

**Before Hearing 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.**

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**STATEMENT OF EVIDENCE OF ANTONY HUGH COLBERT ROBERTS**  
**(CHIEF SCIENTIFIC OFFICER, RAVENSDOWN) ON BEHALF OF**  
**THE FERTILISER ASSOCIATION OF NEW ZEALAND**  
(submitter number 361)

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**Dated 15<sup>th</sup> March 2019**

## **STATEMENT OF EVIDENCE OF ANTONY HUGH COLEBY ROBERTS**

### **INTRODUCTION**

- 1 My name is Antony Hugh Coleby Roberts
- 2 I am the Chief Scientific Officer for Ravensdown Fertiliser Co-Operative Ltd. I have a Bachelor of Agricultural Science degree (1<sup>st</sup> Class Honours) and a Doctor of Philosophy degree in Soil Science, both from Massey University. I obtained a Certificate of Completion for the Massey University Sustainable Nutrient Management in New Zealand Agriculture course in 2004 and one for Advanced Sustainable Nutrient Management in 2006. I am a Fellow of the New Zealand Soil Science Society and a member of the New Zealand Institute of Primary Industry Management and the New Zealand Grassland Association.
- 3 Prior to joining Ravensdown in 2002, I was a practicing agricultural scientist for the past 22 years working for the Ministry of Agriculture and Fisheries Agricultural Research Division as a District Agricultural Scientist based in Taranaki from 1980 to 1988, as the Soils and Organics Group Leader in MAFtech at Palmerston North and Flock House in Manawatu/Rangitikei (1988 to 1990). I transferred to the Waikato (1990 to 2002) where I held the position of Group Leader of the Soils and Fertiliser Group and latterly as a Senior Scientist in the Land Management Group of the Pastoral Agricultural Research Institute of New Zealand, which trades under the name of AgResearch.
- 4 My research and consultancy interests included soil fertility (particularly in dairying), agronomy, heavy metal accumulation in agriculture, environmental performance indicator monitoring and interpretation, and waste utilisation or disposal to grazed pasture. I have also worked in Tasmania, mainland Australia, Japan and South Africa in the area of soil fertility management on pastoral farms. I am either the senior author or a contributing author of 65 refereed Scientific Journal or Conference papers, a further 70 scientific or extension conference papers, 5 book chapters and 4 extension booklets.
- 5 Over the past 25 years I have conducted many soil fertility experiments and also had an active consultancy role, particularly with pastoral farmers throughout the country, on soil fertility management to maximise economic return, and more latterly to couple that with minimising off-farm impacts on the environment. In my current role, I am responsible for managing the research and development for Ravensdown, for training approximately 70 Agri Managers as well as other staff in soils, fertilisers and pastoral agriculture as well as working with many of our Corporate and other farming shareholders.
- 6 In preparing my evidence I have reviewed:
  - Maps in Te Ahu a Turanga; Manawatū Tararua Highway Notices of Requirement for Designations Volume Four: Drawings and plans.

- Map provided by AgResearch showing the location of the treatments and the long term sampling sites in relation to the area affected by the proposed designation.
- The statements of evidence of Mr Morton and Associate Professor Dr Horne on the "Effects on the AgResearch Ballantrae Site" on behalf of the New Zealand Transport Agency.

7 I have reviewed the code of conduct for expert witnesses contained in part 5 of the consolidated Environment Court Practice Note 2011. I have complied with it in preparing my evidence. I confirm that the issues addressed in this statement of evidence are within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

### **SCOPE OF EVIDENCE**

8 My evidence addresses the following with respect to impacts of the proposed designation on the Ballantrae Research Farm long term fertiliser and grazing trial site:

- The value of long term agricultural experimental sites

### **SUMMARY OF EVIDENCE**

9 I have been asked by the Fertiliser Association of New Zealand (FANZ) to prepare evidence relating to the value of the Ballantrae fertiliser trial site and the potential impacts of the proposed designation on the Ballantrae Research Farm long term fertiliser and grazing trial site.

10 This includes:

- 10.1 Global long-term fertiliser research sites and examples of their utility.
- 10.2 New Zealand long-term fertiliser trial sites.
- 10.3 Response to points raised by NZTA expert witnesses Mr Jeff Morton and Dr David Horne.

### **BACKGROUND INFORMATION**

11 Ravensdown and Ballance Agri-Nutrients are 100% farmer owned co-operatives whose shareholders cover the New Zealand agricultural spectrum. Together they market an estimated 98% of all fertiliser products sold in New Zealand. Ravensdown and Ballance are members of the Fertiliser Association of New Zealand (FANZ), which addresses matters of common industry good. On behalf of their shareholders both companies operate superphosphate manufacturing plants, import fertiliser and other products used in agriculture,

operate aerial and ground spreading companies and Ravensdown own and operate lime quarries throughout New Zealand. Many of the two companies' sheep and beef shareholders farm the North Island hill country that relates well with the Ballantrae Research Station, and farm management information established at Ballantrae are applicable, in principle, to hill country sheep and beef farming throughout the rest of New Zealand.

- 12 My evidence is solely offered to the hearing on the basis that the proposed designation is likely to significantly impact on the value of a unique agricultural science toanga.

### **Key points of evidence**

#### **Global long term fertiliser research sites**

- 13 There are few long term trials sites existing around the world, with the most famous being those established by the Rothamsted Experimental Station in England, established in the 1843, celebrating 175 years in 2018 (<https://www.rothamsted.ac.uk/history-and-heritage>).
- 14 In a recent scientific review paper, comparing the effect of the long term use of manures and fertilisers on soil productivity and quality (Edmeades 2003), the author found 14 long term trial sites in the USA, Canada, England, Ireland and Denmark (see Table in Appendix 1), established between 1843 and 1975.
- 15 By studying the results from these trial sites, the author was able to conclude that "the long term use of manures may not necessarily enhance soil quality in the long term relative to applying the same amounts of nutrient as fertiliser."
- 16 Without this sort of trial, the age old perception/argument that manures are more sustainable than 'synthetic' fertiliser as nutrient sources could not be scientifically challenged.
- 17 Of the 14 sites only 3 were in pasture *viz.*, Park Grass, Cockle Park and Hillsborough. These pasture sites are managed under completely different techniques compared to the grazing management used by New Zealand farmers.
- 18 The value of long term trials was again demonstrated in a paper presented by the late Professor Keith Syers at the 19<sup>th</sup> World Congress of Soil Science in 2010 (Syers et al. 2010).
- 19 This study was to challenge the view held in both scientific and public arenas that the efficiency of phosphate (P) fertiliser use is low i.e., 10-25%. The authors state "When efficiency is assessed using the 'balance' method, which takes into account the recovery of P added in previous applications and **when an adequate time period is**

**considered** (my emphasis), the efficiency of P use is high – up to and sometimes in excess of 80%.”

- 20 The authors came to this conclusion by reviewing, analysing and synthesising data from long term trials (10+ years) in Brazil, New Zealand (Winchmore), Western Canada, USA, England, Peru, India and China. Without these trials P fertiliser use efficiency would still be challenged and could have resulted in a lot of misdirected research and advice to farmers in ways to increase P use efficiency resulting in wasted expense and no increase in efficiency.

### **New Zealand long term fertiliser trial sites**

- 21 To my knowledge, New Zealand has the only two long term grazed pasture trials in the world. One was established by the Ministry of Agriculture and Fisheries Research Division at Winchmore and Ballantrae by the Department of Scientific and Industrial Research, Grasslands Division.
- 22 The longest running trial site on the Winchmore Irrigation Research Centre in Canterbury has been running for 67 years and represents irrigated sheep grazed pastures on flat topography. The second trial site is at Ballantrae, has been running for 43 years, and is the only hill country sheep grazed fertiliser trial in the world to my knowledge.
- 23 A key characteristic of the Ballantrae long term fertiliser and grazing trial, unlike the Winchmore site, is that it operates as four ‘farmlets’ where sheep (and sometimes cattle) are grazed year round, and the trial includes a range of different slope and aspects. These are important to understand within the farm system context. Season effects coupled with slope and aspect differences impact on livestock behaviour and also pasture growth and quality. These arise due to very different exposure to rainfall, temperature, sun and wind, at different times of the year.
- 24 I have personally used the scientific information produced from the long-term fertiliser trial site in publications (e.g., Roberts and White 2016) but more especially in at least 50 seminars, field days and discussion groups addressing some estimated 1200 farmers and industry personnel throughout the country in the last 10 years, including in both February and March 2019.

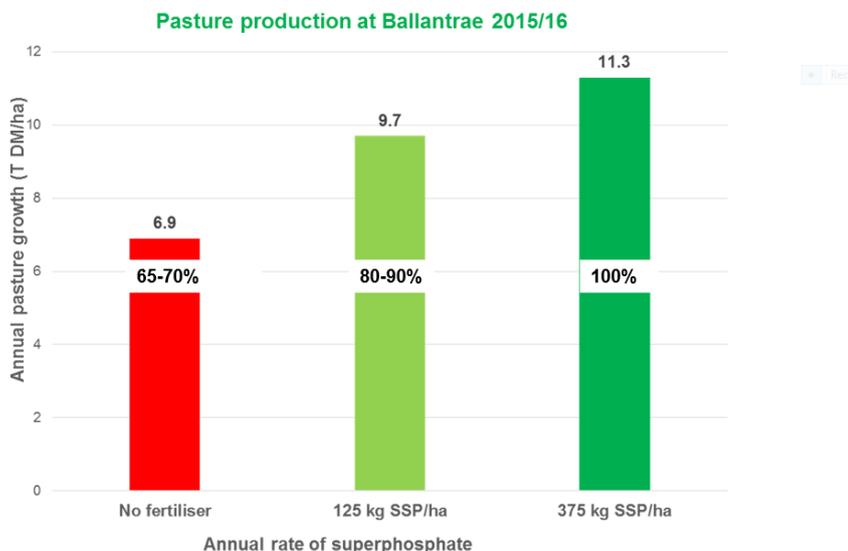
### **Response to NZTA evidence**

- 25 Mr Morton, in his evidence (Statements 19-21), has acknowledged the contribution of past work at this site both in scientific output and as an extension asset. It is true that much of the trial site remains relatively unaffected and could still be used for component trial work and for extension purposes, the proposed designation will, in my

opinion, significantly affect the ability to run future trials as a farmlet system comparison in any research that may be initiated.

- 26 Mr Morton (Statement 44) and Dr Horne (Statement 21) argue that the current farmlets are not balanced for slope, area and aspect - which is true. However, this does not invalidate the site as a research site. While Dr Horne's evidence (Statements 17-20) have shown through LiDAR analysis that low percentages of land will be taken out of each treatment, nevertheless this will 'unbalance' the farmlets further. For example, on the LFLF farmlet the South West aspect is reduced from 16 to 1% and the South east aspect from 7-3% (Attachment 4 of Dr Horne's evidence).
- 27 Mr Morton suggests (Statement 47(a)) of his evidence) that after 43 years of the fertiliser treatments that the key parameters of pasture growth and composition and soil nutrient analysis are in steady state for the LFLF and HFHF farmlets and to a lesser extent the LFNF and HFNF farmlets. Mr Morton adds that this means there will be little change over time in the future and provide a stable environment for further small scale research.
- 28 This is incorrect because the HFHF soil parameters are still increasing, those of the LFNF are declining, and soil biology changes (e.g., Schon et al. 2019) are occurring as is pasture growth, composition and consequent stock management.
- 29 As mentioned incorrectly by Mr Morton (Statement 25), pasture growth was measured in 2014/2015 (when in fact it was the 2015/2016 year) after some years of no measurement (Mackay et al. 2016). Funded by FANZ, this confirmed that not only relative pasture growth differences still persisted (as expected) but also that utilization of the pasture by livestock improved with improving soil fertility levels (Figure 1) which had not previously been reported. The same study measurement (Mackay et al. 2016) suggested that the high fertility system is growing less now than in the 1980s, which is consistent with the fact that stocking rate on the HFHF farmlet have been reduced in recent years.

**Figure 1** Effect of fertiliser on pasture growth and grazing behaviour (2015/16)



- 30 While all measurements have not been continuous, the treatment integrity has been maintained continuously. This is important as new challenges around water quality, soil carbon, soil stability, soil contamination, greenhouse gas emissions, land use suitability, future climates and indeed the social licence for our hill country farmers to operate will require robust scientific information to support farmer behaviour change.
- 31 Some of the above issues could be addressed at newly established sites but any new site will not have the legacy of treatment integrity over many years and the effect of the accumulated years of constant management. This will mean that any farm systems established will undergo considerable periods of transition, in both pasture composition and soil development which may well prejudice the outcome of the studies.
- 32 It is my opinion that systems research, on long term resources such as exists on the Ballantrae site, which is representative of our hill country farming systems will be imperative to find solutions to the issues listed above. Mr Morton appears to agree with this in his evidence (Statement 27).
- 33 Additionally, there are claims every week, in the mainstream and especially farming media, about how unsustainable the use of superphosphate is and that New Zealand should be using alternative farming principles or techniques.
- 34 There are generational changes in the hill country farmer population, and I am still disheartened by the number of farmers I speak to on a weekly basis who lack a good enough knowledge of soil fertility and

fertiliser management to cost effectively operate their businesses and so we must keep providing the science and extension around this for them.

- 35 The continuation, as undisturbed as possible, of the Ballantrae fertiliser and grazing site is imperative in combating the often uninformed challenges to appropriate nutrient use and in informing and showing new entrants to hill country sheep and beef farmers the benefit of good practice nutrient management.

### **SUMMARY AND CONCLUSIONS**

- 36 The trial site represents lower North Island sheep/beef grazed hill country well, and the scientific principles established there are applicable to most sheep/beef grazed hill country pastures throughout New Zealand.
- 37 Long-term fertiliser trial sites around the world are few but highly important for providing credible scientific information to support productive and sustainable agricultural practice and food production.
- 38 New Zealand has the only two long-term fertiliser trial sites under sheep and sheep/cattle grazing and the only long-term trial site in hill country.
- 39 Information from the unique Ballantrae site is highly relevant for the hill country farmers of today and those of the future as well as for industry personnel, regulators and the general public. As the Rothamsted example shows these resources become more important with time, not less.
- 40 It is my opinion that the proposed designation will negatively impact on the ability of the fertiliser and grazing trial site to contribute the same level of high quality science as it has in the past, and relegate the trial site to component not system studies, small plot studies and extension.

Dated 15<sup>th</sup> March 2019

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Dr A H C Roberts

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## Appendix 1.

From Edmeades 2003.

*Table 1.* Summary of trials, locations, dates and references.

Location and identification		Important commencement dates		Reference	
		Trial site	Fertilizer vs. manure comparison		
USA	Morrow	1876	1955	Darmody et al. (1997) Aref and Wander (1998)	
	Sanborn	1888	1888	Buyanovsky et al. (1997)	
	Magruder	1892	1930	Boman et al. (1996)	
	Pendalton	1931	1931	Rasmussen and Smiley (1997)	
	East Lansing	1963	1963	Vitosh et al. (1997)	
	Nebraska	1975	1975	Lesoing and Doran (1997)	
Canada	Breton	1930	1930	Juma et al. (1997)	
England	Broadbalk	1843	1852	Rothamsted Experimental Station (1991)	
				Johnston (1994)	
				Johnston (1997)	
	Barnfield	1843	1876	As above	
	Hoosefield	1849	1856	As above	
	Park Grass	1856	1856	As above	
	Cockle Park	1896	1896	Arnold et al. (1976)	
	Ireland	Hillsborough	1970	1970	Christie (1987)
	Denmark	Askov	1894	1894	Christensen (1989), Christensen et al. (1994)