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To: PRSG – T. Wilkes

From: Terrestrial Ecosystems Unit – J. Marshall

Subject: **Te Kuha Coal Mine**

Summary

- The applicant has provided appropriate and adequate information to assess the vegetation and flora values of the proposed industrial footprint, the impact of the proposal on those values and potential mitigation and compensation actions
- The vegetation and flora values within the Westport Water Conservation Reserve, the Ballarat and Mount Rochfort Conservation Areas and the Lower Buller Gorge Scenic Reserve are clearly significant, particularly the degree of intactness but also the degree of connectivity to other large and relatively unmodified areas of high ecological value, and because of the presence of several “Naturally Uncommon Ecosystems”, two Nationally Threatened plant species, one and potentially two or three plant species in decline – at risk of extinction, and six species with scientifically interesting distributions.
- The site is an ecologically important part of the Ecological District and Region. The elevated Brunner coal measures ecosystems are nationally unique: Te Kuha and Mt William are distinguished from all other parts of the elevated Brunner coal measures as they are the only discrete parts of the system that are essentially intact with no significant disruption to ecological patterns and processes and they represent the best example of coastal hillslope forest remaining on elevated Brunner coal measures.
- The impacts, both in short and long time frames on significant biodiversity values of an opencast coal mine and associated infrastructure, are significant; the remedial effects of active restoration and site rehabilitation will be limited.
- The suggested mitigation actions include avoidance measures, remedial actions and some mitigation and/or compensation suggestions. The avoidance and remedial activities will go some way in reducing the impact of the proposal and the proposed “averted risk” - on site mitigation and compensation through ecosystem management elsewhere, are undeveloped ideas as yet.
- Whilst the technical information within the ecological report is, in my understanding, mostly correct the interpretation of the significance assessment, the importance of the site and the potential effects are debateable; the site is ecologically significant and important and the potential effects on significant and important ecological values will be significant and for some values, irreversible.

Assessment of the terrestrial vegetation information provided with the application

1. The terrestrial vegetation information was provided in the draft technical terrestrial ecology report (Mitchell Partnerships 2013 (subsequently referred to as the ecology report)) which was summarised in the “Application for access to undertake

opencast coal mining and related activities on public conservation land” (BTW South Ltd 2013) – referred to as the application. The latter provides summary information on the existing environment, a description of proposed activities and also an assessment of the environmental and landscape effects of the proposal.

2. The ecology report describes in more detail the ecological setting within the appropriate scale of the Ecological District, identifying the values of significant coal measure vegetation and flora¹, and assessing the extent of protected natural areas. The report provides a subjective assessment of vegetation associations across the Te Kuha area in the form of a map and type descriptions, an ecological significance assessment (*sensu* sec 6 RMA) using the Buller District Council Plan criteria, an assessment of potential effects, an assessment of rehabilitation potential at the mine site and mitigation proposals focused on reducing pest plant invasion and maintaining local populations of native species. The report only assesses vegetation within the mining permit (MP) which includes both public conservation land (PCL) and Crown land held as the Westport Water conservation reserve (WWCR), the project footprint also includes areas outside the MP.
3. The ecology report is supplemented by information from previous reports on the flora and fauna of the area, prepared for an earlier, unsuccessful attempt at a similar proposal last century. The bryophyte information is taken from an earlier report co- produced by Landcare Research and Mitchell s Partnerships staff. The information provided in the ecology report is adequate for the purpose of assessing the current condition of the vegetation and its ecological significance, understanding the potential impacts of the industrial development and the potential to mitigate the inevitable negative effects on the site’s ecological and biodiversity values were the development to proceed.
4. Whilst the technical vegetation information is on the whole correct and appropriate information is provided about the ecological setting of the proposal, the interpretation of the significance assessment; the importance of the site; the vegetation associations and flora elements within the E.D; the pattern and process of vegetation edge in relation to potential effects in these mosaic ecosystems, and the ability to remedy and mitigate biodiversity loss, is debateable and discussed below.

Assessment of terrestrial flora

5. In conjunction with the information provided by the ecology report, five other reports on the ecology of the area exist, four of them are referred to in the ecology report and the fifth is an internal DOC report by Knightbridge et al (2002). Two reports which offer subjective vegetation association mapping descriptions and two provide more objective plot based analysis of the vegetation associations; the results show some differences in interpretation (Table 1). My own field trip reinforced the conclusion that the vegetation patterns reveal a complex set of influences, interactions and ecological gradients, and the resultant mosaic provides a diversity of habitats for locally, regionally and nationally important flora and fauna.

¹ Threat rankings follow deLange et al (2009) and Glenny et al. (2010)

6. Mitchell Partnerships & Landcare Research (2001) described 10 relevant vegetation associations (not including forest on the privately owned land) within that survey area; the ecology report states that 8 of those 10 vegetation associations occur “within the area affected by the current proposal”.
7. Reigner (1986) describes 10 vegetation associations of the Te Kuha area (plus three variants) describing areas in the WWCR, Public Conservation land areas and the privately owned land which will also be affected by the mine infrastructure.
8. The PNA survey of the Ngakawau E.D. (Overmars et al 1998) maps the site as occurring within the coastal hillslopes land system on Brunner coal measures (supporting two forest associations on the landform unit of colluvial slopes);
9. Overmars et al (1998) also describes colluvial hillslopes on basement or sandstone (associated with three vegetation types) occurring within the Te Kuha area, and colluvial hillslope land form units occurring within the coal measure Plateau land system, supporting two vegetation associations. The Plateau land system is described as “a faulted and distorted tableland of Brunner coal measures including minor areas of bedrock and siltstone; sandstone pavements, and hilltops” (Overmars et al 1998). In total the PNA lists three vegetation associations as occurring on the Plateau land system (two which are unique to that land system), and five associations occurring on the coastal hillslopes within the Te Kuha area. The PNA survey (Overmars et al 1998) covered only the mid and higher altitude forests in the mine footprint area, not the lower altitude areas in private ownership.
10. Knightbridge et al (2002) provides an objective classification in which the data were analysed by an ordination and classification analysis which defines three main vegetation associations (with one lower altitude variation) and a further single plot association of manuka-*Dracophyllum politum*/wire rush. The lower number of associations (compared to other reports) is in part due to the level of confidence in the analysis, and Knightbridge does not dispute that further associations could have resulted with more data. Knightbridge sought to assess how unique the vegetation associations on Mt Te Kuha (specifically within the original mine footprint) are, compared to other areas within the Ngakawau E.D. The analysis showed that the manuka shrubland plots are the most unique of associations present on Te Kuha, however tall manuka, similar in composition is found on Mt Rochfort.
11. The ecology report presents a vegetation map which defines 10 relevant vegetation associations within the proposed footprint (not including lowland forest on free hold land), and nine within the MP (reflected in Table 2). The report states that eight are affected by the proposal and describes six within the MP area, it also mentions the lowland alluvial kahikatea forest as an adjunct to the lower slope forest description and briefly mentions the tarns in the Rare Ecosystem section.
12. The variable information on the short stature and wetland vegetation associations is the hardest to align between reports. Figure 11 in the ecology report defines a tarn on the western edge of the coal deposit, this appears to be the same one as the large tarn, outside the footprint, as described by the applicants survey map. The ecology report states that “large tarn” is the *Isolepis* wetland of Mitchell Partnership and Landcare (2001) which is reported as being full of an exotic

Juncus species. The report mentions but dismisses a 3 x 3 m. tarn to be destroyed by the development, and mentions other small tarns also within the proposed footprint; the map in Reigner (1986) sites a tarn in the same place but does not describe it. Tarns are classified as Naturally Uncommon Ecosystems (Landcare Research 2015) and as such are recommended for protection (Ministry for the Environment and DOC 2007).

13. The ecology report briefly describes the area of herbfield just south of the Trig as relatively large and irregularly shaped and lists a number of species present including the little known and Threatened (Nationally Vulnerable) native eyebright, *Euphrasia wettsteiniana* (incorrectly identified as At Risk by the ecology report). Mitchell Partnership and Landcare (2001) describe an equivalent association as prostrate manuka-herbfield 'cushion' vegetation. Reigner (1986) also notes this area and describes it as cushion plant vegetation with significant amounts of wetland cushion bog plants *Donatia novae-zelandiae* and *Centrolepis* sp. Other wetland areas are spread through the "non cushion field" associations in the higher altitudes, as evidenced by the descriptions of manuka-dominated scrub and shrubland vegetation mapped by Mitchell Partnership and Landcare (2001) including *D. novae-zelandiae* in another area south of the Trig and the presence of bog pine, sundews and *Actinotus* on peaty ground around the old water treatment and soil storage areas of the initial proposal Reigner (1986)
14. The herbfield/cushion vegetation area described above grades into what the ecology report defines as Manuka-Dracophyllum rockland, Mitchell Partnership and Landcare (2001) describe it as Manuka Dracophyllum vegetation amongst areas of sandstone outcrops, and Knightbridge (2001) as Manuka-Dracophyllum politum/wire rush shrubland. Species identified in all reports reflect a saturated substrate, such as the native wetland lily *Herpolirion novae-zelandiae*, *Oreobolous* species, and the peat forming wire rush.

Table 1. Equivalencies in four classifications of the vegetation associations of Te Kuha

Mitchell Partnership	Mitchell Partnership & Landcare Research	Knightbridge et al	Reigner
Mountain beech/YSP/Pink pine	Southern rata-YSP-mountain beech forest	Mountain-silver beech/Quintinia-Dracophyllum traversii forest + Mountain beech/YSP-Pink pine/Gahnia procera forest	Southern Rata/YSP-mountain beech-pokaka scrub and forest
YSP-Manuka shrubland	YSP-manuka scrub + manuka-Dracophyllum vegetation+Rata-YSP-mountain beech +manuka dominated scrub and shrubland	Mountain beech/YSP-Pink pine/Gahnia procera forest	YSP-mountain beech-manuka-southern rata scrub
Manuka shrubland	Manuka dominated scrub and shrubland + YSP-manuka shrubland	Manuka/wire rush –tanglefern shrubland	Manuka scrub
Herbfield	Prostrate manuka herbfield and cushion vegetation	Manuka-Dracophyllum politum/wire rush shrubland	Cushion plants
Manuka – Dracophyllum rockland	Manuka - Dracophyllum vegetation	Manuka-Dracophyllum politum/wire rush shrubland	(Manuka)/manuka-anglefern-wire rush shrub-fernland, fern shrubland, sedge -shrubland
Rimu/hard beech	Rimu hard and silver beech	Rimu/Mountain beech-YSP/Pink pine/Gahnia procera forest	(Rimu)/harbeech-silver beech- (mountain beech) Rimu/hardbeech –(silver beech)↔ Toro-quintinia-kamahi-(Gahnia) scrub and forest Rimu-silver beech forest
pakihi	Manuka –tanglefern shrubland		Tanglefern-manuka-pakihi sedge shrubland, fernland-shrubland ↔ Manuka scrub ↔ Wire rush-tanglefern-manuka shrub-sedgeland
Rare ecosystems: tarn	Isolepis swamp, tarn & seepage		Tarn
Rimu-red beech-silver beech	Rimu-red beech-silver beech	with emergent Rimu	(Rimu)-red beech-(silver beech)
(Kahikatea)/silver beech – mountain beech forest			

15. The pakihi present on the vegetation map of the ecology report is not described in the ecology report, but the MP appears to just cross the eastern edge of the pakihi wetland ecosystem on German Terrace (visible in the ecology reports Manuka Shrubland photo). Areas between Coal Creek and its northern most tributary have been identified by DOC as the same ecosystem as the German Terrace pakihi, and are included for management in DOCs Intermediate Outcome 1 priority ecosystem management list (IO. 1 - the diversity of our natural heritage is maintained and restored). These areas are described by Mitchell Partnership and Landcare (2001) as manuka dominated scrub and shrubland and/or manuka tanglefern shrubland, and include several species of interest including three sundew species, an inconspicuous herb *Actinotus novae-zelandia* and a small regionally endemic daisy *Celmisia dubia*: these areas will be affected by the proposed access road. Mitchell Partnership and Landcare (2001) also describe one of their plots (1) as Pakihi with sparse manuka, which is likely very close to the proposed pit. It is my impression that many of these areas potentially meet the criteria for inclusion on the West Coast Regional Councils Schedule of Significant Wetlands.
16. Mitchell Partnerships and Landcare (2001) describe two areas which appear to be in the Coal Deposit footprint as diverse forest and understory which are parts of the lower stature vegetation at the edge of the taller southern rata-yellow silver pine-mountain beech forest. The area around the pit is described as having broken and rocky ground with a diverse combination of species in the canopy including bog pine (incorrectly identified as *Halocarpus biformis* by the ecology report), Quintinnia, *Dracophyllum* spp., totara, rimu and lancewoods. The vegetation west of the ridgeline and south of the Trig is also diverse and contains an interesting conifer rich community which includes bog pine, pink pine, yellow silver pine (YSP), pygmy pine, native cedar, and rimu.
17. The proposed footprint to the east of the ridgeline, within the Mount Rochfort Conservation Area appears to be amongst steep rocky scarps and bluffs, which support the southern rata – YSP-mountain beech association and rimu-red beech-silver beech forest. This area is not described by the ecology report, nor does it appear to have been surveyed in any report, but the PNA report notes that these scarps and bluffs provide distinctive habitats which are inaccessible to introduced browsing animals, and lists a number of palatable species present which occur in no other associations in the survey area, and characteristic bluff species. It is possible that these species also occur in the proposed mine footprint.
18. The lower altitude forests in the footprint are mainly on tertiary sediments and dissected terrace materials and show considerable overlap with the forests above on less fertile substrates. These forests are described as “truly remarkable” (Kelly 1973). Kelly (1973) also recommended “without doubt” that the WWCR should be added to the Scenic Reserve if it became available for purchase.
19. The vegetation assessments from different authors are predictably different from each other not least because they cover slightly different survey areas, but also this outcome reflects the difficulty in subjective assessments of vegetation

associations and the complex and mosaic nature of the entire Te Kuha site. There is broad agreement about the species and variety of vegetation associations creating an overall mosaic with numerous eco-tones which reflects the underlying geology and soils, reflects the sites location at the junction of three E.D's (Overmars 1995) and to some extent human modification from a fire perhaps 80 years ago.

20. The bryophyte assessment states that Te Kuha is a significant site for these non-vascular plants and shows that a number of notable moss and liverwort species occur within the mining permit area, both inside and outside the proposed footprint. Five of the liverwort species are on the national threat ranking list as either Nationally Vulnerable (threatened with extinction) or Naturally Uncommon (at risk of extinction), another nine species are notable for their taxonomic peculiarities. Although it is true that these species occur at other sites, locally, nationally and internationally, the conclusion made in the application that these populations could “sustain any potential effect caused by mining ignores the fact that species on the threat classification list are already under pressure and any further loss of habitat is (or in the case of the little understood distributions of many bryophytes), or could be significant particularly for the Nationally Vulnerable species *Saccogynidium decurvum*. The application does acknowledge the outstanding ecological feature that is the lack of any adventive bryophytes on Mt Te Kuha and admits that this could change with the development of mine infrastructure. In my opinion, it is very likely to change – in the mid 2000's an exotic bryophyte was found on the Denniston Road on disturbed roadside surfaces, previously unrecorded in New Zealand, (Bryophyte Newsletter, Dr A. Fife pers. com.). The ecology report indicates that further bryophyte sampling will be undertaken however no other information is available.
21. The ecology report identifies the Threatened, At Risk (deLange et al 2009), and scientifically interesting vascular plants within the Ngakawau E.D. There are within the footprint; five species that have disjunct distributions, one species common on the east coast but with a small West Coast distribution, one local endemic, two threatened with extinction and one in decline, at risk of extinction. Knightbridge (2001) also recorded an in decline species, the scarlet mistletoe, on the original proposal's road line and suggested others are likely to be in the area. The in decline *Carex* species, *C. carsei* is known from similar habitats in the coal measure systems. There is no information on the presence of rare Lichen or fungi.
22. The ecology report refers to and describes “edge effects” in the section on potential impacts of the proposal. The natural edges of the natural vegetation associations are most often referred to as eco-tones, and their importance in the Brunner coal measure systems has been described elsewhere (Walker et al 2008). These eco-tones represent a highly diverse and an important structural and functional part of the coal measure vegetation.
23. In total the footprint of the proposal and its infrastructure will negatively impact between six and arguably 12 vegetation associations including wetlands, and threatened, at risk and locally important vascular and non vascular plant

species. These associations are composed almost entirely of native species; the species count for the Te Kuha PNA survey area was 220 native vascular plant species and 2 exotic (Overmars et al 1998), a moderately high number of native species for a generally infertile environment within its altitudinal range (100-800m) (S Courtney pers. comm.), and a very low number of exotic species.

Conclusion

24. Botanically the area is of great interest (Reigner, 1986). The vegetation associations form a complex mosaic across the entire footprint of the proposal: high altitude sandstone pavement ridgeline supporting low stature vegetation including wetlands, with steep bluffs and cliffs (currently unexplored) to the east, west facing coastal hillslopes on infertile soils supporting stunted forests and shrublands, dissected by gullies and ridges, to lowland alluvial surfaces with a coastal influence.
25. The vascular and non-vascular vegetation associations are almost entirely devoid of exotic species, and the native species count for the area is moderately high, particularly for a low nutrient system. Amongst the native species there are nine vascular plants of interest due to their national threat status, taxonomic or distributional anomalies, the potential presence of a further species at risk of extinction (scarlet mistletoe), and several non-vascular species of interest with one at threat of extinction.

Assessment of Ecological and Conservation Values

26. The ecology report identifies ecological and social indicators of value through the Significance Assessment and it addresses how well represented the vegetation associations are within the Te Kuha area, and the E.D, and evaluates the “Naturally Uncommon Ecosystem” classification. Over all, it tends to understate the ecological and conservation values of the site.
27. The Ngakawau Ecological District is the only one of the 268 Ecological Districts nationally defined by the presence of extensive Brunner coal measure ecosystems. The particular combination of plant communities and associated landscapes present, particularly on the elevated (above 600m a.s.l) Brunner coal measures occurs nowhere else in New Zealand (Overmars et al 1998). Other examples of coal measure ecosystems occur in the South Island, however the Buller ecosystems are by far the largest and most diverse (Overmars et al 1998). Brunner coal measures support different ecosystems and vegetation associations than any other coal measure system; it is a nationally and internationally unique system (Overmars et al 1998; Walker et al 2008).
28. The Mount William Range and the more coastal Te Kuha to, what was, Mount Augustus range, including the Buller plateaux are the only Brunner coal measure formations at elevation. Compared to the Greymouth (Paparoa) and Reefton (Rotokohu) coal measure formations, Brunner coals are the most resistant to erosion, produce the most acidic and infertile soils and the interplay of these features with the high rainfall, high elevation (above 600m a.s.l.) and coastal location gives rise to the specialised vegetation and fauna that gives the Ngakawau ED its distinctive character (Overmars et al 1998).
29. The entire Westport Water Conservation Reserve was recognised for its high ecological values and the suggestion was mooted that should the opportunity arise the area should be placed in public conservation land, in the Lower Buller Gorge Scenic Reserve (Kelly 1973). Overmars (1995) in his evidence on behalf of the then Director General of Conservation in the Consent hearing for the

original coal mine proposal, particularly identifies the coastal hillslopes at Te Kuha as being the best examples left of this landform and associated vegetation within the Brunner coal measure system, and despite the erection of a small hut in the WWCR, this assessment is still valid.

30. The degree to which ecosystems are represented in the protected area is a relevant matter. The LENZ classification (Leathwick et al 2002) indicates that the land environments within the footprint are reasonably well protected in the PCL, however the degree to which the classification predicts the vegetation associations (the scale of LENZ) means some of the small scale variety is missed by the LENZ classification; the Naturally Uncommon Ecosystem classification identifies those important ecosystems not captured by LENZ. The ecology report notes that none of the LENZ within the footprint fit the “threatened” criteria of the Threatened Environments of NZ classification (Walker et al 2007). Walker et al (2007) state that “the classification directs users to places that are likely to be most imminently threatened... but does not define all that is important for the maintenance and persistence of indigenous biodiversity into the future, or how much is needed to achieve this” and as such, it’s omission from the TENZ classification does not indicate it is of lesser value.
31. The ecology report briefly describes the “Naturally Uncommon Ecosystem” classification (Williams et al 2007) in the Rare Ecosystem section. The ecology report discusses the fact that the Brunner coal measures are not of themselves considered a Naturally Uncommon Ecosystem and states that none of these nationally important (MfE & DOC 2007) ecosystems were found within the footprint, arguing that the “tilted rock platforms” (Regnier 1986) of the Te Kuha ridgeline do not fit the type description of the sandstone erosion pavements, despite this classification being used in Mitchell Partnerships and Landcare (2001) for the ridgeline Manuka-Dracophyllum vegetation association. The ecology report dismissed the characterisation of Te Kuha as sandstone pavement due to 1) the amount of sandstone pavement, and 2) the slope of the Te Kuha pavements “generally” without producing any evidence to support this claim. In my understanding the amount of sandstone pavement, which is without argument less than found at Stockton or Denniston, does not discount its characterisation, and though some of the Te Kuha sandstone pavements may be at a greater angle, by no means do they all appear to be. The Landcare Research (2015) website actually describes sandstone pavements as “areas of flat to gentle slope that have been bared of any topsoil formed through chemical weathering, often through erosion of topsoil or peat” and goes on to say sandstone pavements “occur on ridges, mountain tops and plateaux” and that they range in size from small inter-tussock spaces to many meters across”; Te Kuha does include areas of the Naturally Uncommon Ecosystem sandstone pavement.
32. Four other Naturally Uncommon Ecosystems also occur in the proposed footprint; these are pakihi, at least one seepage (as identified by Mitchell Partnership and Landcare (2001)), the cushion bog, and the cliffs, tors and scarps.

33. The ecology report discusses the proposed mine footprint and its location in an area listed as one of seven Recommended Areas for Protection (RAP) within the Ngakawau Ecological District (Overmars et al 1998). Quite rightly the report states that the proposed footprint falls within “just one” of the seven RAPs; it would have to be a particularly large footprint to fall in more than one RAP.
34. Overmars et al (1998) found 15 landform units and vegetation associations were either inadequately protected, or not at all or had little representation within the protected area network. The WWCR was able to contribute examples of seven of these units to the protected network should the RAPs be adopted. Even though these seven ecological units are represented elsewhere, Te Kuha was included in the RAPs because of the unique level of intactness and naturalness and as Overmars (1995) stated Te Kuha supports the best remaining example of coastal hillslope forests on Brunner coal measures.
35. Of the seven original RAPs (including the draft proposal area at Mount Rochfort which extended east to Trent Stream but was later modified for publication²), the three large RAPs have since that time, all suffered further industrial intrusions, decreasing their ecological integrity. In 2010 I argued that “The Denniston plateau is the only elevated Brunner coal measure plateau without a large area land conversion, and therefore arguably the best representative example of this ecosystem”, and now industrial work has begun on the Denniston plateau leaving Mt William and Te Kuha as the only discrete units of any of the elevated Brunner coal measure landforms without industrial intrusion or permission for mine development (Stockton plateau is already highly modified and Mount William north is consented for coal mining).
36. The ecology report uses the criteria of the Buller District Plan to assess the significance of the site in terms of the RMA. In this assessment the ecology report confuses the terms “representative” and “representation”. The report acknowledges the site would rank highly for “representativeness” because of the southern rata vegetation association, which is under-represented in the PCL; which is true, but this is a different criterion to Representativeness. The site does rank highly for “Representativeness” as it is a very good condition example of typical and special species, associations and landforms within the Ngakawau E.D. (McEwan 1987), and the best example of coastal hill forests on elevated Brunner coal measures.
37. In the significance assessment the ecology report states the area has moderate to high values for distinctiveness, that it scores very highly for how intact the area is, triggers the size criterion, ranks highly for connectivity, ranks moderately high for threatened species presence and habitat, and although not ranked by the ecology report, the scientific interest is high due to the presence of plants at their distribution limits, and with dis-junct distributional boundaries, as well as having a taxonomically interesting bryophyte community. There is no doubt this site is significant in terms of the RMA.

² Refer to DOC dm1025821

38. The ecological and conservation value that this site represents are, in terms of how intact it is, high. All the ecological gradients such as altitude, soil fertility, temperature, and hydrology, and patterns and processes are intact: this value alone distinguishes this site and Mt William from all other sites within the extent of elevated Brunner coal measures. This area is also well connected to other large relatively intact expanses of PCL; this site is both ecologically significant and important.
39. The ecology report states that the Te Kuha area is not a priority management site for DOC, however the proposed access road does appear to intrude on the priority management unit German Terrace Pakihi which has been chosen to support the goals of Intermediate Outcome 1- the diversity of our natural heritage is maintained and restored. Other parts of the PCL held under the Conservation Act are legally protected and their protection is aligned to Intermediate Outcome objective 1.6 – that public conservation land water and species shall be held for now and future generations.

Conclusion

40. Mount Te Kuha is at the southern end of the nationally distinctive elevated Brunner coal measure ecosystems. The WWCR and adjacent Conservation Areas are both ecologically significant and important due to the high quality ecological values, particularly how intact the area is; Mt William and Mt Te Kuha are the last two opportunities to preserve discrete examples of elevated Brunner Coal measure ecosystems, intact across all ecological gradients.

Assessment of the effects of the proposal on terrestrial flora and proposed rehabilitation and mitigation

41. The proposal will have local impacts on up to 25 plant species of interest and fragment and disconnect some of the best examples of nationally unique Brunner coal measure vegetation associations. No species will be significantly affected at a population level however and only 1 vegetation association will be effectively extinguished in the local setting; all species and vegetation associations are represented elsewhere in the E.D.
42. The proposal will directly affect about 80ha of vegetation, soils, and rock which will be destroyed and removed, with a small proportion potentially stored for transfer back within the footprint at a later time. The proposal will negatively affect a further estimated 21ha as described in the discussion on “edge effects” in the ecology report. In this 21 ha the vegetation associations will suffer the effects of increased light, wind, and transpiration, which will reduce plant species abundance and its value as habitat for native animals. The proposal will also directly affect the highly significant value of intactness, significantly reducing its value, it will reduce its connectivity value for a period of decades at least and its ecological naturalness will be permanently affected.
43. Currently one of the outstanding values of the site is its very low ratio of exotic plants to native; weed control would need to be exemplary in order to retain the virtual weed free status the site has. The likelihood that new weed species will appear within the footprint is high and most probably unavoidable were the proposal to go ahead.

44. The ecology report argues that the conservation values of the Te Kuha RAP will be maintained alongside the proposed coal mine as all but one vegetation association also occurs in adequate measure outside the proposed footprint, and approximately 73% of the Brunner Coal measure vegetation at Te Kuha will remain. This argument does not account for the loss of value caused through the fragmentation of an otherwise intact series of ecological gradients.
45. The mine pit and associated infrastructure will fragment the ecosystems of Te Kuha and negatively impact on its value of intactness. The primary impact of fragmentation is through loss of habitat continuity, because any disruption of previously intact vegetation has some effect on the population size of species dependent on that habitat (Soule 1987).
46. Site restoration and rehabilitation will be possible to some extent and the best outcomes are likely to be gained from a well planned and executed series of surface recreations, water control measures, use of transfer material and weed control. The methods and plans for avoidance and remedy suggested in the ecology report are appropriate and reasonable. The experience with Solid Energy New Zealand at Stockton suggests only small areas can be revegetated by direct transfer of vegetation, even with the best resources.
47. Post mining the environment will be substantially different. The landform of the ridge will be permanently altered; the complexity of the mosaic of vegetation associations and features such as bluffs, scarps, tors and sandstone pavement will be permanently reduced. Plant cover will take many decades to recover in the shallow soils and inclement climate, and complex ecological structure, process and pattern will be reduced for centuries.
48. The methods and plans for remedial work suggested in the ecology report will, even if well executed, result in the permanent loss of 80ha of natural habitat and replace it with a manufactured environment which will lack natural complexity and full cover of native species for many decades, taking centuries to fully establish a similar age profile (many conifers were aged at between 5-600 years old (Knightbridge et al 2002).

Conclusion

49. Reasonable plans for avoidance and remedy of ecological harm are presented by the ecological report. Recent evidence from the well resourced remedial vegetation transfer at the Solid Energy Stockton mine suggest that even the current best practise only provides for small areas of direct transfer of vegetation (currently less than 5 ha of best quality transferred vegetation at Stockton mine).
50. There will be significant negative impacts on significant ecological values which will be permanent in terms of the sites naturalness, and intactness, long term (centuries) before a similar age profile is reinstated and decades for native plant cover to recover and reconnect the site to the surrounding public conservation areas, regardless of the planned active avoidance and restoration work. The values of this ecologically important site will be reduced

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