BlueGreen

Memo. BlueGreen Ecology Ltd
M [redacted]
E [redacted]
W BlueGreenEcology.nz

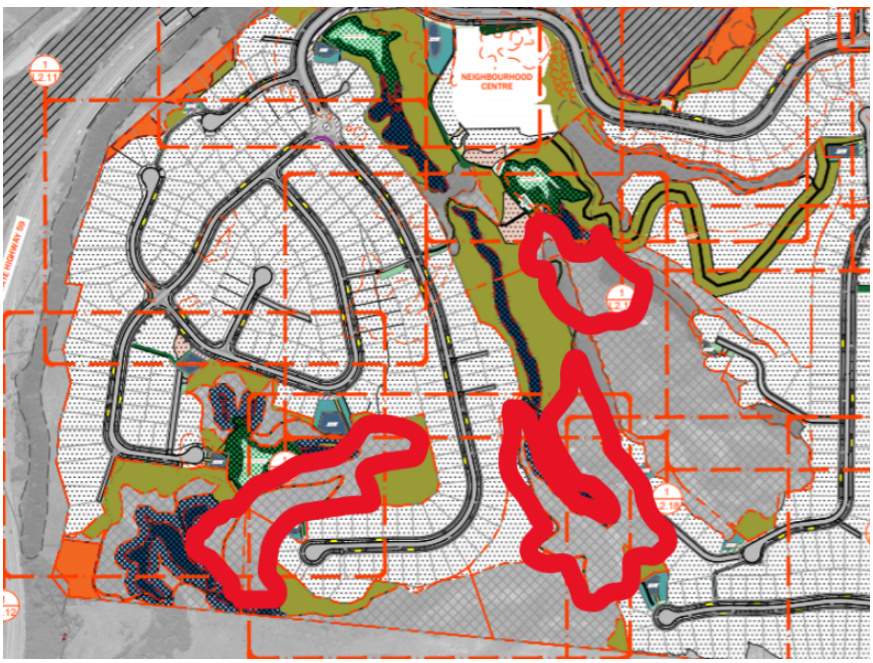
Response to minute 18 Mt Welcome Panel requests - ecology	**To:** The Hearing Panel
	From: Dr Vaughan Keesing
Date: 17.09.2026	**Project title:** Mt Welcome

The following are Dr Keesing's (BlueGreen Ecology) responses to minute 18 information requests. Each minute point relative to Dr Keesing's requirements are repeated below with the response following each point.

[9] *Dr Keesing noted the proposed planting and/ regeneration of slopes adjacent and above the proposed retention wetlands. Can the application please describe what is proposed in greater detail and advise how it is proposed that that work would be maintained, and how its ongoing management would be conditioned. Dr Keesing noted the potential for these areas to be converted to terrestrial ecological offsets and/or compensation if that was considered to be required. Can he please identify the areas suitable for this conversion in greater detail (including with appropriate mapping) and describe how its management would differ (including in conditions) as a result.*

If additional terrestrial offset is deemed to be required (and see below BOAM responses), there are areas that would be suitable in the wetland gullies of retention wetlands A and B. The most useful areas I highlight in large red outline in the diagram below that would contribute most to the gully protection and functioning.

In particular, the steep slopes of the upper gully and side gully of Retention Wetland B has wetland and stream habitat that would benefit most from a wider revegetated gully slope. Currently, in addition to the wetland and riparian margins, this gully has large areas of proposed kanuka-flax revegetation (pale green in the Landscape and Ecology Plan excerpt below) as well as the areas which are proposed to be weed managed but left to naturally regenerate (shown in grey below).



Where they are part of any terrestrial habitat offset, they should adopt the same parameters and treatments of the existing H* coded offset area currently north of SNA 029. I note that those species to be used could be updated as per the list provided below in the BOAM analysis as a tweak to the offset revegetation programme.

I note that the extent of kanuka and flax revegetation (pale green) about the gullies adds substantively to slope protection and where it occurs effectively adds an additional 10m plus to the riparian margins of wetland and stream, but to date the additional benefit has not been factored into the ecological offset or mitigation calculations.

[10] *We confirm our request that Dr Keesing complete a BOAM assessment of areas of SNA27 proposed to be cleared to identify the appropriate offset multiple. This additional ecological work is required by noon on 11 September. Once received, Dr Fea and Ms Hooker have leave to provide comments thereon by noon on 16 September.*

The JWS confirmed that where a BOAM to be undertaken then the following attributes could include:

- Basal area (could be limited to the most common species);
- Canopy cover,
- Canopy height,
- Different tiers of vegetation present,
- Species richness,
- Ground cover.

The model requires a reference of states (the attributes above) which reflects an Ecological District (ED) good condition example, often a mature habitat type of that affected. This determines how distant the habitat affected is from the best state it might be.

At the project site there is some agreement that the SNA 027 is most likely to be a kohekohe forest perhaps with some tawa and ngaio elements.

I have no ability in the required time frame to find and undertake RECCE plots in a mature kohekohe-tawa forest to collect attribute states. However, the National Vegetation Survey (NVS) is a set of RECCE plots across the country that provides a range of vegetative data from fixed plots and while many plots require special permission to access, a range of plot data is open to the public.

I queried the NVS for kohekohe vegetation plot data. The only open-sourced data with kohekohe is on Kapiti Island where there are 3 useful plots. However, those data are not from mature kohekohe forest or if they are they are challenged as the canopy is only 8m and a mature kohekohe forest has a canopy closer to 15m. I searched and examined the open plots for Otari-Wilton, GWRC plots in Belmont Park and the Akatarawa forest, but all those plotted forests are predominantly tawa-podocarp forests. Furthermore, no plot provides cover data only counts and sizes.

The data available from the accessible NVS that is useful for the BOAM process are:

- Canopy height
- Canopy species number
- Sapling stem count
- Tree diameter
- Basal area
- Species richness
- Seedling species richness
- Seedling number

Where a tree is a woody species over 10cm DBH and over 3m and a sapling is any other woody species above 2m but under the tree dimensions.

I consider that the data offered by the NVS is sufficiently similar to the list the JWS agreed to and offers the indicative time of development metrics required by the model (it is essential a time and complexity indices model).

On Saturday the 5th September 2026, I went to SNA 027 and undertook a standard 20m by 20m RECCE plot (see below map 1) and also undertook one in the Shrubland 1 on site (see map 2).

RECCE in SNA 027

In the plot I measured 58 canopy and sub canopy plants, 26 were “trees” and 32 saplings (sub canopy). The species comprising the tree and sapling top cover were:

kawakawa	12
hangehange	9
Five finger	14
mahoe	12
mamaku	4
karamu	4
Silver fern	2
kanuka	1

There are currently no canopy kohekohe or tawa, and an older ngaio present locally was not in the plot.

The average tree canopy height was 6 (5.99) m and the subcanopy (saplings) 4.8m. The average diameter (DBH) of the trees was 15.9cm and of the saplings 5.5cm. The tree basal area was 14.17 sqm/ha.

The number and species of seedlings can be considered a proxy for ground cover, some of which (circa 10%) in the plot was wandering jew. The table below lists the seedling taxa present and the count of those seedlings.

Seedlings	
Kohekohe	41
tawa	15
mahoe	4
rangiora	2
hangehange	21
kawakawa	6
psearb	4
karamu	3
Fuchsia exc	3
pigeonwood	1
Nikau	1
count	101
taxa	11

The total species richness in the plot included taxa not in the above categories (ferns, epiphytes etc) and totaled 23.

Shrubland 1

Shrubland 1 (planted 23 years previously) has some more unusual species including *Pseudopanax laetus* (At Risk declining) and Hoheria, but also 15 of the canopy specimens (35%) (shown in red below) are species inappropriate to the ED. I will not include the statistics for these species in the model as they are technically weeds and are species which are also problematic here in that they are bird dispersed as well, making this feature a source of those weeds.

Tree & saplings	count
akiraho	5
five finger	4
hangehange	1
Hoheria populnea	1
mahoe	2
mamaku	3
P. laetus	4
P. lessonii	4
P. ralphii	1
totara	3
karaka	6
karo	6
pohutukawa	3

The average appropriate tree height (canopy) is 4.8m (the pohutukawa are 6m), the sub canopy (saplings) is 3.9m. The average tree diameter is 13.63 cm, and saplings 7.7 cm. The basal area is 6.1 sqm/ha.

The table below lists the seedling taxa present and the count of those seedlings.

Seedlings	count
Pittosporum ralphii	4

hangehange	28
mapou	2
mahoe	15
akiraho	1
kawakawa	17
lancewood	4
rewarewa	2
five finger	16
karaka	33
Pseudopanax lessonii	1
kohekohe	1
Hoheria populnea	1
count	92
Sp. rich	12

The total species richness in the plot included taxa not in the above categories (ferns, epiphytes etc) and totaled 18.

Information for the BOAM model

	Reference	SNA027	Shrub 1
Canopy height (m)	12*	6	4.8
Canopy species	9	5	6
Sapling stem count	189	32	12
Tree count		26	15
Tree diameter (cm)	8.3[1]	15.9	13.63
Basal area (sqm/ha)	34.8	14.17	6.1
Species richness	27	23	18
Seedling species richness	17	11	12
Seedling number	117	101	92

*= To represent an older, more typical height of more mature kohekohe than represented in the NVS RECCE plots on Kapiti Island.

I use in the model (so as not to double up on metrics that in effect measure the same thing): canopy height, basal area, species richness, seedling number and sapling number.

[1] The NVS RECCE plot shows many smaller kohekohe summing to a greater basal area but each tree relatively thin. A mature kohekohe has a DBH in excess of 1 meter. Other NVS plots had as a common forest tree side 12 cm.

To offset this vegetation / habitat loss the proposal is to undertake the revegetation, protection and management of new forest to adjoin SNA 029 and add (as is anticipated by the PCC structure plan) enhanced connectivity between SNA.

	BIODIVERSITY TYPE
	SNA 027

brown. Cells coloured light green will auto-populate.
Step 11: Repeat Steps 4–10 for as many Biodiversity Attributes as required.
Step 12: Repeat Steps 3–10 for as many Biodiversity Components as required (scrolling down the sheet).

	This section captures which elements of biodiversity, and over what area, will be impacted by the proposal					This section is where the change in measure of each Biodiversity Attribute due to the proposed Impact is quantified, and Attribute Biodiversity Value calculated. Inputs are derived from direct measures, existing data or models where available, or expert estimated predictions			
	Biodiversity Component	Biodiversity Attribute		Measurement Unit	Area of Impact (ha)	Benchmark	Measure prior to Impact	Measure after Impact	Biodiversity Value
0.1	BDLF	0.1a	Canopy height	meter	0.14	12	6	0	-0.07
		0.1b	basel area	sqm/ha	0.14	34.8	14.17	0	-0.06
		0.1c	Species richness	count	0.14	27	23	0	-0.12
		0.1d	seedling number	count	0.14	117	101	0	-0.12
		0.1e	sapling count	count	0.14	189	32	0	-0.02

Offset set up.

The forest to be planted is proposed to be at 1m spacing (5,730 plants at 0.5ha (see below)), 1L sized plants of a suitable mix of canopy and lower canopy and shrub species summing top 18 species. See Landscape and ecology plans. Currently the plant list in the Draft schematic labelled H8 is not quite finalised and will look more similar to the below table.

Species	% proportion	End Canopy
Coprosma lucida	10	
Coprosma rhamnoides	3	
Griselinia lucida	5	
Melicope ternata	5	
Myrsine australis	5	
Shawia paniculata	2	
Five finger	10	yes
mahoe	10	yes
Myoporum laetum	5	yes
Plagianthus regius	5	yes
Hoheria populnea	5	yes
Tawa	5	yes
Pigeonwood	5	yes
Rangiora	5	
kohekohe	5	yes
Wineberry	5	
kanono	5	
Akeake	5	
18	100%	

About 50% of the species to be planted will be represented in the older canopy and 20% in the most mature canopy.

Given the soils, the rainfall and the management (fertilizer, weed and pest control, guards) the expectation is after the first year's establishment, a growth rate of 1m per year. This is a rate that is conservative and experienced in Pukerua Bay and indicated by a range of restoration

literature (Siqueira et al 2025[2]). The spacing determines the sapling number in 10 years and the canopy closure although this is not a BOAM attributed through a lack of data in a reference.

I predict that after 10 years and because it is adjacent to an SNA there will be seedlings of various colonizing species. I assume a 10% rate relative to the reference.

The basal area I predict at year 10 to be 14 sqm/ha based less on individual stem size (which I suggest will be circa 10 cm) but as a combination of size and numerous stems.

The model output under the above regime looks as follows (keeping the higher discount rate of 3%).

#N/A	0.3	accrued over time use the Offset Model_5 yearly worksheet. **Step 7:** Repeat for additional Biodiversity Components (scrolling down the sheet)

This section captures which elements of biodiversity are to be accounted for, and the benchmark value for the Attribute. The information matches that in the Impact Model					These cells provide information about the proposed Offset Actions			Calculations can be made for a finite end point, or at five yearly time-steps over 35 years. Indicate preference in Column K and Follow the instructions in Column L		This section is where the marginal change in the measure of Biodiversity Attribute due to the Offset Action is quantified. Inputs are derived from direct measure, existing data or models where available, or expert estimated predictions. Attribute Biodiversity Value at the Offset Site is compared to the Attribute Biodiversity Value at the Impact Site to calculate the Net Present Biodiversity Value for each Attribute						This is the average Net Present Biodiversity Value for the Biodiversity Component
Biodiversity Component	**Biodiversity Attribute**		**Measurement Unit**	**Benchmark**	**Proposed Offset Actions**	**Offset area (ha)**	**Confidence in Offset Actions**			**Measure prior to Offset**	**Measure after Offset**	**Time till endpoint (years)**	**Biodiversity Value at Offset Site**	**Biodiversity Value at Impact Site**	**Attribute Net Present Biodiversity Value**	**Component Net Present Biodiversity Value**
BDLF	0.1a	Canopy height	meter	12	revegetation	0.5	Confident 75-90%	Finite end point	Continue to Column M	0	8	9	0.03	-0.07	-0.04	0.01
	0.1b	basel area	sqm/ha	34.8	revegetation trees	0.5	Confident 75-90%	Finite end point	Continue to Column M	0	14	10	0.01	-0.06	-0.04	
	0.1c	Species richness	count	27	revegetation	0.5	Very confident >90%	Finite end point	Continue to Column M	0	20	1	0.27	-0.12	0.15	
	0.1d	seedling number	count	117	natural colonisation	0.5	Confident 75-90%	Finite end point	Continue to Column M	0	20	10	0.01	-0.12	-0.12	
	0.1e	sapling count	count	189	revegetation	0.5	Confident 75-90%	Finite end point	Continue to Column M	0	300	5	0.11	-0.02	0.09	

This BOAM results in an offset ratio of 3.6 : 1, which equates to 0.5ha offsetting for 0.14 ha of SNA027 vegetation lost. I believe this is sufficiently close to support the initial 3:1 but if the BOAM model is to be used exactly then a further 800m^2 will need to be added to the offset area of the project. I note that this ratio is highly likely more than what would be required for the poorer 691m^2 of the SNA 029 area affected, should the panel also decide that that area also needs to be offset. I suggest if that area is also to be offset then a 2:1 ratio is most likely the outcome of modeling (see below for Shrubland 1) – and so a further addition of 1382m^2.

Shrubland 1

If the panel were of mind to accept the requirement for offsetting the planted shrubland on site, then the following BOAM should be applied.

[2] Siqueira, D; Ford, C; Llyod, A; Whie, D; Salvatierra, G; Dungey, H. 2025. Container size and site quality affect survival and early growth performance of NZ native tree species. Journal of Forest Research vol 36:51.

The impact model is:

This section captures which elements of biodiversity, and over what area, will be impacted by the proposal					This section is where the change in measure of each Biodiversity Attribute due to the proposed Impact is quantified, and Attribute Biodiversity Value calculated. Inputs are derived from direct measures, existing data or models where available, or expert estimated predictions			
Biodiversity Component	**Biodiversity Attribute**		**Measurement Unit**	**Area of Impact (ha)**	**Benchmark**	**Measure prior to Impact**	**Measure after Impact**	**Biodiversity Value**
	0.3a	Canopy height	meter	0.5	12	4.8	0	-0.20
	0.3b	basel area	sqm/ha	0.5	34.8	13.63	0	-0.20
	0.3c	Species richness	count	0.5	27	18	0	-0.33
	0.3d	seedling number	count	0.5	117	92	0	-0.39
	0.3e	sapling count	count	0.5	189	15	0	-0.04

Using the same offset revegetation metrics as for SNA 027 (above) but because of the modified state and poorer development of that area the predicted ecological loss is less and so the offset ratio is less. The model suggests 2:1 ratio (1ha) is required (with the parameters in the model as they are set).

This section captures which elements of biodiversity are to be accounted for, and the benchmark value for the Attribute. The information matches that in the Impact Model					These cells provide information about the proposed Offset Actions			Calculations can be made for a finite end point, or at five yearly time-steps over 35 years. Indicate preference in Column K and Follow the instructions in Column L		This section is where the marginal change in the measure of Biodiversity Attribute due to the Offset Action is quantified. Inputs are derived from direct measure, existing data or models where available, or expert estimated predictions. Attribute Biodiversity Value at the Offset Site is compared to the Attribute Biodiversity Value at the Impact Site to calculate the Net Present Biodiversity Value for each Attribute						This is the average Net Present Biodiversity Value for the Biodiversity Component
Biodiversity Component	**Biodiversity Attribute**		**Measurement Unit**	**Benchmark**	**Proposed Offset Actions**	**Offset area (ha)**	**Confidence in Offset Actions**			**Measure prior to Offset**	**Measure after Offset**	**Time till endpoint (years)**	**Biodiversity Value at Offset Site**	**Biodiversity Value at Impact Site**	**Attribute Net Present Biodiversity Value**	**Component Net Present Biodiversity Value**
Scrub	0.1a	Canopy height	meter	12	revegetation	1	Confident 75-90%	Finite end point	Continue to Column M	0	8	9	0.05	-0.20	-0.15	0.02
	0.1b	basel area	sqm/ha	34.8	revegetation trees	1	Confident 75-90%	Finite end point	Continue to Column M	0	14	10	0.02	-0.20	-0.17	
	0.1c	Species richness	count	27	revegetation	1	Very confident >90%	Finite end point	Continue to Column M	0	20	0	0.71	-0.33	0.37	
	0.1d	seedling number	count	117	natural colonisation	1	Confident 75-90%	Finite end point	Continue to Column M	0	50	5	0.09	-0.39	-0.30	
	0.1e	sapling count	count	189	revegetation	1	Confident 75-90%	Finite end point	Continue to Column M	0	300	3	0.38	-0.04	0.34	

[11] *Dr Keesing also noted the potential for additional wetland offsets/ compensation on site (of approximately 0.3—0.5ha) and for stream offsets/ compensation in riparian esplanade areas downstream of the site if further offset/ compensation is required. He is requested to document the options available within the same timescale (i.e. by noon on 11 September). If, in the interim, Dr Keesing has identified additional on or off-site offsetting or compensation options for adverse effects on wetlands and streams, he is requested to include them too. The ecological advisors to GWRC and DoC have until noon on 16 September to comment on that material, once produced.*

The following diagram shows where possible additional wetland areas are available for enhancement – or creation.

The western area is 1740m^2 and is a place where careful excavation could create a wetland where currently one does not exist (noting the southern draining stream is in that area also).

The eastern area is one of the typical damp gullies with currently exotic dominated grazed natural wetlands and, as the others on the property could be revegetated to a native representative state. It is an area of around 1198m^2.

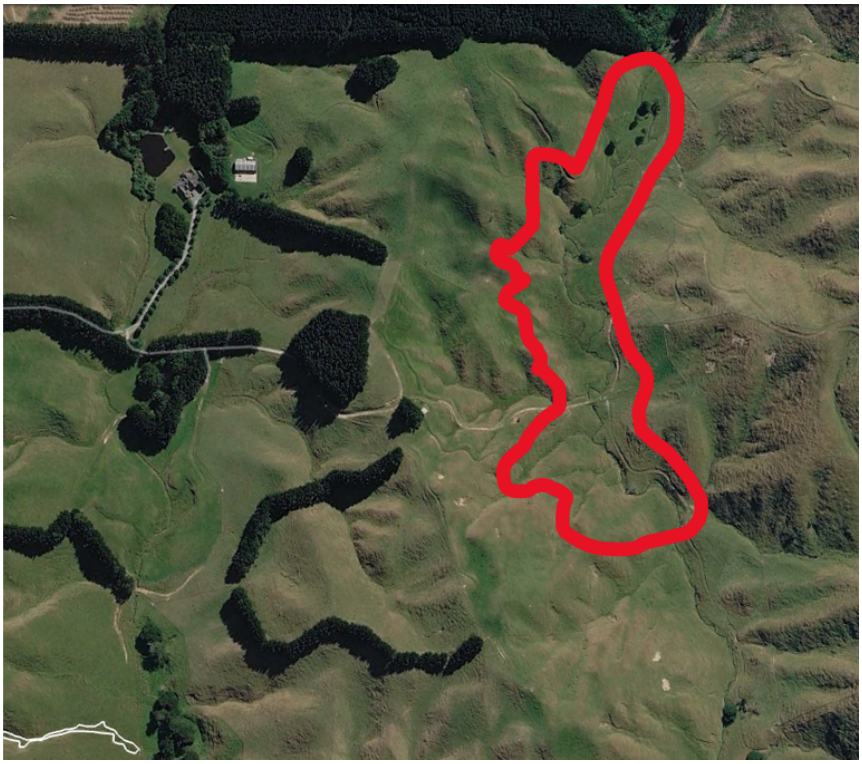
Centrally there is a south draining wetland gully some 935m^2 which is exotic grazed natural wetland and could be revegetated to a more representative state.

These in total sum to 3,873 m^2.

There are no other features or areas with suitable hydrology that I am aware of, that would allow reasonable wetland creation or enhancement nor perennial riparian enhancement.

The only other nearby feature that offers both extensive riparian enhancement to a valued perennial stream and river flats wetland creation or enhancement opportunities are those of the eastern kakaho. That valley, to my knowledge, is not in the ownership of the applicant and any offset / mitigation would need to be by agreement with the landowner (a third party).

This area is shown in the diagram below, the area outlined in red illustrates the stream and valley floor area.



I believe the panel in requesting consideration of a “stream offsets / compensation in riparian esplanade areas downstream of the site”, is referring to the discussion re opening up of downstream fish passage by resolving existing barrier issues such as the track culvert downstream of the tributary to possibly be piped for the round about as other than the east kakaho and certainly in the Taupo west draining catchments there is no other riparian enhancement opportunities.

Such an undertaking is no doubt of some worth but perhaps not as much as some believe because the amount of habitat, and indeed the amount of quality habitat, above the current known blockage of the track culvert (but also east of SH59) is not substantive and is not the kind that supports large older banded kokopu, koaro or eel. It is typically low flow shallow and high sediment habitats, even those in native vegetation and still plagued with under SH road culverts.

Further, to rectify the passage for the one obvious example (the track culvert) would require considerable work spatially to recreate a reasonable gradient and so depth and velocity profile. The vegetation and instream disturbance to create such a system would be considerably difficult to consent come with its own offsets for wetland and vegetation clearance and in the end might not facilitate any new fish migration.

Yours Sincerely

Dr Vaughan Keesing

BlueGreen Ecology.

17.09.2026