

**ANNEXURE A**

**BEFORE INDEPENDENT HEARING COMMISSIONERS APPOINTED BY  
THE CANTERBURY REGIONAL COUNCIL**

**IN THE MATTER OF**      The Resource Management Act 1991

**AND**

**IN THE MATTER OF**      Submissions and further submissions by Irrigation  
New Zealand on Proposed Plan Change 5 to the  
Canterbury Land and Water Regional Plan

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**SECOND SUPPLEMENTARY STATEMENT OF EVIDENCE OF IAN  
MCINDOE**

**14 SEPTEMBER 2016**

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## SECOND STATEMENT OF SUPPLEMENTARY EVIDENCE OF IAN MCINDOE

### Introduction

- 1 My name is Ian McIndoe.
- 2 I am a Soil and Water Engineer, currently employed as Managing Director of Aqualinc Research Ltd (**Aqualinc**).
- 3 My evidence responds to the following direction from Commissioner van Voorthuysen at the Plan Change 5 (**PC5**) hearing on Tuesday 23 August:

*Mr McIndoe to provide a summary comment of the differences between the two methods (being PC5 and that proposed by Irrigation New Zealand) in terms of drainage and N leaching, and expand on that as he sees fit.*

### Qualifications and experience

- 4 My experience and qualifications are set out in paragraphs 5 to 7 of my primary evidence of 22 July 2016.

### Summary comment explaining the difference in drainage

- 5 Under both the Portal and Overseer the amount of modelled drainage arising from irrigation depends primarily on the:
  - 5.1 soil PAW60;
  - 5.2 climate (the timing and magnitude of rainfall and ET); and
  - 5.3 the irrigation rules applying to a specific irrigator type (trigger point and application depth).
- 6 As drainage is due to climate (rainfall and evapotranspiration), soil and irrigator type, it is location specific. To collectively and correctly model the drainage difference between the PC5 irrigation rules and the Irrigation New Zealand (**INZ**) proposed rules, the modelling would need to be applied to every rainfall, soil and irrigator combination in

Canterbury. I have been unable to do this in the time available and with the resources available to INZ, given the thousands of combinations involved and the timeframes that would be needed.

- 7 The irrigation rule parameters that have a significant influence on drainage in Overseer and the Portal are:
  - 7.1 the level of moisture in the soil after each irrigation event (whether there is any gap for rainfall storage); and
  - 7.2 whether the applied water causes the soil moisture to exceed field capacity (when the soil moisture is at its PAW value).
- 8 I have calculated the difference in the amount of rainfall storage/application excess, in millimetres, for each irrigation rule for the preferred and alternative INZ rules compared to the PC5 rules.
- 9 Where the difference is less than 10 mm, I have assessed the drainage as being 'similar'. Without carrying out the specific modelling in specific locations, I cannot conclude whether one would be higher or lower than the other.
- 10 Where the amount of rainfall storage/application excess for the INZ rules is 10 mm or more than the amount of rainfall storage/application excess for the PC5 rules, I have described the difference as 'higher'. In this case, the INZ rules would almost certainly result in more drainage than the PC5 rules.
- 11 Where the amount of rainfall storage/application excess for the PC5 rules is 10 mm or more than the amount of rainfall storage/application excess for the INZ rules, I have described the difference as 'lower'. In this case, the PC5 rules would almost certainly result in more drainage than the INZ rules.
- 12 To provide an indicative ranking between the two sets of rules, I have applied a "+1" to higher, "0" to similar and "-1" to lower and area-averaged the results based on the areas of each irrigation system type on each soil PAW60 category given in the (Brown, 2016) report.

- 13 This analysis provided a factor of +0.44 for the INZ preferred rules and +0.19 for the alternative rules, compared to the PC5 rules. This shows that indicatively, the additional drainage that would be modelled under the INZ preferred rules is just over twice the additional drainage that would be modelled under the alternative rules, compared to the PC5 rules.
- 14 This analysis does not quantify the additional drainage.
- 15 To obtain an indicative assessment of the quantity of additional drainage, I instructed one of my staff (Dr Glen Treweek) to complete Overseer modelling runs for 36 combinations covering:
- 15.1 Four soil PAW's – 40 mm, 60 mm, 80 mm, 100 mm
  - 15.2 Three rainfall bands – Low (Wakanui), Medium (Lauriston), High (Methven)
  - 15.3 Irrigation rules for PC5 (centre-pivot and travelling irrigator)
  - 15.4 Preferred Irrigation rules for INZ
- 16 From the Overseer modelling, I was provided with mean annual drainage values for each combination.
- 17 The above combinations cover 48% of the irrigated land area in Canterbury where irrigation system type is known, so I consider the results will be representative of what would occur in Canterbury as a whole.
- 18 Using the Brown (2016) data, I have area-averaged the drainage values for each of the 36 combinations, with the following results:
- 18.1 Average drainage from PC5 rules – 305 mm/year
  - 18.2 Average drainage from preferred INZ rules – 399 mm/year
  - 18.3 Difference – 98 mm/year
- 19 This shows that indicatively, the proposed INZ rules will result in a 31% increase in drainage above that produced under the PC5 rules.

- 20 Using the 0.44/0.19 factors I had derived for the relative difference between the INZ preferred rules and the INZ alternative rules, I estimate that the alternative rules will result in a 40 mm (13%) increase in drainage compared to PC5.

**Summary comment explaining the difference in N leaching**

- 21 The modelled amount of additional nutrient leached under the INZ rules compared to the PC5 rules is very farm-specific. Generally, nutrient leaching increases with increasing drainage. On that basis, the logical conclusion is that adoption of the INZ rules will result an increase in the modelled amount of nutrient leaching compared to PC5. It may be in the order of 31% for the INZ preferred rules and 13% for the INZ alternative rules.
- 22 I note that whether or not changing the Portal actually results in increased drainage and/or N loss depends on whether a farm is allowed to leach nitrogen up to the GMP numbers calculated.



**Ian McIndoe**  
14 September 2016