Ecology supplementary report – Biodiversity Offset Calculation

February 2018

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NZ TRANSPORT AGENCY WAKA KOTAHI
Mt Messenger Bypass
New Zealand Government

Quality Assurance Statement			
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Contents

Glossary

Term	Meaning
AEE	Assessment of Effects on the Environment Report
EcIA guidelines	Ecological Impact Assessment guidelines
Parininihi	The area spanning the Waipingao Stream catchment located to the west of existing SH3, approximately 1,332ha in size
Pest Management Area	Area of land proposed to be actively managed for pests, across a number of parcels of land
Project	The Mt Messenger Bypass project
Project footprint	The Project footprint includes the road footprint (i.e. the road and its anticipated batters and cuts, spoil disposal sites, haul roads and stormwater ponds), and includes the Additional Works Area (AWA) and 5m edge effects parcel.
SH3	State Highway 3
Transport Agency	New Zealand Transport Agency

1 Introduction

The NZ Transport Agency (Transport Agency) is proposing to construct and operate a new section of State Highway 3 (SH3), generally between Uruti and Ahititi to the north of New Plymouth. The Transport Agency lodged applications for resource consents and a Notice of Requirement on 15 December 2017 to alter the existing SH3 designation, to enable the Mt Messenger Bypass project (the Project) to proceed.

This application included assessments of ecological effects attached as Technical Reports 7a – 7h, in Volume 3 of the Assessment of Effects on the Environment (AEE) report. The ecology technical reports noted the conservative and precautionary approach taken in assessing potential adverse ecological effects from the Project, and that more information would be available following summer field investigations. The Biodiversity Offset Calculation report, dated December 2017,[1] was completed as part of this package.

These field investigations have now concluded, and the information from the Ecology supplementary report – Vegetation (dated February 2018) has been used to refine the biodiversity offset calculation. The purpose of this updated offset calculation was to determine the amount of biodiversity offset required for the Project, with additional information about the vegetation in the wider Project area, in order to result in no net biodiversity loss by year 10 and a net biodiversity gain by year 15.

[1] Appendix A to the Assessment of Ecological Effects – Ecological Mitigation and Offset (Mt Messenger Alliance Technical Report 7h).

2 Further ecological investigations

2.1 Introduction

The original Biodiversity Offset Calculation Assessment, dated December 2017, included assessments of ecological values and potential adverse effects based on the information available at the time the assessment was completed. A description of the methodology used is in the original Biodiversity Offset Calculation Assessment, dated December 2017. As noted throughout that report, and in Section 1 above, a conservative approach was taken when assessing potential adverse effects, noting that future investigations would produce information to support and strengthen these ecological effects assessments.

A specific information gap in the original assessment was that vegetation communities on private land in the lower Mangapepeke Valley had not been physically visited and surveyed, though vegetation was mapped and loss assessed from aerial imagery and observations from adjoining land. The Ecology supplementary report – Vegetation has addressed this information gap and informed this updated offset calculation.

Information obtained from Table 3.1 in the Ecology supplementary report – Vegetation has been used to update the impact model of the biodiversity offset calculations. These calculations include an additional biodiversity component, 'Kahikatea treeland', which has been added as part of the WF8: Kahikatea pukatea forest ecosystem unit. The majority of this habitat was previously included as 'Kahikatea forest'.

As with the original Biodiversity Offset Calculation Assessment, this report has been reviewed by Maseyk (2017), the author of the offset calculator method. Improvements have been implemented from this review within this supplementary report. This includes improvements to the structure of the input of components and attributes, transparency of metrics used for determining ecological integrity scores (Appendix A), and the addition of new components.

Kahikatea trees have been included within the offset calculation as a specific additional component. This component has been included because kahikatea is the dominant tree impacted by the Project within one treeland and two forest communities, which combined occupy 1.325ha. The area where these kahikatea trees occur is also included within the assessment of ecological integrity, to fully capture the ecological values of within these habitat types.

While integrated pest management is expected to result in significant gains in the condition of browse sensitive species within the WF8 offset site, such as increases in canopy condition of swamp maire and regeneration of pukatea, less improvement is expected from this offset method for kahikatea trees and seedlings. This is because kahikatea already occupies large parts of the offset area and regeneration opportunities are less available for it.

Kahikatea is a light demanding species (Ebbett & Ogden 1998) and more readily regenerates beneath dappled light communities such as manuka scrub and within large canopy gaps, both habitat features which are uncommon at the proposed offset site. Dominant secondary communities within the proposed offset site include tree ferns and small broadleaved trees

such as ramarama and kaikomako. These species create a shaded understorey, which is more suited to broadleaved tree regeneration than kahikatea. Kahikatea is also fairly unpalatable to possums and goats, and therefore unlikely to respond significantly to a reduction in pest numbers. It is expected that with a reduction in pests a greater amount of fruit will be available to native birds, so a small benefit will accrue from integrated pest management.

Small refinements in vegetation community boundaries and ecological integrity scores have also been made through using high resolution drone imagery to update the vegetation map in the Mangapepeke Valley and assessments from field work. This has changed the area of loss for all three biodiversity types (WF8: Kahikatea pukatea forest, WF13: Tawa kohekohe hinau podocarp forest and WF14: Kamahi tawa podocarp hard beech forest ecosystem units).

2.2 Results from further investigations

The results from the further investigations are set out in Section 3 of the Ecology supplementary report - Vegetation. The flow-on effects of the further investigations on the Biodiversity Calculation Offset Assessment are set out below.

2.2.1 Impact model

As explained in the original Biodiversity Offset Calculation Assessment, the impact model determines the biodiversity value (BV) of the area of loss (ie, the area in the Project footprint).

The values used to populate the impact model of the biodiversity offset calculator have been updated based on the results set out in the Ecology supplementary report - Vegetation, and are summarised in Table 2.1 below and included within the worksheets in Appendix A.

The new and amended inputs are marked in italics in Table 2.1 for ease of reference.

Table 2.1 - Inputs into impact model

Ecosystem unit	Biodiversity Component (Vegetation community)	Level of forest intactness	Biodiversity Component #	Biodiversity attribute (Ecological Integrity or Canopy cover %)[1]	Total Habitat Loss (ha)
WF8	Kahikatea swamp maire forest and kahikatea forest[2]	Advanced secondary forest	1.1	69	*Amended figure: 0.684* *Original report: 1.231*
	Pukatea treefern treeland	Modified secondary forest	1.2	11	*Amended figure: 0.722* *Original report: 0.721*

Ecosystem unit	Biodiversity Component (Vegetation community)	Level of forest intactness	Biodiversity Component #	Biodiversity attribute (Ecological Integrity or Canopy cover %)[1]	Total Habitat Loss (ha)
	Manuka scrub	Modified secondary forest	1.3	7.5	*Amended figure: 0.582* *Original report: 0.372*
	Kahikatea treeland	*Modified secondary forest*	*1.4*	*17*	*0.641* *New component*
	Kahikatea trees	*Advanced secondary forest and Modified secondary forest*	*1.5*	*55 (Canopy cover)*	*1.325* *New component*
WF13	Tawa rewarewa kamahi forest	Intact primary forest	2.1	70	*Amended figure: 6.457* *Original report: 6.509*
	Tawa nikau tree-fern forest	Modified primary forest	2.2	34	*Amended figure: 8.507* *Original report: 8.731*
	Miro rewarewa kamahi forest	Intact primary forest	2.3	61	0.536 No change
	Pukatea nikau forest	Intact primary forest	2.4	39	*Amended figure: 1.347* *Original report: 1.258*
	Secondary broadleaved forest	Modified secondary forest	2.5	32	*Amended figure: 2.231* *Original report: 2.221*
WF14	Hard beech forest and Tawa	Intact primary forest	3.1	41	*Amended figure:*

Ecosystem unit	Biodiversity Component (Vegetation community)	Level of forest intactness	Biodiversity Component #	Biodiversity attribute (Ecological Integrity or Canopy cover %)[1]	Total Habitat Loss (ha)
	kamahi rewarewa forest[3]				*0.813* *Original report:* *0.081*
	Manuka tree-fern rewarewa forest	Modified secondary forest	3.2	15	*Amended figure:* *3.291* *Original report:* *3.599*

1= excluding 'Kahikatea trees' all scores are ecological integrity

2 = Kahikatea swamp maire forest and kahikatea forest have been aggregated to raise the overall ecological integrity score of Kahikatea forest which was assessed as 22% (see previous Offset Calculation report for full justification).

3 = Hard beech forest and Tawa, kamahi, rewarewa forest are the two predominant vegetation communities within WF14. These have been mapped separately but aggregated in the offset calculation as they are physically adjacent and have identical ecological integrity scores.

2.2.1.1 Kahikatea trees in WF8 vegetation communities

Kahikatea trees occur in three communities within the broader WF8: Kahikatea, pukatea forest ecosystem type: Kahikatea, swamp maire forest, Kahikatea forest and Kahikatea treeland. Kahikatea also occurs in the Pukatea treefern treeland and manuka scrub communities but at low percentage cover (<5%), so was not assessed in these communities.

The biodiversity attribute measured was canopy cover assessed within the three kahikatea dominant community types. These three communities occupied 1.325ha. Canopy cover was measured by comparing the percentage cover of kahikatea trees from high resolution drone images, on which individual trees are clearly discernible, and compared to the Foliage cover scale (Payton *et al.* 1999). Percentage cover scores of 45, 55 and 15% were obtained for 'Kahikatea, swamp maire forest', 'Kahikatea forest' and 'Kahikatea treeland', respectively. Applying a precautionary approach we used 55% within the impact model for the 1.325ha. The benchmark site chosen was the kahikatea stand in the northern tributary of the Mimi Stream, for which drone imagery was also available and assessed as 65% canopy cover.

The chosen offset methodology was restoration planting comprised of 30% kahikatea trees. Canopy cover was forecast from planting (year 0) to year 35, with no net loss at year 10, using Marden & Phillips (n.d.) as a guide. As noted above, kahikatea dominant vegetation communities in the offset site will also receive some benefit from the proposed integrated pest management.

2.2.2 Offset model

As explained in the original Biodiversity Offset Calculation Assessment, the offset model takes the biodiversity attribute of both the Project footprint and the target offset site(s) (as in, where it is anticipated offsetting would occur) to determine the area of biodiversity offset required. No changes were made to the offset model input data:

- Discount rate of 3%
- Benchmark values of 80% Ecological integrity for WF8 & 85% for WF13/WF14
- Medium confidence (75-90%) for WF8 and high confidence (>90%) for WF13/14

For the new biodiversity component, Kahikatea trees, a discount rate of 3%, a benchmark of 65% and a high confidence level (>90%) has been applied. Growth and canopy cover forecast measures were informed by Marden & Phillips (n.d) for canopy spread of kahikatea seedlings over 5 years. At Year 35 the canopy cover of kahikatea within the restoration planting is expected to be 65%, indicative of a pole stand of predominantly kahikatea. The rate of increase is expected initially to be slow, but increasing more quickly from Year 5 to Year 25 before tapering off at year 30 as a pole kahikatea stand develops and the canopy cover approaches the benchmark value (Figure 2.1).

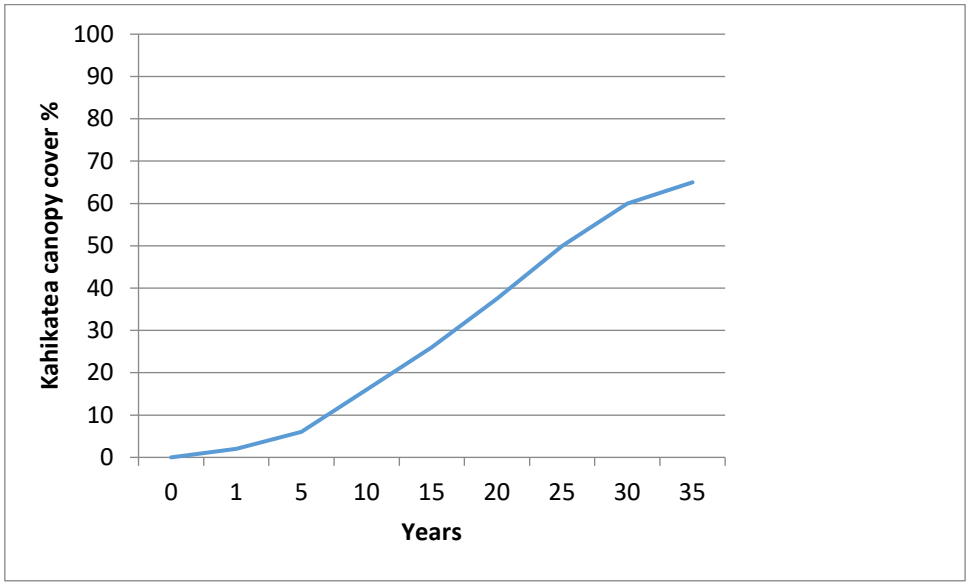

Figure 2.1 - Forecast increase in canopy cover in 6 ha of kahikatea dominant restoration planting

2.2.3 Updated results

The results from the Model, based on the updated information described above, are set out in Table 2.2 below. The results show that using integrated pest management alone in the offset sites for WF13 and WF14 achieves No Net Loss of biodiversity in 10 years for most of the impacted vegetation communities. The areas required in order to achieve No Net Loss are 190 ha of WF13 and 18 ha of WF14.

WF8 requires two types of management to achieve No Net Loss by year 10: integrated pest management and restoration planting, because the structural dominant, kahikatea, does not benefit significantly from integrated pest management alone. For integrated pest management, all communities achieve No Net Loss in 10 years except for kahikatea treeland and manuka scrub within 22ha. At year 10, kahikatea treeland and manuka scrub have biodiversity values of -0.01% of No Net Loss. Combined, all WF8 communities have positive values by Year 10 with a +0.03 gain in biodiversity value. An additional 6 ha of restoration planting for WF8 is also required to achieve No Net Loss within 10 years for 1.325ha of Kahikatea trees lost.

From the point that No Net Loss is achieved, Net Gain begins to accrue for all three ecosystem types between Years 10-15. By Year 35, significant biodiversity benefits are expected as a result of the offsetting programme for the Project.

The amended offset requirements generated by the Model are marked in italics in Table 2.2 for ease of reference.

The full biodiversity offset calculation worksheets can be found in Appendix A.

Table 2.2 - Results from the Model

Ecosystem type	Biodiversity component	Impact area (ha)	Proposed offset	Offset required (ha)	Years until No Net Loss	Biodiversity Value at Year 10
WF8	Kahikatea swamp maire & Kahikatea forest	0.684	Integrated pest management	*Amended figure: 15* *Original report: 18*	10	0.03
	Kahikatea treeland	*0.641*	*Integrated pest management*	*3 (new figure)*	*15*	*-0.01*
	Pukatea treefern treeland	0.722	Integrated pest management	3 No change	10	0.02
	Manuka scrub	0.582	Integrated pest management	1 No change	15	-0.01
	Kahikatea trees	*1.325*	*Restoration planting*	*6 (new figure)*	*10*	*0.00*
WF13	Tawa rewarewa kamahi forest	6.457	Integrated pest management	95 No change	10	0.02
	Tawa nikau treefern forest	8.507	Integrated pest management	*Amended figure: 61* *Original report: 58*	10	0.02
	Miro rewarewa kamahi forest	0.536	Integrated pest management	8 No change	10	0.06

Ecosystem type	Biodiversity component	Impact area (ha)	Proposed offset	Offset required (ha)	Years until No Net Loss	Biodiversity Value at Year 10
	Pukatea nikau forest	1.347	Integrated pest management	*Amended figure: 11* *Original report: 15*	10	0.00
	Secondary mixed broadleaved forest	2.231	Integrated pest management	15 No change	10	0.00
WF14	Hard beech forest and Tawa, kamahi, rewarewa forest	0.813	Integrated pest management	*Amended figure: 7* *Original report: 1*	10	0.00
	Manuka tree-fern rewarewa forest	3.291	Integrated pest management	*Amended figure: 11* *Original report: 8*	10	0.00

2.3 Discussion and recommended mitigation / offset

Overall, across the three ecosystem units (WF8, WF13 and WF14), this means that there has been a minor increase to the total offset required for the Project to 230ha of integrated pest management. Other components such as threatened, rare and regionally distinctive plants including kohurangi (*Brachyglottis kirkii* var. *kirkii*), *Pittosporum cornifolium* and swamp maire (*Syzygium maire*) were not included as separate components because it is expected that all of these species will benefit with integrated pest management at the proposed offset site.

2.3.1 WF8: Kahikatea, pukatea forest

Due to the inclusion of an additional biodiversity component 'Kahikatea treeland', changes to impact area values, and ecological integrity scores have occurred. Integrated pest management was calculated as achieving no net loss for all WF8 communities by year 10. This result was not considered to be sufficient to adequately offset the loss of kahikatea trees within WF8 communities. Therefore 'kahikatea trees' was added as a separate biodiversity component.

The offset required from all components amounts to 22ha of integrated pest management in like for like habitat and 6ha of restoration planting, designed to achieve a 65% canopy cover of kahikatea by year 35. The 6ha total for restoration planting is unchanged, despite the reclassification explained above.

2.3.2 WF13: Tawa kohekohe hinau podocarp forest

High quality drone imagery enabled more accurate mapping of the WF13 forest boundaries in the upper Mangapepeke Valley. This has meant minor adjustments to the areas affected for four of the five vegetation communities. There was a minimal decrease to the offset

required for one biodiversity component (Pukatea nikau forest) and a minimal increase to the offset required for another (Tawa nikau treefern forest).

The updated data has led to an overall decrease of 1ha in offset area required, so the total area of integrated pest management required to offset effects on WF13 habitat is now 190ha.

2.3.3 WF14: Kamahi tawa podocarp hard beech forest

The Ecology supplementary report – Vegetation, identified an additional 0.732ha combined of 'Hard beech forest' and 'Tawa, kamahi, rewarewa forest' within the Project Area, which were of higher ecological integrity than in the original assessment. This has increased the area required for integrated pest management to 18ha.

3 Conclusions

Relatively minor updates to the classification of vegetation community composition and extent have been carried out as a result of field work undertaken and the use of high resolution drone imagery for mapping vegetation within the Mangapepeke Valley. Amendments to the Model inputs, including the addition of 'Kahikatea treeland' and a new component 'Kahikatea trees', and a greater area and higher ecological integrity values of 'Hard beech and tawa, kamahi, rewarewa forest', have been used to adjust the biodiversity offset calculations. Small changes were also made for WF13 communities based on the additional information gathered.

The consequence of this update is a minor increase of 9ha to the area of integrated pest management required for the Project. There is no change to the originally modelled requirement for restoration planting, though the outcome target at 35 years is a canopy cover of 65% kahikatea.

Overall, the updated offset site required is a total of 230ha of integrated pest management and 6ha of restoration planting.

4 References

Ledec, G.C. and Johnson, S.D.R. (2016). *Biodiversity offsets: a user guide*. Washington, D.C.: World Bank Group. http://documents.worldbank.org/curated/en/344901481176051661/Biodiversity-offsets-a-user-guide

Maseyk, F. (2017). SH3 Mt Messenger bypass project. Review of the Mt Messenger biodiversity offsetting proposal. The Catalyst Group Report. TCG017/112. August 2017.

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Payton, I.J.; Pekelharing, C.J.; Frampton, C.M. (1999). Foliar browse index: A method for monitoring possum (*Trichosurus vulpecula*) damage to plant species and forest communities. Manaaki Whenua - Landcare Research, Lincoln, N.Z.

Appendices

Appendix A: Ecological Integrity Metrics

Table A1 - Metrics used for determining ecological integrity, following methodology described in the original Biodiversity Offset Calculation report (NSES 2018)

Ecosystem type	Biodiversity Component	Ecological Integrity Score (%)	Current state	Habitat Condition		
				Canopy condition	Understorey condition	Native dominance
WF8	Kahikatea swamp maire & Kahikatea forest	69	0.85	0.90	1.00	0.90
	Pukatea treefern treeland	11	0.50	0.70	0.60	0.50
	Manuka scrub	7.5	0.25	1.00	0.60	0.50
	Kahikatea treeland	17	0.60	0.70	0.50	0.80
WF13	Tawa rewarewa kamahi forest	70	0.85	0.90	0.95	0.97
	Tawa nikau treefern forest	34	0.95	0.70	0.6	0.85
	Miro rewarewa kamahi forest	61	0.95	0.80	0.80	1.00
	Pukatea nikau forest	39	0.95	0.70	0.55	0.85
	Secondary mixed broadleaved forest	32	0.40	0.90	1.00	0.90
WF14	Hard beech forest	41	0.95	0.80	0.60	0.90
	Manuka treefern rewarewa forest	15	0.60	0.70	0.50	0.70

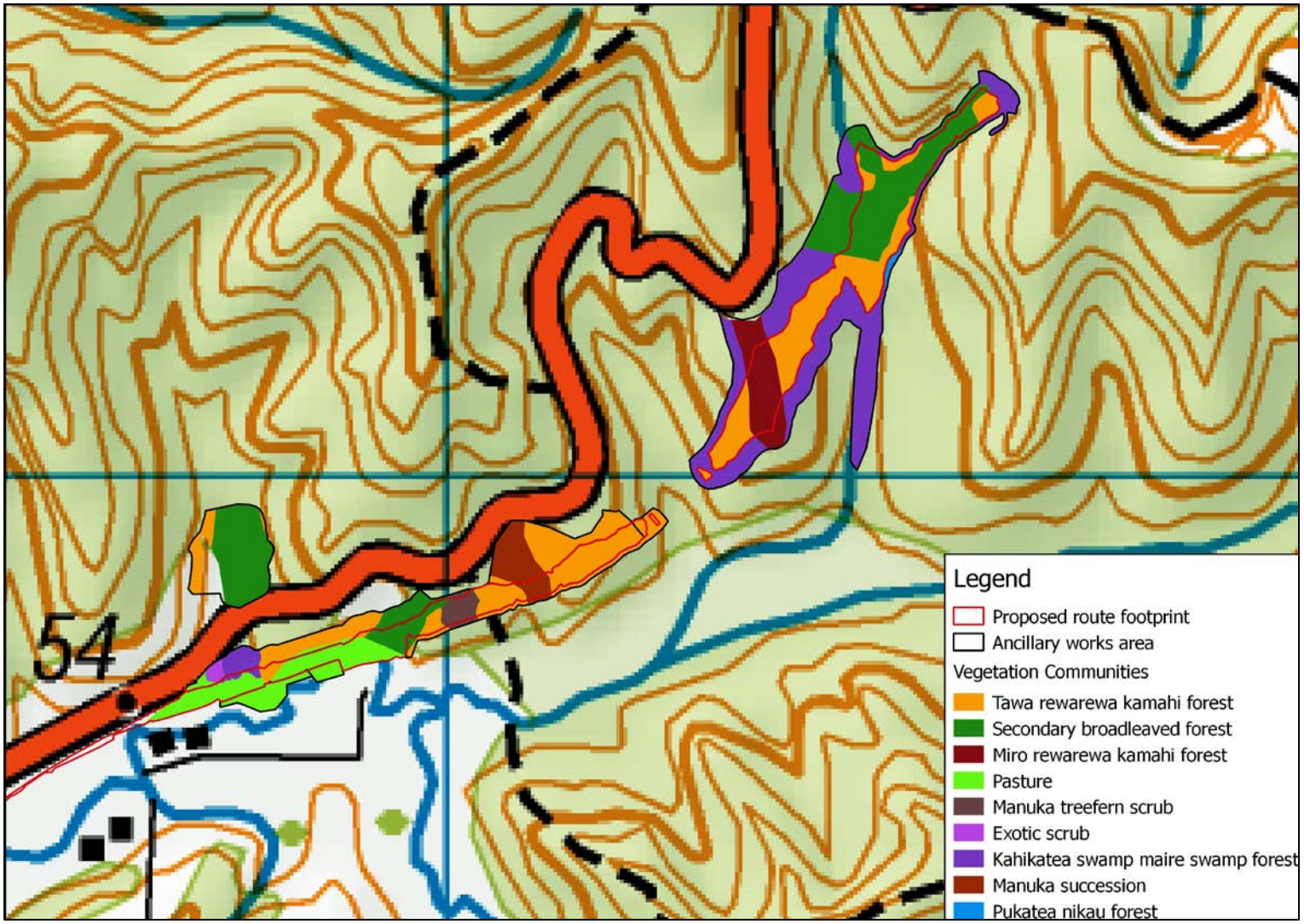

Figure A1 – Vegetation communities within the northern tributary of the Mimi Stream within the proposed route footprint and the Additional Works Area

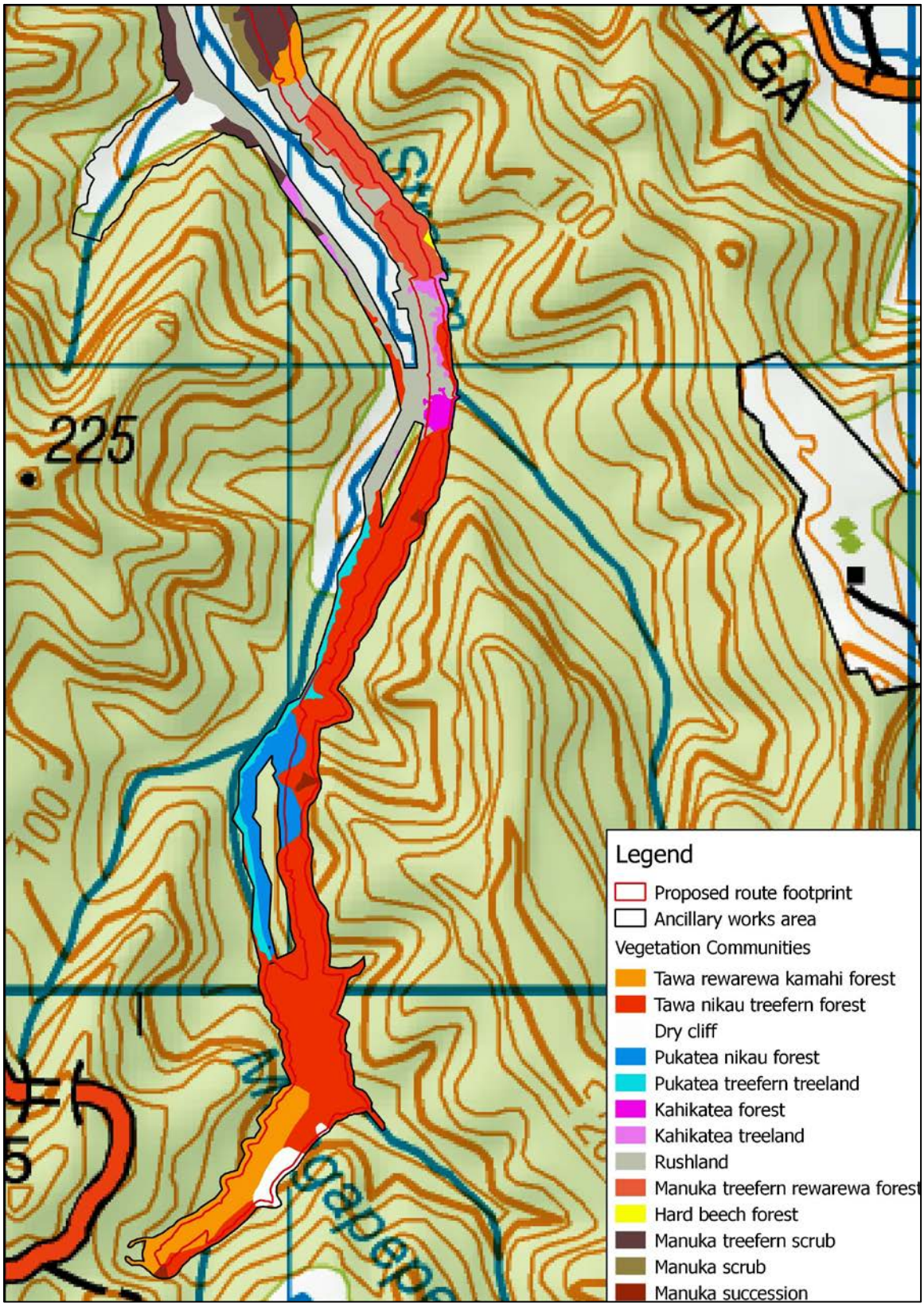

Figure A2 – Vegetation communities within the upper Mangapepeke Stream within the proposed route footprint and the Additional Works Area

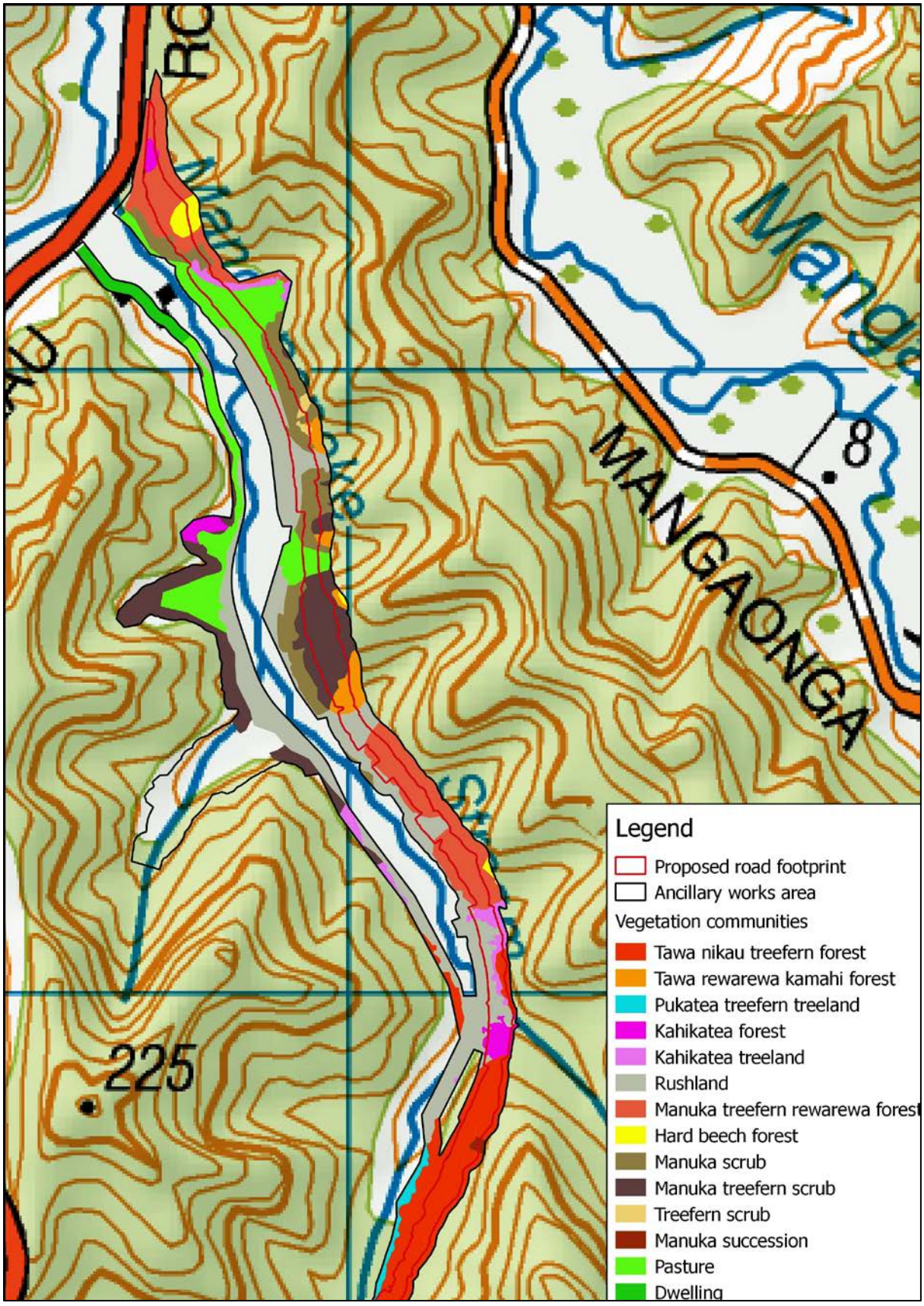

Figure A3 – Vegetation communities within the lower Mangapepeke Stream within the proposed route footprint and the Additional Works Area