**IN THE MATTER** of the Resource Management Act 1991

**AND**

**IN THE MATTER** of applications for resource consent by the Central Plains Water Trust and a notice of requirement for the designation of land by Central Plains Water Limited associated with the construction and operation of the Central Plains Water Scheme

# STATEMENT OF EVIDENCE OF EDWIN NICHOLAS JANSEN ON BEHALF OF NGAI TAHU PROPERTY LIMITED

## 1. INTRODUCTION

1.1 My name is Edwin Nicholas Jansen. I am an employee of Ngäi Tahu Holdings Corporation Limited. My role includes the management and development by Ngäi Tahu Property Limited of the rural lands held by Ngäi Tahu Forest Estates Limited. My role includes: business development, investment analysis, funding, acquisition and disposal, commercial leasing and risk management. I have worked in that role since 1999. Prior to this, I worked with Carter Holt Harvey in the forest and wood processing sectors during which time I worked principally in the areas of silvicultural and estate modelling and valuation.

1.2 I have a Bachelor of Science, a Bachelor of Forestry Science, a Diploma in Accounting plus various papers in market traded securities and property studies at masters level.

1.3 In late 1999, Ngäi Tahu Forest Estates Limited purchased a 6,764 hectare property at Eyrewell on the north bank of the Waimakariri River with the long-term objective to develop this property for irrigated agricultural use. My involvement in irrigation commenced in early 2002 with Ngäi Tahu Forest Estates acquiring interests in Waimakariri Irrigation Limited. In addition, from mid 2003, I have been involved in the Hurunui Water Project. This project attempts to achieve a comprehensive water management regime within the Hurunui catchment together with an irrigation scheme of 40,000 ha. On behalf of Ngäi Tahu Forest Estates Limited, I have engaged engineers, farm consultants, dairy farm developers and asset managers, irrigation specialists and various contractors to assist in the preparation, costing and execution of business plans in relation to Eyrewell and other properties. I am also familiar with the Waimakariri Regional River Plan and have prepared detailed submissions on the Hurunui River Management Regime and the NZ Emissions Trading Scheme.

1.4 Ngäi Tahu Property holds a consent to take 3.96 cumecs of water from the Waimakariri River for the purpose of irrigating the Eyrewell property. The consent number is CRC052033. It provides for the taking of 2.72 cumecs of "A" permit water and 1.24 cumecs of "B" permit water subject to certain events and conditions in relation to the application by Central Plains Water (**CPW**), which is the subject of this hearing.

## 2. SCOPE OF EVIDENCE

2.1 My evidence addresses:

a. Resource allocation in Canterbury;

b. The extent of the environment and implications for economic efficiency;

c. The regional plans and water allocation;

d. Irrigation reliability and determination of when enough water is enough;

e. Irrigation demand and the reasonable need for CPW to take water;

f. Sources of water within Canterbury and an allocation framework that may address all irrigation interests in water;

g. The economic efficiency of the Ngäi Tahu Property consent; and

h. Water allocation and consent conditions appropriate for CPW in relation to the Waimakariri River.

## 3. RESOURCE ALLOCATION

3.1 I understand the primary function of this resource consent hearing (having regard to the nature of the application and the status of regional plans) is to determine the quantity and nature of resources that can be granted (if any) to the applicant to enable the achievement of sustainable management under the Resource Management Act 1991 (**the Act**).

3.2 As will be shown later in my evidence, CPW seeks a consent to take and use a quantity and class of water in excess of their reasonable needs and which if granted (in that form) will, in my view, deny the achievement of sustainable management in the wider community.

3.3 In my experience, the development of sustainable management principles and the awareness of allocative efficiency have come a long way since the preparation of the Waimakariri Regional River Plan (WRRP). While the Proposed Natural Resources Regional Plan (PNRRP) develops these concepts further, the Canterbury Strategic Water Study[1] may ultimately provide the blueprint for sustainable management of the soil and water resources in the Canterbury region. At a national level, the Sustainable Water Programme of Action looks set to create new national policy statements that may be influential in subsequent reviews of river plans.

3.4 The WRRP governs the take of water from the Waimakariri River. It became operative in October 2004 and given recent developments looks outdated. Certainly the WRRP never anticipated or considered the effects of an application of the scale anticipated by CPW. A review of the WRRP will surely follow once the Sustainable Water Programme of Action and the Canterbury Strategic Water Study are complete and the PNRRP becomes operative.

3.5 It is in everyone's interest that this hearing gives full consideration to the purpose of the Act and that consents (if granted to CPW) will survive plan changes and subsequent reviews of conditions. While a consent hearing is not intended to be the forum for the development of river plans, given the magnitude of this application I consider that this hearing should not constrain itself to taking a narrow view of what can and cannot be considered based on provisions derived from an earlier era under different circumstances. My understanding is that the outcome must achieve the over arching purpose of "sustainable management".

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[1] It should be noted the CSWS has concentrated on large scale storage options

## 4. THE EXTENT OF THE ENVIRONMENT AND IMPLICATIONS FOR ECONOMIC EFFICIENCY

4.1 In my view, the purpose of the Act will not be achieved if consents are granted in a way that denies the opportunity to maximise the sustainable development of the soil and water resources within the wider Canterbury region. Clearly the remaining surface water resources that CPW seek to secure could be best allocated and thereby potentially serve a far greater community than the beneficiaries of this particular scheme, being the farmer shareholders.

4.2 The arrangement between CPWT, CPWL and the ultimate shareholders has implications for appropriate water resource allocation and principles of fairness and equity.

4.3 The arrangement between CPWT and CPWL should also not be permitted to shield existing irrigators from disclosing the existing water rights held and the intentions with respect to future use. The absence of this information casts doubt on the ability of this hearing to determine the reasonable needs of the applicant and to consider how existing groundwater rights should be managed by the consent authority to achieve sustainable management.

4.4 Ultimately, when looking through the arrangement, the shareholders of CPWL are seeking additional water rights (over and above the 30,000 hectares of groundwater and the Glenroy consent currently held) to:

a. improve the farm incomes of existing irrigators;

b. enable existing irrigators to increase their irrigated farm areas;

c. improve the reliability of groundwater takes (not already at 100%) to 98%;

d. to increase the area of land irrigated within the CPWT command area from 30,000 to 75,000 hectares; and

e. to take a quantity of water sufficient to achieve 98% overall water reliability.

4.5 I believe that in considering the adverse effects on the environment, one needs to give adequate weighting to the "*social, economic, aesthetic and cultural conditions*" of people and communities. I believe that New Zealand's social and cultural conditions include concepts of fairness, equity, a duty of care, active protection of the interests of the community, the avoidance of arbitrary decisions that create unreasonable outcomes and significantly a social framework that involves wealth distribution to allow people and communities to provide for a minimum standard of living. Before granting additional water resources to existing irrigators, it may be necessary (to give effect to the purpose of the Act and economic efficiency) to consider how those water resources could be used to lift minimum farm incomes of non-irrigating farmers across a broader Canterbury community base.

4.6 There appears to be some divergent views amongst the economists at this hearing, as to whether or not the CPW Scheme is efficient or worthwhile in economic terms, based on what should be included or excluded in such efficiency assessments.

4.7 Michael Copeland, on behalf of Te Rūnanga o Ngāi Tahu , states in paragraph 10 of his evidence:

> *"I believe the economists are in agreement that the term "efficient use" relates to the concept of economic efficiency" … and …"There is a general acceptance among economists that economic efficiency is made up of three component parts – allocative efficiency, productive efficiency and dynamic efficiency"*

4.8 The economist commissioned by the applicant (Philip Donnelly) in his "before verses after" assessment of the CPW Scheme, (rightly or wrongly) refrains from considering alternative uses of the resource in the knowledge that the proposed use need only achieve a benefit in excess of cost. He also refrains from considering the impact on other potential users (now and in the future) in the belief that the first-come, first-served principle gives the applicant a right to the resource of choice and that applications under the Act are to be assessed without consideration of other later applications. The ability to compare competing proposals is discussed further by Mr Christensen in legal submissions. I make the following comments about the efficient allocation of water resources, based on my experience in this area.

4.9 If Canterbury attempted to maximise its economic efficiency, then Canterbury would need a plan that addresses all interests in scarce resources and all possible uses. Maximising economic efficiency would then involve selecting that combination of projects within Canterbury that could be undertaken (now and in the future) with the available soil, water and capital resources to maximise the Net Present Value of the outcome having regard for risk (both environmental and financial) and the community's appetite to take on risk. The end result would likely be water allocated sparingly across all irrigable soils to maximise marginal and overall returns and to minimise environmental cost. Market efficiency would result in the uptake of available resources, as opposed to the re-allocation of resources which is an entirely different matter.

4.10 But what if the water resources were not allocated across all irrigable soils and, as a result, some farmers were denied a viable landuse because they were unable to add as much value to water as other users?

4.11 In my view, enabling communities to provide for their wellbeing takes precedence over maximising economic efficiency. Maximising economic efficiency from a public resource is only valid if the wealth gained and opportunity costs incurred are then redistributed across the community reliant on those resources.

4.12 I consider that the term "efficiency", in relation to public resources, should be qualified as follows:

a. Productive efficiency means maximising marginal output in excess of costs across a broad community base (not "output at lowest cost");

b. Allocative efficiency means allocating resources equitably across society to achieve overall wellbeing (not "resources allocated to production that society values most");

c. Dynamic or innovative efficiency means the promotion and early adoption of new technology to get more out of less resource.

4.13 If the CPW Scheme is viable in itself, but there are other viable uses that in combination (with CPW or otherwise) can achieve a greater distribution of net benefits across the wider community, then these are valid uses that must be taken into account in decisions to allocate public resources.

4.14 In the ideal world, Canterbury would have an optimal resource allocation plan that addresses all interests in resources. Consent applications would continue to be heard on a “first-come, first-served” basis and authorities would determine those applications on the basis of whether or not the proposals were consistent with the plan.

4.15 In the absence of an all encompassing plan that addresses all interests in water, the “first-come, first-served” principle places the burden on a consent authority to hear evidence, request further information and determine (on the facts available) the optimum allocation and use of resources in question.

**Groundwater takes and residual irrigation demand**

4.16 In the year 2000, the Applicant estimated that there was 60,000 hectares of irrigation demand in the Selwyn catchment. It lodged water take applications in 2001 over both the Waimakariri and Rakaia Rivers.

4.17 Without the opportunity to take surface water and with the more attractive option to secure reliable groundwater, farmers within the Selwyn catchment have drawn heavily on groundwater resources. Those groundwater consents were granted because they were proven to be efficient. In 2008, the Applicant estimates that up to 30,000 hectares of the CPWT command area is now irrigated from consented groundwater takes held by CPWT shareholders. (John Bright: July 2005 Ecan Consents database = 18,408 ha); Cliff Tipler: (para 31 Groundwater evidence) 18,408ha to 24,000 ha irrigated; Andrew MacFarlane, (para 45), 22,000 ha plus 8,000 ha other = 30,000 ha.)

4.18 It is clear from the evidence of William Brown (para’s 40-44) and others, that there is no financial incentive to convert efficient groundwater takes to the CPW Scheme. Given the connection cost to the scheme of $6,828/ha, the return on investment is only 3.6% ($61,000/$1.7m) (Brown, para 42).

4.19 It is not surprising however that up to 50% of the CPWL shareholders (by area) already have groundwater consents. The low initial issue cost of the CPWL public offering at $75/ha represents an inexpensive option. It enables the groundwater consent holders with options to either:

a. sell their shares or lease the CPW water rights to dryland farmers at a premium;

b. purchase dryland farms in the command area (with a pre-emptive water right) to expand their business;

c. to enhance the reliability of their groundwater takes (not already at 100% reliability) with a small shareholding in CPW (say 1 share per hectare or 1,000$m^3$/ha) as a precaution to more difficult groundwater consent conditions; or

d. transfer the groundwater rights that are transferable.

4.20 At best, the 30,000 hectares of groundwater irrigators will be the early adopters in the purchase and conversion of adjoining dryland farms. Certainly few will cease using and/or surrender the use of their groundwater consents.

4.21 The 2001 demand of 60,000 hectares must, in 2008, be no more than 50,000 hectares at best. In determining this number, I note from the evidence of Andrew MacFarlane that the command area can sustain around 75,000 hectares of irrigation demand. This leaves 45,000 hectares of unmet demand. If we assume that the 30,000 hectares of groundwater consent holders retain a small shareholding in the CPW Scheme (say 1 share per hectare or 1,000$m^3$/ha for each hectare irrigated by groundwater) then their effective demand would be 5,000 hectares, totalling 50,000 hectares.

4.22 While CPW may have undertaken optimisation work in 2004 to determine that the most cost-effective scheme size was 60,000 hectares, this does not mean there is 60,000 hectares of demand in the command area.

4.23 It is clear that CPW lacks an up-to-date assessment of irrigation demand. CPW is therefore unable to demonstrate the reasonable need for the water takes requested and is unable to demonstrate that it can utilise the water that may be granted. The granting of water take consents in excess of the reasonable need of an applicant will not, in my view, promote the efficient use of the soil and water resources within the wider Canterbury region.

## 5. REGIONAL PLANS AND WATER ALLOCATION

5.1 Regional plans provide guidance on water allocation, water reliability needs and the nature of water rights.

### Regional Policy Statement (RPS)

5.2 Policy 1 of Chapter 9 of the RPS requires that water flow, level or allocation regimes should be set and managed in accordance with specified values within Objective 1.

5.3 Policy 2 states that: "Subject to Policy 1, all water flow, and level, and allocation regimes should be set and managed within the aim of enabling people and communities to maximise the wellbeing obtained from Canterbury's water resources through taking account of its value both in-stream and out-of-stream; and where appropriate enhancing the availability of water for present and future generations through increased efficiency of use, augmentation or storage".

### Proposed Canterbury Natural Resources Regional Plan (PNRRP)

5.4 Objective WQN4: Allocation of the available water resource states that:

a. The available water is allocated in ways that enable communities to maximise their social, economic and cultural wellbeing and their health and safety.

b. Allocation regimes are established that identify at least one allocation block within which the reliability of supply of water does not become a factor that limits the long-term economic viability of users that are dependant on that block of water.

5.5 The above objective outlines the criteria for determining an appropriate level of reliability to promote overall community wellbeing. That is, a degree of reliability that *does not become a factor that limits the long-term economic viability of users*.

5.6 There is a difference between a project that is economically viable (say 90% water reliability) and a project that is awash with surplus resources (such as 98% water reliability).

5.7 The reliability objective also has a time element. This suggests that users within an “A” block (or any other block for that matter) have a legitimate expectation that should water become (over time) a limiting factor, they will be able to change their usage over time to ensure long-term economic viability is maintained.

5.8 Policy 2 of the RPS encourages permit holders (including Waimakariri River “A” permit holders) to enhance water availability via augmentation and storage of their permitted takes as a means of maintaining long-term economic viability.

5.9 Permit holders within an allocation block have a right (in common) to take water within the allocation limits (flow and volume) of the block. For surface water takes, this includes the right to take run-of-river water and a priority right (during the term of their consent) to augment reliability (with storage either collectively or through individual on-farm storage) to maintain long-term economic viability. While a consent authority may require the priority right to be exercised by way of a variation of consent, this requirement does not remove the right.

5.10 In determining when an allocation block is fully allocated, one needs to consider the purpose of the block[2]. Certainly, the grant of consent to take unused water within an “A” Allocation block (if there is such a thing as unused water) should not prevent existing consent holders from achieving (now or in the future) the legitimate expectation expressed above. This is reinforced by Objective WQN8 and Policy WQN21 as follows:

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[2] Objective WQN4 and Policy WQN14 clearly outlines the primary purpose of an “A” allocation block.

***Objective WQN8 Augmentation of water bodies***

*Enable the augmentation of water resources provided that:*

*(a) it is consistent with provisions (a) to (h) of Objective WQN1, Objective WQL1.1 (2) and Objective WQL1.2 (3);*

*(b) it will not adversely affect existing water permit holders' reliability of supply and access to water; and*

*(c) it will result in long-term social, economic and environmental benefits to the regional community.*

***Policy WQN21 Managing the effects of augmentation***

*(2) Augmentation should not diminish the reliability of supply for existing water users without their agreement. Proponents must determine the likely effects on any existing allocation regimes and demonstrate how these can be mitigated or equitably managed.*

5.11 Policy WQN14: Allocation Regimes for surface and ground water; provides guidance on the establishment of allocation regimes as follows:

*a) To establish and apply allocation regimes for all water bodies from which water is, or is likely to be taken, dammed, diverted, discharged or used.*

*b) Where Water Conservation Order's have established allocation regimes, these shall be applied.*

*c) Allocation regimes shall comprise allocation blocks in the following order of priority:*

- *A allocation block*
- *B allocation block – for water supply needs outside the A allocation block including water allocated for retention in-stream; and*
- *additional allocation blocks*

*d) For surface water bodies:*

- *the period of abstraction shall be specified as a condition of each permit to take surface water*

- *where the water permit is to take water for irrigation use, the period of abstraction shall be months of October to April inclusive.*
- *where a surface water body is dammed and water is stored, the limit for each allocation block may also be set to include an annual volume. Where the annual volume is used, the effective allocation shall be determined in the same way as set out for ground water allocation zones as set out in Policy WQN14 (6) (b) and (c).*

*e)* *For a surface water body, when establishing an allocation block for Schedule WQN1, unless an alternative catchment specific approach is more appropriate, the size of the A allocation block shall be set so that all takes from the block have a level of reliability that will provide, on average:*

- *the full allocation rate 95% or more of the time during the period mid October to mid March in 6 years out of 10; and*
- *the full allocation rate 75% or more of the time during the period mid October to mid March in 9 years out of 10.*

5.12 The above policy outlines a specification for water reliability that the plan proposes is necessary to maintain the long-term economic viability of irrigators. Clearly, the level of reliability that CPWT seeks to satisfy (at 98% for 10 years out of 10) is far in excess of what is necessary to satisfy reasonable need.

**Waimakariri River Regional Plan (WRRP)**

5.13 Rule 5.1 of the WRRP defines the taking of water applied by CPW from the Waimakariri River as a discretionary activity, with discretion limited to a number of matters, including:

*a)* *the reasonable need for the quantities of water sought, and the ability of the applicant to abstract and apply those quantities…and*

*b)* *the availability and practicality of using alternative supplies of water including alternative public or community reticulated supplies.*

5.14 As noted in the Canterbury Strategic Water Study ("CSWS") and by various commentators, the level of reliability that can be obtained solely from run-of-river takes of the Waimakariri "A" allocation block is generally regarded as insufficient for intensive agricultural and cropping purposes. Notwithstanding this, it is clear that the "A" allocation block continues to sustain viable dairy farming activities.

## 6. IRRIGATION RELIABILITY – WHEN DO IRRIGATORS HAVE ENOUGH?

6.1 CPW is attempting to justify the water takes and storage volumes on the assumption that there is 60,000 hectares of water demand and that irrigation reliability of 98% is essential and more efficient than say 90% or 95%.

6.2 In my view, an overall reliability of 98% is unreasonably high and requires securing an excessive take of surface water (that will seldom be used) and which is economically inefficient for the wider community as it reduces the total area of land that could be viably irrigated at more modest levels of reliability. I address this issue in the following section of my evidence.

### CPWT reliability and the impact of groundwater

6.3 The Applicant does not appear to have provided any rationale or economic analysis to support the proposition that 98% water reliability is essential for their proposal. No cost benefit analysis has been provided. No sensitivity on marginal farm returns and viability has been provided. As a variable in an uncertain world, the achievement of 95% verses 98% reliability seems to warrant little consideration. We are led to believe that high reliability is more efficient.

6.4 The total annual water demand (of the CPW Scheme) at the farm gate has been assessed at 376m $m^3$/yr. John Bright describes this as "*adequate for an area of 60,000 hectares of mixed property types*" and noted "*I suspect significant competition to develop among the Scheme members*"…."*this will encourage farmers to be as efficient as possible*". Essentially, scarcity of a resource encourages efficient use.

6.5 Cliff Tipler in his evidence, notes that the supply of 376m $m^3$/yr has been determined to provide the design reliability of 90%. While the groundwater effects modelling assumed an application of 376m $m^3$/yr at 90% reliability, the consent application is for a take of water to achieve an overall target reliability of 98% overall.

6.6 Cliff Tipler in his supplementary evidence of the 14 April 2008, considered how the interaction of surface water takes, storage volumes and reliability were affected by the Synlait and Ngäi Tahu Property water takes. The worst-case scenario reduced design reliability from 98.7% to 97.6%.

6.7 Significantly, the evidence of the Applicant examines the impact on reliability, limited solely to combinations of water takes and storage options. CPW does not appear to have factored in any additional reliability that can be achieved from the strategic utilisation of the 30,000 hectares of groundwater consents within the Command Area and held by CPWL shareholders.

6.8 The worst-case design reliability of 97.6% is therefore understated because under the assumptions of the Applicant, 25% of the area irrigated (or 15,000 ha) will still have access to groundwater supplies.

6.9 Alternatively, if the groundwater consent holders do not convert to the scheme, then the total irrigation demand will be less than 60,000 hectares and this also increases reliability.

**Waimakariri River – Reliability**

6.10 Ngäi Tahu Property does not have access to water modelling undertaker by Cliff Tipler to enable an assessment of what 98% reliability means for the CPW Scheme. As a substitute, we commissioned Pattle Delamore Partners Ltd to model the reliability of surface water takes from the Waimakariri River under the following scenarios:

| | |
|---|---|
| **WIL – "A"** | "A" permit water of Waimakariri Irrigation Limited (10.5 cumecs for 18,000 ha @ 0.0583 l/s/ha) |
| **NTP (3.96)** | Consent CRC052033 for 3.96 cumecs comprising "A" permit water of 2.72 cumecs and "B" permit water of 1.24 cumecs (3.96 cumecs for 5,650 ha @ 0.7 l/s/ha) |
| **B1 (5.0)** | A "B1" block of 5.0 cumecs commencing at a minimum flow of 63 cumecs (7,100 ha @ 0.7 l/s/ha) |

6.11 The modelling involves the daily assessment of moisture deficits (over 38 years of data) and irrigation stop and start assumptions consistent with the general assumptions adopted in John Bright's evidence. The Waimakariri Irrigation Limited ("WIL") water take serves as a benchmark. This takes away some of the modelling risks associated with applying various assumptions and assists in interpretation. The modelling also relies on the "unmodified" river flow dataset prepared by Richard de Joux for Fish and Game, because this is the basis of the allocation rules specified in the WRRP.

6.12 The average reliability of these three run-of-river takes is as follows:

**Reliability as a % of Water Demand (38 years daily data)**

| Reliability | Oct | Nov | Dec | Jan | Feb | Mar | Apr | Mean |
|---|---|---|---|---|---|---|---|---|
| **Dryland** | na | na | na | na | na | na | na | **na** |
| **WIL – "A"** | 100% | 100% | 99% | 99% | 86% | 83% | 92% | **94%** |
| **NTP (3.96)** | **97%** | 84% | **88%** | 80% | **74%** | 77% | 90% | **84%** |
| **B1 (5.0)** | 96% | 82% | 86% | 70% | 62% | 70% | 86% | **79%** |

Note:

- reliability is expressed as a percent of daily volumetric water availability divided by water demand;

- The WIL take has the highest reliability at 94% because it comprises solely "A" permit water;
- The reliability of the Ngāi Tahu Property take is 97% in October, 88% in December, 74% in February and 84% overall.

I will use October, December and February as reference points to examine the likely impact of 97%, 88% and 74% reliability on water uses.

6.13 Examining mean results (based on 38 years of daily data) is meaningless when attempting to consider risk, dry matter production, viability and efficient use. The modelling of crop yield responses to changes in soil moisture is the preferred approach. In the absence of this, one can examine soil moisture content as a percentage of Plant Available Water ("**PAW**") and the number of days in a month that water demand is in severe deficit. This information is (firstly) provided as monthly averages as follows:

**Available Water as a % of PAW (38 years daily data)**

| PAW Reliability... | Oct 97%R | Nov | Dec 88%R | Jan | Feb 74%R | Mar | Apr | Mean |
|---|---|---|---|---|---|---|---|---|
| **Dryland** | 62% | 26% | 20% | 17% | 18% | 26% | 39% | **30%** |
| **WIL – "A"** | 73% | 62% | 55% | 52% | 51% | 57% | 71% | **60%** |
| **NTP (3.96)** | 75% | 72% | 71% | 66% | 60% | 61% | 73% | **68%** |
| **B1 (5.0)** | 75% | 71% | 69% | 59% | 50% | 53% | 69% | **64%** |

Note in relation to Ngāi Tahu Property (3.96):

- Water reliability in October of 97% is sufficient to maintain soil moisture at 75% of PAW;
- Water reliability in December of 88% is sufficient to maintain soil moisture at 71% of PAW;
- Water reliability in February of 74% is sufficient to maintain soil moisture at 60% of PAW;
- The Ngāi Tahu Property has a lower overall water reliability than the WIL "A" permit water but is able to achieve higher soil moisture levels because the rate of application at 0.7l/s/ha is higher than the WIL consent at 0.583l/s/ha;

6.14 As a generalisation:

a. Plant growth is likely to be optimised when the soil moisture is in excess of 75% of PAW;

b. Plant growth is likely to be compromised when the soil moisture is below 50% of PAW; (50% of PAW is often used to trigger the start of irrigation)

c. Plant growth is significantly compromised and stressed when the soil moisture is below 25% of PAW (plants really need watering);

d. Permanent wilting point and plant mortality technically occurs when the soil moisture is 0% of PAW (but 0% is extremely rare in practice).

6.15 Examining mean annual results is still however meaningless. The following tables consider the annual and monthly variability of soil moisture resulting from irrigation under the Ngäi Tahu Property consent CRC052033 ("Ngāi Tahu Property (3.96") as follows:

**Ngāi Tahu Property (3.96):**

**Monthly Soil Moisture Balance as a % of Plant Available Water**

| Year | Oct 97%R | Nov | Dec 88%R | Jan | Feb 74%R | Mar | Apr | Mean |
|---|---|---|---|---|---|---|---|---|
| 1967 | 71% | 73% | 79% | 58% | 75% | 70% | 90% | 74% |
| 1968 | 70% | 66% | 68% | 44% | 30% | 35% | 55% | 53% |
| 1969 | 76% | 61% | 76% | 75% | 38% | 64% | 47% | 63% |
| 1970 | 77% | 69% | 65% | 50% | 4% | 5% | 10% | 40% |
| 1971 | 81% | 67% | 71% | 54% | 43% | 38% | 88% | 63% |
| 1972 | 79% | 82% | 76% | 69% | 9% | 7% | 25% | 50% |
| 1973 | 72% | 67% | 67% | 61% | 70% | 76% | 91% | 72% |
| 1974 | 77% | 74% | 65% | 79% | 69% | 77% | 86% | 75% |
| 1975 | 79% | 73% | 75% | 71% | 73% | 75% | 81% | 75% |
| 1976 | 81% | 73% | 81% | 65% | 75% | 78% | 82% | 76% |
| 1977 | 71% | 63% | 67% | 63% | 27% | 12% | 80% | 55% |
| 1978 | 77% | 66% | 78% | 77% | 78% | 81% | 71% | 75% |
| 1979 | 84% | 73% | 79% | 72% | 74% | 79% | 84% | 78% |
| 1980 | 70% | 71% | 75% | 70% | 84% | 74% | 79% | 75% |
| 1981 | 74% | 77% | 76% | 84% | 52% | 70% | 82% | 74% |
| 1982 | 76% | 68% | 74% | 68% | 66% | 38% | 94% | 69% |
| 1983 | 73% | 74% | 76% | 75% | 77% | 84% | 79% | 77% |
| 1984 | 79% | 77% | 65% | 82% | 62% | 26% | 16% | 58% |
| 1985 | 76% | 80% | 72% | 75% | 71% | 80% | 74% | 76% |
| 1986 | 83% | 78% | 73% | 53% | 84% | 79% | 75% | 75% |
| 1987 | 74% | 73% | 75% | 63% | 69% | 73% | 73% | 71% |
| 1988 | 75% | 75% | 74% | 65% | 63% | 79% | 77% | 73% |
| 1989 | 88% | 75% | 58% | 79% | 65% | 62% | 70% | 71% |
| 1990 | 72% | 75% | 55% | 79% | 77% | 50% | 94% | 72% |
| 1991 | 71% | 81% | 69% | 44% | 30% | 34% | 63% | 56% |
| 1992 | 86% | 67% | 71% | 61% | 76% | 71% | 93% | 75% |
| 1993 | 73% | 74% | 73% | 67% | 73% | 69% | 75% | 72% |
| 1994 | 69% | 67% | 62% | 68% | 63% | 71% | 82% | 69% |
| 1995 | 71% | 72% | 65% | 67% | 70% | 77% | 88% | 73% |
| 1996 | 72% | 66% | 73% | 72% | 64% | 81% | 83% | 73% |
| 1997 | 74% | 58% | 74% | 56% | 56% | 80% | 80% | 68% |
| 1998 | 72% | 74% | 73% | 56% | 25% | 86% | 81% | 67% |
| 1999 | 77% | 82% | 67% | 67% | 71% | 72% | 86% | 75% |
| 2000 | 74% | 70% | 53% | 70% | 23% | 2% | 28% | 46% |
| 2001 | 73% | 69% | 68% | 75% | 71% | 52% | 84% | 70% |
| 2002 | 69% | 82% | 69% | 70% | 79% | 43% | 91% | 72% |
| 2003 | 70% | 76% | 71% | 60% | 72% | 80% | 73% | 72% |
| 2004 | 77% | 64% | 82% | 72% | 69% | 77% | 69% | 73% |
| 2005 | 68% | 37% | 54% | 61% | 60% | 50% | 62% | 56% |
| 2006 | 78% | 66% | 80% | 70% | 74% | N/A | N/A | 74% |

Note: Shaded cells reflect soil moisture less than 30% of PAW

**Ngāi Tahu Property (3.96):**

**Number of Days Plant Available Water is below 25%**

| Year | Oct 97%R | Nov | Dec 88%R | Jan | Feb 74%R | Mar | Apr | Total |
|---|---|---|---|---|---|---|---|---|
| 1967 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1968 | 0 | 0 | 0 | 0 | 14 | 3 | 3 | 20 |
| 1969 | 0 | 0 | 0 | 0 | 8 | 8 | 0 | 16 |
| 1970 | 0 | 0 | 0 | 6 | 28 | 31 | 30 | 95 |
| 1971 | 0 | 0 | 0 | 5 | 10 | 10 | 0 | 25 |
| 1972 | 0 | 0 | 0 | 0 | 24 | 31 | 18 | 73 |
| 1973 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1974 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1975 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1976 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1977 | 0 | 0 | 0 | 1 | 17 | 26 | 0 | 44 |
| 1978 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1979 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1980 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1981 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1982 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 6 |
| 1983 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1984 | 0 | 0 | 0 | 0 | 0 | 18 | 23 | 41 |
| 1985 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1986 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1987 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 |
| 1990 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 5 |
| 1991 | 0 | 0 | 0 | 1 | 7 | 13 | 0 | 21 |
| 1992 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 0 | 0 | 0 | 0 | 18 | 0 | 0 | 18 |
| 1999 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 2 |
| 2000 | 0 | 0 | 0 | 0 | 16 | 31 | 10 | 57 |
| 2001 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 6 |
| 2003 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 12 | 0 | 1 | 0 | 0 | 3 | 17 |
| 2006 | 0 | 0 | 0 | 0 | 0 | N/A | N/A | 0 |

Note: Shaded cells reflect soil moisture less than 25% of PAW for more than 10 days in any month.

6.16 I interpret the 38 years of daily data as follows:

a. In October, the average reliability is 97%. Soil moisture averaged 75% of PAW (Low=68%, High =88%). There was one occurrence where the soil moisture dropped below 25% of PAW for more than a 10 day period; (ie, water is surplus to requirements)

b. In December, the average reliability is 88%. Soil moisture averaged 71% of PAW (Low=53%, High=82%). There were no occurrences where the average soil moisture dropped below 25% of PAW for more than a 10 day period; (i.e. water is still sufficient / efficient use)

c. In February, the average reliability is 74%. Soil moisture averaged 60% of PAW (Low=4%, High=84%). There were seven occurrences where the average soil moisture dropped below 25% of PAW for more than a 10 day period; There was one occurrence where the average soil moisture dropped below 25% of PAW for more than a 20 day period; (i.e. water is in deficit)

d. Minimal on-farm storage would assist in the intensification of farming systems;

- No storage is required or justifiable in October through to January (80% to 97% reliability);
- 10 to 15 days of storage would reduce most of the risk in February (74% Reliability) and mitigate some of the concurrent risk in March;
- Without storage, 74% reliability in February is sufficient to maintain soil moisture above 60% of PAW in 8 years out of 10;
- A total of 15 days of storage should be adequate to lift overall reliability from 84% to 86%.

e. In the absence of on-farm storage, it would be prudent to adopt conservative farming practices consistent with those adopted within the Waimakariri Irrigation Limited scheme.

6.17 The above information gives some insights to Cliff Tipler's worst-case scenario where the CPW reliability is reduced from 98.7% to 97.6% overall. Reliability under a storage scheme is likely to be 100% during October through to January with restrictions applying from February onwards:

a. A reliability of 98% is equivalent to 100% for 4 months and then irrigating at 95.3% intensity for 3 months;

b. A reliability of 96% is equivalent to 100% for 4 months and then irrigating at 91% intensity for 3 months;

6.18 The reliability of the CPW Scheme would need to drop below 95% overall before any measurable farm impact would likely occur (if any).

6.19 In determining when enough water is enough, "typically, farming groups now expect irrigation supplies to have reliabilities in excess of 90% and closer to 95-97.5% if possible" (Evidence of Cliff Tipler, in relation submission on CRC052033).

6.20 It is submitted that a farmers expectation for high reliability does not equate to efficiency in allocative usage but rather a desire to intensify landuse and profit margins while taking environmental variability and risk out of the equation.

**Research on dry matter production responses to various irrigation regimes**

6.21 Included in the Appendices of this evidence are three research papers that examine the impact of irrigation intensity and variability on dry matter production and water use efficiency over dryland farming. While "intensity and variability" is different than "reliability", the research indicates how short-term water reliability issues may impact on dry matter production and how farmers should manage this variability (to maintain economic viability).

6.22 The research clearly illustrates that higher rates of water application and low return periods produce more dry matter production than lower rates of application and less frequent return periods. For instance:

a. B.S Thorrold et al illustrates that a 20% range in irrigation intensity (523mm/yr to 411mm/yr) results in a 7% range in dry matter production;

b. V.O. Snow et al illustrates that a 7-day irrigation schedule improves dry matter production by around 13% over a 21-day irrigation schedule;

6.23 The results are less conclusive when examining water use efficiency expressed as either "tonnes of dry matter production per ha" divided by "Million Litres per hectare" or cost (dollars per tonne of dry matter).

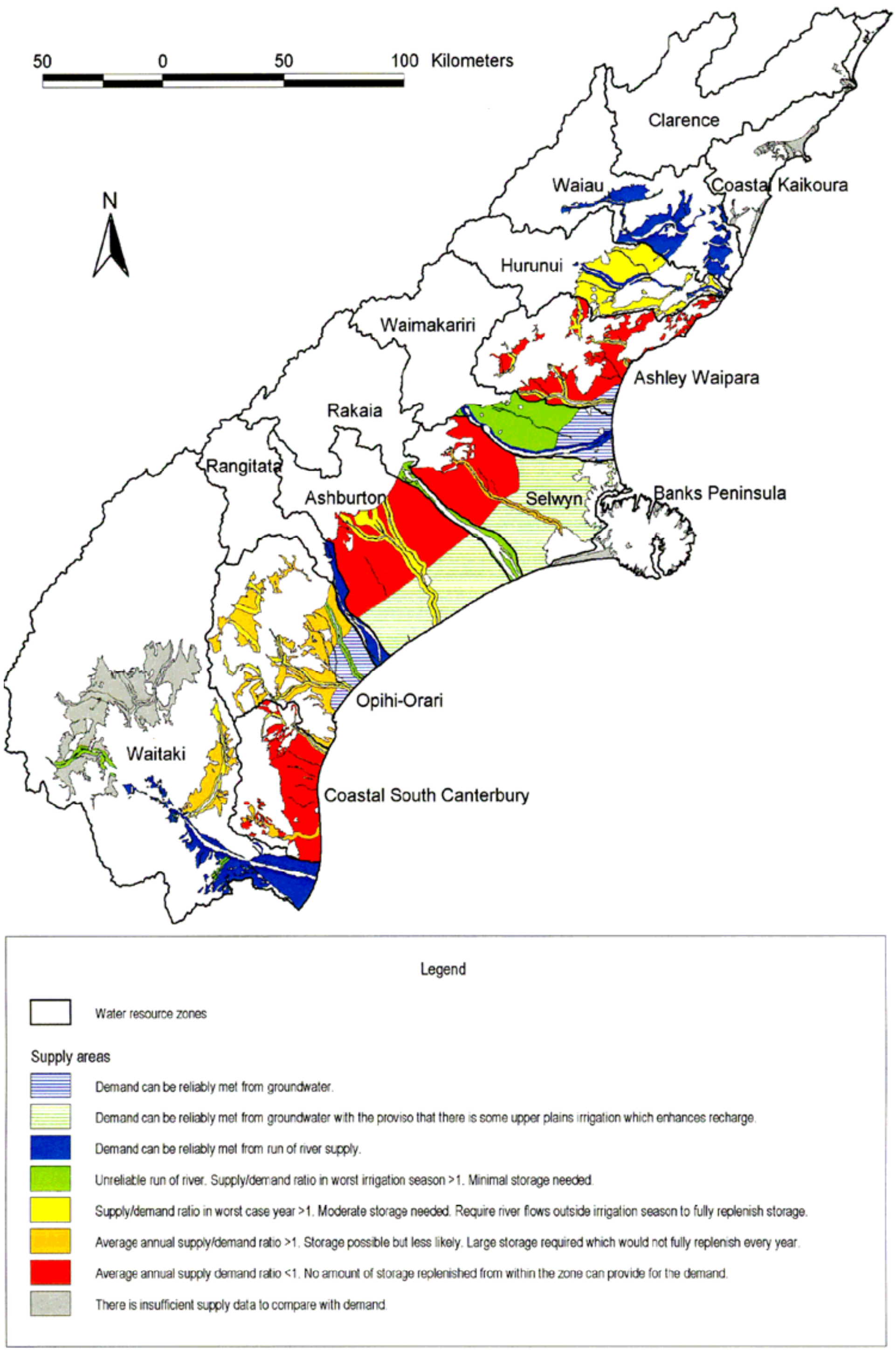
6.24 Clearly, marginal returns and water use efficiency decline as irrigation intensity, frequency and reliability increase.

6.25 Importantly the research illustrates the significant improvement in productivity that can be made when moving from dryland to irrigated farming. Thereafter however, "knowledge" of the reliability of water supply (whether that be 90%, 95% or 98%) and the adoption of appropriate farming systems to suit, is likely to be more important than the reliability itself in managing variability in dry matter production.

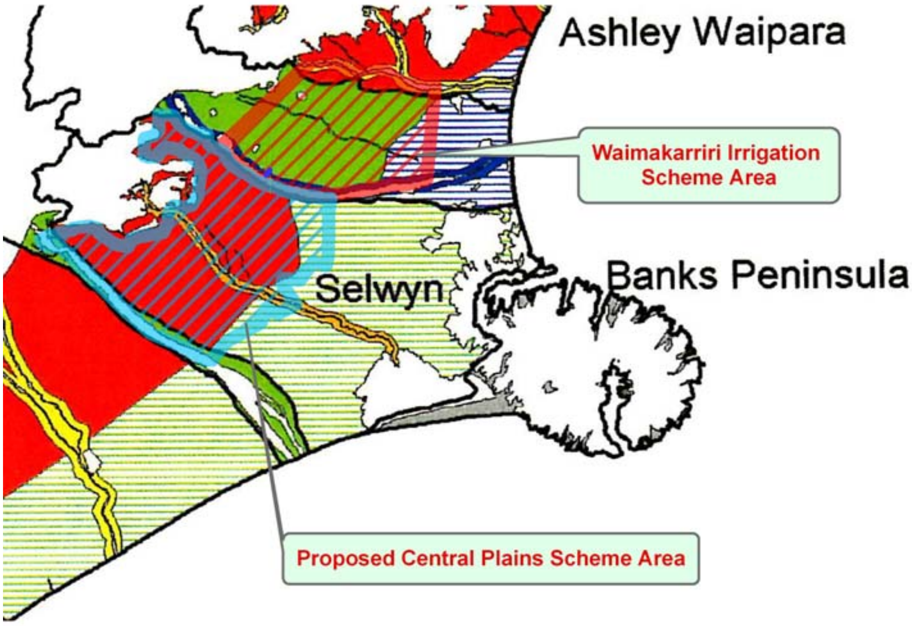
## 7. WATER ALLOCATION IN CANTERBURY

### Canterbury Strategic Water Study (CSWS)

7.1 The Canterbury Strategic Water Study and the evidence provided by John Bright provides valuable insights into water allocation strategies that could be applied to satisfy the water needs of the Selwyn, Ashburton and Waimakariri / Ashley catchments. Figure 7 of the evidence of John Bright is presented below:



7.2 I have superimposed the irrigation command areas of CPW and Waimakariri Irrigation Limited over the map produced by the Canterbury Strategic Water Study as follows:




**Sources of water and efficient allocation**

7.3 In attempting to identify a plan that addresses all irrigation interests in water, I note:

a. the "*environment*" applicable to the CPW application includes the soil and water resources of the Selwyn, Ashburton and Waimakariri / Ashley catchments.

b. Within the CPW command area (85,000 effective farmed hectares):

- The CSWS suggests that approximately 20% of the lower CPWT scheme area (or around 17,000 ha) can be irrigated reliably from groundwater and that the balance of the upper CPWT scheme area (or 68,000 ha) will require out of catchment water transfers (from the Waimakariri and Rakaia catchments);
- The Applicant suggests that there is 30,000 hectares within the CPWT scheme that is currently irrigated from groundwater suggesting that either some of this irrigation is unreliable or the CSWS is conservative;

- the Applicant considers that the Waianiwaniwa storage option is the best large-scale storage option to augment run-of-river takes;

c. Within the Waimakariri Irrigation Limited (**WIL**) command area (40,000 ha):

- Approximately 20% of the lower command area (8,000 ha) can be irrigated reliably from groundwater;
- Approximately 80% of the upper command area (32,000 ha) must rely on unreliable run-of-river irrigation that should be supplemented with on-farm storage. Of this area, about 18,000 ha is currently supplied with “A” permit water from the WIL;
- The evidence of John Bright dismisses Lees Valley as a viable storage option for the Waimakariri / Ashley catchment alone;
- Additional irrigation demand is assumed to be 8,000 ha[4;]
- The majority of the additional demand of 8,000 hectares is in the upper command area and/or beside the Waimakariri River. The groundwater resource in this zone is barely sufficient to satisfy stock water purposes let alone irrigation and/or is considered hydraulically connected to the Waimakariri River;

7.4 Examination of the CSWS information suggests that different locations have different sources of potential residual water supply as follows:

| Potential water supply and storage options (residual) | Upper Selwyn Catchment | Lower Selwyn Catchment | Upper Waimak Catchment | Lower Waimak Catchment |
|---|---|---|---|---|
| Waimakariri: run-of-river | low reliability | low reliability | low reliability | low reliability |
| Rakaia: run-of-river | low reliability | low reliability | No | No |
| Combined Waimakariri and Rakaia takes | med reliability | med reliability | No | No |
| Groundwater (existing consents) | med to high reliability | high reliability | No | High reliability |
| Large-scale storage (3,000 to 4,000m3/ha) | Yes | Yes | No | No |
| On-farm storage (500m3 to 850m3/ha) | Yes | Yes | Yes | Yes |

7.5 An efficient allocation plan that addresses all agricultural interests in the water resources within the Selwyn, Ashburton and Waimakariri / Ashley catchments would attempt to match regional demand with the most efficient source of supply as follows:

a. **Upper Selwyn Catchment**

Satisfy irrigation demand of 45,000 hectares with Rakaia and Waimakariri River run-of-river takes together with large-scale storage to achieve 96% reliability.
Supplement existing groundwater takes of 30,000 hectares with minimal large-scale storage (say 1,000$m^3$/ha) if necessary. (5,000 CPWT hectares)

b. **Lower Selwyn Catchment**

Satisfy demand from groundwater supplemented with upper catchment sources if necessary.

c. **Upper Waimakariri Plains Catchment**

Satisfy additional demand of 8,000 hectares with Waimakariri run-of-river takes comprising "A" permits (with a provision to allow on-farm storage) and a first priority "B" class band of 5 cumecs (with an obligation to provide on-farm storage of at least 750m3 per irrigated hectare).

d. **Lower Waimakariri Plains Catchment**

Satisfy demand from groundwater supplemented with upper catchment sources if necessary.

7.6 It might be argued that it doesn't matter where the initial allocation is made, economic forces will reallocate resources to achieve market efficiency. Markets are however never efficient and the cost of transferring water is high due to the nature of water infrastructure. If excess surface water is allocated to the Selwyn catchment, and this displaces current or future groundwater consents, then that groundwater resource will be lost. It cannot be transferred to the Waimakariri/Ashley catchment because it is in a different groundwater allocation zone.

7.7 Given the options available, it should be reasonably clear that the irrigation demands of the Canterbury community (including various unresolved consents) can be satisfied provided the resources are allocated efficiently having regard for the limited nature of the resources available.

7.8 This approach is consistent with Rule 5.1 of the WRRP. The taking of water applied by CPW from the Waimakariri River as a discretionary activity, with discretion limited to …

> *a) the reasonable need for the quantities of water sought, and the ability of the applicant to abstract and apply those quantities…and*
>
> *b) the availability and practicality of using alternative supplies of water including alternative public or community reticulated supplies.*

7.9 In respect of this discretion:

a. A reliability of 98% is neither reasonable nor efficient;

b. The Applicant is unlikely to be able to apply 60,000 hectares of irrigation within the command area;

c. The Applicant has provided evidence that it does not need to secure the water held by the Ngäi Tahu Property of the Synlait consents to achieve its objectives;

d. It is difficult to justify the replacement of efficient groundwater takes with surface water takes;

**Efficiency – Questions and Answers**

7.10 The application raises several questions concerning efficiency.

a. What is the marginal return of increasing surface water takes to increase water reliability from 96% to 98%?

Answer: The return on investment is likely to be extremely low to negative and is unlikely to exceed the cost of capital. As a consequence, it reduces the viability of the CPWT scheme overall. Efficiency is not proven.

b. What is the marginal return of converting 30,000 hectares of efficient groundwater supply to surface water supply?

Answer: Given the connection cost to the scheme of $6,828/ha, the return on investment is only 3.6% ($61,000/$1.7m) (Brown, para 42). Therefore the benefit does not exceed the cost of capital. It is neither an efficient nor environmentally supportable use of surface water resources.

c. Is it efficient to convert 60,000 hectares of dryland farms to the CPWT scheme?

Answer: There is insufficient information to conclude that there is 60,000 hectares of dryland farms in the command area. The CPWT scheme needs to be scaled back. Efficiency is not proven.

d. If 15,000 hectares of groundwater supply is converted to the CPWT scheme (at a loss), then what is the additional marginal return of retaining the groundwater consents to reduce storage volumes and improve overall reliability?

Answer: Low cost, low water volume usage, good return, low opportunity cost.

e. Does the conversion of 15,000 hectares of groundwater to surface water irrigation within the CPWT command area prevent the conversion of a similar area of dryland to irrigated farmland conversion elsewhere in the community?

Answer: Yes, because the groundwater consents are not transferable outside of the Selwyn Catchment (or a different acquifer) whereas surface water is.

f. If the average reliability capable of supply is 98%, will there be competition among the 60,000 hectares of shareholders for this limited supply?

Answer: No, all demand can be satisfied.

g. Is it efficient to allocate all of the remaining water resources to CPWT (in excess of demonstrated demand?

Answer: No. When water is allocated in excess of reasonable demand and a surplus arises that cannot be employed, a valid opportunity cost outside the command area arises that should be factored into the cost/benefit analysis of the project concerned. Efficiency is not proven.

h. Should the consent conditions allow CPW to sell surplus run-of-river water (whether stored or otherwise) outside of the command area?

Answer: No. This is an undesirable outcome that needs to be prevented. Water in excess of the reasonable needs of the applicant should be left in the river and not privatised. It should be freely available to other consent holders.

## 8. NGÄI TAHU PROPERTY - CONSENT CRC052033

8.1 The Commissioners have asked various questions of the submitting Economists concerning economic efficiency, allocative efficiency, productive efficiency and the NZ Emissions Trading Scheme. The following information is provided to shed light on these issues as they relate to the Ngāi Tahu Property consent CRC052033.

8.2 Ngäi Tahu Property has commenced the conversion of Eyrewell property of 6,764 hectares on the north bank of the Waimakariri River.

Photo: 2004/2005

8.3 At the present time, 1,910 hectares is no longer in trees and the first 630 hectares is planned to come into irrigated production in the 2009/2010 irrigation season.

**Economic Efficiency**

8.4 To aid in interpretation of the economic efficiency of this investment, I have modified our budgets by utilising the same Fonterra share price and payout adopted by Andrew MacFarlane in his evidence. This enables the benchmarking of the Ngäi Tahu project as follows:

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Variables and Outputs | Dryland Stock Farming | Dairy Farming Pre CPW | Dairy Farming Post CPW | NTP Dairy Farm |
| **Variables** | | | | |
| Payout | na | $5.50 / kgMS | $5.50 / kgMS | $5.50 / kgMS |
| Fonterra Share Price | | $6.79 / kgMS | $6.79 / kgMS | $6.79 / kgMS |
| Cows / Hectare | na | 3.5 | 3.75 | 3.7 |
| KgMS / Cow | na | 380 | 430 | 378 |
| KgMS / Hectare | na | 1330 | 1613 | 1399 |
| Cash Farm Working Expenses $/ha | na | $4,901 /ha | $4,711 /ha | $4,588 /ha |
| Cash Farm Working Expenses $/kgMS | na | $3.68 / kgMS | $2.92 / kgMS | $3.28 / kgMS |
| EBIT / hectare | $127 /ha | $2,645 /ha | $4,413 /ha | $3,106 /ha |
| Capital (Excluding Land) | $1,289 /ha | $25,228 /ha | $33,764 /ha | $32,767 /ha |
| EBIT / Capital (Excluding Land) | 9.9% | 10.5% | 13.1% | 9.5% |
| EBIT / Capital (Including Land at Market) | 0.8% | 6.6% | 9.0% | 9.2% |
| EBIT of a 250 hectare farm | $31,750 | $661,250 | $1,103,250 | $776,500 |

Note:

- Columns 1 to 3 are taken from evidence of Andrew Macfarlane;
- Column 4 relates to the dairy farm development being undertaken by Ngäi Tahu Property;
- Column 3 may achieve a higher return by taking on more risk;
- I have not included “Return on Marginal Capital” estimates as this is a simplistic measure that cannot be relied upon in the making of investment decisions. It ignores the time value of money, the actual costs to convert and changes in capital value. The economist’s have not placed reliance on this measure.

- The sustainable yield of 1,399 kgMS/ha (in Column 4) is achieved six years after conversion and is reflective of the performance of surrounding dairy farms operating on the Waimakariri Irrigation Limited scheme.

8.5 The total capital cost of converting cutover forest to a dairy farm including land conversion, grassing, farm development, on and off farm water races, individual on-farm storage of $750m^3$/ha, housing, dairy sheds etc, Fonterra shares, stock and overheads equals $32,767/ha. This excludes deforestation liabilities and is comparable with the $33,764/ha used by Andrew MacFarlane in Column 3.

8.6 While I appreciate that a sustainable yield of 1,613 kgMS/ha (in Column 3) is achievable under efficient management and supplementary feed, there is no rational justification to attribute improvements in management efficiency with the CPW Scheme. Improvements in management efficiency can be achieved simply by investing in education and by focusing on human resource management.

**Kyoto Protocol and the NZ Emissions Trading Scheme**

8.7 The NZ Emission Trading Scheme (**ETS**) legislation is presently before the Select Committee. The ETS regulations for the forest sector will come into force retrospectively from 1 January 2008. The agricultural sector regulations (that are yet to be finalised) will come into force from 1 January 2013.

8.8 Ngäi Tahu has given particular consideration as to whether or not the conversion of Eyrewell from an uneconomic forestry use to irrigated dairy and dairy support usage satisfies a national benefit test. This requires an appreciation of the costs New Zealand taxpayers could incur from deforestation and farm emission liabilities under the Kyoto Protocol as opposed to the emission liabilities imposed on individual participants under the NZ ETS.

8.9 The deforestation obligations that could be imposed on the New Zealand taxpayer by the Kyoto Protocol obligations and the obligations imposed on Ngäi Tahu under the NZ ETS are set out below:

| **Years after Harvest (or Age of Trees)** | **Kyoto Protocol Emissions** | **NZ ETS Emissions (Canterbury)** |
|---|---|---|
| 0 | 493 | 493 |
| 1 | 493 | 493 |
| 2 | 493 | 493 |
| 3 | 5 | 493 |
| 4 | **10** | **493** |
| 5 | 30 | 493 |
| 6 | 62 | 493 |
| 7 | 97 | 493 |
| 8 | 133 | 493 |
| 9 | 159 | **159** |
| 10 | 174 | 174 |
| 11 | 182 | 182 |
| 12 | 187 | 187 |
| … | … | … |
| 23 | 388 | 388 |
| 24 | 415 | 415 |
| 25 | 441 | 441 |
| 26 | 467 | 467 |
| 27 | 493 | 493 |

8.10 By way of example, if Ngäi Tahu deforests 9 years after harvest, then the deforestation liability equals 159 tonnes $CO_2$ per hectare (or $3,975/ha at $25/t). If Ngäi Tahu deforests 4 years after harvest, the cost to New Zealand could be as low as ~$250/ha whereas the cost to Ngäi Tahu will be $12,325/ha. The optimum age for conversion under the NZ ETS is either a 9 year old stand or 9 years after harvest.

8.11 Estimating the costs and returns of Dairy Farming after the introduction of the Kyoto Protocol (2008) and the NZ ETS (2013) is more problematic. At the present time I have applied the standard $CO_2$ emission rates for heifers and cows (1.7 and 2.5 t $CO_2$/yr reduced by nitrification inhibitors) at $25/t$CO_2$ plus a 2.0% real increase in all farm costs. This reduces dairy farming returns (EBIT) by 8% to 18% depending on productivity.

8.12 The economic return on investment to the nation of investing in dairy farming verses forestry at Eyrewell (inclusive of all costs including land conversion) is estimated to be 18.8% prior to any Kyoto Protocol obligations. This return drops to around 17.6% during the first commitment period (2008-2012) and is expected to drop again in the second commitment period (after 2013) to 16.4%. This is because the assumed introduction of "forest offsetting" is more expensive than what the current Kyoto Protocol provisions allow for. The returns are high because forestry on the Canterbury Plains is an uneconomic landuse and inefficient landuse.

8.13 The return on investment to a landowner of converting forested land to irrigated dairy farms at Eyrewell is estimated to be 18.8% prior to the introduction of the NZ ETS. The return on investment drops to around 14.5% during the first commitment period (2008-2012) and is expected to increase to 16.8% during the second commitment period (after 2013). This is because I have assumed that deforestation liabilities will be replaced by cheaper "forest offsetting" requirement. While a reduction in the rate of return from 18.8% to 14.5% may not seem significant, in Net Present Value terms the loss in property value is in excess of 60%.

8.14 A summary table of returns is as follows:

| **Return on investment** (from Forestry to Dairy) | **Kyoto Protocol** | **NZ ETS** |
|---|---|---|
| **Pre 2008** (Before KP or NZ ETS) | 18.8% | 18.8% |
| **2008-2012** | 17.6% | 14.5% |
| **2013 onwards** (includes offsetting costs) | 16.4% | 16.6% |

8.15 After 2013, the cost of deforestation under the Kyoto Protocol and the NZ ETS is expected to be the same. The difference between the higher returns of dairy farming under the NZ ETS (16.6%) as opposed to the Kyoto Protocol (16.4%) is a cost incurred by the NZ taxpayer. This is because the NZ ETS shelters the agriculture sector from the full impact of the Kyoto Protocol.

8.16 The difference in Net Present Value of an operating dairy farm in 2008 under the Kyoto Protocol rules as opposed to the NZ ETS rules is about $1,800 per hectare. This is a direct cost incurred by the NZ taxpayer.

8.17 In summary, the deforestation liability is a direct cost incurred by the landowner as opposed to the taxpayer. The NZ ETS will delay the conversion of Eyrewell and will reduce the return on investment but it remains an efficient use of soil and water resources. The conversion of the land continues to satisfy a national benefit test because forestry on the Canterbury Plains remains uneconomic. The lift in economic return is more efficient than converting dryland farming to irrigated pasture and significantly more efficient than converting efficient groundwater takes to surface water takes.

**Economic Efficiency and natural resource allocation**

8.18 Ngäi Tahu Property is comfortable that the conversion of Eyrewell is a viable proposition and satisfies a national benefit test for the New Zealand economy as a whole. The total conversion of Eyrewell (excluding ETS costs) will require capital investment of around $210m. **The net national benefit exceeds $65m (net of Kyoto deforestation liabilities)**.

8.19 This proposal will not proceed if CPW is granted summer access to the “A” permit water ahead of the consents granted to Ngäi Tahu Property under CRC052033. The wording of this consent is set out in the Appendix to my evidence and is important to consider when drafting the CPW consent (if that occurs).

8.20 Economic efficiency is maximised when resource allocation attempts to maximise overall Net Present Value (**NPV**) having regard for environmental risk. In determining NPV, one needs to consider all of the soil and water resources available within the Canterbury region and the combination of projects that are possible. In considering risk, one needs to elimination projects that pose unacceptable risks either financially or environmentally. The net benefits of allocating public resources under the Resource Management Act 1991, should also (ideally) be spread widely across the community reliant on those resources.

## 9. WAIMAKARIRI RIVER REGIONAL PLAN

9.1 The purpose of this section is to consider how "all interests in water" can be accommodated within the WRRP and to determine the nature of consent conditions that maybe appropriate for the Central Plains Water Scheme.

### Blocks and water user rights

9.2 The WRRP contains an "A" allocation block of 22 cumecs commencing at a Minimum Flow above 41 cumecs and an open-ended "B" allocation block commencing at a flow above 63 cumecs.

9.3 I understand that the "A" Allocation block of 22 cumecs and 1.72 cumecs for the "B" allocation block has been consented (inclusive of CRC052033). The 1.72 cumecs is held by Ngäi Tahu Property (CRC052033: 1.24 cumecs) and P&E Limited (CRC054098: 0.48 cumecs). Note: Both consents held by Ngäi Tahu Property and P&E Limited will become unusable if CPWT is granted an "A" and "B" permit allocation for the same resource. Moreover the proposed development of Ngäi Tahu Property will not remain viable. P&E Limited on the other hand, are located on the south side of the Waimakariri River and are either shareholders of CPWL or have reached some agreement with CPWT concerning the ongoing supply of water (refer P&E decision of Dr Brent Cowie).

9.4 The "First Priority Band (B1) is a term used in both resource consent CRC052033 and CRC054098. It provides for the banding of the open-ended "B" allocation block (should that be considered desirable at a future date) to enable consent holders to better determine the level of reliability afforded by the consent and to undertake investment accordingly. At the present time, the First Priority Band equates to the open-ended "B" allocation block.

9.5 I have previously discussed the purpose of the "A" allocation block and the rights held by consent holders. I believe in principle, that permit holders within the "A" permit allocation block have a priority right to take "A" permit water within the flow limits of that block "*to achieve a reliability of supply of water that does not become a factor that limits the long-term economic viability of users that are dependant on that block of water*". This includes the right to exclude others if the inclusion of others would compromise this objective. This right to take water and to exclude others does not prevent a consent authority from granting subordinate water rights to other uses (that are not "A" permit holders) to take water that is allocated but unused (on any day) provided the subordinate rights do not derogate, now or in the future, the right and practical ability of "A" permit holders to take water (at their permitted rate of take over any period) as necessary to ensure that reliability of supply does not become a factor limiting their economic viability.

9.6 The rights of various permit holders are generally limited to the taking of water from a particular intake location, for a particular application area, over a defined period of time and for a particular land use. Some consent holders may therefore claim more or less rights and limitations than set out above.

9.7 Notwithstanding this qualification, the "A" allocation block may therefore only be fully allocated to the extent that: the peak rate of take (22 cumecs) is fully allocated; the <u>*dependent*</u> consent holders are identified; and the total irrigation area and locations are defined. Provided the adverse effects of allowing the "A" permit block to be used to service a greater irrigation area than originally anticipated (under the WRRP) has been assessed as acceptable, then there is a significant volume of water available for other users.

9.8 I believe the Regional Council has the obligation to manage the taking and use of water. Some people may argue that CPW need simply operate in a Water Users Group with "A" permit holders. In principle, the water rights of CPW should not be subject to the uncertain terms and conditions of a Water Users Group. A Water Users Group comprising the same class of water makes sense during times of water restrictions for that class of water. There are problems however if selected "A" and "B" permit holders are allowed to operate in a Water Users Group that excludes other "B" permit holders. It is more sensible to require all "B" permit holders to operate in a Water Users Group to utilise allocated but unused "A" permit water on any day.

9.9 The inclusion of "*at least one allocation block*" (PNRRP) does not preclude the creation of additional blocks that permit holders can be "dependant on" in terms of certainly of reliability and the right to exclude others.

9.10 As discussed above, there is demand for a "B1" allocation block of at least 5 cumecs supplemented with on-farm storage. There is justification for the Commissioners to leave space to allow such a block to be created.

9.11 A demand side assessment of the river takes from the Waimakariri River would suggest an allocation regime as follows:

| | Purpose | Minimum Flow (cumecs) | Allocation Limit (cumecs) | Volumetric Limit |
|---|---|---|---|---|
| A Block | Run-of-river + plains/on-farm storage | 41 | 22 | na |
| B1 Block or Gap | Run-of-river + plains/on-farm storage | 63 | 5 | na |
| B2 Block | Run-of-river + large scale storage | 75 | na | na |

Where:

a. Minimum flow equals the unmodified flow (as discussed below);

b. The "A" allocation block of 22 cumecs includes the Ngäi Tahu Property consent CRC052033 of 2.74 cumecs;

c. The "Gap" or "B1" block is left unallocated to either: satisfy unmet demand; or to provide for future needs; or to provide a gap for environmental flow purposes; or to allow a duffer for flow measurement deficiencies; and/or to avoid actual adverse effects on existing consent holders;

d. It is presently estimated there is unmet demand for unreliable run-of-river supplemented with on-farm storage ("B1") of 3.2 cumecs comprising:

- Ngāi Tahu Property consent CRC052033: 1.24 cumecs;
- P&E Limited consent CRC054098: 0.48 cumecs;
- WIL waiting list of 1,500 ha: 1.05 cumecs;
- Short term water transfers of 500 ha: 0.35 cumecs; plus
- hydraulically connected farms on either side of Waimakariri River;

e. The CPWT take would commence at a minimum flow of 75 cumecs plus access to all unused "A" and "B1" allocations subject to non-derogation of consent rights;

f. The commencement of a "B2" block occupied solely by CPWT at a minimum flow of 75 cumecs has the impact of creating a gap between existing consent holders and CPWT. This serves several purposes:

- It creates an environmental flow gap between CPWT and other users of around 7 cumecs such that some of the flat-lining of the river at 41 cumecs will be lifted to 48 cumecs; and
- It provides a buffer for flow measurement errors;
- It ensures that "B1" users have a known level of reliability that can reasonably be supplemented with on-farm storage to maintain the efficient use and economic viability of their consents;

9.12 CPW should not be granted consent for the amount of water it has applied for, as it is neither efficient nor necessary for it to take that amount of water (and thereby to exercise what are in effect rights akin to property rights) to ensure a sufficient level of irrigation reliability.

9.13 I suggest that if CPW is to be granted consent, then it should be along the following terms:

a. a consent to take "B" permit water as defined in the WRRP;
b. a right to take "B" permit water within the "Second Priority Band";
c. a right to take "B" permit water plus any other water authorised to be taken by an "A" or "B" permit that is not being exercised on that day;
d. the maximum rate of take will not exceed [25] cumecs from any source when the scheme is operated in the absence of the Waianiwaniwa storage facility;
e. the maximum rate of take will not exceed [40] cumecs from any source when the scheme is operated with the Waianiwaniwa storage facility;
f. the maximum area to be irrigated will not exceed [60,000] hectares and all areas irrigated must be within the command area;
g. Where the restrictions on taking "B" permit water within the "Second Priority Band" is defined as:

Whenever the unmodified flow in the Waimakariri River as estimate by the Canterbury Regional Council is:

- At or below 75,000 litres per second, no water shall be taken;
- Above 75,000 litres per second and at or below 115,000 litres per second, the maximum rate of abstraction of "B" permit water shall be calculated as u-75,000; where u equals the unmodified flow;
- At or above 115,000 litres per second, the maximum rate of "B" permit water may be taken.

h. The consent should not be exercised in a way that derogates the right of an "A" or "B" permit holder to take water and/or to apply for a resource consent and to be granted the right (or a variation of rights) to take water for storage to enable "A" and "B" permit holders to provide for their economic wellbeing.

9.14 In my view, it would be inappropriate to finalise water take consent conditions for such a large take without working through an iterative water modelling process that enables environmental considerations and flows to be optimised in conjunction with economic optimisation.

9.15 The Waianiwaniwa reservoir intake should ideally be as large as possible to enable the winter refilling of the storage reservoir and thus avoid large takes during the spring and early summer. Equally, it would be important to determine whether or not higher minimum flows can be accommodated during February and March by allowing summer recharge of the reservoir at high flows. Intake capacity of 40 cumecs may be more environmentally sound than 25 cumecs depending on how the monthly permitted takes are specified.

9.16 In this respect, Figure 21 of Cliff Tipler's first brief of evidence, illustrating annual flow duration curves should be extended to monthly analysis (and/or separate summer, autumn, winter and spring analysis) with the height of the graph limited to 150 cumecs to assist the Commissioners in making decisions.

9.17 In my view, consent conditions that inadvertently allow the CPW Scheme to proceed in the absence of storage would be a worst-case scenario. Certainly this effect on river hydrology has not been assessed.

9.18 The WRRP establishes a Minimum Flow regime for each “A” and “B” permit allocation based on the Unmodified Flow of the river. Environment Canterbury’s assessment of the Unmodified Flow is however not instantaneous and this creates a lag in determining the permitted takes for the following day. The addition of the CPWT take of 25 to 40 cumecs makes the adverse effects of this situation intolerable and will result in residual river flows being below the Minimum Flow on days when the natural flow is in decline (after a fresh).

9.19 In my view, Environment Canterbury must now establish an upper catchment measurement base for the Waimakariri River (Woodstock) and calibrate this site with the existing lower catchment site (old Waimakariri Bridge). All consented takes from the Waimakariri River should then be amended to reflect an unmodified upper catchment flow (Woodstock) which for all intensive purposes will equal the instantaneous measured flow. This can occur immediately and does not require a formal amendment to the WRRP as no effective change will have occurred to flow levels.

9.20 I believe that CPW will not be able to demonstrate that its proposed water take will not adversely affect river flows or the takes of existing consent holders without the river flows and all consented takes being assessed from an upper catchment measurement base.

**E Jansen**
**June 2008**

**APPENDIX AND REFERENCES**

CRC052033 – Ngäi Tahu Property consent to take and use water.

GN Ward, JL Jacobs and FR McKenzie; 2006; Using limited irrigation water – crops or pasture? *Proceedings of the New Zealand Grasslands Association 68: pgs 173-176.*

VO Snow, RF Zyskowski, RJ Martin, TL Knight, RN Gillespie, MU Riddle, TL Fraser and SM Thomas; 2007; Impact of irrigation variability on pasture production and beneficial water use. *Proceedings of the New Zealand Grasslands Association 69: pgs 59-64.*

BS Thorrold, KP Bright, CA Palmer and ME Wastney; 2004; Modelling the effects of irrigation reliability on pasture growth in a dairy system in Canterbury. *Proceedings of the New Zealand Grasslands Association 66: pgs 31-34.*