

**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 PHILIP GROVE

INTRODUCTION

1. My name is Philip Grove. I am currently employed by Canterbury Regional Council as a land resources scientist (ecologist). I have worked for ten years as an ecologist, including 6 years with the Canterbury Regional Council in Christchurch. I hold a Ph.D. in Botany from the University of Otago. I am a member of the New Zealand Ecological Society.
2. This report is prepared under the provisions of Section 42A of the Resource Management Act 1991 (RMA). This section allows a Council officer to provide a report to the decision-maker on a resource consent application made to the Council, and allows the decision-maker to consider the report at the hearing. Section 41(4) of the RMA allows the decision-maker to request and receive from any person who makes a report under Section 42A "*any information or advice that is relevant and reasonably necessary to determine the application*". This report will provide information and advice related to:
Effects of Works in the river bed on terrestrial ecology, related to the construction and use of intakes for the proposed Central Plains Water Enhancement Scheme.
Effects of water take and water use on terrestrial ecology and wetlands.
Effects of the Waianiwi storage dam on terrestrial ecology and wetlands.
Effects of bywash discharges on terrestrial ecology and wetlands.

Summary of key conclusions

3. The applicant's identification of terrestrial ecology and wetland values is not sufficient. It relies largely on published literature and existing databases, while only limited further field surveys and assessments have been carried out to supplement this information. Although some parts such as Lake Ellesmere are relatively well described, the applicant considered it not feasible to carry out a full ecological assessment of the affected area.
4. I appreciate the large area for which ecological assessment is necessary, but that is inherent in the nature and scale of the CPW scheme. More detail is required as to the exact location and size of areas of indigenous vegetation and habitats, the species present, and their ecological value. It is not possible to fully assess the effects of the CPW scheme on the terrestrial ecology of the affected area, as a comprehensive description of the environment is still absent.
5. Given the limitations in identification of ecological values, the assessment of effects and mitigation measures are also insufficient. The applicants' reliance on producing management plans at some time in the future give no certainty that mitigation will be adequate or effective.
6. The applicant does not appear to have given any commitment to undertake monitoring effects of the CPW scheme on terrestrial ecology and wetlands. This is despite admitting, for example, the difficulty in predicting effects of the scheme on wetland habitats around the Lake Ellesmere shoreline.
7. Uncertainties in the hydrological and water quality models and predictions used, and consequent uncertainties in ecological outcomes are acknowledged by the applicant. Therefore a comprehensive range of ecological monitoring programmes should be required as part of consent conditions.
8. These should include: monitoring effects of changes to flow regime on vegetation and wildlife in the Waimakariri and Rakaia River beds; monitoring effects of changes to groundwater levels on significant terrestrial and wetland vegetation and habitats within the affected area; monitoring effects of increased inflows and nutrient loadings on Lake Ellesmere shoreline wetland habitats; and monitoring effects of landuse intensification on indigenous habitats, vegetation and wildlife throughout the scheme area.

9. A detailed range of mitigation measures needs to be specified in response to various ecological outcomes. It is recommended that management plans for ecological mitigation and habitat restoration be prepared, prior to granting of consents. However it will be very difficult to mitigate for increased predation risk to threatened braided river birds caused by reduced flows as a result of abstraction.

Approach

10. I will provide a brief summary of the main conclusions reached by the Central Plains Water Enhancement Scheme (CPW) on the effects of the scheme on terrestrial ecology and wetlands.
11. I will discuss whether I agree with their overall conclusions, and, if not, my reasons.
12. I will state whether I agree with the conclusions of CPW regarding effects, on whether the assessment and proposed mitigations appear to be appropriate, and if not, the reasons.
13. The nature of the CPW scheme means that the assessment of potential effects on terrestrial ecology and wetlands often follow on from effects on surface and groundwater hydrology, water quality and aquatic ecology. For the purposes of this audit of effects on terrestrial and wetland ecology, I have generally accepted the most recent hydrological, water quality and aquatic ecology predictions and models as presented by the applicant.
14. However, there is considerable uncertainty and variability inherent in hydrological and water quality modelling, and therefore the outcomes for aquatic and terrestrial ecology. The validity of the applicants' models, predictions and assumptions for effects on hydrology, water quality and aquatic ecology are also the subject of separate s.42a audits. If these are shown to be invalid or subsequently revised, then a reassessment of effects on terrestrial ecology and wetlands would also be required.

Effects of works in the river bed on terrestrial ecology issues

CPW conclusions

15. My understanding of the key conclusions reached by CPW in regard to effects of works in the river bed on terrestrial ecology and wetlands are as follows:
 - (a) Both the lower Rakaia and lower Waimakariri river beds are acknowledged as significant areas for a range of natural values
 - (b) Impacts on braided river birds from works in the riverbed are not considered significant as they will be localised and temporary
 - (c) However, effects on other habitats present may be more significant, depending on the exact location and final design of the intake works, and mitigation is considered necessary (Golder Associates 2007).

My analysis

16. CPW identified "general areas of concern during construction" in an earlier report (Kingett Mitchell 2006a), and now recognise that particular habitats or species of concern may occur in the vicinity of the intake locations and associated infrastructure. The applicant notes that destruction of significant vegetation and ecosystems will be avoided as far as practical, and measure put in place to mitigate effects. Generalised mitigation measures are outlined in a draft site rehabilitation plan, with the intention of refining these closer to the consent hearing (Golder Associates 2007).
17. No mention is made of mitigation for effects on braided river birds in the recent Golder Associates report. In the earlier Kingett Mitchell report, the applicant had recognised the potential for adverse effects on nesting sites of threatened bird species, and noted that mitigation measures would be considered.

18. More detail on proposed mitigation was sought in the s.92 request. It is not clear what new information has led the applicant to now claim that impacts on braided river birds will not be significant and therefore not require mitigation.
19. According to the most recent Department of Conservation categorisation, five threatened native birds species characteristic of braided river habitats occur on the lower Waimakariri and Rakaia Rivers: black-fronted tern (nationally endangered); wrybill (nationally vulnerable); black-billed gull (serious decline); banded dotterel (gradual decline); and white-fronted tern (gradual decline) (Hitchmough et al 2005). Effects of works in the river beds are likely to be of regional significance, as described in Section 20.4 of the Canterbury Regional Policy Statement, and for this reason are generally subject to consent conditions.
20. To ensure that effects on braided river birds really are minor, conditions are recommended so that works do not occur within 100 metres of where nesting sites have been identified by a suitably qualified expert. It is also recommended that comprehensive management plans for ecological mitigation and habitat restoration of river bird nesting areas, in the vicinity of the proposed intakes and/or elsewhere on the riverbed, be prepared prior to granting of the consent. This could also help mitigate for broader effects of the water takes on braided river birds (Sections 26-31 below), should the commissioners grant that consent.
21. I agree that significant indigenous vegetation and habitats may occur in the vicinity of the proposed works, and that these should be avoided as far as practical and effects mitigated where necessary. Potentially affected native riverbed vegetation/habitats include cushion-herbfield, riparian wetlands and dry shrublands. Adjoining river terraces in the vicinity of the intake structures and intake canals also support a range of remnant native vegetation/habitats including dry shrublands, open cabbage tree and kowhai treeland, beech-podocarp forest and wetlands. At this stage the applicant has provided little detail about these values, effects of the intake works, and proposed mitigation.
22. The main criteria for assessing ecological significance in a heavily modified landscape like the Canterbury Plains are *Representativeness*, *Rarity* and *Distinctiveness*. In this context, significance is about what is left of the indigenous biota in relation to what was originally or could potentially be there. It is implicit that the less there is of a particular biota or habitat the more valuable or significant it is, especially if it was once common.
23. On the Canterbury Plains virtually every surviving indigenous remnant will be 'significant'. Because each small patch will almost always have a unique assemblage of species, and the total pool is small, then such patches will usually support populations of locally rare species. In addition, some remnant indigenous habitats on the Canterbury Plains are known to support nationally rare and threatened plant species.
24. CPW conclusions on significant sites and species have largely been determined from a 'desk top' inventory of existing information and databases. As virtually all of the remaining indigenous vegetation/habitats on the Canterbury Plains are significant, any localised losses resulting from construction and use of intake structures in the river bed (and elsewhere) can not be considered minor. For this reason, it is inadequate for the AEE to rely largely on existing information and databases, without also carrying out more detailed survey and assessment of areas affected by the proposed works, prior to granting of the consent.
25. The lack of specific detail with regard to implementing proposed mitigation is also of concern. It is recommended that management plans for ecological mitigation and habitat restoration be prepared that include specific concept designs, methodologies and a timeline for each of the proposed mitigation measures to be implemented, relative to the timeframe of the development works. The management plan should also specify the agency that will be responsible for maintenance work, monitoring of

effectiveness of mitigation, and a response strategy in the event that monitoring indicates mitigation objectives are not being met.

CPW conclusions regarding effects of the water takes on terrestrial ecology

26. My understanding of the main conclusions reached by CPW in regard to effects of water abstraction from the Rakaia and Waimakariri Rivers on terrestrial ecology are as follows
- (a) Water abstraction has the potential to affect river and wetland communities through reduced habitat availability, reduced flood frequency and reduced water quality;
 - (b) No adverse effects are anticipated in the Rakaia River due to the rate of take being low relative to flows;
 - (c) While effects of the Waimakariri River take on periphyton biomass and invertebrate abundance may be detectable, these are considered minor and are not expected to reduce food resources of wading birds;
 - (d) It is acknowledged that there are inherent uncertainties to hydrological modelling, and therefore uncertain outcomes for biological communities. CPW has offered mitigation for effects of increased duration of low flow events. This may include not taking water during any minor freshes or floods following periods of sustained low flow, although details of this mitigation have not been finalised.
 - (e) The water take will not significantly affect the frequency or duration of larger flood disturbance events. Thus the water take is not expected to result in increased vegetation encroachment onto the braided river fairway (Golder Associates, 2007; Kingett Mitchell, 2006b).
27. The applicant presented varied and sometimes contrasting results from several modelled studies of feeding habitat availability (using the 'Weighted Useable Area' index) and quality ('Habitat Suitability Index') for black-fronted tern and wrybill plover on the Waimakariri and Rangitata rivers. However, I could find no clear conclusions regarding effects on feeding habitat of braided river birds resulting from the proposed Waimakariri take. Earlier studies (e.g. Robertson et al. 1983) have shown that reduction in flows reduces feeding habitat by decreasing the size and number of small channels as well as the overall useable area of aquatic habitat. More detailed analysis is required to support the applicants' assertion that bird feeding habitat will not be affected by the proposed water takes from the Waimakariri and Rakaia Rivers.
28. Encroachment of exotic vegetation is a problem affecting braided river beds throughout the region, including the Rakaia and Waimakariri. Over recent decades exotic weeds have spread across naturally bare or sparsely-vegetated gravels, excluding native plants and reducing roosting and nesting habitat for threatened birds such as wrybill, black-fronted tern and black-billed gull. This weed cover also increases risk of mammalian predation on ground-nesting birds (Sanders and Maloney, 2000). However both rivers, especially the Waimakariri, still have extensive areas of sparsely-vegetated gravels and native riverbed cushion-herbfield vegetation.
29. A change in the rivers' flow regimes has the potential to affect riverbed vegetation patterns. Frequency and duration of larger flood events is not the only determinant of exotic vegetation encroachment; also relevant is the extent of predominantly exposed gravels available for vegetation establishment. The modal flow of a regime (the most commonly occurring flow) can be used as an indicator of relative exposed gravel extent. Although it could be expected that irrigation abstraction will change modal flows and therefore potential exotic vegetation encroachment, this has not been addressed in the terrestrial ecology AEE. More detailed information and analysis is necessary to explain why the proposed CPW water takes, both in isolation and cumulatively with other takes, will not exacerbate the weed problem on the Rakaia and Waimakariri River beds. This was not specifically requested in the s.92 letter, but it is hoped the applicant will have time to prepare a response before the consent hearing.

30. It is recommended that CPW be required to monitor weed spread at a representative range of sites downstream of the water takes, and have in place a weed control plan if appropriate thresholds are exceeded, should the commissioners grant the consent.
31. Studies have shown that birds nesting on islands in braided rivers appear to have increased breeding success relative to mainland sites, probably because the islands are less accessible to mammalian predators (e.g. Rebergen et al, 1998). Predation risk is generally believed to increase with decreasing flows, as islands become part of the mainland or are surrounded by only small flows. No assessment of these effects appears to have been made for the proposed CPW takes from the Rakaia or Waimakariri Rivers, either in isolation or cumulatively with other takes. This was not specifically requested in the s.92 letter, but it is hoped that the applicant will have time to prepare a response before the consent hearing, considering the high significance of these riverbed habitats for avifauna, and the threat status of a number of the bird species present.
32. However, recent research by the Department of Conservation on the Tasman River has demonstrated the difficulty of protecting threatened braided river birds from mammalian predation with current pest control technology. Therefore it is not considered possible to effectively mitigate for increased risk of bird predation as a result of water abstraction from the Waimakariri and Rakaia Rivers.

CPW conclusions regarding effects of the water takes on wetlands

33. My understanding of the main conclusions reached by CPW in regard to effects of water abstraction from the Rakaia and Waimakariri rivers on wetlands are as follows:
 - (a) Water abstraction has the potential to affect wetland communities through reduced surface and groundwater availability;
 - (b) No adverse effects of the CPW take are anticipated in the Rakaia River due to minimum flow restrictions and flow sharing rules. The CPW Rakaia take will have no significant effect on riparian groundwater levels and associated wetland habitats;
 - (c) The Waimakariri take may result in a small decrease in water levels in riparian wetlands. However effects of the scheme are expected to be minor as wetland vegetation within the affected portion of the catchment is dominated by species tolerant of fluctuations in water level;
 - (d) Increased groundwater levels through the wider Central Plains area will moderate effects of the take on riparian groundwater levels (Golder Associates, 2007).
34. Because of stopbanks and other protection works, most Waimakariri River riparian wetlands are only directly connected to the river during occasional large flood events. For the rest of the time, water levels in these wetlands are relatively constant, fed by steady inflows from groundwater and/or groundwater-sourced streams.
35. While it is true that both the native and exotic plant species present in these wetlands are tolerant of fluctuations in water level, the native plants dominate or compete best against the exotics where water levels are highest. At Sanctuary Swamp, for example, the only part of the wetland where native plants (tussock sedge, kiokio, raupo, flax) form the main vegetation canopy is the central core, where water is knee-to-waist deep (or more). Elsewhere in the wetland where water levels are not so high, exotic crack and grey willow trees dominate the vegetation.
36. A feature of some Waimakariri riparian wetlands (e.g. Sanctuary Swamp, Baynons) is the extensive regeneration of native plants under the exotic willow swamp forest canopy. Again, this process is most apparent where water levels are relatively high. Native plant species are considerably less abundant or absent from the understorey of drier riparian willow forest sites.
37. Vegetation patterns of Waimakariri riparian wetlands suggest that, without mitigation, even a small reduction in water level is likely to reduce abundance and extent of native plants in these habitats. More

precise information is needed on the size of the predicted "small decrease" in water level, how this relates to existing wetland water levels and vegetation patterns, to what extent increased groundwater levels through the wider Central Plains area will moderate this effect, and whether further mitigation is required.

CPW conclusions regarding effects of water use on terrestrial ecology and wetlands

38. My understanding of the key conclusions reached by CPW in regard to effects of water use on terrestrial ecology and wetlands are as follows:
- (a) Increased groundwater levels will not adversely affect known areas of significant native dryland vegetation, but will benefit freshwater wetland ecosystems;
 - (b) Nutrients are currently non-limiting in Lake Ellesmere and therefore wetland vegetation growth is unlikely to change significantly with the input of additional nutrients transported in surface-flows;
 - (c) Increased freshwater inflows into Lake Ellesmere will not greatly increase the lake shore wetland area, but will necessitate more frequent openings to the sea. Increased overall lake salinity may be the result, although salinity may decrease around tributary inflows;
 - (d) This may favour more saltmarsh-type brackish wetland vegetation and less freshwater wetland vegetation than is currently the case around the lake as a whole. However, favourable habitat for freshwater wetland communities may increase around the mouths of tributary inflows;
 - (e) Saltmarsh vegetation is likely to be dominated by native species. However, any increase in freshwater habitat will be tempered by the threat of invasion of exotic willows;
 - (f) It is difficult to predict with great certainty the effects of the CPW scheme on the relative balance of brackish vs. freshwater wetland ecosystems around Lake Ellesmere, but both have inherent ecological value. The AEE notes that of greater concern is the relative dominance of indigenous vs. exotic vegetation around the lake;
 - (g) It is recommended in the AEE that CPW Ltd contribute to protection of Lake Ellesmere ecosystems through the use of its proposed Environmental Management Fund. One use of this fund could be a contribution towards willow control around the lake to benefit native vegetation and improve bird habitat. (Golder Associates, 2007)
39. The applicant acknowledges the significance of remnant native vegetation on the Canterbury Plains. The conclusion that significant dryland vegetation will not be adversely affected by increased groundwater levels as a result of CPW was based on the location of four known dryland vegetation areas on the groundwater level maps of Weir (2007). While these four sites were shown to be unaffected by changes to groundwater levels from this modelling, the applicants recognised that there will be other as yet unidentified sites in the affected area. However, the applicants did not consider it feasible to survey the entire Central Plains Area for significant vegetation (Golder Associates 2007, p.22).
40. This highlights a serious limitation of the whole terrestrial ecology and wetlands AEE. It is not sufficient to rely on existing information and databases without also carrying out further field surveys and detailed ecological assessments of the wider CPW scheme area. There is little discussion of the potential effects of water use on terrestrial ecology and wetlands across the wider CPW area, apart from Lake Ellesmere. It is not possible to assess the effects of CPW water use on the terrestrial and wetland ecology of the affected area as a comprehensive description of the environment is still absent.
41. Many remnant native vegetation and wetland habitats, some supporting nationally-threatened species, are likely to be affected by the scheme's water use. This could be by direct clearance during construction of intake and distribution canals, or subsequent degradation/loss as a result of irrigation and general land use intensification. For example, Environment Canterbury reserve land in the north-eastern corner of the CPW scheme area supports kowhai, prostrate kowhai, kanuka, matagouri, indigenous grasses, herbs and mosses. The acutely threatened shrub *Olearia adenocarpa* occurs here. Areas such as this are also valuable habitat for native invertebrate fauna.

42. The 'Bankside kanuka shrublands' is an area of significant dryland vegetation mentioned by the applicants in their assessment as not being affected by raised groundwater levels. The Bankside kanuka shrublands are outside the CPW irrigation area but provide an indication of the possible future for similar native remnants within the CPW scheme area. Bankside Scientific Reserve is regularly irrigated from neighbouring farm land, while another kanuka shrubland site in the vicinity, on private land, has recently been cleared for pasture development.
43. No analysis has been carried out on the potential ecological effects of increased water flows down stream channels on the Canterbury Plains that are presently dry habitats for much of the time.
44. It is agreed that increased surface flows and groundwater will generally enhance plant growth in riparian and wetland habitats. However, there is no analysis of where and to what extent predicted plant growth would favour exotic or indigenous species, apart from around Lake Ellesmere.
45. I agree that it is difficult at this stage to predict the effects of the CPW scheme on the relative proportion of freshwater and brackish wetland habitats around the shore of Lake Ellesmere, but that freshwater wetlands are more susceptible to weed invasion.
46. If consents are granted and the scheme proceeds, I would support the recommendation that the CPW Ltd Environmental Management Fund contribute towards willow control around the lake shore, as part of a mitigation package for effects on Lake Ellesmere. CPW could also assist with monitoring condition of lake shore wetlands at a representative range of sites, prior to and after commencement of irrigation.

CPW conclusions regarding mitigating effects of landuse intensification

47. My understanding of the main conclusions reached by CPW in regard to mitigating effects of landuse intensification on terrestrial ecology and wetlands are as follows:
 - (a) CPW have prepared a number of draft environmental management plans and consent conditions to avoid and mitigate adverse effects of landuse intensification;
 - (b) A template to be used as a basis for individual farm management plans shall cover a number of management areas, focusing mainly on water quality but also including "biodiversity and ecosystems";
 - (c) Farm management plans will require that cattle, deer and pigs are excluded from rivers and wetlands and their margins adjoining land being irrigated;
 - (d) Farm management plans will also require that any potential mudfish sites from which cattle, deer and pigs are not otherwise excluded are surveyed by an appropriately qualified person and, if found to be actual mudfish habitat are then excluded from such sites, or an equivalent habitat is provided and the mudfish relocated (Golder Associates, 2007).
48. While "biodiversity and ecosystems" are listed in the farm management plan template, specific requirements to avoid disturbance to or mitigate effects on terrestrial native vegetation/habitats do not appear to have been included in the farm management plans. For example, there are no requirements to protect remnant native vegetation/habitats from clearance, cultivation or irrigation under CPW farm management plans.
49. There is no requirement to protect wetlands and river margins not adjoining land being irrigated from heavy stock under CPW farm management plans, unless found to be mudfish habitat.
50. The farm management plan approach as presented lacks sufficient rigour and detail to be assured that biodiversity and ecosystems will be protected from the effects of landuse intensification associated with CPW. Important sites for biodiversity and ecosystem protection throughout the scheme area need to be identified, risks assessed, and appropriate protection and/or mitigation measures specified. Monitoring

against baseline values will need to be carried out, and response identified if monitoring shows management plan objectives are not being met.

Effects of Waianiwaniwa dam on terrestrial ecology and wetlands

51. My understanding of the main conclusions reached by CPW in regard to effects of the Waianiwaniwa Valley storage dam on terrestrial ecology and wetlands are as follows:
 - (a) Few native plants and animal species exist in the valley;
 - (b) Significant wetland habitat is unlikely to exist;
 - (c) No other significant indigenous vegetation or habitats are present (Kingett Mitchell 2006a).
52. The description of the Waianiwaniwa Valley environment is cursory and incomplete. For example, no mention is made of two substantial wetlands on Selwyn Plantation Board land in the southwest corner of the inundation area. Nor is there any discussion of the significance of the presence of *Olearia rani* in the valley, well outside its known distribution range.
53. Identification and assessment of ecological values does not appear to have been done within an appropriate context, with the result that remnant indigenous biodiversity and habitats have been undervalued or overlooked.

Effects of bywash discharges on terrestrial ecology and wetlands

54. My understanding of the main conclusions reached by CPW in regard to effects of bywash discharges on terrestrial ecology and wetlands are as follows:
 - (a) There will be a number of bywash discharges at the lower end of the distributional network, located along the Rakaia, Selwyn, Hawkins and Waimakariri Rivers;
 - (b) During normal operations, bywash will be discharged into small constructed wetlands and then soak to groundwater. Construction and operation effects are considered to be minor;
 - (c) During emergency situations a further three discharge points on the Rakaia, Hororata and Waimakariri Rivers will be used. These larger flows will be routed directly to surface water, and will bypass the constructed wetlands to avoid damaging them. Effects on terrestrial ecology will be minor (URS, 2007).
55. More detailed information is required on the location, existing values, design and ongoing management of both the operational and emergency bywash discharge points to be assured that effects on terrestrial ecology and existing wetlands really will be minor.
56. The applicant claims that no indigenous vegetation/habitats will be affected by construction and operation of the bywash discharges. However, the proposed Waimakariri River discharge points and associated canals/water races between Courtney and Halcott are in the vicinity of significant kowhai treeland vegetation on Environment Canterbury reserve land. More detail is required to support claims that these areas will not be affected. This was not previously requested in the s.92 letter, but it is hoped that the applicant will have time to prepare a response before the consent hearing.

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