IN THE MATTER OF	the Resource Management Act 1991
AND	
IN THE MATTER OF	applications by Central Plains Water Trust to: Canterbury Regional Council for resource consents to take and use water from the Waimakariri and Rakaia Rivers and for all associated consents required for the construction and operation of the Central Plains Water Enhancement Scheme Selwyn District Council for resource consents to construct and operate the Central Plains Water Enhancement Scheme
AND	
IN THE MATTER OF	a notice of requirement by Central Plains Water Limited to: Selwyn District Council for the designation of land for works associated with the construction and operation of the Central Plains Water Enhancement Scheme

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BRIEF OF EVIDENCE OF CLIFFORD JOHN MAXWELL TIPLER

24 September 2008

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Qualifications and experience

1. My full name is Clifford John Maxwell Tipler.

2. My qualifications and experience have been presented to this Committee in my primary brief of evidence and has not been repeated here.

3. I have read the code of conduct for expert witnesses set out in Environment Court practice note, and confirm that I have complied with the code in the preparation of my evidence.

Scope of Evidence

4. I will provide in this section of my evidence, rebuttal to points raised by submitters that relate to my area of expertise. This will include:

   - Uncertainty in groundwater nitrate modelling
   - Evidence of Richard English
   - Nitrate distributions used in modelling
   - Changes in future land use
   - Modified vs Un-modified flows at Old Highway Bridge
   - Te Runanga o Ngai Tahu evidence of Mr White
   - Silver Ferns Farms submission
   - North Canterbury Fish and Game Supplementary evidence
   - Supplementary report of Mr Fietje
   - Supplementary report of Mr Duncan
   - NTPL/CPWES priority
   - Scheme Design Reliability
   - Supplementary report of Dr Meredith

UNCERTAINTY IN GROUNDWATER NITRATE MODELLING

5. Mr Callander in his evidence for the CCC and Mr Hanson in his s42A Report and Supplementary evidence and Mr English, all express the view that there is considerable

uncertainty in the modelling and therefore the state of the environment could be much worse than that I have presented. Mr Callander and Mr Hanson, both expressed concern over the temporal and spatial aspects that are not provided for in a bucket mixing model.

6. I cannot disagree with such statements. However when dealing with uncertainty, I believe it is necessary to acknowledge the uncertainty and then to try to accommodate that in the modelling and interpretation of the data. To my knowledge, my assessment has acknowledged this aspect to a greater degree than any other assessment of nitrate contamination from pastoral farming applications before ECan. Whenever there is uncertainty, one can always say things could be much worse, such is the nature of statistical predictions. Similarly one might be able to say things could be much better. The intention of my analysis has been to attempt to quantify how much worse and how much better, as these are criticisms that can be levelled at any assessment. I will deal with temporal and spatial aspects separately.

7. The temporal aspects relate to a number of factors, including; time span over which baseline data has been collected and changing land use over that period, time lags in the groundwater quality due to travel times vertically and horizontally through the aquifer systems, and the time scale (annual) used in the bucket model. Both Mr Callander and Mr Hanson refer to the seasonal effects of nitrate concentrations and Mr Callander produced a plot of nitrate concentrations in well M35/1003 to demonstrate this point. Nitrate data from this well shows a seasonal trend with lower concentrations over the winter and higher concentrations over the summer. I understand the point being made by Messrs Callander and Hanson to be that seasonal variability will be greater than annual variability and therefore my annual time step included in the model will under predict the variability in the output data.

8. In my modelling of the Pre-CPWES situation I was able to fairly well represent the variability in the measured data, with the predicted data. I refer to my Figure 5 in my second brief of evidence. If the fact that I used annual volumes and annual nitrate losses to estimate groundwater concentrations did dampen or average out the results, then this would have been evident in the Pre-CPWES situation. This was not the case and therefore the assumptions and methods I have used must have been sufficiently conservative to offset this effect. By conservative, I mean that that the modelled loadings must have been larger than in reality so that the variability was increased. The same methods and assumptions have been used in the Post-CPWES situation. One explanation for this is that the modelling does not combine the same annual drainage volumes and leaching losses across the 15 sub-regions for exactly the same year, therefore some areas have high drainage and some have low, which reflects the actual

situation and increases variability. Therefore I believe the variability of the predicted results is a fair representation of what might be expected in the future.

9. The spatial aspects relate to the distribution of nitrate concentrations across the plains. This is discussed in my second brief of evidence and shown as my Figure 11. This shows that in general terms the nitrate concentrations in the central region of the plains are higher than areas closer to the main rivers. This is due to the additional inflow of low nitrate water from the main rivers and the lack of low nitrate recharge in the central portion of the plains. I understand the concern to be that given the already higher concentrations in the central portion of the plains, increases in nitrate loading could elevate existing concentrations to above the MAV,

10. I agree that my assessment does not provide any spatial information. However what can be said is that the primary reason for the high nitrate concentrations in the central portion of the plains is the lack of recharge for dilution. The increased drainage, headrace losses, and distribution network losses will bring proportionately more low nitrate water into that region than previously, and therefore this could be expected to offset the trend to higher concentrations in that region.

11. Also the range of modelled outputs picks up the highs and lows within the statistical evaluation. It could be argued then that, while the model does not attempt to differentiate between areas, the central areas of the plains are likely to be represented by the higher end of the model outputs and the areas nearer the rivers are likely to be represented by the lower model outputs.

12. I have also previously discussed the mixing process where the naturally lower concentration groundwater potentially will increase more than the naturally higher concentration groundwater. This also means that the central portion of the plains where existing concentrations are higher, will exhibit smaller changes than in other parts of the plains. For the above reasons, I believe that the inability of the assessment to replicate spatial variability does not invalidate the assessment.

EVIDENCE OF MR RICHARD ENGLISH

13. Mr English raises three main points concerning my water quality brief of evidence;

- Volumes of water used in my model compared to the Aqualinc model
- Particle tracking and direction of groundwater flow
- Dilution within the CCC distribution network

14. As Mr English points out, I have not used the total water volumes from the Aqualinc model in my assessment. This is for two main reasons. The bottom boundary of my

model is SH1 while the Aqualinc model extends to the coast. Therefore the water balance relevant to my work differs from that presented in the Aqualinc model for the whole of the central plains. My volumes have nevertheless been generated by the Aqualinc model and are consistent with it. Secondly I have chosen not to use the recharge from the Rakaia and Waimakariri Rivers to dilute the additional nitrate. This assumption is conservative in my opinion and therefore does not need to be explained further.

15. I stated that the Aqualinc model had not been developed to include the tools needed to assess contaminant transport. This is not contradictory to the evidence of Mr Weir, where he presents particle tracking results. The model in simple terms plots a path that moves directly up-gradient (perpendicular to the piezometric contour at that site), depending upon which aquifer and depth the particle starts off in. This is very different to including dispersion coefficients within the model to enable contaminant transport to be modelled. Therefore, while Mr Weir’s flow direction predictions are useful, they cannot be used to assess groundwater nitrate concentrations.

16. Mr English overstates the difficulty in managing the CCC water supply to mitigate high nitrate concentration groundwater, should that occur. CCC currently does this to manage pH effects (refer para 141 in my second brief of evidence) and in my opinion could do this at other locations if needed. This particular location (Russley Road) includes three of the six in total shallow wells in the north-west of the city, therefore I do not consider what I described as impractical or difficult and certainly not extremely expensive as suggested by Mr English.

NITRATE DISTRIBUTION USED IN MODELLING

17. Mr Hanson has criticised the distributions I have used both from the perspective of the shape of the distribution and the magnitude of the upper limits. I believe the upper limits are realistic and Mr Hanson and I will have to disagree over the relevance of the data referred to in his para 18, Supplementary brief, that relate to nitrogen application rates of 400 kg/ha/yr. CPWES farm protocols and the conditions proposed (see condition 11(g) of the Administrative conditions for the ECan consents) do not support such a loading, and good practice does not support such loadings. Therefore in my opinion it is unnecessary to base an assessment of effects assuming this might happen. I have similar concerns about the use of data from flood irrigation as discussed by Mr Hanson in his para 19 , Supplementary brief of evidence.

18. Mr Hanson favours a horizontal distribution across a range. This would be a rectangular distribution of nitrate concentrations, such that high values would be equally as likely as mid and low values. I would not expect a natural system to behave in this manner. I would expect data to be more prevalent in the mid-range, with low and high values less

likely. I am unaware of any data that would support the use of a rectangular distribution and therefore I do not agree with his preference stated in his para 16, Supplementary brief.

19. In his oral presentation, Mr Hanson presented a scenario where irrigated pasture nitrate losses were 75 kgN/ha/yr compared to my median loss of 55 kgN/ha/yr. He postulated that this could occur and therefore the increase in groundwater median concentrations would be four times that which I have predicted.

20. Such an assessment is overly simplistic and should not be regarded as a realistic estimate of what might happen. An areal loss of nitrate of 75 kgN/ha/yr over all pasture over all time is simply not supported by the literature, nor by predictive models such as OVERSEER. By examining my Figure 3 in my second brief of evidence, it can be seen that my assessment at times will have assumed losses of 75 kgN/ha/yr and even much higher. The difference with my assessment is that this cannot be expected all of the time and therefore I have assigned a probability to that potential occurrence.

21. Mr Hanson in his oral presentation expressed the concern that my distributions are too peaky, or too narrow about the point of central tendency. I wonder if this observation comes about from my plots, which I could have produced with a reduced vertical axis scale so that they looked broader. Nevertheless I have discussed how the range of values on the horizontal axis is supported by the literature and far exceeds that predicted by OVERSEER. The statistical package used plots a probability distribution such that the area under the graph equals 1, irrespective of the vertical scale. I therefore encourage the Commissioners to look at the range of values used on the horizontal axis and the form of the distribution used, as I believe this to be a fair and reasonable assessment of what might happen in nature.

22. Mr Hanson raises as a further concern, the uncertainty of the area of land currently irrigated that will convert to surface water. I have assumed this area to be 24,000 ha for my assessment. More recent assessments by Dr Mabin are that there is approximately 26,300 ha of groundwater irrigated land held by shareholders, and another 13,400 ha held by non-shareholders. A further 6,000 ha is irrigated from surface water sources. This indicates that some 45,700 ha of land within the scheme area is currently irrigated. Therefore, if anything, my estimate is low. The consequence of this will be to reduce the predicted effects on nitrate concentrations in groundwater because the increase in mass loading of nitrate will be less and the increase in surface water sourced drainage will be more. Therefore, while there is uncertainty in regard to this, my opinion is that my assumption has been conservative.

23. On a similar topic, Mr Callander in para 6.7 for the CCC, has suggested that the scheme be permitted to allow water to be used for up to 60,000 ha with no more than 45,000 ha of new irrigation. On the basis of the assessment of currently irrigated areas by Dr Mabin, there appears to be some 32,500 ha of un-irrigated land in the scheme area, and therefore a condition as suggested by Mr Callander is not needed. CPWES will not be providing water on a per hectare basis, and therefore limiting the area to 60,000 ha does not fit with the proposal. It is possible that a greater area could receive less water, or a smaller area will receive more. The important aspect is the total volume delivered by the scheme, and this has been covered extensively in earlier briefs of my evidence.

CHANGES IN FUTURE LAND USE

24. The Commissioners discussed the potential for land use changes across the plains and postulated the situation that if instead of a 75/25 split of land use between pasture and cropping, it was reversed to 25/75. I do not consider this a realistic scenario due to the balance of soil types across the plains. The soils on the land adjacent to the Waimakariri River generally are deeper and more suitable for cropping compared to the soils adjacent to the Rakaia River. This can be seen in Tables 3 and 4 of my second brief of evidence. In Table 4, I have assumed that virtually all of the deeper soils (120 mm WHC) will be in crops for the 62.5/37.5 land use split. Only 500 ha of the deep soils have remained as pasture. If this converted to cropping as well then the split would have been 63.3/36.7 which is not significantly different. I consider this to be a realistic estimate of the extent to which cropping may maximise over the scheme area.

EFFECTS ON THE WIL INTAKE SITE

25. Mr Callander has discussed the concerns that Waimakariri Irrigation Ltd (WIL) and Waimakariri District Council have in relation to river works and their intakes on the Waimakariri River – para 2.9 brief of evidence on behalf of WIL, WDC and Kaiapoi Community Board. I have discussed this issue with Mr Callander and we agree that an appropriate condition to the effect that CPWES river diversion works should not adversely affect the ability of WIL to train the river towards its intake at Browns Rock. I have therefore included the following condition in my final version of draft conditions.

There shall be no activities in the bed of the Waimakariri River at the Lower Intake Site, that would adversely affect the ability of Waimakariri Irrigation Ltd to train the river towards its intake at Browns Rock.

26. While the above condition should meet the concerns expressed by WIL, it is important to note that CPWES will predominately be taking only B Class water and therefore the diversion and take will have no effect below the Gorge Bridge for unmodified flows of less than 63 m^3/s. This is a frequent and natural state of the river and WIL will have to

manage its diversion and take at flows less than that, so the potential for CPWES to adversely affect its ability to divert the river would be very small.

27. I do not believe CPWES's intake at the upper site would affect the ability of WDC to take from its site immediately downstream of the confluence with the Kowai River as the Kowai River shingle fan diverts the river channel towards the north bank and this would have a much greater influence on the channel location than any works by CPWES upstream. I have not proposed any condition in relation to this.

MODIFIED VS UN-MODIFIED FLOWS AT OLD HIGHWAY BRIDGE

28. The Commissioners have been made aware of the potential difficulty with the wording of conditions in other consents to take water from the Waimakariri River. This is presented in the evidence of Mr Callander for WIL. I have discussed this matter with Mr Callander and Mr Fietje and I have arrived at the conclusion that CPWES should not try to draft conditions to its own consent to address this issue. CPWES is not attempting to derogate from the rights of others to water in the Waimakariri River and I am of the opinion that Environment Canterbury should rectify this situation either through varying the conditions of consents held by others, or as Mr Fietje has indicated through a plan change. CPWES would support either course of action provided there was no material effect on the reliability of supply to any water user. I therefore have crafted my proposed conditions using the terminology of the WRRP, that refers to un-modified flow at the Old Highway Bridge.

TE RUNANGA O NGAI TAHU EVIDENCE OF MR PAUL WHITE

29. Mr White has provided an extensive brief of evidence covering the waters of the Central Plains. The matters that I respond to are:

- Nitrate concentrations over time within groundwater
- Nitrate assessment

30. Mr White presents in his Figure 5.69 a relationship between groundwater level and nitrate concentration for a bore at Rolleston. This shows that the concentration of nitrate tends to increase in spring when groundwater levels have risen in response to winter drainage. This effect is also evident in the well M35/1003 at West Melton presented in Figure 16 of Mr Callander's evidence for CCC and well L36/0317 presented by Mr Hanson in his oral presentation. I agree that the effect is more likely to be a consequence of groundwater rise rather than a "slug" of higher nitrate concentration groundwater passing that well at that time. As such it is interesting to note the consequential fall in concentration, which cannot be due to the groundwater level falling, as nitrate cannot be left behind, nor is it likely to have been transported away from the

well, as it was not transported into the well to start with. I therefore interpret this to be a dissipation of nitrate through the groundwater by dispersion which happens over a very short time period (months rather than years). This dispersion must occur with depth of the aquifer as the nitrate entrained from the unsaturated zone by the rising groundwater mixes with the groundwater in the upper aquifer. Therefore the lower values would be more representative of the long term average nitrate conditions over the whole aquifer depth.

31. What is missing from this data is the depth of aquifer over which the sample is taken and the extent to which it represents the top portion of the aquifer before mixing throughout. However it is encouraging to see this response, as high concentrations of nitrate are seasonal and therefore can be expected to fall as the groundwater moves away from the scheme area. This demonstrates the effectiveness of the aquifer mixing the new load of nitrate collected over the winter with that existing within the groundwater resource.

32. Another aspect of these graphs is that they show the peak concentrations to be a localised effect. Thus the wells respond to land use in the immediate vicinity. Due to the travel times involved in groundwater moving from the scheme area to below SH1, many seasonal peaks will have dissipated to become essentially the background level of nitrate. Peak concentrations down gradient of SH1 are therefore likely to be due to localised land use outside of the scheme area. The issue then becomes the extent to which the added nitrate from CPWES lifts the background nitrate concentrations below the scheme area. To this end, I believe my assessment, with its consideration of uncertainty is realistic.

33. My assessment of the increase in nitrate concentrations in groundwater has included background concentrations at the high values (spring and summer) and the lower values (autumn and winter) and therefore it does not matter in my opinion that I have used an annual time increment as discussed by Mr Hanson.

34. In Mr White's section 8.5 Groundwater quality, he states that various documents have been hard to critically evaluate because various factors are unstated, however at no time did Mr White seek to clarify these points with me. All points he has raised could have been easily provided. He also quotes correctly references from reports that have formed part of the application documents (e.g. Krom and Weir (2006)), however these assessments have been superseded by the analysis presented in later reports and my evidence and should not be used. His conclusions on page 110 should therefore not be heeded. Mr White carries this through to his section on current land uses at 9.7.1.2 on page 135 and notes the inconsistencies. Kingett Mitchell (now Golder) experts have correctly used the nitrate prediction data for their assessments, and the contradiction referred to by Mr White relates to superseded documents.

35. Mr White also correctly states on page 111 that the bucket model is not suitable for estimating local effects on groundwater quality. This does not in my opinion make the use of a bucket model inappropriate. I have clearly stated the limitations in the interpretation of the result in relation to spatial and temporal effects. The model is extremely useful as it provides a range of results recognising the uncertainty in the input data and is to be interpreted in this context.

SILVER FERN FARMS LIMITED (SFF)

36. Mr Keeley presented evidence on behalf of SFF (formerly PPCS). He expressed concern at the decrease in flushing flow frequency as a consequence of CPWES and the potential for increased nitrate in SFF's water supply wells in Belfast.

37. The frequency of flushing flows has been canvassed previously and I will not repeat that discussion. Dr Burrell has further discussed this in his evidence in reply. In my amended conditions attached, I have included a condition that provides for natural flushing flows of 130 m^3/s after a low flow event of 21 days or longer. In this instance I have accepted the recommendation of Mr Duncan on the effectiveness of flows of this magnitude in removing excess periphyton growth from the gravel bed.

38. This issue was discussed by Dr Meredith in his oral presentation. He also expressed concern that CPWES could exacerbate any problems associated with the SSF discharge. However I draw the Commissioner's attention to my hydrographs in Appendix A of my first brief of evidence, and in particular the period October 1970 – August 1971. This shows an extended period from January through to June where the river would have been at minimum flow, irrespective of CPWES. This is one such period where I would have expected filamentous growths associated with the SFF discharge to occur. Further by reference to my Figure 26 in my first brief of evidence, it can be seen that CPWES does not increase the frequency of the long low flow duration periods. Therefore I do not agree that CPWES will exacerbate the existing problems.

39. The potential for the CPWES to contaminant the water supply wells in Christchurch is extremely low as discussed in my second brief of evidence at paragraphs 108 onwards. The potential to contaminant SFF's water supply would be even less, as its bore is further towards the coast and north of the city, well away from any zones within the CPWES area that potentially could affect groundwater quality in that area.

40. I therefore hold the opinion that CPWES does not pose a threat to SSF operations from these two aspects.

NORTH CANTERBURY FISH AND GAME COUNCIL

41. Mr De Joux has presented a Supplementary brief of evidence. I have no disagreement with his comments. As a matter of clarification, when he references consent CRC061972 and notes there is no reference to minimum flows for Class A water, that is because as the law stood at the time I prepared those conditions, NTPL had the remaining Class A water and CPWES had none, therefore I had not included a condition that would relate to Class A water. Should CPWES retain priority following the Supreme Court hearing , then such a condition would be required.

SUPPLEMENTARY REPORT OF MR FIETJE

42. Mr Fietje has prepared a Supplementary s42A report for the Commissioners. I have discussed the issue of modified and un-modified flow above and will not repeat that. The only point I would make in relation to this report relates to his paragraphs 71 – 81. I have proposed a condition that allows existing groundwater consent holders to maintain their consents, but the combined use of those groundwater consents with scheme water is limited by my new condition 19(e) for consent CRC061972 and CRC061973. The extent to which the groundwater resource is allocated is for Environment Canterbury to establish, however in any event it is my understanding that the increase in groundwater levels will result in an increase in the size of the groundwater resource, and the allocation issues for this will not depend upon its scarcity. Rather allocation may become limited in the future based on groundwater quality effects rather than groundwater depletion effects.

SUPPLEMENTARY REPORT OF MR DUNCAN

43. Mr Duncan has prepared a Supplementary s42A report for the Commissioners. I will comment only on those areas relating to the scope of evidence I have previously presented. This includes;

- Flow trigger in consent to take water
- Upper limit to river flow for take
- Impact on Class A takes by CPWES
- Flat lining of flows, and
- Flow scenarios to address submitters issues

44. Before I start, I note that I have no disagreement with any of the analysis provided by Mr Duncan and my comments are intended to provide clarity on the above issues for the Commissioners.

45. Mr Duncan has suggested in his para 31 that my condition 6 of consent CRC061972 be amended such that the flow trigger be increased to 130 m^3/s. I accept the rationale proposed by Mr Duncan and have amended that condition accordingly.

46. Mr Duncan has suggested in his para 37 that abstractions should be prohibited when the instantaneous flow at the Otarama water level recorder indicated that the flow was 500 m^3/s or more. Mr Duncan has proposed that the flows above 500 m^3/s are left unmodified so that the morphology of the river does not change. CPWES is likely to leave the flows above 500 m^3/s unmodified due to the sediment issues. Therefore the two intentions are aligned. This is something that should, in my opinion, be left to CPWES to self manage. Further as Mr Duncan states in para 45, there have been no long term bed elevation issues associated with many takes on Canterbury Rivers. Dr Mabin also is of the opinion that the morphology of the river will not be affected by the CPWES take. I therefore have made no changes to my proposed conditions.

47. Mr Duncan has suggested a gap between the A block and B block allocations as one way to ensure that B Block takes do not reduce the water available to current A Block holders, (para 46). As discussed above, this issue relates to the drafting of the existing Class A takes and this need not be addressed in any consent granted to CPWES. In his oral presentation, Mr Duncan referred to the ~5 m^3/s stockwater take as a reason why the CPWES take may affect the Class A permit holders. I do not see this as an issue provided any conditions are drafted in the same terms as the WRRP, based on unmodified flow.

48. In para 51, Mr Duncan notes that the river can be flat lined at flows as low as 36.104 m^3/s. This however this will not be as a consequence of the CPWES take, assuming all CPWES's take is Class B water. It is only when the un-modified flow falls below 63 m^3/s that the actual flow at the Old Highway Bridge will fall below 41 m^3/s, ignoring all temporal effects. At an unmodified flow of 61 m^3/s the Class A takes are essentially 5 m^3/s for stock water and 16 m^3/s for irrigation. As the un-modified flow falls, the irrigation takes decrease proportionately, but the stock water take does not. The irrigation takes decrease to zero at an un-modified flow of 41 m^3/s, yet at this time, there will be 5 m^3/s of stock water taken and the actual flow at the Old Highway Bridge will be at 36.104 m^3/s assuming all Class A takes are being exercised. Assuming all or most of the CPWES take is Class B, then CPWES will not be taking at these times and therefore does not contribute to this situation. At unmodified flows above 63m^3/s, CPWES will be taking and the flow at the Old Highway Bridge will be 41 m^3/s.

49. Mr Duncan has examined a number of flow regimes to assess their potential to affect a number of recreational and ecological values (Tables 1, 2, 4 and 5). He includes a line in bold that represents the preferred flow range for the particular set of values. Table 1

which refers to the number of islands for river bed nesting birds shows an average number of days of 33 for the unmodified state, 38.3 Pre-CPW, 32.3 Post-CPW, 36.6 for Post-CPW 1:1, and 44.5 and 44.1 for Class B over 90 and 100 respectively. This demonstrates that the Post-CPW will be very similar to the natural or unmodified state and that the 1:1, and Class B over 90 and 100 show a degree of betterment.

50. Table 2 for salmon angling shows a similar situation, where betterment (ie a greater number of days within the most suitable range) occurs for the 1:1 and Class B over 90 and 100 scenarios when comparing to the Pre-CPW state. Tables 4 and 5 both show that for the flow range of 50 – 70 m^3/s, betterment occurs for the 1:1 and Class B over 90 and 100 scenarios when comparing to the Pre-CPW state. This was the flow range preferred for jet boating and was the flow range used by Mr Ward-Holmes from the NZ Recreational Canoeing Association in his Supplementary evidence section 2.

51. This demonstrates how some of the flow regimes can over compensate, and therefore a measure of care is needed when deciding which flow scenario should be selected. I have repeated Mr Duncan's calculation for the 1:1 after 10 scenario and have produced the following results. The slight difference in numbers for the unmodified flow range (Mr Duncan = 65.9 days, my calculation 69.5 day) cannot be explained at this time, but the comparison across the row in the follow table remains valid. As can be seen in Table 1, the difference between the natural and post-CPW 1:1 after 10 scenario for the 50 – 70 day range is approximately 3.5 days per year, which in my opinion is very little.

Table 1: Number of days during the year that mean daily flow was within various flow bands for 1:1 after 10 scenario.

Flow Band m^3/s	Unmodified (days)	Pre-CPW (days)	Post-CPW 1:1 after 10 (days)
50-70	69.5	73.9	65.8

52. Mr Duncan in his oral presentation discussed the various methods that could be used to establish allocation regimes for the takes from the Waimakariri River that provided for a number of values. His conclusion was that the cut-off flow for Class B water should be raised from 63 m^3/s to 80 m^3/s as an un-modified flow.

53. He reached this conclusion by analysing of a number of take scenarios being, 20 m^3/s, 40 m^3/s, and 60 m^3/s. These take series each assumed that if there is water available it would be taken.

54. The CPWES only takes water if there is a demand, not any time there is water available. Therefore the impacts on the river will not be as severe as that shown by Mr Duncan. For example, by reference to Table 11 of my Section 4 brief of evidence of 3 July 08, the monthly volumes taken in July, August, September and October are 12.5 MCM, 8.0 MCM, 5.1 MCM and 8.4 MCM respectively, compared to the months of December, January, February and March of 44.7 MCM, 36.7 MCM, 27.8 MCM and 35.1 MCM. Thus the average winter takes are 4 – 5 times less than the summer takes and therefore less water will be taken than shown in the scenarios of Mr Duncan.

55. While Mr Duncan's analysis may have shown that the 80 Class B regime was the best in terms of the values identified, the effect would not be as severe if the real CPWES take series had been used. For this reason I have included an analysis of my 1:1 after 10 scenario against the flow bands used by Mr Duncan. These data are presented in my Table 2. The most significant effect is on the flow band of 70 – 150 m^3/s where the average number of days before CPWES of 130 falls to 102, a reduction of 22% after CPWES. Generally the other flow bands are similar before to after.

Table 2: Number of days during the year that mean daily flow was within various flow bands for 1:1 after 10 scenario.

Flow Band m^3/s	Unmodified (days)	Pre-CPW (days)	Post-CPW 1:1 after 10 (days)
70-150	178	130	102
50 -150	248	204	168

56. The reason for this is that the flow range 70 – 150 m^3/s is essentially the full range within which CPWES takes occur. Flows of between 70 – 73 m^3/s will be removed (when required) and half the flow between 74 – 132 m^3/s will be taken resulting in measured flows being less than 70 m^3/s, and therefore the resultant flow will be outside the chosen band.

57. However while kayakers have identified 70 – 150 m^3/s (measured flow at the Old Highway Bridge) as the ideal flow range, kayaking does not stop at flows below this. If the flow range of 50 – 150 m^3/s was considered, then the effect would be reduced with and average of 204 days within this band each year before CPWES and 168 days after CPWES. This is a reduction of 18%.

58. In my Section 4 brief of evidence, I outlined a number of other mitigation measures that have been included as proposed conditions. These have been designed to lessen the effects on kayakers further and I will not repeat these here.

NTPL/CPWES PRIORITY

59. NTPL presented Supplementary submissions to the effect that CPWES could achieve its desired reliability whether it or NTPL had priority. NTPL quoted my earlier evidence where I stated that the effect of CPWES gaining priority over NTPL would be to increase the reliability by 0.7%. The impression given was that the consequential impact on CPWES of NTPL retaining priority was small. However NTPL did not state that the consequences of this for CPWES should CPWES gain priority, which would be to reduce the reservoir size by 25 MCM, equivalent to a reduction in capital cost of approximately $18M.

60. I have re-examined the consequences for CPWES in terms of priority for Waimakariri River water for the 1:1 sharing after 10 scenario. In the situation where NTPL has priority, CPWES gets no Class A water and NTPL has priority to the first 1.24 m^3/s of Class B water. CPWES then gets the next 8.76 m^3/s and shares water 1:1 thereafter. In the situation where CPWES gets priority, CPWES gets 2.72 m^3/s of Class A water and the first 10 m^3/s of Class B water and shares water 1:1 thereafter. The analysis is similar to that previously stated, with a reduction in reservoir size by 20 MCM expected, equivalent to a reduction in capital cost of approximately $15M.

61. I therefore believe that situation can be summarised as; if NTPL retains priority to Waimakariri River water, the adverse financial impact on CPWES will be in the order of $15M – $20M of additional capital cost.

SCHEME DESIGN RELIABILITY

62. There has been discussion with the Commissioners over the concept used by CPWES to allocate shares to farmers based on the scheme being designed to provide 90% reliability with the extra water held in storage for purchase should it be required. My understanding from the discussion is that the Commissioners may have interpreted this as meaning that 90% reliability is good enough for most farmers and therefore holding enough water in storage to meet a 98% reliability level is not necessary. Mr Macfarlane specifically addresses farmer behaviour and the need to for them to rely upon a source of water that is 98% reliable. The point I wish to make is that the scheme has been designed to provide a source of water that is 98% reliable, and that the internal mechanism to allocate shares has been based on a volumetric basis where 1 share provides 1,000 m^3/year at a supply reliability of 90%. CPWL believes that this will drive farmer behaviour towards better utilisation of the water and internal transfers to the most

economic use. However for the 60,000 ha anticipated to be developed based on the CPWES supply, all of the water will be needed in years such as 1971, 1973, 1978, and 2001, when the reservoir would have been taken down to its minimum level during the irrigation season. This is demonstrated in my Figures 27 and 28 in my first brief of evidence.

63. There has been considerable discussion on the option of groundwater being used to supplement the supply of scheme water, should the scheme be sized such that it cannot deliver a fully reliable water supply. I have discussed the aspect of excessive use of water from the two sources and proposed a condition to address this. Mr Donkers has outlined in his right of reply evidence how this may be an option only for those farmers who have an existing groundwater supply well. He further states that he believes that use of groundwater to increase reliability is unlikely to make this the cheap option that has been suggested. He supported his view by stating that annual costs would be approximately $234/ha/yr just to have a pump motor connected to the power supply, with energy charges in excess of this. Thus for most years a groundwater pump would not be required, but the above costs would be incurred. These costs would be higher for those farmers who had to install new wells and pumping infrastructure to provide the facility to do this. For these reasons, I do not believe that it is practical or cost effective for the scheme to be designed to rely upon groundwater use to offset storage requirements.

SUPPLEMENTARY REPORT OF DR MEREDITH

64. Dr Meredith suggested that a time element be included in the condition that allows takes after 21 days of low flow if the flow increases above 130 m^3/s. He explained that time was needed for the scouring and flushing effect to occur. The condition as drafted relates to measured flow at the Old Highway Bridge and due to travel times down the river, there will have been adequate travel time up until the flow of 130 m^3/s at the bridge is recorded. Dr Meredith mentioned that if the flow regimes were linked to the Otarama gauging site, then there would be insufficient time for this flushing effect. I do not disagree with Dr Meredith, however the conditions for this consent should be drafted consistent with the WRRP and relate to flows at the Old Highway Bridge. ECan can then in the future address the issue of aligning all consents with the Otarama gauging site once it is operative. This is not a matter for this hearing to resolve.

REVISED CONDITIONS

65. I have attached a revised set of conditions as Revision B for consideration by the Commissioners, should they decide to grant the consents applied for. I note that the conditions primarily in relation to flow regimes on the Waimakariri River have been offered as mitigation should the Commissioners decide that the Take is a discretionary

activity and that the WRRP flow regimes have not adequately provided for the concerns raised by submitters. This has been explained by Counsel for the Applicant in closing submissions and the proposed conditions should be considered in that light.

C. J. M. Tipler

September 2008