Resource Management Act 1991

Notices of Requirement and applications for land use consent, Central Plains Water Ltd and Central Plains Water Trust

Supplementary report on terrestrial ecology

Contents

To:	Hearing commissioners
From:	Mark Davis, Environmental Consultant
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This supplementary officer's report has been prepared under Section 42A of the Resource Management Act 1991 (RMA).

NB: In this report, the acronym CPW covers Central Plains Water Ltd and Central Plains Water Trust.

Introduction

1 My name is Mark Davis. I am an environmental consultant specialising in ecological assessment and resource management issues. My qualifications and experience were outlined previously in my S42A report on terrestrial ecology that I prepared on behalf of Selwyn District Council (SDC) for this hearing.

2 My further report is prepared primarily in response to the evidence presented by Dr Bishop for the applicant, and that presented by Dr Meurk on behalf of Forest and Bird. On this basis I find the applicant has provided little further information about terrestrial ecology, and I have no reason to change the views expressed in my S42A report. That report concluded that the information provided by the applicant was so inadequate that the effects of the proposal on terrestrial ecological values could not be properly assessed.

3 To avoid duplicating information prepared by Dr Grove for Environment Canterbury (Ecan), I address the following issues:

- An explanation of significance that is tailored to the ecological character of the scheme area.
- A description of key significant sites likely to be affected by the proposal, focussing on the Waianiwaniwa Valley, the braided river terraces and the plains. I do not discuss mudfish as they are addressed in detail by other evidence.
- The applicant's sustainability protocol.
- A discussion of effects and proposed mitigation.

4 Dr Grove will address terrestrial ecological values relating to riverbeds and their margins, riparian wetlands, by-wash discharges, Ecan reserve land, and the effects of water use on Te Waihora/Lake Ellesmere and the plains.

5 In discussing effects and mitigation, I largely restrict myself to the scheme footprint and do not address effects on terrestrial ecology within the wider scheme area. This reflects the instruction given by SDC based on the permitted status of agricultural land use under the District Plan, and that many of these effects are considered by Ecan in assessing the 'use' of water on the plains.

6 When addressing specific points in Dr Bishop's evidence, I refer to his brief of evidence and his response to the S42A reports in the following manner: (evidence paragraph 1, response paragraph 1).

The context for significance in the scheme area

7 An understanding of this issue is central to identifying significant terrestrial ecological values within the scheme area, and the effects of the proposal on these values. From my perspective, it is apparent that the applicant has not fully understood this context based on the evidence presented by Dr Bishop.

8 When determining significance in the scheme area, it is essential that it reflects the context of extreme habitat loss and modification. The Waianiwaniwa Valley and Canterbury Plains are among the more modified parts of New Zealand, but they retain important remnants of indigenous biodiversity. While these remnants are typically very modified, this is to be expected given the extremely modified environments in which they occur. This is illustrated by Table 3 of Dr Bishop's main evidence where the relevant Ecological Districts (EDs) generally have an indigenous vegetation cover of around 0.1%. The somewhat higher figures for indigenous forest and secondary vegetation in Whitecliffs ED largely relate to its north-western side, not the Waianiwaniwa Valley.

9 An indigenous vegetation cover of around 0.1% is exceptionally low, and its implications are that virtually anything that remains is important. This is explicitly recognised by National priority 1 in the government's policy on protecting threatened indigenous biodiversity (MfE 2007), with 0.1% being far below the 20% threshold. While Table 4 of Dr Bishop's main evidence correctly records this LENZ information, his evidence typically fails to recognise the importance of these remnants and often devalues them. In contrast Dr Meurk recognised the implications of extreme indigenous biodiversity losses in his evidence, as discussed in paragraphs 55-60.

10 The most extensive ecological survey of the Canterbury Plains to date was undertaken in 1993 (Steven & Meurk 1996). Their report recognised the limitations of applying standard assessment criteria in EDs that have undergone very high levels of modification and loss of indigenous biodiversity. Because of this context, representativeness and local species uncommonness were the key criteria used to identify sites that collectively represent the full extent of remaining natural diversity. It also needs to be recognised that this was a reconnaissance survey, and as a result not all areas were visited and site descriptions are not necessarily detailed. This situation is acknowledged by Dr Meurk (paragraph 19).

11 Appendix 12 of the Selwyn District Plan describes the criteria to be used for identifying significant sites in the district. While the assessments are to be undertaken at an ED level, there is no recognition of the context of extreme modification on the Canterbury Plains. Of the 7 criteria listed, representativeness and rarity are arguably the most useful for assessing sites on the Plains and in the Waianiwaniwa Valley. Appendix 13 lists threatened and uncommon plants, while Appendix 14 lists regionally significant plants on the Canterbury Plains. Combining these two appendices allows the recognition of many threatened or regionally uncommon species, though some regionally uncommon species are not included e.g. *Coprosma* spp. It also appears that *Carmichaelia monroi* should in fact be *Carmichaelia corrugata*. In general less explicit recognition is given to fauna, though application of the criteria can take account of fauna habitat.

12 In attributing significance to sites within the scheme area I have recognised the context of extreme modification and applied Appendices 12-14 of the District Plan. I have accepted the ratings of sites previously identified as potentially significant (e.g. A-C rated sites in the Plains PNAP survey), and attributed significance to a number of previously unknown "new" sites such as wetlands in the Waianiwaniwa Valley.

13 The hearing commissioners requested that a map be produced to show the key ecological sites within the scheme area. Appendix 1 shows significant sites within or adjacent to the scheme area, while Appendix 2 identifies the key areas for terrestrial ecology. These maps are in the process of being prepared and will be provided after this report appears on the Ecan website. Appendix 3 gives the scientific names for plants referred to by their common names in this report].

Description of key significant sites

Waianiwaniwa Valley

14 The valley contains numerous sites of ecological significance, most of which are mudfish habitats. Of particular relevance to my report are three wetlands that are important under Sec.6 (a) RMA and which meet the requirements of Sec. 6(c).

15 The first is a raised peat bog in Bush Gully that was described by Dr Meurk. I have visited the bog which covers around 0.7ha and which occurs in conjunction with a 0.25ha seepage. It is distinctly domed and appears to receive its water from rainfall alone, its correct wetland class therefore being a bog (Johnson & Gerbeaux 2004).

16 The bog is dominated by indigenous plants which form an estimated cover of around 95%, except at the margins where exotic plants dominate. The main species within the bog are pukio, *Baumea rubiginosa*, bog rush, spike sedge, mosses, liverworts and *Nertera depressa*. Other prominent species include native violet, little hard fern, lowland flax, mingimingi, swamp kiokio, creeping buttercup, Yorkshire fog, tall fescue and creeping bent. By combining my data with Dr Meurk's, the species list contains 65 species. More than 50% (35 species) of the flora here is indigenous.

17 The bog does not appear to have been physically damaged by stock, as its quaky nature has presumably prevented their access. Overall its naturalness is at least moderate/high, reflecting its excellent condition and the dominance of indigenous plants. This is remarkable given that it occurs within an agricultural landscape.

18 There appears to be only two other known raised peat bogs in lowland Canterbury, one in the nearby Wairiri Valley and one near Cheviot (Miles Giller pers.comm.). Given its excellent condition and rarity, it is my opinion that the Bush Gully bog is very important in terms of Sec. 6(a) and its vegetation is highly significant under Sec. 6(c). Its faunal habitat is likely to be significant, given the rarity of these bogs in lowland Canterbury. The bog is also of scientific interest as it can provide valuable pollen records. The Wairiri bog is about 6000 years old, and pollen analysis there has made an important contribution to understanding vegetation change in Canterbury (Wilmshurst 2002).

19 There are two substantial wetlands on Selwyn Plantation Board (SPB) land in Bush Gully and 'Tara Stream' valley, these being described in my S42A report. SPB (2006) notes the significance of these remaining wetlands, and Dr Bishop confirms this when discussing significant sites (evidence paragraph 37). I regard these wetlands as important under Sec. 6(a) and consider they support significant vegetation under Sec. 6(c). This assessment reflects their substantial size, their indigenous plant communities and the rarity of wetlands in Whitecliffs ED (< 0.1%, evidence Table 3).

20 I have not visited the smaller wetland in Oyster Gully referred to by the SPB report. During my field visit, I noted a substantial area of raupo in "Tara Valley" below SPB land, and further wetlands are apparent in this valley from using satellite imagery. These wetlands are likely to be important and need to be properly assessed.

21 Other parts of the Waianiwaniwa Valley also support remnants of indigenous vegetation including patches of kowhai, seepages, silver tussock grassland and the threatened (at risk) *Aciphylla subflabellata*. I consider those that were mentioned in my S42A report are likely to be significant. Dr Meurk also refers to a 1ha flax swamp (paragraph 25), and rich fern communities along Malvern Hills Road (paragraph 26). In contrast Dr Bishop is somewhat dismissive of indigenous remnants in the valley, with the exception of the two SPB wetlands (evidence paragraph 32, response paragraph 6).

Braided river terraces

(i) Rakaia River

22 The three Rakaia River terrace shrublands were identified by the Plains PNAP survey and given A & B ratings. The first site is upstream of the intake and is not described here. The Rakaia River shrubland is located on the terrace riser adjacent to the canal footprint. I have not visited this site but I expect it to be similar to the Rakaia terrace dry shrublands, which I have visited. I note that the Plains PNAP survey report states that not all terrace risers and treads were visited in this area, and this means that further ecological values are likely to be present.

23 The Curiosity Shop is associated with a disused lime quarry at the north-western end of the Rakaia terrace dry shrublands. It is a nationally important geopreservation site, where limestone occurs with shallow marine sedimentary structures. It is notable for its beautifully preserved fossils such as molluscs and sharks teeth (GSNZ). The record notes the presence of a low bank in front of the upper face. This was confirmed during my visit to the area, the limestone protruding into a side channel of the Rakaia River. At least 22 indigenous plant species were noted during the Plains PNAP survey, including kowhai, broadleaf, lancewood, grey shrubs, vines, orchids, ferns and mosses. Further species are likely to be present, potentially including specialised limestone plants and animals.

24 The Rakaia terrace dry shrublands extend downstream of the Curiosity Shop on the terrace riser, with smaller remnants occurring on higher and older terrace risers to the east. The shubland on the main riser supports species such as cabbage tree, kowhai, broadleaf, matagouri, porcupine shrub, mingimingi, *Coprosma crassifolia*, bracken, tutu, pohuehue, shrub pohuehue, native jasmine, *Clematis quadribracteolata* and native bindweed. This site and the Curiosity Shop in combination are very significant.

25 Immediately below the Curiosity Shop on a terrace tread is a group of up to 30 kowhai, which includes young and mature trees. They were referred to in my S42A report, but they do not appear to have been identified in previous reports or databases. Plains site 119 occurs on the river side of the footprint about 1km SE of the Curiosity Shop. It represents a wetland of sedges, flax, toetoe, rushes and bog rush, with associated grey shrubs, kowhai and cabbage trees. This site and the kowhai grove are both significant.

26 From this group of sites to where the canal leaves the terrace riser and crosses the plains, there are a number of other indigenous remnants. The beech trees were mentioned in my S42A report as important distribution records, with red beech also being recorded in Plains site 1274. Nearby on the south-western edge of the canal footprint is Plains site 1275, a back swamp containing flax, cabbage trees and kowhai. Plains site 1276 on the terrace riser supports scattered matagouri, *Coprosma ciliata,* cabbage tress and bracken. My visit to that site also identified silver tussock, mingimingi, porcupine shrub, shrub pohuehue, creeping pohuehue and mosses. This community occurs among exotic grasses, scattered gorse, thistles and a small amount of broom. Patches of river boulders are present and the site is a potential lizard habitat. It is also significant.

27 Other patches of grey shrubland and river boulders were seen along the terrace riser but were not visited. Patches of seral riverbed vegetation were seen on the terrace tread, one of which supported the chronically threatened *Raoulia monroi*. Small groves of kowhai occur in a number of places, along with cabbage trees and wetlands. Gorse, broom, conifers and other exotic trees are widespread, while willows are common closer to the river. This does not alter the fact that patches of indigenous shrubs, kowhai trees, wetlands and seral riverbed vegetation occur in or adjacent to the canal footprint. The main terrace riser and its lower tread are large and have not been closely assessed by anyone. Given the important values present, this needs to be done.

28 Dr Bishop refers to relic native scrub, shrubland, herbfield and wetlands on the braided riverbeds generally (evidence paragraph 22), but does not address the vegetation of the main Rakaia terrace riser beyond listing the Plains shrubland sites. While their values are not described, Dr Bishop acknowledges that the terraces of the Rakaia and Waimakariri Rivers are the most likely to support important 'undiscovered' areas of indigenous habitat (response paragraph 8). This view has been born out by the recent discovery of the critically threatened *Melicytus* aff. *flexuosus* on the opposite side of the Rakaia River.

(ii) Waimakariri River

29 Remnant podocarp-beech forest occurs on the terrace immediately adjacent to the diversion channel on the Waimakariri Riverbed. Rutherford's Bush occurs next to the intake, and riparian remnants extend downstream from here. An indication of their species composition was provided in my S42A report and is not expanded here. All these remnants are highly significant, but the applicant has provided no information about them.

30 The long tunnel entrance above the Kowai River enters the main terrace riser near Keens Road wetland. The applicant states that the tunnel portal is located on farmland

with no significant vegetation or terrestrial fauna, but provides no information about what vegetation is present (Section 5.2.1, URS 2007).

31 Plains point 1003 occurs on the riser 750m NW of the portal, while Plains point 986 is 2kms SE on the same riser. The vegetation of both sites is grey shrubland with gorse, broom and pines, and both sites are significant. Viewed from Keens Road, the vegetation of the riser above the portal appears to be similar to these sites. The main exotic plants are gorse, broom and pines, while indigenous plants include cabbage tree, matagouri, mingimingi, kowhai, shrub pohuehue, kohuhu, bracken and necklace fern.

32 The lower intake adjacent to the Waimakariri Bridge is notable for the highly significant Plains site 918 that was mentioned in my S42A report. Species present on the rocky walls include prostrate kowhai, kowhai, cabbage tree, *Corokia cotoneaster, Olearia avicenniifolia*, shrub pohuehue, tutu, kohuhu, native jasmine, *Coprosma ciliata,* flax, lawyer, leather-leaf fern, *Rytidosperma clavatum*, plume grass and pines. The Waimakariri Bridge dry shrubland is mentioned by Dr Bishop (evidence paragraph 47, and significant natural area [SNA] in Table 5) but no descriptive details are provided.

33 From the Bridge to Bleak House Corner, previously recorded SNAs occur near Westwood. Plains site 944 is a wetland occurring at the base of a terrace riser. It is described as an impressive back swamp which is the most eastern of its type on the true right of the river. It contains a diversity of plants such as flax, cabbage tree, raupo, mingimingi, sedges, rushes, toetoe, bog rush, manuka, gorse and possibly *Baumea*. Flax and kowhai are present on the terrace riser above the wetland. This wetland and the gully referred to in paragraph 34 below are briefly described by Kingett Mitchell (2006a).

34 The weedy gully immediately southwest of the wetland is a significant site (Plains point 943) supporting indigenous shrubland, which extends onto the fan adjacent to the wetland. Plants present include cabbage tree, kanuka, kowhai, prostrate kowhai, mingimingi, porcupine shrub, 3 pohuehue species, native jasmine, lawyer, native grasses, ferns and mosses. Exotic broom is widespread in the gully.

35 In addition to these previously known significant sites, scattered indigenous vegetation occurs on the terrace riser directly below the plains. Plants include kowhai, prostrate kowhai, kanuka, kohuhu, grey shrubs, ferns and several extensive patches of leafless lawyer (which is locally rare on the Canterbury plains). The importance of these remnants is reinforced by Dr Meurk who notes that most of the remaining indigenous vegetation on the upper plains is now confined to the major terraces of the braided rivers (paragraph 34).

The plains

36 The applicant has acknowledged that water races provide the only permanent flowing water across the plains, and that "significant terrestrial environments" include water races (Sec. 3.1, Kingett Mitchell 2006a). In his evidence for Forest and Bird, Dr Meurk discusses their importance as naturally colonised habitats rich in plant and animal life (paragraph 61), some of which are significant.

37 Some races are at least 120 years old and they effectively function as surrogate streams. In my S42A report, I referred to Sharlands Road water race. I visited this race again in June 2008 and identified more indigenous species, resulting in a total of 22 species being recorded. As these plants were recorded in winter over a short period of time, it is likely that further indigenous species will be present. Of greater importance is the fact that the indigenous vegetation extends for hundreds of metres along this road. While it is important in its own right, this vegetation also fulfils ecological functions by shading the water and providing habitat for terrestrial invertebrates.

38 Many races support a diversity of aquatic invertebrates and fish. A recent thesis on the ecology of stock water races (Sinton 2008) showed that the diversity and density of aquatic invertebrates in the races was similar that of natural streams on the plains. Threatened freshwater crayfish and freshwater mussels were present at a limited number of sites. Fish species found were trout, upland bully, threatened long-fin eel, very occasional threatened mudfish (in drains) and one torrent fish.

39 A related paper by Sinton and Harding (2007) describes the races as refugia for benthic invertebrates, which are threatened by habitat loss in natural streams caused by agricultural intensification. Of the 58 taxa collected, 10 were unique to water races and 9 were unique to natural streams. They note that the races provide the only permanently connected surface water habitat across the plains, in contrast to many streams which are now ephemeral in their mid reaches.

40 Not all races are of similar value but in my opinion, the combined value of indigenous vegetation and fauna habitat certainly make some of them important under Sec. 6(a) and significant under Sec. 6(c). Existing data would be improved by additional field survey, to help clarify which races are significant for their indigenous biota and connectivity.

41 The applicant does not provide site specific information about water races, and Dr Bishop downplays their importance by referring to "indigenous riparian plantings, low diversity and low natural values" (evidence paragraph 44). This does not recognise the fact that indigenous plants have naturally colonised some races and they provide valuable habitat for terrestrial and aquatic indigenous fauna (including threatened species).

42 Most other indigenous remnants on the plains would not be directly affected by the scheme footprint, except for a small number of roadside Plains sites and threatened species locations (e.g. Canterbury mudfish and at risk *Carex tenuiculmis*). These sites are typically small and may be cleared by the construction of the water distribution network. There may also be other remnants on roadsides or in the canal footprint that have not been documented to date because of limited field surveys.

Description of indigenous fauna

43 Dr Bishop dismisses the presence of lizard and invertebrate habitat in the scheme area, largely because of the highly modified environment and the proposal to undertake detailed surveys in the future (evidence paragraph 80, response paragraph 5). In discussing indigenous birds, their presence within those wetlands likely to be affected by the scheme has not been addressed in any substantive way. Concerns about this lack of

fauna information were raised in my S42A report, but no further information has been provided by the applicant.

44 While the scheme area is highly modified, fauna habitats are nonetheless present and some retain at least moderate levels of naturalness. In the case of potential lizard habitat, the braided river terraces support substantial areas of indigenous shrubland and woodland, with exposed river boulders and talus patches being common. A number of indigenous shrubs, *Muehlenbeckia* vines and lawyers provide fruit for lizards, while wetlands and water races provide potential refugia. Some of these habitats also occur in the Waianiwaniwa Valley. Invertebrates will be present in these habitats, providing a further source of food for lizards.

45 There is little doubt that indigenous invertebrates occur throughout the scheme area. They persist in isolated indigenous habitats such as forests, shrublands and grasslands (Chapter 16, Winterbourn et.al. 2008). In addition, particular indigenous plants are well-known hosts for indigenous invertebrates, including *Coprosma*, matagouri, kowhai, cabbage tree, *Muehlenbeckia*, native broom and speargrass. All of these plants occur in the scheme area and their habitat value for invertebrates should not be ignored.

46 There is also clear evidence to show that indigenous invertebrates persist in exotic conifer plantations and agricultural landscapes generally. Studies have shown that hedges and fencelines provide habitat for a substantial number of endemic beetles and spiders (Chapter 16, Winterbourn et.al. 2008). On this basis it can be expected that some indigenous invertebrates will persist in less disturbed habitats, or by switching to surrogate habitats such as plantations and hedges.

Description of effects

Waianiwaniwa Valley

47 My limited field work has shown that the applicant should have undertaken a more thorough field assessment to determine where important indigenous vegetation and fauna habitats are present. Without this information, it is not possible to properly assess the effects of the reservoir inundation on terrestrial ecological values.

48 Dr Bishop states that inundation will have major ecological effects on the SPB wetlands (response paragraph 53). By using the 280m contour level in GIS, it appears that the reservoir will actually inundate nearly all of Bush Gully wetland, and perhaps a little under half of Tara Stream wetland.

49 In addition to these wetlands and the peat bog, there are other wetlands in the valley whose values have not been described and these would be inundated as well. Remnant silver tussock grassland with sparsely scattered indigenous shrubs and threatened plants occur in the valley and some of these would also be inundated. From what I have seen of these remnants, the effects of inundation on them would certainly be more than minor.

50 Dr Bishop comments that the loss of (SPB) wetlands may be offset by the natural establishment of new wetlands on the lake margins and gully heads, but suggests the net effect is unclear (evidence paragraph 111). This possibility seems very optimistic to me,

as large lake shore fluctuations are unfavourable for the establishment of natural wetlands. The surface area of the lake will vary from 4 – 13km^2 and water level fluctuations of approx. 11m are expected (evidence paragraphs 136 & 137).

51 A suite of potential operational effects is identified by Dr Bishop, including the exposed lakebed becoming devoid of vegetation except perhaps for weed invasion. He points out that this will restrict the establishment and survival of riparian vascular wetland plants and aquatic macrophytes in the littoral zone (evidence paragraph 137), which somewhat contradicts his earlier suggestion (evidence paragraph 111).

Braided river terraces

52 As I have described in paragraphs 22-35, there are numerous indigenous vegetation remnants and fauna habitats associated with the braided river terraces. Many of these significant sites will be destroyed or damaged by the canals as they traverse the terraces. This reality is at odds with the views of Dr Bishop when he generalises that terrestrial ecological values are low, that construction effects will be mostly minor, and that known sites of higher ecological significance will be avoided (evidence paragraphs 107-109).

53 It is clear that a number of Rakaia sites are within the canal footprint and will likely be destroyed, but this is not addressed by Dr Bishop. Dr Mabin's response to the S42A report states that the scheme will have no effect on the Curiosity Shop geopreservation site as it is about 150m from the intake works. This is most unclear as Map 10 of Annexure C (Urbis 2006) shows the canal footprint cutting across the lower part of the site, extending up the prominent spur to the top of the terrace riser. Apart from direct excavation and the removal of indigenous vegetation, there is potential for the site to be damaged by slope instability.

54 Dr Bishop's evidence fails to address specific effects on the Waimakariri sites such as Westwood terrace wetland and shrublands, which are within the canal footprint. While significant construction activities are acknowledged at the Waimakariri Bridge (evidence paragraph 103), only generic effects are summarised (evidence paragraph 108). Riparian podocarp-beech forest remnants occur immediately adjacent to the upper intake and diversion channel. The applicant needs to make it clear whether or not these highly significant remnants will be affected by the proposal, and if so, what the specific effects will be.

Existing water races

55 While existing water races are often damaged or devalued by current management, the construction of the water distribution network will threaten the existence of some races. The network is likely to be comprised of races with a footprint of 14-27m across, which will run alongside roads and through private land (Urbis 2006). The effects of construction and vehicle use are likely to be significant on existing races, and some may be removed altogether.

56 These construction effects are significant, as existing water races support a variety of indigenous plants and animals and they also perform an important ecological function of connecting habitats. The applicant states that construction effects will be less than minor

as the races are considered to be of low natural value (Kingett Mitchell 2006a). I disagree with this statement based on the values I have described in paragraphs 36-39.

57 Dr Bishop states that significant construction activities will be associated with the construction of the water race distribution network (evidence paragraph 103), though he considers that effects will be mostly minor and temporary (paragraphs 107 & 109). Generic examples of effects are provided such as vegetation clearance, weed invasion and disruption of water flow (paragraph 108). Overall Dr Bishop provides no specific information about construction effects on existing water races.

Proposed mitigation

Waianiwaniwa Valley

58 Dr Bishop proposes mitigation options associated with the operation of the reservoir, including establishing indigenous wetland and riparian plants around the reservoir, weed monitoring and weed control (paragraph 140). He also indicates that mitigation will involve increasing the extent of the SPB wetlands upstream from their current locations (response paragraph 51).

59 As I have said previously, I do not think the establishment of wetland vegetation around the reservoir margin is a practical proposition. In this disturbed habitat the most likely colonisers will be exotic plants such as willows, thistles, tall fescue, foxtail grasses, willow weeds, docks and exotic rushes. If any wetland vegetation establishes naturally on the upper shoreline, it is likely to be dominated by exotic plants tolerant of disturbance and fluctuating moisture. This and any planted wetland vegetation cannot be regarded as functional wetlands, as they will not support the expected range of wetland plants and animals typical of more stable lakeshores.

60 In terms of wetland offsets Dr Bishop initially suggested a 6.5ha (1:1) replacement of the inundated SPB wetlands in Whitecliffs ED (evidence paragraph 140). Later this figure was increased to at least twice the size of the wetlands that would be inundated (response paragraph 52). I support such an increase as it will better compensate for the loss of natural wetlands which are difficult to replace. If land was available with similar valley floors and suitable water sources, wetland construction is a realistic option in these low hills.

61 Detailed surveys of the existing swamps would be necessary to clarify their soil types and determine if any uncommon species are present. If there are, they should generally be introduced to the constructed wetlands once the common species have become well established. Over time the wetlands should become self-perpetuating and increasingly functional, though the development of faunal elements is likely to take much longer. To aid the process, large scoops of the existing swamps (soils, plants and fauna) could be 'transplanted' directly into the new wetlands.

62 The raised peat bog in Bush Gully is irreplaceable. Peat accumulates over time through partial decomposition of organic matter, with this bog perhaps being of similar age to the Wairiri bog (6000 years old). The bog and other wetlands in the valley will be inundated, but the applicant has not offered any mitigation for these potential losses. Likewise no

mitigation is offered for other indigenous remnants that may be inundated, such as silver tussock grasslands, kowhai groves and shrubs.

Braided river terraces

63 The mitigation options to address adverse construction effects are partly reliant on future surveys to identify significant vegetation and fauna habitats. Site specific effects would then be dealt with by management plans (evidence paragraph 115). Where these values are present mitigation includes site avoidance, site enhancement and habitat enhancement elsewhere (evidence paragraph 116). Vegetation will be established on exposed surfaces, and weed monitoring and control will be undertaken as needed (evidence paragraph 120 & 121).

64 Dr Bishop considers this approach to be appropriate as most of the scheme area is highly modified and the risk to indigenous habitats is low, as they are very uncommon and highly localised (response paragraphs 5 & 6). Additionally, baseline terrestrial ecological information in the technical reports is considered likely to include the highest quality areas of indigenous vegetation (response paragraph 7).

65 I disagree with Dr Bishop and consider the applicants approach to be deficient. While Dr Bishop is partly correct in suggesting that key vegetation sites on the terraces are likely to have been identified, other remnants have been found after baseline information has been gathered. The applicant has simply listed known sites, and has not undertaken the necessary field work to determine where the remnants are, how important they are, how they will be affected and what specific mitigation should be offered.

66 The applicant has accepted that a number of these sites are significant, and it is clear that some of them will be destroyed or badly damaged by construction of the canals. These effects are obvious and site specific mitigation should have been developed accordingly.

67 Irrespective of this, the requirements of replanting, translocation, propagation and habitat enhancement will be particularly difficult on these terraces. Existing indigenous trees and shrubs cannot be successfully transplanted, and any loss of limestone habitat is irreplaceable. These remnants also provide habitat for indigenous fauna, and many are likely to be destroyed by construction activities. In this respect, the applicant has provided no information about mitigation actions tailored to specific site values and circumstances.

68 Indigenous plantings on or around the canals will not adequately replace the communities that are lost or damaged by excavation. These communities are some of the best remaining on the plains and they are part of important river corridors, as was pointed out by Dr Meurk (paragraph 67). Their soils and associated biota will be disrupted, and much of the planting will then occur on excavated soils. If restoration is to be meaningful, it should occur upstream and downstream of the canals, with additional indigenous planting being undertaken on the canals to link the restored areas. Nothing of this nature has been discussed or suggested by the applicant.

Existing water races

69 It is likely that some existing water races will be destroyed or damaged by construction activities. Despite acknowledging their significance, site specific effects have not been described and no meaningful mitigation is offered beyond listing generic options (evidence paragraphs 115-116).

70 While the planting of indigenous species on the new water races may be of ecological benefit, Dr Meurk points out that it is not equivalent to the values of the existing races (paragraph 62). Given the importance of the existing races, the applicant should have explored the options for retaining key existing water races and enhancing their values. Relevant issues include maintaining their connectivity, retaining and restoring riparian vegetation, improving aquatic habitats and restoring adjoining roadside remnants. These important mitigation options have not been discussed by the applicant.

Suggested conditions

71 Cliff Tippler provided suggested conditions in his Brief of evidence (4 July 2008) in response to a request from the Commissioners. I have reviewed these and find them to be essentially the same as what was in the original application i.e. a reliance on preparing a significant indigenous vegetation protection plan. The plan is to identify and map areas of significant indigenous vegetation and determine suitable methods to protect the vegetation or mitigate its loss. In my opinion, this work should have been done from the outset and the resulting information provided with the application.

<u>Sustainability protocol</u>

72 Dr Bishop promotes the use of farm plans and the sustainability protocol, which was detailed by Claire Mulcock. Key aspects of the protocol relating to terrestrial ecology include:

- If shelter belts are removed for irrigation, farmers will be encouraged to replace them with native plantings to develop a network of corridors. Farmers will be encouraged to apply to the environmental enhancement fund for assistance.
- It will require the completion and implementation of farm plans for sustainable irrigation, the focus being on water management.
- CPW will support the implementation of the Canterbury Region Biodiversity Strategy. Unfortunately, the strategy has some inherent limitations such as:
  - ⇒ Wetlands are not specifically included in the priorities for management, despite being in priority 2 of the government policy on protecting threatened indigenous biodiversity (MfE 2007).
  - ⇒ It does not promote the protection ‘at risk’ threatened species.
  - ⇒ It seeks to identify the top 10 priority sites for protection, and 3 additional sites per year after that. This is the critical action but in my opinion, it will not adequately address lowland sites.
  - ⇒ All the actions are voluntary.
- In terms of waterway and riparian management the exclusion of cattle, deer and pigs appears to compulsory. The requirements for riparian buffers are based on Ecan waterway management guidelines, which are voluntary.
- The intent that dairy farmers meet the minimum requirements of the Clean Streams Accord is unclear, as stock exclusion from waterways and the protection

of "regionally significant wetlands" are voluntary. The protocol makes no comment on what might happen if the Accord targets fall behind schedule.

- Compliance and enforcement procedures are to be established and implemented when necessary.

73 In general the protocol relies on voluntary measures to promote and protect indigenous biodiversity. The focus is on waterways and riparian management, while wetlands and terrestrial indigenous biodiversity receive little attention. Finally, the protocol's reliance on the Regional Biodiversity Strategy is misplaced as it prioritises protection across the entire region, and this is not an appropriate context for the scheme area.

Conclusions

74 I consider that the applicant has poorly described terrestrial ecological values within the scheme area. While some important sites have been identified from existing information, minimal field assessments appear to have been done and descriptions are often superficial.

75 As a consequence a number of 'new' important sites have not been visited or described, and it is probable that other important sites are still to be identified in the scheme area.

76 The applicant has failed to understand the all-important ecological context for assessing significance in the scheme area, with the result that sites and terrestrial indigenous biodiversity are typically undervalued.

77 Except for the reservoir, the effects of the scheme on terrestrial ecological values in the footprint area and the mitigation offered are largely generic. This lack of specificity and a reliance on future surveys and management plans means that effects and mitigation are poorly described.

78 My overall conclusion is that information provided by the applicant about terrestrial ecological values and how they will be affected by the scheme footprint is seriously deficient.

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Appendix 1: Significant sites map [to be provided separately]

Appendix 2: Key ecological areas map [to be provided separately]

Appendix 3: Common plant names (exotic species are denoted by an asterisk)

Common name	Scientific name
Beech	*Nothofagus* spp.
Bog rush	*Schoenus pauciflorus*
Bracken	*Pteridium esculentum*
Broadleaf	*Griselinia littoralis*
Broom	*Cytisus scoparius**
Cabbage tree	*Cordyline australis*
Creeping buttercup	*Ranunculus repens**
Creeping bent	*Agrostis stolonifera**
Creeping pohuehue	*Muehlenbeckia axillaris*
Docks	*Rumex** spp.
Foxtail grasses	*Alopecurus** spp.
Gorse	*Ulex europaeus**
Kanuka	*Kunzea ericoides*
Kohuhu	*Pittosporum tenuifolium*
Kowhai (South Island)	*Sophora microphylla*
Lancewood	*Pseudopanax crassifolius*
Lawyer	*Rubus schmidelioides*
Leafless lawyer	*Rubus squarrosus*
Leather-leaf fern	*Pyrrosia eleagnifolia*
Little hard fern	*Blechnum penna-marina*
Lowland flax (or flax)	*Phormium tenax*
Manuka	*Leptospermum scoparium*
Matagouri	*Discaria toumatou*
Mingimingi	*Coprosma propinqua*
Native bindweed	*Calystegia tuguriorum*
Native broom	*Carmichaelia* spp.
Native jasmine	*Parsonsia capsularis* or *P. heterophylla*
Native violet	*Viola cunninghamii*
Necklace fern	*Asplenium flabellifolium*
Plume grass	*Dichelachne crinita*
Pohuehue	*Muehlenbeckia australis*
Porcupine shrub	*Melicytus alpinus*
Prostrate kowhai	*Sophora prostrata*
Pukio	*Carex secta*
Raupo	*Typha orientalis*
Red beech	*Nothofagus fusca*
Shrub pohuehue	*Muehlenbeckia complexa*
Silver tussock	*Poa cita*
Speargrass	*Aciphylla* spp.
Spike sedge	*Eleocharis acuta*
Swamp kiokio	*Blechnum minus*
Tall fescue	*Festuca arundinacea**
Thistles	*Cirsium** spp.
Toetoe	*Cortaderia richardii*
Tutu	*Coriaria sarmentosa*
Willow weeds	*Polygonum** spp.
Willows	*Salix** spp.
Yorkshire fog	*Holcus lanatus**