BEFORE THE HEARINGS PANEL

IN THE MATTER	of the Resource Management Act 1991
AND	
IN THE MATTER	of proposed Plan Change G: Aokautere Urban Growth to the Palmerston North City Council District Plan

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SECTION 42A TECHNICAL REPORT OF ADAM SEAN FORBES
ON BEHALF OF PALMERSTON NORTH CITY COUNCIL

TECHNICAL – ECOLOGY

Dated 15 September 2023

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A. EXECUTIVE SUMMARY

1. The key conclusions of my section 42A technical report are:

   (a) Terrestrial vegetation constraints within the proposed Plan Change G (**PCG**) area range from very high (Manawatū-Whanganui (Horizons Regional Council) One Plan Schedule F kānuka forest) to low (exotic grassland or gorse). Restoration of gully forests will benefit the health of streams in the gullies. In the outer eastern area five additional areas of native forest have also been identified for protection and restoration. PCG includes the rezoning of gullies to Conservation and Amenity zoning and I support this change in zone status of the gullies.

   (b) A number of wetland areas are present in the eastern part of the PCG area. These are seepage/spring wetlands and are a rare habitat type regarding Schedule F. Wetlands are underrepresented at regional and national scales and their protection and restoration is a priority.

   (c) A range of hydroclasses are present within the plan change area and effects should be managed, particularly in permanent and intermittent reaches which by definition have the status of a River under the Resource Management Act 1991 (**RMA**).

   (d) Works and structures are required in and around waterways for stormwater management purposes. I have worked with the project's stormwater specialists and understand the mitigation hierarchy has been applied to its fullest extent possible. Some residual adverse effects remain and these will require freshwater offsets. I have assessed these offsets at a high level using readily available data and it appears there is sufficient freshwater habitat to achieve a no-net-loss, or net-gain, position for freshwater biodiversity within the plan change area.

B. INTRODUCTION

2. My name is Adam Sean Forbes. I am the founding Director and Principal Ecologist at the ecological consultancy Forbes Ecology Limited.

3. I have 19 years professional experience as a Consulting Ecologist. The first 8 of those years I was employed by the international consulting firm MWH Ltd (now Stantec). In 2012 I established my own consulting business and have been self-employed over the remainder of my career. Over my consulting career I have worked extensively with RMA ecological assessments for a diversity of infrastructure proposals. My roles have included ecological assessments of freshwater, wetland and terrestrial ecosystems. I have worked in roles as Ecological Assessor, Author, and Peer Reviewer for a range of private and government clients.

4. Between 2013-2015 I completed a PhD in Forestry with the University of Canterbury New Zealand School of Forestry. Earlier I completed an MSc in Environmental Science (Applied Ecology and Conservation; University of Auckland; 2010) and a BApplSci in Natural Resource Management (Massey University; 2003).

5. I have been engaged by Palmerston North City Council (**Council**) in relation to PCG, which seeks to rezone a new greenfield growth area in Aokautere for residential development and inserts an accompanying structure plan and provisions (objectives, policies and rules) into the District Plan.

6. I have been involved with PCG since November 2019. My role has involved the following aspects:

   (a) Identifying ecological constraints associated with vegetation growing in the gully systems located across the PCG area to inform development of the Structure Plan;

   (b) Identification of wetland ecosystems across the PCG area;

   (c) Classification of waterway hydroclasses along streams in the PCG area;

   (d) Collaboration with Council's stormwater engineers to ensure effects to ecosystems from stormwater infrastructure are avoided, remedied, or mitigated and that any residual adverse effects are manageable within the plan change area.

7. As part of my role I authored the following reports:

(a) Aokautere Structure Plan Ecological Features, Constraints, and Restoration (15 June 2020), Pp 43 (report) (the "**June 2020 Report**"). This involved the delineation of ecological features present (excluding the Waters Block) and mapping them as levels of constraint to assist project shaping. Included consideration of One Plan criteria.

(b) Review of Waters Block for Aokautere Master Plan (4 March 2021), Pp 8 (letter report). This involved site assessment of the Waters Block to assess how the ecological features present relate to significant habitat types (i.e., One Plan Schedule F).

(c) Aokautere Masterplan Stream Hydroclass Classifications (14 April 2023), Pp 24 (letter report) (the "**2023 Report**"). The work was undertaken in relation to a request by Horizons Regional Council (**Horizons**) to have stream hydraulic classifications (hereafter hydroclasses) defined across the PCG area to assist the RMA regulatory process.

8. The report/s described above are attached to my section 42A technical report as **Attachments A-C**, respectively.

C. CODE OF CONDUCT

9. I confirm that I have read and agree to comply with the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2023. I confirm that I have stated the reasons for my opinions I express in this report, and have considered all the material facts that I am aware of that might alter or detract from those opinions.

10. Statements expressed in this report are within the scope of my expertise.

11. I have all the information necessary to assess the application within the scope of my expertise and am not aware of any gaps in the information or my knowledge.

12. I am familiar with the site for the PCG proposal, having visited it on the following dates:

- 15 November 2019;
- 10 December 2019;

- 7 January 2020;
- 17 January 2020;
- 28 February 2023; and
- 1 March 2023.

D. SCOPE

13. In my s42A report I provide an overview of the following issues:

    (a) Constraints associated with vegetation and wetlands in gullies;

    (b) Waterway hydro classifications;

    (c) Recommendations for gully restoration; and

    (d) Responding to submissions received relevant to ecology.

14. In addition to my own observations, I rely on the technical s 42A report of Reiko Baugham and Tony Miller, including, the Technical Memorandum of 28 August 2023[1] for the description and quantification of likely stormwater treatment features.

15. I have reviewed submissions and further submissions on PCG. Of particular note when considering my field of expertise are the submissions relating to the following issues:

    (e) Clarifying the locations of perennial, intermittent and ephemeral stream hydroclasses;

    (f) Protection of gullies and their habitats;

    (g) The risk of light/noise pollution on fauna in gullies; and

    (h) The merit of including Gully 10 portion in Conservation and Amenity Zone.

[1] Appendix C of the Stormwater Section 42A Report, Ms Baugham and Mr Millar, 15 September 2023.

E. BACKGROUND

16. PCG seeks to rezone a new greenfield growth area to the south-east of Palmerston North for residential development and inserts an accompanying structure plan and provisions (objectives, policies, and rules) into the District Plan. The plan change will provide for additional housing supply in Aokautere (and the City), to help meet growth projections for Palmerston North over the medium to long term, while addressing the specific topography and environmental issues in Aokautere.

17. Given past agricultural and urban development that has occurred across the Structure Plan area, most remaining ecology values are confined to the numerous gully systems present across the area. The landforms of the gullies are steeper and less accessible compared to intervening flats/terraces meaning the past effects of agriculture and urban development has been less in gullies. Some of the gullies contain regenerating forests, waterways and wetlands. Therefore, the gully landforms have been a main focus of the ecology work for the PCG area.

F. ASSUMPTIONS AND METHODOLOGY

Terrestrial vegetation constraints

18. Levels of constraint were assigned to terrestrial vegetation and habitats based on the composition of the vegetation canopy. This included consideration of degrees of nativeness and levels of successional development which was determined from the species identities present and their stature. Specific reference to the composition and threat status of One Plan Schedule F ecosystem types was included. Terrestrial constraints were assigned as described in Table 1.

Table 1. Terrestrial ecological constraint categories and thresholds adopted for the assessment.

Constraint Level	Canopy Composition	One Plan Schedule F
Very High	Representing old-growth forest	Threatened or At-Risk habitat type
High	Representing advanced secondary forest	Not Threatened habitat type
Moderate	Representing young secondary forest	

Constraint Level	Canopy Composition	One Plan Schedule F
Low	Predominately exotic woody vegetation with potential for indigenous regeneration	

Wetland constraints

19. Wetland constraints were identified using a combination of vegetation, soil, hydraulic and topographic characteristics to interpret wetland extents. The Ministry for the Environment's National wetland delineation protocols[2] and One Plan Schedule F criteria guided the assessment.

Waterway hydro classification

20. Waterway hydroclasses were assessed using the Auckland Unitary Plan Practice and Guidance Note for River/Stream Classification[3]. The method uses a combination of desktop and field assessment. The field assessment uses the Table 2 criteria to distinguish hydroclasses in the field. To distinguish intermittent from ephemeral reaches, three of the six "intermittent river or stream, or ephemeral stream" criteria need to be present to indicate intermittent status, with less than three criteria being met indicating ephemeral status. The difference between intermittent and ephemeral classes is important as ephemeral reaches do not meet the RMA definition of a river, whereas intermittent (and permanent) reaches do.

Table 2. AUP(OP) criteria for permanent, intermittent rivers and streams and ephemeral streams

Criterion	Definition
Permanent river or stream	
1	Evidence of continuous flow
Intermittent river or stream, or ephemeral stream	
1	Evidence of natural pools
2	Well defined channel. Banks and bed can be distinguished
3	Surface water present (more than >60hrs after a rain event)

[2] See Ministry for the Environment. 2022. Wetland delineation protocols. Wellington: Ministry for the Environment.

[3] See https://content.aucklanddesignmanual.co.nz/regulations/practice-notes/Documents/RC%203.3.17%20Stream%20Classification.pdf.

4	Rooted terrestrial vegetation not present across the entire cross-sectional width of channel
5	Organic debris present in floodplain
6	Evidence of substrate sorting processes, including scour and deposition
Ephemeral stream	
1	Stream bed above the water table at all times
2	Water present only during and shortly after rainfall

High-level freshwater offset assessment

21. While freshwater effects will be addressed through a subsequent resource consenting process with Horizons, for the purposes of PCG I have completed a high-level assessment of the ability to address residual adverse effects from necessary stormwater works within unaffected perennial and intermittent stream reaches in the PCG area. Since notification of PCG, I have worked with the project's stormwater specialists and understand the mitigation hierarchy has been applied to its fullest extent possible. However, some residual adverse effects remain and these will require freshwater offsets at the time of works.

22. I carried out this high level offset assessment as follows:

(i) Tabulated the effected stream lengths data taken directly from the Table 1 in the GHD Technical Memorandum of 28 August 2023 for Gullies 1, 3 and 11. This memorandum is attached as Appendix C of the s 42A report of Ms Baugham and Mr Millar, and sets out a package pf measures proposed to reduce the volume and velocity of runoff generated by development in Aokatuere, including (among other measures) instream works designed to reduce velocities and sediment transport during frequent rainfall events.

(j) Sourced applicable average Stream Ecological Valuation Environmental Compensation Ratio (i.e., ECR = 2.48) from freshwater expert evidence[4] submitted during the regional consenting phase of the nearby Te Ahu a

[4] The expert evidence at paragraph 272 gives a mean ECR of 2.48. I have therefore adopted ECR 2.48 as an indicative multiplier for these workings. The statement of evidence is available online at this location: https://www.nzta.govt.nz/assets/projects/sh3-manawatu/rma-consenting/Technical-Assessment-H-Freshwater-Ecology.pdf.

Turanga; Manawatū Tararua Highway Project. This ECR is an appropriate proxy for the purposes of PCG as it relates to similar scaled waterways of equivalent hydro classes and from a similar geographical location.

(k) I then estimated from my stream hydroclass mapping and use of Google Earth Pro imagery the following:

(i) overall length of reaches;

(ii) reach length remaining unaffected post proposed works,

(iii) using the ECR and effects length how much restoration would be required; and

(iv) what surplus of stream length exists after application of ECR derived effects lengths.

G. OVERVIEW OF ECOLOGY ASSESSMENTS

Vegetation and wetland constraints

23. Levels of ecological constraint for terrestrial vegetation varied from very high to low. The very high level of constraint was associated with mature kānuka forest located in Gully 4 (red polygon in Fig. 1). Mature kānuka forest is a threatened habitat type defined in Schedule F of the One Plan. Of high constraint was the lower true right side of Gully 2 (blue polygon in Fig. 1) where the native regeneration is more advanced and features occasional lowland tōtara and kānuka trees amongst mixed broadleaved forest. Moderate levels of ecological constraint were found in early stage indigenous-dominant secondary forest featuring species such as māhoe and mānuka (see yellow polygons in Fig. 1). Remaining vegetation in gullies is of low ecological constraint. These low constraint communities are normally exotic gorse dominated (see purple polygons in Fig. 1).

24. The above constraints have helped shape the layout of the proposed development areas and proposed zoning as set out in the s42A reports of Mr Andrew Burns and Ms Anita Copplestone. Also see Appendix A for the June 2020 Report. I note Attachment 1 of the June 2020 Report (the Draft Biodiversity NPS Preliminary Significance

Assessment) where I evaluated the gully systems against the draft National Policy Statement – Indigenous Biodiversity ecological significance criteria.

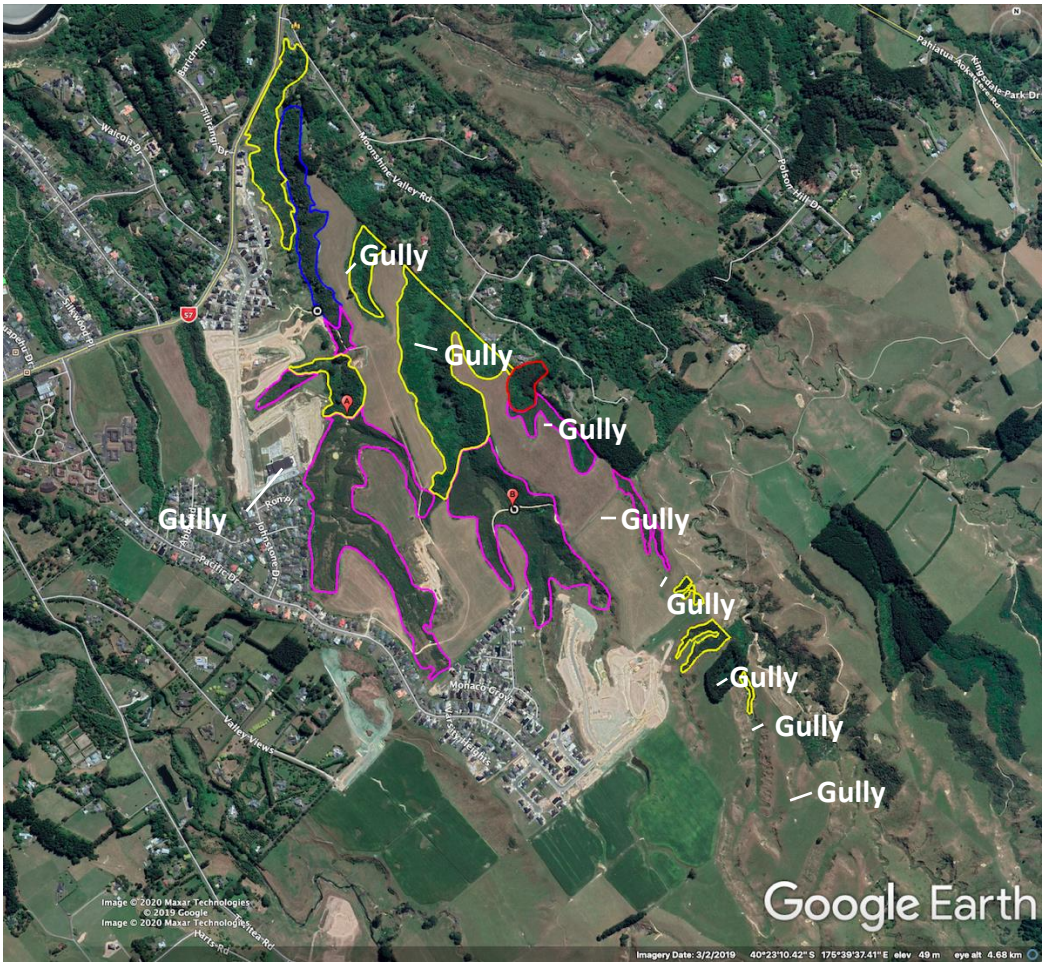

Figure 1. Levels of ecological constraint within the proposed Aokautere master plan area.

25. A number of wetland areas were identified and mapped, particularly in the eastern parts of the Structure Plan area. Wetland extents are shown as red polygons in Figure 2. The vegetation structure across the wetlands is predominantly non-woody having been modified by past land clearance and agricultural land use. The wetlands represent seepage/spring classification which are a rare habitat type with respect to One Plan Schedule F. It is recommended that these wetlands be retired from stock grazing, protected, and restored. I understand from the s42 reports of Mr Burns and Ms

Copplestone that these wetland features have been appropriately provided for within the Structure Plan area.

26. Beyond these wetlands are a number of areas of rushes which occur due to a combination of soil type (drainage status) and pasture management. However, I consider that these areas should be excluded from wetland status by the criteria contained in Schedule F Table F.2(b) iii[5]. See Appendix B for the full report for further details.

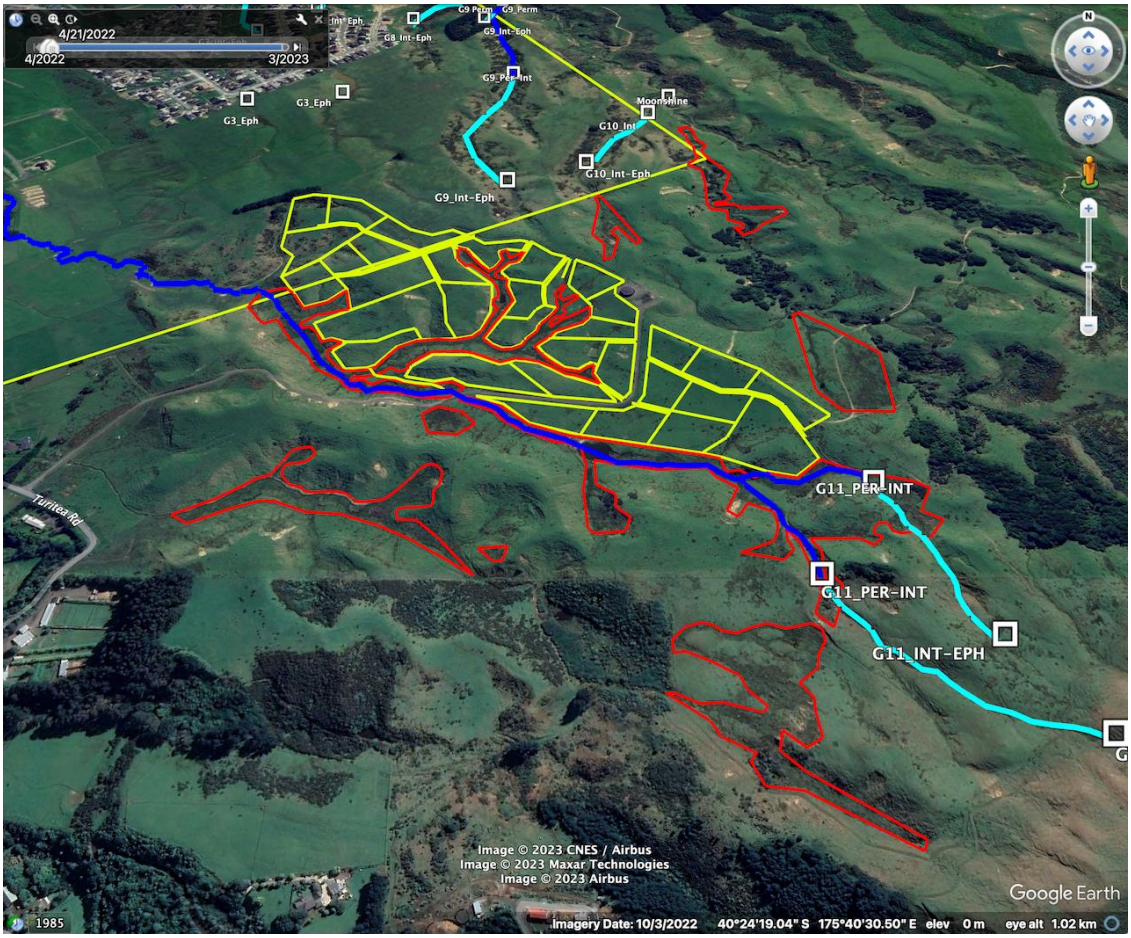

Figure 2. Wetland extents are shown here as red polygons.

27. In addition to the above features, areas of native vegetation have been identified in outer areas at the east and south of the PCG area (see Fig. 3). It is

[5] Damp gully heads, or paddocks subject to regular ponding, dominated by pasture or exotic species in association with wetland sedge and rush species.

recommended that these features be retired, protected and restored as part of the PCG process.

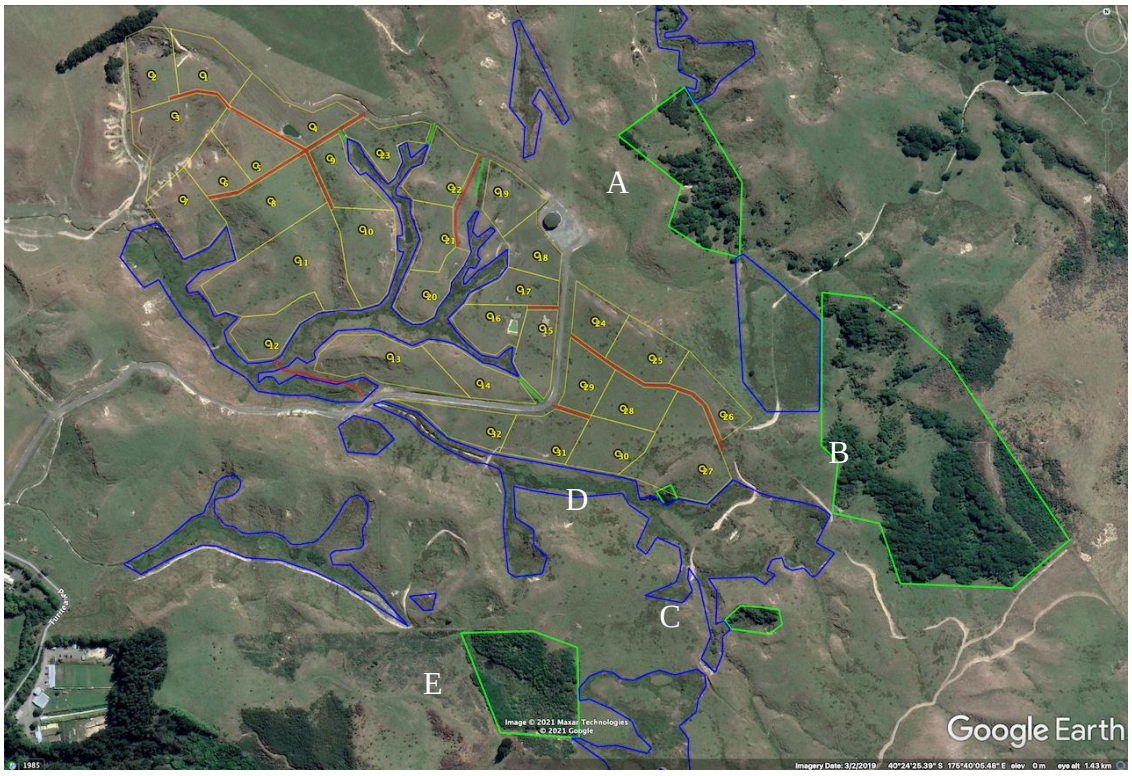

Figure 3. Areas of the Water's land featuring native forests (A-E) which are recommended for specific treatment under the Aokautere Structure Plan.

H. FURTHER ASSESSMENT

28. Since notification, further work has been completed receipt of submissions. Matters raised in submissions (relevant to my area of expertise) related to:

(a) the definition of stream hydroclasses;

(b) the likely biodiversity offsetting outcomes arising from the necessary stormwater works; and

(c) further description of gully revegetation to optimise land stability and resilience.

29. Any earlier conclusions or statements regarding stream classifications made in the June 2020 Report are superseded by the 2023 Report. The assessment is summarised below, with the 2023 Report available as Appendix C. I describe the outcomes of the high-level

freshwater biodiversity offsetting assessment and further description of gully revegetation below.

Stream hydroclass assessment

30. Gullies across the Structure Plan area contain a range of stream hydroclasses. Permanent and intermittent reaches along with the change points between these, and between intermittent and ephemeral, are mapped in Figure 4 A and B. In summary, four gullies (G1, G3, G9, & G11) contained reaches of permanently flowing water. Eels and koura were seen in several locations within these reaches. Nine gullies (G1–G3, G8–G11, Adderstone, & Mangotane) contained intermittently flowing reaches. Five gullies (G3a–G7) contained only ephemeral hydroclasses.

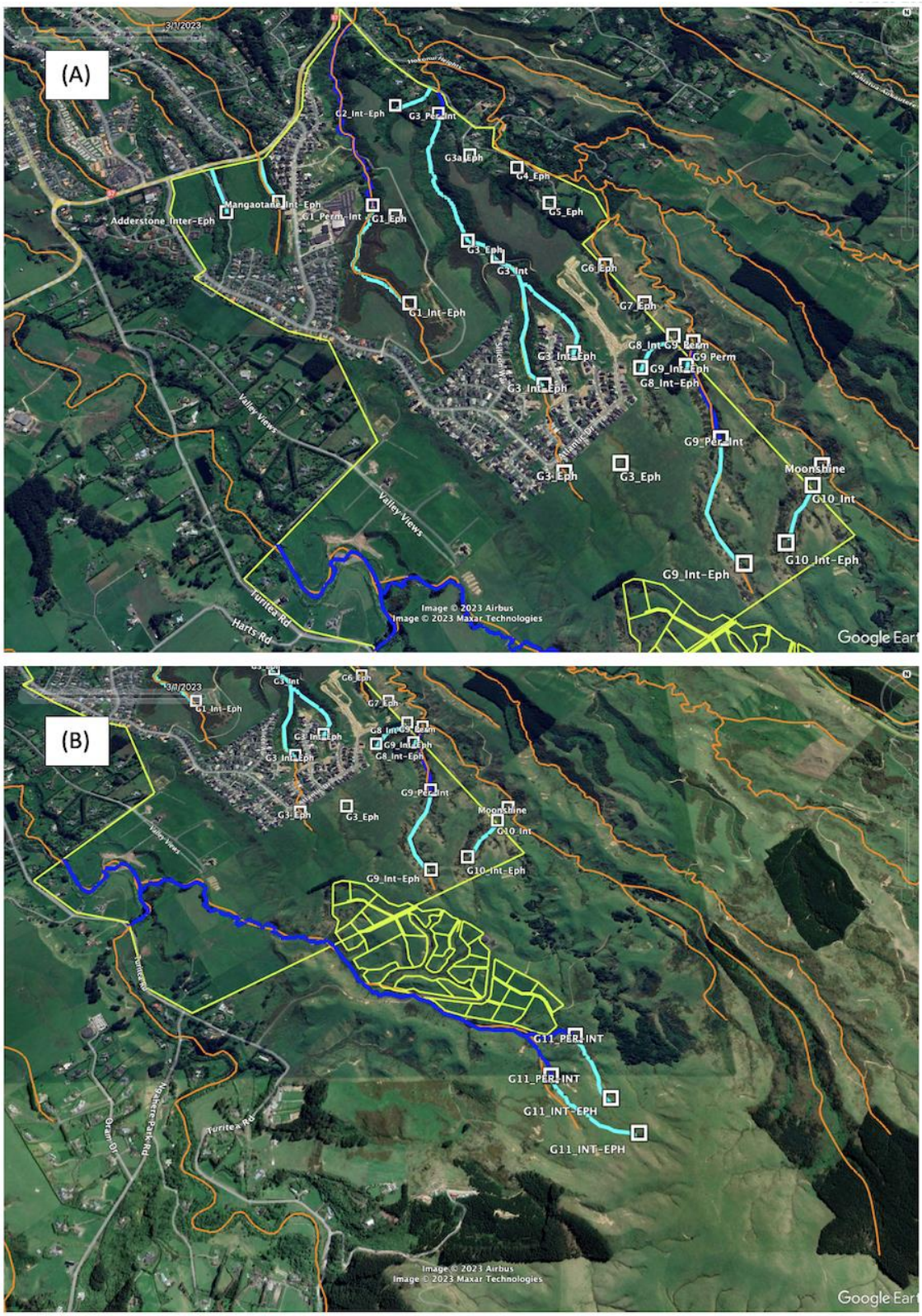

Figure 4. A & B. A - Northern parts of the Structure Plan area showing hydroclass boundaries and results for Gullies 1-10 plus Adderstone and Mangotane reserves and the Moonshine Stream. B – Hydroclass results for the Waters Block in the southern portion of the Structure Plan area. Dark blue = permanent hydroclass. Light blue = Intermittent hydroclass. Orange lines = PNCC stream layer.

High-level freshwater offsetting assessment

31. The outcomes of the high-level analysis of the ability to offset the adverse effects of the recommended stormwater mitigation works are set out below and summarised in Table 3:

(a) Gully 1 contains approximately 1,906 m of perennial and intermittent waterway length. The stormwater experts, Ms Baugham and Mr Millar, estimate that 285 m of stream would be directly affected by structures (culverts and cascading weirs). Applying the ECR of 2.48 this generates a need for 707 m of freshwater restoration along unaffected reaches to reach a no-net-loss position for freshwater biodiversity. On this basis, within Gully 1, there would be a surplus of 914 m after appropriate offsetting is applied.

(b) Gully 3 contains approximately 1,778 m of perennial and intermittent waterway length. Ms Baugham and Mr Millar estimate that 390 m of stream would be directly affected by structures (cascading weirs, below ground dam, inline dry pond). Applying the ECR of 2.48 this generates a need for 967 m of freshwater restoration along unaffected reaches to reach a no-net-loss position for freshwater biodiversity. On this basis, within Gully 3, there would be a surplus of 421 m after effects management is applied.

(c) In Gully 11 two bridge abutment structures are envisaged totalling 40 m of work around the stream. In my opinion, Gully 11 contains ample unaffected stream length to offset these works.

(d) In summary, I have applied a reputable average ECR from a local project to the recommended stream works and the results of this indicate there is surplus stream length to manage adverse effects through offsetting as part of any consenting process, within the plan change area.

Table 3. Lengths (m) of each GHD recommended stormwater treatment and the availability of perennial and intermittent stream reaches available for offsetting within the Structure Plan area.

	Effects lengths (m)							Reach accounting (m)			
Gully #	**Culvert**	**Cascading weirs**	**Below ground dam**	**Inline dry pond**	**Online pond**	**Bridge abutments**	**Affected length**	**Reach available**	**Unaffected reach after works**	**Restoration required**	**Reach surplus**
1	100	185	0	0	0	0	285	1906	1621	707	914
3	0	250	40	40	60	0	390	1778	1388	967	421
11	0	0	0	0	0	40	40	N/A	N/A	99	N/A

Notes. N/A = not assessed in relation to the Structure Plan due to the extensive reach length available and the limited affected length.

Specific revegetation measures for optimising gully stability and resilience

32. The optimal vegetation type for stabilisation of the gully sides is mature native forest. Exotic grassland provides the least stabilising effect on soils, and gorse and seral native forest would be intermediate in stabilising performance. I have recommended enrichment planting in gorse (see Section 5 of the June 2020 Report) to direct and accelerate succession to native forest. Areas in grassland which are at potential risk of instability (due to their slope) should be actively planted to achieve forest cover. It is critical that the gully sides are protected and managed so that they regenerate and succeed to mature native forest. The pace of this process is naturally relatively slow (i.e., multiple decades), and it is important that management commences at the outset and is sustained to support the best possible rates of forest regeneration and succession.

33. Planting in the riparian zone (20 m either side of the wetted channel) should comprise species adapted to floodplain conditions as such species are most suited to alluvial soils and the potential for periodic inundation. In particular, planted sedges provide a first line of defence regarding stabilising soils and enduring inundation. Taller statures shrub and tree species are also important with regarding to provision of shading, overhead cover, and habitat. A suitable species list for riparian planting can be found at this website[6].

I. SUBMISSIONS

34. I have considered the submissions and further submissions for PCG. I have identified a number of key issues, which I address by reference to submissions in detail below.

Horizons Regional Council – S60

35. Horizons raised a concern over the way the June 2020 Report grouped intermittent and ephemeral waterways. I have now classified all waterways across the plan change area as either ephemeral, intermittent or perennial in accordance with the AUP method,

[6] See https://www.horizons.govt.nz/HRC/media/Media/Water/201263Riparian-Planting-Guides-TONGARIRO-Copy.pdf?ext=.pdf.

which is regarded as best practice. Part of this assessment was carried out in the field with a Horizons representative.

36. In summary, the waterway assessment[7] I carried out, concluded:

(l) Hydroclasses were determined at a total of 24 locations across 14 gullies of the Structure Plan area in late February-early March 2023.

(m) Four gullies (G1, G3, G9, & G11) contained reaches of permanently flowing water. Eels and koura were seen in several locations within these reaches.

(n) Nine gullies (G1–G3, G8–G11, Adderstone, & Mangotane) contained intermittently flowing reaches.

(o) Five gullies (G3a–G7) contained ephemeral hydroclass.

37. The full assessment is available as **Appendix C**.

Mary Morgan-Richards – S13, Royal Forest and Bird Protection Society – S97, and Prabandha Samal – S107

38. These three submitters requested better protection of gullies and their habitats, including mature and emerging canopy trees. From my perspective, it is positive that the gullies (G1-G18 in the Structure Plan) and bush areas (F1-F4 in the Structure Plan) are proposed to be zoned for conservation and amenity purposes. Specific protection of mature native trees in the young regenerating forests of the gullies would provide additional security. Other mechanisms I would support as part of PCG (or generally) would be conservation covenants placed on wetlands and forest ecosystems such as bush areas F1-F4.

39. I would also add that while legal protection is important for forest and wetland ecosystems, active management is also critical to ensure the health and integrity of these ecosystems. For instance, bush areas F1-F4 require active management, such as excluding browsing animals (e.g., stock) by fencing and allowing for natural regeneration and also planting appropriate species when those species are unable to

[7] As described in the 2023 Report.

establish themselves at the restoration site (enrichment planting). I have recommended in the June 2020 Report a number of restoration measures, including:

(p) Forest restoration plantings in exotic pasture.

(q) Enrichment planting in gorse.

(r) Enrichment planting and weed control in seral (regenerating) broadleaved forest.

40. Gully restoration will assist the reestablishment of riparian forest where these are not existing and this will benefit the health of the gully streams. Details of the purpose, methods, locations, and extents of these recommended restoration treatments are set out in the June 2020 Report.[8]

41. I also note that Forest and Bird seek a rule preventing cat ownership within the PCG area. While I appreciate the concept, the reality is feral cats will be present in adjacent farmland, and other predators such as mice, rats, hedgehogs and mustelids will be ongoing threats and unable to be eradicated at the scale of the gullies (i.e., there will be ongoing immigration of all predators). I do not consider the values present within the gullies justify banning cats. Further, banning cats only partly addresses the cat issue and does not address the predation issue.

Elizabeth Fisher – S80

42. Elizabeth Fisher questioned whether there is a risk of light/noise pollution from development on gully edges adversely affecting ecological values in the gullies. In response, I do not consider that fauna species present in the ecosystems of the masterplan would be sensitive to the light or noise that would be emitted from adjoining properties once they are developed.

Les Fugle – S58

43. Mr Fugle opposes the change in zoning from Residential to Conservation and Amenity across the area of land immediately south of the proposed gully (Gully 10) crossing

[8] Appendix A, at pages 35-42.

connection from Abby Road to Johnstone Drive. Mr Fugle notes that this area of land has been previously partly filled and has no particular natural or amenity values.

44. I visited this area on Wednesday 1 March as part of the stream hydroclass site assessment process. I passed through gully vegetation to access the gully floor where any stream channel would be found. I identified an intermittent to ephemeral hydroclass boundary approximately 130m downgradient of the proposed road crossing location. Based on this distance and my knowledge of the site I am confident that at the crossing location any channel would be of ephemeral hydroclass.

45. The dominant vegetation in the area concerned is exotic gorse. While not directly of biodiversity concern, within the PCG area gorse stands do reliably form nursery conditions for the natural establishment of native forest tree species, or as per my recommendations, shelter sites for planting a diversity of native tree species. I noted this point in the June 2020 Report[9]. Therefore, it is my opinion that management of the gully area referred to by Mr Fugle for restoration purposes would help boost connectivity and native area in the plan change area. I consider that these are both important ecological factors to be promoted through PCG.

46. Another point raised by Mr Fugle is a question over the presence of a stream in G1/Church Stream extending through North Village site to the existing residential area to the southeast. I have assessed waterway hydroclasses in G1 and the point where the waterway class changes from intermittent to ephemeral is described in the 2023 Report at Appendix C. A copy of the location is shown in Figure 4 A of my section 42A report.

Susan and Yann Le Moigne – S71

47. This submission calls for 30m setbacks at the top of gullies to reduce the potential for tall native tree species to shade and create nuisance to adjacent residences. Given the deep entrenched nature of the gully topographies I am not concerned about shading or nuisance issues relating to revegetation of the gully sides. These concerns could be addressed through landscape design limiting the density of tall trees in the zone near the top of the gully sides, however I do not consider this necessary.

[9] At page 36.

48. This submitter also calls for a 30 m setback to address fly tipping garden waste into the gullies. Fly tipping of waste is a potential source of invasive plants to the gullies but a 30 m setback is not required to address this. I suggest a setback of 5-10 m would be adequate.

J. RECOMMENDATIONS

49. The hydroclass boundaries in the June 2023 Report should be taken as the source of hydroclass data for the Structure Plan.

50. The gully systems should be protected and managed to restore biodiversity values across the PCG area. Protection should include Conservation and Amenity Zoning and Conservation Covenants. Management should include protection from browsing mammals, enrichment planting, forest restoration planting, and weed control. I understand that these matters have been addressed through the proposed Structure Plan and related provisions.

51. With appropriate management gully areas in exotic grass or exotic gorse can in time serve as valuable extensions to native habitats in the Structure Plan.

Adam Forbes

15 September 2023

K. APPENDICES

- **Appendix A**: Aokautere Structure Plan Ecological Features, Constraints, and Restoration (15 June 2020), Pp 43 (report)
- **Appendix B**: Review of Waters Block for Aokautere Masterplan (4 March 2021), Pp 8 (letter report)
- **Appendix C**: Aokautere Masterplan Stream Hydroclass Classifications (14 April 2023), Pp 24 (letter report)

Appendix A

Forbes Ecology

Aokautere Structure Plan

Ecological Features, Constraints and Restoration

Commissioned by Palmerston North City Council

Table of Contents

Author:
Dr Adam Forbes
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Havelock North (4157)

Date:
July 2021

Signed:  (15/06/2020)

Reviewer:
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Senior Planner and Ecologist
Beale Consulting Limited
P.O. Box 113
Queenstown 9348

Signed:  (15/06/2020)

Cover photograph:
View north west looking down Gully 3 in the Aokautere Structure Plan area.

1.0 INTRODUCTION

1.1 Project Scope and Deliverables

Palmerston North City Council (PNCC) contracted Forbes Ecology Limited to prepare an ecological constraints assessment regarding residential development of hill county located south-east of Palmerston North, at Aokautere, for which a structure plan is being prepared.

The ecology work aimed to delineate the nature of ecological features present and map the corresponding levels of ecological constraint. Information on the spatial distribution of ecological constraints would then be available to the wider project team to assist project shaping with regard to analysing development configurations and opportunities for restoration.

The scope for ecology work comprised the following key steps:

Desktop:

1. Desktop review of existing ecological data sources.
2. Develop base ecological constraints map and methodology for subsequent field survey.

Field survey:

3. Delineation and classification of ecological features according to levels of constraint.

Reporting:

4. Describe identified ecological features in ecological and One Plan contexts.
5. Map levels of ecological constraint.

A key deliverable is a map of the study delineating ecological features and levels of constraint (Fig. 1).

The scope of work was extended part way through the contract to include a review of implications of the Draft National Policy Statement (NPS) for Freshwater Management (hereafter Draft Freshwater NPS) and the Draft NPS for Indigenous Biodiversity (hereafter Draft Biodiversity NPS; including a review against Draft Biodiversity NPS Appendix 1 ecological significance assessment criteria, appended to this report as Attachment 1) and to scope out appropriate ecological restoration actions for the Aokautere Structure Plan area.

2.0 METHODS

2.1 Desktop Review and GIS Analysis

The following existing data sources were reviewed for information relevant to the assessment:

- Horizons One Plan.
- Online spatial databases:
  - Our Environment (Landcare Research web portal).
    - Predicted Potential Vegetation.
    - Threatened Environment Classification.
    - Land Cover Database.
    - Pre-Human Wetlands.
    - Protected natural areas (Crown Conservation Estate, regional parks, and a range of covenant schemes: Nga Whenua Rahui, Nature Heritage Fund, Queen Elizabeth II National Trust, or local council reserves via the Reserves Act).
  - DOC GIS.
  - New Zealand Plant Conservation Network online botanical survey species lists.

2.2 Field Survey and Constraints Analysis

Ecology field visits were undertaken on the following dates in the company of various members of the project team:

- 15th November 2019 – Adam Forbes and John Hudson
- 10th December 2019 – Adam Forbes
- 7th January 2020 – Adam Forbes, David Arseneau, Victoria Edmonds
- 17th January 2020 – Adam Forbes, Victoria Edmonds

For terrestrial vegetation and habitats, the vegetation canopy composition and extent of canopy coverage was marked on satellite imagery and documented with photographs and a hand-held GPS.

Levels of constraint were assigned to terrestrial vegetation and habitats based on the composition of the vegetation canopy. This included consideration of degrees of nativeness and levels of successional development which was determined from the species identities present and their stature. Specific reference to the composition and threat status of One Plan Schedule F ecosystem types was included.

Terrestrial constraints were assigned as described in Table 1.

Table 1. Terrestrial ecological constraint categories and thresholds adopted for the assessment

Constraint Level	Canopy Composition	One Plan Schedule F
Very High	Representing old-growth forest	Threatened or At-Risk habitat type
High	Representing advanced secondary	Not Threatened habitat type
Moderate	Representing young secondary forest	
Low	Predominately exotic woody vegetation with potential for indigenous regeneration	

Freshwater ecosystems were assessed according to their apparent hydroclass based on application of stream classification definitions contained in J1 Definitions of the Auckland Unitary Plan[1], as follows:

> *Permanent river or stream:*
>
> *The continually flowing reaches of any river or stream.*
>
> *Intermittent stream:*
>
> *Stream reaches that cease to flow for periods of the year because the bed is periodically above the water table. This category is defined by those stream reaches that do not meet the definition of permanent river or stream and meet at least three of the following criteria:*
>
> *a) it has natural pools;*
> *b) it has a well-defined channel, such that the bed and banks can be distinguished;*
> *c) it contains surface water more than 48 hours after a rain event which results in stream flow;*
> *d) rooted terrestrial vegetation is not established across the entire cross-sectional width of the channel;*
> *e) organic debris resulting from flood can be seen on the floodplain; or*
> *f) there is evidence of substrate sorting process, including scour and deposition.*
>
> *Ephemeral stream:*
>
> *Stream reaches with a bed above the water table at all times, with water only flowing during and shortly after rain events. This category is defined as those stream*

[1] The classifications can be found at the following website: https://unitaryplan.aucklandcouncil.govt.nz/Images/Auckland%20Unitary%20Plan%20Operative/Chapter%20J%20Definitions/Chapter%20J%20-%20Definitions.pdf

reaches that do not meet the definition of permanent river or stream or intermittent stream.

The survey and assessment grouped intermittent and ephemeral stream reaches. The assessment was made on the day of the site visit with consideration to seasonal variation and the preceding rainfall depth.

Freshwater constraints were assigned as described in Table 2.

Table 2. Freshwater ecological constraint categories and thresholds adopted for the assessment

Constraint Level	**Assessed Hydroclass**	**One Plan Schedule B Reach Specific**
Very High	–	Site of Significance – Aquatic or riparian
High	Permanent	Reach not of significance
Moderate	–	
Low	Intermittent or ephemeral	

It is important to note the context in which this constraints assessment is made. In the absence of detailed data on ecological values, the scope of the constraints assessment focuses on delineating ecological features and describing levels of ecological constraints. This is in contrast to determining ecological values and magnitudes of effect which is the process of ecological impact assessment (EIANZ, 2018), as would be required to inform an assessment of a preferred engineering option as part of an RMA environmental effects assessment.

3.0 ECOLOGICAL FEATURES AND CONSTRAINTS

3.1 Areas of Ecological Constraint

Areas of ecological constraint are mapped in Figure 1 across nine gullies in the study area. The colour of polygons classifies vegetation areas according to levels of ecological constraint. Red areas are of very high constraint, blue are high, yellow are moderate and violet are of low ecological constraint (Figure 1).

Points A and B in Figure 1 signify locations of transition between permanent and intermittent stream hydroclasses. In these locations, streams are intermittent south of the transition points and permanent north of the transition points. Two small circles with black centres show locations of perched culverts noted during the site assessments.

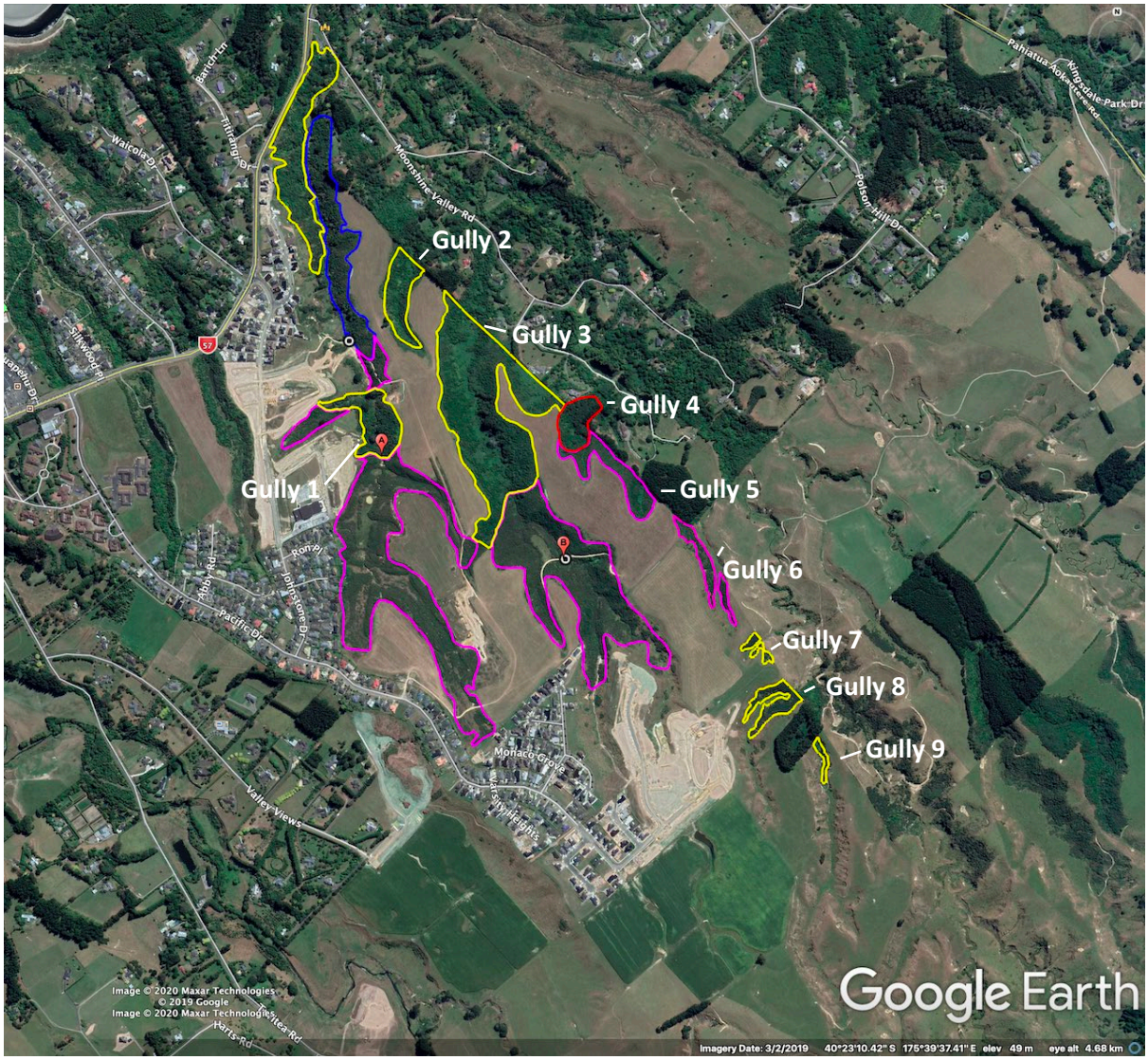

Figure 1. Levels of ecological constraint within the proposed Aokautere Structure Plan area.

3.2 Terrestrial Ecosystems

Areas of Very High Ecological Constraint

The majority of the land area surrounding Aokautere has predicted pre-human (Leathwick *et al*., 2005) forest canopy composition comprising tawa-rimu forest on elevated terraces and hill country and indigenous conifer forests in gullies and on alluvial surfaces (Figure 2). The vegetation present today has regenerated following clearance and is therefore secondary vegetation rather than primary forest. Primary/old-growth remnants are present more distant to the site, in Moonshine Valley (e.g. Tutukiwi Reserve) and on hill country several kilometres southeast of the study area on the western flanks of Bryant Hill (345 m a.s.l.). Although the predicted pre-human forest compositions are no longer present in the study area, a stand of kānuka (*Kunzea robusta*) forest is present and this is classed by One Plan Schedule F as a Threatened Ecosystem type. Accordingly, the kānuka stand has been classed as Very High constraint (Figures 1 & 3).

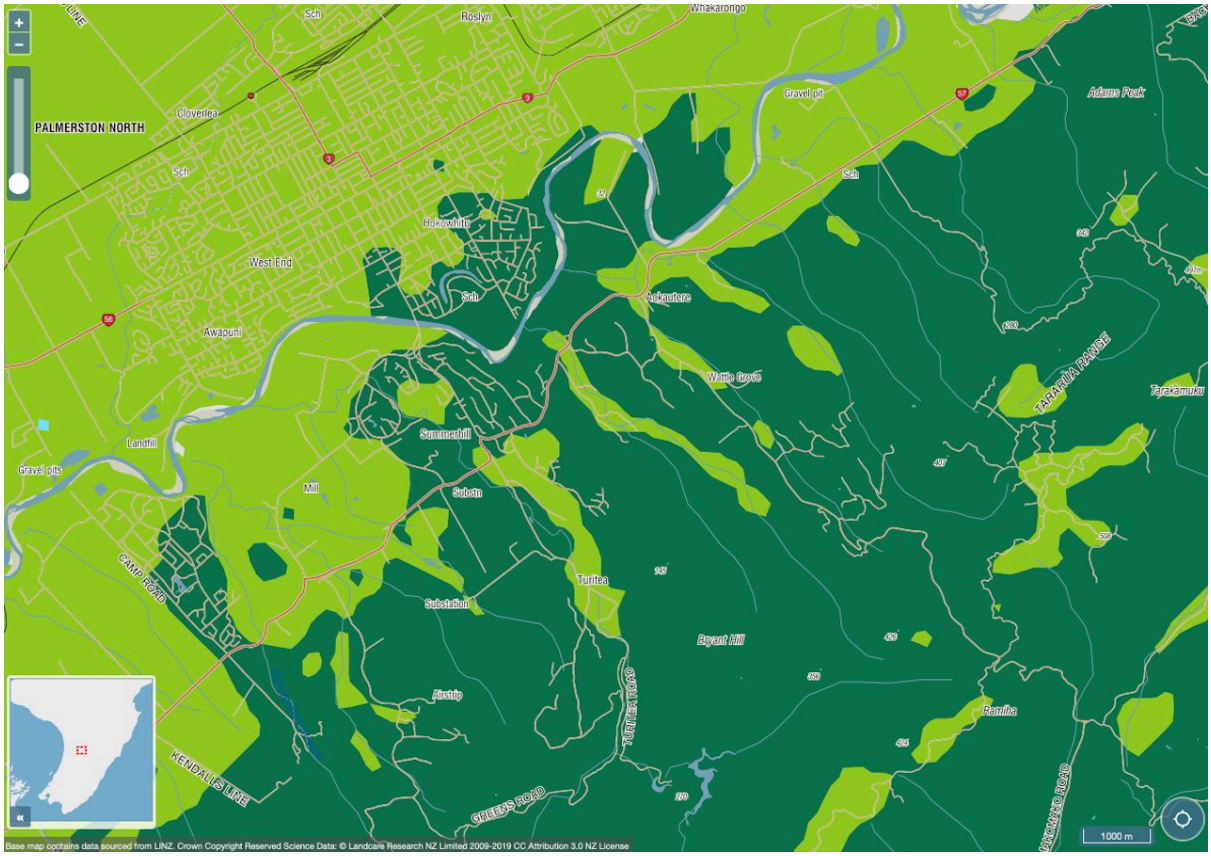

Figure 2. Predicted potential natural vegetation (Leathwick *et al*., 2005) for the Aokautere area and surrounds. Dark green areas (hill country and elevated terraces) would have supported rimu-tawa forest in pre-human times. Light green areas (gullies and alluvial surfaces) would have supported indigenous conifer forests.

Figure 3. A stand of kānuka forest in Gully 4. Kānuka forest is listed in the One Plan as a Threatened Ecosystem type and has been classed as a very high level of constraint accordingly. Photograph taken 17 January 2020.

Areas of High Ecological Constraint

Below the existing track crossing of Gully 1, the regeneration on the true right (south-west to western aspects) is advanced secondary forest which is indicated by trees of lowland tōtara and tall kānuka (Figure 4).


Figure 4. Advanced secondary forest on the true right side of Gully 1 below the existing track crossing.

Areas of Moderate Ecological Constraint

Areas of indigenous-dominant secondary forest present moderate levels of ecological constraint. Examples of these features occur in Gullies 1, 2, 3, 7, 8 and 9 (Figures 5, 6, & 7).

Figure 5. Indigenous broadleaved species such as māhoe along with mānuka regenerating in Gully 4. Photograph taken 7th January 2020.

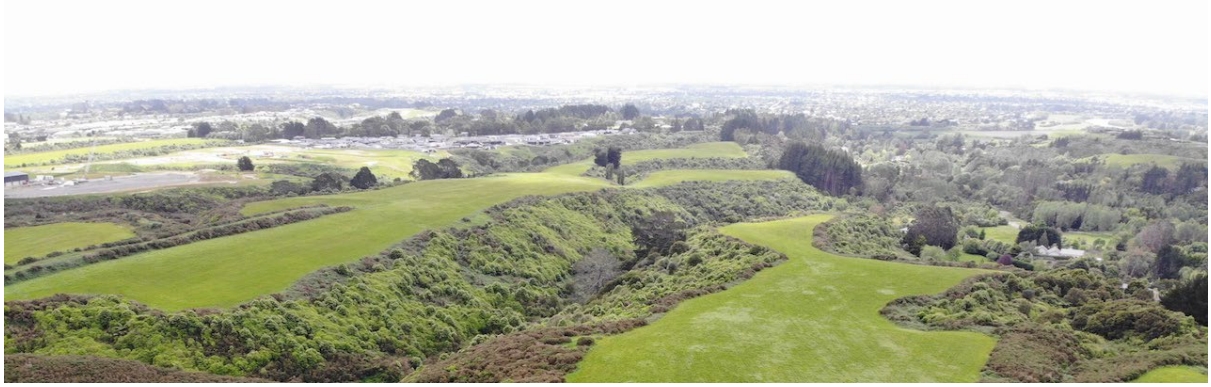

Figure 6. Indigenous broadleaved species have regenerated amongst a nursery of gorse and now forms a low-statured, indigenous-dominated forest canopy. Photograph taken 15th November 2019.

Figure 7. Kānuka has regenerated in Gully 7. Photograph taken 7th January 2020.

Areas of Low Ecological Constraint

Areas of exotic-dominant vegetation present low levels of ecological constraint. These sites still have some value as buffers for waterways and as sites where indigenous tree species can regenerate in the future. Examples of these features occur in Gullies 1, 3, 4, 5, and 6 (Figure 8).

Figure 8. Exotic gorse (brown colour in foreground) has invaded exotic pasture which in turn will be invaded by indigenous tree species. Photograph of Gully 3 taken on the 15th November 2019.

3.3 Freshwater Ecosystems

The site is drained by a number of gully systems, which feature a range of habitats along a gradient from permanent aquatic to intermittent and ephemeral, and terrestrial (i.e., forested, as addressed above).

Gully 1 features continually flowing reaches up to a point where the gully appears to have been filled in the past (Figures 9, 10, 11, & 12). The surface of the fill (upstream) was inspected and there was no evidence of continually flowing stream reaches. The permanent stream habitat in Gully 1 was characterised at a location approximately 50 m downstream of the perched culvert (Figure 13) shown in Figure 14 (see Attachment 2 for stream habitat survey data). The overall aquatic habitat in Gully 1 scored 48% (Figure 14). Aquatic habitat parameters scoring best (both 10/10) related to riparian width and shading, this was due to the abundant cover of indigenous species for >30 m either side of the waterway at the survey location and also the dense overhead cover of woody indigenous species. Factors detracting most from aquatic habitat values were the extensive deposition of fine sediment which smothered the bed of the survey reach, a poor diversity of fish cover diversity and abundance, extensive bank erosion, and few areas favourable for pollution-sensitive (EPT) macroinvertebrate colonisation. Nevertheless, the permanent waterway presents a high

level of constraint while the reaches above this present low level of constraint to urbanisation.

Gully 3 features continually flowing reaches up to the perched culvert (Figure 15) and track crossing point (Figure 16), where the stream flow was very minor (i.e., almost nil flow). The stream habitat at this location scored 30%. The best habitat attribute was the wooded riparian width (>30 m on each bank), although this contributed only moderate shading and was composed largely of exotic gorse. The stream bed was choked with a deposition of fine sediment, around 50% of the bank lengths were eroded, and there were poor habitat opportunities for both macroinvertebrates and fish. The permanent waterway presents a high level of constraint while the reaches above this present low level of constraint.

Figure 9. Gully 1 at the c.3-4 m tall cliff, which is at the transition point between permanent and intermittent stream hydrosystems (point A, Figure 1). Photograph taken 17th January 2020.

Figure 10. Gully 1 within 10 m downstream of the c.3-4 m tall cliff, which is at the transition point between permanent and intermittent stream hydrosystems (point A, Figure 1). The photograph shows permeable piping embedded in the stream bed presumably acting as a discharge point from the upstream area. Photograph taken 17th January 2020.

Figure 11. Gully 1 within 15 m downstream of the c.3-4 m tall cliff, which is at the transition point between permanent and intermittent stream hydrosystems (point A, Figure 1). The photograph shows the establishment on continuous stream flow. Photograph taken 17th January 2020.

Figure 12. Gully 1 midway between transition point and monitoring point, showing continuous stream flow. Photograph taken 17th January 2020.

Figure 13. Gully 1 showing perched culvert at the location marked on Figure 1. Photograph taken 17th January 2020.

Figure 14. Gully 1 at the habitat assessment point. Photograph taken 17th January 2020.

Figure 15. Gully 3 showing the perched culvert (with perched culvert extension) at the location shown in Figure 1. Photograph taken 17th January 2020.

Figure 16. Gully 3 at the transition point between permanent and intermittent stream hydrosystems (point B, Figure 1). Photograph taken 17th January 2020.

3.4 Potential Features of Statutory Ecological Significance

The One Plan Policy 13-5 (a) provides criteria for assessing the ecological significance of an area of habitat. Each of the broad vegetation types are provisionally assessed against the Policy 13-5 (a) criteria below.

Based on the information currently available, it is clear that the kānuka forest would trigger statutory ecological significance (i.e., RMA S6c) for representativeness. Further detailed ecological surveys might determine additional attributes that are ecologically significant. Additionally, kānuka (*K. robusta*) holds the threat ranking Threatened-Nationally Vulnerable (de Lange et al. 2018) adding a rarity component to the significance of this forest type.

Table 3. Preliminary assessment of One Plan Policy 13-5 (a) significance assessment criteria

Policy 13–5 (a)	Criteria Description	Kānuka forest	Advanced secondary forest	Young secondary forest	Exotic woody scrub
Representativeness (i)	Habitat that:				
	(A) Comprises indigenous habitat type that is underrepresented (20% or less of known or likely former cover), or	Potentially Significant			
	(B) Is an area of indigenous vegetation that is typical of the habitat type in terms of species composition, structure and diversity, or large relative to other areas in the Ecological District or Ecological Region or has functioning ecosystem processes.				
Rarity and Distinctiveness	Habitat that supports an indigenous species or community that:				
	(A) Is classed as threatened (as determined by the New Zealand Threat Classification System and Lists), or	Potentially Significant			
	(B) Is distinctive to the region, or				
	(C) Is at a natural distributional limit, or				

	(D) Has a naturally disjunct distribution that defines a floristic gap, or				
	(E) Was originally (i.e. prehuman) uncommon within New Zealand, and supports an indigenous species or community of indigenous species.				
Ecological Context (iii)	Habitat that provides:				
	(A) Connectivity (physical or process connections) between two or more areas of indigenous habitat, or				
	(B) An ecological buffer (provides protection) to an adjacent area of indigenous habitat (terrestrial or aquatic) that is ecologically significant, or				
	(C) Part of an indigenous ecological sequence or connectivity between different habitat types across a gradient (e.g. altitudinal or hydrological), or				
	(D) Important breeding areas, seasonal food sources, or an important component of a migration path for indigenous species, or				
	(E) Habitat for indigenous species that are dependent on large and contiguous habitats.				
	Significance assessment results	**Potentially Significant**			

4.0 IMPLICATIONS OF DRAFT POLICY FRAMEWORKS

4.1 Draft Freshwater NPS

At the time of writing, the Government is consulting on a Draft Freshwater NPS. The following elements of the Draft Freshwater NPS have potential implications for the Aokautere Structure Plan:

NPS Objective:

The objective of this National Policy Statement is to ensure that resources are managed in a way that prioritises:

(a) first, the health and wellbeing of waterbodies and freshwater ecosystems;
(b) second, the essential health needs of people; and
(c) third, the ability of people and communities to provide for their social, economic, and cultural wellbeing, now and in the future.

NPS Policies:

***Policy 3:** The condition of waterbodies and freshwater ecosystems is systematically monitored over time, and action is taken to reverse deteriorating trends;*

***Policy 4:** Freshwater is managed in an integrated way that considers the effects of the use and development of land on a whole-of-catchments basis, including the effects on sensitive receiving environments;*

***Policy 5:** Iwi and hapū are involved in freshwater management, and tangata whenua values and interests are identified and reflected in the management of, and decisions relating to waterbodies and freshwater ecosystems;*

***Policy 6:** The national target for water quality improvement (as set out in Appendix 3) is achieved;*

***Policy 9:** There is no further net loss of streams;*

***Policy 11:** The habitats of indigenous freshwater species are safeguarded;*

***Policy 13:** Communities are enabled to provide for their economic wellbeing while managing freshwater in a manner consistent with Te Mana o te Wai and as required by the national objectives framework and other requirements of this National Policy Statement.*

Waterbodies receiving urban runoff from the Aokautere Structure Plan area may be the subject of aquatic monitoring via a whole-of-catchment approach and adverse trends may be the subject of follow-up action. It would be expected that Iwi and hapū be involved in management and decisions relating to the freshwater ecosystems. Specific water quality

parameters may need to be achieved. Stream works could not result in net loss of stream extent and the habitats of freshwater species are safeguarded. The Te Mana o te Wai philosophy should guide freshwater decision making for the Aokautere Structure Plan.

NPS Implementation of Objectives and Policies:

The draft Freshwater NPS, at Sections 3.2 and 3.3, direct freshwater management to follow the principles of Te Mana o te Wai[2] and requires the engagement and input of Tangata Whena into freshwater management and decision making.

3.2 Te Mana o te Wai

(1) Every regional council must include the following objective (or words to the same effect) in its regional policy statement:

> *"The management of freshwater in our region must be carried out in a manner that gives effect to Te Mana o te Wai, as it is described in the National Policy Statement for Freshwater Management 2019 and understood locally."*

(2) Every regional council must give effect to Te Mana o te Wai in implementing this National Policy Statement.

(3) Te Mana o te Wai must inform the interpretation of:

a) the objective and policies of this National Policy Statement; and

b) the objectives and policies required by this National Policy Statement to be included in local authority policy statements and plans.

(4) As part of the requirement to give effect to Te Mana o te Wai, when implementing this National Policy Statement regional councils must specifically engage in discussion with communities and tangata whenua to determine local understandings of Te Mana o te Wai as applied to freshwater bodies in the region.

(5) In particular, every regional council must develop, and articulate in its regional policy statement, a long-term vision that gives effect to Te Mana o te Wai.

(6) The long-term vision must:

---

[2] *Te Mana o te Wai, "the mana of the water", refers to the fundamental value of water and the importance of prioritising the health and wellbeing of water before providing for human needs and wants. It expresses New Zealanders' special connection with freshwater. When Te Mana o te Wai is upheld, the future wellbeing of people and our unique ecosystems is protected* — Draft Freshwater NPS, 2019.

a) be developed through discussion with communities and tangata whenua about their long-term wishes for waterbodies in the region; and

b) be informed by an understanding of the history of, and current pressures on, waterbodies in the region; and

c) express what communities and tangata whenua want their waterbodies to be like in the future.

(7) Every regional council must assess whether waterbodies in the region can both sustain current pressures on them and provide for the long-term vision articulated in its regional policy statement.

(8) The long-term vision and the discussions that led to it must inform and provide the context for all subsequent freshwater management and freshwater planning decisions in the region.

3.3 Tangata whenua roles and interests

(1) As part of the requirement to give effect to Te Mana o te Wai, regional councils must engage with tangata whenua in the management of waterbodies and freshwater ecosystems.

(2) Engagement with tangata whenua requires taking reasonable steps to:

a) involve tangata whenua in freshwater management and decision-making regarding freshwater planning; and

b) identify tangata whenua values and interests in relation to waterbodies and freshwater ecosystems; and

c) reflect those values and interests in the management of, and decision-making regarding, the waterbodies and freshwater ecosystems in the region.

At section 3.4, Regional Councils are required to manage freshwater, land use and development in an integrated and sustainable way, to manage effects, including cumulative effects. Regional Councils would expect growth and development to be sequenced and co-ordinated with infrastructure. District Plans would be amended at the next review to include objectives, policies and methods to manage adverse effects of urban development on waterbodies and sensitive receiving environments. This might include aspects such as regulating impervious cover extent and/or requiring on-site infiltration, source treatment of contaminants, zoning to preclude development in areas where effects are unmanageable and promoting the use of green infrastructure.

3.4 Integrated management

(1) Regional councils must, consistent with Te Mana o te Wai:

a) recognise the interactions ki uta ki tai between freshwater, land, waterbodies, freshwater ecosystems, other ecosystems, and sensitive receiving environments, including the coastal environment; and

b) manage freshwater, and land use and development, in catchments in an integrated and sustainable way to avoid, remedy, or mitigate adverse effects, including cumulative effects.

(2) Regional councils must make or change their regional policy statements to the extent needed to provide for the integrated management of the effects of:

a) the use and development of land on freshwater; and

b) the use and development of land and freshwater on sensitive receiving environments.

(3) Giving effect to subclause (2) includes encouraging the co-ordination and sequencing of regional or urban growth, land use and development, and the provision of infrastructure.

(4) In order to give effect to this National Policy Statement, local authorities that share jurisdiction over a catchment should co-operate in the integrated management of the effects on freshwater of land use and development.

(5) Every regional council must insert the following method (or words to the same effect) into its regional policy statement:

> *"District plans must include objectives, policies, and methods to avoid, remedy, or mitigate the cumulative adverse effects of land use on freshwater bodies, freshwater ecosystems, and sensitive receiving environments resulting from urban development."*

(6) Every territorial authority must include objectives, policies, and methods in its district plan at the next review of the plan to avoid, remedy, or mitigate the cumulative adverse effects of land use resulting from urban development on waterbodies and sensitive receiving environments.

Information note:

The following are examples of the kinds of methods territorial authorities could use to comply with clause 3.4(6):

- *Regulating impervious surface cover and/or requiring on-site infiltration;*
- *Requiring treatment of contaminants at* source;
- *Using zoning/designations to avoid all, or certain types of development in areas where the effects on freshwater could not be adequately managed;*
- *Provision of green infrastructure (especially for stormwater management);*
- *Use of best practice Water Sensitive Urban Design or Low Impact Design techniques.*

At section 3.16, Regional Councils would adopt policy that directs the extent and ecosystem health of rivers and streams (and their associated ecosystems) to be at least maintained. Stream works such as culverting and diversions would not be allowed to result in net loss of extent or ecosystem health of a stream. Reclamation of streams or rivers would be avoided unless there are no other practical alternatives and it is part of an activity that aims to

restore ecosystems, is for nationally significant infrastructure, or is required for flood prevention or erosion control.

3.16 Streams

(1) Every regional council must include the following policy (or words to the same effect) in its regional policy statement:

> *"The extent and ecosystem health of rivers and streams in the region, and their associated freshwater ecosystems, are at least maintained".*

(2) However, the policy must be read subject to any rules that give effect to the requirements of the National Environmental Standards for Freshwater, or to any more stringent rules that the council, as permitted by those Standards, includes in its regional plan.

(3) Every regional council must make or change its policy statement and plan to ensure that, when considering an application for a consent, adverse effects on any stream are managed by applying the effects management hierarchy.

(4) Every regional council must make or change its regional policy statement and plans to ensure that the following do not result in a net loss in the extent or ecosystem health of a stream:

> *a) permanently diverting a stream;*
>
> *b) culverting a stream, where that is allowed and as far as practicable.*

(5) Every regional council must make or change its regional policies and plans to ensure that the infilling of river or stream beds is avoided, unless there are no other practicable alternative methods of providing for the activity, and it is part of an activity:

> *a) designed to restore or enhance the natural values of the stream or of any adjacent or associated ecosystem; or*
>
> *b) necessary to enable the development, operation, maintenance and upgrade of nationally significant infrastructure; or*
>
> *c) required for the purposes of flood prevention or erosion control.*

(6) However, subclause (5) is subject to any rules that give effect to the requirements of the National Environmental Standards for Freshwater, or to any more stringent rules that the council, as permitted by those Standards, includes in its regional plan.

At section 3.17, the identification of fish passage needs and the management of fish passage in association with instream structures would be embedded in regional planning documents.

3.17 Fish passage

(1) Every regional council must make or change its regional plan to include aquatic life objectives to achieve diversity and abundance of fish in all or specified streams.

(2) When preparing the objective, regional councils must:

a) identify the valued species, and their relevant life stages, for which instream structures must provide passage; and

b) identify undesirable species whose passage can or should be prevented; and

c) identify streams where fish passage for undesirable fish species is to be impeded in order to manage their adverse effects on fish populations upstream of any barrier; and

d) take into account any Freshwater Fisheries Management Plans and Sports Fish and Game Management Plans approved by the Minister of Conservation under the Conservation Act 1987; and

e) consult with the Department of Conservation to identify any threatened fish species that may benefit from natural or built barriers to exclude undesirable species.

(3) Regional councils must make or change their plans to require that regard is had to at least the following when considering an application for a consent relating to an instream structure:

a) the extent to which the structure provides, and will continue to provide for the foreseeable life of the structure, the council's aquatic life objective for fish;

b) the extent to which the structure does not cause a greater impediment to fish movements than in adjacent stream reaches;

c) the extent to which it provides efficient and safe passage for all fish (other than undesirable species) at all their life stages;

d) the extent to which it provides a diversity of physical and hydraulic conditions leading to a high diversity of passage opportunities for fish;

e) any proposed monitoring and maintenance plan for ensuring that the structure meets the council's aquatic life objective for fish now and in the future.

(4) Regional councils must establish and implement a work programme to improve the extent to which existing structures achieve the council's aquatic life objectives for fish.

(5) The work programme must include the following:

a) identifying existing instream structures within the region, and evaluating the risk they present as an undesirable barrier to fish migrations;

b) prioritising structures for remediation, applying the ecological criteria described in Table 5.1, of the New Zealand Fish Passage Guidelines;

c) documenting the structures or locations that have been prioritised, the remediation that is required to achieve the desired outcome, and how and when this will be achieved;

d) identification of structures that have been remediated since the commencement date;

e) how the ongoing performance of the remediated structure will be monitored and evaluated.

(6) Regional councils must collect, maintain, and publish records of new and (known) existing instream structures and assess their likely impact on fish passage and river connectivity.

4.2 Draft Biodiversity NPS

At the time of writing, the Government is consulting on a Draft Biodiversity NPS for. The following elements of the Draft Biodiversity NPS have potential implications for the Aokautere Structure Plan:

NPS Objectives:

Objective 1: *to maintain indigenous biodiversity:*

Objective 5: *to restore indigenous biodiversity and enhance the ecological integrity of ecosystems:*

Objective 6: *to recognise the role of landowners, communities and tangata whenua as stewards and kaitiaki of indigenous biodiversity by:*

b) allowing people and communities to provide for their social, economic and cultural wellbeing now and in the future; and

c) supporting people and communities in their understanding of and connection to, nature.

With respect to Aokautere Structure Plan, the maintenance and restoration of biodiversity and enhancement of ecosystem integrity are key objectives. The ecosystems in gully systems present an opportunity for people (including PNCC) and the community to act as stewards and kaitiaki of the indigenous biodiversity components present.

NPS Policies:

Policy 2: *to ensure that local authorities adopt a precautionary approach towards proposed activities with effects on indigenous biodiversity that are uncertain, unknown, or little understood but potentially significant:*

Policy 5: *to improve information on the effects of existing and proposed subdivision, use and development on indigenous biodiversity:*

Policy 6: *to identify and protect areas of significant indigenous vegetation or significant habitat of indigenous fauna by identifying and managing them as SNAs:*

Policy 7: *to manage subdivision, use and development outside SNAs as necessary to ensure indigenous biodiversity is maintained:*

Policy 8: *to recognise the locational constraints that apply to specific subdivisions, uses and developments:*

Policy 11: *to provide for the restoration and enhancement of specific areas and environments that are important for maintaining indigenous biodiversity:*

Policy 12: *to identify and protect indigenous species and ecosystems that are taonga:*

Policy 13: *to identify possible presence of, and manage highly mobile fauna:*

Where effects of the Aokautere Structure Plan to biodiversity are uncertain but potentially significant, Council would be expected to take a precautionary approach to effects management. It could be that monitoring would help understand the effects of the Structure Plan implementation. If significant natural areas (SNAs) occur within the Structure Plan area, these would need to be identified and effects managed appropriately. Development of the Structure Plan area would need to be conducted in a manner that indigenous biodiversity outside of SNAs is maintained.

Locational constraints would need to be specified and observed in the Structure Plan. Specific areas and environments that are important for managing biodiversity, such as the ecosystems of the gullies, would be restored and enhanced. Taonga species would be identified, along with corresponding measures for their protection. The possible presence of highly mobile fauna (e.g., indigenous birds such as kereru, tūī, or korimako) would be accommodated by existing or reconstructed habitats within the Structure Plan area.

<u>NPS Implementation of Objectives and Policies:</u>

The Draft Biodiversity NPS, at Sections 3.2 and 3.3, direct biodiversity management to follow the principles of Hutia Te Rito[3] and requires the engagement and input of Tangata Whenua into biodiversity management and decision making.

3.2 Hutia Te Rito

(1) Local authorities must recognise and provide for Hutia Te Rito in implementing this National Policy Statement.

(2) This requires, at a minimum, that local authorities must –

a) recognise and provide for the interrelationships between te hauora o te tangata (the health of the people) and –

i. te hauora o te koiora (the health of indigenous biodiversity); and

[3] *Hutia Te Rito is an overarching concept that can incorporate the values of tangata whenua and the wider community into the way indigenous biodiversity is managed so that it is maintained*. — Draft Freshwater NPS, 2019.

ii. te hauora o te taonga (the health of species and ecosystems that are taonga); and

iii. te hauora o te taiao (the health of the wider environment); and

b) recognise the maintenance of indigenous biodiversity requires kaitiakitanga and stewardship; and

c) take steps to ensure indigenous biodiversity is maintained and enhanced for the health, enjoyment and use by all New Zealanders, now and in the future.

3.3 Tangata whenua as kaitiaki

(1) When making or changing policy statements and plans to give effect to this National Policy Statement, every local authority must –

a) involve tangata whenua by undertaking consultation that is early, meaningful and (as far as practicable) in accordance with tikanga Māori; and

b) collaborate with tangata whenua to –

i. identify taonga, as required by clause 3.14, recognising tangata whenua have the right to choose not to identify taonga; and

ii. develop objectives, policies and methods that recognise and provide for Hutia Te Rito.

(2) Local authorities must, with the consent of tangata whenua and as far as practicable in accordance with tikanga Māori, take all reasonable steps to incorporate mātauranga Māori relating to indigenous biodiversity in implementing this National Policy Statement.

(3) Local authorities must take all reasonable steps to provide opportunities for tangata whenua to exercise kaitiakitanga over indigenous biodiversity, including through measures such as –

a) bringing cultural understanding to monitoring;

b) providing appropriate methods for managing and protecting identified taonga; and

c) allowing for sustainable customary use of indigenous vegetation.

(4) Local authorities must take all reasonable steps to provide opportunities for tangata whenua to be involved in decision-making relating to indigenous biodiversity in implementing this National Policy Statement.

Section 3.4 directs local authorities to manage biodiversity and the effects on it from subdivision in a way that recognises interactions between environments. For example, promoting corridors between the eastern hill country and the plains, and protecting and restoring riparian areas to benefit freshwater ecosystems. The requirements of existing strategies and other planning tools would be considered.

3.4 Integrated approach

Local authorities must manage indigenous biodiversity and the effects on it of subdivision, use and development, in an integrated way, which means –

a) recognising the interactions ki uta ki tai (from the mountains to the sea) between the terrestrial environment, freshwater and the coastal marine area; and

b) providing for the coordinated management and control of subdivision, use and development, as it affects indigenous biodiversity across administrative boundaries; and

c) considering the requirements of strategies and other planning tools required or provided for in legislation and relevant to indigenous biodiversity.

Section 3.7 directs local authorities to undertake subdivision in appropriate places and forms, within appropriate limits, so that indigenous biodiversity is maintained. Relationships and contributions of tangata whenua, landowners, people and communities to the maintenance and enhancement of biodiversity would be built through the Structure Plan and subsequent planning processes.

3.7 Social, economic and cultural wellbeing

In implementing this National Policy Statement, local authorities must recognise –

a) that the maintenance of indigenous biodiversity contributes to the social, economic and cultural wellbeing of people and communities; and

b) that the maintenance of indigenous biodiversity does not preclude subdivision, use and development in appropriate places and forms, within appropriate limits; and

c) that people are critical to maintaining and enhancing indigenous biodiversity; and

d) the importance of forming partnerships between local authorities, tangata whenua, landowners, people and communities in maintaining and enhancing indigenous biodiversity; and

e) the importance of respecting and fostering the contribution of landowners as stewards and kaitiaki; and

f) the value of supporting people and communities in understanding, connecting to and enjoying indigenous biodiversity.

Section 3.8 requires Significant Natural Areas (SNA) within the structure plan area to be identified using the Draft Biodiversity NPS criteria, including classing features found to be significant as either High or Medium.

3.8 Identifying significant natural areas

(1) Every territorial authority must–

a) undertake a district wide assessment in accordance with Appendix 1 to determine if an area is significant indigenous vegetation and /or significant habitat of indigenous fauna; and if it is,

b) classify areas of significant indigenous vegetation and /or significant habitat of indigenous fauna as either High or Medium, in accordance with Appendix 2.

(2) Territorial authorities must use the following principles and approaches when undertaking the assessment and classification required by subclause (1).

*a) **partnership**: territorial authorities must seek to engage with landowners early and share information about indigenous biodiversity, potential management options and any support and incentives that may be available:*

*b) **transparency**: territorial authorities must clearly inform landowners about how information gathered will be used and make existing information, draft assessments and other relevant information available to relevant landowners for review:*

*c) **quality**: wherever practicable, the values and extent of natural areas assessed as potentially meeting the criteria in Appendix 1 for classification as an SNA should be verified by physical inspection:*

*d) **access**: where permission to access a property on a voluntary basis is not given, territorial authorities should first rely on a desktop assessment by an ecological expert, and powers of entry under section 333 of the Act should be used only as a last resort:*

*e) **consistency**: the identification of an SNA must be based on the indigenous biodiversity present, identified through the consistent application of the criteria in Appendix 1, and regardless of who owns the land*

*f) **boundaries**: an area assessed as significant indigenous vegetation and significant habitat of indigenous fauna must be determined by the extent and ecological integrity of the indigenous vegetation or habitat as whole, unaffected by artificial margins such as property boundaries.*

Section 3.9 requires Council to ensure that in relation to subdivision, particular effects are avoided and that other effects are managed according to the mitigation hierarchy. In other circumstances effects would be allowed to be managed using the mitigation hierarchy.

3.9 Managing adverse effects on SNAs

Except as provided in subclauses (2), (3) and (4), local authorities must ensure that, in relation to any new subdivision, use or development that takes place in or affects, an SNA –

a) the following adverse effects on the SNA are avoided:

i. loss of ecosystem representation and extent:

ii. disruption to sequences, mosaics or ecosystem function:

iii. fragmentation or loss of buffering or connectivity within the SNA and between other indigenous habitats and ecosystems:

iv. a reduction in population size or occupancy of threatened species using the SNA for any part of their life cycle; and

b) the effects management hierarchy is applied to all other adverse effects.

All adverse effects of a new subdivision, use or development must be managed using the effects management hierarchy if –

a) the subdivision, use or development is to take place in, or affects, an SNA classified as Medium; and

b) there is a functional or operational need for the subdivision, use or development to be in that particular location; and

c) there are no practicable alternative locations for the subdivision, use or development; and

d) the subdivision, use or development is associated with:

i. nationally significant infrastructure:

ii. mineral and aggregate extraction:

iii. the provision of papakainga, marae and ancillary community facilities associated with customary activities on Māori land:

iv. the use of Māori land in a way that will make a significant contribution to enhancing the social, cultural or economic wellbeing of tangata whenua.

Outside of SNAs, Section 3.13 requires local authorities to take steps to maintain biodiversity, require significance assessment of those areas, and manage effects through the mitigation hierarchy.

3.13 General rules applying outside SNAs

(1) Local authorities must take steps to maintain indigenous biodiversity outside SNAs, including by making or changing their policy statements and plans to do all the following:

a) specify where, how and when controls on subdivision, use and development in areas outside SNAs are necessary to maintain indigenous biodiversity:

b) apply the effects management hierarchy to adverse effects, except that biodiversity compensation may be considered as an alternative to biodiversity offsetting (and not only when biodiversity offsetting is not demonstrably achievable):

c) specify where, how and when, for any area outside an SNA, the assessment and classification required by clause 3.8(1) is required.

(2) If an area outside an SNA is assessed as significant indigenous vegetation and significant habitat of indigenous fauna following an assessment in accordance with Appendix 1, a local authority must manage the adverse effects on indigenous biodiversity in the area as if the area were an SNA.

(3) In preparing policy statements and plans giving effect to subclause (1), local authorities must have particular regard to the potential of Māori land to provide for the social, cultural and economic wellbeing of Māori.

Tangata whenua would advise on which taonga species relate to the Structure Plan area. Provisions to protect and restore taonga species would be incorporated in the Structure Plan and subsequent planning processes.

3.14 Identified taonga

(1) Every regional council must work together with all the territorial authorities in its region and with tangata whenua (in the manner required by clause 3.3) to agree a process for –

a) identifying indigenous species and ecosystems that are taonga; and

b) describing the taonga; and

c) mapping or describing the location of the taonga; and

d) describing the values of each taonga.

(2) Local authorities must recognise tangata whenua have the right to choose not to identify taonga and to choose the level of detail at which identified taonga or their location or values, are described.

(3) Territorial authorities must make or change their district plans to include (to the extent agreed to by tangata whenua) the description of identified taonga and their values and a description or map of their location.

(4) Local authorities must manage identified taonga located in an SNA in accordance with clause 3.9.

(5) In relation to identified taonga located outside SNAs, local authorities must –

a) manage them as necessary to protect the taonga and their values; and

b) provide opportunities to restore and enhance them and their values.

Highly mobile fauna would be identified for the Structure Plan area and the effects of subdivision on these species would be managed so as to maintain viable populations.

3.15 Highly mobile fauna

(1) Every regional council must work together with the territorial authorities in its region to survey and record areas outside SNAs where highly mobile fauna have been, or are likely to be, sometimes present (in this clause referred to as highly mobile fauna areas).

(2) If it will help manage highly mobile fauna, a territorial authority must (where possible) include in its district plan a map or description of the location of highly mobile fauna areas.

(3) Local authorities must provide information to their communities about –

a) highly mobile fauna and their habitats; and

b) best practice techniques for managing adverse effects on any highly mobile species in their regions and districts, and their habitats.

(4) Local authorities must include objectives, policies or methods in their policy statements and plans for managing the adverse effects of subdivision, use and development in highly mobile fauna areas, as necessary to maintain viable populations of highly mobile fauna across their natural range.

Degraded SNAs and areas that provide important connectivity or buffering functions within the Structure Plan area would be identified along with actions to restore and enhance those features. These features, as well as sites for which national biodiversity priorities apply would be prioritised over the restoration of other ecological features. These restoration actions could be imposed by conditions on resource consents and designations.

3.16 Restoration and enhancement

(1) This clause applies to the following areas:

a) wetlands:

b) SNAs whose ecological integrity is degraded:

c) areas that provide important connectivity or buffering functions:

d) former wetlands.

(2) Territorial authorities must identify the location of areas referred to in subclause (1)(b) and (c) and regional councils must record those locations (with appropriate descriptions) in their regional policy statements.

(3) Local authorities must promote, through objectives, policies and methods in policy statements and plans, the restoration and enhancement (including through reconstruction) of areas to which this clause applies.

(4) The objectives, policies or methods must identify opportunities for restoration and enhancement of those areas, prioritising all of the following over other indigenous biodiversity restoration projects:

a) wetlands whose ecological integrity is degraded or where the presence of indigenous species is reduced:

b) SNAs whose ecological integrity is degraded:

c) areas that provide important connectivity or buffering functions:

d) former wetlands that no longer retain their indigenous vegetation or habitat for indigenous fauna, but where reconstruction is likely to result in that vegetation or habitat being regained:

e) any national priorities for indigenous biodiversity protection.

(5) In areas to which this clause applies, local authorities may provide incentives for restoration and enhancement and in particular on Māori land, in recognition of the opportunity cost of maintaining indigenous biodiversity on that land.

(6) Local authorities may impose or review restoration or enhancement conditions on resource consents and designations relating to activities in areas prioritised for restoration and enhancement.

The Structure Plan area should be designed so that >10% of indigenous vegetation cover occurs in the urban area. Achieving representative communities and a natural diversity, at landscape scales, would be important.

3.17 Increasing indigenous vegetation cover

(1) Every regional council must assess the percentage of the urban and rural areas in its region that have indigenous vegetation cover.

(2) The regional council must specify which areas it will treat as urban for the purposes of this clause (which must be predominantly urban in character) and which it will treat as rural (which must be predominantly non-urban in character).

(3) The assessment of the percentage of indigenous vegetation cover may be done by a desktop analysis, by ground truthing or both.

(4) For urban areas, if the assessment indicates an area has less than 10 per cent indigenous vegetation cover, the regional council must include in its regional policy statement a target (expressed as a percentage figure within a specified time) for increasing indigenous vegetation cover in that area to at least 10 per cent of the area.

(5) For rural areas, if the assessment indicates an area has less than 10 per cent indigenous vegetation cover, the regional council must include in its regional policy statement a target (expressed as a percentage figure within a specified time) for increasing indigenous vegetation cover in the area.

(6) For any urban or rural area where the assessment indicates the area already has 10 per cent or more indigenous vegetation cover, the regional council may include in its regional policy statement targets (expressed as a percentage figure within a specified time) for increasing indigenous vegetation cover in the area.

(7) Every regional council must include objectives, policies or methods for increasing indigenous vegetation cover in its region and for achieving the targets set under this clause, giving priority to all of the following:

a) areas to which clause 3.16 applies:

b) areas representative of ecosystems naturally and formerly present:

c) ensuring species richness:

d) restoration and enhancement at a landscape scale across the region.

The effects of the development would be assessed (using best practice methodologies and in accordance with the Draft Biodiversity NPS) as to whether any part of the site is in or affects an SNA, indigenous vegetation, habitats of indigenous fauna, an area used by highly mobile fauna, an area providing connectivity or buffering, or identified taonga features.

3.19 Assessment of environmental effects

(1) Local authorities must change their plans to include a requirement that the following information be included in any assessment of environmental effects whether all or any part of the site covered by the application is in or affects –

a) an SNA; or

b) an area of indigenous vegetation; or

c) a habitat of indigenous fauna; or

d) an area identified as highly mobile fauna area (as described in clause 3.15), in which case it must include information about the use of the area by highly mobile fauna; or

e) an area providing connectivity or buffering; or

f) an area identified as or containing, identified taonga.

(2) Local authorities must make or change their policy statements and plans to include a requirement that the assessment of environmental effects required by clause 7(1) of Schedule 4 the Act –

a) for the purposes of clause 7(1)(c) of Schedule 4 of the Act –

i. addresses effects of the proposal (if relevant) on the areas referred to in subclause (1)(a)(i) to (vi); and

ii. includes sufficient information to demonstrate the effective management of adverse effects as required by this National Policy Statement; and

b) for the purposes of clause 7(1)(d) of Schedule 4 of the Act, addresses –

i. the effects on identified taonga; and

ii. ecosystem services associated with indigenous biodiversity at the site; and

iii. the site's role in maintaining the ecological integrity of and connections between it and the wider ecosystem; and

c) uses biodiversity methodologies consistent with best practice for the ecosystem types present at the site; and

d) considers including mātauranga Māori and tikanga Māori assessment methodology where relevant.

(3) Local authorities must directly insert the following policy into their plans in accordance with section 55(2A) of the RMA within one year of commencement date:

"If the regional policy statement or this plan requires a site to be assessed to determine whether it is an area of significant indigenous vegetation of significant habitat of indigenous fauna:

(a) the assessment must be done in accordance with Appendix 1 of the National Policy Statement for Indigenous Biodiversity 2020.; and
(b) any site confirmed as an SNA through that assessment must be classified as High or Medium in accordance with Appendix 2 of the National Policy Statement for Indigenous Biodiversity 2020."; and

(4) Local authorities may amend their plans to remove the policy in (3) when replacing with like-for-like content as part of a plan change to give effect to this National Policy Statement.

5.0 MEASURES TO PROTECT AND RESTORE BIODIVERSITY

5.1 Protection and Restoration of Vegetation Communities

Indigenous vegetation at the landscape scale is confined to small patches in gully landforms or on terrace rises (Fig. 17). Large areas of indigenous forest are present within 5 km on the eastern hill country. Existing woody vegetation within the structure plan area comprises a combined c. 23.6 ha of kānuka and mixed regenerating broadleaved forest (i.e., the blue areas in Fig. 18). Also, within the structure plan area, gorse covers c. 24.3 ha and is located mostly in gully systems (Fig. 18).

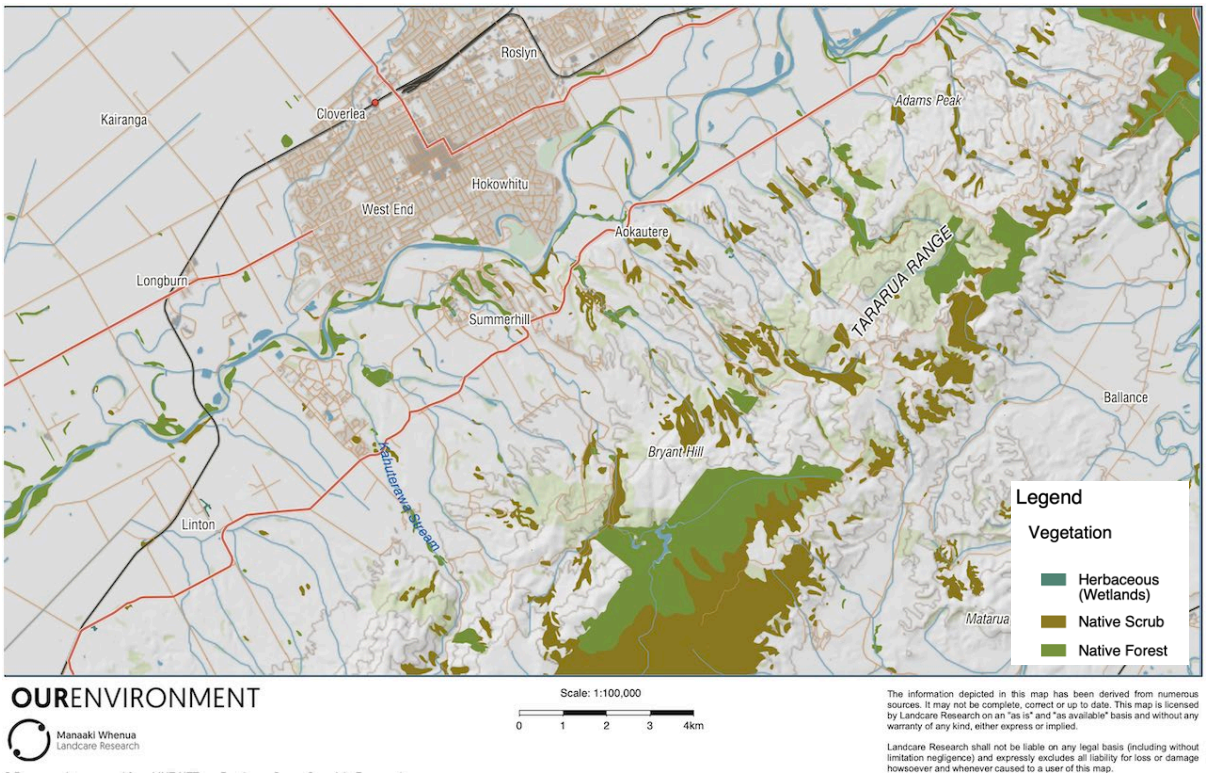

Figure 17. Indigenous cover (1:100,000 scale) in the wider landscape surrounding the Aokautere Structure Plan Area.

The first priority of ecological restoration should be to protect existing ecological features (Norton et al. 2018). One reason for this is that protection is a more cost-effective method of maintaining biodiversity compared to reconstructing ecosystems from scratch. This philosophy is consistent with the RMA mitigation hierarchy and protection outcomes would be achieved by avoiding and otherwise appropriately managing the locational constraints identified in this report from the effects of development.

In highly depleted Land Environments, such as those that occur across the Aokautere Structure plan area (Acutely and Chronically Threatened Environments), effective maintenance of biodiversity is dependent on reconstructing indigenous cover to levels

exceeding 10%, and preferably attaining much greater cover than this minimum threshold. With an extent of 375 ha, the structure plan area currently features c. 6.3% indigenous cover. With protection and specific interventions (enrichment planting; see Forbes et al. 2020), these gorse areas can be transitioned to diverse indigenous forest and this could lead to a total indigenous cover of c. 13%. Further, areas of exotic grassland could be planted with indigenous seedlings to achieve further indigenous habitat coverage. Forest restoration plantings could be located strategically to achieve ecological corridors connecting along gullies and streams to the eastern hill country. These approaches justify for protecting and restoring the gully systems including, those reaches currently in gorse or exotic grassland.

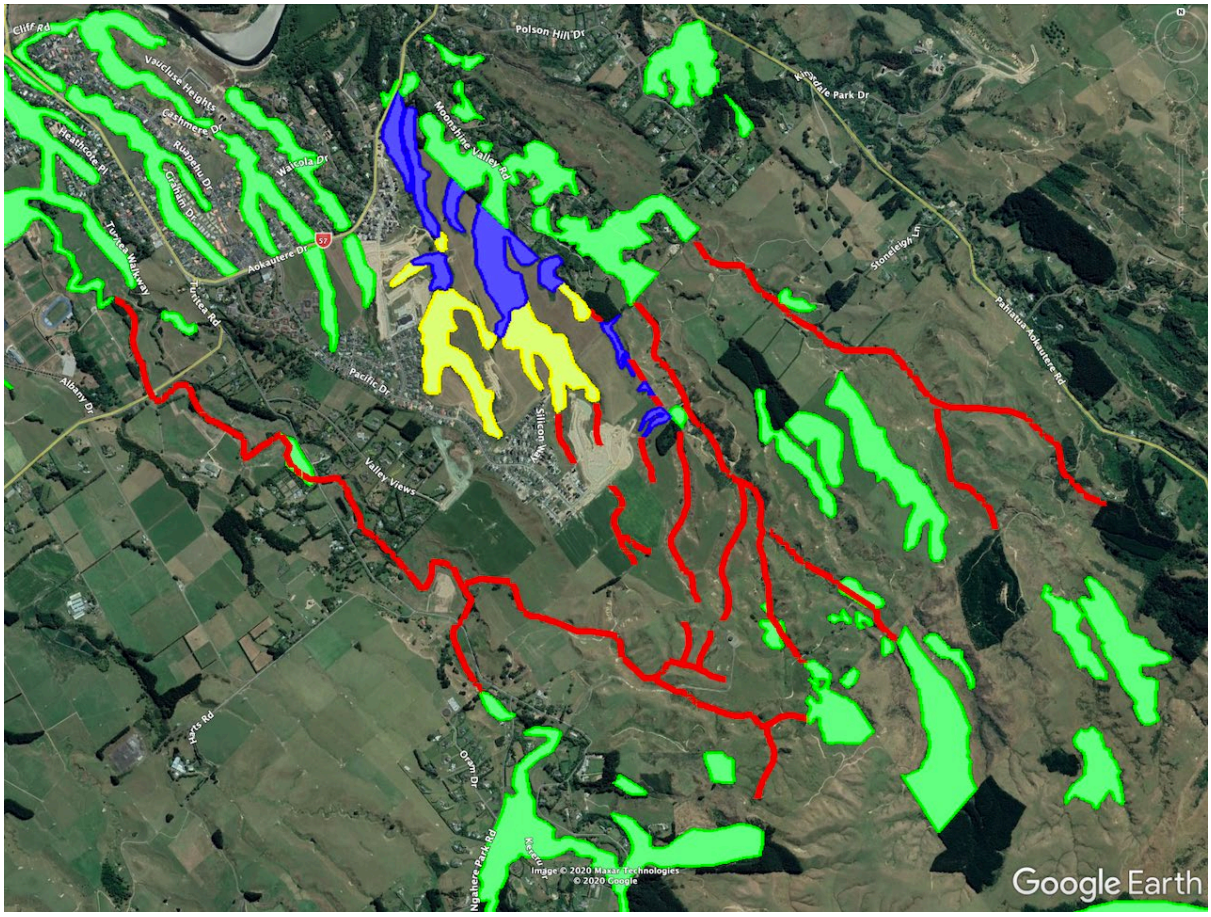

Figure 18. Approximate extents of existing indigenous cover surrounding the structure plan area (green), existing indigenous cover within the structure plan area (blue), and gorse cover within the structure plan area (yellow). Red lines indicate general alignments of recommended biodiversity corridors with the intention of connecting to the eastern hill country.

Good examples of highly mobile species relevant to the existing and potential ecosystems in the Aokautere Structure Plan area are kererū, korimako, and tūī. These bird species serve critical dispersal services for natural forest communities and management of their habitats (through predator control and revegetation) will help attain diverse forests and the presence of these conspicuous birds will appeal to many future residents of the structure plan area.

Habitats should be designed to represent pre-human compositions and to connect and function as part of the wider landscape. Opportunities for community involvement would be a central theme of restoration at the Aokautere Structure Plan area. Tangata Whenua should be engaged at an early stage of restoration planning and they should be invited to define taonga species to assist the cultural dimension of restoration.

5.2 Locations and Methods of Ecological Restoration

The main treatments for restoration within the structure plan area are:

- Forest restoration plantings in exotic pasture,
- Enrichment planting in gorse,
- Enrichment planting and weed control in seral (regenerating) broadleaved forest.

All restoration areas should be legally protected for conservation purposes and predator and weed control should be established and sustained for those restoration areas in perpetuity. Restoration treatments are photographed and mapped at varying levels of detail below (Figs. 19–24). A restoration implementation plan should be prepared confirming all restorative treatments in due course.

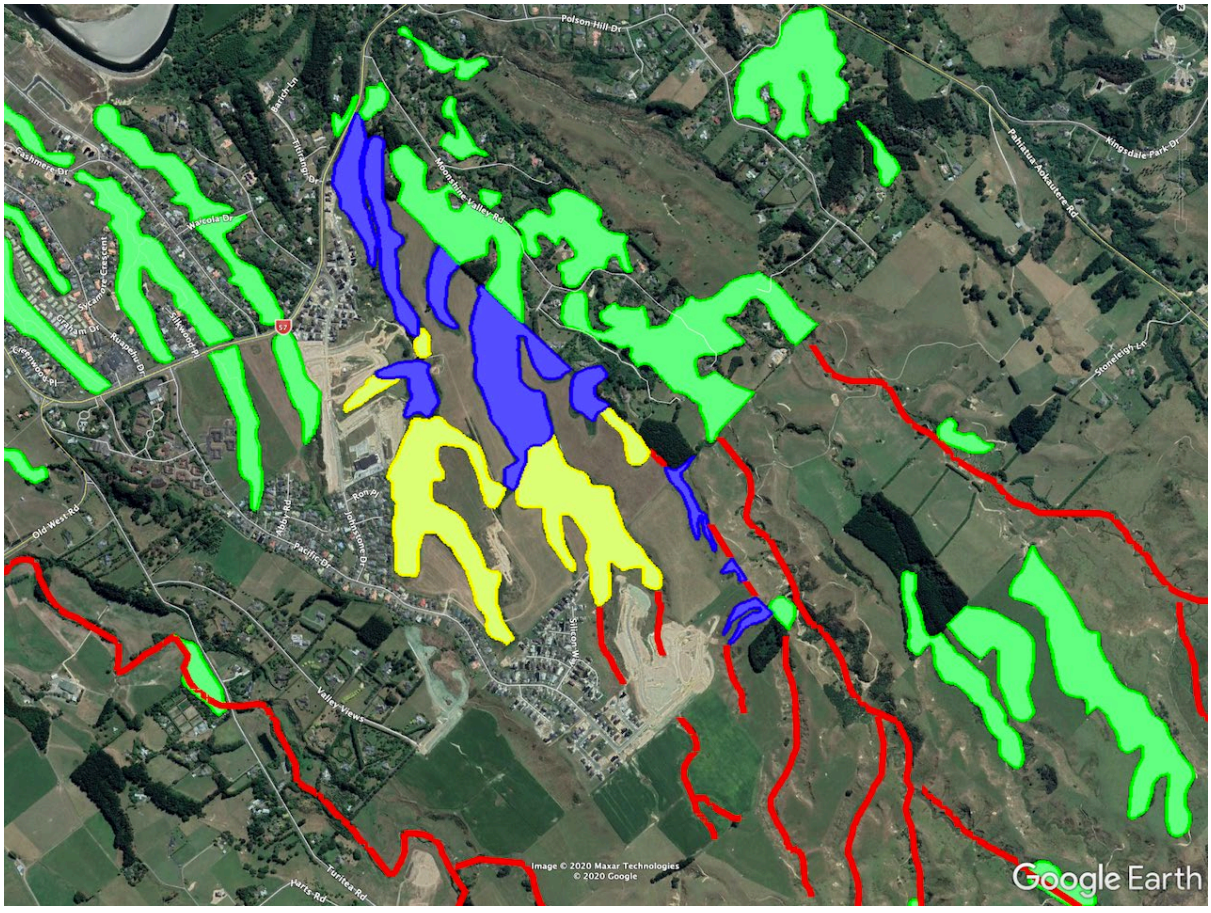

Figure 19. Locations of forest restoration treatments. Blue = existing seral broadleaved forest. Yellow = exotic gorse. Red = suggested ecological corridor alignment.

Forest restoration in exotic pasture

The purpose of this restoration treatment is to establish a diverse indigenous forest canopy. Due to the competitive nature of retired exotic grasslands, a close spacing (1–2 m spacing/10,000–2500 stems ha^{-1}) of fast-growing pioneer species is required to attain rapid canopy closure. Beyond the establishment period of the pioneer plantings, a second round of planting is required to introduced tree species that require a higher level of shelter for successful recruitment.

These planting treatments would occur around the margins of, or in clearings within, existing forest (i.e., the blue areas of Fig. 19), or in expanses of existing grassland (Fig. 20 A & B). This forest restoration planting treatment would be a critical means of rapidly achieving biodiversity corridors, and therefore, connections across the wider landscape. Planting an indigenous forest canopy would also be advisable on heavily disturbed sites (e.g., on surfaces resulting from gully filling; and such sites should be checked for adequacy of the topsoil stratum).

Species lists and spacings should be developed on a site-specific basis (taking into account site factors such as topography, soils, levels of disturbance, existing vegetation cover, etc) once restoration areas are confirmed in due course.

Figures 20 A and B. examples of exotic grassland sites where high-density forest restoration plantings are required.

Forest restoration in gorse

The purpose of this restoration treatment is to use the microclimate provided by the existing gorse stand to facilitate the recruitment of species that are representative of the ecosystems that would have occurred prior to human disturbance.

The planting treatment would involve cutting rows though the gorse at the locations shown in Figure 22. Rows should be cut to be 1.5 times the height of the gorse in a given location (this reduces competition from gorse but retains a microclimate for planted forest species to thrive in). Seedlings should be planted at c. 3 m spacings (1,111 stems ha^{-1}) within cut rows. The focus should be on planting indigenous conifer and mature forest canopy species, such as tōtara, rimu, matai, miro, kahikatea, horoeka, kapuka, hinau, tawa, pigeonwood, and others. Seedlings should be of an advanced grade, pot 2.5L or >1 m tall when planted. A final species list should be developed in due course.

Figure 21. An example of gorse cover suggested for enrichment planting.

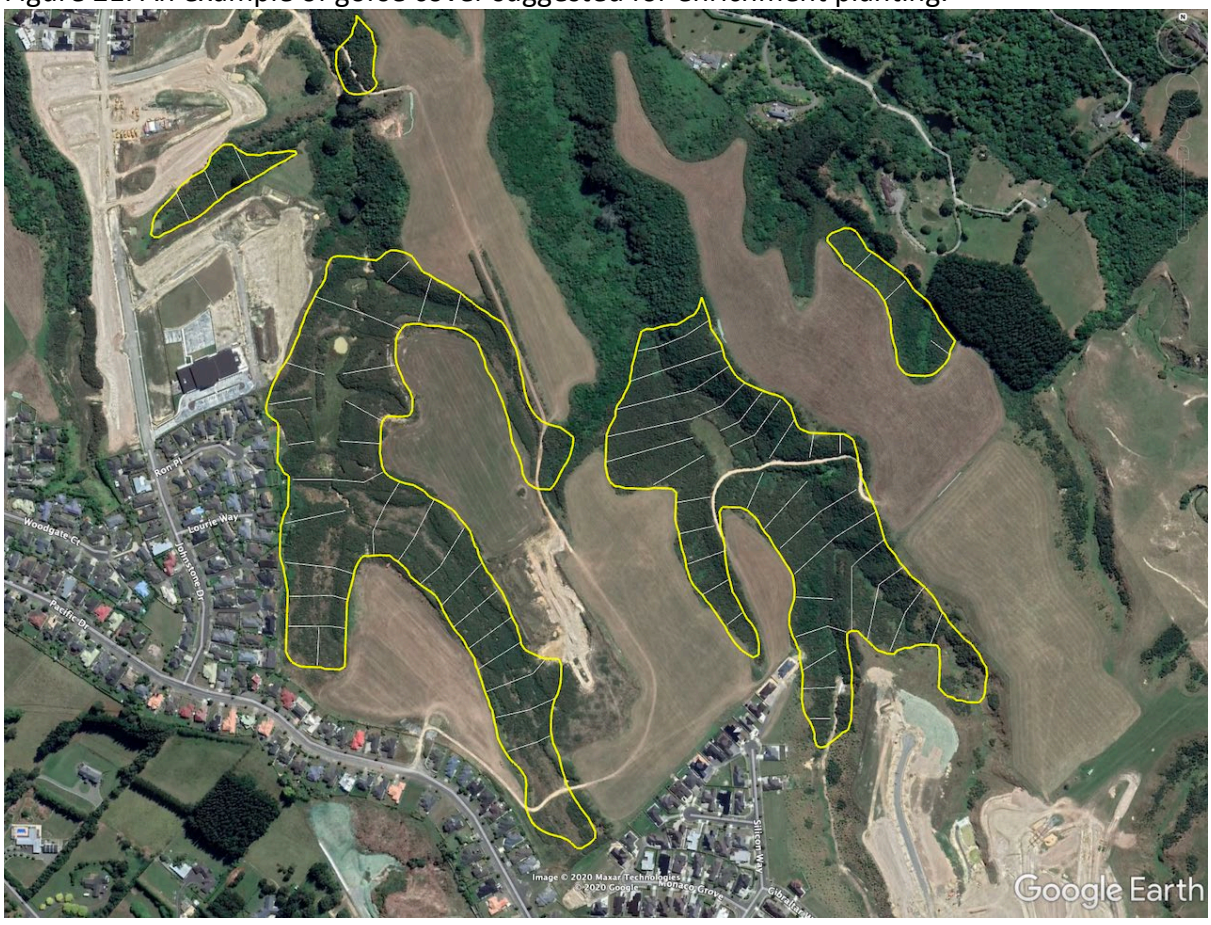

Figure 22. Suggested arrangement for row cutting and enrichment planting of exotic gorse. White lines indicate suggested locations of row cutting and planting.

Forest restoration in seral broadleaved forest

The purpose of this restoration treatment is to enhance and diversify the existing seral forests by removing environmental weeds (e.g., climbing and woody weeds) and undertaking enrichment planting with mature forest canopy species. Enrichment planting could be spread across forests or concentrated in one seed island per hectare. Details of weed control and planting should be determined on a site-specific basis in due course.

Figure 23. Example of seral broadleaved forest in lower Gully 1.

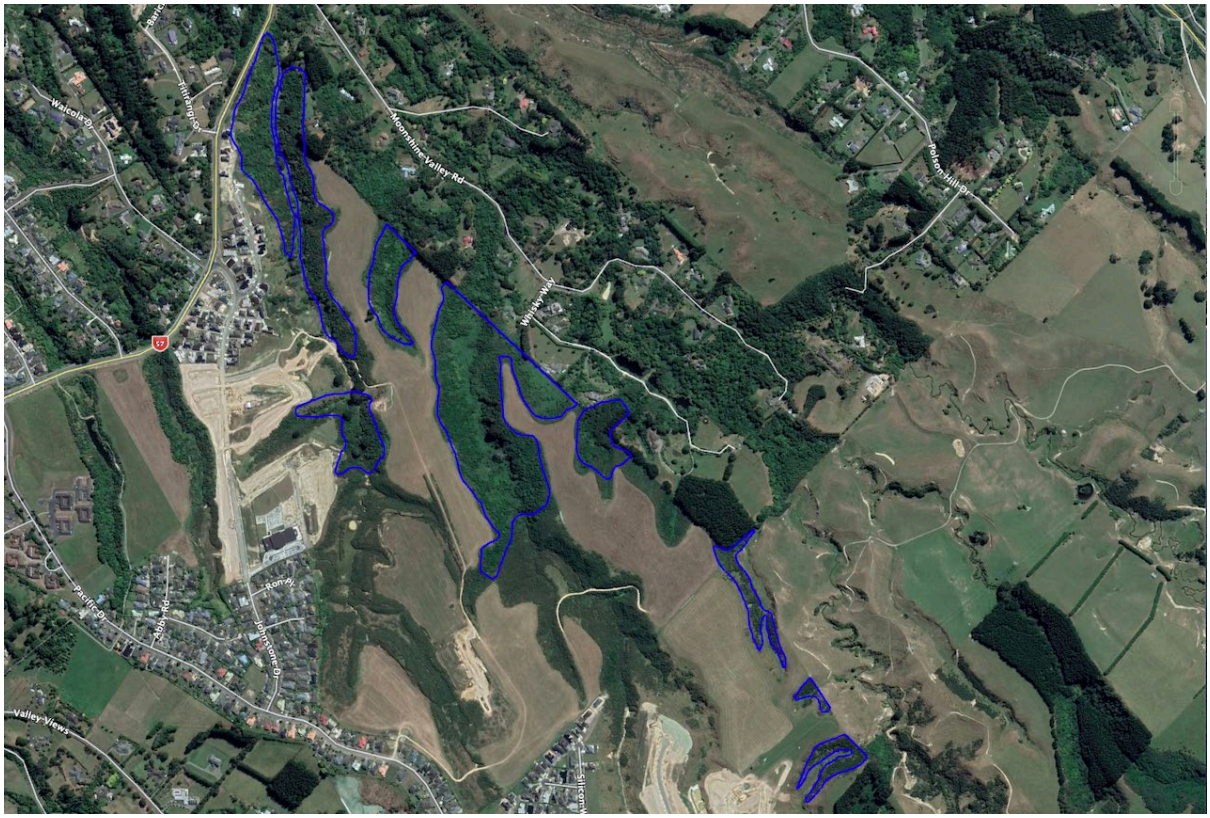

Figure 24. Areas of seral broadleaved forest suggested for weed control and enrichment planting.

5.2 Restoration of Freshwater Communities

The focus on protection and restoration of gully systems provides an excellent basis to effect stream restoration. Quantitative sampling should be undertaken to confirm fish and macroinvertebrate values in the waterways and lower catchment areas. This information will help determine the levels of sensitivity and the physical requirements (e.g., treatments for fish passage amendment; priorities for habitat creation) for stream restoration.

A principle of development should be to avoid net loss of stream area and ecosystem health in relation to stream works. Use of permanent hard structures such as culverts should be avoided where possible.

Where instream structures are unavoidable, these must be designed to facilitate fish passage for all species actually and potentially present. Existing impediments to fish passage (there are at least two) should be addressed to restore fish passage.

Stormwater quality and quantity should be managed so that freshwater receiving environments are no further impacted by urban development. This should include an emphasis on reduced hardstanding, site treatment of stormwater, green stormwater infrastructure, and minimal direct impacts to gully systems from stormwater infrastructure.

A full riparian cover should be attained over waterways located in the gully systems.

6.0 CONCLUSIONS AND RECOMMENDATIONS

This ecological constraints exercise has reached the following conclusions:

With respect to vegetation and habitats:

1. The gully systems in the Aokautere Structure Plan area contain levels of ecological constraint ranging from low to very high.
2. Gully 4 contains mature kānuka forest which is a Threatened Ecosystem type in the One Plan and has the national threat ranking of Threatened-Nationally Vulnerable (de Lange et al. 2018), thus triggering the rarity criterion of One Plan Policy 13-5.
3. Lower areas of the main Gullies 1 and 3, and areas of the smaller Gullies 2, 7, 8, and 9 feature vegetation and habitats of moderate to high constraint.
4. In comparison to One Plan Policy 13-5, the Draft Biodiversity NPS ecological significance criteria result in greater levels of ecological significance across the structure plan area.

With respect to freshwater habitats:

5. Gullies 1 and 3 contain freshwater habitats of moderate habitat quality.
6. Clear change points were identified in hydroclass between continually flowing/permanent stream and intermittent/ephemeral stream.
7. Continually flowing/permanent streams were assigned a high level of ecological constraint while intermittent/ephemeral stream were assigned low level of ecological constraint.

Regarding ecological restoration, the following conclusions and recommendations are drawn:

1. Indigenous vegetation in the landscape surrounding the structure plan area is typically configured as small and isolated forest sites in gullies and on terrace risers.
2. Within the structure plan area, c. 23.6 ha of seral indigenous forest and c. 24.3 ha of exotic gorse is present. This equates to a c. 6.3% cover of indigenous vegetation in the structure plan area. The proportion should be increased to >10% and this could be achieved by actively transitioning the existing gorse to indigenous forest cover. Forest restoration plantings in exotic grassland can expand indigenous cover even further while creating ecological corridors connecting to the eastern hill country.
3. Protecting existing ecological features is the first priority. Enhancing and reconstructing new ecological features is an important second priority.
4. Restoration treatments are outlined in Section 5.2 for forest restoration plantings in exotic pasture, enrichment planting in gorse, and enrichment planting and weed control in seral broadleaved forests.

5. A restoration implementation plan should be developed to further plan and guide the implementation of restoration treatments.
6. Quantitative surveys of freshwater biota will enable sensitivities and physical requirements to be understood.
7. Net loss of stream area and ecosystem health should be avoided.
8. Existing and proposed instream structures should provide for fish passage.
9. Urban development should be designed and implemented to that effects on stormwater quality and quantity are appropriately managed.

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Attachment 1 – Draft Biodiversity NPS Preliminary Significance Assessment

Representativeness (A4 a) & b)).

The kānuka forest in Gully 4 (Fig. 1) is a small forest area buffered by gorse and seral broadleaved species. The forest occurs on a terrace tread landform unit. Across the Manawatu Plains Ecological District (MPED; Ravine, 1995), only 8 ha of kānuka forest was identified on terrace tread landform units and these were mainly forests of mixed canopies of kānuka with other canopy species. To date, the kānuka forest has not been accessed as part of the structure plan work so it is not possible to confirm the attributes of the stand at this stage. It is expected, however, that the stand would have typical character for kānuka on terrace treads in the MPED – thus the stand has been given a preliminary (i.e., pre-site visit) ranking of Medium for Representativeness A4 a). In this case, criterion A4 b) cannot be assessed without specific surveys to assess the types and range of fauna species present within the stand.

Many of the gullies within the structure plan area feature regenerating indigenous vegetation (see Figs. 1, 4–8). Successions in these gullies start with exotic pasture, which is invaded by exotic gorse, which is in turn rapidly invaded by māhoe and a greater diversity of indigenous species then accumulate over time. Where disturbance does not reinitiate this pattern, successional development (thus floristic diversity) is most advanced at the downgradient extent of gully systems. In particular, regarding criterion A4a, Gully 1 (see Fig. 1; specifically the northernmost yellow and blue polygons) contains vegetation that would be considered seral and of a species composition typical of indigenous shrub-hardwood forest in this area of the MPED. These forest areas demonstrate a moderate level of ecological integrity. Gullies 2, 3, 5–9 features seral indigenous vegetation of lesser floristic diversity but levels deserving of significance are not present. Specific site surveys would be required to determine the fauna values of these seral broadleaved forest habitats.

Diversity and pattern (B5 a) & b)).

Ecological features within the structure plan area are not of special diversity and are not expressive of strong physical diversity.

Rarity and distinctiveness (C6 a)–i)).

The Land Environments (Leathwick et al. 2003) of the structure plan area are depleted of indigenous vegetation at a national scale (Threatened Environments Classification). The Land Environments present feature 10–20% or <10% indigenous vegetation cover. This makes vegetation occurring in these Land Environments significant under C6 d). Fauna rarity requires specific site assessment.

Ecological context (D3 a)–f)).

Regarding size and shape, the kānuka forest in Gully 4 is too small to trigger significance. The advanced secondary forest in combination with the adjacent forest polygon located in the northern part of Gully 1 together are of moderate size in the MPED context and for highly mobile species these sites serve as a partial link between local habitats and habitats in the eastern hill country. The young secondary forest in Gully 3 is assessed as significant as it is of a moderate size in the MPED context and provides a partial link between local habitats and habitats in the eastern hill country.

Summary of Draft Biodiversity NPS preliminary significance assessment findings.

The kānuka forest is significant for representativeness (Medium) and rarity. The northern extent of Gully 1 is significant for representativeness (Medium) and rarity; together these two broadleaved forest areas are significant for their moderate size and as a partial linkage for highly mobile species between local habitats and the eastern hill country. Areas mapped yellow in Figure 1 for the middle reach of Gully 1, all of Gully 2, Parts of Gullies 3, 7, 8 and 9 are significant for rarity. The area of Gully 3 mapped yellow is significant for size and linkage. No areas covered predominantly in gorse are assessed as significant. Fauna values (e.g., invertebrates, lizards, birds) require summertime surveys to determine levels of significance.

Application of the Draft Biodiversity NPS significance assessment criteria

Draft Biodiversity NPS Criteria (Appendix 1)	Criteria Description	Kānuka forest	Advanced secondary forest	Young secondary forest	Exotic woody scrub
Representativeness	**Significant Natural Areas** that qualify under this criterion will have at least one of the following attributes:				
	a) ecological unit(s) present which has ecological integrity[4] that is typical of the indigenous character of the ecological district;	Significant - preliminary **Medium**[5]	Significant - **Medium**	Significant - **Medium.** Northernmost yellow polygon in Fig.1 is seral broadleaved forest representative of regenerating shrub-hardwood forests of this area of the MPED. The remainder are not significant for this criterion	Not significant
	b) habitat that supports a typical suite of indigenous fauna that is characteristic of the habitat type in the ecological district and the range of species expected for that habitat type in the ecological district.	TBC – the suite of fauna present has not been assessed[6]	TBC – the suite of fauna present has not been assessed	TBC – the suite of fauna present has not been assessed	Not significant
Diversity and Pattern	**Significant Natural Areas** that qualify under this criterion will have at least one of the following attributes:				
	a) diversity of indigenous species, vegetation, habitats of indigenous fauna or communities in the context of the ecological district:	Not significant	Not significant	Not significant	Not significant

[4] Ecological integrity means the extent to which an ecosystem is able to support and maintain its – a) composition (being its natural diversity of indigenous species, habitats and communities); and, b) structure (being its biotic and abiotic physical features); and, c) functions (being its ecological and physical processes).

[5] Requires site visit to confirm the level of integrity.

[6] Requires site visit to confirm the suite of fauna and range of species present.

	b) presence of ecotones, complete or partial gradients or sequences:	Not significant	Not significant	Not significant	Not significant
Rarity and distinctiveness	**Significant Natural Areas** that qualify under this criterion will have at least one of the following:				
	a) provides habitat for an indigenous species that is listed as Threatened or At-risk in the New Zealand Threat Classification System lists:	Flora – Not significant Fauna – Not assessed	Flora – Not significant Fauna – Not assessed	Flora – Not significant Fauna – Not assessed	Flora – Not significant Fauna – Not assessed
	b) an indigenous vegetation type or an indigenous species that is uncommon within the region or ecological district:	Flora – Not significant Fauna – Not assessed	Flora – Not significant Fauna – Not assessed	Flora – Not significant Fauna – Not assessed	Flora – Not significant Fauna – Not assessed
	c) an indigenous species or plant community at or near its distributional limit:	Flora – Not significant Fauna – Not assessed	Flora – Not significant Fauna – Not assessed	Flora – Not significant Fauna – Not assessed	Flora – Not significant Fauna – Not assessed
	d) indigenous vegetation that has been reduced to less than 30 per cent of its former extent in the ecological district, region or land environment:	Significant – **High**	Significant – **High**	Significant[7] – **High**	Not significant
	e) indigenous vegetation or habitat of indigenous fauna occurring on sand dunes:	Not significant	Not significant	Not significant	Not significant
	f) indigenous vegetation or habitat of indigenous fauna occurring on naturally uncommon ecosystems:	Not significant	Not significant	Not significant	Not significant
	g) the type locality of an indigenous species:	Not significant	Not significant	Not significant	Not significant
	h) the presence of a distinctive assemblage or community of indigenous species:	Flora – Not significant Fauna – Not assessed	Flora – Not significant Fauna – Not assessed	Flora – Not significant Fauna – Not assessed	Flora – Not significant Fauna – Not assessed
	i) the presence of a special ecological or scientific feature.	Flora – Not significant Fauna – Not assessed	Flora – Not significant Fauna – Not assessed	Flora – Not significant Fauna – Not assessed	Flora – Not significant Fauna – Not assessed
Ecological Context (iii)	**Significant Natural Areas** that qualify under this criterion will have at least one of the following:				
	a) moderate to large size and compact shape, in the context of the ecological district:	Not significant	Significant	Significant (Gully 3)	Not significant
	b) well-buffered relative to remaining habitats in the ecological district:	Not significant	Not significant	Not significant	Not significant

[7] Significance relates to the yellow polygons shown in Figure 1 for Gullies 1–3 and 7–9.

	c) provides a full or partial buffer to or link between, other important habitat(s) of indigenous fauna or significant natural area(s):	Not significant	Significant – **Medium**	Significant (Gully 3) – **Medium**	Not significant
	d) important for the natural functioning of an ecosystem relative to remaining habitats in the ecological district:	Not significant	Not significant	Not significant	Not significant
	e) supports large numbers of indigenous fauna:	Not assessed	Not assessed	Not significant	Not significant
	f) provides critical habitat for indigenous fauna, including feeding, breeding, refuge or resting habitat.	Not significant	Not significant	Not significant	Not significant

Attachment 2 – Stream Habitat Survey Data

P1 - Site characterization field sheet

Site	Site code	Site 1		Site name	Stream 1		GPS	S 40 23 08.5	
	Assessor			Date				E 175 39 00.1	
Channel & Bank	Wetted channel width	1 m	Vegetated bank width		20m + m	Site length	10 m	* Channel & bank notes	
	Channel shape	Artificially channelised	Straight		Weakly sinuous	Strongly sinuous			
	Flow conditions	Low flow	Base flow		High flow				
	Flow types present	Riffle/rapid ☑	Run ☑		Pool ☑	Other ☐			
	Lower bank height	L – 1.2 m	R – 0.5 m		Upper bank height	L – – m	R – – m		
	Bank stability	Stable	Mostly stable		Highly unstable	Bank undercut	Yes/No	Vertical banks eroding in places	
	Bank cover	Soil ☐	Stony ☐		Grass ☐	Tussock ☐	Shrubs ☐	Trees ☑	Artificial ☐
In-stream	Stream bed substrate	Clay/mud ☑	Silt/sand ☐		Gravel ☐	Cobble ☑	Boulder ☐	Bedrock ☐	Artificial ☐
	Bed stability	Highly stable	Moderately stable		Highly unstable			* In-stream notes	
	Macrophytes	Submerged ☐	Marginal ☐		Emergent ☐				
	Periphyton	None visible	Sparse		Common	Abundant	Dominating		
	Wood	Absent	Sparse		Common	Abundant	Dominating		
	Moss	Absent	Sparse		Common	Abundant	Dominating		
	Leaves	Absent	Sparse		Common	Abundant	Dominating		
	Shading	Open	Partial		Heavily shaded	Overhanging vegetation	Yes/No		
Riparian & Catchment	Riparian width	L – 20+ m	R – 20+ m		Stock access	L – Yes/No	R – Yes/No	* Riparian & catchment notes	
	Stock damage	None	Minor		Moderate	High			
	Problem plants	Yes/No	Photo taken – Yes/No			Type(s)			
	Riparian cover	Soil ☐	Rock/ gravel ☐		Grass ☑	Tussock ☐	Wetland plants ☐		
		Ferns ☐	Shrubs ☑		Native trees ☑	Deciduous exotic ☐	Conifers ☐	Other ☐	
	Adjacent land use	Conservation/ reserve ☐	Short grazed ☐		Long ungrazed ☐	Production forest ☐	Dairy cattle ☐	Beef cattle ☐	Sheep ☐
		Crop ☐	Horticulture ☐		Deer ☐	Horse ☐	Urban ☑	Road ☐	Other ☐
	Catchment land use	Native forest ☐	Plantation forest ☐		Farming ☑	Urban ☑	Industry ☐	Mining ☐	Other ☐

Site 1

Habitat parameter	Condition category										SCORE
1. Deposited sediment	*The percentage of the stream bed covered by fine sediment.*										
	0	*5*	*10*	*15*	*20*	*30*	*40*	*50*	*60*	*≥ 75*	
SCORE	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	1
2. Invertebrate habitat diversity	*The number of different substrate types such as boulders, cobbles, gravel, sand, wood, leaves, root mats, macrophytes, periphyton. Presence of interstitial space score higher.*										
	≥ 5	*5*	*5*	*4*	*4*	*3*	*3*	*2*	*2*	*1*	
SCORE	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	6
3. Invertebrate habitat abundance	*The percentage of substrate favourable for EPT colonisation, for example flowing water over gravel-cobbles clear of filamentous algae/macrophytes.*										
	95	*75*	*70*	*60*	*50*	*40*	*30*	*25*	*15*	*5*	
SCORE	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	3
4. Fish cover diversity	*The number of different substrate types such as woody debris, root mats, undercut banks, overhanging/encroaching vegetation, macrophytes, boulders, cobbles. Presence of substrates providing spatial complexity score higher.*										
	≥ 5	*5*	*5*	*4*	*4*	*3*	*3*	*2*	*2*	*1*	
SCORE	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	2
5. Fish cover abundance	*The percentage of fish cover available.*										
	95	*75*	*60*	*50*	*40*	*30*	*20*	*10*	*5*	*0*	
SCORE	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	3
6. Hydraulic heterogeneity	*The number of of hydraulic components such as pool, riffle, fast run, slow run, rapid, cascade/waterfall, turbulance, backwater. Presence of deep pools score higher.*										
	≥ 5	*5*	*4*	*4*	*3*	*3*	*2*	*2*	*2*	*1*	
SCORE	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	5
7. Bank erosion	*The percentage of the stream bank recently/actively eroding due to scouring at the water line, slumping of the bank or stock pugging.*										
Left bank	*0*	*≤ 5*	*5*	*15*	*25*	*35*	*50*	*65*	*75*	*> 75*	
Right bank	*0*	*≤ 5*	*5*	*15*	*25*	*35*	*50*	*65*	*75*	*> 75*	
SCORE	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	3
8. Bank vegetation	*The maturity, diversity and naturalness of bank vegetation.*										
Left bank AND Right bank	*Mature native trees with diverse and intact understorey*		*Regenerating native or flaxes/sedges/tussock > dense exotic*			*Mature shrubs, sparse tree cover > young exotic, long grass*			*Heavily grazed or mown grass > bare/impervious ground.*		
SCORE	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	5
9. Riparian width	*The width (m) of the riparian buffer constrained by vegetation, fence or other structure(s).*										
Left bank	*≥ 30*	*15*	*10*	*7*	*5*	*4*	*3*	*2*	*1*	*0*	
Right bank	*≥ 30*	*15*	*10*	*7*	*5*	*4*	*3*	*2*	*1*	*0*	
SCORE	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	10
10. Riparian shade	*The percentage of shading of the stream bed throughout the day due to vegetation, banks or other structure(s).*										
	≥ 90	*80*	*70*	*60*	*50*	*40*	*25*	*15*	*10*	*≤ 5*	
SCORE	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	10
TOTAL	(Sum of parameters 1-10)										48/100

Stream 3 Track Crossing

P1 - Site characterization field sheet

Site	Site code		Site name	Stream 3		GPS	N-S 4078285		
	Assessor		Date				E - 1753955		
Channel & Bank	Wetted channel width	1 m	Vegetated bank width	20+ m	Site length	15 m	* Channel & bank notes		
	Channel shape	Artificially channelised	Straight	Weakly sinuous	Strongly sinuous				
	Flow conditions	Low flow	Base flow	High flow					
	Flow types present	Riffle/rapid ☐	Run ☐	Pool ☑	Other ☐				
	Lower bank height	L – 0.2 m	R – 0.2 m	Upper bank height	L – — m	R – — m			
	Bank stability	Stable	Mostly stable	Highly unstable	Bank undercut	Yes/No			
	Bank cover	Soil ☐	Stony ☐	Grass ☑	Tussock ☐	Shrubs ☑	Trees ☐	Artificial ☐	
In-stream	Stream bed substrate	Clay/mud ☑	Silt/sand ☑	Gravel ☑	Cobble ☑	Boulder ☐	Bedrock ☐	Artificial ☐	
	Bed stability	Highly stable	Moderately stable	Highly unstable			* In-stream notes		
	Macrophytes	Submerged ☐	Marginal ☐	Emergent ☐					
	Periphyton	None visible	Sparse	Common	Abundant	Dominating			
	Wood	Absent	Sparse	Common	Abundant	Dominating			
	Moss	Absent	Sparse	Common	Abundant	Dominating			
	Leaves	Absent	Sparse	Common	Abundant	Dominating			
	Shading	Open	Partial	Heavily shaded	Overhanging vegetation	Yes/No			
Riparian & Catchment	Riparian width	L – 20+ m	R – 20+ m	Stock access	L – Yes/No	R – Yes/No	* Riparian & catchment notes		
	Stock damage	None	Minor	Moderate	High				
	Problem plants	Yes/No	Photo taken ~~Yes/No~~		Type(s)				
	Riparian cover	Soil ☐	Rock/ gravel ☐	Grass ☑	Tussock ☐	Wetland plants ☐			
		Ferns ☐	Shrubs ☑	Native trees ☐	Deciduous exotic ☐	Conifers ☐	Other ☑ Gorse		
	Adjacent land use	Conservation/ reserve ☐	Short grazed ☐	Long ungrazed ☐	Production forest ☐	Dairy cattle ☐	Beef cattle ☐	Sheep ☑	
		Crop ☐	Horticulture ☐	Deer ☐	Horse ☐	Urban ☑	Road ☐	Other ☐	
	Catchment land use	Native forest ☐	Plantation forest ☐	Farming ☑	Urban ☑	Industry ☐	Mining ☐	Other ☐	

Stream 3 - track crossing

Habitat parameter	Condition category										SCORE
1. Deposited sediment	*The percentage of the stream bed covered by fine sediment.*										
	0	*5*	*10*	*15*	*20*	*30*	*40*	*50*	*60*	*≥ 75*	
SCORE	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	1
2. Invertebrate habitat diversity	*The number of different substrate types such as boulders, cobbles, gravel, sand, wood, leaves, root mats, macrophytes, periphyton. Presence of interstitial space score higher.*										
	≥ 5	*5*	*5*	*4*	*4*	*3*	*3*	*2*	*2*	*1*	
SCORE	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	2
3. Invertebrate habitat abundance	*The percentage of substrate favourable for EPT colonisation, for example flowing water over gravel-cobbles clear of filamentous algae/macrophytes.*										
	95	*75*	*70*	*60*	*50*	*40*	*30*	*25*	*15*	*5*	
SCORE	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	1
4. Fish cover diversity	*The number of different substrate types such as woody debris, root mats, undercut banks, overhanging/encroaching vegetation, macrophytes, boulders, cobbles. Presence of substrates providing spatial complexity score higher.*										
	≥ 5	*5*	*5*	*4*	*4*	*3*	*3*	*2*	*2*	*1*	
SCORE	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	1
5. Fish cover abundance	*The percentage of fish cover available.*										
	95	*75*	*60*	*50*	*40*	*30*	*20*	*10*	*5*	*0*	
SCORE	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	1
6. Hydraulic heterogeneity	*The number of of hydraulic components such as pool, riffle, fast run, slow run, rapid, cascade/waterfall, turbulance, backwater. Presence of deep pools score higher.*										
	≥ 5	*5*	*4*	*4*	*3*	*3*	*2*	*2*	*2*	*1*	
SCORE	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	2
7. Bank erosion	*The percentage of the stream bank recently/actively eroding due to scouring at the water line, slumping of the bank or stock pugging.*										
Left bank	*0*	*≤ 5*	*5*	*15*	*25*	*35*	*50*	*65*	*75*	*> 75*	
Right bank	*0*	*≤ 5*	*5*	*15*	*25*	*35*	*50*	*65*	*75*	*> 75*	
SCORE	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	4
8. Bank vegetation	*The maturity, diversity and naturalness of bank vegetation.*										
Left bank AND Right bank	*Mature native trees with diverse and intact understorey*		*Regenerating native or flaxes/sedges/tussock > dense exotic*			*Mature shrubs, sparse tree cover > young exotic, long grass*			*Heavily grazed or mown grass > bare/impervious ground.*		
SCORE	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	3
9. Riparian width	*The width (m) of the riparian buffer constrained by vegetation, fence or other structure(s).*										
Left bank	*≥ 30*	*15*	*10*	*7*	*5*	*4*	*3*	*2*	*1*	*0*	
Right bank	*≥ 30*	*15*	*10*	*7*	*5*	*4*	*3*	*2*	*1*	*0*	
SCORE	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	10
10. Riparian shade	*The percentage of shading of the stream bed throughout the day due to vegetation, banks or other structure(s).*										
	≥ 90	*80*	*70*	*60*	*50*	*40*	*25*	*15*	*10*	*≤ 5*	
SCORE	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	5
TOTAL	(Sum of parameters 1-10)										30/100

Appendix B

4 March 2021
By E-mail

Palmerston North City Council
32 The Square
Palmerston North 4410

Attn: Victoria Edmonds

Forbes Ecology
Dr. Adam Forbes
PO Box 8740
Havelock North (4157)
Hastings
New Zealand

Dear Victoria,

Re: Review of Waters Block for Aokautere Master Plan

Background/method:

This letter sets out a brief assessment I undertook of the above property to assist with development of the Aokautere Master Plan. Here I describe my approach, key findings and recommendations along with a supporting series of photographs.

I visited the site on 3rd March 2021 and spent three hours traversing the site on foot. During this time I also covered the site with high resolution drone imagery. For forest vegetation, I assessed qualitatively the composition and structure of the vegetation present. From these observations I can interpret successional stages and how the sites relate to One Plan Schedule F Habitat Types. I also assessed the land status regarding the Threatened Environments layer which partly informs an assessment of rarity values. For wetlands, I considered a combination of vegetation, soils, hydrology and topography to interpret wetland extents. National wetland deliniation protocols and Schedule F criteria provided useful guidance on wetland deliniation and values assessment.

Key Findings and Recommendations:

- Old-growth remnants (labelled A & B; Fig. 1) are representitive of tawa-rimu forest which is a Threatened habitat type. Both areas should be a very high priority for protection and restoration. These bush areas are currently grazed. I recommend they be incorporated into the structure plan area so that they can be managed appropriately (retired, protected, and restored).
- Secondary forest patches C & D (Fig. 1) are each of less than 0.25 ha and are therefore of too small an area to be regarded under Schedule F. These are however well developed forest patches (indicated by the species present, the stem diameters, and the developed extent of lianes cover). I recommend both sites be retired, protected, and restored.

- Area E (Fig. 1) is secondary forest on Chronically Threatened Environment (10-20% remaining) which would be regarded under the Schedule F Rarity criterion. I recommend this area be retired, protected, and restored.
- Areas in blue (Fig. 1) broadly represent seepage/spring wetlands which are a Rare habitat type and therefore would be regarded under Schedule F. These wetland areas should be retired, protected, and restored.
- Note that a combination of soil type (drainage status) and pasture management have resulted in numerous areas of rushes beyond the blue areas which I believe would be excluded by Schedule F Table F.2(b) iii.

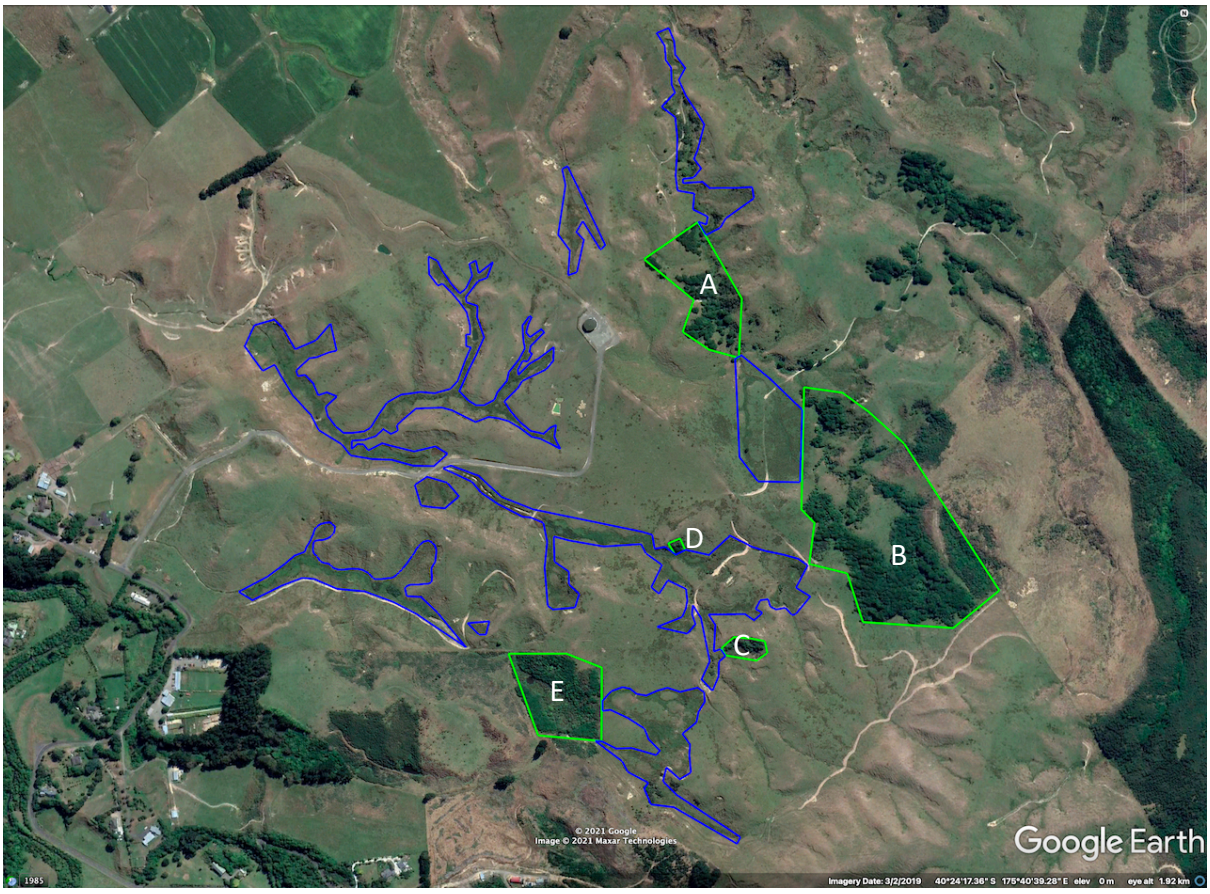


Figure 1. Areas of the Water's land featuring native forests and wetlands which are recommended for specific treatment under the Aokautere Structure Plan.

Photographs 1 to 12 below are captioned to help illustrate my findings and recommendations. Please let me know if you have any questions on this advice or would like any further input from me at any time.

Yours Sincerely,

Dr Adam Forbes
Director and Principal Ecologist
Forbes Ecology Limited

Photograph 1: Old-growth bush remnants (some with secondary fringes) Areas A (foreground) and B (distant).

Photograph 2: Canopy close up of old-growth bush remnant Area B showing tawa dominance with native conifers, nikau, pukatea and other canopy species present.

Photograph 3: Central part of the Water's block with spring and seepage wetlands along with Areas C and D bush patches partly visible at centre top and bottom.

Photograph 4: View of Area C bush patch.

Photograph 5: View of Area D bush patch with surrounding wetland.

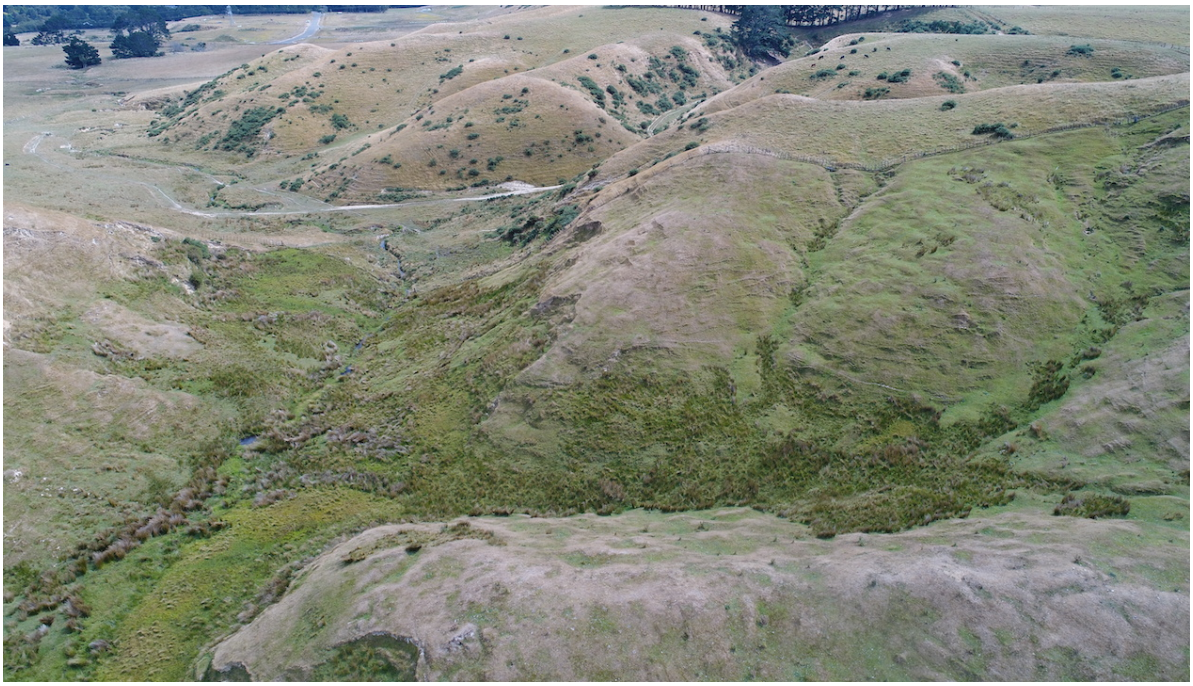
Photograph 6: Wetland viewed upslope towards Area E which is at top right.

Photograph 7: Area E looking northwest.

Photograph 8: Central area viewed to the northwest, featuring wetland in gully.

Photograph 9: Continuation from Photograph 8 in northwestern direction.

Photograph 10: Continuation from Photograph 9 in northwestern direction.



Photograph 11: Continuation from Photograph 10 in northwestern direction.

Photograph 12: Overview of much of the Water's block viewed to the southeast.

Appendix C

14 April 2023
By E-mail

Forbes Ecology
Dr. Adam Forbes
0223672326
adam@forbesecology.co.nz
www.forbesecology.co.nz

Palmerston North City Council
32 The Square
Palmerston North
New Zealand

Attn: Michael Duindam

Dear Michael,

Re: Aokautere Masterplan Stream Hydroclass Classifications

INTRODUCTION

Palmerston North City Council engaged Forbes Ecology Limited to assess stream hydroclasses across the Aokautere masterplan area. The work was undertaken in relation to a request by Horizons Regional Council to have stream hydroclass classifications defined across the masterplan area to assist the RMA (1991) regulatory process.

METHODS

The methods for stream classification follow the Auckland Unitary Plan Practice and Guidance Note for River/Stream Classification[1]. Three hydroclasses were assessed as defined in the Appendix.

Step 1: Non-survey/desk top analysis

The following information sources were used to initally improve confidence in drainage system classifications:

- Existing GIS data and tools (e.g., PNCC stream layer, NIWA NZ river maps),
- Existing site data (from previous site visits),
- Current and historic aerial imagery,
- Relationships between drainage features and topography on the site and in the catchment.

[1] See: https://content.aucklanddesignmanual.co.nz/regulations/practice-notes/Documents/RC%203.3.17%20Stream%20Classification.pdf

Step 2: Field survey

Field assessments were undertaken by Dr Adam Forbes in the presence of Keegan Aplin-Thane (PNCC Senior Planner) and, in part (i.e., part of first day), Logan Brown (Horizons Freshwater and Partnerships Manager) on 28 February and 1 March 2023.

Rainfall depths[2] preceding the field surveys are presented in Table 1. The assessment was not undertaken during the wet season and a rain event of 12-70 mm (i.e., significant rain event) had not occurred within 48 hours of the field assessments. As a significant rain event had not occurred within 48 hours the focus of the assessment of surface water was to assess at a time of >60 hrs the presence and not the absence of surface water.

Table 1. Rainfall depths prior to the field surveys

Days prior to field surveys	Accumulated rainfall depth (mm)	
	28 February 2023	1 March 2023
2	4	0
7	5.5	5.5
14	59	48.5
30	136.5	114.5

Watercourses were assessed for evidence of intermittently or permanently flowing water. The following aspects were taken as evidence of extended periods of surface water or base flow in a watercourse:

- Aquatic macroinvertebrates presence,
- Obligate or facultative wetland or aquatic vegetation presence,
- Algal growths,
- Anaerobic / hydric soil presence,
- Presence of a spring (hard to observe in summer),
- Fish species presence,
- Historical evidence (e.g., fish records and historical flow data – prolonged flows).

If the watercourse exhibited some or all of the above features, then it was considered to be, at a minimum, an intermittent river.

Boundaries between intermittent and ephemeral hydroclasses were determined in the field using the Table 2 criteria.

[2] Rainfall data are sourced from Horizons website for the Ngahere Park rainfall gauge, located within 2 km to the south west of the sites assessed.

Table 2. AUP(OP) criteria for permanent, intermittent rivers and streams and ephemeral streams

Criterion	Definition
Permanent river or stream	
1	Evidence of continuous flow
Intermittent river or stream, or ephemeral stream	
1	Evidence of natural pools
2	Well defined channel. Banks and bed can be distinguished
3	Surface water present (more than >60hrs after a rain event)
4	Rooted terrestrial vegetation not present across the entire cross-sectional width of channel
5	Organic debris present in floodplain
6	Evidence of substrate sorting processes, including scour and deposition
Ephemeral stream	
1	Stream bed above the water table at all times
2	Water present only during and shortly after rainfall

When undertaking a field-based assessment, the following were applied:

- Familiarise with the catchment drainage system in the area. Before going to site, note the catchment drainage system in terms of its size and any modelled overland flow paths and use this as a high-level indication of the point of origin of the rivers onsite.
- The modelled overland flow path extent has generally shown a good correlation with survey data in instances where groundwater tables have not been artificially lowered. However, the modelled data should be treated as indicative only. It is recommended the actual extent of watercourses are obtained during the site inspection / field survey.
- Go to the site with the outcomes of the non-survey / desktop outcomes in mind and annotated on maps.
- Walk down from the top of the catchment and walk all tributaries; if the catchment extends beyond the property, assess the drainage system above and below the property in question to better understand the drainage features on the property.
- Walk over remainder of the site to determine if any offline wetlands are present (i.e., those wetlands not immediately associated with a river network).
- The assessment should not be spatially limited to any specific property, as rivers are connected systems and individual reaches cannot be considered in isolation.
- Assess drainage features that are visible at that time of year and that can be assessed with high confidence.
- Where high confidence predictions can be made, include these in the assessment (including assumptions).
- Compensate for levels of land use disturbance / anthropogenic impact.

- Consider factors such as preceding rainfall in comparison to the long-term rainfall mean and seasonality of the high water table. Local rainfall gauges should be detected to determine the volume and time since the last rainfall. Where flow gauges are available, these will also provide useful information.

Where livestock have had an impact on the watercourse, assess areas where stock have not had access immediately upstream or downstream of the site if possible, and carry out comparative assessments within less impacted areas as close as possible to the catchment. The assessment must not be made by observing one point, but rather should be made by observing the entire reach and upstream and downstream (where practicable).

RESULTS

Desktop analysis

The results of the desktop analysis focused on identifying water reaches of permanent hydroclass. Three independent reaches were identified as holding permanent hydroclass (mapped red in Fig. 1). The hydroclass status of these reaches was refined with data collected during the scheduled field analysis. Also at that time reaches marked white in Figure 1 which were thought to be of either intermittent and ephemeral hydroclass were assessed to confirm hydroclass status and change points in hydroclass.

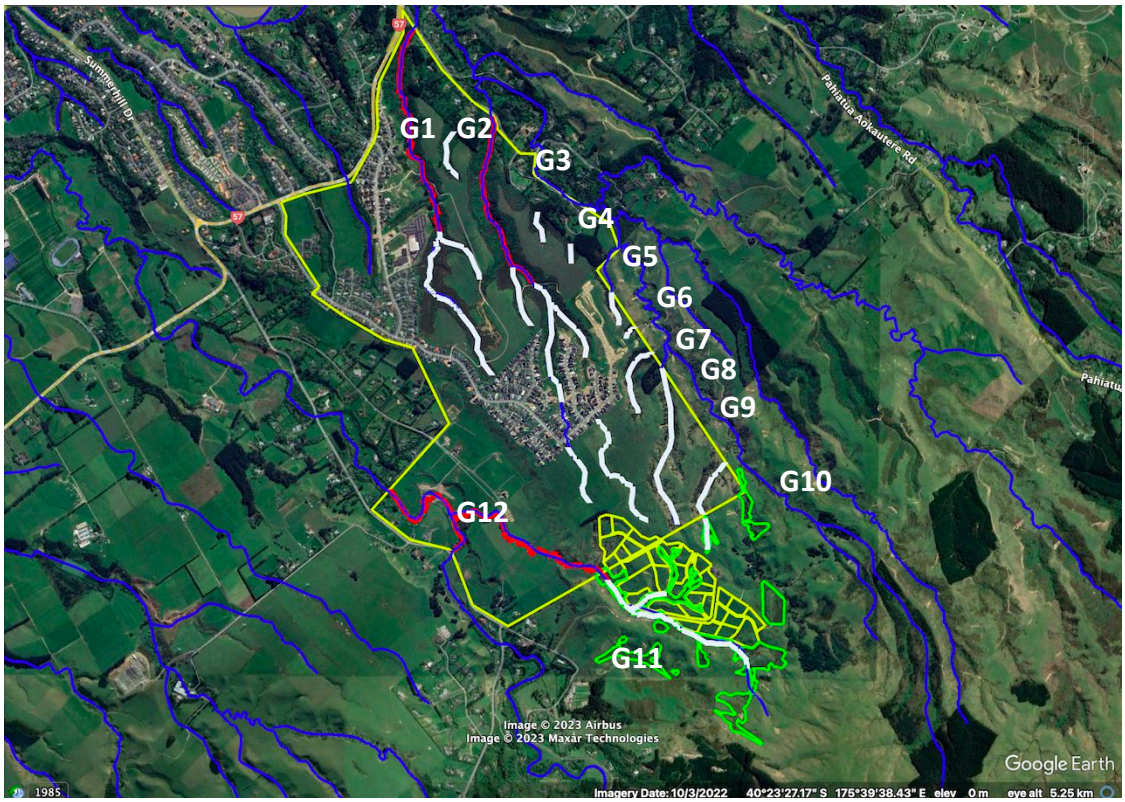


Figure 1. Desktop assessment of hydro classes (red) and reaches requiring specific field assessment (white) overlaid on the PNCC Stream Layer (blue). Wetlands previously identified are green and the boundaries of the structure plan are yellow.

Field analysis

Field analyses advanced the desktop analysis by significantly redefining most of the desktop results. All gullies across the site were assessed and the results are summarised below and documented in detail in Figure 2, Table 2, and the photographs below.

Gully 1 (G1)

Permanently flowing water from the point of the existing fill face (Photo A – G1). Intermittent above this point to a point a short distance above the stormwater treatment pond (Photo B – G1). Ephemeral above this point to the urban edge. A gully on the true right near the permanent-intermittent transition point is ephemeral.

Gully 2 (G2)

Ephemeral at the boundary (Photo C – G2).

Gully 3 (G3)

Permanently flowing water with eels seen upstream of Moonshine Valley Road (Photo D – G3). Transitions to intermittent for a long reach to Sardinia Grove. In the latter part of this reach the waterway branches to form two intermittent reaches (Photo E – G3 and Photo F – G3). Two ephemeral headwaters exist southeast of Atlantic Drive. A contributing gully located on the true left approximately 170 m downstream of the farm track culvert crossing is ephemeral.

Gully 3a (G3a)

Ephemeral at the boundary (Photo G – G3a).

Gully 4 (G4)

Ephemeral at the boundary (Photo H – G4).

Gully 5 (G5)

Ephemeral at the boundary (Photo I – G5).

Gully 6 (G6)

Ephemeral at the boundary (Photo J – G6).

Gully 7 (G7)

Ephemeral at the boundary (Photo K – G7).

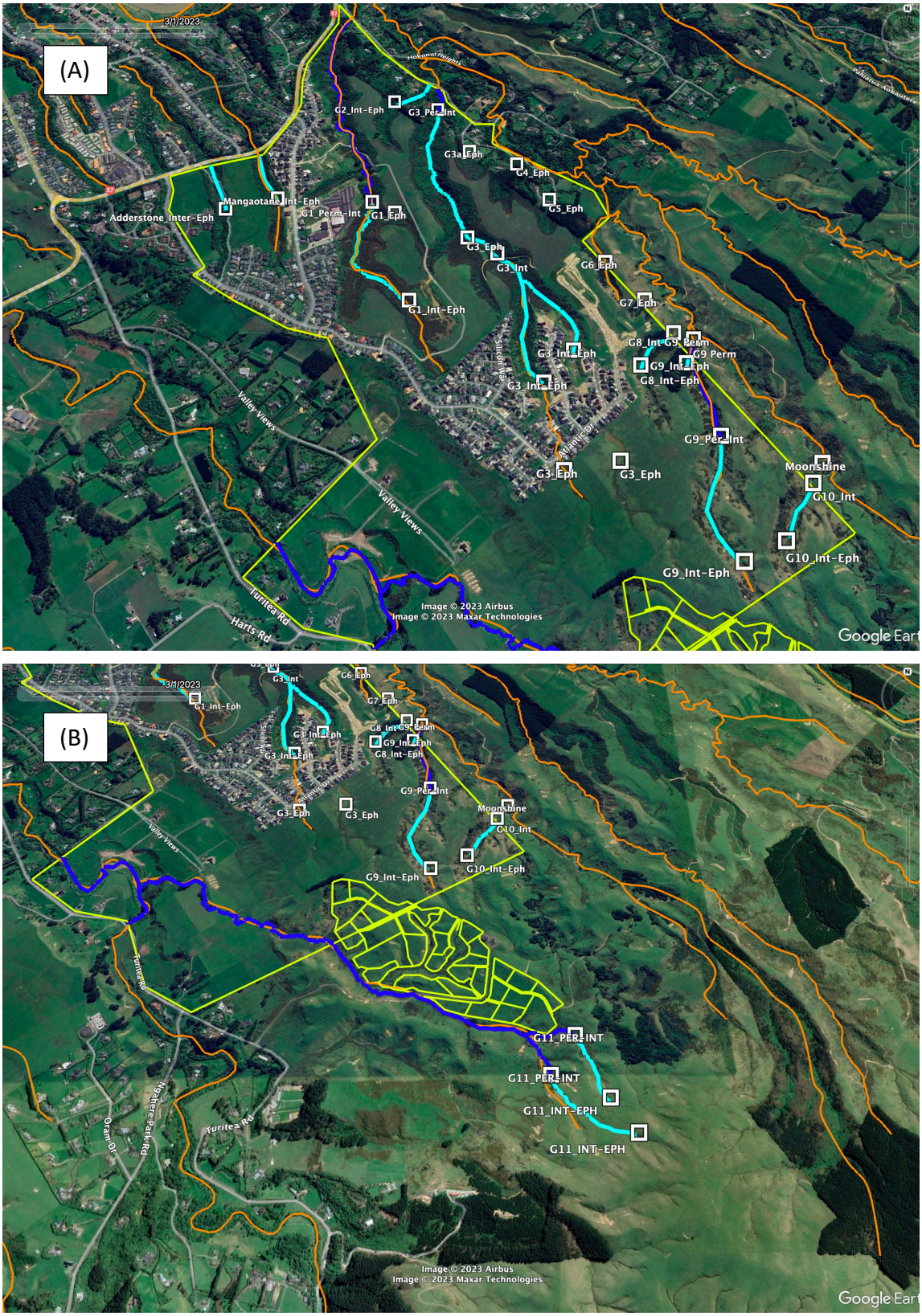


Figure 2 A & B. A - Northern parts of the masterplan area showing hydroclass boundaries and results for Gullies 1-10 plus Adderstone and Mangotane reserves and the Moonshine Stream. B – Hydroclass results for the Waters Block in the southern portion of the masterplan area. Dark blue = permanent hydroclass. Light blue = Intermittent hydroclass. Orange lines = PNCC stream layer.

Gully 8 (G8)

Intermittent approximately 200 m upstream of the boundary (Photo L – G8). Ephemeral above this point.

Gully 9 (G9)

Permanent at the boundary and permanently flowing water (Photo M – G9) continues for approximately 340 m to a point where the hydroclass transitions to intermittent (Photo N – G9). Ephemeral above the upper intermittent extent (Photo P – G9). The lower reach of permanent flow is through a deep ravine where a short steep tributary containing a length of intermittent hydroclass (located in the pines) converges on the true left (Photo O – G9).

Gully 10 (G10)

Intermittent at the boundary extending upstream for approximately 270 m before transitioning to ephemeral hydroclass (Photo Q – G10).

Gully 11 (G11)

Permanent hydroclass unnamed tributary of the Turitea Stream. Flows through various wetland areas, at times both diffusely and in a defined channel. In the upper reach the waterway branches to form two permanently flowing waterways (Photo R – G11 & Photo S – G11), each with intermittent reach climbing to elevations of 175 and 217 m a.s.l (Photo T – G11 & Photo U – G11 respectively) on the northwestern slopes of Bryant Hill. In addition, three contributing areas were assessed as either ephemeral or wetland with no permanent or intermittent stream elements present and therefore these areas are not mapped as stream habitat.

Moonshine Stream, Adderstone and Mangotane Reserves

The Moonshine stream was assessed to the east of the masterplan area where it is permanent (Photo V – Moonshine).

For completeness, Adderstone reserve was assessed and the boundary between intermittent and ephemeral hydroclass was defined (Photo W – Adderstone). The adjacent reserve, Mangotane was assessed – access was difficult however a boundary between intermittent and ephemeral hydroclass was approximately defined (Photo X – Mangotane).

Table 2. Hydroclasses within the Aokautere Structure Plan area.

Reach ref	Hydroclass	Waypoint (WGS89)		Elevation (m.a.s.l)	Defined channel	Pools	Surface water >60 hrs	Terr vege not present	Debris on flood plain	Sorting, scour, deposition	Photo ref
		South	East								
G1	Perm-Int	40°23'20.1"S	175°39'04.2"E	56	Y	Y	Y	Y	Y	Y	A
G1	Int-Eph	40°23'35.4"S	175°39'11.0"E	87	N	Y	Y	Y	N	Y	B
G2	Int-Eph	40°23'02.2"S	175°39'07.5"E	52	Y	Y	Y	Y	N	Y	C
G3	Per-Int	40°23'03.8"S	175°39'15.6"E	37	Y	Y	Y	Y	Y	Y	D
G3	Int-Eph	40°23'46.9"S	175°39'32.1"E	81	Y	N	Y	N	Y	N	E
G3	Int-Eph	40°23'42.7"S	175°39'37.1"E	80	Y	Y	Y	Y	N	N	F
G3a	Eph	40°23'11.6"S	175°39'21.4"E	60	N	N	N	N	N	N	G
G4	Eph	40°23'13.9"S	175°39'29.8"E	53	N	N	N	Y	N	N	H
G5	Eph	40°23'20.1"S	175°39'35.2"E	56	N	N	N	N	N	N	I
G6	Eph	40°23'30.1"S	175°39'43.7"E	74	N	N	N	N	N	N	J
G7	Eph	40°23'35.8"S	175°39'49.4"E	80	N	N	Y	N	N	N	K
G8	Int-Eph	40°23'44.8"S	175°39'47.4"E	79	Y	Y	Y	Y	N	Y	L
G9	Perm	40°23'41.4"S	175°39'56.3"E	57	Y	Y	Y	Y	Y	Y	M
G9	Perm-Int	40°23'53.9"S	175°39'58.0"E	78	Y	Y	Y	Y	N	Y	N
G9	Int-Eph	40°23'44.6"S	175°39'54.6"E	64	N	Y	Y	Y	N	Y	O
G9	Int-Eph	40°24'08.0"S	175°39'58.2"E	91	Y	N	Y	Y	N	N	P
G10	Int-Eph	40°24'05.9"S	175°40'04.6"E	84	Y	Y	Y	Y	N	N	Q
G11	Perm-Int	40°24'32.8"S	175°40'20.9"E	114	Y	Y	Y	Y	N	Y	R
G11	Perm-Int	40°24'37.9"S	175°40'16.7"E	121	Y	Y	Y	Y	Y	Y	S
G11	Int-Eph	40°24'40.8"S	175°40'25.4"E	175	Y	N	Y	Y	N	Y	T
G11	Int-Eph	40°24'45.0"S	175°40'29.0"E	217	Y	Y	Y	Y	Y	N	U
Moonshine	Permanent	40°23'57.3"S	175°40'12.2"E	100	Y	Y	Y	Y	Y	Y	V

Adderstone	Int-Eph	40°23'20.9"S	175°38'38.8"E	68	Y	Y	Y	Y	N	N	W
Mangatane	Int-Eph	40°23'19.3"S	175°38'47.6"E	68	Y	Y	Y	Y	N	N	X

Notes: Int = Intermittent, Eph = Ephemeral, Perm = Permanent. Y = Yes, N = No.

A - G1. Permanent-Intermittent. S 40 23 20.1 E 175 39 04.2 (WGS89). 56 m.a.s.l

B - G1. Intermittent-Ephemeral. S 40 23 35.4 E 175 39 11.0 (WGS89). 87 m.a.s.l

C - G2. Intermittent-Ephemeral. S 40 23 02.2 E 175 39 07.5 (WGS89). 52 m.a.s.l

D - G3. Permanent-Intermittent. S 40 23 03.8 E 175 39 15.6 (WGS89). 37 m.a.s.l

E - G3. Intermittent-Ephemeral. S 40 23 46.9 E 175 39 32.1 (WGS89). 81 m.a.s.l

F - G3. Intermittent-Ephemeral. S 40 23 42.7 E 175 39 37.1 (WGS89). 80 m.a.s.l

G - G3a. Ephemeral. S 40 23 11.6 E 175 39 21.4 (WGS89). 60 m.a.s.l.

H - G4. Ephemeral. S 40 23 13.9 E 175 39 29.8 (WGS89). 53 m.a.s.l.

I - G5. Intermittent-Ephemeral. S 40 23 20.1 E 175 39 35.2 (WGS89). 56 m.a.s.l

J - G6. Ephemeral. S 40 23 30.1 E 175 39 43.7 (WGS89). 74 m.a.s.l

K - G7. Ephemeral. S 40 23 35.8 E 175 39 49.4 (WGS89). 80 m.a.s.l

L - G8. Intermittent-Ephemeral. S 40 23 44.8 E 175 39 47.4 (WGS89). 79 m.a.s.l

M - G9. Permanent. S 40 23 41.4 E 175 39 56.3 (WGS89). 57 m.a.s.l

N - G9. Permanent-Intermittent. S 40 23 53.9 E 175 39 58.0 (WGS89). 78 m.a.s.l

O - G9. Intermittent-Ephemeral. S 40 23 44.6 E 175 39 54.6 (WGS89). 64 m.a.s.l

P - G9. Intermittent-Ephemeral. S 40 24 08.0 E 175 39 58.2 (WGS89). 91 m.a.s.l

Q - G10. Intermittent-Ephemeral. S 40 24 05.9 E 175 40 04.6 (WGS89). 84 m.a.s.l

R - G11. Permanent-Intermittent. S 40 24 32.8 E 175 40 20.9 (WGS89). 114 m.a.s.l

S - G11. Permanent-Intermittent. S 40 24 37.9 E 175 40 16.7 (WGS89). 121 m.a.s.l

T - G11. Intermittent-Ephemeral. S 40 24 40.8 E 175 40 25.4 (WGS89). 175 m.a.s.l

U - G11. Intermittent-Ephemeral. S 40 24 45.0 E 175 40 29.0 (WGS89). 217 m.a.s.l

V – Moonshine. Permanent. S 40 23 57.3 E 175 40 12.2 (WGS89). 100 m.a.s.l

W – Adderstone. Intermittent-Ephemeral. S 40 23 20.9 E 175 38 38.8 (WGS89). 68 m.a.s.l

X – Mangotane. Intermittent-Ephemeral. S 40 23 19.3 E 175 38 47.6 (WGS89). 68 m.a.s.l

CONCLUSIONS

Hydroclasses were determined at a total of 24 locations across 14 gullies of the Aokautere masterplan area in late February-early March 2023.

Four gullies (G1, G3, G9, & G11) contained reaches of permanently flowing water. Eels and koura were seen in several locations within these reaches.

Nine gullies (G1–G3, G8–G11, Adderstone, & Mangotane) contained intermittently flowing reaches.

Five gullies (G3a–G7) contained only ephemeral hydroclass.

Yours Sincerely,

Dr Adam Forbes
Principal Ecologist
Forbes Ecology Limited

APPENDIX – RELEVANT DEFINITIONS AS PRESENTED IN THE AUCKLAND UNITARY PLAN (AUP) PRACTICE AND GUIDANCE NOTE RIVER/ STREAM CLASSIFICATION

The RMA defines river as:

> *A continually or intermittently flowing body of fresh water; and includes a stream and modified watercourse; but does not include any artificial watercourse (including an irrigation canal, water supply race, canal for the supply of water for electricity power generation, and farm drainage canal)*

The AUP(OP) refers to both rivers and streams. The AUP(OP) in Chapter J defines rivers and stream types as:

River or stream

> *A continually or intermittently flowing body of fresh water, excluding ephemeral streams, and includes a stream or modified watercourse; but does not include any artificial watercourse (including an irrigation canal, water supply race, canal for the supply of water for electricity power generation, and farm drainage canal except where it is a modified element of a natural drainage system).*

Permanent river or stream

> *The continually flowing reaches of any river or stream.*

Intermittent stream

> *Stream reaches that cease to flow for periods of the year because the bed is periodically above the water table. This category is defined by those stream reaches that do not meet the definition of permanent river or stream and meet at least three of the following criteria:*
>
> *a) it has natural pools*
> *b) it has a well-defined channel, such that the bed and banks can be distinguished*
> *c) it contains surface water more than 48 hours after a rain event which results in stream flow*
> *d) rooted terrestrial vegetation is not established across the entire cross-sectional width of the channel*
> *e) organic debris resulting from flood can be seen on the floodplain or*
> *f) there is evidence of substrate sorting process, including scour and deposition.*

Ephemeral stream

Stream reaches with a bed above the water table at all times, with water only flowing during and shortly after rain events. This category is defined as those stream reaches that do not meet the definition of permanent river or stream or intermittent stream.