

**Before the Commissioners appointed by Canterbury
Regional Council**

IN THE MATTER OF The Resource Management Act
1991

AND

IN THE MATTER OF Applications by the Central Plains
Water Trust and Central Plains
Water Ltd. to Take and Use Water
for Irrigation in the Central Plains
area.

Section 42A Officer's Report

Date of Hearing: 25 February 2008

Report of KERI JOY JOHNSTON

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Qualifications and Experience

1. I hold a Bachelor of Engineering (honours) in Natural Resources Engineering from the University of Canterbury.
2. I am a Professional Member of the Institute of Professional Engineers New Zealand (MIPENZ) and a Chartered Professional Engineer (CPEng).
3. Upon completion of my degree, I worked for Meridian Energy Limited as a graduate civil engineer, based in Manapouri and Twizel.
4. During my time in Manapouri, I worked on the Second Manapouri Tailrace Tunnel. In Twizel, I was involved in the dam safety assurance programme for the dams in the Waitaki Power Scheme, and also Manapouri Power Station.
5. After twelve months, I accepted a position with Environment Canterbury (ECan) as a Consents Investigating Officer before taking on the role of Environmental Management Systems Engineer with the River Engineering Section of ECan.
6. During my three and a half years with ECan, I was the Consents Investigating Officer for the applications associated with the Canterbury Regional Landfill at Kate Valley, and developed environmental management systems in accordance with ISO 14001 for several units within ECan.
7. I left ECan to join RJ Hall Civil and Environmental Consulting Limited (RJH) as an Environmental Engineering Consultant. I was employed in this position for the previous three and a half years. My work mainly involved the preparation of resource consent applications for all land and water activities, and engineering related works.
8. I am currently a director of Irricon Resource Solutions, a small consultancy firm based in Ashburton.
9. I have continued to assist ECan in the auditing of resource consent applications during my time with RJH and Irricon Resource Solutions.

Scope of Evidence

10. I have been asked by Ecan to consider the following aspects of the consent applications:
 - (a) The effects of taking water on public safety;
 - (b) The effects of bywash discharges on public safety;
 - (c) The effects of bywash discharges on flood carrying capacity and erosion of the receiving waterbody and on artificial structures;
 - (d) The effects of works on natural and physical resources, ecosystems, habitats and species;
 - (e) The effects of works on flood carrying capacity and erosion of the bed and banks of water bodies and on artificial structures;
 - (f) The effects of works on amenity values, people and communities;
 - (g) The effects of discharging stormwater, sediment and hazardous substances to land and water during construction;
 - (h) The effects of discharging contaminants, principally dust, to air during construction;
 - (i) The effects of dam failure;
 - (j) The efficient use of water for irrigation purposes.

11. In doing this, I have reviewed the following:

- (a) The Code of Conduct for Expert Witnesses (Rule 330A, High Court Rules and Environment Court Practise Note) prepared by Principal Environment Court Judge R.J. Bollard. I agree to comply with it. I have complied with it in the preparation of this Brief of Evidence.
- (b) The Proposed Natural Resources Regional Plan.
- (c) The application and further information provided for the applications associated with the Central Plains Scheme.
- (d) A report prepared by Tonkin and Taylor on the Central Plains Water Enhancement Scheme dam safety issues.

12. The following abbreviations have been used:

- (a) CPW or CPWT = Central Plains Water (aka "the applicant")
- (b) PNRRP = Proposed Natural Resources Regional Plan
- (c) ECan = Environment Canterbury
- (d) CRC = Canterbury Regional Council
- (e) AEE = Assessment of Environmental Effects dated November 2006
- (f) SDC = Selwyn District Council

Effects of Taking Water on Public Safety

- 13. The Rakaia and Waimakariri Rivers are highly used for recreational activities, including jet boating and angling.
- 14. Submitters have raised concerns about the safety and navigability of such a structure and whether it will affect recreational users of the river, including the concern that the preliminary drawings of the intake show little concern for the safe passage of kayakers and canoeists and other non-motorised boat river users. Concern was also raised about the use of steel grills and the physical harm they may cause to a person caught against them. and the lowering of the water level to such a degree that is too shallow for rudders, for example.
- 15. In the AEE (Dec 2001) relating to the taking of water from the Rakaia and Waimakariri Rivers, the applicant stated that water based activities are likely to be directly affected by any water take from the rivers, and that intake structures will have appropriate signage warning recreational users of their location, and that the inlets to the box culvert intakes will have steel grills placed over them.
- 16. My concern with the proposed mitigation is that warning signs, no matter how big and bright, can be ignored. In addition, if a recreational boat user enters the river at a location where there is no signage, then they are not informed of the location of the intakes.
- 17. If a kayaker, for example, enters an area of water in the vicinity of an intake structure while water is being taken into the intake at a flow rate of up to 40 m³/s, the kayaker would be unable to paddle out, potentially being pulled against the steel grill. The consequences could be dire.
- 18. If the commissioners chose to grant the applications, I suggest that further safety measures including, but not limited to, a buoy line being constructed a distance back from the entrance of the intake, are required. For a recreational boat user who has not seen any signs, the buoy line is a visual warning.
- 19. The lowering of the water level is another issue. There is only B allocation remaining in the Waimakariri River, however CPW have applied to access A allocation water when it is not in use by current consent

holders. Given this, B allocation water will be taken predominantly, and water levels are unlikely to be lowered to such a degree that it is unsafe for recreational users. When A allocation water is being accessed, it is only be taken at a rate equal to the consented rate of take not in use, and therefore, should not lower water levels beyond what is experienced now.

20. With respect to the Rakaia River, the applicant advises that water abstractions that can comply with the National Water Conservation Order (NWCO) for the Rakaia River have been judged to not significantly alter the provision of recreational opportunities.
21. The Rakaia River also generally flows at higher rates than the Waimakariri River, and therefore, any abstraction consistent with the NWCO is likely to have less of an effect on the lowering of water levels. CPW have also applied for Band 5 water which means that water will only be able to be taken at higher flows from this river as well.

Effects of Bywash Discharges on Public Safety

22. Under normal scheme operation, it will be necessary to discharge small volumes of surplus water at the end of the network branches. This is necessary to maintain flow past the last farmer taking scheme water on each race. The by-wash will be minimised and in general discharged through ground soakage via constructed wetlands, existing stockwater races, or into the headrace or reservoir inlet canal.
23. The wetlands will be located adjacent to existing water courses but to prevent overflow, they will not have any surface water connection.
24. Water bodies subject to operational discharges are the Waimakariri, Hawkins, Waianiwi, Selwyn and Rakaia Rivers.
25. In the proposed conditions, the applicant has restricted the rate of discharge into each of these water bodies to 10 m³/s (10, 000 L/s).
26. At rare and brief times, the full intake volume may have to be discharged. This could occur as a result of a district wide power cut when the canals are carrying full flow capacity, or a sudden heavy rainfall event that would cause irrigators to shut down their pumps before the intake race gates are closed. The wetlands would not be able to take such flows without overflowing.
27. Emergency discharges may occur into the rivers listed above as well as into the Hororata River. The maximum emergency flow at any one location is 18 m³/s (18, 000 L/s) (Nov 2006 AEE), however, this was not carried through to the applicant's proposed conditions.
28. The applicant has not considered the effects of the bywash discharges (operational or emergency) on public safety.
29. In the Rakaia and Waimakariri Rivers, bywash discharges are small in the context of the flows that naturally occur in those rivers (the mean flow of the Rakaia River is 221 m³/s and 122 m³/s for the Waimakariri River).
30. However, for the other water bodies, which are smaller, the bywash discharges may increase the flows substantially and have an adverse effect on public safety. For example, the mean flow of the Selwyn River 3.3 m³/s, and therefore a discharge of 10 m³/s could impact on public safety.

31. Submitters raised concerns about the immediate and erratic increase in flows and the potential hazard that this may have to groups such as paddlers, as well as contractors working in the rivers.
32. In the interest of protecting public safety, I believe that restricting the rate of discharge into a water body is not enough and further mitigation is required.
33. Warning signs are one example of mitigation, advising the public at each of the discharge points that water levels may rise rapidly without warning as a result of discharges from the Central Plains Irrigation Scheme. Sirens are also a possibility as warning signs could easily be ignored as the discharges will be infrequent.
34. The applicant needs to give further consideration to this issue, and propose a mitigation strategy to ensure the public is adequately advised of the proposed risk to them from the bywash discharges. It is not just a question of making sure the public know the risk to themselves, it is also a question of whether the risk to the public is acceptable. For example, should the rate of discharge be limited further to 1.5x the mean flow, or limited to only the larger rivers that are more able to cope with such discharges.
35. At this stage, I cannot conclude that the effects of the operational and emergency discharges on public safety are minor.

Effects of Bywash Discharges on the Flood Carrying Capacity and Erosion of the Receiving Water Body and on Artificial Structures

36. With respect to operational bywash discharges, the applicant has advised that with maximum rates of discharge between 100L/s and 1, 500 L/s, the physical effects will be de minimis.
37. For emergency discharges, the applicant advised that the discharge will only be for a few hours while the system is being emptied, and that the discharge points will be designed to minimise any erosion of the bed or banks of the respective rivers, and therefore the physical effects of these discharges will also de minimis.
38. The applicant has provided no detailed design of the discharge points, therefore I cannot comment on the proposed designs from an engineering perspective.
39. Submissions have been received in relation to this topic from the Canterbury Regional Council's River Engineering Section, who manages flood and erosion protection schemes (river rating districts) on the Rakaia, Waimakariri and Selwyn Rivers.
40. It is absolutely necessary for the discharge structures to incorporate erosion protection features. The discharges may result in erosion of the bed, as well as deterioration of any existing upstream and downstream flood and erosion protection systems.
41. Where the discharges are to occur within a river rating district, the type of erosion protection incorporated into the discharge structures should be carried out in consultation and agreement with the River Engineering Section.
42. Where the discharges are to occur outside of a river rating district, the following should apply:
 - (a) Erosion protection works should consist of rip rap upstream and downstream of the structure, and tree protection (anchored tree protection, deep pole planting).
 - (b) Any trees damaged as a result of the proposed works or used for riverbank/structure protection, shall be replaced with three metre long deep planted willow pole trees.
 - (c) In the event of any erosion occurring to the bed or banks of the river as a result of the works or structure, the consent holder shall be responsible for rectifying the situation as soon as practicable.

(d) All practicable measures shall be undertaken to ensure that the water discharged is not deflected into the berm.

43. Given this, effects of the bywash discharges on flood carrying capacity and erosion and on artificial structures should be able to be mitigated.

Effects of Works on Natural and Physical Resources, Ecosystems, Habitats and Species

44. The works in these rivers involve:

- (a) Construction and maintenance of intake structures;
- (b) Construction and maintenance of discharge structures;
- (c) Erosion protection;
- (d) Construction and maintenance of siphon and pipe structures.

45. The intake for the Rakaia River is proposed on the true left bank of the river approximately 8km downstream of the Gorge Bridge.

46. The applicant proposes that the intake system will consist of:

- (a) A low diversion bank, if required, across part of the riverbed to direct water towards the intake area.
- (b) A low level breachable gravel weir, if required, to turn water into the intake channel.
- (c) An excavated channel, as required, off a major braid to ensure water enters the intake channel (the diversion channel (?)).
- (d) Works to protect the intake system from erosion and flooding, such as stopbanks, rock groynes, rock lined banks and vegetative protection.
- (e) A gated intake structure at the downstream end of the diversion channel.
- (f) A short sediment trap including an overflow spillway, downstream from the intake gates, to settle fine gravels and coarse suspended sediments (ie sands and a small proportion of silts) and then discharge them back to the river via a sluice gate and side channel. They may also be removed mechanically from time to time.
- (g) A gated flow control structure at the downstream end of the sediment trap to control the flow approaching the fish screen and the subsequent intake canal to the headrace.
- (h) Fish screens shortly downstream from the sluicing race to exclude (particularly) downstream migrating fish from the scheme works and then return them to the river.
- (i) A pump station about 6km downstream from the control structure to lift water up the terraces for the Windwhistle areas that are higher than can be serviced from the gravity intake.
- (j) A sidling canal to carry water to the top of the river terraces and into the main scheme canal.

47. The design of the intake has not been finalised, but the applicant has provided schematics of how it is envisaged the intake could look.

48. There are two intakes proposed on the Waimakariri River, referred to as the 'upper' and 'lower' intakes.

49. The upper intake will be located on the true right bank of the Waimakariri River, 3 kilometres upstream of the Kowai River confluence, at the lower end of the Waimakariri River Gorge. The June 2006 AEE states that it is at the downstream end of a relatively stable and generally single thread section of the river through the gorge. River diversion works are likely to be needed from time to time to maintain an adequate flow on right bank into the intake channel. The works will not include a weir or dam to direct the flow into the intake.

50. Downstream of the diversion channel, works would be similar to the proposed Rakaia river intake with a gated intake structure, sediment trap and sluice race, overflow spillway, flow control structure and fish screen and return channels.
51. The lower intake is proposed at the Gorge Bridge, on the true right bank. The site is described by the applicant as having a deep and stable channel, and is therefore not expected to need any river training works. At worst, works would be occasional and minimal.
52. The Wainiwaniwa River works relate predominantly to the construction of the dam. The dam site will be excavated to allow for a cut off trench below the base of the dam, and this will be well below the existing valley floor. Because of this, the existing stream will be diverted around the excavation or piped across the excavation.

Rakaia and Waimakariri Rivers

53. The applicant concludes that both these rivers typically transport heavy loads of sediment, both suspended and bedload, therefore there will be minimal impact from any sediment released, and that fish habitat and passage will not be affected by any of the proposed works.
54. The following mitigation measures are proposed in the AEE.
- (a) Notification to Fish & Game NZ and the Department of Conservation 48 hours prior to works commencing.
 - (b) Keeping vehicles and machinery to established tracks and crossings and preventing soil debris and vegetation entering flowing water.
 - (c) An inspection of the works site by a qualified person to identify nesting sites of threatened bird species immediately prior to works commencing and communication of these sites to those persons carrying out the works.
 - (d) Instream works only being carried out between 1 October to 30 March unless a report has been prepared to show that effects on birds and fish will be minor is provided to the CRC and CRC allow those works to proceed.
 - (e) Works shall not prevent the passage of fish or cause stranding in pools or channels.
 - (f) No plant species listed in schedule BLR1 of chapter 6 of the PNRRP (pest plants) shall be planted.
55. In relation to work required after initial installation works, it is understood that they are likely to be reinstatement works, to facilitate the diversion of water, which should be limited in duration and scale.
56. Given the values that the Rakaia River supports as outlined in the National Water Conservation Order, it is recommended that further conditions should be included to ensure that effects are minimised, particularly where works will occur in flowing water or there is the potential for sediment to enter water as a result of works. I think the conditions below should apply equally to the Waimakariri River as this also has important values for both birds and fish.
57. If the commissioners chose to grant the consents, additional conditions are recommended to ensure that:
- (a) Works do not occur within 100 metres of nesting sites identified by the suitably qualified expert.
 - (b) Vehicles, as far as practicable, shall not enter river channels containing flowing water.
 - (c) There shall be no storage or refuelling of vehicles and machinery anywhere on the bed of the river.
 - (d) All practicable measures shall be taken to minimise the discharge of sediment to the Rakaia River arising from the works.
 - (e) Apart from structures constructed under this consent, on completion of works work sites shall as far as practicable be left in a state consistent with the surrounding natural river bed.

58. Provided works are carried out in accordance with the recommended conditions, effects on ecosystems are likely to be acceptable.

Waianiwaniwa River

59. The Waianiwaniwa site is the largest of the construction sites within the Central Plains Scheme. However, ultimately the Waianiwaniwa River Valley will be completely altered and the effects of construction on the river are minor in comparison to the transformation that will result once the dam is completed and operational. Therefore, the effects on the Waianiwaniwa River in this section are those resulting from the construction of the reservoir.

60. There will be significant potential for sediment to be discharged from the dam construction site, and this will be mitigated with the use of sediment retention ponds. However, it is also noted that the applicant states that given that the Waianiwaniwa river valley will ultimately be flooded, any sediment discharge that is contained within the valley will be of negligible consequence.

61. Additional mitigation measures proposed in the AEE include:

- (a) Notification to Fish & Game NZ and the Department of Conservation 48 hours prior to works commencing.
- (b) Keeping vehicles and machinery to established tracks and crossings and preventing soil debris and vegetation entering flowing water.
- (c) An inspection of the works site by a qualified person to identify nesting sites of threatened bird species immediately prior to works commencing and communication of these sites to those persons carrying out the works.
- (d) Instream works only being carried out between 1 October to 30 March unless a report has been prepared to show that effects on birds and fish will be minor is provided to the CRC and CRC allow those works to proceed.
- (e) Works shall not prevent the passage of fish or cause stranding in pools or channels.
- (f) No plant species listed in schedule BLR1 of chapter 6 of the PNRRP (pest plants) shall be planted.

62. If the commissioner chose to grant the consents, additional conditions are recommended to ensure that:

- (a) Works do not occur within 100 metres of where those nesting sites have been identified by the suitably qualified expert.
- (b) Vehicles as far as practicable shall not enter river channels containing flowing water.
- (c) There shall be no storage or refuelling of vehicles and machinery anywhere on the bed of the river.
- (d) Apart from structures constructed under this consent, on completion of works work sites shall as far as practicable be left in a state consistent with the surrounding natural river bed.

63. It is also noted in the section of this report related to the damming of water in the Waianiwaniwa River that a significant population of Canterbury mudfish will be lost. Mitigation to address this effect has been detailed in the application for resource consent to dam water. This is commented on in the report prepared by Adrian Meredith, Environment Canterbury Surface Water Scientist.

Other Water bodies within the Scheme Area

64. The applicant advises that construction works in these water bodies will result in the release of sediment in either run-off from the site or as a consequence of disturbance of the water body concerned, and that standard practices including sediment traps and retention ponds and sediment barriers in the stream beds will be used to minimise the discharge effects. Ongoing maintenance is required.

65. In the AEE, it is also noted that physical works may destroy any aquatic biota in the immediate vicinity of the works.
66. The applicant concludes that due to the localised nature of the effect, and the fact that affected habitats are already highly modified and have low sensitivities to disturbance, the impact will not be significant.
67. Mitigation measures proposed in the June 2006 AEE include:
- (a) Notification to Fish & Game NZ and the Department of Conservation 48 hours prior to works commencing.
 - (b) Keeping vehicles and machinery to established tracks and crossings and preventing soil debris and vegetation entering flowing water.
 - (c) An inspection of the works site by a qualified person to identify nesting sites of threatened bird species immediately prior to works commencing and communication of these sites to those persons carrying out the works.
 - (d) Instream works only being carried out between 1 October to 30 March unless a report has been prepared to show that effects on birds and fish will be minor is provided to the CRC and CRC allow those works to proceed.
 - (e) Works shall not prevent the passage of fish or cause stranding in pools or channels.
 - (f) No plant species listed in schedule BLR1 of chapter 6 of the PNRRP (pest plants) shall be planted.
68. If the commissioners chose to grant the consents, additional conditions are recommended to ensure that:
- (a) Works do not occur within 100 metres of where those nesting sites have been identified by the suitably qualified expert.
 - (b) Vehicles as far as practicable shall not enter river channels containing flowing water.
 - (c) There shall be no storage or refuelling of vehicles and machinery anywhere on the bed of the river.
 - (d) Apart from structures constructed under this consent, on completion of works work sites shall as far as practicable be left in a state consistent with the surrounding natural river bed.
69. Provided works are carried out in accordance with the recommended conditions, effects on ecosystems are likely to be acceptable.

Effects of Works on Flood Carrying Capacity and Erosion of the Bed and Banks of the Water bodies and on Artificial Structures

Rakaia and Waimakariri Rivers

70. It is concluded by the applicant that works will not alter the flood carrying capacity of the river, as floods will wash out the gravel training banks.
71. A condition has been proposed by the applicant in Schedule 1: General conditions that:
- (a) The activities and any associated equipment, materials, or debris shall not obstruct or alter the passage of water in a manner that causes:
 - (I) Any increase in the risk or potential for flooding of surrounding lands;
 - (II) Any destabilising of lawfully established flood control structures or other lawfully established structures within the bed of the river;
 - (III) Any increase in erosion of river bed or banks.
72. Both rivers are managed as part of a Rating District Scheme by Canterbury Regional Council River Engineers. A submission was received from the Rating District Scheme.

- 73.** With respect to the Rakaia River, provided the works do not cause erosion, reduce the flood carrying capacity, or deflect water into the berm, there is unlikely to be any effects on existing artificial structures. Within this section of the Rakaia River, there are no other bridges or crossing structures that could be compromised. Bank protection measures may be in place along property edges. Additional conditions are recommended to ensure that the activities do not exacerbate adverse effects.
- (b) All practicable measures shall be undertaken to ensure that works do not deflect floodwaters into the berm.
 - (c) Works shall not cause erosion of the bed or banks of the Rakaia River.
- 74.** Effects of the proposed works on the Rakaia River in relation to flood carrying capacity and erosion and on artificial structures could be considered to be minor.
- 75.** The Waimakariri River Rating District scheme is the largest administered by the Canterbury Regional Council, both financially and in area, because of the threat the Waimakariri River poses to Christchurch and surrounds if the river protection scheme is breached. For this reason, particular attention needs to be given to the potential effects that any river works may have on the Waimakariri River Rating District Scheme.
- 76.** A submission was received from the Canterbury Regional Council in relation to this matter. Concerns were raised regarding the following:
- (a) Uncontrolled planting resulting in seeding along the berm, channel or fairway (uncontrolled vegetation can cause flooding and erosion);
 - (b) Disturbance and/or removal of flood and erosion protection works in highly vulnerable areas;
 - (c) Excavation of gravel resulting in degradation, channel shift and other adverse effects;
 - (d) Impact on access to the bed, berm, and banks and any flood control structure and works for maintenance and repair;
 - (e) The suitability of structures proposed by CPWT for use within the Rating District Scheme;
- 77.** The submission requests that any increase in costs to the Rating District Scheme resulting from works carried out by CPWT and the ongoing impact their structures may have are to be borne by CPWT.
- 78.** The mitigation proposed by the CPWT with respect to this is very general. Therefore, additional mitigation to that proposed by the applicant is also recommended:
- (a) The design of any structures within the bed or banks of the Waimakariri River, including intakes, that are to be constructed by the Central Plains Water Trust, will be carried out by a Chartered Professional Engineer with relevant expertise in this area. The designs will be reviewed and approved by the Waimakariri River Rating District before construction commences.
 - (b) Any river works in the bed or banks of the Waimakariri River, including planting, is only carried out once written approval from the Waimakariri River Rating District has been received.
 - (c) A detailed plan outlining any flood or erosion control planting that is to be carried out by the Central Plains Water Trust in the bed, channel or fairway of the Waimakariri River, and how this will be controlled and maintained is to be prepared at least one month prior to any such works commencing and forwarded to the Waimakariri River Rating District for approval.
 - (d) If the approved plan outlined above is not adhered too, any costs associated with completing the works by the Waimakariri River Rating District will be charged to the Central Plains Water Trust.
 - (e) Access to the Waimakariri River Rating District flood control structures and works shall not be impeded. The location of access points is to be determined in consultation with the Waimakariri River Rating District.
 - (f) The quantity and location of any gravel, sand or other material excavated from the bed or banks of the Waimakariri River will be determined in consultation with the Waimakariri River Rating District.
- 79.** If the proposed mitigation is adopted, the effects on the Waimakariri River in relation to flood carrying capacity and erosion and on artificial structures could be considered to be minor.

Waianiwaniwa River

80. The applicant acknowledges that the hydrology of the Waianiwaniwa River will be significantly altered, and this is an inevitable part of constructing a dam that will inevitably prevent flow from the valley.
81. Given the small catchment area of the Waianiwaniwa River (55 km²), it is unlikely that any adverse effects to flood carrying capacity and erosion will occur as a result of construction works and the mitigation proposed by the applicant is sufficient to address the temporary effects associated with the works in the river.

Other Water bodies within the Scheme Area

82. The applicant advises that there will be no significant adverse effects on river or stream hydrology as a consequence of the activities proposed.
83. A condition has been proposed by the applicant in Schedule 1: General conditions that:
- (a) The activities and any associated equipment, materials, or debris shall not obstruct or alter the passage of water in a manner that causes:
 - (I) Any increase in the risk or potential for flooding of surrounding lands;
 - (II) Any destabilising of lawfully established flood control structures or other lawfully established structures within the bed of the river;
 - (III) Any increase in erosion of river bed or banks.
84. Submissions have been received in relation to this topic from the Canterbury Regional Council's River Engineering Section, which manages river rating districts on the Selwyn River and its tributaries.
85. The Section has specific concerns relating too:
- (a) The disturbance and/or removal of flood and erosion protection works;
 - (b) Where the structures are situated within 50 metres of, or cross over stopbanks, that this could destabilise the banks and increase the risk of failure.
 - (c) CPWT structures impacting on access to its flood and erosion protection works.
86. Any works in a river rating district need to be carried out in consultation with the River Engineering Section as to ensure that integrity of the flood and erosion protection scheme is not compromised or made vulnerable.
87. If any flood or erosion protection works are compromised as result of CPWT, then the onus must be on the consent holder to rectify the situation as soon as possible.
88. It is vital that access to the flood and erosion protection schemes is maintained, and this should also be set down as a condition of consent, if granted.
89. The works are of a localised nature, and with mitigation in place, it is unlikely that any adverse effects to flood carrying capacity and erosion will occur. The proposed conditions are sufficient to address the temporary effects associated with works in these rivers.

Effects of Works on Amenity Values, People and Communities

90. The Rakaia, Waimakariri and Selwyn Rivers in particular are highly used for recreational activities, including jet boating, kayaking/canoeing and angling.

91. The applicant has advised that large civil engineering projects of this nature involve the stripping and removal of vegetation and topsoil and create a large visual impact, albeit temporary in nature.
92. This is an effect that cannot be avoided during construction, but the sites should be rehabilitated as soon as practicable to ensure that the visual effect does not extend beyond the construction timeframe. Conditions of resource consent requiring the applicant to do this are needed should consent be granted.
93. The applicant has also advised that loss of some recreational opportunities due to restricted access during construction will be offset by the increase in recreational activities long term.
94. It also states that there will be public interest in the construction of the scheme and that signs will be erected advising people of what is occurring.
95. Submissions have been received regarding this issue.
96. There has been no mitigation proposed by the applicant regarding restricted access to rivers during construction, and whilst it is acknowledged that there may be periods during the building of the scheme where restricted access at certain locations is unavoidable, all practicable measures should be taken to ensure that access is maintained or alternate access provided.
97. The applicant needs to propose a strategy in relation to how it will maintain access during the construction of the scheme. This should include providing signage regarding the location of new access points.
98. People's enjoyment of work areas will be affected during the construction, but provided other conditions adhered to, this should be minimised, and disruption will be temporary. Creation of the dam / lake will alter experiences in the Waianiwi valley, but overall, there should be increased recreational opportunities, including passive enjoyment of the lake.

Effects of Discharging Stormwater, Sediment and Hazardous Substances to Land and Water during Construction

99. The applicant advises in the June 2006 AEE that construction of the scheme will result in the release of sediment in either run-off from the site or as a consequence of the disturbance of the bed of the river/stream concerned. The relevant construction sites include the intake construction sites, Waianiwiwa dam construction sites, the tunnel portals and the headrace and distribution network.
100. Rainwater can collect a range of contaminants as it flows over surfaces. If the water has sufficient energy it can entrain loose contaminants such as litter, leaves, sediment and faecal material.
101. The primary contaminant likely to be present in stormwater from the construction activities is sediment. If these enter a surface watercourse they have the potential to lower the water quality and smother in-stream biota. Suspended solids will also have adverse effects if they enter a public drinking water well.
102. The applicant has proposed the following general mitigation specific to the discharge of stormwater:
 - (a) Where the discharge is sediment a management plan will be prepared detailing how to minimise sediment suspension and transport
 - (b) The discharge shall be only stormwater from hardstanding and unpaved surfaces
 - (c) A Spill Contingency Plan will be prepared.
 - (d) Any substance, which is a hazardous substance in terms of the Hazardous Substance and New Organisms Act (HASNO) (1996) shall be stored in a bunded or contained area.

- (e) In the event of a spillage of fuel or any other contaminant stored, used or handled at a site, emergency response procedures shall be undertaken to prevent contaminants leaving the site. These procedures shall include but not be limited to:
- (I) Informing the Canterbury Regional Council of any significant contaminant spill event at the time the event occurs; and
 - (II) Maintaining a record of any spill where contaminants enter the stormwater system. The record shall be made available to staff at the Canterbury Regional Council on request. The record shall include the following information:
 - i. The date, time and duration of the incident.
 - ii. The type, including proprietary names where appropriate, of contaminant(s) spilled.
 - iii. An estimate of the volume of contaminant(s) spilled; and
 - iv. Details of the steps taken to control and remediate the effects of any such spill event on the receiving environment.
- (f) A stormwater management plan for the stormwater treatment and disposal system will also be prepared. This plan will set out how the system will be operated and maintained to ensure compliance with conditions of this consent. The plan shall include but not necessarily be limited to:
- (I) Design plans of stormwater collection and discharge systems.
 - (II) Details of the activities that will occur on site.
 - (III) Any hazardous chemicals (including fuel and oils) that will be held on site and their storage requirements.

Rakaia and Waimakariri Water Intake sites

103. The applicant advises that sediment will be released from the construction sites as stormwater run-off. Both the Rakaia and Waimakariri Rivers typically transport heavy loads of sediment, both suspended and bedload, and therefore there will be minimal impacts from any sediment released.

Waianiwaniwa dam site

104. The applicant advises that there will be a significant potential for sediment to be discharged from the dam construction site. The site will be provided with sediment retention ponds to minimise the effects of the discharge. The applicant also advises that given the Waianiwaniwa Valley will ultimately be flooded, any sediment discharge that is contained in the valley will be of negligible consequence. Sediment discharges towards Coalgate (where they have the potential to enter the river downstream of the dam) are of greater concern, and it is this area that will be protected by sediment traps and retention ponds.

Tunnel Portals

105. Sediment ponds will be provided at the tunnel portals. The applicant considers that the impacts of sediment discharges will be minor.

Headrace and Distribution Network

106. The headrace crosses a number of stream beds, many of which are dry, and therefore, the impacts of sediment discharges on these will be less than minor as long as lots of loose sediment is not left in the bed to be entrained next time the stream flows.

107. The Selwyn River flows underground just downstream of the main headrace and therefore sediment released to that reach of the river will be filtered out and will not significantly affect the lower reaches with higher ecological values. And, the lower river does flow occasionally, therefore the discharge needs to be well managed at any time there is flowing water downstream of the discharge point.

- 108.** However, it may still affect the values off the upper reach, as there will be ecological values there.
- 109.** The distribution network also crosses many small streams and water races. The applicant advises that standard practice is to place sediment traps downstream of the works to minimise the impacts of sediment, and that this will ensure any effects are minor.
- 110.** The applicant places heavy reliance on management plans that are yet to be prepared. While it is generally agreed that the effects of such activities could be minor where sufficient mitigation is proposed, in this instance, I am unable to determine this.
- 111.** Management plans are useful tools, but in the instance that they have not been prepared prior to resource consents being granted. While they can become the basis for detailing how conditions of resource consents will be complied with, they cannot be relied on to determine the conditions of resource consent.
- 112.** Examples of such conditions are as follows:
- (a) Where settling ponds are to be constructed.
 - (b) The capacity/ability that the ponds will have. For example: The settling ponds will be designed to store a 1% Annual Exceedance Probability (AEP) for the site.
 - (c) The level of treatment the settling ponds can be expected to achieve. For example: The discharge shall be via a system that removes at least 75% of total suspended solids (TSS).
 - (d) The volume and rate of the discharge shall not exceed the capability of the soil and subsoil layers at the site to reduce contaminant concentrations in the discharge to an certain level.
 - (e) The infiltration capacity of the soil and subsoil layers at the site.
 - (f) The discharge into a water body shall not increase the flow in the receiving water body by more than 5% of a flood event for that water body with an Annual Exceedance Probability (AEP) of 20%.
 - (g) Where sediment traps will be used.
 - (h) Details of the types of sediment management. For example: Sediment management will be designed and constructed in accordance with ARC Technical Publication TP 90.
 - (i) The discharge will not cause erosion to the bed or banks of the receiving water body.
- 113.** Until further detail is provided by the applicant, conditions cannot be finalised, and therefore, no conclusion can be made with regard to the effects of these discharges.

Hazardous Substances

- 114.** The storage of hazardous substances in the construction areas poses a risk to the community due to the potential for spills. The applicant advises that the storage of fuel oil will be in specially designated areas and tanks in excess of 10,000 Litres will be stored in bunded areas to control any spills should they occur. Runoff from major construction areas will pass through sediment traps or settling basins before they discharge into the rivers. This will provide protection against discharges of hazardous substances. It is also noted that the applicant proposes to prepare a spill contingency plan which will specifically address the ways in which the risks to water quality from construction activities will be addressed.
- 115.** A land use consent is required to store hazardous substances, and as well as the spill contingency plan proposed, mitigation proposed by the applicant for the land use consent includes limiting the volume stored and providing a containment system around any storage vessels. This is considered to be appropriate mitigation for this activity.

Effects of Discharging Contaminants, Principally Dust, to Air during Construction

- 116.** The main source of dust emissions are from open dust sources, where wind or machinery acts on exposed surfaces. This includes the movement of vehicles on unsealed roads.
- 117.** Fugitive emissions are those that enter the atmosphere without first passing through a duct or stack. The discharge of contaminants that are associated with the proposed activity include fugitive dust emissions from:
- (a) Wind action on stockpiles;
 - (b) Crushing of alluvial material; and
 - (c) Dust lifted by traffic movement within the site.
- 118.** Fugitive dust emissions usually show a high degree of temporal variability (Buonicore and Davis 1992), as they are frequently related to batch processes and/or dependant meteorological conditions.
- 119.** With respect to dust on construction sites, the following can be concluded:
- (a) The dust particles can vary greatly in size, but generally have a diameter of larger than 30 microns.
 - (b) Particles of this size tend to represent little health hazard, being easily filtered out in the nasal passages.
 - (c) The dust tends to settle quickly, and should be confined within or very near to the boundary of the operation.
 - (d) These particles will be composed of naturally occurring mineral fragments, many of which have low or no potential toxic effects.
 - (e) The dust may contain traces of products from the operation of motor vehicles including rubber from tyre and engine wear, oil and fuel leaks.

(Buonicore and Davis 1992).

- 120.** The contaminants produced by the proposed activity are considered unlikely to have significant adverse health effects. Any adverse effects resulting from the discharge are likely to be nuisance effects.
- 121.** The applicant proposes the following mitigation:
- (a) The consent holder shall submit to the Canterbury Regional Council at least one month prior to the commencement of works, a Dust Management Plan outlining the construction practices and procedures to be adopted in order that compliance with the conditions of this consent can be achieved and the effects of construction activities are minimised to the greatest extent practicable. The plan shall include, but not be limited to:
 - (I) The areal extent of the construction activities where dust could be generated.
 - (II) The types of construction methods to be adopted.
 - (III) The mitigation measures to be adopted to minimise the effects of dust beyond the boundary of the construction site.
 - (IV) Contact details for the person in charge of the site works.
 - (b) The discharge shall be limited to dust arising from the construction, maintenance and operation of the Central Plains Water Enhancement Scheme.
 - (c) All practicable measures shall be made to limit the duration and frequency that dust associated with construction, operation and maintenance activities is discharged to air.

122. If the commissioners chose to grant the consents, more specific mitigation is suggested to be added to this to ensure that the effects of nuisance dust are minor. These include:

- (a) The consent holder shall adopt all practicable measures to minimise the emissions of fugitive dust. These will include, but are not limited to:
 - Regular cleaning of sealed surfaces to prevent accumulation of dust;
 - Wetting down of unsealed surfaces with sufficient water to maintain them in a wetted state;
 - In wind speeds of greater than 10km/hour, unsealed surfaces will be wetted at least hourly; and
 - Maintaining the material excavated from the river in a wetted state
- (b) The discharge shall not cause deposition of particulate matter to the extent that it is offensive or objectionable beyond the construction site on which the consent is exercised.
- (c) A record of any complaints relating to particulate matter shall be maintained and include:
 - Location where particulate matter was detected;
 - Date and time when particulate matter was detected;
 - A description of the physical conditions including wind speed and direction;
 - The most likely cause of the particulate matter detected;
 - Any corrective action undertaken by the consent holder to avoid, remedy or mitigate suspension of the particulate matter.

123. Given the construction sites are near to rural towns and the fact that dust can be a nuisance, consideration could be given to limiting the hours of work as an extra mitigation measure.

124. Discharge to air will also occur from construction activities including welding, abrasive blasting, water blasting and painting associated with the Central Plains Water Enhancement Scheme, and from pump stations and emergency generators. The applicant, in addition to mitigation proposed under the preceding section, also proposes the following:

- (a) The total weight of welding rods and solder used at each construction site shall not exceed 250 kilograms per month.

125. Dry abrasive blasting, for example, typically generates large quantities of dust, much of which is in the larger size fractions ($>PM_{10}$), settles quickly and can cause a localised adverse nuisance effect. However, it is likely that some dust in the respirable size range (i.e. PM_{10}) will also be contained in the discharge.

126. Discharges from painting are expected to be restricted to airborne paint particulates and various types of solvents used as thinners and diluents in the paints, however, these emissions are difficult to quantify.

127. The mitigation as proposed does not adequately address the potential effects associated with the proposed discharges. Given this, if the commissioners chose to grant the consents, further mitigation is proposed. Suggested conditions are as follows:

- (a) The discharges shall only occur from abrasive blasting, and spray painting. See comment on types of contaminants above. The conditions need to be combined and need to limit it to dust plus these ones.
- (b) While work is occurring, signs are to be erected to advise members of the public in the vicinity of the works taking place to advise them of the discharge.
- (c) All discharges will be contained on site.
- (d) Where the discharges are within 20 metres of any water body, a temporary silt fence will be constructed at the downstream end of the work site to prevent any particulate matter from entering the water body. Woolly.

- (e) Whenever blasting is undertaken, at the end of each work interval, all practicable measures shall be taken to collect and remove blasting debris from and around the structure being blasted.
- (f) The discharges will not occur in wind speeds higher than 10 km/hour to minimise the discharge of particulate matter and other contaminants into the air, and toward sensitive nearby receptors.
- (g) The consent holder shall inform the Canterbury Regional Council not less than 12 hours prior to the commencement of any abrasive blasting, water blasting or spray painting. The notification shall include the time of commencement, location and likely duration of the activities. Written confirmation of the notification shall be provided to the Canterbury Regional Council prior to the commencement of any abrasive blasting, or spray painting.

Effects of Dam Failure

- 128.** The Central Plains Water Enhancement Scheme requires the construction of a dam located in the mouth of the Waianiwaniwa Valley, immediately upstream of the Coalgate Township. The Waianiwaniwa catchment is in the eastern Malvern Hills and covers an area of approximately 55 square kilometres.
- 129.** The proposed dam is to be up to 55 metres in height, storing 280 million cubic metres of water, covering 1,200 hectares of land (12 square kilometres).
- 130.** The applicant is also seeking a designation for the proposed dam in the Selwyn District Plan. Given this, Tonkin and Taylor, on behalf of SDC have undertaken an assessment of the proposed dam. I have reviewed this report, and agree with its findings in relation to resource consents being sought from ECan.
- 131.** The primary effect of damming water to be considered is the effect of dam failure. In the event of dam failure, the energy of the water released from behind a dam is capable of causing loss of life and property damage if there are people in the flood path downstream of the dam.
- 132.** By international standards, the dam is classified as a large dam. The New Zealand Dam Safety Guidelines defines the proposed dam as a high potential impact dam, meaning that there is potential for loss of life and severe damage to property and the environment in the event of the dam failing.
- 133.** In the AEE, the applicant states that the risk of dam failure from flooding and overtopping would be negligible. Further information was provided in March 2006 (*Dam Safety Assurance Report*) that assessed the risk failure of the dam, and provided a dam break analysis for the dam.
- 134.** The risk assessment is based on the ANCOLD¹ (2003) guidelines. Risk is defined as being equal to the probability of failure times the consequences. The applicant concluded that incorporating modern defensive design features will achieve a very low probability of failure (i.e. 1 in 4, 000, 000), at least one order of magnitude below the ANCOLD (2003) tolerable risk² guidelines for a new dam.
- 135.** The modern defensive design measures as specified *Dam Safety Assurance Report, March 2006* include:
- (a) A freeboard of 2 – 3 metres to reduce the risk of overtopping;
 - (b) A crest width of 10 metres to provide additional protection against a modest amount of overtopping;
 - (c) A spillway designed to convey the Probable Maximum Flood for the catchment;
 - (d) Treatment of geological defects in the foundation rock;

¹ Australian National Committee on Large Dams Inc.

² A risk society is willing to live with so as to secure certain net benefits in the confidence that the risk is being properly controlled, kept under review and further reduced as and when possible.

- (e) Removal of weak, poor quality materials from the foundations;
- (f) Careful placement and compaction of fill materials in construction;
- (g) The embankment will be comprised of a zoned earthfill section;
- (h) Incorporating filter zones into the shoulder materials to prevent piping of the core;
- (i) Inclusion of drainage zones to collect seepage flows and control soil water pressures within the foundation and downstream shoulder to acceptable levels

- 136.** During construction, a coffer dam will be constructed to protect the construction site and safely divert run-off water from the Waianiwaniwa catchment. The coffer dam will be designed to withstand a 1000 year flood event for the Waianiwaniwa River.
- 137.** Water in the Waianiwaniwa River will be diverted through an outlet structure of the reservoir, constructed in advance, or through a temporary outlet structure. The outflow will have a capacity of 45 m³/s. Flow rates in excess of this will be stored behind the coffer dam.
- 138.** There are a number of international organisations dedicated to the developing best practise safety guidelines and standards for investigating, designing, constructing, operating and maintaining large earth dams.
- 139.** In this case, dam failure caused by flooding is less likely than for many large dams because of the small catchment area.
- 140.** However, earthquake loading is a concern due to an active fault within 2 to 4 kilometres from the dam site. Dams in New Zealand are required to withstand a severe earthquake without breaching. Dams built in the vicinity of active faults in New Zealand are not uncommon and in New Zealand include the Aviemore Dam.
- 141.** In the modern age, large dams are able to be designed and constructed to ensure that the risk of failure is as low as estimated. NZSOLD Guidelines set out criteria that high potential impact dams have to meet. This includes the requirement for the design of all high potential impact dams to be peer reviewed. Many of the requirements of NZSOLD have been proposed as mitigation by the applicant.
- 142.** A key principle for the design of safe dams is provision of “multiple lines of defence”. This means incorporating multiple safety features into a dam to prevent adverse performance. Therefore, if one design feature fails to perform as expected, there are other features to prevent dam failure. This approach has been adopted by the applicant.
- 143.** The applicant undertook a dam break analysis using three modes of failure that could be attributed to the dam (overtopping, earthquake and piping (internal erosion)), at different locations on the dam, to simulate breach hydrographs which were then used to model the flooding downstream of the dam. Assessments were carried out for during construction and once the dam is operational.
- 144.** This showed that the potential impacts of a dam failure spread from the dam site right down to Lake Ellesmere (Te Waihora). It is self evident that this analysis depicts devastating effects.
- 145.** However, it is crucial to understand the context in which the dam break analysis is interpreted, to prevent unnecessary alarm particularly regarding the probability of a dam failure.
- 146.** The applicant presented the dam risk assessment to the Coalgate Community prior to the report’s release. This meeting focused on dam safety measures and the “multiple lines of defence” built into modern dam design.

147. It has to be noted however, that the risk posed by the dam, albeit very small, is being imposed upon the community of Coalgate and beyond. It is an imposed risk; unlike other perceived dangerous activities one may chose to partake in such as flying or skydiving.
148. For this reason, there were many submissions received on the dam.
149. I understand that the proposed dam is something that the people of Coalgate and beyond have not chosen to have in their surrounds, and that any risk of a dam failure is unacceptable to them.
150. I agree with the analysis and conclusions of the applicant's dam breach assessment with respect to the mechanisms that may cause a dam failure, the outcome of such an event, and the extremely small risk of such an event ever occurring. However, the community is still concerned about the proposed dam, and the fact that it is being imposed on them.
151. The dam is crucial to the overall scheme – it could not work without it. The risk of a dam failure is extremely small, and hence, from an engineering perspective, I have no issues with the proposed dam, but consideration does need to be given to those persons living in its vicinity that are having a risk (no matter how small) imposed on them.
152. With respect to the conditions proposed by the applicant, Tonkin and Taylor have recommended changes to these, and have included additional mitigation. The intent of the conditions proposed by the applicant has not been altered, and it is considered appropriate that the conditions be based on international and New Zealand best practice guidelines such as NZSOLD and ANCOLD. I concur with these changes, and if the commissioners chose the grant the consents, should be conditions of consent.

The Efficient Use of Water for Irrigation Purposes

153. The use of water is a discretionary activity under Chapter 5, Rule WQN26 of the PNRRP. Rule 26 states that the discretion of Environment Canterbury will include but is not limited to the following matters:
- (a) The rate of take and volume and rates of use reasonably required for the intended use(s).
 - (b) The effectiveness and efficiency of the methods of conveyance and application of the water.
 - (c) The effects of irrigation on groundwater and downstream water bodies and drains, including any cumulative effects arising from the irrigation of the combination of properties supplied by an irrigation scheme.
154. Condition (1) of Rule 26 states that the use shall not be within the Christchurch Groundwater Recharge Zone (Map Volume Part 1 Planning Maps). The scheme does not include any areas within the recharge zone.
155. Further information was requested from the applicant, relating to how the scheme will ensure that the amount of water used annually within the scheme area will be an efficient use of water as well as the question of how this would be ensured during the staged development of the scheme when the intake capacity might be greater than needed for the area of land developed.
156. The applicant responded that:

'Firstly there is unlikely to be a large disparity between scheme supply capabilities and area of land ready to be irrigated. A large proportion of the scheme area is expected to be ready to receive scheme water as soon as it is available. The area presently irrigated within the scheme boundaries has been estimated at between 18,400 ha (Aqualinc, 2006, based on ECan data of 2002) and 30,000 ha (Macfarlane, 2006, based on ECan data of 2005), i.e. up to half the scheme area, and it is

expected that this land will switch immediately to scheme supply. In addition it is probable that other land within the scheme boundaries will seek to obtain groundwater supplies while awaiting scheme implementation and yet more land will install irrigation equipment to coincide with scheme opening.

Secondly all individual water takes will be subject to the terms of a Sustainability Protocol that CPWL is in the process of developing, including a Farm Plan for Sustainable Irrigation. This protocol will specify minimum standards of efficiency of water use and will require monitoring and reporting to ensure these are achieved. The AEE has proposed an off-farm efficiency of 80%, and the current draft Sustainability Protocol proposes an on-farm efficiency of 80%.'

- 157.** The applicant advised that the following clauses should be added to the original conditions of Take and Use in Appendix D of the AEE:
- (a) The scheme will be required to operate according to the Sustainability Protocol, including achieving a minimum efficiency of water use off-farm of 80%, and on-farm of 80%, and both the scheme and individual irrigators will be required to operate in accordance with that agreement as a condition of receiving water from the scheme,
 - (b) The Company will provide an annual report to the Central Plains Water Trust detailing the hectares irrigated and volume of water delivered,
 - (c) The CPWT will provide an annual report to ECan detailing the hectares irrigated and volume of water delivered.
- 158.** In a technical sense, when using efficient irrigation management practices, application rates do not exceed the soil infiltration rate or the ability of plants to uptake water, and with the use of appropriate irrigation scheduling there should be no surface runoff, or potential for deep percolation of water and nutrients beneath the root zone. Also no leakages in the delivery system and no irrigation of waste areas ensures good water conservation management practices.
- 159.** The following mitigation is proposed by the applicant:
- (a) Ensure that the volume of water used for irrigation per design return period does not exceed 50% of the soil water holding capacity and how this will be achieved;
 - (b) Ensure that the irrigation system is maintained in good repair (i.e. no leaks);
- 160.** Policy WQN17(3)(b) of Chapter 5 states that where the seasonal irrigation demand standards in Schedule WQN9 are not met, the use is a discretionary activity, and exceptions shall only be made in accordance with the situations outlined in WQN17(3)(b)(i) and (ii) which include circumstances where it can be demonstrated that the demand conditions are different to those mapped on the PNRRP Map Volume Part 1 Planning Maps, due to micro climate or other variations, and where a lower efficiency or where mitigating circumstances can be clearly demonstrated.
- 161.** In the further information received from the applicant in December 2007, the creation of farm management plans has been included as mitigation, however, the mitigation does not extend to specifying annual volumes for each property.
- 162.** While annual volumes are not used by ECan to allocate water or cap cumulative takes from a discrete resource in managing surface water abstractions, as they are for groundwater allocation blocks, they are used by ECan to ensure the efficient use of water over a season. However, in the case of an irrigation scheme, proposing a consented annual volume either on a scheme basis or on a property by property basis is difficult due to the range of variables involved. The issue is really to ensure reasonable and efficient use of water.

- 163.** The applicant has proposed to ensure the efficiency of the delivery and on-farm irrigation systems, but they have not proposed a volume or application rate. Whilst they refer to the Sustainability Protocol, this is not yet a completed document, therefore, it cannot be relied upon.
- 164.** It is noted that other consents have been granted by ECan with an application rate per hectare per season specified, such as 0.6 L/s/ha. In this instance, an application rate of 0.6 L/s/ha assumes an average maximum daily demand of 4.1 mm/day with an application efficiency of 80%. However, as demand relies on a number of variables including climate, soil, maximum allowable deficit and land use, an application rate is not considered to be appropriate mitigation for a scheme such as that proposed.
- 165.** Given that the scheme will be a staged process, it seems most practical to expand on the proposed condition concept of annual reporting of water delivered, rather than trying to determine a maximum WQN9 volume of water to be supplied by the scheme assuming 100% area irrigated.
- 166.** Site specific characteristics of each farm will dictate how much water is required, and therefore it is proposed that a condition be included requiring the consent holder to hold records for each property serviced by the scheme. This should include the property characteristics and volume of water to be provided each irrigation season for each property serviced, including how this interacts with any existing surface or groundwater consents to irrigate that may be held for that property. This information will help to form the basis of the annual reporting to ECan on how much water has been used within the scheme area. This should be done as changes occur (not annually as proposed by the applicant).
- 167.** It is recognised that there is a substantial economic incentive to use water efficiently, and that Chapter 5, PNRRP is in its early stages of development, with hearings on submissions and further submissions currently underway. Therefore, the appropriateness of using Schedule WQN9 as a tool for determining on farm requirements is open to the applicant to comment upon and provide justification for alternative methodology if they so desire.
- 168.** Given this, the following mitigation is proposed, which addresses these issues. The mitigation is based on ensuring that each property the scheme supplies uses efficient irrigation practices and that the “roll on” effects of inefficient irrigation (leaching, run-off) are minimised. The mitigation should include:
- (a) The creation of an environmental farm plan for each property the scheme supplies which will detail how the property will manage irrigation efficiently, including application rate and annual volume requirement;
 - (b) The requirement for the environmental farm plans detailing irrigation management to be audited on an annual basis;
 - (c) Any non-compliance with the environmental farm plan to be rectified within one month and if there is failure to do so within this time, supply to that property ceases until such time as the property complies fully.
- 169.** It is also noted that some of the properties may have existing consents to take and use groundwater.
- 170.** The environmental farm management plan should therefore also:
- (a) Identify any other sources of water allocated to the property and contain details of how this water any other water allocated to the property is managed to ensure that water is used efficiently.
- 171.** If the commissioners chose to grant the consents, with the additional mitigation proposed, effects on an inefficient take on other users are likely to be minor.

