

**BEFORE THE INDEPENDENT COMMISSIONERS
OF THE
QUEENSTOWN LAKES DISTRICT COUNCIL**

IN THE MATTER of the Resource Management Act, 1991

AND

IN THE MATTER Peninsula Bay Joint Venture
Peninsula Bay North Plan Change 51

STATEMENT OF SUPPLEMENTAL EVIDENCE OF DAWN PALMER

9 August 2016

Relevant Professional Background - Additional Information

1. I have introduced my broad qualifications, background and international experience in my evidence in chief and will not repeat that in my supplementary evidence.
2. However, I would like to make a few balancing points in relation to the experience Dr Bramley has gained in other areas of New Zealand as an ecologist for Mitchell Partnerships; compared with my own. I have been fortunate within my consultancy business to have been able to focus on local ecology and the protection and restoration of local indigenous biodiversity over the past 23 years in Queenstown Lakes District Council area.
3. I have however undertaken ecological assessments in Northern Southland relating to the potential ecological effects of conifer spread following the establishment of extensive plantations, a report I co-authored with Nick Ledgard of Scion in Christchurch. I also co-authored Council's first wilding conifer strategy in 2004. I have also provided ecological assessment and preliminary enhancement plans for a large McKenzie Basin property; I have co-authored a paper accepted last month for publication by Austral Ecology, the journal of the Australian Ecological Society on the trial translocation of the buff weka into an unfenced mainland site (Motatapu Valley).
4. I have prepared ecological assessments and recommendations for Plan Change applications in Kingston, Peninsula Bay, Riverside Stage 6, Shotover Country, Henley Downs, Three Parks and Arrowtown South. I have prepared and handed over operational implementation plans for enhancement planting at Hillend Station. Mitchell Partnerships engaged my services for several of these projects.
5. I have also surveyed gulls, terns and waders for Otago Regional Council in the Rees and Shotover Rivers, Dr Bramley relied on some of my work for his.
6. I have recently provided pro bono, collegiate advice to Dr Bramley and Steven Tuck a consultant for Mitchell Partnerships regarding planting and rabbit control on an Emerald Bay project for which they have expressed gratitude.
7. I have managed the monitoring and remediation of skifield developments at Coronet Peak, Remarkables and Treble Cone from 1996 – 2001 and 2004 to the present.
8. I have very strong local knowledge of the District's ecology and practical experience relating to the reinstatement of indigenous biodiversity. I have prepared and supervised the ecological enhancement of Council administered reserves in Gorge Road, Queenstown, the south end of Lake Hayes, co-authored the Albert Town Reserve management plan; and have overseen the ecological enhancement of several local

properties over the past 14 years, some examples that have informed my views in respect of this Plan Change application are provided as **Attachment 1A to 1E** at the back of my supplemental evidence.

9. I will clarify issues raised in the evidence of Ms Taylor, Dr Bramley and Mr Botting, and I will aim to simplify the salient issues that need to be addressed. While some discussion of history is necessary to understand the issues, I agree with Ms Taylor that a forward thinking approach will be the most helpful to the panel.

Matters Arising from Louise Taylor's Evidence

10. Points of Clarification

11. Paragraph 10.4 of Ms Taylor's Evidence summarises the key ecological consideration arising from my evidence as she understands them.

12. I would like to clarify her statement of understanding in paragraph 10.4 (d) :

"(d) The site's biodiversity will be reduced and will result in a net loss of the species present;"

And refer the panel to

Paragraph 129 of my evidence in chief, in which I stated

"It is my view that the proposal as it stands will not sufficiently enhance, protect, maintain or safeguard the site's biodiversity or deliver "improved ecological integrity, diversity, function and connection between existing patches of habitat, and a net positive ecological outcome". Rather, it will result in a net loss of kanuka and depleted fescue grassland at this site where it can currently be readily seen and experienced as a local example of a once more widespread community, in need of improved management; an opportunity to "halt the decline".¹"

13. I did not say the biodiversity would be reduced, nor that there would be a net loss of species present.
14. Ms Taylor misunderstood my point in Paragraph 10.4 (f) *"Monitoring the replanting and its ongoing maintenance is difficult. The outcomes would be more certain if such planting occurred on public land."*

¹ New Zealand Biodiversity Strategy (2000) Ministry for the Environment, Wellington. Goal Three.

15. I referred to the difficulty of monitoring compliance in respect of planting on private land in my Paragraph 79, this led to my recommendation that plantings occur substantially within open space; this amendment has been made by the requestor.
16. I do not consider that ongoing maintenance of plantings will be difficult, it will simply be required during establishment and the maintenance of the overall values in the open space otherwise conifers will establish and suppress the existing and potentially planted communities; whatever they are. Residents of the subdivision will no doubt already be weeding Douglas firs from their gardens.
17. Clarification to paragraph 10.5 (b), there are no “endangered” species present to my knowledge however there have been at least 3 At Risk² plant species recorded and a New Zealand falcon (At Risk – recovering) which was found perched on a stump in proposed Lot 16.

At Risk species:

- Cushion Pimelea *Pimelea sericeovillosa* subsp. *pulvinaris* (not commercially available) – At Risk – declining
- Prostrate bluegrass *Connorochloa tenuis*
- Beauverds Scabweed *Raoulia beauverdii* - At Risk – Naturally uncommon

Data Deficit species

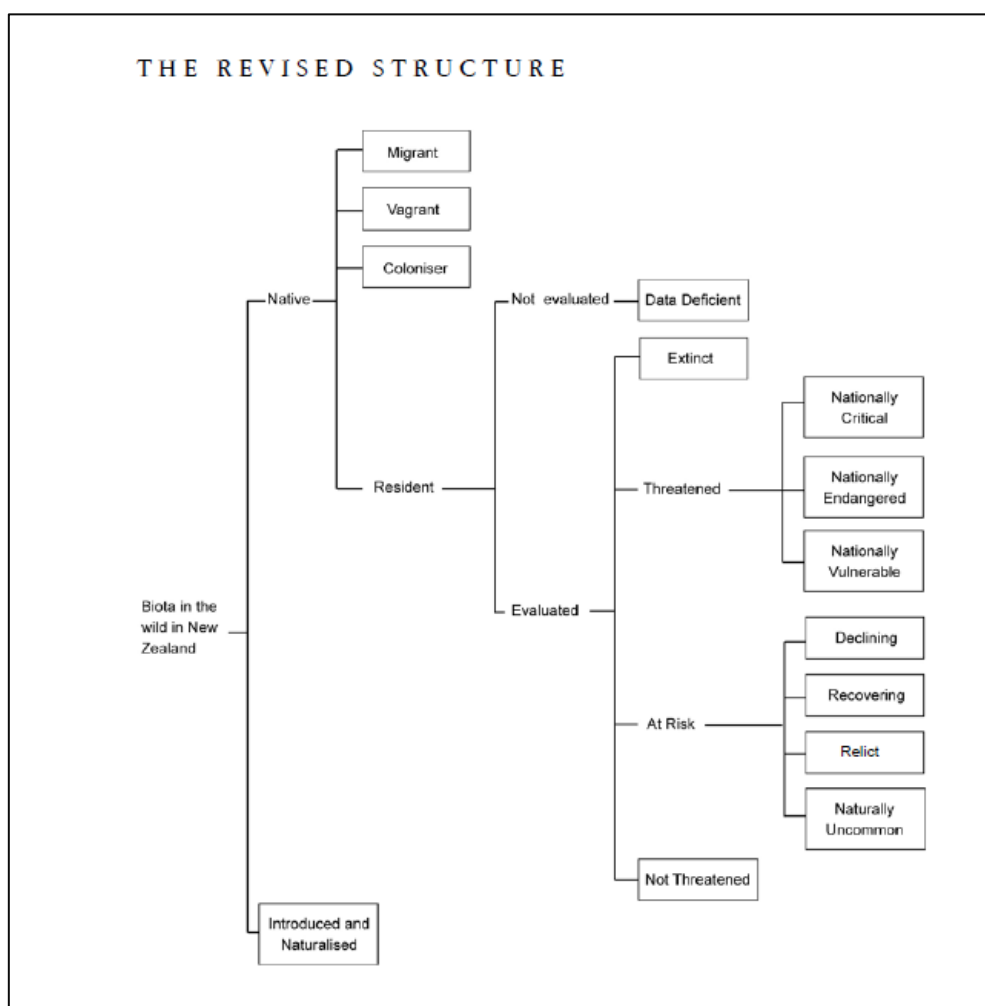
- Possibly *Coprosma brunnea* – Data Deficient – it’s threat classification had not been assessed when the Conservation Status of New Zealand’s Vascular Plants was last updated and published in 2012; a photograph of a species was sent to me by Anne Steven on 27th July who recorded it in Lot 13.

18. A chart clarifying the hierarchy of threat is provided for information below.

² Townsend, A.J. et al, (2008) New Zealand Threat Classification System manual. Science & Technical Publishing Department of Conservation, Wellington

19. Clarification of 10.5 (e) *“The introduction of new woody species for the purpose of amenity/mitigation planting should not be seen as providing ecological benefit.”*

20. The introduction of indigenous species other than those present will provide ecological benefit to the area in so far as birds and invertebrate are likely to benefit from their presence. However, the replacement of indigenous vegetation naturally associated with an environment, with indigenous vegetation not naturally associated with an environment undermines the integrity of the existing community if it does not replace it outright. I therefore considered the benefits to be related to landscape amenity and not a reasonable compensation or mitigation for the loss of the existing community, containing At Risk species in an acutely threatened environment.



Historical Vegetation

21. In addition to the references cited in my evidence in chief, I also relied on and therefore should have cited the helpful maps (last updated in 2014) produced by Leathwick (2001) which provide an alternative approach for predicting New Zealand's potential forest pattern prior to the Maori fires about 800 years before present – I have provided a copy of this as my **Attachment 2**. I also referred to Wardle (1991)³, Burrell (1965), Walker, et.al. (2006), Cieraad, et.al. (2015) and Wardle (2001), referenced below.

22. Leathwick's (2001)⁴ analysis and modelling were used to predict forest patterns based on species – environment relationships. His results agreed closely with published descriptions of New Zealand's forests (including Wardle, 2001), and are considered reliable predictors for sites which have long been deforested. This modelling work was undertaken around the time of the development and subsequent publication of LENZ. We (ecologists) use the LENZ classifications as surrogates for the potential full range of terrestrial ecosystems and their associated biodiversity (Walker, et. al. (2006)⁵. In 2007, this work was extended into the Threatened Environment Classification. A review of that system has just been published by Cieraad, et. al. (2015).⁶

23. Reconstructions of the pre-clearance vegetation patterns have, prior to the models developed by Leathwick (2001), relied on a range of publications including one by Molloy et. al. (1963)⁷, who identified and described the distribution of subfossil forest remains collected in the eastern South Island. In Central Otago, Molloy et.al (1963) reported most of the fallen totara logs were found between 450 and 1050 masl., and in drier areas, mostly on southern aspects, while beech charcoal was comparatively scarce but found between 760 masl and 1220 masl.

³ Wardle, P. (1991) *The Vegetation of New Zealand*. The Blackburn Press

⁴ Leathwick, J.R. (2001), 'New Zealand's potential forest pattern as predicted from current species-environment relationship' *New Zealand Journal of Botany* 36:447-464.

⁵ Walker, S. et. al. (2006) Recent loss of indigenous cover in New Zealand. *NZ Journal of Ecology* (2006) 30(2): 169-177 ©New Zealand Ecological Society

⁶ Cieraad, E. et.al (2015) An updated assessment of indigenous cover remaining and legal protection in New Zealand's land environments *New Zealand Journal of Ecology* (2015) **39(2)**: 309-315 ©New Zealand Ecological Society

⁷ Molloy, B. P. J.; Burrows, C. J.; Cox, J. E.; Johnston, J. A.; Wardle, P. 1963: Distribution of subfossil forest remains, eastern South Island, New Zealand. *New Zealand Journal of Botany* 1: 68-77.

in deep mountain gullies. Molloy mapped the broad distributions of forest remains and these compare closely to the maps produced by Leathwick, (2001) and Wardle (2001).

24. Wardle (2001) cited by Dr Bramley, described and summarised the recent distribution of beech forest and also identifies that manuka (*Leptospermum scoparium*) and kanuka (*Kunzea ericoides*) – as it was known, are successional to broad-leaved forest, but in the drier areas they are self-perpetuating. He has summarised that as one approaches the 900mm isohyet from areas of higher rainfall, e.g. the around Emerald Bluffs, a site, Dr Bramley is clearly familiar with, or the elevated ranges of the Pisa Ranges, the pattern of forest is fragmented with only isolated stands in sheltered locations in the drier areas. I have reproduced this figure also in **Attachment 2**.

25. I believe Dr Bramley has misinterpreted or incorrectly extrapolated from Figure 1 in Wardle (2001) to draw a conclusion that the shared rainfall isohyet of Wanaka, Cardrona Valley, Luggate Creek and the southern end of Lake Hawea mean that beech forest would have been present in the Plan Change site, (paragraph 22 (d) of Dr Bramley’s evidence. I believe he has overlooked the influence of the sheltering mountains (in Q2 Land Environments) on the distribution of beech in those areas compared to the exposed environment of the Peninsula (N5.1c). This relationship is well illustrated in the map based on Leathwick (2001) discussed above and copied from the Landcare Research “Our Environment” web site, included in **Attachment 2**.

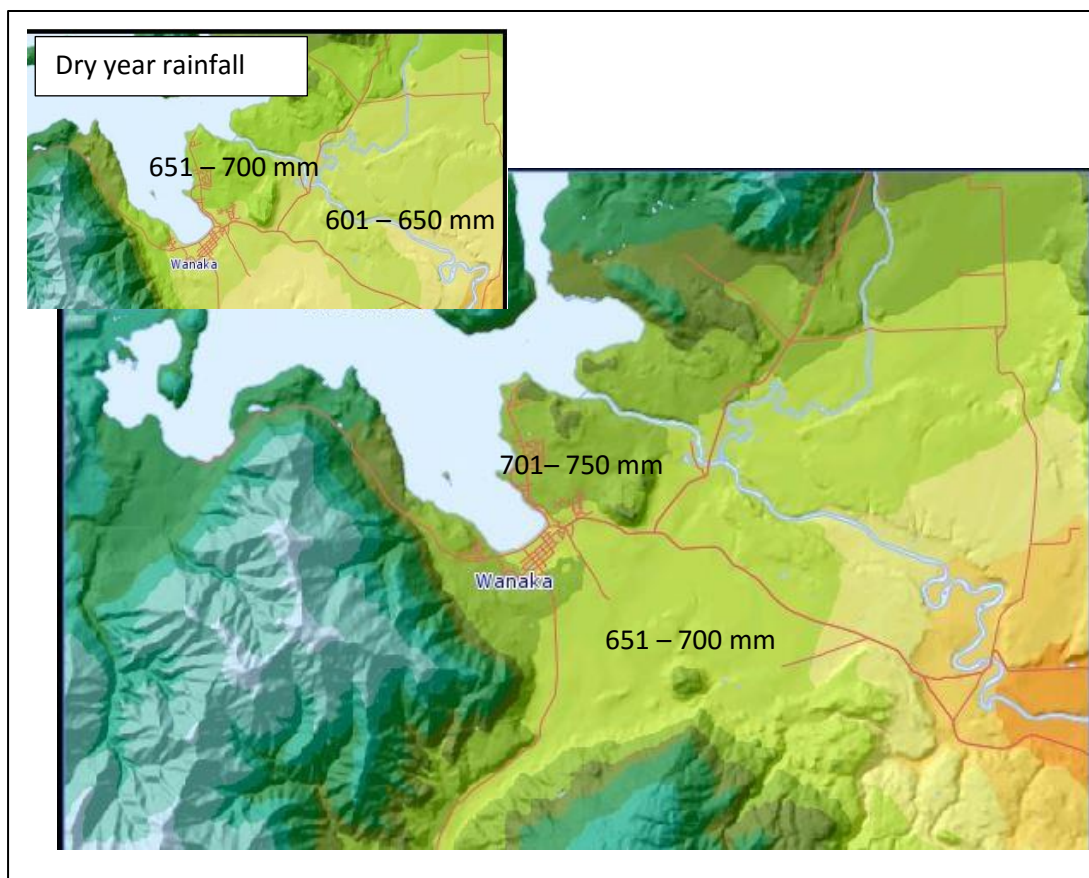
26. Wardle (2001) also notes that grey scrub (including small kowhai trees and *Olearia* spp.), and dominated by matagouri is widespread on slopes where rainfall is low and on river flats where rainfall is higher”, “despite over a century of attempts to destroy it”.

27. Wardle (2001) relies on Burrell (1965) in relation to the distributions of kanuka and manuka shrublands.

28. Wardle (2001), citing Burrell (1965) describes the extension of manuka’s distribution into moister sites with higher rainfall. And the presence of “self-perpetuating stands of kanuka” which are extensive on dry, shallow soils on gravelly terraces between Hawea, Wanaka, Queensberry and Tarras. On the driest sites, the plants remain short and separated by bare surfaces. At the Plan Change 51 site, we see these open gaps occupied by depleted fescue

tussock, *Pimelea* spp., *Coprosma petriei*, *Melicytus alpinus*, *Raoulia australis*, and *R. beauverdii* mosses and lichen and others.

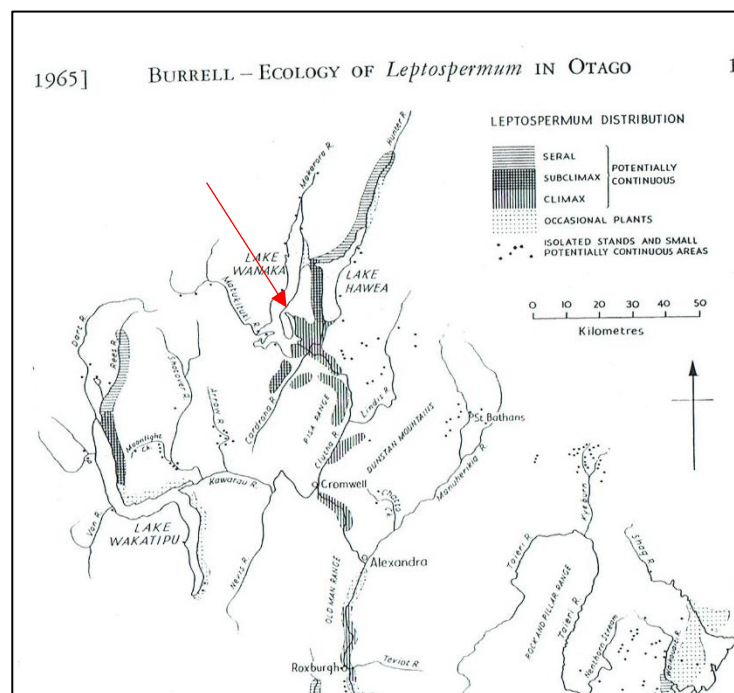
29. Consideration of rainfall therefore becomes an important abiotic driver of the extent and distribution of beech forest and kanuka, and self-sustaining kanuka communities, refer to the median annual rainfall map I have copied from the Grow Otago website - **Map 1** below.
30. In 1965 when Burrell published her research into the ecology of *Leptospermum* in Otago, both kanuka and manuka were placed within the genus of *Leptospermum*. Burrell (1965) states that the where rainfall exceeds 750mm on the provisional rainfall maps in publication at the time, *Leptospermum* is seral towards forest initiating this by invading grassland. Climax *Leptospermum* stands are reported to develop “where the rainfall is about 600 mm”. Burrell mapped the vegetation on the Peninsula north of Wanaka as Climax kanuka stands – I have reproduced her *Figure 3*, as my **Figure 1** below.



Map 1 Median Annual Rainfall with a dry year inset (<http://growotago.orc.govt.nz/>), based on rainfall data spanning **1970 to 2001**.

31. Burrell's 1965 description of climax *Leptospermum ericoides* (kanuka) stands uses as an example, a stand in Wanaka Flat, near Alberttown. This provides a very useful and similar comparison to the existing vegetation found at the Plan Change site.
32. The climax kanuka stands consist of "widely spaced bushes", "rarely exceeding 4 metres in height", they never form a closed canopy but the roots extend up to 30 metres across the gaps. "The vegetation in these openings is a sparse turf of *Raoulia australis*, small herbs, lichens, and mosses dotted with occasional shrubs less than 0.5 metres high," e.g. *Pimelea* spp. The amount of regeneration is influenced by the death of mature trees with mortality giving rise to regeneration. This closely matches the vegetation found, particularly in the area of Lots 6 and 13 to 16.
33. Dr Bramley has frequently referred to the fescue grassland community as unsustainable, as kanuka will invade the grassland, this is a natural process. I accept Burrell's (1965) peer reviewed study that as a Climax community, the open areas are likely to persist as they have to this point, unless infested by conifers.

Figure 1 The distribution of *Leptospermum* in Otago reproduced from Burrell (1965).



34. While not wanting to belabour the issue, understanding of historical vegetation patterns, provides the foundation for my assessment of representativeness and ultimately, along with other considerations addressed by Dr Bramley, significance. It also provides a foundation upon which to consider goals for restoration enabling us to turn towards a forward focus.
35. I stand by my earlier view regarding the historical vegetation of the site. In fact, review of published articles refreshes my understanding of the background to the opinion I formed after considering all the information and revisions for this application.
36. The chronology of the references I rely on may be helpful in understanding the value of the remaining community; Molloy et.al. (1963) used sub-fossil charcoal to map the historic distribution of beech, Leathwick (2001) cites this but uses regression modelling of species-environment relationships to achieve a similar map of historic beech distribution. Burrell (1965) provided a benchmark peer reviewed publication for the distribution of kanuka and manuka and a description of the ecology of these species. Her paper continues to be cited in peer reviewed literature. Wardle (2001) published his paper on the recent and current distribution of forest in the Upper Clutha providing another benchmark for change; and as I have said, he deferred to Burrell (1965) on kanuka/ manuka distributions. Walker, Lee and Rogers (2003), also undertook to model the present and past distributions of the woody vegetation of Central Otago for the purpose of identifying future restoration needs⁸. Their model places the Plan Change area into woody vegetation zone 4 – kanuka – kowhai – Hall's totara. Their models suggest that the Upper Clutha valley floors were dominated by these species and drought tolerant shrubs, they acknowledge that more diversity may have been present based on pollen and subfossil research but beech trees are and were present and they increase in their dominance on the hill slopes surrounding the valley floors. This is consistent with my interpretation of the findings of all the other references I have cited.
37. The kanuka climax community present is similar to that described by Burrell (1965). It remains my view that the kanuka and associated depleted fescue tussock community, while modified, provides a valuable and representative example of the community historically more widespread. In fact, the very small area of fescue tussock grassland remaining in the Plan Change area may actually be the best of what remains in the District. While not the best

⁸ Walker, S., Lee, W.G and Rogers, G.M (2003) The woody vegetation of Central Otago, New Zealand: its present and past distribution and future restoration needs. Department of Conservation , Wellington

(nationally), it is still valuable. We may have to travel towards the McKenzie Basin to find a better example. If I remember correctly, this point was made by Di Lucas in during the Variation 5 hearings in 2005.

38. In describing the significance of the site, we have also referred to the Threatened Environment Classification and acutely threatened environments. Refer to **Figure 2** below. It is important to note that this community has persisted within an acutely threatened environment despite the history of farming, fires, rabbits and more recently informal tracks and recreation.

39. The site still sustains the recognisable composition of the benchmark communities, At Risk species and it is my view the vegetation present, particularly in the north eastern area of Lots 13 to 26 is definitely locally if not regionally significant. My review of the literature has consolidated this view.

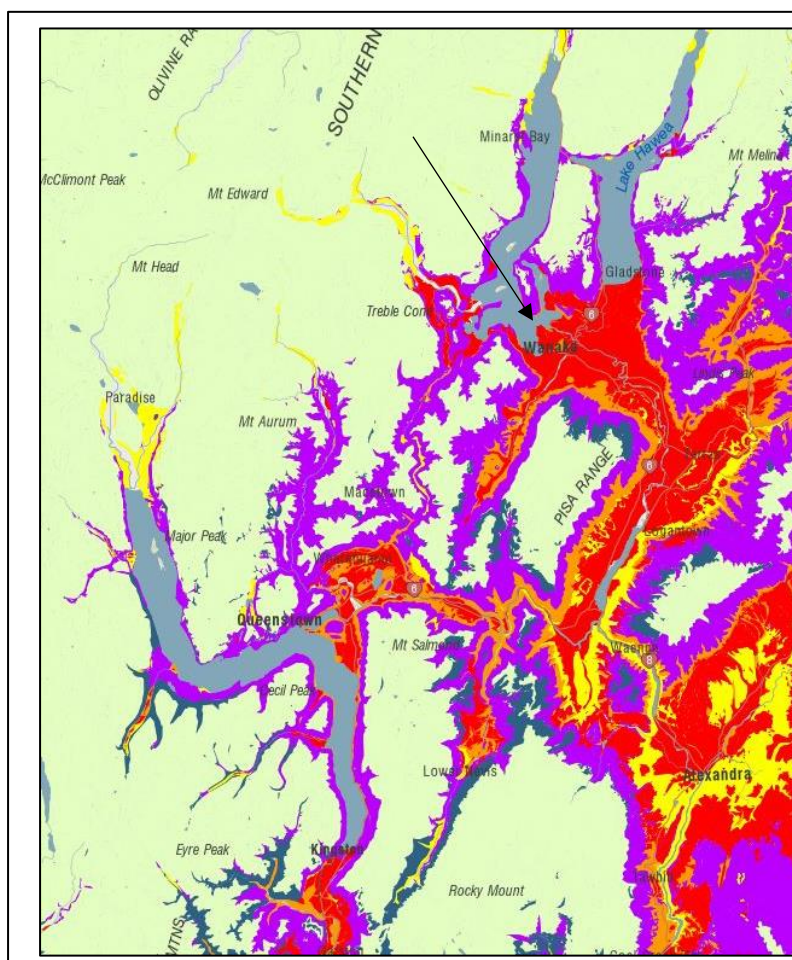


Figure 3: Acutely threatened land environments have < 10% cover left; in this instance, about 2.5%. Within threatened environments generally, habitats of indigenous species have been lost or substantially modified, little indigenous biodiversity remains and where it persists it may be vulnerable to further loss. About 0.7% of the vegetation associated with this environment is protected.

Figure 2 – Threatened Environment Classifications in the Lakes and Central Otago Ecological Regions

<http://ourenvironment.scinfo.org.nz/ourenvironment>

40. It is my opinion that the appropriate forward focused management response should not therefore be to establish a 26 Lot subdivision upon the land and replace the existing community that has persisted potentially since before humans occupied New Zealand, with beech forest because it is suggested by Dr Bramley that it would be more sustainable and cost effective to manage. Additionally, he considers the management of the short tussock grassland present to be unsustainable although it has persisted in the face of threats thus far.

Cost of Maintenance

41. I have addressed differences of opinion between Dr Bramley and I with respect to the historical vegetation. I would now turn to the matter of the cost of maintenance compared to replacement of the existing community with a larger, different community.
42. I will now address the issue of the 'significant cost of maintenance' raised by Dr Bramley and Ms Taylor.
43. The cost of status quo. I have not yet seen or heard any detail around what the estimated costs are to substantiate the view that the cost of the status quo option is unacceptable?
44. I can however, provide examples of recent projects that I have supervised, been associated with or in the case of the Whitechapel Reserve, have been watching. Photos of these examples are provided as **Attachments 1A to 1E**.
45. The Littles Stream example (Attachment 1A) covered an area of about 6.1 hectares(ha), however only about 4 ha were planted, 1.5 ha were planted with oaks, ashes and poplars. The Resource Consent conditions applying to this site required a 10 year, bonded maintenance regime. The goals were to reinstate indigenous diversity, to achieve this in a way that blended with the surrounding pastoral landscape, to create what appeared to be remnants of indigenous vegetation within an open, Arcadian landscape. I supervised the implementation of planting and maintenance from start to finish. The budget was in the order of about \$500,000. Almost 35,000 plants were included in the initial plant out with a further 1,500 replacement plants introduced. Rabbits were never an issue at the site. Stock were fenced out and the cost of this was not included in the figure given above.

46. In Areas 1 and 4 of the Littles Stream project, we planted silver tussocks and *Elymus solandri*, (blue wheat grass). The dry northern face of Area 1 has retained the *Elymus* well, while in Area 4, silver tussocks were vigorous at year 4 to 5 and have since relaxed into the pasture sward. Shrubs planted into the south facing slopes of Area 4 have now emerged and provide a visible contribution to the site. I have observed skinks within the grassland and fantails within the shrubland communities established and, I've disturbed nesting harriers on some of my more recent monitoring visits, falcon also hunt over this area. The biodiversity of the area has been supported and enhanced with a low key addition of diversity. Littles Stream as a Q2 environment would be likely to follow a succession towards beech forest.
47. The example given in Attachment 1B is a property also located in the Wakatipu Basin. The goal of the client here is to support the existing vegetation by boosting its diversity. The land is rabbit ridden. Before starting planting, rabbit control was undertaken and the areas scheduled for planting were rabbit fenced. Follow up rabbit control occurred after the fences were completed and continues. Plants were protected with rabbit guards. Failure to maintain the fence will allow rabbits to gain access to the *Coprosma*, *Olearia*, native broom, kowhai, *Melicytus alpinus* (porcupine shrub) and tussock grasses (*Elymus*, *Poa colensoi* (blue tussock) and silver tussocks. At this site more than 40 ha is scheduled for planting as open, low density clusters. The initial budget was about \$250,000, for 3 years, including the preliminary rabbit control and fencing. This project is in its initial stages in a N4.1d environment.
48. The example provided in Attachment 1C is a site on the western flanks of the Remarkables, south of the Remarkables ski field access road in a N4.1d environment. Tussocks (silver, narrow-leaved and red) were planted to reinstate a shrubland community dominated by matagouri, *Coprosma*, *Olearia*, *Ozothamnus*, native broom etc. The site was irrigated, rabbits and deer were excluded and reinvasions controlled by fencing and follow up. Sycamore, broom, briar and conifers were removed prior to planting and control of woody weeds continues on an annual basis 14 years later⁹. I am not able to provide the total budget on this project.
49. The example provide in Attachment 1D is located to the west of the example above adjacent to SH6, lower on the slopes within an N5.1c environment, the same as the Plan Change area. It shows where the height of a berm was increased and planted with silver tussocks into pasture grass. 10 years later, in this drier, open site, the tussocks have persisted.

⁹ Personal communication Grant Hensman, 8/8/2016

50. As to the ease or ability to recreate, and transplant the diversity of the existing fescue tussock community within the Plan Change area, I draw on a more local example of a site I monitored on Hawea Flat. The conditions of that Resource Consent required 2 at Risk species (*Raoulia beaverdii* and *Leptinella serullata*) to be translocated out of the footprint of disturbance for a residential dwelling. We surveyed the surrounding area to identify where these species were and to ensure we could find similar and appropriate locations to move the plants into. The transplanting could not be considered a success. We lifted plants while protecting their entire root structures with supporting soil, planted these into prepared sites, bedded them in, tagged them, photographed them. The site response was that rabbits were attracted to the disturbed soils and dug around the translocated blocks of soil and plants. The disturbed soil released an annual legume (suckling clover) which shaded the translocated plants. Dry summer conditions were not managed, the plants were not irrigated or weeded and in the end I believe most failed to establish. Surveys found that the species were well distributed across the site and that the persistence of these species at the site was not threatened. Ironically, the browsing pressure of sheep and rabbits at that site helps maintain the openness that enables the persistence of these species.

51. The learning from these examples that can be transferred to the Plan Change area is that without doubt, it is easier to protect, enhance and maintain the existing vegetation than to re-create or replace it. Transplanting is not, based on my recent experience, a reliable means of retaining the At Risk species unless close maintenance is planned and the effort considered as a trial. The portion of the site where the ecological values remain and are highest are in the areas identified within Lots 6, and 13 to 26.

52. It remains my view that the best management of the site is protection, release from infestations of conifer and rabbits and enhanced with supplementary planting to support the existing diversity or to plant additional seral shrubland species to support the kanuka shrubland. The site does not need as a management response to be planted to transition the small area remaining, towards a more diverse beech forest community. The remaining community is a fragment, at the northern margin of a peninsula.

53. The support of progress towards a kanuka climax shrubland is also not inappropriate at this site.

54. The response of the requestor to my concerns in this regard, has been to increase the area to be planted using a “species palette” that could be dominated by beech forest species. Given the isolation of the site and its relative contiguousness with the band of similar kanuka dominated vegetation extending around the lake edge to the Clutha Outlet and down the Clutha River, supplemental planting of kanuka and fescue grassland is a response that better supports the character and context (pattern) of the site than introducing a pocket of beech forest, which will introduce more native diversity but does not support the character of the existing community, or result in *“improved ecological integrity, function and connection between existing patches of habitat.”*
55. This is the primary crux of the difference in opinion between Dr Bramley and I.
56. In terms of whether the proposal better meets or enables Part 2 of the RMA; in this situation, more is not necessarily better. When we are looking to balance a site with its surrounding environment and support the ecological context it shares with its existing environment; maintaining, enhancing and protecting the life supporting capacity of what is here, can be achieved through better custodial management. Status quo with better management is a preferred outcome for this site. i.e. declining the plan change which will facilitate subdivision and development, and under the amended proposal, would trigger the replacement of a large portion of the existing communities with houses, gardens and further modification of the indigenous vegetation.
57. I agree with Dr Bramley that trying to reinstate the natural diversity of the fescue grassland associated with the climax kanuka community would be very difficult. Some of the smaller herbs, rushes, moss and lichen are simply not commercially available. Prostrate blue wheat grass is not commercially available and it produces a very small amount of seed, yet I have found it as a component of several dry, exotic grassland sites within the District. It’s better to manage the existing than replace with a community perceived as being easier to manage. It is more cost effective to protect and maintain than to recreate or replace the community and protection is more appropriate than replacement with alternative communities intended to push the site along a successional advancement towards beech forest.

58. This is a fringe area of kanuka and short tussock grassland – pasture grassland, I don't think it practically reasonable to anticipate that this area will follow a path of succession towards beech forest because we plant some in the revegetation areas.

59. Regardless of which future management option is adopted or approved, management of wilding conifers and rabbits is recommended. Beech forest species are more palatable than kanuka (which is why kanuka regeneration is continuing to occur naturally).

The cost of maintenance and protection from rabbits

60. The cost of rabbit control may range from (\$70 per hectare to \$160 depending on the methods used). Follow up is required and that may entail a cost of about \$60 per hour for a dog, gas and gun operation.

61. It is my strong recommendation that no planting should occur unless rabbit control is first undertaken and plantings protected from browse. I refer you to my Attachment 1E which illustrates the work required to protect plants where rabbit control has not occurred. You see in the photographs taken last year that rabbits have come through the rabbit netting and eaten through guards to access establishing plants. There are guards on guards at this site.

62. Rabbits are present under the existing kanuka at the site in contradiction to a suggestion that they may not be. Refer to my **Figure 3** below. Release from this rabbit infestation will enable kanuka regeneration to continue and any shrubs or grasses planted within or at the margins of this stand to establish. It would be a poor use of resources to attempt to plant into this area without first undertaking rabbit control.



Figure 3 – Rabbit warren within Kanuka stand between proposed Lots 12 and 13. Photo taken by D Palmer 22nd June 2016.

63. The cost of Status quo and improved custodial management may therefore require rabbit control over the site and surrounding area, ideally in an effort co-ordinated with the other land owners. This would release the site and regeneration from the pressure of browse.
64. The second recommended maintenance task is in relation to conifer control. If no control were to be undertaken on the land, conifers will continue to infest the site and eventually, if un-checked, dominate the kanuka stand. This will happen regardless of who owns it and whether its planted or not planted.
65. I would suggest that landowners in the establishing subdivision to the south suffer from rabbits eating their garden plants and are weeding conifers from within their allotments or gardens. That won't change unless rabbits are controlled and seed rain of conifers is removed.
66. On this note, the Status quo of "no management" on the site is also not a static situation. It seems likely that the conifers will be harvested at some point in the future and the seed rain will be removed or substantially diminished.

67. Additionally, I am advised by animal pest control staff of Otago Regional Council¹⁰, the Animal Health Board (AHB) has been liaising with Australian research organisations in relation to the release of the K5 (Korean) RHDV-5 strain of the calicivirus, this strain has recently been approved for release in Australia in Autumn 2017. Approval from the Minister of Primary Industries and the Environment Protection Authority (EPA) is required before it can be imported to New Zealand. But it is estimated that it could reduce rabbit numbers by 30%.¹¹

68. The control of animal pests occurs on public and private land all over New Zealand. Inconvenience to dog owners is usually managed by public notification procedures that may include public engagement and consultation. This is part and parcel of the issues associated with having these sorts of land management problems at the margin of residential areas.

Planting and maintenance costs.

69. From my recent and ongoing project experience in reinstating indigenous biodiversity I estimate that the cost of supply, planting and maintaining a plant in the ground for 3 years is approximately \$15 dollars, this allows for some replacement costs and release from competition during establishment and includes a protective guard. If 2.4 ha are planted with a plant per metre squared I estimate the initial establishment costs to be about \$360,000. Excluding rabbit control. Boundary fencing will very likely be an unpopular and unreliable option given the amount of recreational use.

Matters in relation to Mr Botting's Evidence

70. Referring to paragraph 50 of Mike Botting's evidence, in providing my estimations he is correct, I relied on the use of Google Earth Pro to estimate clearance of vegetation to facilitate construction of the tracks identified on the Plan dated 5 November 2015. I used the same tool for estimating vegetation losses over the site.

71. The metres of track that dissected kanuka were estimated to be about 578 metres, (see Table 1A below). I also relied on an estimate of up to 5 metres of clearance which was a width given to me by Jeannie Galavazi as a maximum potential width, depending on the standard to which tracks would be constructed (this would clearly be a worst case scenario).

¹⁰ Personal communication, Haines Battrich, ORC, Alexandra 17/2/2016.

¹¹ <http://www.landcareresearch.co.nz/about/news/media-releases/new-virus-to-control-rabbits>

72. In relation to paragraph 50 of Mr Botting's evidence; the draft land covenant condition 9 in the notified application proposed that "fence and boundary lines may be cleared of vegetation for the purpose of establishing the fence only". The covenant conditions were then incorporated into the proposed rules of the Plan Change. The Structure Plan dated 5 July 2016 also allows for vegetation clearance for the purpose of establishing a fence.
73. My estimates of potential vegetation loss, were drawn from the areas shown in Figure 1 (page 9) of my evidence in chief. It was, and is my opinion based on the information provided by the requestor in November 2015, that the full extent of potential clearance and potential loss had not been fully appreciated and or disclosed, and this led to my view that the the ecological benefits of their proposal were over stated.
74. The area of fencing through kanuka and short tussock grassland in the areas of Lots 13 to 26 as shown on the Revised Structure Plan dated 1 August 2016 appears to have increased the amount of clearance for fencing.
75. The post and rail fencing shown in Figure 10 of my evidence is the fence bounding the existing subdivision along Infinity Drive. The vegetation clearance and set back of vegetation from the fence suggests that an estimation of 2 metres from the fence line was not unreasonable. In fact, I had forgotten to include the fence line adjacent to Lots 23 and 24, I should have estimated the clearance as 187 metres multiplied by a 2 metre clearance width which would have resulted in 374 m² to be cleared by fencing. I only measured fence lines that appeared to dissect rather than fringe an area of kanuka.
76. I note that the applicant's ecologist has updated the areas of vegetation to be cleared and planted to achieve a total net gain of 5,680 m² of kanuka although their plans suggest that could actually be beech forest.

Table 1A Estimated length of track through kanuka

Existing Community	New Track Location	Estimated length (5 Nov)	Estimated length (1 Aug)
kanuka	Trk N of Lot 6	38	0
kanuka	Proposed tracks near Lots 12 - 13	115	115
kanuka	Track north of Lot 20	64	64
kanuka	Track south of sign north-west of Lot 12	15	15
kanuka	ATN - CP1 to Venus landing SE of Lot 25-26	106	68
kanuka	ATN - new track A	240	<i>not shown*</i>
estimated metres of track thorough kanuka		578	262
2 m wide construction disturbance		1156 m ²	524 m ²
5 m wide construction disturbance		2890 m ²	1310 m ²

Table 1B Clearance associated with fence construction

Existing Community	Fence Location	Estimated length – metres (5 Nov)
kanuka	Lot 20	53
kanuka	Lot 21 - 22	31
kanuka	Lot 22	43
kanuka	Lot 23 - 24	60
estimated metres of track through kanuka		187
2 m wide construction disturbance		374m ²

Summary and final points of clarification

77. The expanded areas clearly increase the area to be revegetated, there will be no doubt that there is a net gain in the revegetated areas versus areas cleared, however the net gain is not a replacement of like for like.

78. I think the option of lots 1-3 and 7 -11 becomes more viable under the proposal, however this is under the condition that there is some further compromise by the requestor in relation to the composition of the planting plan. I have again provided a revised Table 1 attached to this supplementary evidence, as a more appropriate response to the site, but consider the shrubland plantings should be 80 to 90 % kanuka and species such as *Hebe subalpina* and *Chionochloa macra* should be removed from the grassland plantings which should include a dominance of *Festuca novae-zealandiae* and *Poa colensoi* in the grasses planted.

79. However, I remain of the view that beech forest communities are not appropriate for this site, although I could accept isolated trees as landscape or garden elements.

80. The PBJV view of better providing for the sustainable management of the kanuka shrubland is that they will introduce diversity not currently (or likely to have been historically) present to try to initiate a succession towards forest, arguing this as a way to more sustainably manage the kanuka. I do not see the proposed revegetation as being appropriate for this site nor for managing the communities of kanuka and short tussock grassland which characterise the acutely threatened environment they are found in and I do not agree that it will be any easier to manage the replacement communities.
81. If approved, the ecological enhancement would be stronger if it was also coupled with removal of invading conifers from the Whole Open Space area prior to vesting the balance from any area subdivided with Council if they are successful. I understand this amendment has been made.
82. Kanuka climax shrubland is also not inappropriate at this site.
83. If approved, in part or in its entirety, there is a balance to be found between integration of diversity to support the existing community while introducing screening that may be required from lake views.
84. If consent were approved for some development, I consider there is still reasonable ecological gain that can be achieved if Lots 13 to 26 are removed from the proposal and management of the remaining open space focuses on the same objectives of protection, enhancement and maintenance. Additional planting can provide a subtler extension and support to the existing fringe of the communities rather than a replacement with another community, even though well intended. A simplified plan will provide a more cost effective solution that meets the requirements of Part 2 of the RMA.
85. If planting occurred to enhance the diversity of Kanuka shrubland with divaricating shrubland species and fescue tussocks and mat forming species, there would be a valuable ecological benefit. I have explained this to Dr Bramley. However, I would suggest that if rabbits were controlled, it would be more than just kanuka that regenerates naturally on the site.
86. If beech trees must be included, they should be clustered where needed to provide screening for residential dwellings viewed from the lake, however, it may be that kanuka will achieve

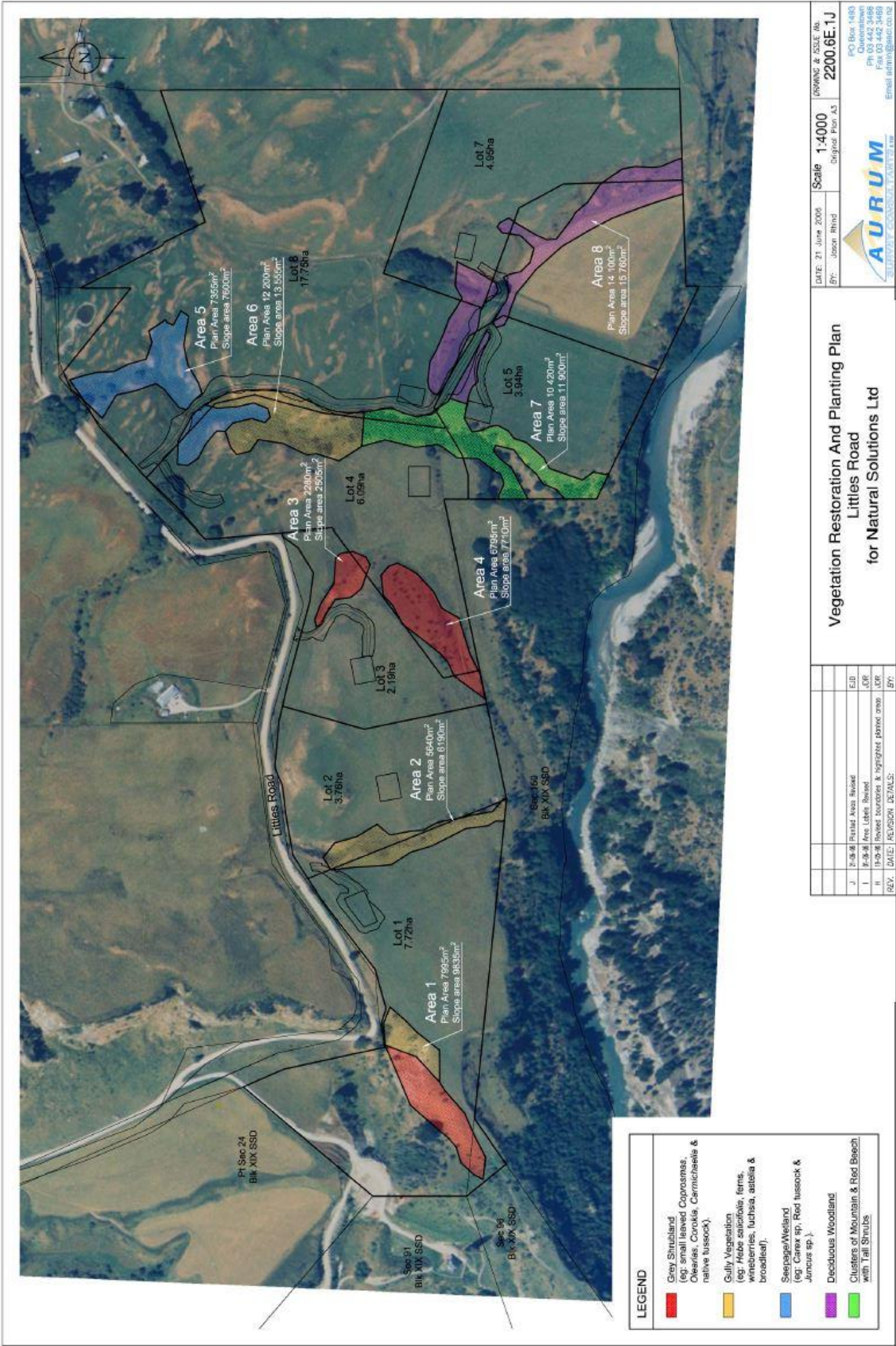
sufficient screening. I will defer to the opinions of the landscape architects on the need for tall vegetation to screen dwellings.

Amended Table 1 – Species recommended for inclusion in the Landscape Design Plan for Open Space and Allotment revegetation, enhancement or remediation planting

Species considered to be challenging to establish are noted as being “risky” and should be trialled before substantial commitments to planting them.

Screening or Garden Landscape species should not be in the revegetation areas.

Species name	Common Name	Community		
		Shrubland	Grassland	Screening/ Garden Landscapes
<i>Anthosachne solandri</i>	Blue wheat grass			
<i>Carmichaelia petriei</i>	native broom	W		
<i>Chionochloa rigida</i>	Narrow leaved snow tussock			
<i>Coprosma crassifolia</i>				
<i>Coprosma intertexta</i>				
<i>Coprosma petriei</i>	Turfy Coprosma		Risky	
<i>Coprosma propinqua</i>		W		
<i>Coprosma virescens</i>		W		
<i>Corokia cotoneaster</i>				
<i>Festuca novae-zelandiae</i>	Hard tussock			
<i>Fuscospora cliffortioides</i> ***	Mountain beech			
<i>Griselinia littoralis</i> ***	Broadleaf			(F) Low
<i>Hoheria lyallii</i>	Mountain lacebark			Risky - (F) Low/ Mod
<i>Kunzea</i> spp.*	Kanuka	W	sparse	(F) High
<i>Melicytus alpinus</i>	porcupine shrub	W		
<i>Muehlenbeckia axillaris</i>	Creeping pohuehue		Risky	
<i>Myrsine divaricata</i>				
<i>Olearia hectorii</i> **	Hector’s Tree daisy			
<i>Olearia lineata</i>				
<i>Olearia nummulariifolia</i>				
<i>Olearia odorata</i>				
<i>Phyllocladus alpinus</i> +	Mountain celery pine			
<i>Pimelea aridula</i>				
<i>Plagianthus regius</i> **	Mountain ribbonwood			(F) Low/ Mod
<i>Poa cita</i>	Silver tussock			
<i>Poa colensoi</i>	Blue tussock			
<i>Podocarpus laetus</i>	totara			(F) Mod/ High
<i>Sophora microphylla</i>	kowhai	W		
<i>Teucrium parvifolium</i>	<i>Teucrium</i>	W		
<i>Veronica (Hebe) odora</i>	Hebe			
<i>Veronica (Hebe) salicifolia</i> ***	koromiko			(F) Low/ Mod
<i>Veronica (Leonohebe) cupressoides</i>	Cypress hebe			





Above 16 August 2005 – Ecological Restoration Area 4, Littles Stream, Wakatipu Basin



15 December 2006 above; planted spring 2006, silver tussock with clusters of shrubs. Rabbits have never been a problem at this site. Release from conifer and sycamore infestation has occurred every few years over a 10 year maintenance period.



Above: 5 December 2010, grazing retired, silver tussocks at 4 years, shrubs becoming visible.

Below: 8 August 2016, Shrubs are emerging over rank grass, silver tussocks are competing with rank cocksfoot on a cold, south facing slope in a Q2.2b environment.





August 2005 - Ecological Restoration Area 2, Littles Stream

13 April 2016 – Ecological Restoration Area 2, Littles Stream – Coprosma, Olearia, manuka, kowhai, cabbage trees, tussocks (silver, red and narrow-leaved) and hebes reinstated to provide a small pocket of the historically present community.





A site (more than 40 hectares scheduled for planting) within the Wakatipu Basin, Queenstown on the boundary of N5.1c and N5.1d environment. Photo taken by Dawn Palmer, 22 September 2015 of a south facing gully with a dry, rocky north facing area scheduled for rabbit control, fencing and enhancement planting. Progressive control of hawthorn and broom underway.



Photos: Dawn Palmer, 1st November 2015. Initial rabbit control occurring during the preceding winter, and follow up control followed completion of fencing. Combi-guards with green netting protect grey shrubland and kowhai plantings clustered around existing vegetation to enhance the remnant community.







2 December 2002 - This site (Scope Resources, SH6 – Frankton - Kingston) in an N4.1d environment, previously contained quarry scalpings and so has had a lower level of competition from woody weeds. Planted in about 2009, the dry west facing site has been irrigated and woody weeds controlled each year (personal communication Grant Hensman 8/8/16). The entire site (about 20 hectares) containing approximately 5 hectares of planting (clustered and mass planting) was deer fenced and with rabbit netting attached. **Below:** 24 November 2012



24 November 2012 – View South West





19 April 2002; initial quarry edge



Above 3 May 2007 raised quarry edge prepared for planting; Below 5 August 2016 – Silver tussocks established into the grass sward (N5.1c LENZ classification).



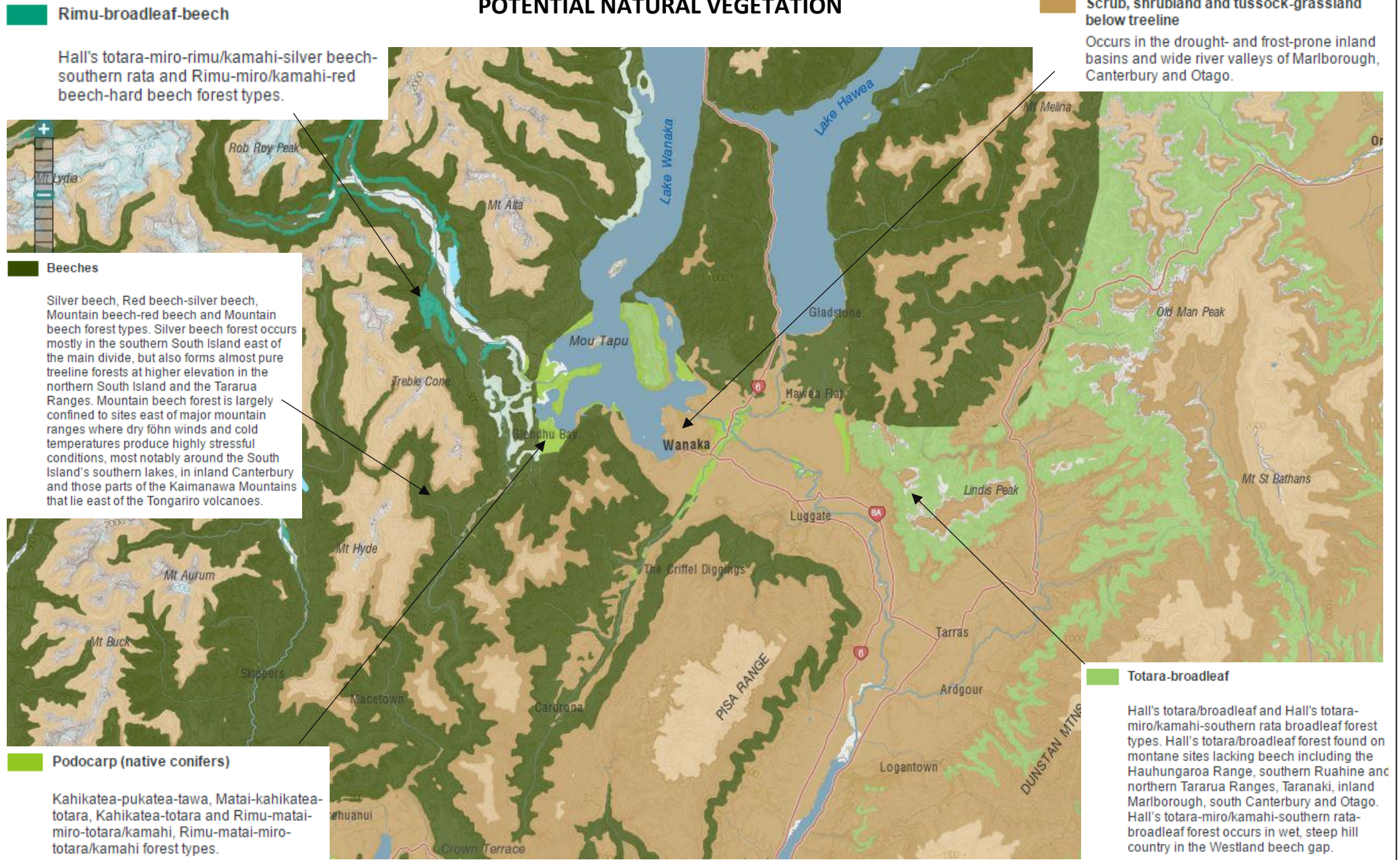


Whitechapel, Arrow Junction, Grey shrubland planting by Wakatipu Re-afforestation Trust.
Rabbit netting, rabbit guards, combi-guards, and KBC tree tubes (black netting), the cost of planting with inadequate rabbit control
Photographs D Palmer, 28 October, 2015

Attachment 1E - Example Whitechapel planting without rabbit control



POTENTIAL NATURAL VEGETATION



¹ <http://ourenvironment.scinfo.org.nz/>

