

**BEFORE THE COMMISSIONERS
At PALMERSTON NORTH**

UNDER: the resource management Act 1991

IN THE MATTER OF: an application for a **Notice of Requirement** by **New Zealand Transport Agency** to the Palmerston North City Council, Manawatu District Council and Tararua District Council for **E AHU A TŪRANGA MANAWATŪ TARARUA HIGHWAY.**

Statement of evidence of Harold Victor Henderson on behalf of AgResearch Ltd

Dated 15 March 2019

STATEMENT OF EVIDENCE OF HAROLD VICTOR HENDERSON

INTRODUCTION

1. My name is Harold Victor Henderson.
2. I hold a PhD in Biometry from Cornell University, gained in 1979.
3. I am currently a statistician at AgResearch Ruakura. I have worked as a Biometrician/Statistician at Ruakura Research Centre since 1979.

EXPERT WITNESS CODE OF CONDUCT

4. I have read and am familiar with the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2014. I agree to comply with that Code. Other than where I state that I am relying on the advice of another person, this evidence is within my area of expertise and I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

PURPOSE AND SCOPE OF EVIDENCE

5. I provide expert opinion on the impact that the proposed road Project will have on future data and statistical analysis from the long-term phosphorus fertiliser and sheep grazing trial established in 1975, which is located on the AgResearch Ballantrae Hill Country Research Station.

EXECUTIVE SUMMARY

6. The impact of the Project on the future data from the trial is the loss of or impact on the 72 sampling sites. 25 (35%) of the 72 sampling sites would be lost or impacted by the Project. 16 (67%) of the 24 SW Aspect sampling sites would be lost or impacted. The balance of 2 sampling sites at each of Slope x Aspect category for each Farmlet would be lost. The reduction in trial area and, in particular, the loss or impact on sampling sites and the lack of balance will have significant effects on the statistical viability of future research from the trial.

EVIDENCE

7. The Ballantrae Trial comprises four self-contained farmlets. The fertiliser treatments are: Big Hill (HFHF - High Fertiliser High Fertiliser); Pylon East (HFNF - High Fertiliser No Fertiliser); Pylon West (LFLF – Low Fertiliser Low Fertiliser) and Pylon Centre (LFNF – Low Fertiliser No Fertiliser).

8. Within the trial there are 72 permanent field measurement sampling sites for measuring soil, pasture and animal attributes and their changes through time. These sites are shown on the map, prepared by Des Costall, AgResearch. The sites are coloured by impact of the Project. Sites outside 20m of the NZTA Designated Area are classified as unaffected.

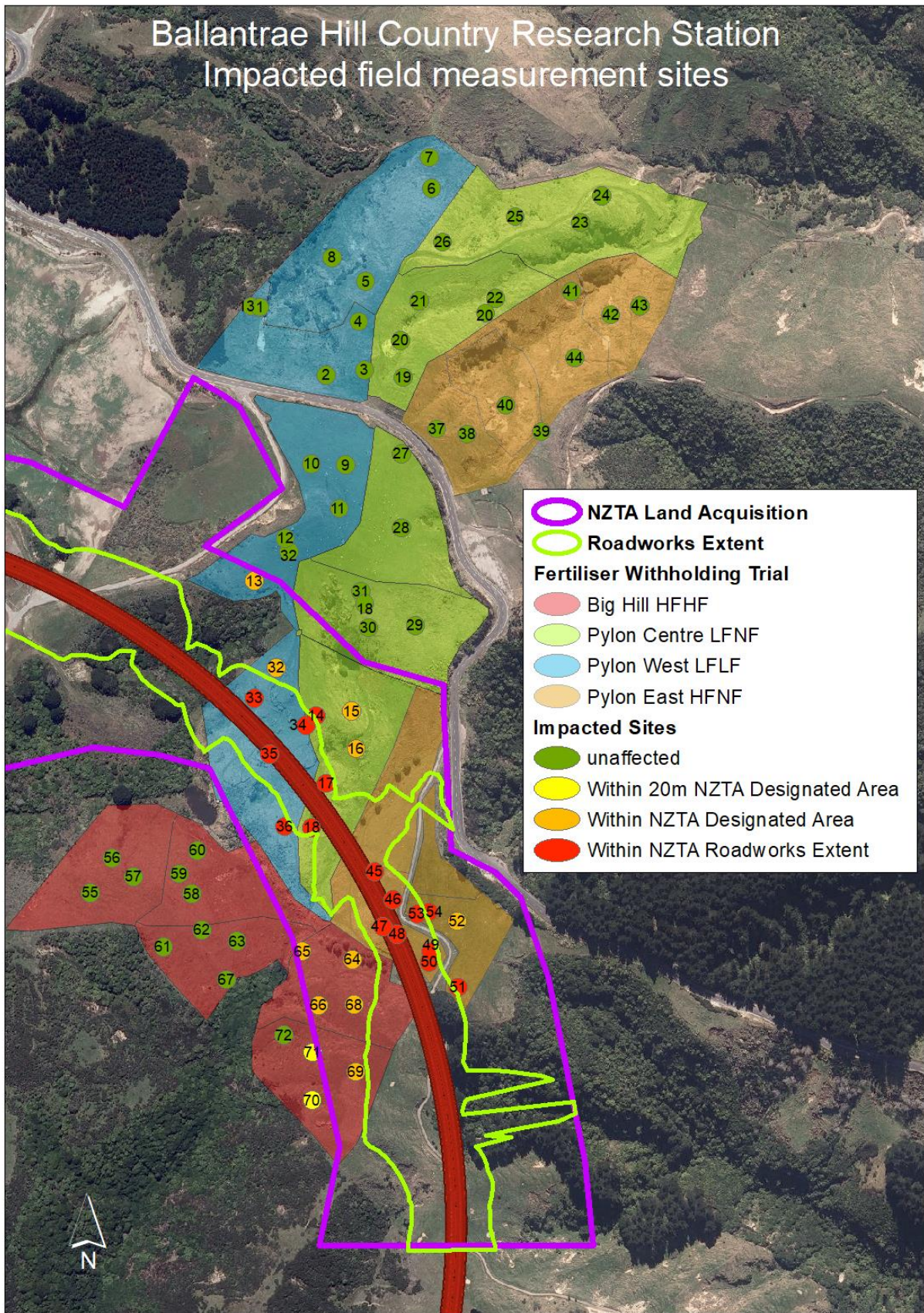


Figure 1: A map of the farmlets, field sampling sites and the proposed path of the Project

9. In each Farmlet there are 2 sampling sites at each of the Slope (Low slope: 1-12°, Medium slope: 13-25°, High slope: ≥26°) x Aspect (SW, E and NW) categories, a total of 72 sampling sites. These slope and aspect positions have been the basis for monitoring since the long-term study was established in 1975. The number of current field measurement sampling sites are shown in the table by Slope, Aspect and Farmlet. The data are balanced, with 2 sampling sites at each of Slope x Aspect category for each Farmlet.

Current Sampling Site distribution										
Slope	1-12°			13-25°			≥26°			Total
Aspect	SW	E	NW	SW	E	NW	SW	E	NW	
Farmlet										
LFNF	2	2	2	2	2	2	2	2	2	18
LFLF	2	2	2	2	2	2	2	2	2	18
HFNF	2	2	2	2	2	2	2	2	2	18
HFHF	2	2	2	2	2	2	2	2	2	18
Total	8	8	8	8	8	8	8	8	8	72

Table 1: Current Sampling Site distribution by Slope, Aspect and Farmlet.

10. 25 of these 72 sampling sites are impacted by the roadworks - 23 are within the NZTA Designated Area and 2 (sites 70 and 71) are within 20m of the NZTA Designated Area. The sites are shown on the map by Farmlet and are summarized in the table by Slope, Aspect and Farmlet. The balance of 2 sampling sites at each of Slope x Aspect category for each Farmlet will be lost. Six combinations will no longer be represented (the holes in the table) and 13 will only have 1 site.

Post Roadworks Sampling Site distribution										
Slope	1-12°			13-25°			≥26°			Total
Aspect	SW	E	NW	SW	E	NW	SW	E	NW	
Farmlet										
LFNF	1	2	2	2	2	2		1	2	14
LFLF	1	2	2	1	2	2		2	2	14
HFNF		1	1		1	1		2	2	8
HFHF	1	2	1	1	2		1	2	1	11
Total	3	7	6	4	7	5	1	7	7	47

Table 2: Post Roadworks Sampling Site distribution by Slope, Aspect and Farmlet.

11. Farmlets would lose between 4 and 10 of their 18 sampling sites, that is 22% to 56% of their sampling sites, with overall 35% of sampling sites lost.

Post Roadworks Sampling Sites				
Farmlet	Current	Post	Reduction	Reduction %
LFNF	18	14	4	22
LFLF	18	14	4	22
HFNF	18	8	10	56
HFHF	18	11	7	39
Total	72	47	25	35

Table 3: Post Roadworks Sampling Site Loss by Farmlet

12. There are currently 8 sites (2 in each Farmlet) of each Slope x Aspect combination. They vary in impact from only 1 of the 8 remaining for High $\geq 26^\circ$ Slope - SW Aspect, through to 7 remaining for 4 combinations as shown in the table.

Post Roadworks Sampling Sites				
	Aspect			
Slope	SW	E	NW	Total
1-12°	3	7	6	16
13-25°	4	7	5	16
$\geq 26^\circ$	1	7	7	15
Total	8	21	18	47

Table 4: Post Roadworks Sampling Site by Slope and Aspect

13. 16 of the 24 SW Aspect sampling sites are lost or impacted, that is 67% of the SW sampling sites.

Sampling Sites			
Aspect	SW	E	NW
Current	24	24	24
Post	8	21	18
Reduction	16	3	6
Reduction %	67	13	25

Table 5: Post Roadworks Sampling Site Loss by Aspect

14. The impact of the Project on future data from the trial is the loss of or impact on the 72 sampling sites. 35% of the sampling sites are impacted or lost to the NZTA Designated Area or within 20m of the NZTA Designated Area.

Farmlet	Percent reduction in sampling sites within NZTA Designated Area and within 20m of the NZTA Designated Area (%)
LFNF	22
LFLF	22
HFNF	56
HFHF	39
Total	35

Table 7: Percentage reduction in number of sampling sites for each of the four farmlets

15. This loss of or impact on 35% of the sampling sites and, in particular, 67% of SW Aspect sampling sites will have significant effects on the statistical viability of future research from the trial.

CONCLUSIONS

16. The impact of the Project on the future data is the loss of or impact on sampling sites. 25 (35%) of the 72 sampling sites would be lost or impacted by the Project - 23 are within the NZTA Designated Area and 2 (sites 70 and 71) are within 20m of the NZTA Designated Area.
17. 16 (67%) of the 24 SW Aspect sampling sites would be lost or impacted.
18. The balance of 2 sampling sites at each of Slope x Aspect category for each Farmlet would be lost.
19. The reduction in trial area and, in particular, the loss or impact on sampling sites and the lack of balance will have significant effects on the statistical viability of future research from the trial.

Dated: 15th March 2019.