In the matter of Plan Change 69, of Selwyn District Council

Evidence of Associate Professor Peter Almond (Versatile soils)

Dated: November 24, 2021

EXPERT EVIDENCE FROM ASSOCIATE PROFESSOR PETER ALMOND, LINCOLN UNIVERSITY

The essence of my previously submitted expert evidence was

1. S-Map provides quality assured and accurate soil information and should be relied on for assessing Land Use Capability (LUC)
2. Existing LUC information is obsolete
3. An evaluation of LUC using S-Map data provided for this hearing by Manaaki Whenua Landcare Research indicates approximately 12 ha of class 2s land (moderately well drained Templeton soils), 88 ha of class 2w land (imperfectly drained Wakanui soils) and 98 ha of class 3w land (poorly drained Flaxton, Temuka and Taitapu soils).
4. The whole of PC69 area includes land that would be considered under the Draft National Policy Statement for Highly Productive Land as "Highly Productive" (LUC classes 1-3)
5. As a complement to a high level technocratic classification of highly productive land and as a rebuttal to the evidence of Katherine McCusker's first submission I provided an analysis of the frequency of cultivation on the dairy farm within the boundaries of PC69 and adjacent areas, based on Google Earth imagery.
   a. Ms McCusker claimed the Wakanui soils were too poorly drained for cultivation.
   b. In the dairy farm, paddocks on Wakanui soils were cultivated up to three times in the 10 years between February 2011 and November 2020.
   c. The market garden area on Wakanui soils was cultivated 16 times.
6. Both lines of evidence indicate approval of PC69 would lead to a loss of at least 100 ha of highly productive land (moderately well and imperfectly drained Templeton and Wakanui soils)

Katherine McCusker has since submitted a rebuttal (Update 23 Nov. 2021) of some points of my evidence, claiming in one instance that our method was flawed.

1.1 CULTIVATION FREQUENCY

The following excepts relate to my assessment of cultivation frequency of the market garden.
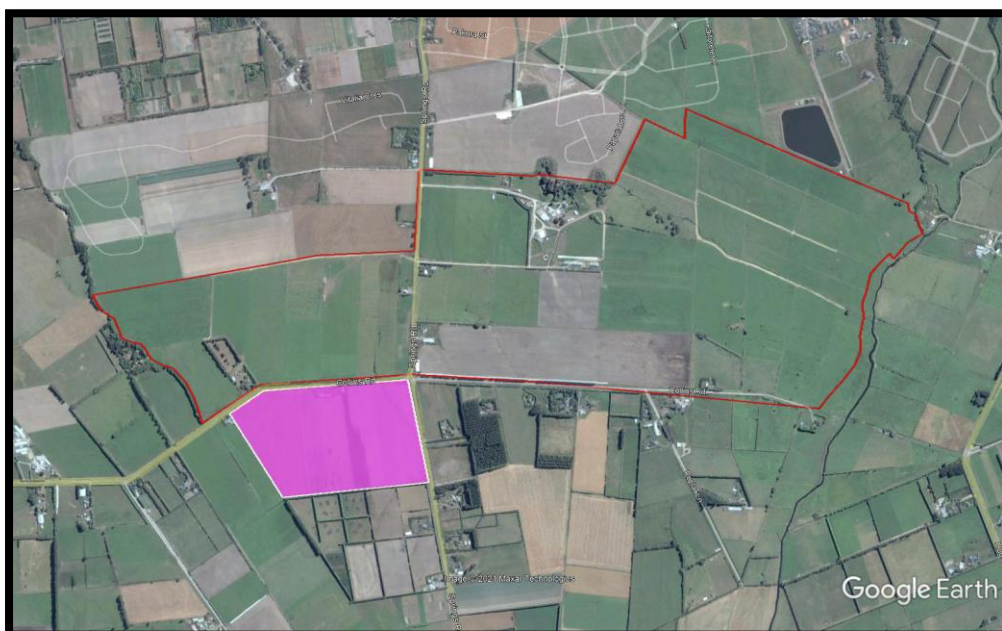
Figure 1. PC69 boundary shown in red with area of market garden in pink.

In **Paragraph 18** Ms McCusker states "He appears to have counted the number of times a paddock appears to have bare soil. For example, on the property identified as a market garden in Apr -17, May -17 and Aug -17, all the images have bare soil."

The dates of imagery for assessing cultivation are clearly stated in para. 15 of my submission. Images from May -17 and Aug -17 weren't used because Google Earth displays the same image throughout this time frame. Therefore, it was assumed that there was only one cultivation event prior to the image captured in April (the image used).

Paragraph 18 – "Google earth shows no crops growing in winter 2011, 2013 and 2015, …"

As mentioned by Ms McCusker herself, images captured and presented by Google Earth are sporadic. Typically, with only a few captured in a year. Absence of evidence is not evidence of absence.

2011 – There is no update of imagery between March 2011 – June 2012. Ms McCusker cannot make this claim.

2013 – There is no update of imagery between March 2013 and August 2013. However, in the latter image, green shoots are clearly visible suggesting there was a recent cultivation. Again, Ms McCusker cannot be so definitive.

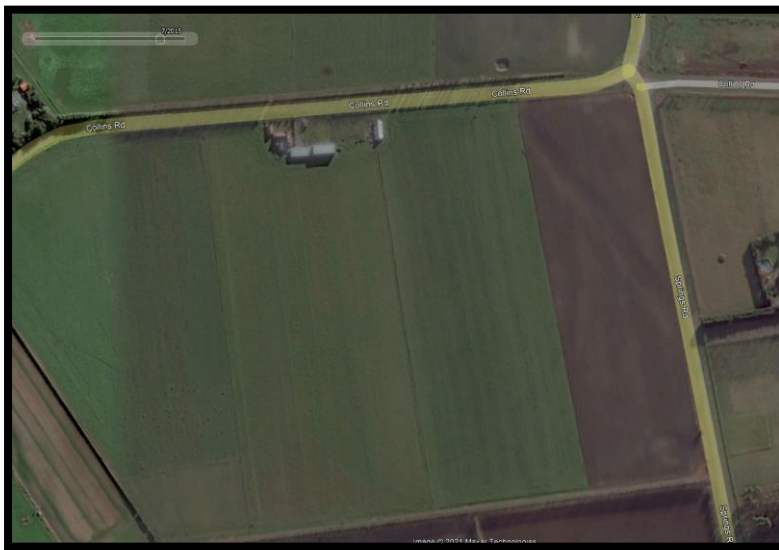2015 – All images available over the winter period clearly show crops growing (Fig. 2).

Figure 2. Recently and currently tilled ground is obvious in the image of July 2015

Paragraph 18 –"…. only one paddock out of 4 had crops in winters 2014, 2016, 2020."

2016 – the imagery was not updated between November 2015 to November 2016, nor between November 2019 and November 2020. No definitive statements about cultivation in the winters of 2016 or 2020 can be made.

What is unequivocal is that the market garden area on imperfectly drained Wakanui soils across Collins Rd immediately to the south of PC69 is a highly productive arable farm (Fig. 3).

Feb 2008	**July 2009**	March 2010
Feb 2011	**October 2012**	March 2013
August 2013	**July 2014**	**July 2015**
November 2015	**November 2016**	**October 2017**
August 2018	December 2020	

Figure 3. Sequential Google Earth imagery showing cultivation events from 2008 to 2020. Spring and winter imagery has bold labels.

Paragraph 20 states "Figure 5 also identifies that within the PC69 area shown as block 37, 40 and 41 on his figure 5 as having 16 cultivation events, however when I view these images it shows an absence of green grass due to being rank brown grass, dryness…"

Ms McCusker has misread the figure. We counted only three cultivation events for each of those blocks and that is what Fig. 5 of my original submission shows.

1.1.1 The Onion Farm

Ms McCusker provides what she claims as evidence of ponding on the onion farm to the west of the PC69 area. Two points are pertinent here: 1) the onion farm sits on Flaxton soils not Wakanui soils, which are the soils in dispute; 2) the evidence of ponding is equivocal – the soil in the image is moist. There is no standing water.

DEPTH TO GROUNDWATER

Katherine McCusker presents evidence of depth to groundwater stating it is as little as 0.2 m below ground level in the east of the PC69 area. It is well accepted and recognised in the soil maps (see Flaxton, Temuka and Taitapu soils) and the LUC that the far east of the block is a poorly drained area, which poses limitations for intensive land use.

In the area of imperfectly drained Wakanui soils east of Springs Rd, the summer groundwater is in the range of 1.48 m to 2.58 m (Fig. 4). She states that the groundwater table is sufficiently shallow to cause problems for soil aeration and crop growth, which would require the water table to be in the root zone during periods of active plant growth. Very few arable crops will suffer with a water table 1.5 m or more from the surface, and hence I presume Ms McCusker refers to times of the year outside of summer.
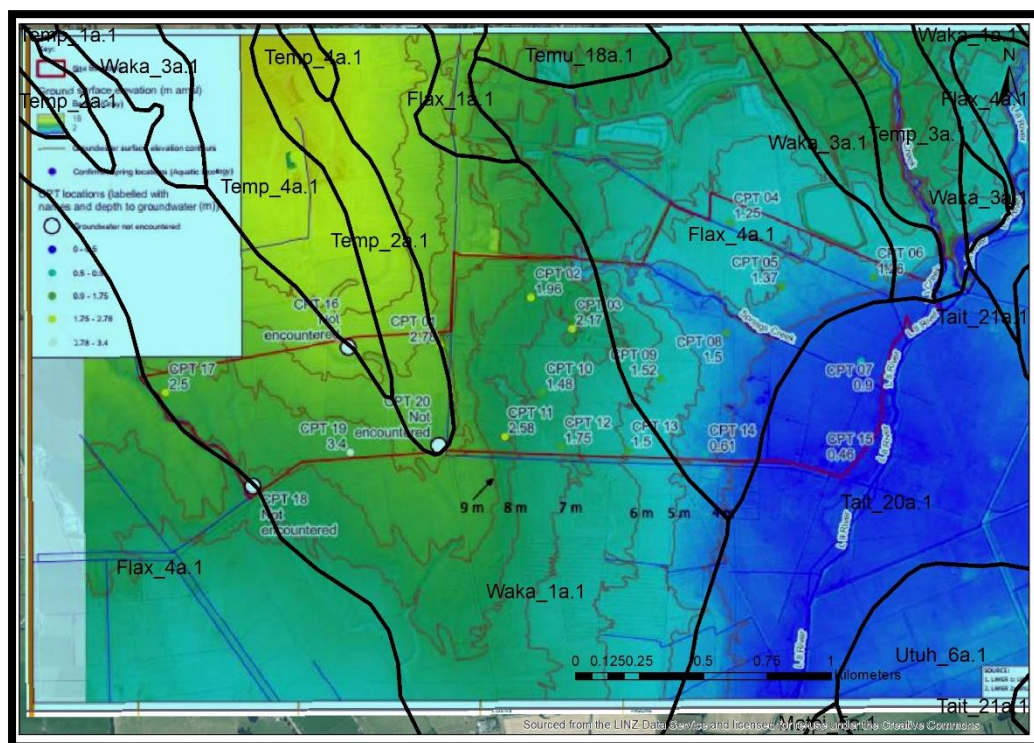

Figure 4. Soil map overlain on the summer groundwater map of Bas Veendrick.

In the absence of soil moisture monitoring through the year the judgement of the duration of soil saturation is usually made on soil morphological grounds. This relies on assessment of the abundance of grey colours in the soil that result from the chemical reduction of Fe when the soil is saturated and anaerobic (a process known as gleying). According to the definition of Wakanui soils, subsoil saturation and intense Fe reduction must occur no closer to the surface than 30 cm. Moreover, the degree of soil gleying usually represents the natural state under which the soil

formed because soil colour patterns are persistent features. Where soils are artificially drained, they are likely to be better aerated than their morphology suggests. As a worst case scenario, one might expect the water table to get within 30 cm of the soil surface and at times of the year when crops were not actively growing and hence less sensitive to anaerobsis. Nonetheless, if the water table was to get this high there would be restriction to cultivation.

Ms McCusker states "Across the western half of the site (48 ha), observed groundwater levels are deeper, at 2 m -3.5 m below ground level…" from which I infer she believes the Wakanui soils on the western part of the block to be different from (better than) the Wakanui soils to the east. In respect of that I have redrawn the boundary of the Wakanui soils according to the EMa50 map she presented in her first submission. I have redrawn the eastern boundary so that EMa values in the area bounded by Wakanui soils are no less than those to the west. In so doing soils of similar texture and water content (as of winter 2014) are grouped together (Fig. 5). The new boundary reduces the area of Wakanui soils by 20 ha to 68 ha. Using this area the total area of highly productive soils is 80 ha.
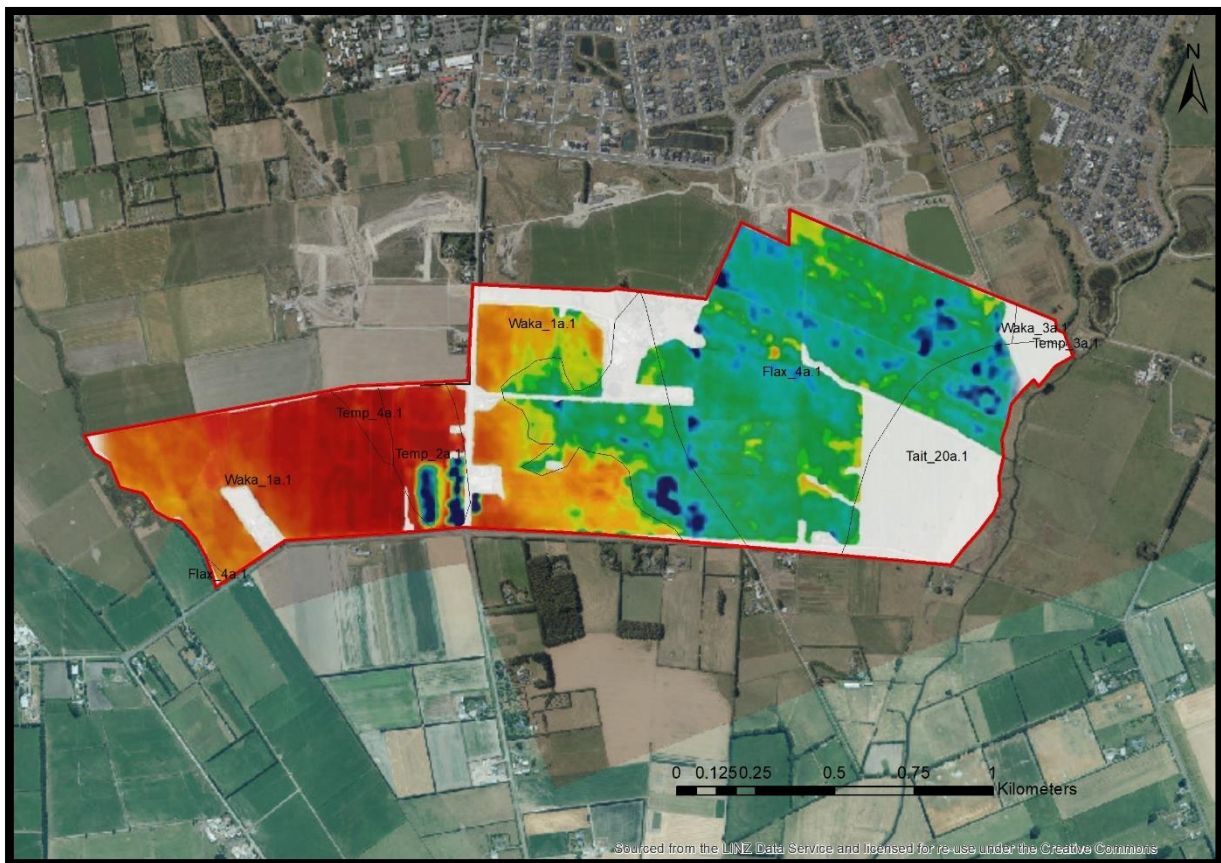

Figure 5. S-Map soil boundaries redrawn to align with (EMa50) data presented by Katherine McCusker.

CONCLUSIONS

- In a technocratic sense and from empirical evidence highly productive soils (Templeton and Wakanui soils) occur in the area bounded by PC69.

- There are also areas of poor drainage that present problems for intensive agriculture (Flaxton, Temuka, Taitapu soils)
- The criticism of Katherine McCusker of the validity of my analysis on cultivation frequency does not hold-up.
- The area of highly versatile soils lost if PC69 were approved ranges from 80 ha to 100 ha. The uncertainty reflects the precision of the current soil maps.