

**IN THE MATTER OF**

The Resource Management Act 1991

**AND**

**IN THE MATTER OF**

Notices of requirement for designations under section 168 of the Act, in relation to Te Ahu a Turanga; Manawatū Tararua Highway Project

**BY**

**NEW ZEALAND TRANSPORT AGENCY**  
Requiring Authority

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**STATEMENT OF EVIDENCE OF DAVID JOHN HORNE (EFFECTS ON  
AGRESEACH BALLANTRAE SITE) ON BEHALF OF THE NZ TRANSPORT  
AGENCY**

**8 March 2019**

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## TABLE OF CONTENTS

INTRODUCTION .....	3
METHOD OF ANALYSIS .....	4
RESULTS OF THE ANALYSIS .....	5
FURTHER COMMENT ARISING FROM THE ANALYSIS .....	7
ATTACHMENT 1: MAP OF THE PROJECT INDICATIVE CONSTRUCTION FOOTPRINT IN RELATION TO THE BALLANTRAE TRIAL SITE FARMLETS .....	8
ATTACHMENT 2: A MAP OF THE BALLANTRAE TRIAL SITE SHOWING RELEVANT FARMLETS BY AREA FOLLOWING PROJECT CONSTRUCTION....	9
ATTACHMENT 3: EFFECT OF THE PROJECT ON SLOPE BALANCE OF EACH FARMLET .....	10
ATTACHMENT 4: EFFECT OF THE PROJECT ON ASPECT BALANCE OF EACH FARMLET .....	11
ATTACHMENT 5: EFFECT OF THE PROJECT ON SOIL TYPE BALANCE OF EACH FARMLET .....	12

## **INTRODUCTION**

1. My full name is **David John Horne**.
2. I hold a PhD in Soil Science from Massey University.
3. I am an Associate Professor in Soil Science at the 'School of Agriculture and Environment' at Massey University where I have been teaching and researching in Soil Science for the past 30 years.
4. I have been engaged by the NZ Transport Agency ("**Transport Agency**") to consider the potential effects of Te Ahu a Turanga; Manawatū Tararua Highway Project ("**the Project**") on the Ballantrae Hill Country Research Station ("**Ballantrae Station**"), which is owned by AgResearch Ltd ("**AgResearch**"). Of particular relevance is the part of Ballantrae Station that has been subject to a long term grazing trial, which I refer to as the "Ballantrae trial site".
5. In preparing my evidence I have:
  - (a) visited Ballantrae Station and in particular Ballantrae trial site on 1 March 2019. That visit was part of a fulsome meeting to discuss the issues with AgResearch, other submitters, and the Project team. During that meeting we discussed the analysis I have carried out, as presented in my evidence below;
  - (b) discussed my analysis, and subsequently the potential broader effects of the Project on the Ballantrae trial site, as well as appropriate measures to address those effects, with **Jeff Morton**.

## **Code of conduct**

6. I confirm that I have read the Code of Conduct for expert witnesses contained in the Environment Court Practice Note 2014. My evidence has been prepared in compliance with that Code, as if it were evidence being given in Environment Court proceedings. In particular, unless I state otherwise, 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 I express.

## **Purpose and scope of evidence**

7. The purpose of my evidence is to assess the impact of the Project on the area of each of the four specific farmlets at the Ballantrae trial site. I also

consider the impact of the Project on the mix of slopes, aspects and soil types on each of the farmlets

8. My primary role has been to provide detailed analysis of the effect the Project construction footprint will have on the makeup of the farmlets at the Ballantrae trial site. That analysis has then been relied on, by **Mr Morton** in particular, to consider the potential broader effects of the Project, and appropriate measures to address those potential effects.

#### **METHOD OF ANALYSIS**

9. To allow for my analysis, a map of the four farmlets at the Ballantrae trial site, and the construction footprint of the Project as it crosses the trial site, was supplied by GHD on 5 February 2019.<sup>1</sup> I note that my analysis was based on the indicative construction footprint, and not the full designation corridor. I attach the plan supplied by GHD as **Attachment 1** to my evidence.
10. Soil type distribution for each farmlet was obtained by digitising a PDF document supplied by AgResearch on 14 February 2019. This document was based on a soil survey carried out in the area by LandVision in 2008 at a scale of 1:8000.
11. Calculation of slope and aspect distribution requires a digital elevation model (“**DEM**”), the resolution of which is dependent on the technology used to scan the relevant land surface. Initially, a DEM derived from LiDAR scanning (1m x 1m) resolution was investigated, but this did not cover the entirety of the Ballantrae trial site. As a result, a 15m x 15m DEM model (Columbus et al., 2011) was used to calculate slope and aspect at this resolution.
12. All calculations involving areas, slopes, and aspects were performed using ArcGIS Pro version 2.3.0. Slopes were classified according to those defined by the NZ Land Resource Inventory (Land Use Capability Survey Handbook, 3rd edition), as per Table 1 below:

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<sup>1</sup> GHD is the Transport Agency’s design consultancy on the Project.

**Table 1: Description of classes used to differentiate slope**

<b>Slope Group</b>	<b>Slope Angle (degrees)</b>	<b>Description</b>
A	0 - 3	Flat to gently undulating
B	4 - 7	Undulating
C	8 - 15	Rolling
D	16 - 20	Strongly rolling
E	21 - 25	Moderately steep
F	26 - 35	Steep
G	> 35	Very steep

13. Aspect classes were set at 45 degree arcs centred on north (N), northeast (NE), east (E), southeast (SE), south (S), southwest (SW), west (W), and northwest (NW) directions.

## **RESULTS OF THE ANALYSIS**

### **Note on isolated sections of three farmlets**

14. As an initial point, I note that the Project construction footprint, as currently proposed, would isolate four small parcels of land (totalling 0.74 ha) areas from the rest of three of the four farmlets (referred to as LFNF, LFLF and HFNF). These small areas would be to the southwest of the Project footprint.
15. This can be seen in the map at **Attachment 2** of my evidence, which shows the four farmlets by colour coding, and with the relevant areas (in hectares) marked. The gap in the colour, towards the bottom of the map, represents the Project construction footprint as currently indicated. The Saddle Road bisects three of the farmlets, at the northern part of the Ballantrae Trial site.
16. As these areas would be very small, and separated from the rest of their farmlet by the proposed road, their future use in the larger trial is impracticable. Following discussion with **Mr Morton** and with AgResearch and other submitters, these areas have been excluded in further analysis and were essentially counted as part of the Project footprint.

### Effect on overall size of the Ballantrae trial site and the farmlets

17. Upon completion of the Project, the total trial area will decrease in size from 31.14 ha to 26.35 ha (refer to Table 2 below). This is a reduction in size of 4.79 ha, or 15%.
18. Farmlet **LFLF** will undergo the largest reduction in area i.e. 2.04 ha or 26%. However, it is currently the second largest farmlet (at 7.73 ha).
19. **HFNF** will reduce in size from 6.89 ha to 5.60 ha, being a 19% reduction in area.
20. The **LFNF** and **HFHF** farmlets face similar, relatively small, decreases in area (0.81 ha and 0.65 ha or 8% and 9%, respectively) as a result of the project.

**Table 2: Effect of the Project on areas of each of the four farmlets**

Farmlet	Area prior to the Project (ha)	Area post the Project (ha)	Reduction in area (ha)	Reduction in area (%)
LFLF	7.73	5.69	2.04	26
LFNF	9.60	8.79	0.81	8
HFNF	6.89	5.60	1.29	19
HFHF	6.92	6.27	0.65	9
Total	31.14	26.35	4.79	15

### Effect on slope, aspect and soil type balances

21. The farmlets are not currently balanced for slope, aspect or soil type. This would be almost impossible to achieve in a complex hill country landscape, such as the one at the Ballantrae trial site. This fact is reflected in the variability in slopes, aspects and soil types between farmlets.
22. I have set out in detail the effect the construction of the Project will have on the relative proportions of slopes, aspects and soil types for each farmlet in **Attachments 3 - 5**. While there will be changes, in general terms the changes are not significant. As an overall comment, the balances are more or less preserved after the construction of the Project.
23. Accordingly, the Project has little effect on the degree of variability in slope, aspects and soil types between farmlets.
24. The most striking effect of the Project on the mix of aspect on the farmlets is on **LFLF**, where almost all (1.15 ha) of the south west and much of the

south east aspect (0.41 ha) is lost to the Project footprint, and so southerly facing aspects on this treatment are reduced from 2.63 ha to 0.83 ha. However, this marked reduction in south facing aspects is not observed on the other farmlets. Furthermore, the north facing aspects on all the farmlets are much larger in area and, therefore, it might be argued that they are more significant. There is currently very large variability in the area of these southerly aspects between farmlets (3.15 ha for **LFNF** c.f. 0.68 ha for **HFNF**).

#### **FURTHER COMMENT ARISING FROM THE ANALYSIS**

25. Based on the results of the analysis as described in my evidence (as in the effect of the Project on overall areas, and the mixes of slope, aspect and soil types on each of the farmlets), I see no clear reason why the current fertiliser trial cannot continue, even if this is in a slightly modified form.
26. If there are other reasons as to why the current trial should be abandoned in its present form, then there are (and will be after construction of the Project) significant areas of a representative range of slopes, aspects and soil types that would potentially make an excellent resource for future hill country research, should funding be available.

**David John Horne**

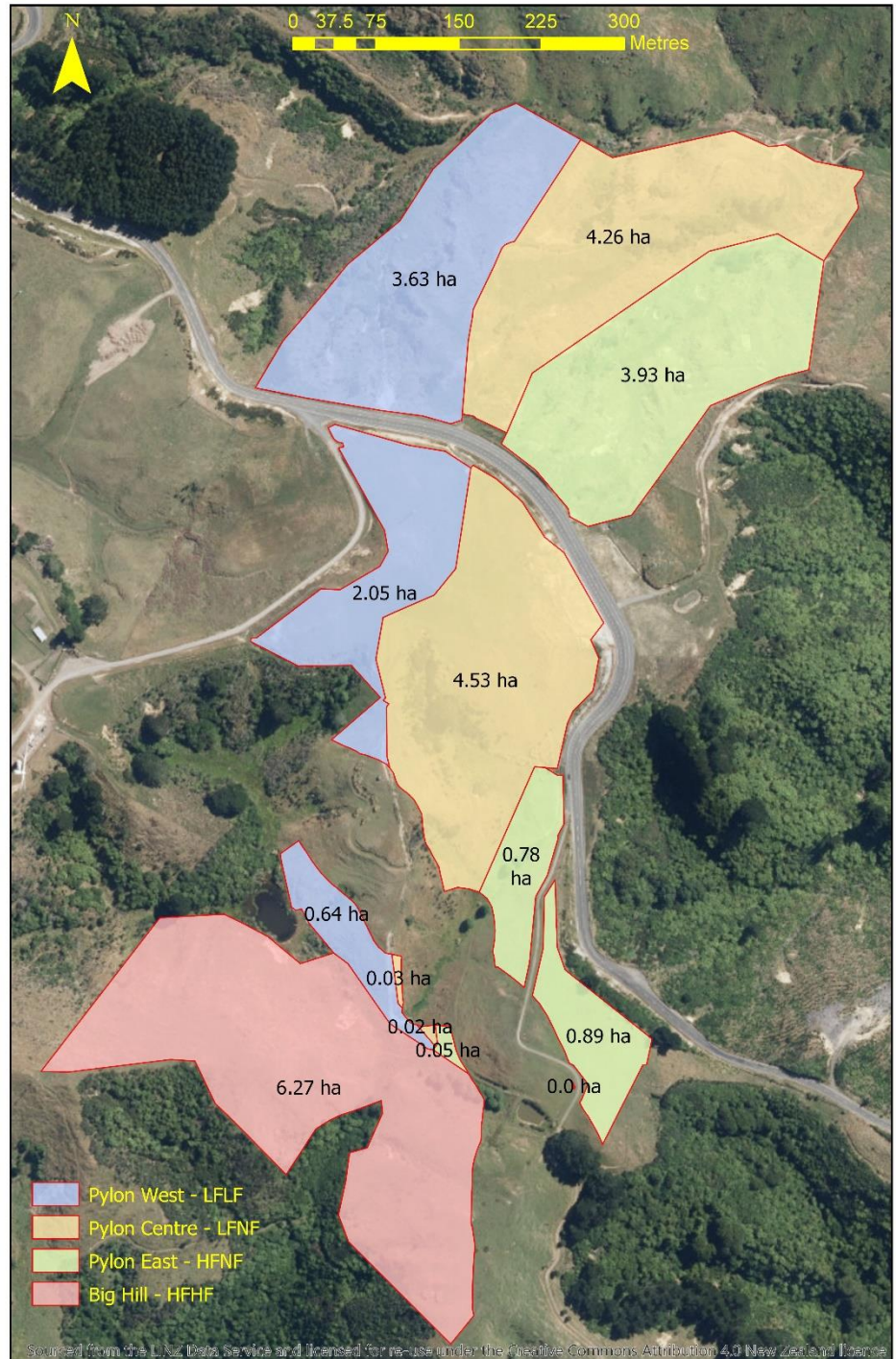
**8 March 2019**

**ATTACHMENT 1: MAP OF THE PROJECT INDICATIVE CONSTRUCTION  
FOOTPRINT IN RELATION TO THE BALLANTRAE TRIAL SITE FARMLETS**

Provided separately



**ATTACHMENT 2: A MAP OF THE BALLANTRAE TRIAL SITE SHOWING RELEVANT FARMLETS BY AREA FOLLOWING PROJECT CONSTRUCTION**



**ATTACHMENT 3: EFFECT OF THE PROJECT ON SLOPE BALANCE OF EACH FARMLET**

Areas prior to the Project				Areas post the Project	
Farmlet	Slope Class	Area of slope (ha)	Area of slope (%)	Area of slope (ha)	Area of slope (%)
<b>LFLF</b>	A (0 - 3 degrees)	0.90	12	0.70	12
	B (4 - 7 degrees)	0.70	9	0.50	9
	C (8 - 15 degrees)	0.99	13	0.50	9
	D (16 - 20 degrees)	0.65	8	0.43	8
	E (21 - 25 degrees)	1.60	21	1.10	19
	F (26 - 35 degrees)	2.00	26	1.55	27
	G (> 35 degrees)	0.92	12	0.92	16
	SUM	7.76	100	5.69	100
<b>LFNF</b>	A (0 - 3 degrees)	0.23	2	0.07	1
	B (4 - 7 degrees)	0.36	4	0.23	3
	C (8 - 15 degrees)	1.44	15	1.13	13
	D (16 - 20 degrees)	1.40	15	1.35	15
	E (21 - 25 degrees)	3.06	32	3.02	35
	F (26 - 35 degrees)	2.77	29	2.70	31
	G (> 35 degrees)	0.25	3	0.25	3
	SUM	9.50	100	8.73	100
<b>HFNF</b>	A (0 - 3 degrees)	0.50	7	0.27	5
	B (4 - 7 degrees)	0.72	10	0.14	2
	C (8 - 15 degrees)	1.98	29	1.55	28
	D (16 - 20 degrees)	0.63	9	0.59	10
	E (21 - 25 degrees)	0.81	12	0.81	15
	F (26 - 35 degrees)	1.28	19	1.28	23
	G (> 35 degrees)	0.95	14	0.95	17
	SUM	6.86	100	5.58	100
<b>HFHF</b>	A (0 - 3 degrees)	0.09	1	0.05	1
	B (4 - 7 degrees)	0.79	11	0.36	6
	C (8 - 15 degrees)	1.85	27	1.73	27
	D (16 - 20 degrees)	1.26	18	1.24	20
	E (21 - 25 degrees)	1.64	24	1.62	26
	F (26 - 35 degrees)	1.10	16	1.10	17
	G (> 35 degrees)	0.23	3	0.23	4
	SUM	6.95	100	6.32	100

**ATTACHMENT 4: EFFECT OF THE PROJECT ON ASPECT BALANCE OF EACH FARMLET**

Farmlet	Areas prior to the Project			Areas post the Project	
	Aspect Class	Area of aspect (ha)	Area of aspect (%)	Area of aspect (ha)	Area of aspect (%)
<b>LFLF</b>	N	2.48	32	2.43	43
	NE	1.19	15	1.19	21
	E	0.09	1	0.07	1
	SE	0.56	7	0.16	3
	S	0.86	11	0.61	11
	SW	1.22	16	0.07	1
	W	0.25	3	0.14	2
	NW	1.13	14	1.04	18
	SUM	7.76	100	5.69	100
<b>LFNF</b>	N	0.83	9	0.83	10
	NE	2.36	25	2.36	27
	E	2.81	30	2.81	32
	SE	1.87	20	1.55	18
	S	1.06	11	0.95	11
	SW	0.23	2	0.00	0
	W	0.07	1	0.00	0
	NW	0.27	3	0.23	3
	SUM	9.50	100	8.73	100
<b>HFNF</b>	N	1.82	27	1.82	33
	NE	1.76	26	1.76	31
	E	1.67	24	1.53	27
	SE	0.45	7	0.25	4
	S	0.09	1	0.00	0
	SW	0.14	2	0.00	0
	W	0.70	10	0.07	1
	NW	0.25	4	0.16	3
	SUM	6.86	100	5.58	100
<b>HFHF</b>	N	1.15	17	0.99	16
	NE	1.58	23	1.28	20
	E	0.70	10	0.65	10
	SE	1.17	17	1.13	18
	S	0.11	2	0.11	2
	SW	0.27	4	0.27	4
	W	1.31	19	1.28	20
	NW	0.68	10	0.61	10
	SUM	6.95	100	6.32	100





# Ballantrae Fertiliser Trial Area

