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

JOINT STATEMENT OF EXPERTS ON EFFECTS ON THE AGRESEARCH BALLANTRAE SITE

22 March 2019

INTRODUCTION

1. This joint witness statement relates to expert conferencing on the topic of effects on the AgResearch Ballantrae site.

2. This joint witness statement relates to the notices of requirement lodged by the New Zealand Transport Agency ("**Transport Agency**") for designations under section 168 of the Resource Management Act 1991 ("**RMA**"), in relation to Te Ahu a Turanga; Manawatū Tararua Highway Project (the "**Project**").

3. The expert conferencing was held on **22 March 2019** at GHD, 52 The Square, Palmerston North.

4. Attendees at the conference were:

   (a) Dr David Horne (Massey University) for the Transport Agency;

   (b) Jeffrey Morton (MortonAg) for the Transport Agency;

   (c) Dr Brent Clothier (Plant and Food Research) for AgResearch Limited ("**AgResearch**");

   (d) Dr Alec Mackay for AgResearch;

   (e) Dr Harold Henderson for AgResearch;

   (f) Dr Antony Roberts (Ravensdown) for Fertiliser Association of New Zealand ("**FANZ**"); and

   (g) Dr Cory Matthew.

CODE OF CONDUCT

5. This joint statement is prepared in accordance with section 4.7 if the Environment Court Practice Note 2014.

6. We confirm that we have read the Environment Court Practice Note 2014, and in particular Appendix 3 – Protocol for Expert Witness Conferencing, and agree to abide by it.

PURPOSE AND SCOPE OF CONFERENCING

7. The purpose of conferencing was to identify, discuss, and highlight points of agreement and disagreement on effects on the long-term phosphorus fertiliser and sheep grazing experiment located at the AgResearch Ballantrae

Hill Country Research Station arising from the notices of requirement relating to the Project, and the submissions received in relation to them.

8. The scope of the issues covered at this conference included:

   (a) The value, importance and status of the long term systems trial;

   (b) Viability and integrity of the long-term systems trial;

   (c) Future use of the site, including land required for construction; and

   (d) Implications of a smaller footprint on the long-term systems trial.

KEY FACTS AND ASSUMPTIONS

9. Refer to Annexure A.

METHODOLOGIES AND STANDARDS

10. Refer to Annexure A.

AGREED ISSUES

11. Refer to Annexure A.

DISAGREEMENT AND REASONS

12. Refer to Annexure A.

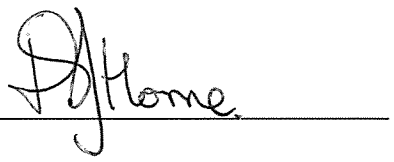
PRIMARY DATA

13. Refer to Annexure A.

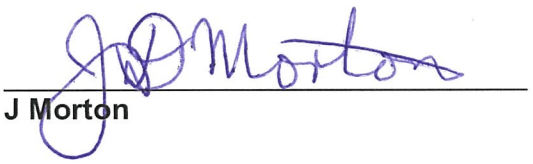
RESERVATIONS

14. Refer to Annexure A.

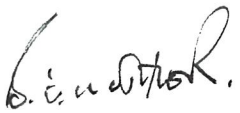
Date: 22 March 2019



Dr Horne



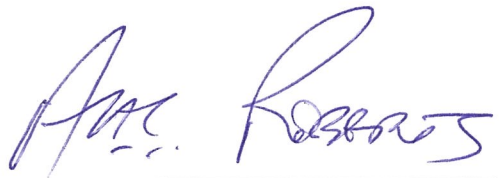
J Morton



Dr Clothier

Dr Mackay

Dr Henderson



Dr Roberts

Dr Matthew

ANNEXURE A

In the matter of notices of requirement for designations under section 168 of the Resource Management Act 1991, in relation to Te Ahu a Turanga; Manawatū Tararua Highway Project.

Expert conferencing – effects on the long-term phosphorus fertiliser and sheep grazing experiment located at the AgResearch Ballantrae Hill Country Research Station

Participants: Dr Horne (DH), Jeffrey Morton (JM), Dr Clothier (BC), Dr Mackay (AM), Dr Henderson (HH), Dr Roberts (AR), Dr Matthew (CM).

Primary data identified by experts

- Full LIDAR set – summary data and maps attached as appendix to this JWS
- Location of field measurement sites from Dr Mackay's evidence

Key facts and assumptions (not already in the body of the JWS)

- 10ha designation corridor
- The long-term systems trial is defined as the long-term phosphorus fertiliser and sheep grazing experiment located at the AgResearch Ballantrae Hill Country Research Station.

- The long-term trial site is defined as the four farmlets that cover 33.3 ha of land in the north east of Ballantrae, at the intersection of Saddle and Morgan Roads.

Methodology and standards

- DEM resolution currently varies between sets of evidence, for example use of 15m (Horne's evidence) resolution versus use of 0.5m (Mackay's evidence) resolution. This has implications for proportion of slope classes and the connectedness of the hydrology. The 15m resolution sees more flat land and less steep land and the 0.5m shows more steep land greater than 25 degrees.

Inadequate issue identification and why

- Effect of vehicle emissions on the long-term trial site – not within the area of expertise of the experts.

Issue	Statements	Agreed Position	Disagreements, with reasons
The value of the long-term systems trial	The long-term systems trial has been, is, and can continue to be, an invaluable resource for science, teaching and extension (i.e. students and farmers), land-based	All	

Issue	Statements	Agreed Position	Disagreements, with reasons
	industries, resource policy, regulatory agencies.		
Importance of the long-term systems trial	This is the only long-term fertiliser and sheep-grazed systems trial in New Zealand and globally, that is on hill country.	All	
Contemporary status of the long-term systems trial	Valuable results continue to be obtained from the long-term systems trial regardless of the frequency of measurement because of the long-term continuity of the experiment has been maintained. The fertiliser and stocking rate treatments continue to be maintained across the four farmlets (which is a significant logistical exercise) on a year on year basis	All	

Issue	Statements	Agreed Position	Disagreements, with reasons
	and the effects of those treatments continue to accrue.		
Viability and integrity of the long-term systems trial, during construction and once the road is constructed	If the designation corridor was to remain in the same location the credibility of the ongoing/future data collected from the long-term systems trial would come to an end because of the disruption to the systems and loss of permanent sites.	All	
	Avoiding the long-term trial site is the only option to ensure on-going validity of the long-term systems trial.	BC, AR, AM, HH, CM	JM abstains because the statement is too strong. DH because the potential to rescue the trial warrants further consideration.

Issue	Statements	Agreed Position	Disagreements, with reasons
Future use of the approximately 5ha of the trial site which is required for construction purposes.	Depending on how land within the designation corridor is managed during construction (e.g. grass is grazed, dung and urine returned, minimal heavy machinery disturbance, no contaminants) the potential to undertake component research on this part of the trial site post-construction remains.	JM DH It would depend on the effects of construction and what the component research was.	BC abstains because he doesn't consider it's his role to reach a view on this point. AR disagrees because as an industry funder he can't have confidence that the site hasn't been compromised. CM disagrees because when setting up an experiment you try to minimise doubts about the site history. AM because of the uncertainty. HH because too much uncertainty to use it.

Issue	Statements	Agreed Position	Disagreements, with reasons
Future new uses of trial site outside of the designation corridor	There is potential for future component research on the remainder of the trial site (approximately 23 ha) outside of the designation corridor.	JM, AM, DH, HH AR subject to the remainder of the site being appropriate for the type of research that might be funded on the site given the changed site characteristics, practices etc. CM/HH subject to being able to identify a research question which fitted the modified site context.	BC abstains because he doesn't consider it's his role to reach a view on this point.
Benefit of a smaller designation corridor	The smaller the footprint, the greater the potential for future component research, i.e. a potential reduction from 10 to 5 ha for the construction corridor.	JM, DH	BC, AM, CM, AR, HH because of the low value of the extra land and possibly compromised value that would come through construction.
What would the implication on the long-term trial be of a smaller	A smaller corridor (i.e. reduce the number of sampling sites which are lost from approximately 25 to 15 of		AR/HH because even the loss of 15 sites (21%) compromises the long term value of the continuous record

Issue	Statements	Agreed Position	Disagreements, with reasons
designation and construction footprint?	72) would avoid some of the effects of road construction and location on the long-term systems trial to the extent that the trial integrity remains.		of results from those sites and a disproportionate loss of SW aspects. CM because of percentage loss of sites, changed animal behaviour and unknown effect of vehicle emissions. JM/DH because they were not aware of the map showing the sampling sites when his evidence was written BC because of the unknown break in the hydrologic connection between these sites and all others AM because of disruption to the systems, which include animal behaviours, loss of disproportionate

Issue	Statements	Agreed Position	Disagreements, with reasons
			number of SW sites and loss of the permanent sites.

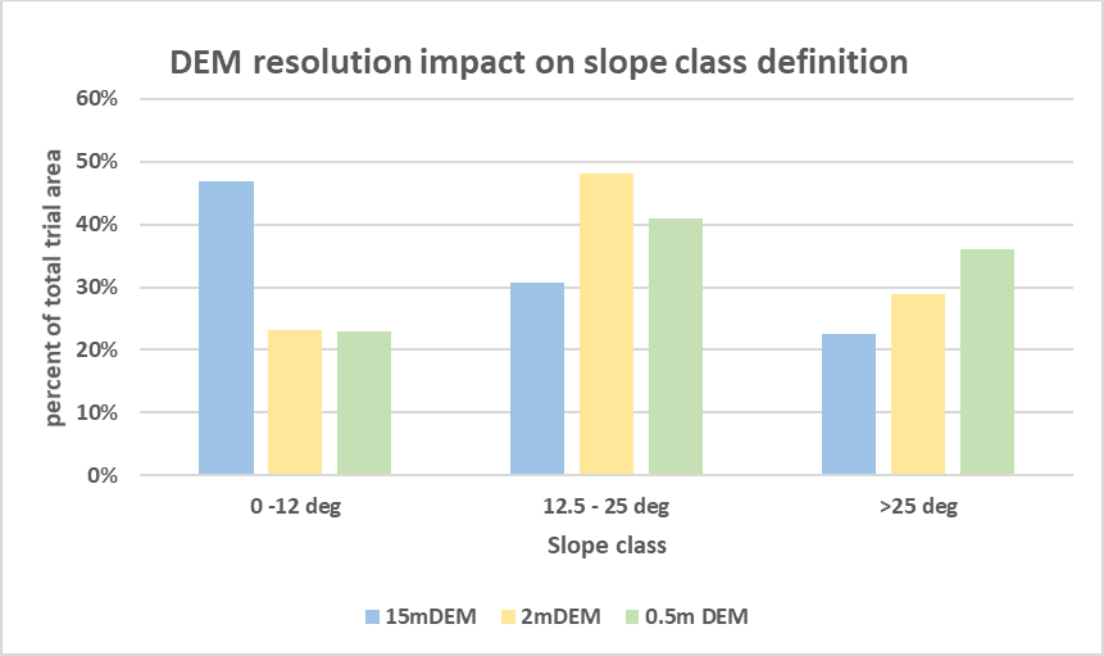
The impact of elevation source resolution on estimates of slope and aspect

Three resolutions of digital elevation models (DEM) have been evaluated

- 15 m DEM – sourced from LINZ data
- 2 m DEM – sourced from NZAM aerial survey
- 0.m DEM – derived from NZTA LIDAR survey

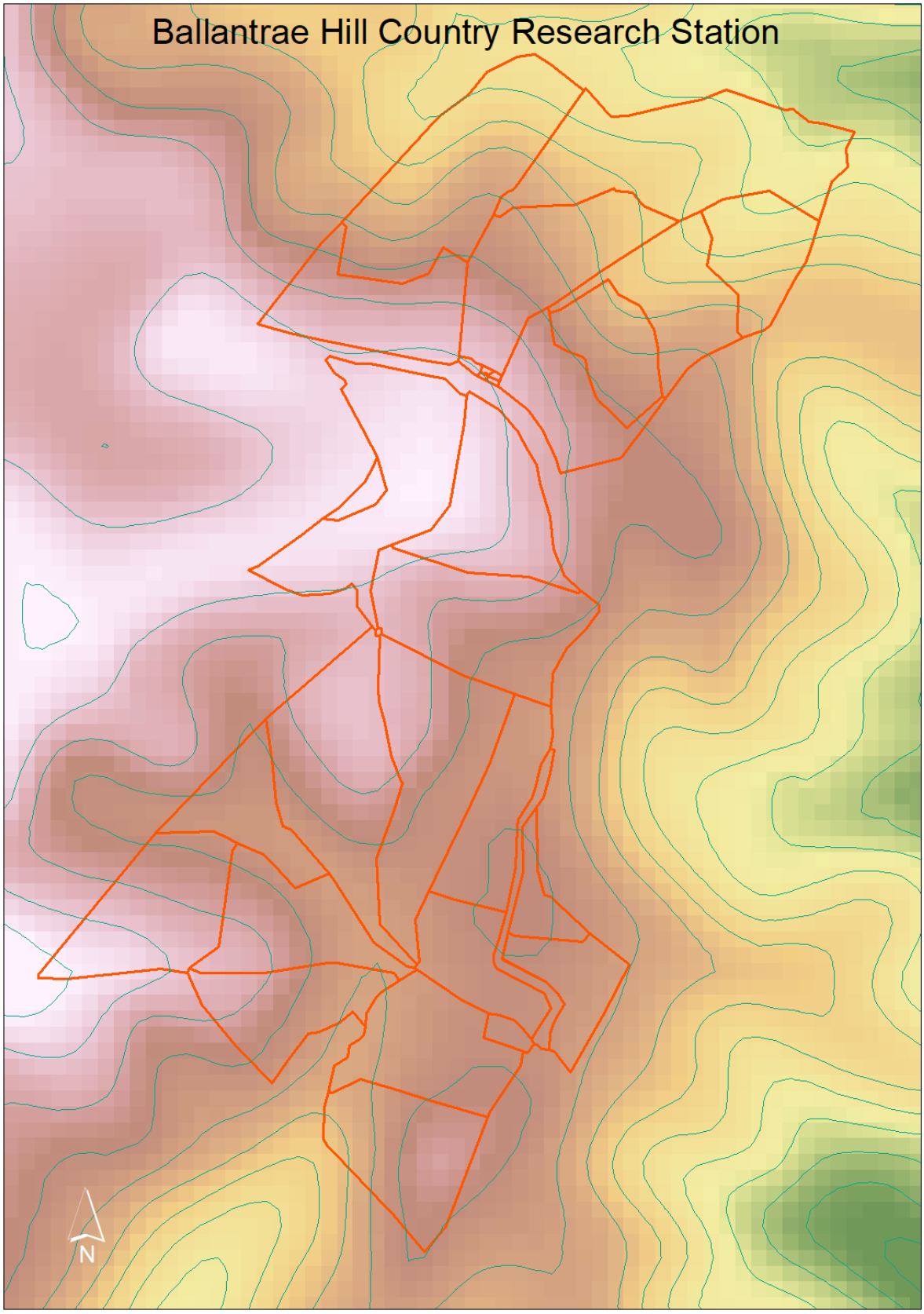
The table below highlights the differences in slope class definition across the 3 DEM resolutions

	Slope Class		
Source	0 -12 deg	12.5 - 25 deg	>25 deg
15mDEM	47%	31%	22%
2mDEM	23%	48%	29%
0.5m DEM	23%	41%	36%

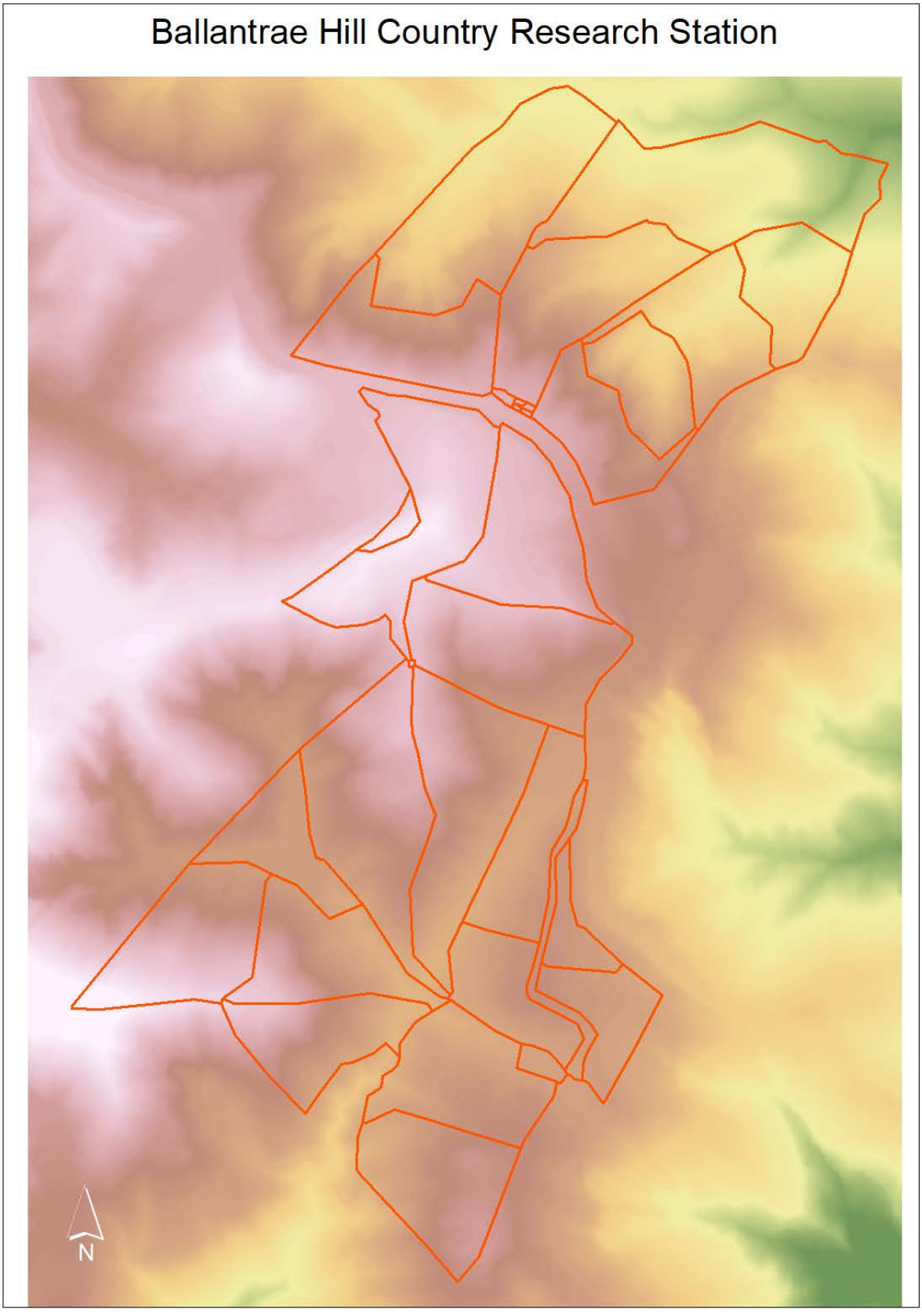


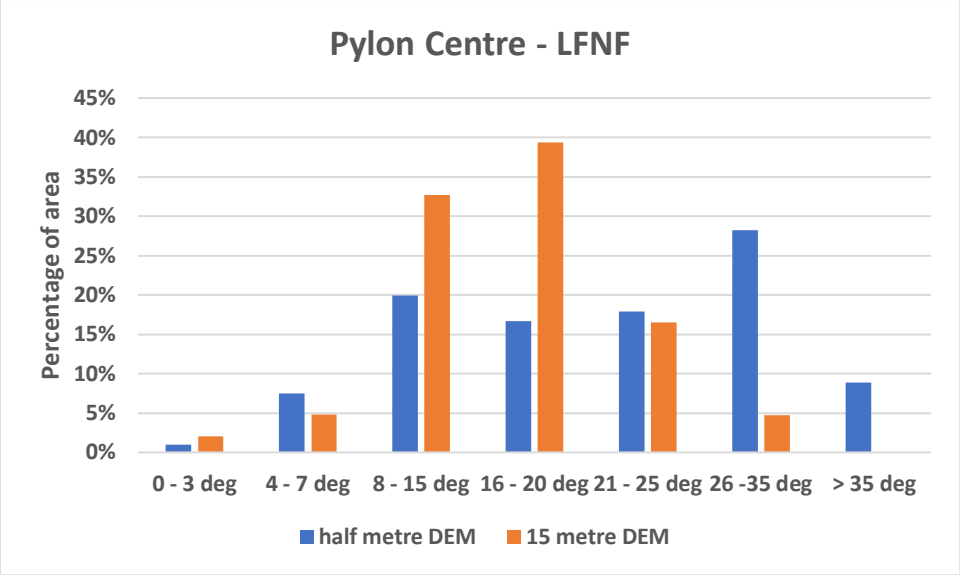
- The 15 m DEM tends to overestimate areas of low slope
- The 2 m and 0.5 m DEM's define a greater percentage of the area as moderate or steep
- The 0.5 m DEM also creates a flat class, i.e. those areas that have zero slope and hence no aspect, approximately 1% of the area falls into this category
- When working in hill country at the plot, paddock or farmlet scale the higher resolution DEM delivers the best description of the terrain

15 metre DEM with 15 m contour



0.5 metre DEM

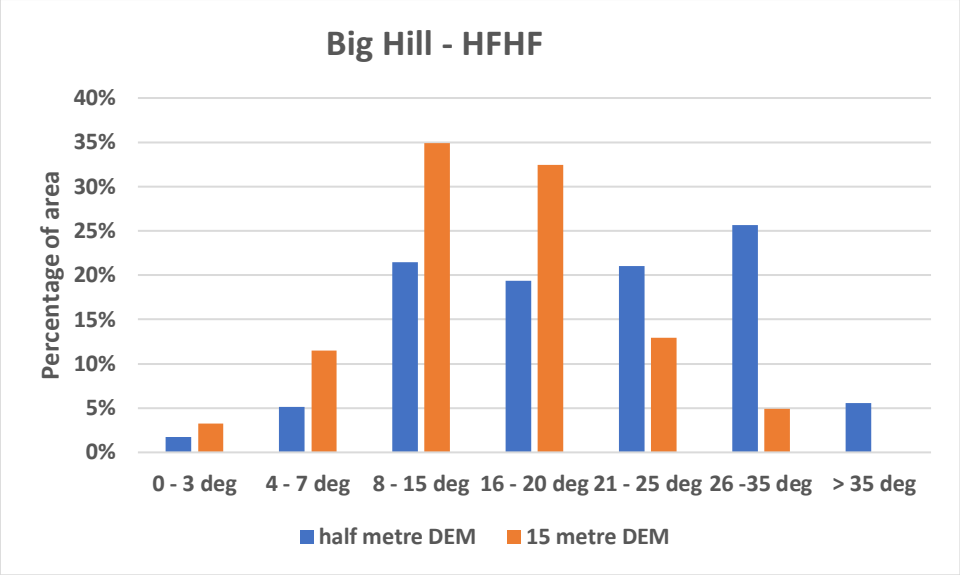




Distribution of slope classes derived from a 0.5 m DEM and a 15 m DEM

Pylon Centre - LFLF

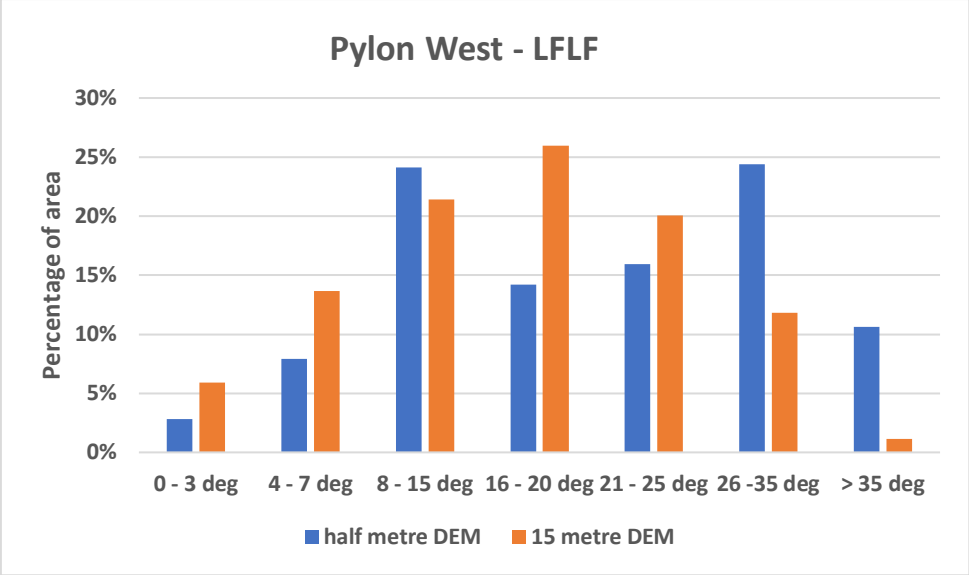
	half metre DEM	half metre DEM	15 metre DEM	15 metre DEM
Slope class	**Sum of Area**	**%**	**Sum of Area**	**%**
0 - 3 deg	916	0.9%	1937	2.0%
4 - 7 deg	7259.75	7.5%	4658.25	4.8%
8 - 15 deg	19234	19.9%	31530.75	32.7%
16 - 20 deg	16095.25	16.7%	37975.5	39.3%
21 - 25 deg	17240.5	17.9%	15924.5	16.5%
26 -35 deg	27244.5	28.2%	4530.5	4.7%
> 35 deg	8566.5	8.9%	0	0.0%
	96556.5	**100%**	**96556.5**	**100%**



Distribution of slope classes derived from a 0.5 m DEM and a 15 m DEM

Big Hill - HFHF

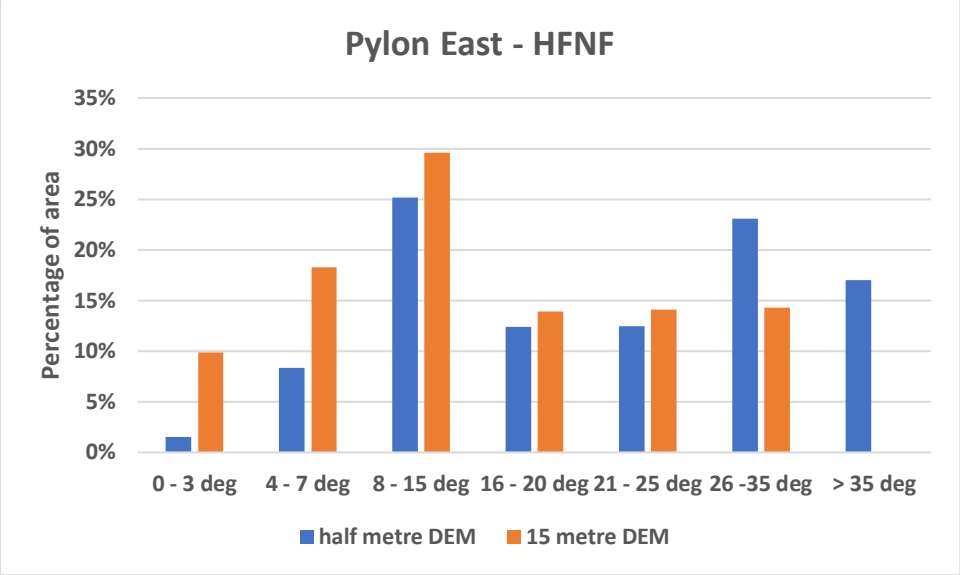
	half metre DEM	half metre DEM	15 metre DEM	15 metre DEM
Slope class	**Sum of Area**	**%**	**Sum of Area**	**%**
0 - 3 deg	1203.75	1.8%	2222.25	3.2%
4 - 7 deg	3496.25	5.1%	7862.5	11.5%
8 - 15 deg	14695.5	21.5%	23863	34.9%
16 - 20 deg	13247.75	19.4%	22219.25	32.5%
21 - 25 deg	14398.75	21.0%	8872.75	13.0%
26 -35 deg	17545.25	25.6%	3365.25	4.9%
> 35 deg	3817.75	5.6%	0	0.0%
	68405	**100.0%**	**68405**	**100.0%**



Distribution of slope classes derived from a 0.5 m DEM and a 15 m DEM

Pylon West - LFLF

	half metre DEM	half metre DEM	15 metre DEM	15 metre DEM
Slope class	**Sum of Area**	**%**	**Sum of Area**	**%**
0 - 3 deg	2239.75	2.8%	4667.25	5.9%
4 - 7 deg	6227.75	7.9%	10779	13.7%
8 - 15 deg	19021.75	24.1%	16894.75	21.4%
16 - 20 deg	11199.25	14.2%	20503.25	26.0%
21 - 25 deg	12587.5	16.0%	15832.75	20.1%
26 -35 deg	19234.25	24.4%	9322.25	11.8%
> 35 deg	8389	10.6%	900	1.1%
	78899.25	**100.0%**	**78899.25**	**100.0%**



Distribution of slope classes derived from a 0.5 m DEM and a 15 m DEM

Pylon East - HFNF

	half metre DEM	half metre DEM	15 metre DEM	15 metre DEM
Slope class	**Sum of Area**	**%**	**Sum of Area**	**%**
0 - 3 deg	916	0.9%	1937	2.0%
4 - 7 deg	7259.75	7.5%	4658.25	4.8%
8 - 15 deg	19234	19.9%	31530.75	32.7%
16 - 20 deg	16095.25	16.7%	37975.5	39.3%
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