurate than simple ones. The dynamic nature of complex models is equivalent to assumptions building on assumptions with the end result reflecting not only the assumptions made but the sequencing of these, and the way one assumption interacts with another.

Assumptions about pollution loads under a 'no policy' baseline

15. On the key issue of pollution loads under a 'no policy' baseline, it is not clear from the report provided by DairyNZ what assumptions they make about the pollution loads occurring when they assume full compliance with the AHW package in 2050. We know they assume production and profit have increased under their 'no policy' baseline but the implications of this for pollution loads by 2050 is not reported. If they assume pollution loads have increased, the impact of the AHW package will be greater than if today's pollution loads were assumed (as in official's estimates).

Differences in data

16. DairyNZ has access to private farm data, which is not publicly available. Ultimately, the impact of having different data is seen in the relative quality of the assumptions made. In this case, the key assumptions to compare are the mitigation costs.
17. It is not possible from the material supplied by DairyNZ to know what direct mitigation costs they assumed when considered in isolation from (ie, holding constant) the other endogenous variables. Hence, we do not know to what degree data differences led to different assumptions in this area, and we cannot form a view as to the impact of data differences on the results.

Next Steps

18. A suite of documents including outlines of the modelling methodology and results will be released once decisions on the AHW package are announced.
19. We have been advised that MPI is providing a paper to Minister O'Connor on 1 May 2020 recommending a meeting between officials and DairyNZ in the week of 4 May to discuss the results of the modelling that feeds into the Cabinet paper. MfE does not consider it appropriate to meet with individual non-governmental stakeholders to discuss the policy proposals modelled and included in the Cabinet paper prior to Cabinet decisions and public announcements. MfE is happy to meet DairyNZ, or other stakeholders, to discuss the contents of modelling reports after they are released online after announcements.