in the matter of: the Resource Management Act 1991

and: submissions and further submissions in relation to proposed variation 1 to the proposed Canterbury Land and Water Regional Plan

and: **Fonterra Co-operative Group Limited**
Submitter

Statement of evidence of Peter Francis Callander (water allocation)

Dated: 29 August 2014

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STATEMENT OF EVIDENCE OF PETER FRANCIS CALLANDER

INTRODUCTION

1 My name is Peter Francis Callander.

2 I have been a Director of Pattle Delamore Partners Limited (PDP) since 1997. I hold the qualifications of BSc (Geology) from the University of Auckland and MSc (Earth Sciences) from the University of Waterloo (Canada). I am a member of the New Zealand Hydrological Society and the USA based National Ground Water Association. I have over 25 years of experience as an environmental scientist specialising in groundwater and surface water resources. Prior to my employment at PDP, I had been employed for seven years by the Canterbury Regional Council and its predecessor the North Canterbury Catchment Board.

3 I have particular experience in the management of water resources. This has included work on numerous projects where I have modelled and advised on the management of water quality impacts associated with irrigation including work for the Waimakariri Irrigation Scheme, Rangitata South Irrigation, Barrhill-Chertsey Irrigation, the Southern Valleys Irrigation Scheme and Wairau Valley Water Enhancement Scheme. I have also reviewed work completed by other parties for the proposed Central Plains irrigation scheme (on behalf of the Christchurch City Council and others) and applications for irrigated land use change in the MacKenzie basin (on behalf of Meridian Energy).

4 I provide the following statement of evidence regarding the submission lodged by Fonterra Co-operative Group Limited (Fonterra) for variation 1 (*Variation 1*) of the proposed Canterbury Land and Water Regional Plan (*pLWRP*).

SUMMARY

5 Fonterra take groundwater from deep bores for use in their milk processing plant in Darfield and they discharge the wastewater generated from that process to land via irrigation systems. The plant is located within the Selwyn-Waihora zone as described in the pLWRP. Variation 1 proposes cutbacks to groundwater allocation and abstraction in the Selwyn-Waihora Zone which do not differentiate between industrial use and normal farming operations and do not allow for water use activities that generate discharges that enhance the groundwater resource.

6 In particular, the current Fonterra Darfield operation produces additional water (over and above that which is abstracted), primarily because the milk processing plant generates condensate water via the milk evaporation process. This water is irrigated to land resulting in extra

drainage back to the aquifer and a net gain for the groundwater resource.

SCOPE OF EVIDENCE

7 In my evidence I will provide the following:

7.1 An overview of the Darfield milk processing Plant;

7.2 A description of the authorised groundwater take and wastewater discharge to land;

7.3 A comparison between the amount of groundwater used and amount of wastewater generated and discharged to land for the Darfield plant compared to a typical irrigation activity;

7.4 Discussion of relevant Variation 1 Policies and Rules from the Fonterra submission in light of my evidence.

8 Although this is not a Court hearing, I have read the Environment Court's Code of Conduct for Expert Witnesses, and I agree to comply with it. My qualifications as an expert are set out above. I confirm that the issues addressed in this brief of evidence are within my area of expertise, except where I state I am relying on what I have been told by another person. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

DEFINITIONS AND ABBREVIATIONS

9 There are a number of terms describing the various components of water used and wastewater generated. In my evidence the following abbreviations and definitions are used:

9.1 **Clean process water**: Condensate water (sometimes also referred to as COW water), obtained by evaporating the water content out of milk and cooling water.

9.2 **Wastewater**: Treated factory wastewater from the washing down of trucks, equipment, tanks and pipes in process areas, consisting of water, milk, milk products, traces of nitiric acid, caustic soda and dairy sanitisers, clean process water and stormwater runoff from coal and milk load in and out areas and from the balance tank and silo areas.

(a) **D1** – Dryer 1

(b) **D2** - Dryer 2

(c) **D3** – Dryer 3

DARFIELD MILK POWDER PLANT

10 As discussed in detail by **Mr Ian Goldschmidt**, Fonterra operates a milk processing plant in Darfield which currently operates two milk powder dryers (D1 and D2) capable of processing up to 7.2 Million litres of per day. The plant uses bore water in the production process and generates wastewater (including clean process water) which is irrigated to land.

11 The bore water abstraction and the wastewater discharge to land is authorised under resource consents held by Fonterra as detailed in **Mr Goldschmidt's** evidence. Details of the authorised bore water abstraction and wastewater irrigation to land are provided in paragraph 13 to 18 of my evidence.

12 D1 and D2 are currently fully operational with the Fonterra land and Gunn and Gray properties providing sufficient area to irrigate all the generated wastewater to land. There is the potential that Fonterra may build a third milk powder dryer (D3) which would increase the amount of wastewater generated as detailed in paragraph 21 of my evidence.

DESCRIPTION OF THE AUTHORISED GROUNDWATER TAKE AND WASTEWATER DISCHARGE

13 The taking of groundwater at the Darfield site can occur at a rate of up to 75 L/s from each of bores L35/0883 and L35/0884 (245 m and 251.6 m deep respectively with a standing water level of ~150m). The annual volume on the consent is 2,599,000 m^3. **Appendix B** appended shows the locations of each bore and the dairy plant.

14 The resource consent for the groundwater take includes adaptive management conditions which potentially restrict the volume of water that can be abstracted each year depending on groundwater levels measured every spring in addition to historic groundwater levels. Condition 7 of the consent outlines the adaptive management requirements (see consent CRC060458.3 **Annexure 1** of **Mr Goldschmidt's** evidence).

15 These conditions require that the annual volume is calculated for each forthcoming year by the consent holder based on a set methodology relating to recent and historic groundwater levels. However, condition 7(b) is an addition to the original (irrigation) consent which allows for "Additional Volume" to be added to the Annual Volume calculated under condition 7(a) where it is found that this annual volume is likely to limit full consented milk production for that dairy season.

16 Under the consent, the "Additional Volume" shall equal the annual condensate volume which is estimated based on the annual predicted milk volume to be processed into milk powder.

17 The inclusion of condition 7(b) allows for the unrestricted use of water for milk processing even for the situation where condition 7(a) would otherwise indicate that restrictions are required. Therefore this addition to the original consent conditions (based on irrigation use) provides Fonterra with security of supply to process milk and fulfil its obligations under DIRA, as outlined by Mr Goldschmidt, even if the assessment carried out under condition 7(a) was unfavourable.

18 The conditions of the consents to discharge wastewater and clean process water (CRC103594 (Fonterra), CRC140775 (Gunn) and CRC140777 (Gray) (see Annexure 1 of **Mr Goldschmidt's** evidence)) include various controls on the irrigation activity such as limits on irrigation volumes, minimum irrigation areas, application rates which vary dependent on soil moisture level, nitrogen loading rates etc. Since the Gunn and Gray properties are irrigated with clean process water only the controls on the irrigation activity are different to the controls on the Fonterra land.

CURRENT AND FUTURE WATER USE AND WASTEWATER GENERATED

19 Fonterra have supplied me with bore water abstraction data and wastewater irrigation data for the 2012/2013 year and for the 2013/2014 year. D1 was fully operational in 2012/2013 and D1 and D2 were fully operational in the 2013/2014 season. I therefore consider the 2013/2014 data to be the best representation of current water use and generated wastewater. A summary of the total measured abstracted groundwater volume and measured total generated wastewater volume for the 2013/2014 season is provided in **Table 1** below. The cumulative measured abstracted amount of groundwater and generated wastewater is shown in **Appendix C**.

Table 1: Comparison of abstracted groundwater and total wastewater generated for 2013/2014 season (m^3)

Abstracted groundwater	Total wastewater generated	Wastewater (excluding segregated clean process water)	Clean process water
1,444,000	2,411,000	1,575,000	836,000

20 **Table 1** and **Appendix C** shows that the amount of wastewater generated (and irrigated to land) is much greater than the amount of groundwater abstracted. This is due to the condensate water (cow water) produced in the milk processing plant obtained by evaporating the water content out of milk and cooling water. The ratio between total

wastewater generated and total abstracted groundwater is approximately 1.67 (i.e. 2,411,000 m^3 / 1,444,000 m^3).

21 As detailed in paragraph 12 of my evidence D1 and D2 are currently fully operational and Fonterra is considering building a third milk powder dryer (D3) which would increase both the amount of groundwater abstracted and wastewater generated. Fonterra have provided estimates for the additional wastewater volumes generated by the plant as a result of adding D3. The addition of D3 would bring the total wastewater generation from the plant to around 4,299,000 m^3. Based on the ratio of 1.67 between total wastewater generated and total abstracted groundwater the total future estimated groundwater abstraction would be around 2,574,000 m^3 which is close to the maximum annual volume of 2,599,000 m^3 as specified in the groundwater take consent.

DRAINAGE AND NET AQUIFER GAIN OR LOSS FOR THE FONTERRA MILK PROCESSING PLANT COMPARED TO A NORMAL IRRIGATED FARMING OPERATION

22 In order to determine the net gain/loss of water to the underlying aquifer under normal farming operation and under the operation for the Fonterra plant PDP staff have modelled the drainage volumes under several different scenarios. This section of my evidence describes the different scenarios and model methodology to estimate the net gain/loss to groundwater. The model consists of two areas, 492 ha, which represents the Fonterra land and an additional area of 296 ha representing the Gunn and Gray properties. Both properties were modelled for all scenarios.

Scenario description

23 In order to compare the Fonterra Darfield operation with a normal irrigated farming activity the following two scenarios were modelled:

23.1 Scenario 1 is the current Fonterra operation with D1 and D2 operational with clean process water and waste water disposed of via irrigation across 492 ha of Fonterra land and 296 ha on the Gunn and Gray properties, in accordance with the current consent conditions. The key control to irrigation activity on the Fonterra land is consent condition 9 of consent CRC103594 which restricts irrigation to 25 mm and 16 mm (if the soil moisture balance is above 85% of field capacity) over an average return period of 16 days.

23.2 Scenario 2 assumes normal agricultural irrigation occurs across a reduced land area of 452 ha, in order to match the typical irrigation estimate for an 80% reliability criteria (given the consented volume of water). The application depth applied was 5

mm/day which is representative of a typical irrigated farm in the catchment.

24 A summary of the model methodology and input data is presented in **Appendix D**.

25 For scenario 1 (current Fonterra operation with D1 and D2 operational) the amount of wastewater applied depends on the consent conditions specified for the individual properties. For scenario 2 (normal irrigated farming operation) irrigation water is applied based on a soil moisture deficit calculation.

Results

26 The annual drainage and net aquifer gain/loss for the modelled scenarios is presented in **Table 2**.

27 The annual drainage increases as more water is applied to the land. The differences in drainage volumes (shown in **Table 2**) between scenarios 1 and 2 are relatively small, but there is a much more significant difference between them for the volume of groundwater that is abstracted.

28 The net aquifer gain/loss has been estimated by deducting any groundwater abstractions from drainage. For the normal irrigated farming operation, the bore water abstracted for irrigation is deducted from the drainage total, whilst for the Fonterra operation, bore water abstracted for use in the plant is deducted from the drainage total.

29 The net aquifer gain/loss represents the effect of the activity on the aquifer in terms of abstraction/recharge. Scenario 2, representing the normal irrigated farming operation, returns a negative value, representing a net loss of water for the aquifer. In comparison, the Fonterra Darfield operation shows a net gain for the aquifer relative to the quantity of water abstracted.

30 It is worth noting that there are some differences between drainage and aquifer gain/loss for the Fonterra property and the Gunn and Gray properties. This is because for the modelling it was assumed that the Fonterra property has priority access to the application of wastewater to land.

Table 2: Bore water abstraction, average annual drainage and net aquifer gain/loss for the Fonterra and Gunn and Gray properties

Scenario		Abstraction (mm)	Drainage (mm)	Aquifer Gain/Loss (mm)
1. Current operation with D1 and D2 operational	Fonterra Darfield Operation	-183	413	230
	Fonterra irrigation of Gunn & Gray property	-183	334	150
2. Irrigated scenario as per typical farming practice	Normal farming operation	-415	390	-25

DISCUSSION OF RELEVANT VARIATION 1 POLICIES AND RULES

31 This section of my evidence will review the relevant policies and rules raised in the Fonterra submission to Variation 1 with respect to the management of groundwater abstractions and the information presented in this evidence. The policies and rules are discussed in more detail in the evidence **Ms Sharon Dines**.

32 **Policy 11.4.22** seeks to discourage the transfer of water so as to claw back water allocation and avoid adverse cumulative effects of abstraction. It includes clause (c) which describes a provision for 50% of any transferred water to be surrendered. That is an arbitrary and punitive restriction, although the Section 42A report did not support any changes to it.

33 In my opinion it would seem inappropriate to restrict the transferred quantity if the water was to be used in a way that did not contribute to the cumulative abstraction effects. The Fonterra Darfield situation summarised in **Table 2** is such an example and could be allowed for by rewording Policy 11.4.22 (as amended by the Officer's Report) to read:

> *Restrict the transfer of water permits within the Rakaia-Selwyn and Selwyn-Waimakariri water allocation zones to minimise the cumulative effects on flows in hill-fed lowland and spring-fed*

plains rivers from the use of allocated but unused water, by requiring that:

(a) Irrigation scheme shareholders within the Irrigation Scheme Area shown on the Planning Maps do not transfer their permits to take and use groundwater; and

~~*(b) No permit to take and use groundwater is transferred from down-plains to up-plains; and*~~

~~*(c) (b) In all other cases, except in relation to a community water supply, 50% of any transferred water is surrendered.*~~

(b) 50% of any transferred water is surrendered except where:

(i) the water is used for a community water supply, or

(ii) the water take is for an industrial activity and, when considered in conjunction with other activities on the site to which the water is transferred, results in a neutral or positive water balance.

34 **Rule 11.5.37** is the related rule which also promotes a 50% reduction in the volume transferred. It would be a more reasonable and balanced management tool if it included a similar exemption to the change proposed in the paragraph 33. Therefore clause 4 of rule 11.5.37 could be reworded as:

If the transfer is within the Rakaia-Selwyn or Selwyn-Waimakariri Combined Surface and Groundwater Allocation Zones 50% of the volume of transferred water is to be surrendered. ~~.~~ *unless:*

(a) the water take is for an industrial activity and, when considered in conjunction with other activities on the site to which the water is transferred, results in a neutral or positive water balance.

35 **Policy 11.4.23** is another policy that seeks to reduce the over allocation of the groundwater in the Rakaia-Selwyn and Selwyn- Waimakariri water allocation zone by requiring that water will only be reallocated to existing resource consent holders at a rate and volume that reflects demonstrated use.

36 As detailed in paragraph 12 and 21 of my evidence Fonterra is considering building a third milk powder dryer (D3) which would increase the amount of groundwater abstracted (and wastewater generated). As detailed in paragraph 13 and 19 of my evidence the annual volume on the consent is 2,599,000 m^3 of which currently (based on D1 and D2 being operational) only 1,444,000 m^3 is used.

37 Consent CRC060458.3 expires in 2020 and at this stage it is unclear when and whether a third milk powder dryer will be build. Therefore if D3 becomes operational after the expiry date of the consent and a replacement consent is granted based on demonstrated use further expansion of the Fonterra operation will be prevented. Therefore as requested in the Fonterra submission to Policy 11.4.23, it should not apply to industrial and trade activities where a resource consent to take water is in place and where this provides for planned future development.

38 The Section 42A Officers report agrees with this amendment (paragraph 13.95 of the Officers Report), but then goes on to say (paragraph 13.96) that the amendment sought is not required if the policy is re-worded to refer to Schedule 10 (Reasonable Use Test) because that only applies to irrigation.

39 Whilst it is good to have the Officers support, the re-wording of the policy should be more clearly stated because the wastewater disposal is still occurring via irrigation and could still be evaluated in that way at some point in the future if the Officers approach is adopted. It would be helpful to more clearly distinguish between typical farm irrigation requirements and other activities (such as wastewater disposal irrigation requirements). This could be achieved by the following wording:

> *''For activities using water for agricultural irrigation purposes, only reallocate water to existing resource consent holders at a rate and volume that reflects reasonable use as calculated in accordance with Schedule 10 to provide a volume required to meet demand conditions in eight and a half out of ten years for a system with an application efficiency of 80%.*
>
> *Note: This policy and the reasonable use test in Schedule 10 do not apply to industrial and trade processes that take water and then discharge wastewater and clean process water by irrigation to land under an authorised discharge permit''*

40 **Policy 11.4.27** reads:

> *'Apply adaptive management conditions to groundwater resource consents that have previously been subject to adaptive management conditions'*

41 As detailed in paragraphs 14 - 17 of my evidence condition 7 of consent CRC060458.3 includes adaptive management conditions which potentially restrict the volume of water that can be abstracted each year. However, an addition to the original (irrigation) consent (condition 7(b)) allows for "Additional Volume" to be added to the Annual Volume calculated under condition 7(a) where it is found that this annual volume is likely to limit full consented milk production for that dairy season. The

inclusion of condition 7(b) recognises the significance of the Fonterra industrial activity and allows for the unrestricted use of water for milk processing even for the situation where condition 7(a) indicates restrictions for irrigation users are required. This exemption is critical for the Fonterra operation in Darfield.

42 Based on these considerations and as requested by Fonterra Policy 11.4.27 should allow for retaining this 'additional volume' to allow for unrestricted use of water for milk processing. The Section 42A Officers Report agrees with that requirement and therefore Fonterra's requirements are met by the Officers proposed wording:

> *"Until such time as the allocation Tables 11(e) and 11(f) are no longer exceeded, apply adaptive management conditions upon replacement of any groundwater resource consents that have previously been subject to adaptive management conditions on the same or similar terms as the pre-existing conditions where the proposed use of water remains the same."*

CONCLUSION

43 Based on my assessment of water use and drainage for the Fonterra operation in Darfield compared to a normal irrigated farming operation it is apparent that:

43.1 For a normal irrigated farming operation there is a net loss from groundwater because groundwater abstraction exceeds drainage;

43.2 The Fonterra operation is an essential industrial activity for many farming operations and, in the case of the current Darfield plant operation, additional water is produced (over and above that which is abstracted), primarily because the milk processing plant generates condensate water via the evaporation process. This water is irrigated to land resulting in extra drainage back to the aquifer.

44 I consider that the milk processing operation should not be subject to the same groundwater abstraction restrictions that are applied to typical farming operations and the Policies and Rules of Variation 1 of the pLWRP should be worded to recognise that situation.

Dated: 29 August 2014

Peter Francis Callander

REFERENCES

Greenwood, P.B. (April 2011), Soil Assessment for Wastewater Irrigation Darfield. First Assessment, May 201: Racecourse Hill, Second Assessment, April 2011: Gray and Gunn Properties. Soilwork Ltd, April 2011.

Appendix A

Fonterra Milk Processing Plant and Irrigation Land

KEY :

- Factory Area
- Fonterra Property
- Gunn Property
- Gray Property

A	ISSUE 1	0001	BT
NO.	REVISION	00001	LE

CLIENT :

Fonterra

PROJECT :

Net groundwater use for typical irrigated farm operation and Fonterra Darfield milk processing plant

TITLE :

Appendix A: Fonterra factory area, Fonterra land and Gunn and Gray properties

pdp solutions for your environment
PATTLE DELAMORE PARTNERS LTD
Auckland Tauranga Wellington **Christchurch**

SCALE : 1:40,000 (A3)

0 0.25 0.5 0.75 1 km

PROJECT NO. :	FIGURE NO. :	REVISION :
C02623500	001	001

Appendix B

Location of Fonterra Bores and Fonterra Darfield Plant

SOURCE:
GOOGLE EARTH IMAGE
TAKEN ON 26/01/2013

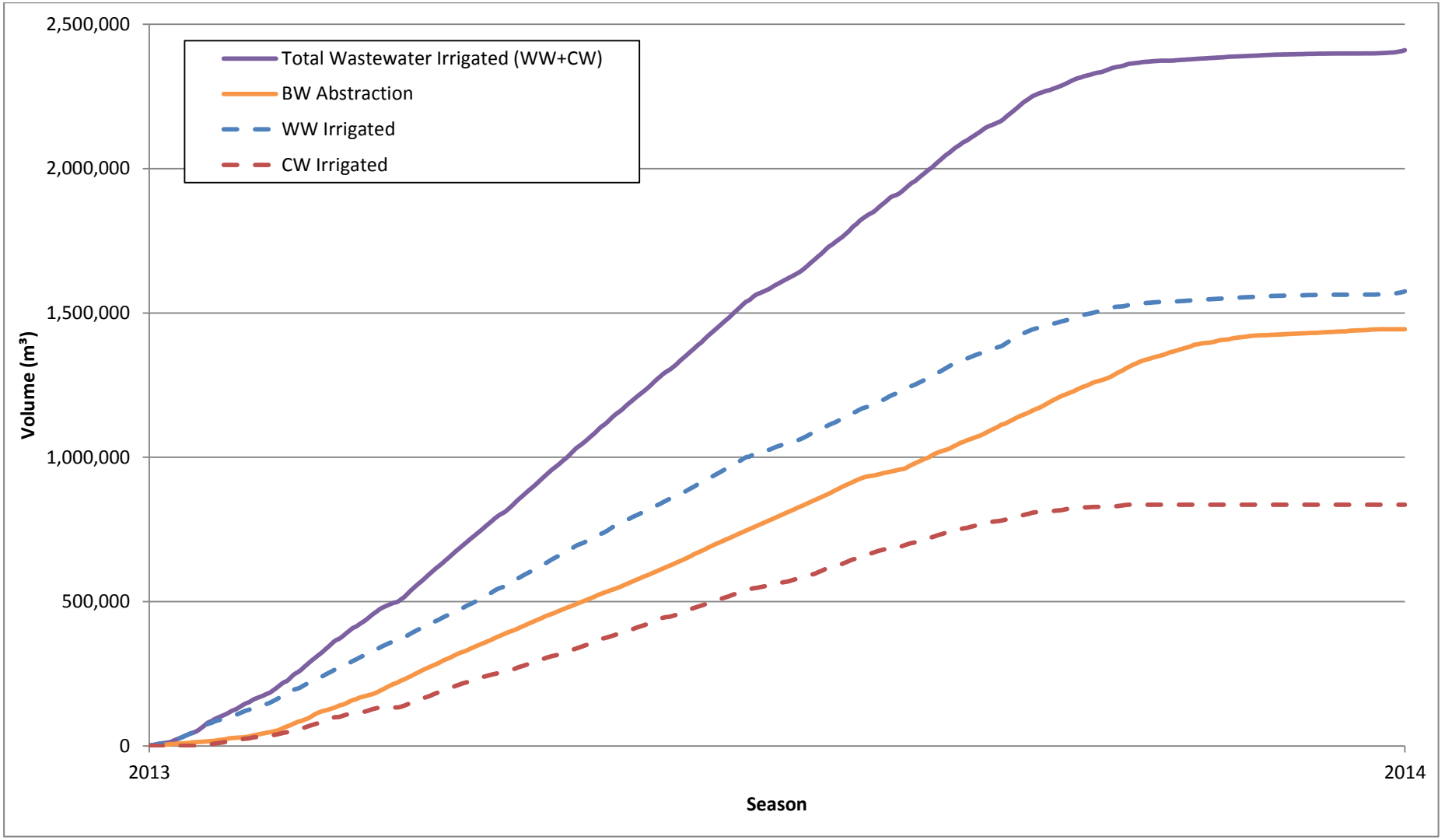
APPENDIX C : LOCATION OF FONTERRA BORES AND FONTERRA DARFIELD PLANT

0 50 100 200 300
Meters

S:\C02623\C02623500\C02623500Z001_Appendix_B_FonterraBores.mxd

Appendix C

Cumulative Abstracted Bore Water Volume and Generated Wastewater Volume



Appendix D: Cumulative Abstracted Bore Water Volume and Irrigated Wastewater Volume for 2013/2014 Season

Appendix D

Soil Moisture Balance Modelling Methodology

Model Methodology and input data

1. A Soil Moisture Balance (SMB) Model was developed to estimate the amount of drainage under each scenario. This section of my evidence describes the Soil Moisture Balance model and the associated inputs such as rainfall, evaporation, soil type and application of wastewater to land.

2. The SMB model incorporates both the Fonterra property and the Gunn and Gray property and calculates the daily SMB and the associated water deficit.

3. The SMB model spans 41 years to obtain a range of climate conditions. Model inputs include, rainfall, evaporation and wastewater volumes. Outputs from the model include drainage from the soil to the underlying groundwater (excess wastewater and rainwater volumes).

4. The SMB is calculated using rainfall and evaporation data from the Darfield climate station and synthetic data from the National Institute for Water and Atmospheric Research (NIWA). The Darfield station was the closest record containing both evaporation and rainfall data and has a record length of approximately 10 years. This record was considered too short to represent the full range of climatic conditions and was therefore supplemented with the NIWA synthetic data (virtual climate network).

5. Regression analyses were performed to compare the Darfield station ET and rainfall data with the synthetic data. For both data sets, an R^2 value of greater than 0.95 was obtained and therefore the virtual climate network is considered suitable for use in soil moisture balance modelling.

6. PDP have used the soil assessment from Greenwood (April 2011) to determine the likely soil composition on the Fonterra land and Gunn and Gray property. The following soils are present at the properties:

   Fonterra land:

   - Lismore stony silt loam;
   - Lismore moderately deep stony silt loam;
   - Hatfield moderately silt loam.

   Gray property:

- Lismore stony silt loam;
- Lismore moderately deep stony silt loam.

Gunn property:

- Lismore stony silt loam;
- Lismore moderately deep stony silt loam;
- Hatfield moderately silt loam;
- Templeton moderately deep fine sandy loam;
- Eyre shallow stony fine sandy loam;
- Ashley silt loam to Hatfield moderately deep silt loam intergrade.

7. The Available Water Capacity (AWC) for each of the eight pivots on the Fonterra land has been set to the AWC values as estimated by Greenwood (April 2011). For the four pivots on the Gunn and Gray property the average AWC values for the individual properties were used.

8. The application of water (bore water and/or generated wastewater) to the Fonterra Land and the Gunn and Gray properties under the different scenarios outlined in paragraph 20 of the evidence is based on a SMB calculation which calculates the amount of water in the soil profile based on the soil AWC, rainfall, evapotranspiration and amount of water applied in previous days.